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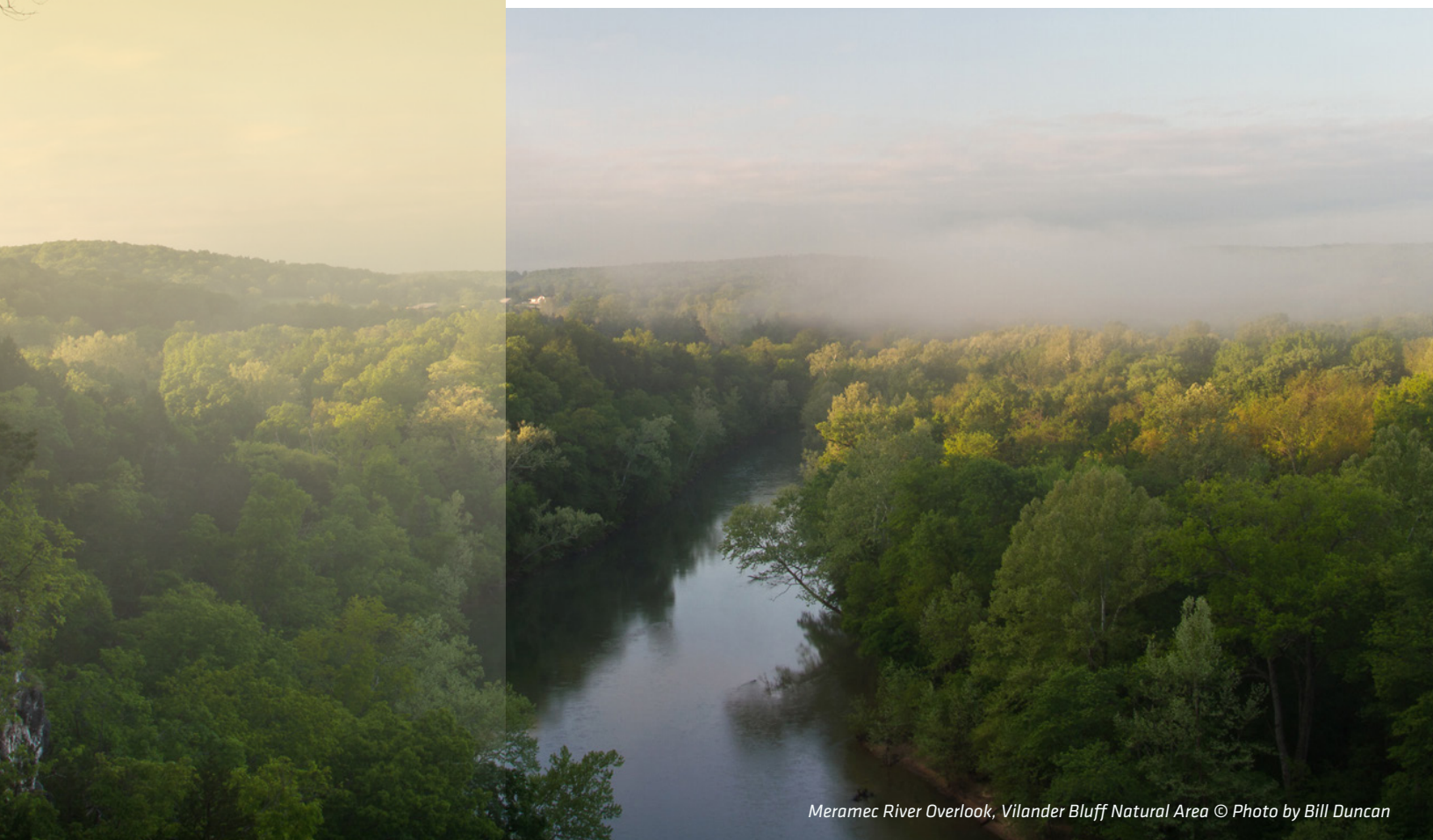
Healthy Watershed Options for Floodplain Management

LOWER MERAMEC WATERSHED



Meramec River Overlook, Vilander Bluff Natural Area © Photo by Bill Duncan

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The Meramec River/Big River Urban Waters Federal Partnership (UWFP) is a partnership of local, state and federal agencies and nonprofit organizations. UWFP's vision is improved coordination among federal agencies and collaboration with community-led revitalization efforts to improve our Nation's water systems and promote their economic, environmental and social benefits.

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Background & History

The Lower Meramec Watershed is highly flood-prone due to increased frequency of heavy rain events, topography and development that has reduced wetland areas and open spaces able to soak up rainfall. Communities in the Lower Meramec Watershed have experienced repetitive flood damage and three record flood events since 2015.

As a result of the flooding, the United States Army Corps of Engineers (USACE) Silver Jackets initiated a Floodplain Management Plan project that brought together local, state and federal organizations to reduce flood risk and other disasters. Initiated by the Urban Waters Federal Partnership, the Healthy Watershed Options for the Meramec River Project was developed as a piece of the ongoing risk mitigation efforts.

Lower Meramec Watershed Communities

City of Arnold
City of Eureka
City of Fenton
City of Pacific
City of Sunset Hills
City of Union
City of Valley Park
City of Wildwood
Franklin County
Jefferson County
St. Louis County

Meramec River, Photo by East-West Gateway.

As the risk mitigation efforts progressed, the use of nature-based stormwater solutions was identified as an area of interest. Of particular interest is using healthy watershed best practices, such as source water protection, green infrastructure (GI), including low impact development (LID), and open space protection to mitigate flooding and enhance the value of ecosystem services and aesthetic values.

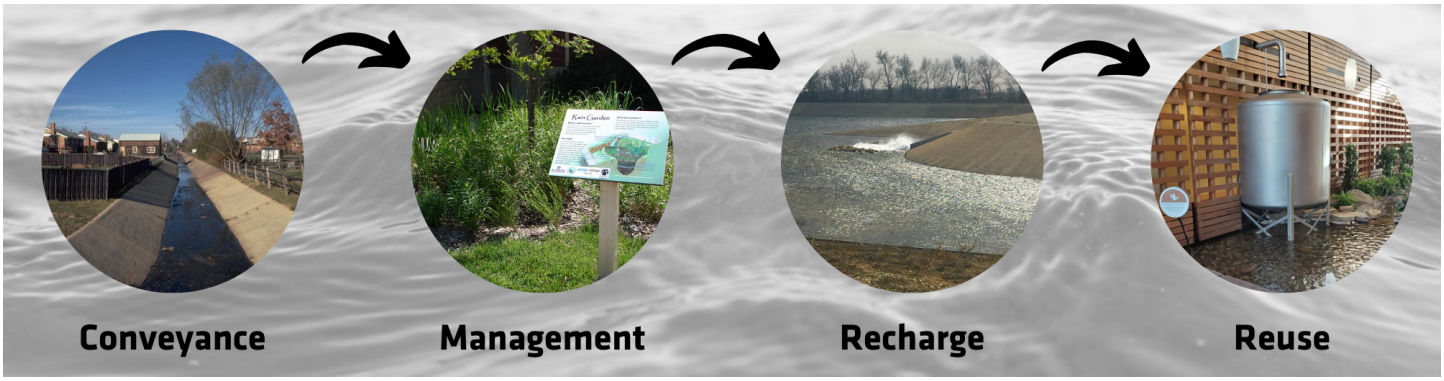
Communities in the watershed identified political, capacity and funding as barriers to implementation of healthy watershed options, and requested that a cost-benefit analysis be developed, along with resources and tools that could be used to support decision-making for healthy watershed stormwater projects.

Stormwater 101

Stormwater management is evolving. In decades past, stormwater systems were built simply to move water from where it fell to nearby rivers or drainage areas as quickly as possible. Most of the time, stormwater was an "extra" responsibility of the public works or streets department.

Today, stormwater is more than a system of conveyance. It is part of a comprehensive and integrated urban water resource that is managed to enhance water quality, water quantity, recreation, neighborhood aesthetics, groundwater recharge and wildlife habitat. Stormwater is now seen as part of the "one water" system: a system that understands the value of water no matter where it is in the water cycle.

The Evolution of Stormwater



Today, stormwater is part of a comprehensive and integrated urban water resource. Water is conveyed in a way that will direct water to a central location, where it can be managed and strategically delivered to groundwater sources, like aquifers, that will then be recharged with water. Finally, water is reused before being released back into the natural watershed again.

The "Guidance for Municipal Stormwater Funding" warns that "The new [stormwater] paradigm has … resulted in greater public expectations. In addition to the effective control of drainage and flooding, the public also expects riparian corridors, wetlands, recreation amenities, trails, visually pleasing facilities, and a continued maintenance effort."[1]

Higher level of service expectations, along with increasing regulations, more intense rainfall, construction costs and aging infrastructure, has created a gap between what is expected and what can be done within a stormwater program with available funding. In that gap stands a barrier that is preventing the stormwater program from meeting community expectations.

The New Stormwater Paradigm

flood control, fast drainage, parks, trails, regular maintenance, riparian corridors, water quality, groundwater recharge, wildlife habitat

public perception, historical stormwater management concepts, competition for funds, reluctance or cynicism for taxes or fees

new construction, rehabilitation of aging infrastructure, regulatory requirements, green infrastructure, grey infrastructure, more intense rainfall, ongoing operations and maintenance

[1] National Association of Flood and Stormwater Management Agencies. (2006) Guidance for municipal stormwater funding. Environmental Protection Agency. January: 1-140.

Stormwater Funding

A stormwater management program needs two types of funding:

1. **Revenue** – an ongoing stable flow of funding that provides financial support for staff, ongoing services, system repairs, regulatory compliance, etc.
2. **Project Funds** – a one-time targeted funding that provides financial support for construction, new development, system upgrades, etc.

Revenue

Ongoing revenue for a stormwater management program is often provided by general use dollars which competes with all other community priorities – parks, police, fire safety, libraries, streets, etc. Since stormwater is rarely the priority for decision makers or community members, stormwater programs are often underfunded, and build up maintenance and project backlogs.

Many communities are moving towards developing their own funding stream for stormwater management programs. There are various ways to provide this dedicated funding source that do not compete with other community priorities. Taxes, fees, incentives, etc. can be used as a mechanism to build a stormwater fund that sufficiently provides for on-going operation, maintenance, regulatory compliance, repairs, staff, equipment, bond repayment and building a reserve fund.

Project Funds

Some stormwater projects are too costly to implement without outside resources. Examples of these types of projects may be new development or new regulatory requirements.

Grants, loans and bonds can provide a one-time influx of funding to accomplish specific and targeted projects that enhance the community's stormwater management.

Most communities use a mixture of funding sources to meet their stormwater service goals. Grants, loans and bonds are not recommended for the ongoing, regular operation of a stormwater management program. Revenue should be sufficient for a stormwater program's ongoing expenses. Project funds are used to help a community reach their desired level of service, while revenue funds maintain the desired level of service.

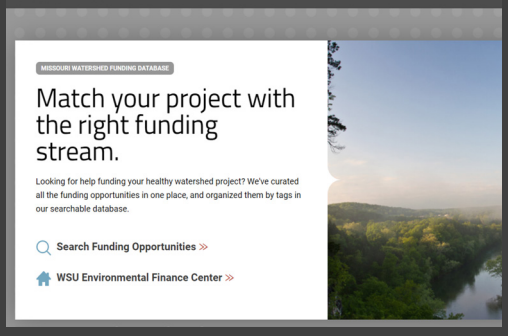
See the "Funding Options" section of this report for details on more than 40 funding sources that communities can use to develop a funding portfolio that provides for capital and revenue needs of a stormwater management program.

New! Meramec Healthy Watershed Funding Online Database

Check out WSU Environmental Finance Center's online database of Meramec River Healthy Watershed Funding options.

Search by keywords and tags that will help match your project needs with the right funding stream.

EFC's Missouri Healthy Watershed Funding Search Tool



www.wichita.edu/mowatershedfunding

What is a Watershed?

A watershed is an area of land that channels rainfall to nearby creeks, streams and rivers. Rainwater "sheds" off the land and drains to one spot. Every community is part of at least one watershed. For example, a drop of rain may fall on a parking lot at the local grocery store, then, travel across the grass, along the gutter, down the stormdrain and into the nearest body of water (stream, river, pond, etc.). This is the raindrop's journey across a watershed.

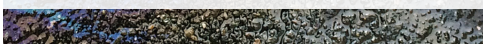
Watersheds are a natural part of the water cycle. When cities and towns are built, impervious surfaces like roads, parking lots and roofs keep rain from absorbing, or infiltrating, into the ground. Because our built structures and surfaces are impermeable, we have to create methods of moving the water away to avoid water damage. Traditionally, communities build gutters, storm drains and pipes to move the water from where it falls to the nearest body of water.

Nonpoint source pollution is pollution that comes from a source that cannot be "pointed to."

Every person contributes to nonpoint source pollution in watersheds from lawns, farm fields, homes, cars, pets, etc. These seemingly small sources add up to make a big impact on water quality.

Make a positive impact on community watersheds:

- pick up litter and pet waste
- maintain cars and fix leaks
- dispose of or recycle oils, chemicals and paint properly
- maintain septic tanks
- apply fertilizers according to label instructions



In an uninterrupted, natural, water cycle, most stormwater soaks into the ground. Only a portion of rainwater naturally flows to nearby creeks and rivers. However, human-made stormwater management systems quickly move rainwater from impervious surfaces to waterways.

This increase in stormwater flowing into natural waterways can cause flash-flooding (flooding lasting for hours) or long-term flooding (flooding lasting for weeks). Stormwater that moves across roads, parking lots, farm fields and lawns can pick up pollutants, like motor oil, lawn or agriculture chemicals, soil, litter, pet waste, etc. This is called **nonpoint source pollution**.

Stormwater is not funneled to a treatment plant like household sewage is. Despite the nonpoint source pollution it picks up, stormwater is not treated or cleaned before it is released into the environment. These pollutants can damage water quality in creeks, rivers and lakes. Many public drinking water utilities take in water from rivers and lakes impacted by nonpoint source pollution. The more communities protect watersheds from nonpoint source pollution, the less drinking water systems have to work to make safe, clean drinking water.

There are a variety of practices that stormwater managers can implement with the support of community and local decision-makers to create a healthy watershed in their communities. These stormwater practices incorporate natural elements of the water cycle, allow stormwater to soak into the soil and reduce nonpoint source pollution.

Stormwater infrastructure that uses concrete and other impervious materials to move water quickly from where it falls to the nearest creek or river is called grey infrastructure. Green infrastructure holds water near where it falls so it can infiltrate into the ground to reduce runoff, restore groundwater, capture pollutants and improve overall watershed health. Green infrastructure uses elements of the natural water cycle in strategic ways to protect and enhance the community. Healthy watersheds reduce flooding and provide safe, clean and desirable communities for residents to live, work and play.

CASE STUDY

Rahway River Watershed, New Jersey[2]

PROBLEM
Frequent flooding caused by development and destruction of natural wetlands and floodplains.

SOLUTION
The restoration of a 4.45 acre riparian wetland in the Rahway River floodplain. The project removed 14 houses, and incorporated the floodplain into the Union County Parks System as the Michael S. Bezenga Wetlands Observation area.

DIVERSE PARTNERS
The project partners included state, local and federal agencies, local environmental organizations, church groups and large corporations. Cooperation, goal alignment and close collaboration created an environment for success.

Construction was completed mostly by city and county public works staff. Various agencies and organizations provided in-kind equipment use. Volunteers provided sweat equity by planting native plants and ongoing invasive species removal.

ALIGNING GOALS
Like all flood reduction and water quality projects, the Rahway River Watershed project had multiple benefits for the community and the environment. The success of this project is due to the engagement of many diverse stakeholders who, through the process and project, each achieved personal, community or organizational goals. Just a few of these goals and benefits are:

- Flood risk reduction
- Wildlife habitat
- Nonpoint source pollution reduction
- Wetland restoration
- Increased recreation and public access
- Care for creation – creating a sustainable community
- Establishment of a new educational resource

DIVERSE FUNDING PORTFOLIO
This complex project was funded by six different funding sources. Each funding source had restrictions. For example, some funds could only be used for constructing wetlands, while others could only be used to purchase vegetation. Diverse funding sources increase the management workload. Project managers indicated that managing the various grant contacts was significant work, yet the diversity was key to the success of the project.

[2] C. C. Obropta and P. L. Kallin, "The restoration of an urban floodplain in Rahway, New Jersey," Ecol. Restor., vol. 25, no. 3, pp. 175–182, 2007. https://www.jstor.org/stable/43443071?seq=1

Healthy Watershed Options

There are a variety of stormwater practices that promote a healthy, more natural process that benefits the community and the environment. Flood risks can be reduced and water quality improved by implementing projects that allow stormwater to infiltrate (soak in), instead of running off impervious surfaces where water quickly fills and floods stormdrains.

Flood-prone Property Acquisition – Property acquisition is the most permanent form of flood hazard mitigation. Property owners volunteer to sell and local officials agree to buy land and/or structures, at market value, in the floodplain or flood-prone areas. Structures are demolished and future development is prohibited. Typically, the land is either managed as a floodplain restoration or an open space preservation project.

Floodplain Restoration – Targeted floodplain lands are purchased or set aside to reestablish natural hydrology. Restoration includes removal of structures, bank or wetland restoration, vegetation, tree planting, etc., and can be small targeted projects or large comprehensive projects.

Green Open Space Preservation – Preserving land as green open space allows for large areas of stormwater infiltration. It also provides community health and recreation benefits through the development of parks, walking trails and other recreational opportunities.

Bioretention – Installation of bioretention as part of larger, publicly-managed projects, or an extension of smaller projects on private property, reduces flood risk throughout the stormwater system by collecting, slowing and absorbing runoff within the developed area of the community. Bioretention projects mimic natural hydrology by collecting, infiltrating, evaporating and transpiring stormwater runoff via a vegetated basin. Bioretention can range from small (less than 2,000 square feet) rain gardens that collect stormwater from rooftops, sidewalks, small parking lots or streets, to large (more than 2,001 square foot) projects that collect stormwater from a vast area. Larger bioretention projects typically require engineering, stormwater plans, permits and an underdrain.

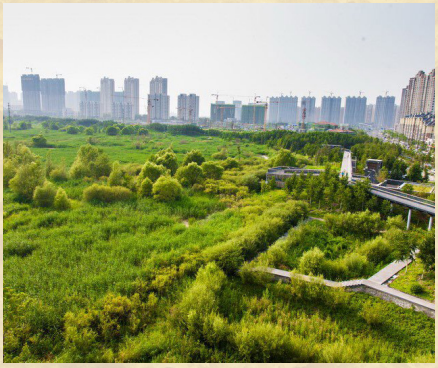
Unfortunately, there is no one-size-fits-all, quick fix to a healthy watershed. There is no singular healthy watershed or flood reduction project that will take care of a community's flood risk or water quality problems.

To maximize flood reduction in your community, make it a goal to incorporate healthy watershed and flood reduction projects into all local projects. Insert bioretention, green space preservation or floodplain restoration into all new or significant redevelopment projects. According to the Water Environment Federation's 2015 article, "The Real Cost of Green Infrastructure," communities can save 30-60% by integrating green infrastructure with other infrastructure improvements, like road reconstruction, utility restoration, transportation corridor upgrades, pedestrian safety projects, neighborhood revitalization, etc.[3]

Use the Cost-Benefit Analysis in this report to support healthy watershed projects. Then, discover funding opportunities for the implementation of healthy watershed projects in the Funding Options section.

Sponge City

Trees, bushes, grasses, flowers and soil are nature's sponges. The more sponges in and around a community, the more opportunities there are to soak up stormwater, reduce runoff, reduce nonpoint source pollution and alleviate flood-risks.



[3] Water Environment Federation. (2015). The real cost of green infrastructure. Stormwater Report. December.

*A **healthy watershed** has mostly natural land cover, especially near its waters; good water quality, quantity and flow; and habitats with diverse aquatic life. Together, these components support long-term, sustainable benefits to people and the environment.*

EPA Healthy Wastersheds Program
EPA 841-F-16-008, Dec 2016

Meramec River, June 2015. Photo by Amy Hepler Welch.

Why Healthy Watershed Options?

Integrated Planning Benefits
Healthy watershed options can be incorporated into a variety of planning efforts. Inclusion of green infrastructure in water resource planning is increasingly encouraged at the state and federal levels.

By incorporating healthy watershed projects into a range of planning conversations, processes and documents, projects will become more coordinated and supported by a variety of departments, agencies and public interests. Integrated planning highlights the interconnectedness of water and the co-benefits of healthy watersheds to almost every aspect of a community.

Healthy watershed options are an ideal fit for hazard mitigation plans (HMPs). HMPs are long-term strategies for protecting people and property from hazardous events. HMPs are vital to breaking the cycle of disaster, damage, reconstruction and repeated damage.[4]

By including watershed planning and green infrastructure into state hazard mitigation plans, communities can:

- Institutionalize green infrastructure and other healthy watershed options into state hazard mitigation planning.
- Leverage funds under the Clean Water Act for implementing healthy watershed options.
- Leverage FEMA Hazard Mitigation Grant Programs.
- Provide year-round benefits for hazard mitigation projects.
- Increase eligibility for insurance discounts for Community Rating System (CRS) jurisdictions.[5]
- Create opportunities for public education and outreach.
- Align other local and regional plans, increasing the likelihood plans are fulfilled and funded.

Incorporate Healthy Watershed Projects into:

- Hazard mitigation plans
- Floodplain management plans
- State or regional stormwater management plans
- Capital improvement plans
- Clean Water Act Section 319 Nonpoint Source Watershed Program plans
- Source water protection plans
- Water infrastructure risk and resilience assessments
- Parks and recreation plans
- Land-use plans

[4] Hazard Mitigation Planning. (2019) Federal Emergency Management Agency.
[5] Including watershed planning and green infrastructure into state hazard mitigation plans. (2019). Environmental Protection Agency. 1-2.

CASE STUDY

Blueprint Columbus, Ohio

PROBLEM

Aging infrastructure put a strain on the City of Columbus' sanitary sewer system. Overflows and basement backups were becoming too common, and in 2002 the City was put under a Sanitary Sewer Overflow Consent Order by Ohio EPA.

SOLUTION

The City of Columbus, Ohio implemented the Blueprint program[6] to reduce stormwater from entering the sanitary sewer system and creating overflows. Through strategies such as lateral lining, roof water redirection and voluntary sump pump installation, stormwater is prevented from entering the sanitary system via cracked pipes, joints and foundation drains. Stormwater is then directed to nearby green infrastructure, installed on city-owned properties and in the right-of-way in targeted residential neighborhoods. This green infrastructure filters multiple pollutants from the water and slowly drains to the storm sewer system, improving water quality in the nearby rivers and streams. Green infrastructure projects include: bioretention basins, rain gardens and permeable pavement on residential roadways.

FUNDING

Lateral lining, rooftop redirection and sump pumps are provided at no cost to homeowners in Blueprint priority neighborhoods. In order to fund these projects, the City of Columbus uses various funding strategies:

1. Blueprint, Columbus receives a portion of the sewer rate, which provides a dedicated funding source for ongoing program revenue.
2. To better manage sewer rate increases, the City uses Ohio EPA's Water Pollution Control Loan Fund, a low-interest loan, to fund Blueprint design and construction.
3. Community Development Block Grant (CDBG) funds are being explored as an opportunity to enhance green infrastructure development with park benches, shelters, playground equipment, etc. CDBG funds are often planned in conjunction with other city departments, meeting identified needs in the neighborhood for parks or green space.
4. Franklin County Soil & Water District (FCSWD) receives funding from the City of Columbus to gather and analyze watershed data that informs ongoing Blueprint solution development. This partnership helps city dollars go further, as FCSWD is able to leverage these funds as match for state grants.

[6] https://www.columbus.gov/utilities/projects/blueprint/

Increased Funding Potential
When healthy watershed projects are included in hazard mitigation plans, projects are eligible for FEMA Hazard Mitigation Assistance funding.[7]

Healthy watershed treatments provide multiple benefits in one project and address numerous water-related issues, including stormwater management, flood mitigation, water quality, public safety, property protection, increased property value and aesthetics, job growth, economic development, etc. Communities are often able to seek funding from multiple agencies and organizations because one healthy watershed project may help multiple funders reach their goals.

Flood Insurance Discounts
According to the 2018 Missouri State Hazard Mitigation Plan, St. Louis, Jefferson and Franklin Counties are each in the top 10 for flood insurance dollars paid from 1978-2017, numbers one, three and seven, respectively. These three counties are also in the top 10 for building loss and displaced population.[8]

The FEMA Community Rating System is an incentive program designed to encourage floodplain management that exceeds minimum requirements. In this program, healthy watershed projects that protect properties insured from flood loss by the National Flood Insurance Program may help a community receive flood insurance discounts.[9]

Planning or implementing low-impact development (LID), green infrastructure (GI), open space protection and stormwater management regulations may allow a community to earn points towards flood insurance discounts. For every 500 points, a community can receive a 5% discount, up to 45%, for properties in the 100-year floodplain.

A few of the healthy watershed activities that are eligible for FEMA's Community Rating System credits are:

- Maintaining a flood protection website that can include relevant healthy watershed information.
- Prohibiting fill in the 100-year floodplain.
- Adopting building codes that contains LID/GI requirements and practices.
- Using dedicated funding for new or retrofit LID/GI projects in a capital improvement plan.
- Conducting outreach that may include LID/GI and stream protection information.
- Open space preservation, with additional credit for supporting natural floodplain functions (natural flood control, water quality protection, habitat preservation). Land must remain open space in perpetuity.

Climate Resiliency
The reduced flood risk benefits that healthy watershed stormwater practices provide can help increase a community's climate resiliency.

The 2014 National Climate Assessment indicates that the Midwest, including Missouri, will experience more extreme heat, heavy downpours and flooding— to the point that infrastructure, health, agriculture, forestry, transportation, air and water quality will be impacted. The trend of increased extreme rainfall events and flooding that have been seen over the last century are expected to continue.[10]

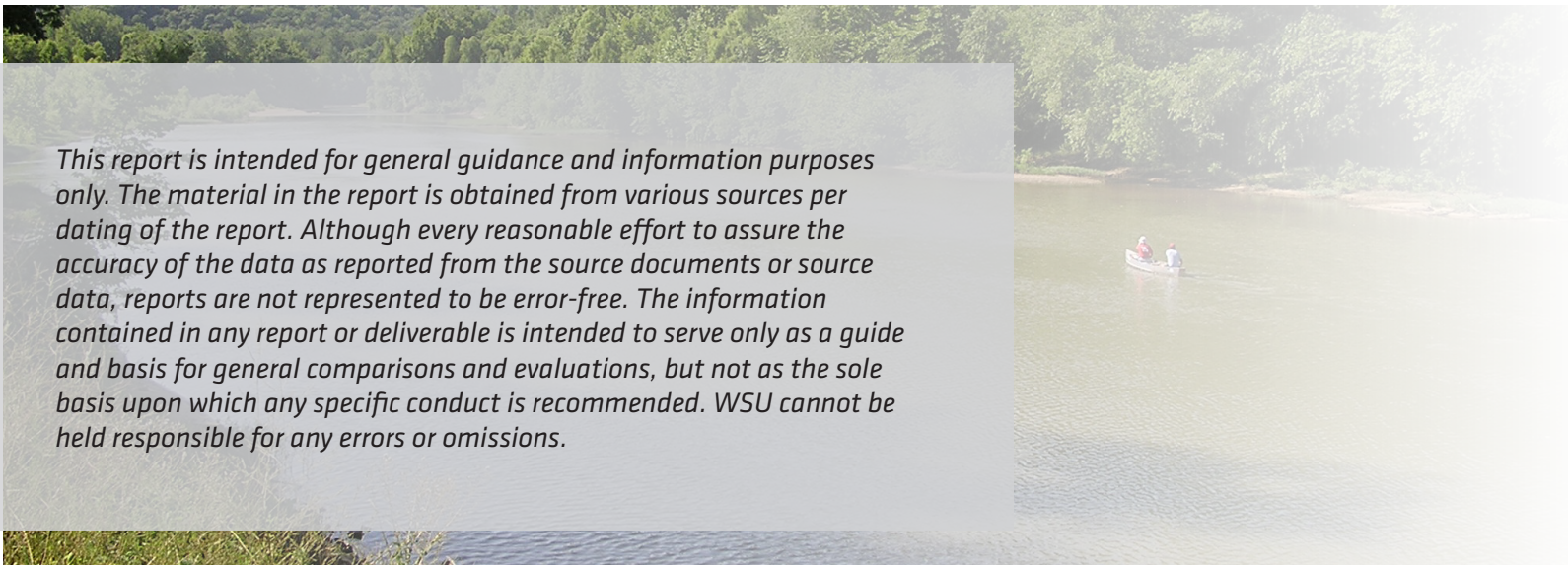
[7] Hazard Mitigation Assistance. (2019). Federal Emergency Management Agency.
[8] Missouri State Hazard Mitigation Plan. (2018). Missouri Department of Public Safety Emergency Management. 1-1228.
[9] Office of Wetlands, Oceans, and Watersheds. (2015). Get flood insurance discounts with low impact development, open space protection plans, and stormwater management regulations. Environmental Protection Agency. 1-2.
[10] National Climate Assessment. (2014). U.S. Global Change Research Program.

According to the 2013 "Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100" report, the area and depth of river floodplains with a 1% chance of flooding annually are projected to grow nearly 31-40% in East Central Missouri by 2100.[11]

This means that more homes, businesses, schools and hospitals will regularly be at risk for flood damage. Implementing healthy watershed practices can help a community mitigate potential damage that climate experts predict for the Lower Meramec Watershed.

There are many different types of projects that a community can implement to reduce flooding and improve watersheds. The following projects are four examples of healthy watershed opportunities:

- Local governments can purchase flood-prone properties and break the cycle of disaster, damage and reconstruction, which may allow the property owner to find a more resilient investment.
- Flood-prone properties can be restored into natural floodplain ecosystems which allow stormwater to soak in, reducing runoff and erosion, and benefiting downstream communities.
- Flood-prone properties can also be transformed into green open spaces (parks, walking trails, recreational opportunities, etc.) that become community amenities that promote active lifestyles and encourage outdoor recreation. This new, open space also increases infiltration, however, typically less than floodplain restoration.
- Bioretention, rain gardens or other types of green infrastructure can be installed in any urban area that needs improved stormwater management, and can increase infiltration, reduce sediment runoff and increase aesthetic and property value.



Meramec River at Pacific Palisades. Photo provided by East-West Gateway Council of Governments.

[11]AECOM, Baker Jr., M. & Deloitte Consulting. (2013). The impact of climate change and population growth on the national flood insurance program through 2100. June: 1-257.

Cost-Benefit Analysis

Communities in the Lower Meramec Watershed have a variety of healthy watershed project choices. Still, funding is often limited, and local priorities compete with flood risk reduction and other watershed projects. When considering a healthy watershed project, a community should consider more than the cost of the project in dollars. It should also weigh the potential benefits that the implementation of that project will provide to the community.

Community benefits for healthy watershed projects can include:

- Flood risk reduction
- Stormwater retention
- Erosion control/reduction
- Biological control
- Pollinator benefits
- Air quality improvement
- Climate regulation
- Increased property value
- Decreased insurance payouts
- Aesthetic value
- Recreation and tourism

Please Note

All CBAs in this report are limited and do not fully account for all social, environmental and economic impacts. There are costs that are unaccounted for when residences or businesses are removed from the floodplain. There may also be benefits unaccounted for, like reduced stress, fewer days of school or work missed and reduced physical injuries.

A cost-benefit analysis (CBA) is a decision-making tool that estimates the costs and benefits of a project to help determine the best way to achieve the community's goals while maximizing the benefits at the lowest cost.

The CBA for the Lower Meramec Healthy Watershed Options project estimates the costs and benefits of implementing three healthy watershed options:

1. Flood-prone property acquisition
2. Floodplain restoration
3. Open space preservation (parkland, ball fields, walking paths, etc.)

An analysis is provided for flood-prone properties in each city and county in the Lower Meramec Watershed project area.[12]

City of Arnold	City of Sunset Hills	Franklin County[12]
City of Eureka	City of Union	Jefferson County
City of Fenton	City of Valley Park	St. Louis County
City of Pacific	City of Wildwood	

Municipalities are encouraged to consult with their trusted financial advisors to interpret and assess the results of this report. Financial advisors can guide staff and decision-makers as healthy watershed projects are considered, designed and implemented using the following CBA scores and calculations.

[12] Franklin County, outside of the City of Pacific, was not included in the analysis because the data source did not include residential property information, and there were no flood-prone properties indicated for analysis.

Flood-Prone Property Acquisition

Typically, the first step in implementing any healthy watershed option is flood-prone property acquisition. Acquisition occurs when local officials agree to buy land or structures, at market value, in the floodplain, or flood-prone areas, and then tear down structures and prohibit future development. From then on, the land is then either managed as a floodplain restoration or an open space preservation project.

All properties along the Lower Meramec River that are in the 1% AEP, also known as the "100-year floodplain," are included in this Flood-Prone Property Acquisition CBA, regardless of base-flood elevation, geographic location and land use (i.e. commercial, industrial, agricultural, residential). The properties identified align with the Army Corps of Engineers "Lower Meramec Multi-Jurisdictional Floodplain Management Plan: For the Communities of the Lower Meramec Basin."[13]

What is a flood-prone property?

For this report, a flood-prone property is one that is within the zone that FEMA has designated as having a 1% **Annual Exceedance Probability** (AEP). This means that the land in that zone has a 1% chance of being flooded in any given year.

Sometimes properties in the 1% AEP are said to be "in the 100-year floodplain." This can be misleading because floods are possible on these properties more often than once every 100 years. For example, from August 2015 – Fall 2019, there were three record flood events.

Meramec communities have a wide range of acres and unique land-use mixes within their 1% AEP. For example, Arnold's 286 acres in the 1% AEP consist, almost entirely, of residential land, a mix of stick-built (59) and mobile (57) homes. On the other hand, Eureka has fewer residential properties (17) located in the floodplain. Commercial (23) and industrial (8) properties make up over two-thirds of Eureka's 154 acres in the 1% AEP. The variation in property type and the number of acres in the 1% AEP lead to a range in CBA scores across the communities for flood-prone property acquisition projects (Table 1. Flood-Prone Property Acquisition Score).

The CBA Acquisition Score took into account:

- Current market value of the properties, as collected from each County's Assessors Office 2017 valuations.
- Parcel acreage totals.[14]
- Average payouts for flood insurance claims for each community.[15]
- Residential demolition costs.[15]

The CBA Acquisition Score for each city and county is based on a ratio that compares the benefit (the savings from avoided future flood insurance claims) to the cost (the property's market value, lost property tax income to the municipality and demolition costs.)

The CBA has the potential to undervalue the monetary damage of flooded properties, if the property damage is greater than $250,000 for residential and $500,000 for commercial/industrial properties, due to the maximum coverage provided by the National Flood Insurance Program.

All analyses were performed at a community level. No property specific analysis.

$$\frac{\text{Average Historical Insurance Claims}^{16}}{\text{Year 1 Market Value + 20 Years of Lost Property Tax + Demolition Costs}} = \frac{\text{Benefits}}{\text{Costs}}$$

[13] The Army Corp of Engineers "Lower Meramec Floodplain Management Plan" provides property specific details and recommendations for mitigation measures (elevation, acquisition, relocation, floodproofing, sewer valve checks, and relocation of utilities) to reduce flood risk, decrease flood damages, and potentially eliminate life-loss.

[14] For most, the Assessor's Office provided this information. If not, a median or average number was used for those properties. See Appendix A to find out how this affected each community's CBA.

[15] Demolition costs are calculated as an average of the actual demolition costs for residential properties in the watershed - $14,000.

[16] The Average Historical Insurance Claims are calculated for each city and county. However, insurance payout information was not available for Kirkwood and Jefferson County, thus were not included in this portion of the analysis.

The majority of the cost for a flood-prone property acquisition project occurs in the first year when the property is purchased. The benefits (insurance savings) are incurred over time and are ongoing. As a way of accounting for the benefits over time, a 20-year time frame is used for this CBA.

In a CBA, when the benefits outweigh the costs, the CBA score will be greater than one. If the score is less than one, the costs are higher than the calculated benefits. When costs equal benefits, the score is exactly one.

For the Lower Meramec Flood-Prone Property Acquisition CBA, a score greater than one means that the cost savings in avoided flood insurance claims are greater than the cost of purchasing the properties, residential demolition and the loss of property taxes over 20 years. (Remember this is not for purchasing individual properties, but for purchasing all of the properties in the 1% AEP within each community.)

Scores less than one indicate that the cost of purchasing the properties in that community, residential property demolition and the loss of the property taxes on those properties is greater than the benefits seen by avoiding flood insurance claims on those properties over 20 years.

Cost-Benefit Analysis Score

Cost-Benefit Analysis (CBA) Score is the ratio of a project, expressed in monetary terms, relative to its costs.

CBA Score = Program Benefits / Program Costs

- > 1 Benefits outweigh the costs
- < 1 Costs outweigh the benefits
- = 1 Costs equal benefits

The higher the CBA score, the better the investment.

Since CBA scores are tied directly to costs, they can be read as dollar-for-dollar returns on investment. In this report, the return on investment is the calculated benefit for the community for each healthy watershed opportunity. For example, if a project costs $10,000 (property purchase + loss of property taxes over 20 years), and the CBA score is 1.50, then the expected benefits are $15,000 (10,000 x 1.50) over the same 20-year period.

Results

Arnold is the only municipality that has a Flood-Prone Property Acquisition score higher than one, and only at the 1% discount rate. This means that the City of Arnold is the only community where the purchase of all properties in the 1% AEP is cost-effective (the benefits outweigh the costs). At a 1% discount rate for every $1,000 that the City of Arnold spends on flood-prone property acquisition, the community will receive $1,040 in benefits (avoided flood insurance claims).

These results are not surprising. In this scenario, there is only one benefit, avoided flood insurance claims, to outweigh the costs (the property's market value, demolition costs of residential properties and the loss in property taxes). According to this CBA, flood-prone property acquisition must be done in conjunction with another project that is projected to have greater benefits to the community and the environment. Most communities need to add additional healthy watershed options, like floodplain restoration or open green space, to their acquisition plan to gain additional benefits as a way of achieving a CBA score greater than one.

Turning CBA Scores into Dollars

CBA scores relate directly to project costs. For every dollar of project costs, the CBA score indicates the return on that investment. Remember, costs include actual project costs and the indirect costs to the community, (*Ex: loss of property taxes).* The return on investment is the calculated benefits to the community that may include avoided flood insurance claims, recreation and tourism, soil control, etc.

If the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.

Calculation: Project Costs x CBA Score = Community Return on Investment over a 20-year period

Project costs = $100,000

CBA score = 2.75

$100,000 x 2.75 = $275,000 in overall community benefits over a 20-year period

Flood-Prone Property Acquisition CBA Scores

Table 1. Cost-Benefit Analysis Scores, by discount rate, for Flood-Prone Property Acquisitions in cities and counties of the Lower Meramec Watershed. Scores relate directly to costs. CBA Scores indicate the value of the potential benefits for the community (avoided flood insurance claims) if the healthy watershed investment occurs.

For example: if the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.

Community	Discount Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
	Arnold	1.04	.95	.88	.81	.75	.70	.65	.61	.57	.54
	Eureka	.12	.11	.10	.09	.09	.08	.08	.07	.07	.06
	Fenton	.12	.11	.10	.09	.08	.08	.07	.07	.06	.06
	Pacific	.14	.13	.12	.11	.10	.10	.09	.08	.08	.07
	Sunset Hills	.89	.82	.75	.70	.65	.60	.56	.53	.49	.47
	Wildwood	.18	.17	.15	.14	.13	.12	.11	.11	10	.09
	Valley Park	.80	.73	.67	.62	.58	.54	.50	.47	.44	.42
	St. Louis County	.89	.82	.75	.70	.65	.60	.56	.53	.49	.47

Insurance payout information was not available for Kirkwood and Jefferson County, thus were not included in this portion of the analysis.

Conclusion

- Flood-prone property acquisition is *Step 1* to reducing flood risk with nature-based solutions.
- Flood-prone property acquisitions must be paired with other community enhancing efforts in order for the benefits (as calculated in this study) to outweigh the costs.

Discount Rates

Discount rates put a present value on the costs and benefits that will occur in the future. Choosing the discount rate for your community project is important in helping to determine how much to invest today for the benefit of the future.

A discount rate that is too high can cause under-investment in public projects.
A discount rate that is too low can cause over-investment in public projects.

How do you choose a discount rate for your community or your healthy watershed project analysis?

- Ask, "how much is guarding against future Meramec flooding worth to my community now?"
- Weigh the benefits of avoiding floods in your community (and communities downstream) for the near future, as well as the benefits for the next generation or two, against the costs your community will have to bear today to implement the project.

Lower Discount Rates (1% - 5%):

- Favor investment in future generations
- Puts more weight on the future, assumes more investment is needed now to guard against future costs
- Stakeholders who benefit from the project favor low discount rates

Higher Discount Rates (6% - 10%):

- Guard the current generation from making sacrifices
- Puts less weight on the future, assumes less investment is needed now to guard against future costs
- Stakeholders who want more immediate returns favor high discount rates

Office of Management and Budget uses 10%

US Fish and Wildlife Service uses 7.8%

US Forest Service uses 4%

Municipal governments typically use ~ 3%

US Army Corps of Engineers uses 7%

Floodplain Restoration

This portion of the CBA builds on the previous section – flood-prone property acquisition. Simply acquiring a property provides some benefit to the community and environment. Repurposing the land provides environmental, economic and social benefits that turn a costly property acquisition and restoration project into a beneficial investment for the entire community.

Floodplain restoration is the process of restoring a river's floodplain to its original condition after it has been affected by human development (residential, industrial, etc.). The ultimate goal of restoring floodplains is to return the area to a natural system that stores and slows floodwaters and is a buffer that allows the river to flood without affecting homes, businesses or communities. Restored floodplains also provide natural resource and recreational benefits.

Floodplain restoration is estimated to cost between $10,000 and $30,000 per acre.[17] Restoration costs depend on the development type that will be removed, access to the development, elevation of the land and the potential need for cleanup of industrial or commercial waste. A floodplain restoration CBA was calculated for low-cost ($10,000) and high-cost ($30,000) estimates to ensure a full range of cost variability was considered. The benefits included in the CBA calculations for floodplain restoration in Meramec communities are quantified, in dollars, and align with FEMA's CBA, "Final Sustainability Benefits Methodology Report." In this CBA, the following environmental and flood hazard reduction benefits are calculated annually, per acre of floodplain restored.

For the Lower Meramec Floodplain Restoration CBA, the costs and benefits of property acquisition (as determined in the previous section) are added to the costs and benefits for floodplain restoration, so the entire project is included in the score.

Floodplain Restoration Benefits

Benefit	Definition	Value *Per Acre, Per Year*
Aesthetic Value	The role natural beauty plays in attracting people to live, work and recreate in an area	$580.87
Air Quality	Filtering of pollutants from the atmosphere by natural resources (wetlands, trees, plants, soil)	$215.06
Biological Control	Natural control of diseases and pest species	$163.68
Climate Regulation	Regulation of global and local temperature, climate and weather including evapotranspiration, cloud formation and rainfall	$204.21
Erosion Control/Soil Retention	Erosion protection provided by plant roots and tree cover	$11,447.30
Flood Hazard Reduction	Reduction of damages to life and property caused by flood events	$4,007.01
Habitat and Biodiversity	Provide habitat for plants and animals and their full diversity	$835.41
Recreation and Tourism	The contribution of ecosystems and environments in attracting people to engage in recreational activities	$15,178.07
Water Quality/Water Filtration	Absorption or organic waste, natural water filtration and nonpoint source pollution reduction	$4,251.89
TOTAL VALUE OF FLOODPLAIN RESTORATION PER ACRE PER YEAR		**$36,883.50**

[17] *Floodplain Restoration and Stormwater Management: Guidance and Case Study*, Chagrin River Watershed Partners, Inc. and Biohabitats, March, 2009. Floodplain restoration cost estimate does not include demolition of structures, but does include soil amendments, rubble removal, invasive plan removal, bare root trees, container trees, and balled and burlapped trees.

Results

Scores less than one indicate that the cost of purchasing the properties and restoring the land to a natural floodplain is greater than the benefits provided by the acquisition and the environmental and flood hazard reduction benefits over 20 years. Only Fenton, for both the low- and high-cost restoration, has a CBA score less than one for floodplain restoration at the highest discount rates.

Flood-prone property acquisitions and floodplain restoration appear to be cost-effective over a 20-year project lifespan for most communities. For all Lower Meramec communities, including Fenton, at the discount rates below 7%, floodplain restoration benefits over 20 years outweigh the cost of acquisition and restoration, even at the highest restoration cost estimates.

For cities in the Lower Meramec Watershed, at the 3% discount rate, community benefits over 20 years for low-cost floodplain restoration ($10,000 per acre) over the project area calculated to be between $1,410 in Fenton, and $17,600 in Arnold, for every $1,000 spent. When the higher floodplain restoration costs ($30,000 per acre) are used to calculate the community benefits over 20 years, the return on investment is between $1,340 and $10,700 for every $1,000 in cost.

Counties have even higher returns, at $15,710 in St. Louis County and $33,100 in Jefferson County at a 3% discount rate, for every $1,000 spent for a project at the low-cost estimate for floodplain restoration. When the higher cost estimates for floodplain restoration are calculated, the community benefits are $9,970 in St. Louis County and $14,950 in Jefferson County.

Conclusion

- Over 20-years, the benefits of restoring the 1% AEP to natural floodplain are greater than the costs.
- The cost of purchasing flood-prone properties and restoring the land to floodplain is less than the benefits provided by the reduction in flood losses and improvements in the ecosystem.

Reducing Flood Risk with Natural Floodplains

Wetlands on Captree Island, Long Island, New York. Jeanethe Falvey, US EPA via the Flickr Creative Commons.

Natural floodplains provide flood risk reduction benefits by slowing runoff and storing flood water. They also provide other benefits of considerable economic, social and environmental value that are often overlooked when local land-use decisions are made.

FEMA, https://www.fema.gov/benefits-natural-floodplains

Low-Cost Floodplain Restoration CBA Scores

Table 2. Cost-Benefit Analysis Scores, by discount rate, for the low-cost ($10,000/acre) Floodplain Restoration and Flood-Prone Property Acquisition in cities and counties of the Lower Meramec Watershed. CBA scores indicate the value of the potential benefits for the community (aesthetic value, water quality, etc.) if the healthy watershed investment occurs. *For example: if the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.*

Community	Discount Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
	Arnold	20.94	19.16	17.60	16.24	15.03	13.97	13.02	12.18	11.43	10.76
	Eureka	2.12	1.94	1.78	1.64	1.52	1.41	1.32	1.23	1.16	1.09
	Fenton	1.68	1.54	1.41	1.30	1.20	1.12	1.04	.98	.92	.86
	Kirkwood	10.50	9.61	8.83	8.15	7.54	7.01	6.53	6.11	5.73	5.40
	Pacific	5.32	4.87	4.48	4.13	3.82	3.55	3.31	3.10	2.91	2.74
	Sunset Hills	6.90	6.32	5.80	5.35	4.95	4.60	4.29	4.01	3.77	3.55
	Wildwood	11.62	10.63	9.77	9.01	8.34	7.75	7.22	6.76	6.34	5.97
	Valley Park	3.69	3.37	3.10	2.86	2.65	2.46	2.29	2.14	2.01	1.89
	Jefferson County	39.37	36.03	33.10	30.53	28.27	26.26	24.49	22.90	21.49	20.23
	St. Louis County	18.68	17.10	15.71	14.49	13.41	12.46	11.62	10.87	10.20	9.60

High-Cost Floodplain Restoration CBA Scores

Table 5. Cost-Benefit Analysis Scores, by discount rate, for high-cost estimates of the Meramec Models (low-acreage community, community and county). CBA Scores indicate the value of the potential benefits for the community (pollination, air quality, etc.) if the healthy watershed investment occurs. *For example: if the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.*

Community	Discount Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
	Arnold	12.72	11.64	10.70	9.87	9.13	8.49	7.91	7.40	6.94	6.54
	Eureka	1.99	1.82	1.67	1.54	1.43	1.33	1.24	1.16	1.09	1.02
	Fenton	1.60	1.46	1.34	1.24	1.15	1.06	.99	.93	.87	.82
	Kirkwood	7.93	7.26	6.67	6.15	5.70	5.29	4.93	4.62	4.33	4.08
	Pacific	4.57	4.19	3.85	3.55	3.28	3.05	2.84	2.66	2.50	2.35
	Sunset Hills	5.69	5.21	4.78	4.41	4.09	3.80	3.54	3.31	3.11	2.92
	Wildwood	8.55	7.83	7.19	6.63	6.14	5.70	5.32	4.98	4.67	4.39
	Valley Park	3.31	3.03	2.78	2.57	2.38	2.21	2.06	1.93	1.81	1.70
	Jefferson County	17.78	16.27	14.95	13.79	12.76	11.86	11.06	10.34	9.71	9.14
	St. Louis County	11.85	10.85	9.97	9.19	8.51	7.91	7.37	6.90	6.47	6.09

Healthy Watershed Model CBA with Open Space

It is unrealistic that a community would apply the same treatment, floodplain restoration, across their entire 1% AEP. To provide a more realistic and well-rounded approach to healthy watersheds, models were developed. The Meramec Models combine healthy watershed projects across each community. The combination and corresponding CBAs allow communities to determine the feasibility and effectiveness of developing projects across the entire 1% AEP in their city or county.

Low-Acreage Community Model

There are two cities in the project area that have less than 25 acres in the 1% AEP:

Kirkwood (14.3 acres) *and* Wildwood (24.6 acres)

The Low-Acreage Community Model, for communities with less than 25 acres in the 1% AEP, includes:

- One-acre of developed park land
- Floodplain restoration on the remaining land within the 1% AEP
- Walking trail (unpaved) installed[18]; 2 to 3-feet wide, 417 linear feet per acre
- All features include installation and maintenance over 20 years[19]

Community Model

The remaining cities in the project area have between 112 and 411 acres of land in the 1% AEP:

Arnold (285.9 acres)
Eureka (153.6 acres)
Fenton (112.4 acres)
Pacific (410.9 acres)
Sunset Hills (256.7 acres)
Valley Park (113.8 acres)

The Community Model, for communities with more than 100 acres of land in the 1% AEP, includes:

- One-acre of developed park land for every 99 acres of floodplain restoration
- Floodplain restoration on the remaining land within the 1% AEP
- Walking trail (unpaved) installed; 2 to 3-feet wide, 417 linear feet per acre
- All features include installation and maintenance over 20 years

County Model

The County Model was applied to Jefferson and St. Louis Counties. Franklin County was not included, due to unreliable acreage estimates, but may assume to have results that are in line with the other counties in the study. Each county has more than 1,000 acres in the 1% AEP:

Jefferson County (1,555.7 acres) *and* St. Louis County (1,263.3 acres)

The County Model includes:

- One-acre of developed park land for every 499 acres of floodplain restoration
- Floodplain restoration on the remaining land within the 1% AEP
- Walking trail (unpaved) installed; two- to three-feet wide, 417 linear feet per acre
- All features include installation and maintenance

[18] Walking trail installation estimates were calculated with the assumption that the paths would be dirt paths that are twice the length of the total area. Calculation: the square root of the number of square feet in an acre (43,560 square feet per acre) is approximately 208 feet, which is the total length of one side of the perimeter of the area. Then, that total was multiplied by two, equaling approximately 417 linear feet.

[19] Annual maintenance costs for park land are estimated at $18,000 annually per acre. Annual maintenance costs for trails are estimated at $333-$1,332 per year, and includes litter, branch, targeted mowing, and tree and poison ivy removal.

Costs for the Meramec Models vary due to land values, geography, current land development and size of 1% AEP. A low-cost and high-cost version of the model was developed for each community to ensure the full range of cost variability was considered in the scores.

The benefits for the three models include the benefits from the previous two sets of CBAs, (Acquisitions and Floodplain Restoration) along with Open Space Preservation benefits, which were determined through alignment with FEMA's CBA *Final Sustainability Benefits Methodology Report*. The following environmental and flood hazard reduction benefits are calculated annually, per acre of open space preserved:

Open Space Preservation Benefits

Benefit	Definition	Value *Per Acre, Per Year*
Aesthetic Value	The role natural beauty plays in attracting people to live, work and recreate in an area	$1,622.37
Air Quality	Filtering of pollutants from the atmosphere by natural resources (wetlands, trees, plants, soil)	$204.47
Climate Regulation	Regulation of global and local temperature, climate and weather including evapotranspiration, cloud formation and rainfall	$13.19
Erosion Control/Soil Retention	Erosion protection provided by plant roots and tree cover	$64.88
Flood Hazard Reduction	Reduction of damages to life and property caused by flood events	$293.02
Pollination	Increase of native pollinator species and natural pollination mechanisms to aid in the natural fertilization of plants and crops	$290.08
Recreation and Tourism	The contribution of ecosystems and environments in attracting people to engage in recreational activities	$5,365.26
TOTAL VALUE OF OPEN SPACE PRESERVATION PER ACRE PER YEAR		**$7,853.27**

Factors for Counties

In this report, the counties in the Meramec Watershed have high CBA scores for their targeted models. These high scores are due to the large number of acres that accrue benefits on a per acre basis, paired with lower land values, per acre, when compared to cities. In a real-world scenario, county benefits are expected to be lower because it is likely that not all land identified in this analysis is eligible for floodplain restoration, reducing CBA score.

For the Meramec Models CBA, the costs and benefits of the property acquisition, floodplain restoration, open space preservation (parkland), trails and 20 years of maintenance are calculated and weighed to determine the score.

For all Lower Meramec communities, excluding Fenton, at the highest discount rates, the benefits of implementing the models, over 20 years, outweigh the cost of installing and maintaining the model's various treatments, even at the highest restoration cost estimates. Each model appears to be cost-effective over a 20-year project lifespan.

At the 3% discount rate (low-cost model), the community's overall return on investment for cities in the watershed is between $1,530 and $16,670 for every $1,000 spent. At the high-cost model, return on investment is between $1,340 and $10,360. Counties have even higher returns. For every $1,000 in cost for implementing the Meramec County Model, St. Louis County could see $14,680/$9,500 (low-cost estimate/high-cost estimate) in returns on investment. Jefferson County could experience $28,190/$13,690 in benefits for every $1,000 spent.

Conclusion

- Even when additional costs are incurred through the installation and maintenance of parks and walking trails, the community and environmental benefits outweigh the costs.

Impact of Property Type: Residential vs Commercial Properties

This CBA does not fully account for all economic factors of commercial or industrial properties. There are unknown economic implications of acquiring these properties and taking them out of the economic profile of a community.

It is expected that for communities with higher numbers of commercial and industrial properties, the CBA Score's will be significantly lower once those factors are taken into account.

However, this CBA works well for communities with higher numbers of residential properties in the 1% AEP. Residential properties cost less per acre than commercial properties, and communities will incur less economic loss when they acquire them for flood risk reduction. Residential properties are easier to convert into restored floodplain or open space, and they will ultimately provide the same benefits to the community.

Meramec River flooding, December 2015. Photos by Dr. Rose Wyland, United States Geological Survey.

Low-Cost Meramec Models CBA Scores

Table 4. Cost-Benefit Analysis Scores, by discount rate, for low-cost estimates of the Meramec Models (low-acreage community, community and county). CBA scores indicate the value of potential benefits for the community (pollination, air quality, etc.) if the healthy watershed investment occurs. *For example: if the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.*

Community	Discount Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
	Kirkwood	7.08	6.64	6.24	5.87	5.54	5.23	4.95	4.69	4.46	4.24	Low Acreage Model
	Wildwood	9.32	8.68	8.09	7.56	7.08	6.65	6.26	5.90	5.58	5.29	
	Arnold	19.48	17.99	16.67	15.49	14.44	13.49	12.65	11.89	11.20	10.58	Community Model
	Eureka	2.23	2.04	1.88	1.74	1.61	1.50	1.40	1.31	1.23	1.16	
	Fenton	1.82	1.67	1.53	1.41	1.31	1.22	1.14	1.06	1.00	.94	
	Pacific	5.32	4.89	4.51	4.17	3.87	3.61	3.37	3.16	2.91	2.80	
	Sunset Hills	6.84	6.28	5.79	5.35	4.97	4.62	4.32	4.05	3.80	3.58	
	Valley Park	4.33	3.98	3.67	3.39	3.15	2.94	2.74	2.57	2.42	2.57	
	Jefferson County	35.52	30.24	28.19	26.33	24.65	23.14	21.77	20.53	19.41	18.39	County Model
	St. Louis County	17.14	15.84	14.68	13.64	12.72	11.89	11.14	10.47	9.87	9.32	

High-Cost Meramec Models CBA Scores

Table 5. Cost-Benefit Analysis Scores, by discount rate, for the high-cost estimates of the Meramec Models (low-acreage community, community and county). CBA scores indicate the value of the potential benefits for the community (pollination, air quality, etc.) if the healthy watershed investment occurs. *For example: if the CBA score is 1.50, for every $1 spent, the benefits are worth $1.50. If the CBA score is 0.50, for every $1 spent, the benefits are worth 50 cents.*

Community	Discount Rate	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
	Kirkwood	5.79	5.41	5.07	4.76	4.47	4.21	3.98	3.76	3.57	3.39	Low Acreage Model
	Wildwood	7.21	6.69	6.22	5.81	5.43	5.09	4.78	4.50	4.25	4.03	
	Arnold	12.14	11.20	10.36	9.62	8.95	8.36	7.83	7.35	6.92	6.53	Community Model
	Eureka	2.09	1.92	1.76	1.63	1.51	1.41	1.31	1.23	1.16	1.09	
	Fenton	1.59	1.45	1.34	1.24	1.15	1.07	1.00	.93	.88	.83	
	Pacific	4.56	4.19	3.87	3.58	3.32	3.10	2.89	2.71	2.55	2.40	
	Sunset Hills	5.62	5.16	4.76	4.40	4.08	3.80	3.55	3.33	3.13	2.95	
	Valley Park	3.88	3.57	3.29	3.04	2.83	2.63	2.46	2.31	2.17	2.05	
	Jefferson County*	15.95	14.76	13.69	12.74	11.89	11.12	10.43	9.81	9.25	8.75	County Model
	St. Louis County*	11.13	10.27	9.50	8.82	8.21	7.67	7.18	6.74	6.35	6.00	

Conclusion

Cost-Benefit Analysis scores greater than one calculated in this Healthy Watershed Options project indicate that it would be cost-effective for all Lower Meramec communities to acquire all properties in their 1% AEP and restore the area to natural floodplain, or convert to a mix of floodplain and open green space. Most CBA scores that include floodplain restoration and open green space implementation show that communities will reap benefits greater than the cost of the project over 20 years.

When residential and industrial properties remain in the floodplain, communities increase flood risk, social burdens, financial hazards and negative environmental impacts. Whereas, converting lands in the 1% AEP to nature-based solutions provides economic, environmental and social benefits to the entire community. When benefits are calculated over 20 years and weighed against project costs, the benefits win-out by providing more, sometimes substantially more, value to the community.

Due to an ever-changing climate, and the expectation that rainfall could continue to increase in quantity and intensity, communities should take action to mitigate their footprint on floodplains. Fully functional floodplains protect and benefit the community, and improve the overall health of the watershed.

The City of Arnold, seemingly, has the highest benefit potential for flood-prone property acquisition and floodplain and open green space restoration. Even at the highest estimated cost for project implementation, this analysis estimates that for every dollar that the City of Arnold spends, it could yield $11.53 in community benefits (3% discount rate).

The cities of Kirkwood, Pacific, Sunset Hills and Valley Park all generally could expect a community benefit of $4 to $5 for every dollar spent. The cities of Eureka and Fenton could expect lower community benefits of $1.35 to $2 per dollar spent. This lower community benefit is due to the high rates of industrial and commercial properties located in the 1% AEP, which are significantly more expensive to acquire, and property tax loss is greater.

For cities and counties in the Lower Meramec Project Area, healthy watershed projects are cost-effective when considered community-wide. The CBA scores are an average. Some properties are going to fall below the community-wide CBA score, and some will be higher. When considering specific property acquisitions and individual healthy watershed projects, municipalities should be sure to determine individual property costs and try to include the potential economic costs that could be associated with removing that development from the community. As noted earlier, some properties will have additional economic costs and benefits that were not within the scope of this analysis, such as residents who move away, job losses, fewer days of work missed, fewer physical injuries, etc.

Over this study's 20-year time frame, community benefits typically outweigh the costs of implementing healthy watershed options that include flood-prone property acquisition, floodplain restoration and open greenspace establishment. The Cost-Benefit Analysis indicates that there are financial, environmental and social benefits that can be estimated, quantified and used to justify decisions that increase the investment in nature-based solutions that reduce flooding for the Lower Meramec Watershed.

Conclusion Key Takeaways

- The first step to reducing flood risk with healthy watershed solutions is to acquire the flood-prone properties in the 1% AEP.
- In most cases, to ensure that the benefits outweigh the costs of the healthy watershed project, flood-prone property acquisitions must be paired with floodplain restoration or enhancement (parks, open space, trails, etc.) that provides environmental or social benefits.
- Over a 20-year period, the benefits of floodplain restoration and/or parks and walking trails, including installation and ongoing maintenance, are greater than the costs.
- For most communities this CBA shows that investment in flood-prone property acquisition paired with floodplain restoration or acquisition paired with parks, open space and trails is cost effective and provides long-term environmental, financial, safety and quality of life benefits to the community.

Funding Options

The following section provides information about potential sources of funding for healthy watershed projects in the Lower Meramec Watershed. The following are a comprehensive listing of funding sources, however, there may be other sources of funding that are not included. By following the hyperlinks, online readers can explore funding options further. ***For an online, searchable version of this list, visit www.wichita.edu/mowatershedfunding.***

Consult your community's attorney and financial advisors prior to moving forward with any funding options. Any reference in this document to any person, or organization, or activities, products, or services related to such person or organization, or any linkages to the website of another party, do not constitute or imply the endorsement, recommendation, or favoring of companies or organizations.

GOVERNMENTAL GRANTS

Grants make funding available for a specific purpose. Some grants are available for projects that protect or enhance quality of life for community members. Other grants are available for projects that protect or enhance natural resources.

Grants have **eligibility** limitations. First, determine whether the grant would cover the project type. Then, decide if the grant amount is sufficient for the size and scope of the intended project, or, are multiple funding sources needed. Finally, read through the eligibility requirements to ensure the agency or organization who will apply for the grant is eligible to receive the funds.

For example, the Community Development Block Grant (CDBG) Program has two pools of funding. The State of Missouri CDBG funds are available for cities under 50,000 and counties under 200,000. For larger cities and counties, the CDBG Entitlement funds are available directly from the Department of Housing and Urban Development. In the Meramec Watershed, "entitlement" communities include Jefferson and St. Louis Counties, and the cities within those counties.

Most often, federal grants and programs are **competitive**. Communities, agencies and organizations are applying for limited funds, and there is rarely enough to fund all applications. To rise to the top, be sure to directly address how the healthy watershed project(s) in the proposal aligns with the grantor's stated mission and goals. Use language similar to the language the grantor uses in their mission, and give concrete examples of how the proposed project will help the grantor meet that mission. Show the grantors that their investment in your project will help them fulfill their mission.

Many federal grants require **match**. Match is a share of the costs that the grantee or its partners contribute to the grant project. Match shows the grantors that grantees are also invested in the project. Federal grants have standard regulations that govern what can be counted as match and how match should be documented. In most cases, other federal funds cannot be used to match a federal grant. Each grant is unique, but in most cases, besides actual dollars, match can include in-kind services like staff or volunteer time, materials or equipment donated or owned by other organizations, services paid for by another funding source and indirect costs.

MATCH

Partnerships with foundations or nonprofit organizations, such as The Nature Conservancy, on restoration or protection projects may be a way to secure matching funds and in-kind contributions which can leverage public dollars. A TNC partnership, or funding/support from another nonprofit organization or foundation, may be able to provide matching funds which can leverage public dollars.

Advantages	*Disadvantages*
• No repayment required • Large funding amounts may be available • Likely that grant program and HMP goals align • Typically, available to state, local governments, nonprofits, and tribes • Great way to test proof-of-concept • May help fund planning efforts	• Highly competitive • Often have a lengthy application process • Potential lengthy reporting requirements • Often strict in scope • Variable and limited funding amounts • May or may not be offered on a regular basis • May require matching funds • Typically, does not fund operations and maintenance (need to identify an additional funding stream for ongoing expenses)

Federal Grants & Programs

Federal Emergency Management Agency (FEMA)

Flood Mitigation Assistance (FMA) Grant | $25,000 - $10M

The Federal Emergency Management Agency (FEMA) provides funding through Flood Mitigation Assistance (FMA) grant to help reduce or eliminate risk of repetitive flood damage to buildings and other structures insured under the National Flood Insurance Program. Funded projects include wetland restoration/creation, floodplain and stream restoration, buyouts for open space preservation, demolition and much more. Local governments are sub-applicants and must apply to the state Hazard Mitigation Officer at the Missouri State Emergency Management Agency during the open application cycle.

Pre-Disaster Mitigation (PDM) Grant | $150,000 - $4M

FEMA provides funding through Pre-Disaster Mitigation (PDM) grant for planning, projects or public awareness to reduce future flood risks to the population or structures. Funded projects include flood mitigation planning, public education, saferooms, generators, sirens, etc. Local, state and tribal governments are eligible to apply, as well as territories. Local governments are sub-applicants and must apply to the state Hazard Mitigation Officer at the Missouri State Emergency Management Agency during the open application cycle.

The Hazard Mitigation Grant Program (HMGP) | formula based funding

HMGP is funding available to states, local governments, tribes and nonprofits when authorized under a Presidential Major Disaster Declaration, in areas of the state requested by the governor. HMGP's purpose is to help communities reduce future losses and break the cycle of damage from natural hazards. Funding may cover post-disaster projects like: flood-prone property acquisition, demolition, relocation, planning, open space preservation, bioretention, green infrastructure. Applications are submitted to the Missouri State Emergency Management Agency.

CASE STUDY

Jersey County, Illinois[20]

PROBLEM

Jersey County, Illinois is located near the confluence of the Illinois and Mississippi rivers. Large flood events in the mid-1990s resulted in Jersey County to be ranked one of the worst counties in Illinois for repetitive losses.

SOLUTION

In order to fight back against the cycle of "flood-damage-reconstruction-repeat," Jersey County began the hard work of applying for, obtaining and managing federal grant dollars for flood-risk mitigation activities. At the end of 1995, Jersey County had acquired and demolished 268 structures.

In 2002, Jersey County hired a fulltime floodplain coordinator to help coordinate flood mitigation efforts, and to work on the 50 National Flood Insurance Program violations revealed after a state audit. After 2002, an additional 147 structures were acquired or elevated.

Then, after a flood in 2008, the county and state agencies targeted the cabins on the flood-prone lands managed by the US Army Corps of Engineers (USACE) and successfully reduced future flood losses by acquiring and demolishing, or elevating, more than 100 cabins.

A 2019 study by the USACE found that for every $1 spent on mitigation, Jersey County saw $2.89 in avoided losses during the nine storm events from 1993 to 2017, a 289% return on investment.

FUNDING

Jersey County leveraged federal FEMA and state funding to acquire and demolish flood-prone property and structures.

REGULATORY ACTIONS

Jersey County worked with the Illinois Department of Natural Resources' Office of Water Resources to develop and enforce floodplain regulatory standards that are higher than FEMA's minimum standards. In Jersey County, structures with damage estimates greater than 50% of the market value are required to be brought into compliance with current flood protection codes. Some officials say that these regulatory actions have a greater impact on flood-risk mitigation than property acquisitions.

[20] U.S. Army Corps of Engineers, "Jersey County, Illinois Modified Loss Avoidance Study," March 2019. https://www.cabdirect.org/cabdirect/abstract/20083003415.

Department of Housing and Urban Development (HUD)

The Community Development Block Grant (CDBG) Entitlement Program | $10,000 - $750,000

The CDBG Entitlement Program provides entitled communities with resources to develop viable urban communities that include decent housing, a suitable living environment and economic opportunities. Activities must meet national objectives. Funds may be used for property acquisition, construction or improvement of public facilities (water, wastewater, streets, etc.) CDBG projects are encouraged to incorporate green infrastructure into design and construction.

Environmental Protection Agency (EPA)

Urban Waters Small Grants | $60,000

The EPA Urban Waters Program is helping grow local businesses and enhancing educational, recreational, social, and employment opportunities by investing in healthy and accessible urban waters. Funds community engagement, education, restoration projects, studies, planning and citizen science.

Environmental Justice Small Grants | $30,000

The EPA provides Environmental Justice Small Grant funding to community organizations and tribes to build partnerships and to work on projects to address environmental and/or public health issues in their community using the "Environmental Justice Collaborative Problem-Solving Model." Funds partnership building, public education, demonstration projects, and planning for local environmental or public health issues. Healthy watershed opportunities presented by Environmental Justice Small Grants are projects that engage the community around flood risk or water quality including sampling, stormwater, green infrastructure, emergency preparedness, disaster resiliency, environmental job training and youth development.

Wetland Program Development Grants | $100,000 - $300,000

Wetland Program Development Grants are planning grants. The purpose of this grant is to increase the capacity of all levels of government to develop and refine effective, comprehensive programs for wetland protection and management. Including healthy watershed options like floodplain restoration, green infrastructure, green space preservation and others into a wetland program plan may increase future support and implementation funding opportunities.

For an online, searchable version of this list, visit www.wichita.edu/mowatershedfunding, or click on the blue funding opportunity titles in this document to view more info online.

BRIC Program

The Building Resilient Infrastructure and Communities (BRIC) program, part of the Disaster Recovery Reform Act signed by the President in October 2018, will replace the Pre-disaster Mitigation Program at some point in the future. This program is a new mitigation program that is currently under rulemaking. After regulations and guidance are developed, the program will be announced through a Notice Of Funding Availability (NOFA). Be on the lookout for this opportunity.

U.S. Fish and Wildlife Service (USFWS)

National Fish Passage Program | average $70,000

The National Fish Passage Program provides financial and technical assistance to restore waterway connectivity. Inventories, assessments, research, levee breaches, road crossings, engineering and fish passage training are among the projects covered. After disasters, communities can reach out to USFWS to achieve flooding and wildlife benefits.

National Fish Habitat Partnership | variable

Through the National Fish Habitat Partnership, the USFWS invests along with Federal, State, Tribal and privately raised funds to conserve fish habitat. Healthy watersheds lead to healthy fish populations. Partnering with the Fish Habitat Partnership may lead to partnerships with co-benefits for fish and the local community.

Healthy watershed projects are not stand-alone projects, but can and should be incorporated into every housing, commercial, road, sidewalk, walking path construction or reconstruction project. One way to include green infrastructure throughout the community is by including bioretention, permeable pavement and tree trenches into projects funded by the US Department of Transportation (DOT).

The DOT provides funding through the Transportation Alternatives Program (TAP) program for a variety of smaller-scale transportation projects such as pedestrian and bicycle facilities, safe routes to school projects, community improvements such as historic preservation and vegetation management and environmental mitigation related to stormwater and habitat connectivity. Local match is required.

To incorporate green infrastructure into a transportation project, work with your local unit of government, local Metropolitan Planning Organization or state department of transportation to get healthy watershed project elements incorporated into projects.

State Grants & Programs

Missouri Department of Natural Resources

Section 319 Nonpoint Source Pollution Grants | $50,000 - $300,000

The EPA provides nonpoint source pollution funding to the Missouri Department of Natural Resources Section 319 Subgrants to assist communities/organizations that have approved Nine-Element Watershed Management Plans with the implementation of the plan's best management practices and associated activities in order to restore and protect waters that have been impaired or threatened by nonpoint source pollution (NPS). This grant can fund planning and implementation of the nine-element plan, land management practices, public outreach/education, demonstration projects and much more.

Missouri Department of Conservation

Community Conservation Grant | $50,000

The Community Conservation Grant Program provides funding for wildlife habitat, partnerships for land stewardship and natural landscape management training. These grants are open to local governments, schools and nonprofits and fund projects that include stream restoration, prairie reconstruction, forest management, wetland enhancement, wildlife habitat improvement and partner/staff training.

Community Conservation Cost Share | $15,000, plus more if population is over 100,000

MDC's Community Conservation Cost Share program promotes sustainable development practices and the establishment of natural resource conservation practices in urban and developing areas. Funding may go toward urban green space planning, engineering, native prairie restorations, forest management, invasive species control, and more. Local governments, schools and nonprofits are eligible.

Tree Resource Improvement and Maintenance (TRIM) Grant | $1,000 - $25,000
The TRIM program is designed to help Missouri communities initiate and improve their efforts to care for publicly owned trees. State and local governments, nonprofits and schools are eligible for projects that include tree projects on publicly owned land – tree planting, care, inventory, plan development, removal or pruning, volunteer, staff training and outreach.

Missouri Department of Economic Development
Community Development Block Grant (CDBG) State Program | $10,000 - $750,000
HUD provides funds through Missouri's Community Development Block Grant to help communities with resources to address a wide range of community development needs in unique ways that fit each community. CDBG strives to ensure affordable and safe housing, provide services to the most vulnerable in each community, and create jobs. Most CDBG projects present opportunities to incorporate healthy watershed projects like floodplain restoration, open-space preservation, bioretention and other green infrastructure.

Missouri Natural Resource Conservation Service
PL-566 Watershed Projects | variable
The PL-566 Watershed Project provides technical and financial assistance to help watersheds solve natural resource and related economic problems on a watershed basis. Funding can cover plan development, flood prevention and damage reduction, erosion and sediment control which could include floodplain restoration and bioretention, fish and wildlife habitat enhancement and much more. Local and state governments, soil and water conservation districts and watershed districts are eligible, and project applications must be submitted by local or state government sponsors and prioritized by the Missouri Soil and Water Conservation District Commission.

NON-GOVERNMENTAL ORGANIZATION GRANTS & PROGRAMS

Many foundations and charitable organizations have begun to support stormwater related projects through grants. These organizations are often interested in the quality of life or environmental benefits that the stormwater project will bring to the community. Innovative and demonstration projects are often highly regarded by these non-governmental organizations.

The most important thing you can do when writing a grant is to do your research. The more you know about the organization you are applying to, the better you will be able to explain how your project will help them fulfill their mission and goals. Reaching out to a staff member to gain insight about the organization will help identify where your project and their mission align. Then, be sure to highlight this alignment in the application. The staff member may also be able to speak

Advantages	*Disadvantages*
• No repayment required • Typically, no matching funds required • Application process may be simpler than government grants	• Highly competitive • May be limited on type of entity that can apply • Scope of grant and project may not align perfectly • Variable and limited funding amounts • Typically, does not fund operations and maintenance

CASE STUDY

Greenseams Program, Milwaukee, Wisconsin[21]

PROBLEM

Rapid population growth, 3.68% over the past 20 years, has, and will continue to, increase impervious surfaces in the Milwaukee region. Increased storm frequency, intensity, and a history of devastating floods (the 1997 and 1998 floods resulted in millions of dollars in damage), further exacerbate flood damage and cost of rehabilitating and rebuilding.

SOLUTION

The innovative flood management program, Greenseams, conserves and protects open spaces in the watershed where major suburban growth is expected. Milwaukee Metropolitan Sewerage District (MMSD) makes voluntary purchases of undeveloped properties along streams and wetlands to preserve land for infiltration and riparian services. Floodplain or wetland properties are chosen for their water-absorbing soils and their connection to public spaces or environmental corridors. The Greenseams program aims to create an area that can hold 1.3 billion gallons of water.

PROGRAM MANAGEMENT

The MMSD hired The Conservation Fund, a national nonprofit, to run Greenseams and complete the real estate transactions. The Conservation Fund develops partnerships and markets the Greenseams voluntary purchase opportunity to landowners.

ALIGNING GOALS

Environmental, social, agency and public benefits align in the Greenseams program. Environmental and agency outcomes include breaking the disaster-rebuild cycle, flood risk reduction, reduced water pollution, habitat preservation and flood management infrastructure protection.

The public finds benefits in the Greenseams properties because they are open to the public, provide residents with passive outdoor recreation opportunities (hiking, bird watching, cross country skiing, snow shoeing, etc.) and a destination that attracts visitors. Hunting and fishing are allowed, with proper permits, on designated lands.

When it's time for families to sell land, they choose Greenseams – so that the land remains undeveloped and open to the public in order to preserve the legacy of enjoying the natural landscape and wildlife that has been in the family for generations.

PROGRAM FUNDING

The Conservation Fund has an established revolving fund, established in 1986, that makes capital readily available for acquisition of lands with high conservation value. When funds are repaid, the money goes back into the pool to be ready for the next conservation opportunity.

Funding for land purchases come from the MMSD's general operative expenses. However, federal, state and local dollars are leveraged when possible. About 40% comes from outside funding. Project costs, outside of land purchase, come from grants, foundations, private donations, etc.

[21] https://www.mmsd.com/what-we-do/flood-management/greenseams

to new or arising interests the organization may have that could give an added boost to your application.

Missouri Conservation Heritage Foundation (MCHF)

Missouri Conservation Heritage Foundation | $500 - $5,000

The Missouri Conservation Heritage Foundation provides funding for projects that meet conservation and outdoor recreation goals of the organization. Funds projects which promote conservation, including species and natural community management and restoration, stream quality, good forest management practices, and watershed health.

National Fish and Wildlife Foundation (NFWF)

Monarch Butterfly and Pollinators Conservation Fund | $50,000 - $300,000

The Monarch Butterfly and Pollinators Conservation Fund supports projects that benefit monarch butterflies and one or more federally listed, candidate or proposed native insect pollinator species. Funded projects included floodplain or wetland restoration, removal of invasive species, restoration planning/design/permitting and bioretention.

Five-Star and Urban Waters Restoration Grants | $20,000 - $50,000

Five-Star Grants focus on stewardship and restoration of wetland and riparian ecosystems. Local and state governments, tribal governments, nonprofits and universities/colleges are eligible to apply. Funding priorities include habitat restoration, meaningful education, measurable benefits and partnerships.

Wells Fargo & NFWF

Resilient Communities Program | $200,000 - $500,000

Wells Fargo and the National Fish and Wildlife Foundation have partnered to provide Resilient Communities funding to help communities prepare for future impacts of sea-level rise, sustain water quality and quantity, and enhance forest conservation. Local governments, nonprofits and tribes are eligible. Funding can cover green infrastructure, bioretention, urban tree canopy, invasive species management, stream buffer enhancements and more.

American Water

Environmental Grant Program | $10,000

American Water's Environmental Grant Program provides funding to address watershed or source water protection in local communities in the American Water service area. Local governments, nonprofits and community groups are eligible to apply to fund projects that include floodplain and riparian restoration, reforestation, habitat restoration, watershed clean-up, outreach and education.

The Scherman Foundation Fund

Rosin Funds' Environment Program | $100,000 - $250,000

The Scherman Foundation provides grant funds to nonprofit organizations, through the Rosin Funds' Environmental Program, for innovative projects that have a transformative impact on a critical environmental issue. Nonprofits are eligible to apply with innovative, short-term and high-impact projects, including green infrastructure and open space, that address critical environmental issues.

PUBLIC – PRIVATE PARTNERSHIP

Public-Private Partnership | variety

A Public-Private Partnership allows businesses to fund public projects that help them meet their social or environmental goals to ensure a future that is financially sustainable. Eligible projects include planning, development, construction, acquisition, and operation, as well as a full range of healthy watershed activities. There are also "project banks" that allow communities to advertise projects to potential private partners for funding.

LOANS

Federal and state governments provide low-to-no-interest, short and long-term loan opportunities in order to help local governments install infrastructure that benefit the health, safety, economy and environment in our communities. Healthy watershed projects can be incorporated into larger infrastructure projects seeking loan funding.

Advantages	*Disadvantages*
• Not limited in size or scope of project • A few loan programs forgive a portion of the loan amount	• Repayment required • May require increasing of fees or rates to cover cost of repayment and interest

Missouri Department of Natural Resources

Clean Water State Revolving Fund | short-term (1-3 year) loan or long-term (20-year) loan

The Missouri Clean Water State Revolving Fund (CWSRF) provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. Local governments, businesses and nonprofits are eligible to apply. The EPA has identified the CWSRF as a funding resource for green infrastructure and stormwater projects.

Drinking Water State Revolving Fund | maximum funding is 30% of total available or $10M

The Missouri Drinking Water State Revolving Fund (DWSRF) provides communities a permanent, independent source of low-interest financing to construct drinking water projects that protect public health. This includes projects like source intake, wells, treatment plant, consolidation and much more. Incorporate healthy watershed options into project design where appropriate. Community public water systems as well as nonprofit and non-community public water systems are eligible to apply.

Environmental Protection Agency

Water Infrastructure Finance and Innovation Act (WIFIA)

$20M large communities, $5M small communities (25,000 or less), no more than 49% of project cost

The Water Infrastructure Finance and Innovation Act's purpose is to accelerate investment in our nations water and wastewater infrastructure by providing long-term, low-cost supplemental credit assistance under customized terms to creditworthy water and wastewater projects of national and regional significance. Local, state and federal governments as well as nonprofits, corporations, trusts and SRF programs are eligible to apply. Incorporate green infrastructure and healthy watershed opportunities into WIFIA projects through site design: green roof, pervious pavement, conservation of land, etc.

US Department of Agriculture (USDA)

Water & Waste Disposal Loan & Grant Program | variable, 40-year payback period

The Water and Waste Disposal Loan and Grant program helps very small, financially distressed rural communities extend and improve, among other priorities, stormwater collection, transmission and drainage that serves local households and businesses. Local and state governments as well as nonprofits and tribes are eligible to apply.

Department of Housing and Urban Development (HUD)

The Section 108 Loan Guarantee Program | typically $500,000 - $140M

The Section 108 program allows communities to transform a small portion of the Community Development Block Grant

(CDBG) funds into federally guaranteed loans large enough to pursue physical and economic revitalization projects capable of revitalizing entire neighborhoods.

BONDS

Bonds provide local governments the ability to borrow money to fund infrastructure projects, typically for a low-cost, tax-exempt rate of interest. Some types of bonds require voter approval, some do not. Consult your municipal attorney prior to moving forward with bond opportunities.

Advantages	*Disadvantages*
• Not limited in size or scope of project	• Repayment required • May require increasing of fees or rates to cover cost of repayment and interest

General Obligation Bond
Provides local governments the ability to borrow money to fund infrastructure projects, typically for a low-cost, tax-exempt rate of interest. Repayment as well as voter approval is required.

Revenue Bonds
Revenue Bonds are backed by the revenue generated by the project for which the bond is issued. The infrastructure projects these municipal bonds pay for, must generate revenue that then goes to pay back the interest and principal to the investors. Even though healthy watershed projects do not typically generate income, any revenue bond project can include healthy watershed practices. Voter approval may be required.

Green Bonds, Green-Muni Bonds, Climate Bonds or Environmental Bonds
Provides local governments the ability to borrow money to fund environmental, sustainable infrastructure projects, typically for a low-cost, tax-exempt rate of interest. These projects are not limited in size or scope, and they are tax-exempt and low-interest. Voter approval may be required.

Environmental Impact Bonds
Also known as Pay-For-Success Bonds, are a performance-based financing mechanism. Private funders provide upfront capital to fund the healthy watershed project. The local government's repayment is based on how the project measures up to pre-established goals. If the project underperforms, the investors the investor pays a "risk-sharing" payment. If the project performs well, the municipality pays an outcome payment. Environmental Impact Bonds allow communities to share the risks and rewards of financing large projects based on outcomes. Benefits include low interest rate, no limit in size or scope or project and the sharing of performance risk. Performance metrics are developed upfront, and performance data is collected during and after the project is completed to determine repayment.

REVENUE THAT BUILDS A DEDICATED FUNDING SOURCE

The development of a dedicated stormwater fund provides a secure funding source for planned projects, operations, maintenance, and could be a useful source to leverage local matching funds. There are several methods that can be used to develop the capital for a dedicated stormwater fund, including capital improvement plans, taxes, fees and incentive programs. There are advantages and disavantages to these types of dedicated funding sources:

Advantages	*Disadvantages*
• Not limited on project size • Not limited on project scope • Funds do not compete with other community priorities • Funds ongoing, available and flexible • Funds can go towards operations and maintenance • Funds can be set aside in reserve for future projects or priorities	• Decision-makers or public may be resistant to use political capital to implement a tax, fee, incentive program, etc. • Potential for increased burden on low-income residents

Capital Improvement Plan (CIP)

Capital Improvement Plans are non-binding, long-term planning documents that schedule major infrastructure improvements and spread the capital costs over many years to avoid large rate increases. Healthy watershed practices, like bioretention, green space preservation and floodplain restoration, are typically large undertakings and require significant time to develop, coordinate and fund. Incorporating healthy watershed practices into the CIP allows local governments to better understand and plan for long-term project and funding needs, and helps coordinate efforts, saving time and money.

Taxes

Taxes are often a go-to source for funding. In Missouri, sales and property taxes require voter approval. There are two key questions to ask before pursuing taxes as a stormwater funding source:

1. **Are your decision makers willing to go to the voters to ask them to vote "yes" on a tax for this purpose?**
2. **Are the voters willing to say "yes" to a tax for this purpose?**

Do not assume the answer will be "no." If flooding in your community is a major issue, a majority of residents may be proactive about solving the flooding issue, and their answer to the tax question may be a strong "yes." If you are unsure of the community's interest, make some informal or formal inquiries at various local meetings or groups. As you reach out to educate the community, find out their willingness to pay. Conduct a social media survey.

If the community is not interested in paying for stormwater with their tax dollars, move on to other funding sources. If it is determined that the community would be supportive of a tax to fund stormwater efforts to reduce flood risks, the next step is to start a conversation with your city/county attorney. There are a wide variety of taxing options, and each community is

CASE STUDY

Sales Tax, Eureka and Pacific, Missouri

PROBLEM

Frequent flooding is taking a toll on the communities' bridges, roadways and structures.

SOLUTION

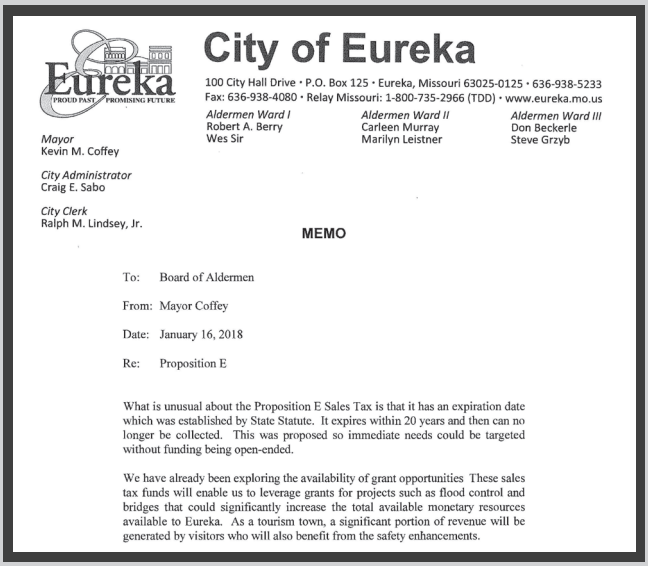
In 2018, the City of Eureka, Missouri approved a 0.5% sales tax that covers three public safety efforts; 1) police facility and equipment, 2) bridge and roadway infrastructure improvements, 3) flood control measures. Estimates indicate that the sales tax will generate $15.8M over 20 years, $2M of which will go towards flood risk reduction projects identified by the US Army Corps of Engineers' flood study.

In 2019, the City of Pacific, Missouri approved a 0.5% sales tax to benefit parks and stormwater improvements. It is estimated that the tax will generate $400,000 annually.

PUBLIC OUTREACH

In Missouri, new taxes require voter approval. No one gets excited about paying more taxes. "Making the case" that the tax increase will improve lives and the benefits will outweigh the costs is vital to the successful passing of a new tax.

More information and details about what tax revenues will go towards, highlighting the need and the cost of not completing the proposed projects, is key to winning community buy-in. The City of Eureka developed a Proposition E Fact Sheet and a letter from the mayor and shared the reports highlighting the need for the investments.



Eureka
PROUD PAST ... PROMISING FUTURE

City of Eureka

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Aldermen Ward I
Robert A. Berry
Wes Sir

Aldermen Ward II
Carleen Murray
Marilyn Leistner

Aldermen Ward III
Don Beckerle
Steve Grzyb

Mayor
Kevin M. Coffey

City Administrator
Craig E. Sabo

City Clerk
Ralph M. Lindsey, Jr.

MEMO

To: Board of Aldermen

From: Mayor Coffey

Date: January 16, 2018

Re: Proposition E

What is unusual about the Proposition E Sales Tax is that it has an expiration date which was established by State Statute. It expires within 20 years and then can no longer be collected. This was proposed so immediate needs could be targeted without funding being open-ended.

We have already been exploring the availability of grant opportunities These sales tax funds will enable us to leverage grants for projects such as flood control and bridges that could significantly increase the total available monetary resources available to Eureka. As a tourism town, a significant portion of revenue will be generated by visitors who will also benefit from the safety enhancements.

different. It is important that each community assess their own tax payers willingness to pay and implement the type of tax that is equitable and appropriate. Do not assume your community will vote exactly like neighboring communities.

Sales Tax

Sales tax is levied at the point of sale and can become a dedicated funding source. However, sales tax increases often requite voter approval and may be viewed as a burden on the community.

Watershed Improvement District

A Watershed Improvement District is a special taxing district, governed by an appointed board of trustees, that implements projects that protect the watershed and prevent flood damage. Benefits are that proceeds collected can be used on a wide range of public purposes, including stormwater infrastructure.

Community Improvement District

A Community Improvement District is a special purpose district whose property owners voluntarily tax themselves to fund public improvements or services to support the community and promote economic development. This allows local residents to obtain the expanded services they want at a price they are willing to pay.

Neighborhood Improvement District

A Neighborhood Improvement District is a special taxing district whose property owners voluntarily tax themselves to fund public improvements or services to support the community. Eligible improvements include stormwater projects, engineering, gutters, parks, property acquisition, sidewalks, signage and more.

Tax Increment Financing (TIF)

Tax Increment Financing is a local economic development tool that leverages new property taxes generated by public projects in a specified district. The purpose is to fund public infrastructure or facilities to stimulate economic development. TIFs can be used to service bond payments for large-scale healthy watershed projects. The TIF revenue can be used as a stable funding source for small project implementation, as well as operations and maintenance of previously built healthy watershed projects.

Soil and Water Conservation Subdistrict

A Soil and Water Conservation Subdistrict may be formed to carry out watershed protection and flood prevention programs. This allows landowners to develop and implement a plan for the properties in their watershed to reduce flooding and increase watershed protection.

Funding Options Quick-List

View all of the Meramec Healthy Watershed funding options in one list by downloading our funding "quick-list" Microsoft Excel file here. Also see Appendix B of this report for a printable quick-list page.

Fees

Fees are another way to build a dedicated fund for stormwater. Since stormwater management service is similar to drinking water and wastewater service, the model is growing in popularity. Utility fees may not require voter approval, but can cost decision makers political capital, so providing decision makers with solid rationale and return on investment information is crucial to support and implementation.

Stormwater Fee

Stormwater fees are a fee for service of providing conveyance of stormwater away from properties' impervious surfaces into collection systems, natural drainage or waterways. These fees are based on the contribution of stormwater to the city's stormwater management system and implemented by the stormwater utility or local government to cover the costs of stormwater infrastructure's operation and maintenance. Stormwater fees represent the most equitable way for the community to share the cost of the public service of stormwater management and provides dedicated funds for stormwater projects. However, in Missouri, developing and implementing the fee structure can be a major undertaking and may require a public vote.

Development Impact Fee

A one-time fee assessed by a local government on new development to pay for all or a portion of the costs of providing public services to the new development. Development impact fees help to create dedicated funds for expanding utilities, including water, wastewater, stormwater and more.

Fee In-Lieu of Stormwater Management Practices

In-Lieu Fees allow developers to opt-out of stormwater management by paying a sponsor (nonprofit, local government, etc.) a fee. Those fees become dedicated funds for stormwater projects.

On-Bill Donations

On-Bill Donations are voluntary payments from utility customers to a dedicated fund, foundation or trust that uses funds for specified healthy watershed projects. When implementing this type of program, be sure to show your community how these donations help to meet your community or utility's mission. Basic level-of-service should be funded by rates, fees and taxes – not donations.

Incentive Programs

Incentives are typically one-time payments or other "perks" that encourage the implementation of a best management practice or other behavior or project that helps a community meet their flood reduction or stormwater goals. Incentives could include, but are not limited to: reduced permit fees, reduced permitting time, tax credits, zoning exceptions, recognition or rebates. Get creative and make the incentives specific to your community.

Environmental Incentives or Pay-for-Performance

Environmental incentives, also known as pay-for-performance, are financial incentives for private companies, property owners or government agencies to implement environmental or healthy watershed projects. This economic incentive program links payment to measurable outcomes, while increasing public trust. Environmental incentives focus on project effectiveness, not the lowest-cost. For example, California's Mokelumne Watershed Environmental Benefits Program provides land manager incentives to implement best practices like forest, meadow and streamside restoration, that ensure watershed sustainability. Environmental benefits are tracked, incentives are provided accordingly, and credits/incentives can be traded.

Stormwater Credits

Stormwater credits are financial incentives given to property owners (homeowners and/or businesses) who reduce their property's stormwater runoff by installing green infrastructure (bioretention, rain gardens, permeable pavement, green roofs, etc.). Some programs allow credits to be sold or traded to other property owners. Stormwater credit programs enhance the perception of "user fees" because they recognize stormwater reduction actions, and give homeowners and businesses voluntary control over their fees.

Stormwater and Development Incentives

A stormwater or development incentive program gives one-time incentives to property owners or developers to implement healthy watershed practices on-site. Incentives could include, but are not limited to: reduced permit fees, reduced permitting time, tax credits, zoning exceptions, recognition or rebates. Be creative and make the incentives specific to your community. There is great potential to see stormwater benefits that outweigh the cost of program implementation.

MATERIALS AND SERVICES RESOURCES

Communities can also access technical assistance, materials and other services that could help implement healthy watershed projects more cost-effectively, with more input from experts. These resources could also help leverage other types of funding and act as match.

Technical Assistance

Greening America's Communities

Each year, through the Greening America's Communities program, the EPA helps 3-4 cities and towns develop an implementable vision of environmentally friendly neighborhoods that incorporate innovative green infrastructure and other sustainable design strategies. Local governments, cities, counties and nonprofits partnering with a city or county are eligible to apply.

Rivers, Trails and Conservation Assistance Program

The National Parks Service's River, Trails and Conservation Assistance program supports community-led natural resource conservation and outdoor recreation projects across the nation by providing a wide range of services and skills. Projects that may align with healthy watershed opportunities are: improved access to outdoor recreation and parks, conservation and stewardship of public lands, waterways and wildlife habitat, connecting young people to the outdoors and strengthening community partnerships.

Building Blocks for Sustainable Communities

Each year, through the Building Blocks for Sustainable Communities program, EPA provides technical assistance to a few communities, delivered by a team of experts, with experience in an area of need, that helps to address the threats of natural disasters. The experts provide tools and guidance to the community in order to protect the people, economy and quality of life in the community.

Land Easements

The Emergency Watershed Protection Program – Floodplain Easements

The Emergency Watershed Protection Program can be used when acquiring an easement in lieu of recovery measures and is the most economical and prudent approach to reduce flood risk. Easements are great options for accomplishing floodplain restoration, and may also include demolition of structures and debris removal.

Materials

Forest ReLeaf of Missouri Grants

Forest ReLeaf of Missouri provides trees to communities in order to restore and sustain urban forests. The Priority ReLeaf program can fund up to 300 trees per season (spring and fall) and provides trees post-disaster. With the help of thousands of volunteers, Forest ReLeaf has planted over 200,000 trees throughout Missouri and Illinois, improving thousands of communities.

Other

404 Mitigation Credits, In-Lieu Fees – Land Learning Foundation

Developers can pay in-lieu fees to a sponsor, like the Land Learning Foundation through their 404 Mitigation Credits program, for damages to wetlands and streams. The fee represents the expected cost of replacing the stream or wetland functions lost due to development. At no-cost to local jurisdictions, the Land Learning Institute or other in-lieu sponsors, may be potential partners in providing targeted land acquisition, floodplain restoration and other healthy watershed projects.

Campus RainWorks Challenge – outreach, education, demonstration

The Campus RainWorks Challenge is a green infrastructure design competition, through the EPA, for colleges and universities. Student groups can develop a plan for a green infrastructure project or implement a demonstration project. Working with a local college or university is a positive and fun way to educate and engage the community in the stormwater conversation.

New! Meramec Healthy Watershed Online Funding Database

Interested in learning more details about a specific funding opportunity described in this report? Check out the WSU Environmental Finance Center's online searchable database of healthy watershed funding opportunities. Filter or search for opportunities based on your community's needs, and find helpful links to additional resources and information.

www.wichita.edu/mowatershedfunding

Appendix A

Model CBA Calculation Methodology

Costs for the Meramec Models vary due to land values, geography, current land development and size of the 1% AEP. For each community, a low-cost estimate and high-cost estimate were calculated to ensure that a full range of potential costs was considered in the scores.

To account for the time value of money concept, which says that a dollar earned today is less than a dollar earned in the future, net present value was used to compare costs to benefits. Net present values are calculated using a discount rate.

Discount rates in these calculations are listed at 5% and 10%. Higher discount rates (10%) reflect a determination that inflation rates will be high over time and places more emphasis on current costs and benefits. Lower discount rates (5%) reflect a determination that inflation rates will be low over time and emphasizes current spending for future impacts. Municipalities should work with financial advisors to determine the appropriate discount rate to use for cost-benefit analysis and project decision-making in their communities.

Low-Acreage Community Model CBA

Cities with less than 25 acres in the 1% AEP

The Low-Acreage Community Model, for communities with less than 25 acres in the 1% AEP, includes:

- One acre of developed park land
- Floodplain restoration on the remaining land within the 1% AEP
- Dirt trails installed[1]; 2 to 3-feet wide, 417 linear feet per acre
- All features include installation and maintenance[2] over 20 years

Kirkwood | 14.3 acres in the 1% AEP

The cost range for 1 acre of developed park land and 13.3 acres of floodplain restoration is estimated to be between $186,331-$456,494. Benefits are calculated using FEMA's benefit-cost analysis methodology[3] for green open space and floodplain. Additionally, the average annual cost of insurance payouts is included in the calculation. The total benefit is $498,403 per year. Based on USACE reports, the buyback costs are calculated at $739,800. The total acquisition and treatment costs total $928,429-$1,196,294. The total maintenance costs are estimated at $18,333-$19,332 per year after the treatment year.

Low Estimate Calculations

Using net present value (NPV), costs over 20 years are $1,101,006 (10% Discount Rate) to $1,177,762 (5% Discount Rate). Total benefits equals $6,521,734 (5%) and $4,667,512 (10%). The CBA score is between 4.24 (10%) and 5.54 (5%) when the lower cost estimates are used in the calculations.

High Estimate Calculations

Using NPV, costs over 20 years are $1,377,231 (10%) to $1,457,705 (5%). Total benefits are between $4,667,511 (10%) and $6,521,774 (5%). The CBA score is between 3.38 (10%) and 4.47 (5%) when the lower cost estimates are used in the calculations. This treatment plan appears to be cost-effective over a 20-year lifespan.

[1] Dirt trail installation estimates were calculated with the assumption that the paths would be twice the length of the total area. Calculation: the square root of the number of square feet in an acre (43,560 square feet per acre) is approximately 208 feet, which is the total length of one side of the perimeter of the area. Then, that total was multiplied by two, totaling approximately 417 linear feet.

[2] Annual maintenance costs for park land are estimated at $18,000 annually per acre. Annual maintenance costs for trails are estimated at $333-$1,332 per year.

[3] *Final Sustainability Benefits Methodology Report, August 23, 2012*

Wildwood | 24.63 acres in the 1% AEP
The cost range for one acre of developed park land and 23.63 acres of floodplain restoration is estimated to be between $292,218-$772,215. Benefits are estimated to be $879,410. Buyback costs are between $1,420,818-$1,900,816. The total maintenance costs per year after treatment are estimated at $20,367.

Low Estimate Calculations
NPV costs over 20 years are $1,506,337 (10%)-$1,575,506 (5%). The benefits range from $8,340,667 (10%)-$11,654,163 (5%). The CBA score ranges from 5.54 to 7.40.

High Estimate Calculations
NPV costs over 20 years are $2,001,187 (10%) - 2,076,961 (5%). The benefits range from $8,340,667 (10%) - $11,654,163(5%). The CBA score ranges from 4.17 and 5.61.

Community Model CBA
Cities with 25 acres or more in the 1% AEP

Arnold | 285.93 acres in the 1% AEP
Costs for installation plus buyback are between $9,044,403 (low-cost estimates) and $14,791,028 (high-cost estimates). Benefits are expected to be $10,463,129 per year. The CBA score range is 10.58 (10%)-14.44 (5%) for the low-cost estimates and 6.53 (10%)-8.95 (5%) for high-cost estimates.

Eureka | 153.63 acres in the 1% AEP
Costs for installation plus buyback are between $47,175,131-$50,212,233. Benefits are expected to be $5,621,812 per year. The CBA score range is 1.16 (10%)-1.61 (5%) for the low-cost estimates and 1.09 (10%)-1.51 (5%) for high-cost estimates.

Fenton | 112.39 acres in the 1% AEP
Costs for installation plus buyback are between $43,511,523-$48,943,778. Benefits are expected $4,112,709 per year. The CBA score range is 0.94 (10)-1.31 (5%) for the low-cost estimates and 0.83 (10%)-1.15 (5%) for high-cost estimates.

Pacific | 410.88 acres in the 1% AEP
Costs for installation plus buyback are between $50,335,979-$58,618,757. Benefits are expected to be $15,035,428 per year. The CBA score range is 2.80 (10%)-3.87 (5%) for the low-cost estimates and 2.40 (10%)-3.32 (5%) for high-cost estimates.

Sunset Hills | 256.66 acres in the 1% AEP
Costs for installation plus buyback are between $24,285,590-$29,447,006. Benefits are expected to be $9,392,010 per year. The CBA score range is 3.58 (10%)-4.97 (5%) for the low-cost estimates and 2.95 (10%)-4.08 (5%) for high-cost estimates.

Valley Park | 113.78 acres in the 1% AEP
Costs for installation plus buyback are between $20,121,905-$22,410,013. Benefits are expected to be $4,163,574 per year. The CBA score range is 2.28 (10%)-3.15 (5%) for the low-cost estimates and 2.05 (10%)-2.83 (5%) for high-cost estimates.

Net Present Value

Money in the present is worth more than the same amount of money in the future because of inflation and the earning potential of other investments that could be made during the same period.

A dollar earned in the future won't be worth as much as one earned in the present.

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

NPV = (Today's value of expected cash flows) – (Today's value of invested cash)

County Model CBA Details

Counties with available data in the Lower Meramec Watershed

Jefferson County | 1,550.65 acres in the 1% AEP

Costs for installation plus buyback are between $26,558,098-$57,741629. Benefits are expected to be $57,103,478. The CBA score range is 18.39 (10%)-24.65 (5%) for the low-cost estimates and 8.75 (10%)-11.89 (5%) for high-cost estimates.

St. Louis County | 1,263.30 acres in the 1% AEP

Costs for installation plus buyback are between $44,678,079-$70,122,081. Benefits are expected to be $47,376160 per year. The CBA score range is 12.72 (10%)-12.72 (5%) for the low-cost estimates and 6.00 (10%)-8.21 (5%) for high-cost estimates.

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Appendix B

Meramec Healthy Watershed Options Project: Grant Funding Sources Quick List

$ = less than$ 5,000 $$ = $5,001 - $15,000
$$$ = $15,001 - $50,000 $$$$ = $50,001+

G - local gov't
N - nonprofit, schools, etc
P - Individual property owners
B - businesses, commercial

	Grant Name	Funding Organization	Funding Amount	Match Required	Flood Prone Property Asquisition	Demolition	Floodplain Restoration	Green Open Space	Bioretention	Planning	Education	GI Incorporation Encouraged	Who's Eligible?	Level of Effort
Federal Grant	Flood Mitigation Assistance (FMA)	FEMA	$$$$	75-25	X	X	X	X	X	X		X	G	High
	Pre-Disaster Mitigation (PDM)	FEMA	$$$$	75-25	X	X		X	X	X	X	X	G	High
	Hazard Mitigation Grant Program (HMGP)	FEMA, SEMA	$$$$	75-25	X	X		X	X	X	X	X	GN	High
	Community Development Block Grant Entitlement Program	HUD	$$$$	various	X	X			X			X	G	High
	Urban Waters Small Grants	EPA	$$$$	?					X		X	X	GN	High
	Environmental Justice Small Grants	EPA	$$$	No			X		X	X	X	X	N	High
	Wetland Program Development Grant	EPA	Variable				X						G	Medium
	National Fish Passage Program	FWS	Variable	dam, culvert, barrier removal									G	High
	National Fish Habitate Partnership	FWS	Variable				X						G	High
State Grants	Community Conservation Cost Share	MDC	$$$	50-75%			X	X	X	X		X	GN	Medium
	Tree Resource Improvement and Maintenance	MDC	$ - $$$	60-40 If Tree City USA 75-25			X	X		X	X		GN	Low
	Community Development Block Grant State Program	MODED	$$$$	Varies	X		X	X	X			X	G	High
	PL-566 Watershed Projects	MoNRCS, USDA	Variable	Varies			X	X	X	X			G	High
NGO Grants or Programs	Missouri Conservation Hertage Foundation	MDC	$-$$$$	Preferred			X	X	X		X		MO Dept of Conservation	Medium
	Five-Star and Urban Waters Restoration Grant	NFWF	$$$	50-50			X				X		GN	Medium
	Monarch Butterfly and Polinators Conservation Fund	NFWF	$$$$	50-50			X	X	X	X			GN	Medium
	Resilient Communities Program	NFWF & Wells Fargo	$$$$	50-50	X	X	X	X	X	X	X	X	GN	Medium
	Environmental Grant Program	American Water	$$	No			X	X	X		X		GN	High
	Rosin Fund	Scherman Foundation	$$$$				X	X	X	X	X	X	GNPB	Medium
	Public - Private Partnership		Variable	No	X	X	X	X	X	X	X		GNPB	High
Loans	Clean Water State Revolving Loan Fund	EPA & MDNR	$$$$	No			X	X	X			X	GNB	Medium
	Drinking Water State Revolving Loan Fund	EPA & MDNR					X	X	X			X	G	Medium
	Water Infrastructure Finance and Innovation Act	EPA	$$$$	49-51 (can use SRF for 51%)	X	X	X			X			GNB	Medium
	Water and Waste Disposal Loan and Grant	USDA			X		X		X				GN	Medium
	Section 108 Loan Guarantee Program	HUD	$$$$	(in combo with CDBG)	X	X			X			X	G	Medium
Bonds	General Obligation Bonds		Variable	No	X	X	X	X	X				G	Medium
	Revenue Bonds		Variable	No	X	X	X	X	X				G	High
	Green or Environmental Bonds		Variable	No	X	X	X	X	X				G	Medium
	Environmental Impact Bonds	Private Funders; Local	Variable	No	X	X	X	X	X				GPB	High
Revenue that Builds Dedicated Funding	Include HWO in the Capital Improvement Plan		Variable	No	X	X	X	X	X	X	X	X	G	Medium
	Sales Tax	Community and those visiting community	Variable	No	X	X	X	X	X	X	X		G	High
	Watershed Improvement District Tax	From property tax	Variable	No	X	X	X	X	X	X	X		G	High
	Community Improvement District Tax	Non-profit corporation or political subdivision	Variable	No	X	X	X	X	X	X	X		G	High
	Neighborhood Improvement District Tax	Community	Variable	No	X	X	X	X	X	X	X		G	High
	Tax Increment Financing District	From property tax	Variable	No	X	X	X	X	X	X	X		G	High
	Soil and Water Conservation Subdistrict Tax	Property Owners	Variable	No	X	X	X	X	X	X	X		G	High
	Stormwater Fee	Tax Payers	Variable	No	X	X	X	X	X	X	X	X	G	High
	Development Impact Fee	Developer	Variable	No	X	X	X	X	X	X	X		B	Medium
	Fee "in-lieu" of Stormwater Management Practices	Developer	Variable	No	X	X	X	X	X	X	X		G	Medium
	On-Bill Donations	Homeowners, property	Variable	No					X		X		G	Low
Incentive Programs	Enviornmental Incentives - Pay for Performance	Businesses, property owners or government agencies		NA		X	X	X	X			X	GNBP	High
	Stormwater Credits	Homeowners, business owners, property owners		NA		X		X	X			X	GNBP	Medium
	Development and Stormwater Incentives	Homeowners, business owners, property owners		NA		X	X	X	X			X	GNBP	Medium
Materials and Services Resources	Greening America's Communities	EPA	Technical Assistance				X	X	X	X	X	X	G	Low
	Rivers, Trails and Conservation Assistance	NPS	Technical Assistance				X	X		X	X		GN	Low
	Building Blocks for Sustainable Communities	EPA	Technical Assistance	No						X	X		GN	Medium
	Emergency Watershed Protection - Floodplain Easement Options	NRCS, USDA	Variable	No	X	X	X						P	Low
	Forrest ReLeaf of Missouri	Missouri ReLeaf	300 trees per season	No									GN	Low
	404 Mitigation Credits	Land Learning Foundation			X	X	X	X	X				GPNPB	Medium
	Rainworks Challenge	EPA	Project planning, design, implementation						X	X	X	X	N	Medium