



# LOUISIANA WATERSHED INITIATIVE

working together for sustainability and resilience

## Strategies for Funding Watershed Management and Flood Risk Reduction in Louisiana

**MARCH 2021**

**Author:** *Stephen C. Picou, Adaptation Strategies*

**With contributions from:** *Grasshopper Mendoza, CFM;  
Andrea B. Calvin, Ph.D.; and Tara Tolford, AICP, Adaptation Strategies*

### Introduction

Floods are the most frequently occurring disaster on the planet, and a growing number of financial tools, techniques and systems are emerging to address this reality. Watershed-oriented flood management is a relatively new approach, and the Louisiana Watershed Initiative is at the forefront of efforts by several states to adopt similar methods.

Because watershed and flood risk management involve complex systems, best practices for long-term funding inevitably require multiple sources and a mix of mechanisms and organizations to receive and manage funds. As an examination of funding mechanisms, this paper aims to introduce the reader to new strategies to consider in developing funding strategies. Some of these strategies are familiar, some new to Louisiana; all have potential to generate substantial revenue streams.

Our success in designing and funding policies and programs necessary for effective watershed-based solutions will determine the fate of current and future generations living in Louisiana.



## Table of Contents

---

Funding Fundamentals .....	3
Methodology and Findings .....	4
A Selection of Funding Strategies .....	6
Other Management Strategies.....	11
Flood-Ready = Fund-Ready .....	14
Conclusion .....	18
Suggested Reading .....	19
Works Cited .....	20
Appendix A: Research Locations Table .....	24
Appendix B: Water Use Potential Revenue Table .....	28



## Funding Fundamentals

Funds arise from two sources: public and private. Public funds include general budget outlays, grants and distribution of revenue from taxes, fees and penalties, as well as from debt-obligation mechanisms such as bonds and loans. Private sources include philanthropy, donations and public-private partnership models.

Funding effective watershed management and flood risk reduction requires every available source. Successful programming uses an “all hands” approach connecting people across demographic groups as well as professional and governmental systems. Large infrastructure funding gaps are a national issue ([ASCE, 2020](#)), and the federal government depends upon deficit spending. States are prevented from deficit spending and depend upon a combination of federal, state and local mechanisms to achieve even modest infrastructure investments and maintenance.

### The range of public funding mechanisms supporting watershed management includes:

- Stormwater fees and other fee structures
- Property taxes and special assessments
- Sales taxes
- Bonds including general obligation, revenue and green bonds
- General budget outlays and capital outlays
- Federal and state grants
- Infrastructure banks
- Revolving loan funds
- Tax Increment Financing and special improvement districts
- Carbon and resource pricing/trading systems

### Private and nongovernmental funding mechanisms include:

- Philanthropy
- Public-private partnerships
- Mitigation banks
- Land trusts
- Brownfields and other remediation projects
- Bonds

See *Suggested Readings* for a list of funding guides and resources.





## Methodology and Findings

---

Watershed-oriented and flood risk reduction funding strategies were evaluated to determine key aspects of funding, operational best practices and equity framework. This paper provides examples of successful funding strategies from various programs in the U.S. that can be replicated or adapted in Louisiana.

### Questions addressed include:

Genesis of the funding source

- What is the genesis of the funding source? Legislation?

Characteristics of the funding source

- Is the funding source recurring and from a consistent source?
- Did fees or taxes require authorization (and often regular reauthorization) by legislative bodies or the vote of the citizenry?
- Is there a mandated equity component?
- Is there an effective website, funding guide or portal?

Applicability to Louisiana

- Is the funding source applicable to Louisiana? If so, how?

## RESULTS

**Geography and Population:** Appendix A explores varied approaches side-by-side. The locations ranged widely in geographic scale and population. From small towns like Nashville, North Carolina, with a population of 5,500 in a 4.7-square mile land area, to large states like Texas with a population of 29 million and a land area of nearly 87,000-square miles, flood risk mitigation and best practices for watershed management are addressable at all scales from yards and neighborhoods to sprawling, multi-state efforts.

**Programs:** Appendix A also shows that with variance in geography and population, programmatic efforts ranged widely (dependent on each state's particular issues and organizational structure), but generally included stormwater, nature-based solutions, green infrastructure, infrastructure, climate change adaptation, watersheds, water quantity and quality solutions, as well as holistic approaches, such as transportation and quality of life issues.



### State and local governments are:

- Leveraging existing federal and state funding opportunities to build upon stormwater, NBS, GI, watershed, hazard mitigation and climate adaptation activities
- Using a nonprofit organization to coordinate funding and standards among watersheds in support of education and outreach efforts
- Financing through infrastructure banks to accelerate project, economic and workforce development
- Looking holistically at stormwater, NBS, GI, green spaces, public recreation, transportation and social equity
- Using sales taxes, property taxes and bonds to focus on environmental issues
- Establishing new user and impact fees as a means of long-term financing of stormwater infrastructure
- Creating watershed-scale entities with jurisdiction over an entire watershed
- Investing in combinations of green and gray infrastructure
- Educating citizens on flood risk and the need for hazard-resistant development standards, taxes and fees to support solutions
- Using funding received through carbon pricing programs to fund watershed and flood risk management
- Assessing fees on commercial users of water resources to fund water management

### The findings of this analysis include:

- The stability of long-term funding requires a mix of funding sources.
- The organization of flood mitigation programs occurs at different levels, from local to regional to state, and can be conducted by governmental, quasi-governmental or nonprofit organizations.
- Jurisdictions of vastly different sizes – geographically and in terms of populations – can implement stormwater, watershed and climate resilience programs.
- Most funding approaches require specialized legislation or a vote.
- Educating the citizenry and elected officials early in the process is necessary to gain support.

While no “silver bullet” or singular solution emerged, the options and approaches highlighted in this paper, in combination with existing efforts, can address Louisiana’s long-term funding goals.



## A Selection of Funding Strategies

All of the projects, initiatives and locations reviewed used a combination of funding strategies from federal and state programs and grants, to local budgets, fees and taxes, to investment by commercial and philanthropic entities. Funding mechanisms varied by location and were based on factors such as geography, history of flooding and natural disasters, population, urban density and other needs.

### USER FEES

Louisiana is water-rich, but the state barely taps into this wealth. Water use is one of the easiest metrics to assess, predict and improve. Nationally, more than 82 billion gallons per day of freshwater are drawn from aquifers ([NGWA, 2020](#)). In Louisiana, the number is 1.7 billion gallons per day of groundwater and 6.7 billion from surface waters like the Mississippi River, mostly for energy and industrial production, and mostly at no cost ([DOTD, 2015](#)). In a 2020 report, Louisiana's Management of Water Resources, the Legislative Auditor noted that a statewide water use plan, as proposed by numerous studies over the decades, is yet to be drafted ([LLA, 2020](#)).

Freshwater is freely extracted in most locations throughout the United States. Of the locations that do charge, fees vary widely, as do systems of measurement. For example, prices per acre-foot range from a dollar to more than \$1,000 ([NGWA, 2020](#)). In California, at an average of \$40 per acre-foot, the fee equates to \$123 per million gallons ([Baldocchi, 2018](#)).

### CAPITAL AREA GROUNDWATER COMMISSION

The six-parish Capital Area Groundwater Conservation Commission, administered within the Department of Natural Resources, is responsible for a user fee-based system that seeks to protect public water resources from over-extraction. Fees currently support research and policy development. Today, the Capital Area Groundwater Conservation Commission charges a fee of \$20 per million gallons. In 2018, the fee was only \$10 per million gallons and generated nearly six hundred thousand dollars that year ([LLA, 2019](#)). At the 2018 rate, potential revenue from all of Louisiana's commercial water use would produce in the range of \$30 million annually for the state (see Appendix B).



## STORMWATER FEES

*“Stormwater utility fees are generally the most effective means to ensure a stable, consistent revenue stream to implement a green infrastructure plan.” (EPA, 2014)*

In developed regions, our homes, businesses, streets and parking lots contribute significantly to everyday flooding and pollution at a cost easily calculated. Stormwater fees based on local calculations provide predictable annual funding for water-related public services and infrastructure.

As of 2018, more than 1,700 districts in 21 states use stormwater fees ([Black and Veatch 2018](#)). The EPA finds that these fees are generally more equitable than other revenue sources because they can be based on the city’s actual cost to manage stormwater from each property. Additionally, tax-exempt properties, such as universities and hospitals, can be required to pay their share of stormwater management costs. Stormwater utilities often use incentives for property owners to invest in green infrastructure ([EPA, 2014](#)).

### TULSA, OK

Tulsa, having a population similar to New Orleans, suffered a deadly flood in 1984. Two years later, the city enacted a stormwater fee and a phased implementation program for stormwater projects and buyouts identified in the city’s basin drainage plans. Tulsa’s stormwater fee is assessed at \$8.35 a month per equivalency service unit, the projected annual cost of maintaining 2,650 square feet of property ([City of Tulsa, 2020](#)). A residential property counts for one ESU per month per developed parcel. Fees for multifamily, commercial and industrial properties are calculated as the number of ESUs, in total square feet. The fee generates approximately \$9 million per year ([Averill, 2019](#)).

### NASHVILLE, TN

To meet existing and anticipated stormwater infrastructure, water quality and flood management needs, the city of Nashville instituted a stormwater fee in 2017 ([City of Nashville, 2020](#)). The fee generates about \$34 million per year for the city of nearly 1.2 million ([Garrison, 2017](#)). While nationally, stormwater fees generally range from \$2 to \$30 per typical residence, with a median of \$6.67, Nashville is slightly below the national median at \$6.00 for a “typical” residential property. The program features several creative incentives, such as a stormwater education credit ([Metro Water Services, 2016](#)).

### NASHVILLE, NC

Demonstrating the applicability of stormwater fees throughout a wide range of jurisdictions, the town of Nashville, with a population of about 5,000, approved an [ad valorem stormwater fee](#) in 2017 to fund storm drain and ditch maintenance. The fee of \$2.50 per month, or \$30 per year per residential property, or \$30 per 2,500 square-feet of impervious surface for non-residential property, generates approximately \$140,000 per year for the municipality, supporting the development of a new stormwater division within the public works department ([Town of Nashville, n.d.](#); [UNC, 2020](#)).

## INFRASTRUCTURE BANK

An infrastructure bank supports and finances investment in a wide range of projects via the issuance of bonds, loans and grants and the mobilization of public and private capital sources. Financing can be used as seed money to jump-start federal and state-funded projects. In addition, infrastructure banks can serve as hubs of innovation and knowledge.





## RHODE ISLAND

[Rhode Island Infrastructure Bank](#) is the state's central hub for financing infrastructure improvements for municipalities, businesses and homeowners. RIIB leverages limited capital in a revolving fund to offer financing for infrastructure-based projects, including water and wastewater, road and bridge, energy efficiency, renewable energy and brownfield remediation.

In particular:

- The Stormwater Project Accelerator provides upfront capital for green stormwater infrastructure projects.
- The Municipal Resilience Program provides direct support to cities and towns to complete a municipal-driven process to connect climate change projections and local knowledge to identify and prioritize hazards, challenges and community strengths.

Since its inception in 1989, the bank has provided over \$2.2 billion in financing and supported the creation of more than 62,000 jobs ([RIIB, n.d.](#)).

## TEXAS

[Texas Water Development Board](#), established in 1957, provides low-interest loan financing for water projects, including stormwater management ([TWDB a, n.d.](#)). In 2013, Texas voters approved a constitutional amendment creating two funds to finance \$27 billion in planned projects included in the State Water Plan that was approved by one or more of the state's 16 regional water planning groups ([TWDB, n.d.](#)). In 2019, TWDB's role expanded again, instituting a river basin approach to flood management, with regional plans expected in 2023 and a statewide plan in 2024. In 2019, the legislature made a one-time transfer of \$793 million from the state's Economic Stabilization Fund to pay for a flood financial assistance program ([TWDB, b, n.d.](#)).

## GREEN BONDS AND ENVIRONMENTAL IMPACT BONDS

A green bond is a fixed-income tool to raise money for climate and environmental projects and typically comes with tax benefits for investors ([Segal, 2020](#)). More than \$250 billion in green bonds were issued globally in 2019 in this growing financial sector ([Climate Bonds Initiative, 2020](#)).

An environmental impact bond uses a "pay for success" approach to provide funding for innovative environmental projects. Investors pay upfront costs, and returns are based on performance or other agreed-upon metrics. Once targets are met, the "payer" that benefits from these solutions repays investors an amount based on the achievement of agreed-upon outcomes ([Quantified Ventures, 2018](#)). These asset-linked investment tools weave a mix of incentives and public benefits attractive to investors.

## MASSACHUSETTS

Massachusetts passed a \$2.4 billion environmental bond in 2018, which codified a 2016 executive order outlining a comprehensive approach to climate adaptation and funded it at \$200 million ([Commonwealth of Massachusetts, 2018](#)). The bond includes funding for the Municipal Vulnerability Preparedness Program, which requires local governments to participate in a training course to develop integrated MVP and hazard mitigation plans, aligning language, data and goals throughout the state. Jurisdictions that participate in this training become eligible to apply for project implementation grants ([Municipal Vulnerability Preparedness, n.d.](#)).





## RHODE ISLAND

In addition to the funding mechanisms described earlier, the Rhode Island Infrastructure Bank also issues green bonds. Since 2017, RIIB has issued more than \$150 million in green bonds, ranging in value from less than \$1 million to more than \$33 million, funding 24 projects in numerous jurisdictions. Investments include capital projects aimed at water and climate resilience; replacement of water lines; pumping stations; water treatment plants; conversion of lighting and street lights to LED; and improvements and climate resilience of wastewater lines and facilities ([RIIB, 2020](#)).

## LOUISIANA

In 2018, the Louisiana Community Development Authority participated in the state's first green bond ([LCDA, 2018](#)). Using funds from the state's share of the Gulf of Mexico Energy Security Act, the LCDA authorized nearly \$12 million in funding for environmental infrastructure work to address shoreline erosion in Cameron Parish. The Louisiana Coastal Protection and Restoration Authority is currently studying the feasibility of green bonds to support wetland restoration ([EDF, 2020](#)).

## NEW ORLEANS, LA

In 2020, the City of New Orleans and the Finance Authority of New Orleans were awarded assistance from the Mississippi River Cities and Towns Initiative to study environmental impact bonds to support green infrastructure. Projected revenue from the bonds is \$30 million. One aspect of the bond funds is to allow the city to offer green mortgages to homeowners and developers that require installation of measures that manage stormwater. Additionally, the city plans to create a pool of capital for other resilience projects that include water and flood management ([CityBusiness, 2020](#)).

## CARBON PRICING/TRADING MARKETS

Carbon pricing is an approach to reducing carbon dioxide emissions, or greenhouse gases, by using market mechanisms to pass the cost of emitting on to emitters as "polluter pays." The broad goal is to discourage the use of carbon dioxide-emitting fossil fuels ([Carbon Pricing Leadership Coalition, 2018](#)). Carbon markets are mature, growing, templated, collaborative and revenue-ready; states simply join, systems activate and dollars flow.

As a state hosting a significant number of international carbon and water intense industries, many of which are already shifting to meet carbon-neutral goals, Louisiana is positioned to benefit significantly from participation in carbon markets. Funds from these markets serve a broad range of needs, including watershed management and flood risk reduction.

A first-day [executive order](#) by the Biden Administration, followed by a [memorandum](#) to all federal executive departments and agencies, set new carbon [policies](#) and baseline pricing of [\\$51 per ton](#) of carbon dioxide for the determination of climate impacts of all federal activities.

## VIRGINIA

In July 2020, Virginia enacted the Community Flood Preparedness Fund as part of the Clean Energy and Community Flood Preparedness Act under its Department of Conservation and Recreation. Under the act, 45% of revenues from the sale of [Regional Greenhouse Gas Initiative](#) carbon allowances accrue to the fund to be used "for the purpose of assisting localities and their residents affected by recurrent flooding, sea-level rise and flooding from severe weather events," through a grant and loan program administered by



DCR and the Virginia Resources Authority. Twenty-five percent of the funding from the Community Flood Preparedness Fund will target low-income areas ([Miller and Rovner, 2020](#)). First-year revenue estimates are between \$45 and \$100 million per year beginning in 2021 ([Rankin, 2020](#)).

## LOUISIANA

In 2017, the Louisiana Legislature passed [HB423](#) authorizing the Louisiana Department of Environmental Quality to establish and administer a water quality trading program. Water users with “high costs of reducing pollution can purchase equal or greater pollution reductions from sources with lower costs ([LDEQ, n.d.](#)). A mix of stakeholders are actively developing the program, which is yet to generate funds ([LDEQ, 2019](#)).

In August 2020, in an effort to achieve zero emissions by 2050, Governor John Bel Edwards signed [Executive Order JBE 2020-18](#) to launch a [Climate Initiatives Task Force](#) of experts and stakeholders to identify ways to reduce greenhouse gas emissions and identify carbon management strategies that support integrated coastal management and adaptation.

## PROPERTY TAXES / MILLAGE

Some communities find a successful, recurring source of revenue to be a property tax, or millage, dedicated to funding water quantity and quality issues within jurisdictional boundaries. A challenge is that tax-exempt entities, such as properties owned by churches, schools and local governments can be exempt even though they may contribute significantly to runoff.

### BAYOU VERMILION DISTRICT

The Lafayette Parish Bayou Vermilion District serves as an established example of a Louisiana entity focused on watershed management. BVD is authorized to generate revenue through property taxes to manage and maintain water quality and offer public outreach and education ([LA Act 161, 1984](#)). The District is funded primarily through a 10-year .75 mil property tax assessment, which has been consistently renewed at the ballot box, most recently in 2017 by 57% of voters ([Gastinell, 2017](#)) and which generated more than \$2.1 million in 2019 ([Wright et al, 2020](#)). Notably, BVD supplements tax revenue with recreation/tourism revenue and leverages educational outreach to build awareness and support for water quality improvement projects, economic development and watershed management.

## SALES TAX

Many cities and parishes have the authority to enact a local sales tax if approved by voters. However, governments and stakeholders have to educate the public about the importance of the tax if it is to pass. A community will only vote to approve a tax if they understand the value of it.

### ST. PETERS, MO

St. Peters, Missouri, passed two sales tax initiatives to fund stormwater projects and parks. The first passed in 2000 and raised the sales tax one-tenth of a cent, which was used to develop several well-promoted public projects and as 50/50 match funds for projects on private property. The second passed in 2012 with 68% of the vote, and added four-tenths of a cent ([City of St. Peters, n.d.](#)). Raising the sales tax was seen as the preferred, least-cost alternative over property tax or a stormwater fee for generating revenue to support bond issues, allowing the city to draw revenue from visitors as well as residents.



## Other Management Strategies

### COMMUNITY-BASED PUBLIC-PRIVATE PARTNERSHIPS

The CBP3 model invests in green infrastructure approaches that provide for local economic growth and improved quality of life in urban and underserved communities. Through the CBP3 model, local government partners with a private entity to provide flexibility and access to advanced technology, address community development goals and encourage long-term financial support for integrating green infrastructure into stormwater programs ([EPA, n.d.](#)).

#### MILWAUKEE, WI

In 2019, the Milwaukee Metropolitan Sewerage District released a request for proposals to identify a private partner to develop 20 million gallons of green infrastructure-based stormwater capture projects over three years ([MMSD, 2020](#)). Corvias, the company selected, finances projects upfront and is paid based on the number of gallons captured. The partnership allows the agency to accelerate the pace of implementation and to achieve economies of scale compared to distributed, project-by-project contracting and construction.

### MITIGATION BANKS AND LAND TRUSTS

Investments in mitigation banks and land trusts grow organically and financially. Mitigation banks are a land-based trading system in which unavoidable damages to natural wetlands are offset by investing in the restoration or preservation of another site's wetland habitats, usually on the same or nearby watershed ([Wood, 2018](#)). Mitigation banks create permanent conservation easements that protect specific natural functions of the land in perpetuity.

A land trust is a charitable organization that acquires and manages land for a range of conservation purposes ([We Conserve CPA, n.d.](#)). Land trusts offer partnership and fundraising opportunities to align and leverage dollars and systems, and whether created to serve a region or the state, provide another vehicle for conservation easements.

Louisiana is home to many mitigation banks and land trust projects actively working to restore watersheds, floodplains, streams and marshes. Though not a traditional funding source, mitigation banks can help leverage and connect partners, affect significant tracts of land and generate numerous co-benefits and long-term management opportunities. Land trusts can often provide matching capital, in-kind resources and corporate and philanthropic partnerships that leverage funds to achieve regional watershed and flood risk management goals.



### RED CHUTE MITIGATION BANK, BOSSIER PARISH, LA

This mitigation bank focuses on the restoration of more than nine hundred acres of bottomland hardwood wetlands on the Red River to re-establish natural functions, restore habitat and return the floodplain to its original roles ([RES, n.d.](#)).

### CANE BAYOU MITIGATION BANK, ST. TAMMANY PARISH, LA

Using an opportunity to leverage mitigation credits purchased from out-of-state companies, St. Tammany Parish will restore and protect 1,169 acres of land in the headwaters of Cane Bayou. The parish expects the project to generate opportunities to trade the credits at rates considerably higher than the purchase costs. The conservation project restores and protects tracts in the floodplain, helping offset nearby development impacts ([STPG, n.d.](#)).

### LAND TRUST FOR LOUISIANA

The [Land Trust for Louisiana](#) concentrates on four types of conservation: forest and natural areas, agricultural lands, freshwater and coastal resources and urban green space, offering a flexible range of potential opportunities for regional watershed managers. The organization currently manages 20 conservation projects on more than 7,000 acres spread across southeast Louisiana.

## BROWNFIELDS PROGRAM

### LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY BROWNFIELDS PROGRAM

LDEQ manages the [Brownfields Program](#), which provides support and funding for remediating and repurposing vacant industrial or commercial sites into productive use that returns properties to tax rolls. Often used as part of the mix of funding and partners in the development of commercial projects, the program can also be used to support [parks and sites](#) that showcase risk reduction and water management best practices.

## USING TRANSPORTATION FUNDING TO MAXIMIZE STORMWATER CO-BENEFITS

Designing programs to maximize co-benefits opens up funding sources that would otherwise not be available for stormwater management projects or programs. For example, communities like the [City of New Orleans](#) are creatively using transportation and street design funding for the co-benefits of stormwater management and equity.

### GREATER MEMPHIS, TN METROPOLITAN AREA

The Mid-South Regional Greenprint was created to effectively combine multiple sources of federal, state and local funding – including transportation funding for recreational trails – to implement a regional plan for trails and open space to mitigate flooding and promote community growth. In the Greenprint, the greater Memphis region (including portions of Tennessee, Mississippi and Arkansas) holistically addresses flooding, green space, recreation opportunities, employment centers and the transportation network while prioritizing social equity ([LRK Inc. et al, 2014](#)).

## HAZARD-RESISTANT BUILDING AND DEVELOPMENT CODES

Statewide consistency in development standards offers a proven way to achieve long-term cost savings and risk reduction. The rise of flood risk ratings in the [insurance](#), [real estate](#), and [banking](#) industries makes the risks faced by owners of commercial and residential real estate more transparent. In October 2021,





the National Flood Insurance Program is scheduled to implement Risk Rating 2.0, which incentivizes risk reduction and penalizes inaction and locations ([FEMA a, n.d.](#)). Communities that lack modern, hazard-resistant development standards will experience higher insurance rates leading to depreciating real estate values and strained tax bases.

In 2020, FEMA released *Building Codes Save: A Nationwide Study*, a comprehensive examination of disasters and buildings. The study determined that “modern building codes lead to a major reduction in property losses from natural disasters” ([FEMA, 2020](#)). According to FEMA and the National Institute of Building Sciences, designing buildings to meet the 2018 International Residential Code and 2018 International Building Code “led to a national benefit of \$11 saved for every dollar invested in comparison to older generations of code” ([FEMA, n.d.](#)).

Adopting higher building standards only reduces risk for newly constructed buildings or buildings with significant renovations that require upgrading to the new building code. For existing buildings, communities can incentivize property owners to retrofit properties to reduce their risk. Revolving loan funds, grants and other mechanisms can equitably invest in reducing collective risk and protect future revenue streams.

Hazard-resistant building codes protect people and property, saving money through reduced insurance premiums and avoiding future costs of mitigation and recovery. They also stabilize the financial future of homeowners and communities as resilient properties built to higher standards are more likely to withstand disasters and appreciate in value.

## NON-PROFIT COORDINATION OF WATERSHED AND STORMWATER INTERESTS

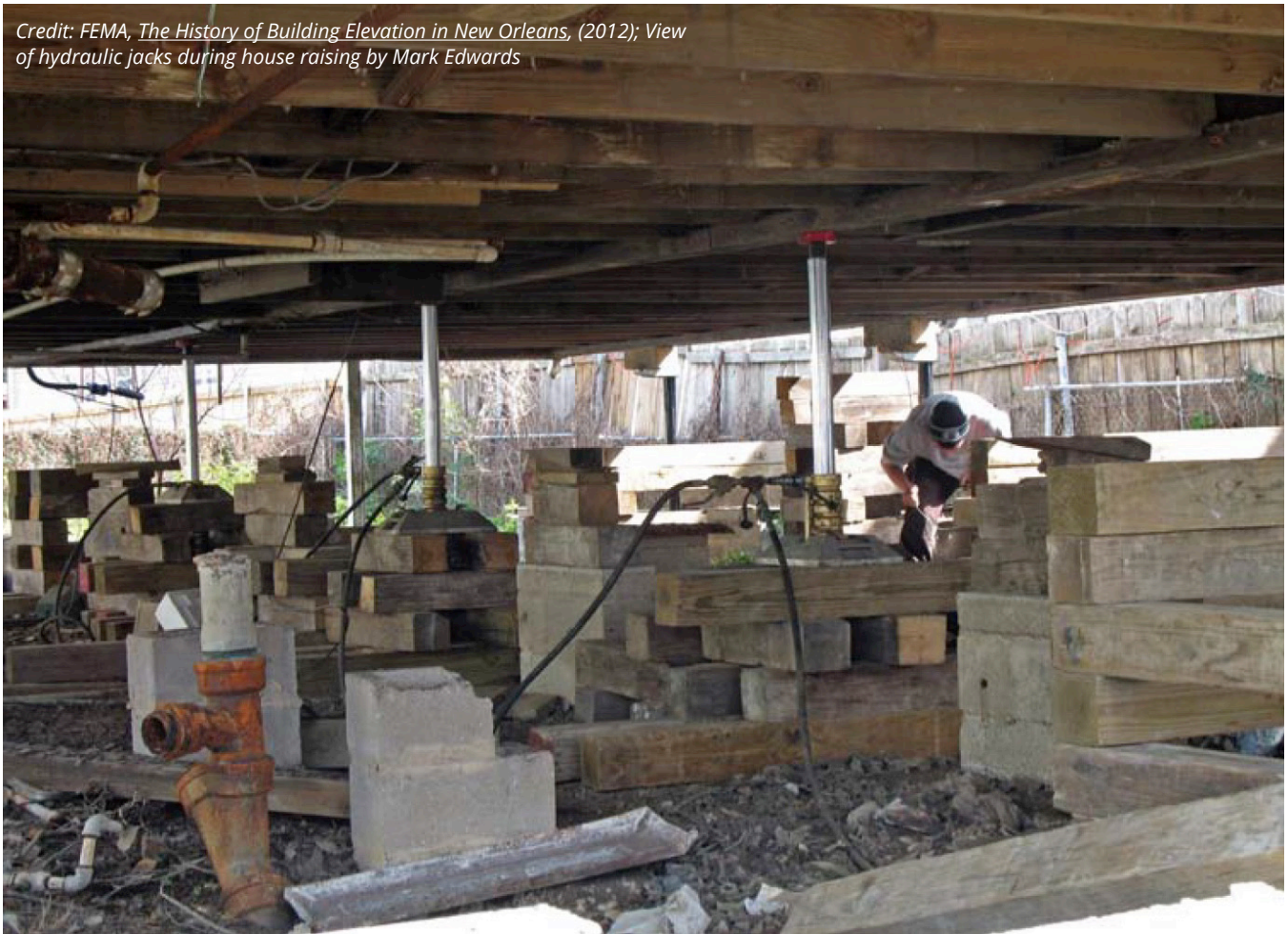
A statewide gap analysis revealed that no existing public entities currently have the full range of multijurisdictional authority and responsibilities needed to administer regional watershed management and flood-risk reduction ([LWI, 2018](#)). Additionally, some entities have overlapping authority and geographic boundaries, making it unclear which entities have jurisdiction over certain elements of water management ([LWI, 2020](#)). In some states, nonprofit organizations assume various stormwater and watershed responsibilities and serve as hubs for planning, design standards, community education, economic and workforce development and timely information on funding opportunities.

### NEW JERSEY

In 2019, New Jersey passed [NJ S1073](#), which authorizes counties and municipalities to establish and operate stormwater utilities. In response to this law and in recognition of the need to quickly increase local capacity to take advantage of it, New Jersey Future, a statewide, nonprofit focused on growth, development and infrastructure, partnered with Flood Defense New Jersey, a coalition of state and local nonprofit organizations organized around flood and pollution mitigation. Together, they took a lead role in stormwater management through the New Jersey Stormwater Utility Resource Center to support local governments in creating stormwater utilities ([SURC, n.d.](#)).



*Credit: FEMA, The History of Building Elevation in New Orleans, (2012); View of hydraulic jacks during house raising by Mark Edwards*



## Flood-Ready = Fund-Ready

Aspiring to be flood-ready has the power to drive positive actions connecting the environmental, social and economic fabrics of Louisiana. Flood-ready infrastructure, jobs, buildings, agriculture, transportation, communications and response services are just some of the areas in which the state can build new socio-economic strengths. Aligning regional academic, business, government and nonprofit efforts to identify and nurture innovative solutions for what it means to be flood-ready offers transformative economic opportunities found in Louisiana's water economy potential.

Regional managers face distinct challenges to be fund-ready within the context of the many funding opportunities available. Requirements for public and private funding sources require regions to possess a suite of legal authorities and organizational capacities. In the digital age, funding preparedness involves building capacity and expertise within reach of every community. Web-based applications and resources offer open access to funds and supportive tools and resources to guide novice users, creating new opportunities for watershed and flood risk managers. Being fund-ready also means being discoverable by systems seeking to support watersheds, flood risk mitigation and nature-based solutions.



## PREPARE FOR FUNDING

### Align with international terminology, data, and metrics

- Be Found - Be Funded: The rise of artificial intelligence and machine learning is creating a standardization of terms and measures that help with monitoring, verification, reporting, transparency and consistency ([Jaycocks, 2020](#)). Finance and insurance administrators use the data to develop plans and portfolios that drive global markets.
- Support statewide hazard-resistant building and development codes that meet or exceed FEMA [NFIP](#) and [ASFPM](#) recommendations.
- Maximize benefits: Benefit-cost accounting for nature-based solutions is evolving rapidly and new tools are available for measuring benefits and co-benefits ([Shiao et. al., 2020](#)). See [FEMA Cost-Benefit Toolkit](#)
- Expand funding opportunities: Flood risk reduction frequently falls under climate and adaptation data. Climate adaptation resources offer a broader range of funding opportunities, co-benefits and returns.
- Use available tools: Cities working on projects that address pressing social, environmental and economic needs now have access to a growing number of tools and services using standardized data ([CPI, 2020](#)).

### Build civic pride and engagement in regional water resources and activities

- Engage and celebrate corporate, academic, governmental and citizen support
- Work with schools to create learning and volunteer hubs, and [future water leaders](#)
- Establish land trust and [litter](#) partnerships in each region

Focus on local and regional [economic](#) and adaptation opportunities in every action whether planning, mitigation, response, or recovery and build capacities to generate revenue, nurture innovation, encourage [entrepreneurship](#) and build the workforce of the future.

## NATURAL CAPITAL: ASSETS THAT GROW

Natural capital is an economic term to describe all the natural components of the planet: air, soil, water and biomass, produced by all living things, which, though often freely extracted in ways that deplete and damage vital resources, typically is not factored in determining economic data such as gross domestic product. Infrastructure planning terms relating to natural capital include [nature-based solutions](#), [green infrastructure](#), biodiversity, [biomimicry](#), [regenerative design](#) and [ecosystem services](#) and are increasingly part of the decision-making vocabulary used by banks, insurers and funders of all types. New tools for assessing the value of natural capital and ecosystem services during the design phase of projects are available and provide quantifiable dollar values for [benefit-cost analysis](#). Natural capital-oriented BCA tools support consistency in how plans are developed and decided upon. When done successfully, projects guided by these principles become natural and economic assets with multiple benefits, some of which literally grow over time and improve the quality of life.





## NATURE-BASED SOLUTIONS = GREEN INFRASTRUCTURE

Nature-based solutions and green infrastructure represent an evolution of how humans develop and adapt to the natural environment. NBS and GI are built around the concept of working with natural systems in the design of hard, or “gray” infrastructure, to enhance the performance of infrastructure such as transportation and water management and to ensure infrastructure and development work more harmoniously and less destructively with natural systems. NBS and GI are increasingly driving design as [environmental standards](#) become part of codes and processes within organizations such as the U.S. Army Corps of Engineers, whose [Engineering with Nature](#) initiative offers valuable guidance. NBS and GI can be interchangeable terms, and each may be specified in contracts and design codes and principles.

## THE CIRCULAR ECONOMY

A global movement is underway to transform our linear, take-make-waste economy into a systems-oriented, circular economy. Most of the world’s largest corporations, along with a growing number of countries, are reimagining how humanity, the planet and economies can thrive. As noted by the [Ellen MacArthur Foundation](#), a circular economy is:

- A systemic approach to economic development designed to benefit businesses, society, and the environment
- Restorative and regenerative by design
- Keeps products and materials in use and designs out waste and pollution

The pursuit of circular principles leads to innovation as managers rethink water systems and infrastructure to be more efficient and in harmony with natural systems. From multijurisdictional sharing of resources, personnel and equipment to digital technologies for real-time monitoring to closed-loop wastewater systems that generate energy, nutrients and clean water, the shift to the circular economy is underway globally ([Jeffreys and Fall, 2020](#)).

Including [circular economy principles](#) in regional watershed management decision-making offers a chance to nurture innovation, collaboration and modern efficiencies in the design and construction of local projects, creating business opportunities and new sources of long-term revenue.



*Mollicy Farms Floodplain Restoration Project, Credit: Nature Conservancy.*





## THE LOUISIANA WATER ECONOMY

Seven economic sectors constitute [Louisiana's water economy](#), encompassing all economic and social activities in which water is an important and/or dominant factor, and in which Louisiana's relative water "wealth" and abundance – whether for "good," or as is the case with costly surge, flood, and disaster management, for "bad" – contributes to the existence of the sector, resource or activity ([Picou and Mendoza, 2017](#)).

The seven sectors: agriculture and fisheries, coast and environment, ecotourism and recreation, energy and industry, law and policy, maritime and ports and water infrastructure are the foundation of Louisiana's quality of life and economy. Each sector is impacted by flooding, and each can, and should, participate in developing risk reduction and funding opportunities. Identifying and including stakeholders from the seven sectors in shaping and supporting Louisiana's watershed vision is a key piece of the funding puzzle.

All Louisiana water economy sectors feature water-centric circular economy opportunities, with ongoing or developing programs in [agriculture](#), [municipal infrastructure](#), [energy](#) and [industry](#), [law and policy](#), [maritime and ports](#), [ecotourism and recreation](#), and [coast and environment](#). Existing, planned and potential spending on water projects offer Louisiana transformational economic, entrepreneurial and workforce opportunities if we build a common vision for what it means to be regenerative and prosperous, and if we work together to make it happen.





## Conclusion

---

Louisiana is water wealthy, and water is everybody's business. Long-term and effective funding of public service activities in water management ultimately depend upon a change in how we value water and watersheds and upon our ability to adapt and improve organizational and governance structures.

In the past, our hubris caused us to take water for granted. Lulled by its abundance, we fail to appreciate water's fragility and power or to place value to its large-scale use. Two challenges are at the heart of gaps in our funding mechanisms and stewardship of this precious resource: the ability to measure and value water's use and to recognize and learn to live with water's cycles and roles.



## Suggested Reading

---

- Funding
  - 2020 [\*Louisiana Water and Wastewater Funding Sources\*](#)
  - [\*GNO Urban Water Plan\*](#): (See [\*Implementation\*](#) Appendices A, B, C)
  - [\*Building Codes Save: A Nationwide Study\*](#), FEMA 2020
  - [\*How State Governments Can Help Communities Invest in Climate Resilience\*](#), Plastrik/Coffee, et al 2020
  - [\*Hunting for Money: U.S. Cities Need a System for Financing Climate Resilience and Adaptation\*](#), Cleveland et al 2019
  - [\*Climate Adaptation and Finance in California\*](#), Keenan 2018
  - [\*Mechanisms for Funding Infrastructure Resilience Improvements: A Review of Options\*](#), 2018
- Stormwater Fees
  - [\*2018 Stormwater Utility Survey\*](#), Black & Veatch
  - [\*Building for the Future: Five Midwestern Communities Reduce Flood-Risk\*](#), Headwaters Economics 2020
  - [\*Do Stormwater Fees Make Sense for New Orleans?\*](#), Bureau of Governmental Research 2017
- Equity
  - [\*An Equitable Water Future: Milwaukee\*](#), U.S. Water Alliance, 2020
- National Overview
  - [\*Recovering Stronger: Transforming Water Management Post COVID-19\*](#), U.S. Water Alliance, 2021
  - [\*The Economic Benefits of Investing in Water Infrastructure: How a Failure to Act Would Affect the U.S. Economic Recovery\*](#), ASCE, 2020





## Works Cited

---

- American Society of Civil Engineers. (2020). *The Economic Benefits of Investing in Water Infrastructure*. Value of Water Campaign. [http://uswateralliance.org/sites/uswateralliance.org/files/publications/VOW%20Economic%20Paper\\_1.pdf](http://uswateralliance.org/sites/uswateralliance.org/files/publications/VOW%20Economic%20Paper_1.pdf)
- Averill, D. (1994). Stormwater Management: After 10 Years, How is the New Department Doing? *Tulsa World*. [https://tulsaworld.com/archive/stormwater-management-after-10-years-how-is-the-new-departmentdoing/article\\_3e7b0f2c-050d-52fb-a4e2-c679d78f07e2.html#:~:text=a%20fee%20to%20pay%20for%20flood%2Dmitigation%20efforts.&text=in%20about%20%249%20million%20per%20year](https://tulsaworld.com/archive/stormwater-management-after-10-years-how-is-the-new-departmentdoing/article_3e7b0f2c-050d-52fb-a4e2-c679d78f07e2.html#:~:text=a%20fee%20to%20pay%20for%20flood%2Dmitigation%20efforts.&text=in%20about%20%249%20million%20per%20year)
- Baldocchi, D. (2018). The cost of irrigation water and urban farming. *Berkeley News*. [https://news.berkeley.edu/berkeley\\_blog/the-cost-of-irrigation-water-and-urban-farming/](https://news.berkeley.edu/berkeley_blog/the-cost-of-irrigation-water-and-urban-farming/)
- Black & Veatch Management Consulting. (2018). *2018 Stormwater Utility Survey*. [https://www.bv.com/sites/default/files/2019-10/18%20Stormwater%20Utility%20Survey%20Report%20WEB\\_0.pdf](https://www.bv.com/sites/default/files/2019-10/18%20Stormwater%20Utility%20Survey%20Report%20WEB_0.pdf)
- Carbon Pricing Leadership Coalition. (2018). *What is Carbon Pricing?* <https://www.carbonpricingleadership.org/what>
- City of Nashville, TN. (n.d.). *Stormwater Fee*. Metro Government of Nashville and Davidson County, Tennessee. Retrieved November 2020, from <https://www.nashville.gov/Water-Services/Stormwater/Stormwater-Fee.aspx>
- City of St. Peters, Missouri (n.d.) *Proposition P Information*. My Hometown: St. Peters Missouri. Retrieved November, 2020, from <https://www.stpetersmo.net/proposition-p.aspx>
- City of Tulsa, OK. (n.d.). *Stormwater Fee and Funding*. City of Tulsa: A New Kind of Energy. Retrieved November 2020, from <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/stormwater-fee-and-funding/>
- CityBusiness. (2020, March 5). New Orleans to try new approach for funding green infrastructure. *New Orleans City Business*. <https://neworleanscitybusiness.com/blog/2020/03/05/new-orleans-to-try-new-approach-for-funding-green-infrastructure/>
- Climate Bonds Initiative. (n.d). *Green Bonds Market 2020*. Retrieved November, 2020, from <https://www.climatebonds.net/>
- Climate Policy Initiative (CPI). (2020, November 2). *Alliance members create harmonized application for project preparation facilities*. <https://www.climatepolicyinitiative.org/press-release/alliance-members-create-harmonized-application-for-project-preparation-facilities/>
- Commonwealth of Massachusetts. (2018). *Chapter 209: An act promoting climate change adaptation, environmental and natural resource protection, and investment in recreational assets and opportunity*. Massachusetts Acts of 2018. <https://malegislature.gov/laws/sessionlaws/acts/2018/chapter209>
- Environmental Defense Fund (EDF). (n.d). *Environmental Impact Bonds: Financing for wetlands restoration*. Retrieved November, 2020, from <https://www.edf.org/ecosystems/environmental-impact-bonds-.....financing-wetlands-restoration>
- Federal Emergency Management Agency (FEMA). (2020). *Building Codes Save: A National Study*. [https://www.fema.gov/sites/default/files/2020-11/fema\\_building-codes-save\\_study.pdf](https://www.fema.gov/sites/default/files/2020-11/fema_building-codes-save_study.pdf)
- Federal Emergency Management Agency (FEMA) a. (n.d.) *Risk Rating 2.0: Equity in Action*. Retrieved January, 2021 from <https://www.fema.gov/flood-insurance/work-with-nfip/risk-rating>





- Federal Emergency Management Agency (FEMA) b. (n.d.). *Building Science*. Retrieved January, 2021 from <https://www.fema.gov/emergency-managers/risk-management/building-science>
- Garrison, J. (2017, April 4). Nashville water bills to go up after approval of Barry's stormwater fee hike. *The Tennessean*. <https://www.tennessean.com/story/news/2017/04/04/nashville-water-bills-go-up-after-approval-barrystormwater-fee-hike/100019390/>
- Gastinell, C. (2017, December 27). BVD receives public vote of confidence, funding. *The Vermilion*. [https://www.thevermillion.com/news/bvd-receives-public-vote-of-confidence-funding/article\\_4b51e717-567a-5836-923f-919cbdda99c.html](https://www.thevermillion.com/news/bvd-receives-public-vote-of-confidence-funding/article_4b51e717-567a-5836-923f-919cbdda99c.html)
- Jaycocks, A. (2020). *Climate Finance and Green Bond Evolution: Informing Policy with Machine Learning Text Analytics*. Rand Corporation. [https://www.rand.org/pubs/rgs\\_dissertations/RGSDA678-1.html](https://www.rand.org/pubs/rgs_dissertations/RGSDA678-1.html)
- Jeffreys, N. and Fall, T. (2020, August 3). The power of water: Circular economy for our most useful resource. *Medium*. <https://medium.com/circulatenews/the-power-of-water-a23d57853686>
- Louisiana Act 161. (1984). La. R.S. § 33:9201, §1; Acts 2015, No. 442, §1. Louisiana State Legislature. <http://legis.la.gov/legis/Law.aspx?d=91753>
- Louisiana Community Development Authority. (2018, June 20). *LCDA announces the recent closing on the first of its kind municipal bond issue in Louisiana and the United States for Cameron Parish, Louisiana*. <https://www.louisianacda.com/content/lcda-announces-recent-closing-first-its-kind-municipal-bond-issue-louisiana-and-united>
- Louisiana Department of Environmental Quality (LDEQ). (2019). *Louisiana Water Quality Trading Guidance*. (2019). State of Louisiana. [https://www.deq.louisiana.gov/assets/docs/Water/LouisianaWaterQualityTradingGuidance\\_DRAFT\\_10182019.pdf](https://www.deq.louisiana.gov/assets/docs/Water/LouisianaWaterQualityTradingGuidance_DRAFT_10182019.pdf)
- Louisiana Department of Environmental Quality (LDEQ). (n.d.) *Water Quality Trading*. State of Louisiana. <https://www.deq.louisiana.gov/page/water-quality-trading>
- Louisiana Department of Transportation and Development (DOTD). (2015). *Water Use in Louisiana, 2015: Water Resources Special Report No. 18*. U.S. Geological Survey. [https://wise.er.usgs.gov/dp/pdfs/WaterUseinLouisiana\\_2015.pdf](https://wise.er.usgs.gov/dp/pdfs/WaterUseinLouisiana_2015.pdf)
- Louisiana Legislative Auditor. (2019). *Regulation of Groundwater Resources Greater Baton Rouge Area*. (2019). State of Louisiana. [https://www.lla.la.gov/PublicReports.nsf/782AD0921011AF4E862583F60053DA0D/\\$FILE/0001CAA9.pdf](https://www.lla.la.gov/PublicReports.nsf/782AD0921011AF4E862583F60053DA0D/$FILE/0001CAA9.pdf)
- Louisiana Legislative Auditor. (2020). *Louisiana's Management of Water Resources*. State of Louisiana. [http://app.lla.state.la.us/PublicReports.nsf/07AE69DA84B7F7E89862585040079C762/\\$FILE/LMWR.pdf?OpenElement&.777309822](http://app.lla.state.la.us/PublicReports.nsf/07AE69DA84B7F7E89862585040079C762/$FILE/LMWR.pdf?OpenElement&.777309822)
- Louisiana Watershed Initiative. (2018). *Phase 1 Investigation: Louisiana Statewide Comprehensive Watershed Based Floodplain Based Management Program Development*. State of Louisiana. [https://watershed.la.gov/assets/docs/Phase-1-Full-Report-with-Appendices\\_compressed.pdf](https://watershed.la.gov/assets/docs/Phase-1-Full-Report-with-Appendices_compressed.pdf)
- Louisiana Watershed Initiative. (2020). *Regional Watershed Management in Louisiana: A Guidebook to Local and Regional Entities, Their Authorities and Functions*. State of Louisiana. [https://watershed.la.gov/assets/docs/Regional-Watershed-Management-Guidebook\\_10-20-20.pdf](https://watershed.la.gov/assets/docs/Regional-Watershed-Management-Guidebook_10-20-20.pdf)
- LRK Inc., Alta/Greenways, the Trust for Public Land, Placeways Inc., Trust Marketing, LTA Consulting, Powers Hill Design, and Orion Planning. (2014). *Funding Guide for Green Space Connectivity: Mid-South Regional Greenprint & Sustainability Plan*. Memphis and Shelby County Division of Planning and Development and the Mid-South Regional Greenprint Consortium. <http://new.midsouthgreenprint.org/wp-content/>



[uploads/2015/04/FUNDING-GUIDE-FORGREEN-SPACE-CONNECTIVITY.pdf](#)

Municipal Vulnerability Preparedness. (n.d.). *MVP Program Information*. <https://resilientma.org/mvp/>

Metro Water Services. (2016). *Stormwater User Fee Credit Manual*. Metropolitan Government of Nashville and Davidson County. [https://www.nashville.gov/Portals/0/SiteContent/WaterServices/Stormwater/docs/SWMM/2016/StormwaterUserFeeCreditManual\\_2016.pdf](https://www.nashville.gov/Portals/0/SiteContent/WaterServices/Stormwater/docs/SWMM/2016/StormwaterUserFeeCreditManual_2016.pdf)

Miller, Y, and Rovner, N. (2020, July 7). *Virginia's New Flood-Preparedness Program Is a Statewide Win*. Pew. <https://www.pewtrusts.org/en/about/news-room/opinion/2020/07/07/virginias-new-flood-preparedness-program-is-a-statewide-win> Milwaukee Metropolitan Sewerage District (MMSD). (2020, January 27). *MMSD Accelerating Green Program to Reduce Overflows and Protect Lake Michigan*. <https://www.mmsd.com/about-us/news/mmsd-community-based-green-infrastructure-program-2020>

National Groundwater Association (NGWA). (2020). *Groundwater Use in the United States of America* [Fact Sheet]. [https://www.ngwa.org/docs/default-source/default-document-library/groundwater/usa-groundwater-use-fact-sheet.pdf?sfvrsn=5c7a0db8\\_4](https://www.ngwa.org/docs/default-source/default-document-library/groundwater/usa-groundwater-use-fact-sheet.pdf?sfvrsn=5c7a0db8_4)

New Jersey Stormwater Utility Stormwater Resource Center (SURC). (n.d.). *Why a Stormwater Utility?* New Jersey Future. Retrieved November 2020, from <https://stormwaterutilities.njfuture.org/what-is-a-stormwater-utility/>

Picou, S. and Mendoza, G (2017). *The Louisiana Water Economy: Our Shared Destiny, Finding and Recommendations for the Greater New Orleans Region* (Report No. 1). *Adaptation Strategies*. [https://www.researchgate.net/publication/326305252\\_The\\_Louisiana\\_Water\\_Economy\\_Our\\_Shared\\_Destiny\\_Findings\\_Recommendations\\_for\\_the\\_Greater\\_New\\_Orleans\\_Region](https://www.researchgate.net/publication/326305252_The_Louisiana_Water_Economy_Our_Shared_Destiny_Findings_Recommendations_for_the_Greater_New_Orleans_Region) Rhode Island Infrastructure Bank (RIIB). (2020). *Annual Report 2020*. [https://www.riib.org/sites/default/files/Annual\\_Report\\_RIIB\\_2020.pdf](https://www.riib.org/sites/default/files/Annual_Report_RIIB_2020.pdf)

Quantified Ventures. (2018, October 31). *Sharing Risk, Rewarding Outcomes: The Environmental Impact Bond*. <https://www.quantifiedventures.com/blog/what-is-an-environmental-impact-bond>

Rankin, S. (2020, February 27). *Virginia moves toward joining cap-and-trade program*. *AP News*. <https://apnews.com/article/c3c455631eee64caf01aff0765c849d4>

Resource Environmental Solutions (RES). (n.d.) *Red Chute Mitigation Bank*. Retrieved November 2020, from <https://res.us/projects/red-chute-mitigation-bank/>

Rhode Island Infrastructure Bank. (n.d.) *The Results*. Retrieved November 2020, from <https://www.riib.org/results>

Segal, T. (2020, March 9). *Green Bond*. Investopedia. <https://www.investopedia.com/terms/g/green-bond.asp>

Shiao, T., Kammeyer, C., Brill, G., Feinstein, L., Matosich, K., Vigerstol, K. and Müller-Zantop, C. (2020). *Benefit Accounting of Nature-Based Solutions for Watersheds Landscape Assessment*. United Nations Global Compact CEO Water Mandate. <https://ceowatermandate.org/nbs/wp-content/uploads/sites/41/2020/08/landscape.pdf>

St. Tammany Parish Government (2019, April 29). *Cane Bayou Mitigation Bank will Save Money and Preserve over 1,000 Acres of Land*. <http://www.stpgov.org/residents/news/item/4089-cane-bayou-mitigation-bank-will-save-money-and-preserve-over-1-000-acres-of-land>

Texas Water Development Board (TWDB) a. (n.d.). *About the Texas Water Development Board*. Retrieved November 2020, from <https://www.twdb.texas.gov/about/index.asp#twdb-history>

Texas Water Development Board (TWDB) b. (n.d.). *TWDB Flood programs*. Retrieved November 2020, from <https://www.twdb.texas.gov/flood/index.asp>



- Town of Nashville. (n.d). *Stormwater Utility Fee*. Nashville, NC. Retrieved November 2020, from <https://www.townofnashville.com/government/public-works/storm-water-run-off/storm-water-utility-fee>
- United States Environmental Protection Agency (EPA). (n.d). *Financing Green Infrastructure - Is a Community-Based Public-Private Partnerships (CBP3) Right for You?* Retrieved December 2020, from <https://www.epa.gov/G3/financing-green-infrastructure-community-based-public-private-partnerships-cbp3-right-you>
- United States Environmental Protection Agency (EPA). (2014). *Getting to Green: Paying for Green Infrastructure Financing Options and Resources for Local Decision-Makers* (EPA 842-R-14-005). Office of Wetlands, Oceans, and Watersheds, National Estuary Program. [https://www.epa.gov/sites/production/files/2015-02/documents/gi\\_financing\\_options\\_12-2014\\_4.pdf](https://www.epa.gov/sites/production/files/2015-02/documents/gi_financing_options_12-2014_4.pdf)
- University of North Carolina. (2020). *2019-2020 North Carolina Stormwater Fee Dashboard*. Environmental Finance Center at the University of North Carolina school of Government. <https://efc.sog.unc.edu/resource/2019-20-north-carolina-stormwater-fee-dashboard>
- We Conserve PA. (n.d). *What is a Land Trust?*. Retrieved December 2020, from <https://conservationtools.org/guides/150-what-is-a-land-trust>
- Wood, A. (2018, October 23). *Taking Mitigation to the Bank - Mitigation Credits Offer a Lucrative Upside for Forest Landowners Who Have the Requisite Property, Patience and Openness to Conservation*. American Forest Management. <https://americanforestmanagement.com/about-us/news/taking-mitigation-to-the-bank-mitigation-credits-offer-a-lucrative-upside-for-forest-landowners-who-have-the-requisite-property-patience-and-openness-to-conservation/64>
- Wright, et al. (2020). *Lafayette Parish Bayou Vermilion District Financial Report*. Lafayette Parish Bayou Vermilion District Board of Commissioners. [http://app.la.state.la.us/PublicReports.nsf/0/C035243AA6B47AA38625860700565FCD/\\$FILE/0002187D.pdf](http://app.la.state.la.us/PublicReports.nsf/0/C035243AA6B47AA38625860700565FCD/$FILE/0002187D.pdf)



## Appendix A: Research Locations Table

LOCATION	Baton Rouge, LA	Bayou Vermilion, LA	Massachusetts
Type of Organization	State Agency, 6 Parish Authority	State subdivision	State Agency
Name of Authority/ Program	The Capital Area Groundwater Conservation Commission, DNR	Lafayette Parish Bayou Vermilion District	Executive Office of Energy and Environmental Affairs - Municipal Vulnerability Preparedness Program, Integrated Hazard Mitigation and Climate Adaptation Plans
Funding Source(s)	User Fees	Property tax; enabled to issue bonds; business-type activities	<a href="#">\$2.4 billion 2018 Environmental Bond; carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative</a>
Recurring/Consistent?	Yes	Renewed since 1980's	No
Operational Best Practices	Multi-parish jurisdictional authority.	Generates additional revenue for watershed management through recreation/tourism activities and grant-driven water quality improvement projects. Entrepreneurial, working with partners in public and private sectors. Includes strong economic opportunity focus.	Using carbon auction (cap and trade) program (multi-state coalition). Mandatory participation in a cross-discipline education program is a prerequisite for funding. Integrated Hazard Mitigation and Climate Adaptation Plans
Applicable to LA	LA	Exemplary program in Louisiana.	<a href="#">Community resilience-building framework and funding system for plans and actions. Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.</a>
Effective website and/or funding portal?		<a href="#">Yes</a> , but not for funding opportunities.	
Establishment Legislation	<a href="#">LA R.S. 38:3071-3084</a>	<a href="#">LA R.S. 33:9201</a>	<a href="#">Executive Order No.569; H.4835 (2018); Sec 22</a> Carbon dioxide cap and trade program
Equity Plan for allocation			
Date Established	1974	1984	2016
Land Area	88.65 mi <sup>2</sup>	55.65 mi <sup>2</sup>	10,565 mi <sup>2</sup>
Population	216,701	244,390	6,893,000





LOCATION	Memphis, TN	Milwaukee, WI	Nashville, NC	Nashville, TN
Type of Organization	Implemented by Shelby County, TN	Regional government agency	Municipal Government	Municipal Government
Name of Authority/ Program	Mid South Regional Greenprint; City of Memphis Stormwater Program	Milwaukee Metropolitan Sewerage District (MMSD) - <a href="#">Community Based Green Infrastructure</a> (CBGI) program	Town of Nashville Stormwater Division	City of Nashville - Metro Water Services
Funding Source(s)	HUD grant, redirecting and aligning current state funding (especially transportation), stormwater fee, carbon legislation introduced 2020	Property tax, user fees, private capital, green bonds (planned)	Parcel-based annual stormwater fee	<a href="#">Partially funded through a tiered stormwater fee</a> for residential and commercial properties. Carbon legislation introduced 2020
Recurring/Consistent?	Varies	Yes	Yes	Yes
Operational Best Practices	Regional plan for multiple counties in three states. Cost benefit analysis includes Resilience and Environmental Value, Community Development and Economic Revitalization	CBP3 using performance-based pricing to construct total of 20MG capacity of green infrastructure stormwater projects in three years; accelerating pace of construction via up-front private capital. Public interface via <a href="#">Fresh Coast Resource Center</a>	Annual stormwater fee funds equipment and programs for street and drain cleaning, pro-active enforcement and community education via town website.	Fee structure tied to square footage of impervious surface, residential property included (more equitable, but more data intensive).
Applicable to LA	Holistically combines stormwater needs, green space, transportation, quality of life, and social equity issues. Transportation funding stresses these co-benefits.	Opportunity for upscale ad hoc development of green infrastructure for greater impact and efficiency	Example of scalable funding for small towns to initiate actions	Yes. Requires hardscape assessment.
Effective website and/ or funding portal?	<a href="#">Yes</a> , but not for funding opportunities	<a href="#">Yes</a>		
Establishment Legislation	Established through a HUD grant.	MMSD contract	<a href="#">Municipal Ordinance</a>	<a href="#">Municipal Ordinance</a>
Equity Plan for allocation	Yes. 51 percent of all NDRC funds will be spent on activities benefiting LMI persons.	<a href="#">2020 Equity Report</a> , 25% DBE		
Date Established	2011, through HUD funded project	2019	2017	Stormwater fee established 2009 by ordinance
Land Area	3013 mi <sup>2</sup>	348 mi <sup>2</sup>	4.7 mi <sup>2</sup>	526 mi <sup>2</sup>
Population	1,200,000	1,100,000	5531	692,587



LOCATION	New Jersey	Rhode Island	St Peters, MO
Type of Organization	State and Coalition of nonprofit organizations	State Agency	Municipal Government
Name of Authority/ Program	New Jersey Stormwater Utility Resource Center---Dept. Environmental Protection, Board of Public Utilities and Economic Development Authority	RI Infrastructure Bank- Stormwater Project Accelerator	Department of Water, Wastewater and Stormwater Services
Funding Source(s)	<a href="#">Private/Philanthropic program providing guidance/support. Carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative</a> and raised \$80 million to fund mitigation and restoration.	<a href="#">Bonds, grants, public and private capital, carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative.</a>	Sales tax, bonds
Recurring/Consistent?	Varies	Varies	Varies
Operational Best Practices	Using carbon auction (cap and trade) program (multi-state coalition) to support flood-related coastal restoration. Comprehensive portal and resources in support of the formation and operations of stormwater utilities and related watershed management systems throughout the state.	An Infrastructure Bank to help finance water-related projects, including Green Infrastructure and watershed management. Program design includes Green Bonds and other financial tools. Using carbon auction (cap and trade) program (multi-state coalition).	Voters passed two sales tax propositions (1/10 cent in 2000; 4/10 cent in 2012) to fund stormwater projects and parks. Projects completed through tax revenue funds are well-promoted to show impact.
Applicable to LA	Use of nonprofit for statewide coordination among watersheds and educational messaging. Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.	<a href="#">Potential to build on our strengths by expanding the mission/roles of LA's recently enacted infrastructure bank.</a> Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.	Demonstrating (and promoting) impacts of early projects helps build public support for larger sales tax proposition; can be a means of generating revenue from non-residents where appropriate
Effective website and/or funding portal?	<a href="#">Yes</a>	<a href="#">Yes</a>	
Establishment Legislation	N/A; in support of NJ S1073 (enacted 2019)	<a href="#">State Law</a>	<a href="#">Proposition P (2012)</a>
Equity Plan for allocation			
Date Established	2020	1989, by Rhode Island General Assembly	2000 (1/10 cent tax); 2012 (4/10 cent tax)
Land Area	8,729 mi <sup>2</sup>	1,212 mi <sup>2</sup>	22.41 mi <sup>2</sup>
Population	8,882,000	1,009,904	57,127



LOCATION	Texas	Tulsa, OK	Virginia
Type of Organization	State Agency	Division within a municipality	State Agency
Name of Authority/ Program	Texas Water Development Board State Water Implementation Fund for Texas (SWIFT)	City of Tulsa's Flood Control Division- Under Engineering Services Division	Virginia Department of Conservation and Recreation, Community Flood Preparedness Fund
Funding Source(s)	Mix of one-time and recurring funding. Taxes, fees, bonds, and programmatic support from state Rainy Day Fund.	Stormwater fee and mixed funds.	<a href="#">Member of 11 state Regional Greenhouse Gas Initiative, \$100 million</a> in expected first year revenue from carbon auctions.
Recurring/Consistent?	Yes	Yes	Yes
Operational Best Practices	Has a Texas Water Plan, finance board, innovation center, and recently initiated river basin flood management system similar to LWI. Legislatively directed to finance \$27 billion in the state's Water Plan projects over the next 50 years.	Successful implementation of stormwater fees in combination with other local and federal sources and buyouts	Using funding through carbon pricing to fund stormwater and climate resilience projects, with an emphasis on low income areas.
Applicable to LA	Mirroring LWI with recently launched regional approach to watershed management. Includes strong economic development and innovation programming.	Yes. Most commonly used funding mechanism. Abundant resources available for model codes and education/outreach.	Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.
Effective website and/or funding portal?	<a href="#">Yes</a>		
Establishment Legislation	Senate Bill 7 of the 86th Texas Legislature	<a href="#">Municipal Code 11-A</a>	<a href="#">2020</a> Fund Draft; The Clean Energy and Community Flood Preparedness Act <a href="#">2020</a>
Equity Plan for allocation			Yes, 25% of budget for low-income areas
Date Established	1957 (2019)	Stormwater fee established 1986 by ordinance	<a href="#">HB 981</a> 2020, Statutory Req. for Fund, 10.1-603.25
Land Area	268,597 mi <sup>2</sup>	187 mi <sup>2</sup>	39,490 mi <sup>2</sup>
Population	29,000,000	396,543	8,569,000



## Appendix B: Water Use Potential Revenue Table

### 2015 COMMERCIAL WATER USE IN LOUISIANA

#### POTENTIAL REVENUE EXAMPLE

This table applies an overview of water use and withdrawals in Louisiana to calculate possible revenue. The Withdrawal Sectors aggregate household/human consumption uses, and two commercial groups: agriculture/ livestock/aquaculture, and industrial and power generation. The \$10 per million gallon example is based on the 2018 rate for water withdrawals in the Capital Area, which recently was raised to \$20 PMG.

If the State of Louisiana charged a consistently applied fee of \$10 PMG for water extraction, a total of \$31 million in annual revenue is possible. Of note is that approximately 48% of all groundwater extraction in Louisiana is from the Chicot Aquifer while 70% of surface water is derived from the Mississippi River.

Withdrawal Sector	Daily Use in MGD	Annual Use in MG	@ \$10 per MG
Public/Rural Domestic	754	275,210	\$2.75m
Ag/Livestock/Aqua	1,546	564,290	\$5.64m
Industrial/Power Gen	6,420	2,343,300	\$23.43m

Sources: [DOTD, 2015](#); [LLA, 2020](#)