



LOUISIANA WATERSHED INITIATIVE

working together for sustainability and resilience

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

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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 (LWI) 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 strategies not yet widely used in Louisiana. 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.



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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, 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 flood-risk reduction funding strategies were evaluated to determine key aspects of funding, operational best practices, and equity framework. By taking a snapshot of various programs in the U.S., potential applicability to Louisiana can be examined.

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/taxes require authorization (and often regular reauthorization) by legislative bodies and/or the vote of the citizenry?
- Is there a mandated equity component?
- Is there an effective website and/or funding guide or portal?

Applicability to Louisiana

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

RESULTS

Geography & 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 4.7mi² land area, to states like Texas with a population of 29,000,000 and a land area of nearly 87,000mi², 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 were generally encompassed under stormwater, nature-based solutions (NBS), green infrastructure (GI), infrastructure, climate change adaptation, watersheds, water quantity and quality, and holistic (including transportation and quality of life issues) approaches.



States and local governments are:

- Coordinating and leveraging existing federal and state funding to build upon stormwater, NBS, GI, watershed, hazard mitigation, and climate adaptation activities
- Utilizing a nonprofit organization for coordination of funding and standards among watersheds and to support education/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
- Focusing sales taxes, property taxes, and bonds 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 the citizenry to understand flood-risk and the need to adopt hazard-resistant development standards, taxes, and fees to support solutions
- Utilizing 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:

- 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 non-profit organizations
- Jurisdictions of vastly different sizes (geographically and in terms of populations) can implement stormwater/watershed/climate resilience programs
- Most funding approaches require specialized legislation and/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 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 communities. Funding mechanisms varied by location based on factors such as geography, history of flooding and natural disasters, population, urban density, and other needs. Each approach is a tool for watershed management and flood-risk reduction.

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 their 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](#)).

Nationally, freshwater is often freely extracted. Of the locations that do charge, fees vary widely, as do systems of measurement. For example, prices per acre-foot can be as little as a dollar to more than one thousand dollars (NGWA, 2020). In California, at an average of \$40 per acre-foot, the fee equates to \$123 per million gallons ([Berkeley, 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 development of policies. Over the multi-parish Capital Area region, a fee of \$20 per million gallons (PMG) is charged. In 2018 the fee was \$10 PMG and generated nearly six hundred thousand dollars ([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, and 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 1700 districts in 21 states utilize stormwater fees ([Black and Veatch 2018](#)). EPA finds that these fees are generally more equitable than other revenue sources because they can be based on the actual cost the city incurs to manage stormwater from each property. Additionally, tax-exempt properties, such as universities and hospitals, can be required to pay their share of the costs for stormwater management. Stormwater utilities often use incentives for property owners to invest in green infrastructure ([USEPA, 2014](#)).

TULSA, OK

With a population similar to New Orleans, Tulsa 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 Square Unit (ESU= the projected annual cost of maintaining 2,650 square feet of property) ([City of Tulsa, 2020](#)). A residential property is 1 ESU per month per developed parcel. Fees for Multifamily, Commercial, Industrial are calculated as the number of ESUs (in total sf). 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, Nashville, TN instituted a stormwater fee in 2017 ([City of Nashville, 2020](#)). The fee generates approximately \$34 million per year for the city of nearly 700,000 ([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](#)).

TOWN OF NASHVILLE, NC

Demonstrating the applicability of stormwater fees across a wide range of jurisdictions, Nashville, NC (population ~5,000) approved an [ad valorem stormwater fee](#) in 2017, to fund storm drain and ditch maintenance. The fee, \$2.50 per month or \$30 per year, per residential property or \$30 per 2500 sf 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, 2020](#); [UNC, 2020](#)).

INFRASTRUCTURE BANK

An infrastructure bank supports and finances investment in a wide range of projects via the issuance of bonds, loans, grants, and mobilization of sources of public and private capital. 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 (RIIB) 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 and renewable energy, and brownfield remediation ([RIIB, 2020](#)). In particular:

- The **Stormwater Project Accelerator (SPA)** provides upfront capital for green stormwater infrastructure projects.
- The **Municipal Resilience Program (MRP)** 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, 2020](#)).

TEXAS

Texas Water Development Board (TWDB), established in 1957, provides low-interest loan financing for water projects, including stormwater management ([TWDBa, 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 and approved by one or more of the state's 16 regional water planning groups ([TWDBa, 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 or "Rainy Day" Fund to fund a flood financial assistance program ([TWDB, n.d.](#)).

GREEN BONDS / ENVIRONMENTAL IMPACT BONDS

A green bond is a fixed-income tool to raise money for climate and environmental projects and typically come with tax benefits for investors ([Investopedia, 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 (EIB) uses a "pay for success" approach to provide funding for innovative environmental projects. Investors pay upfront costs, and returns are based on the performance or other agreed-upon metrics. Once targets are met, the "payor" that benefits from these solutions repays investors an amount based on achievement of agreed-upon outcomes ([Qualified 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 ([Massachusetts Acts, 2018](#)), which codified and funds (at \$200M) a 2016 executive order outlining a comprehensive approach to climate adaptation. The bond includes funding for the Municipal Vulnerability Preparedness (MVP) program which requires local governments to participate in a training course to develop integrated MVP/Hazard Mitigation Plans (HMPs), aligning language, data, and goals across the state. Jurisdictions that participate in this training become eligible to apply for project implementation grants ([Massachusetts Office of Energy and Environmental Affairs 2020](#)).



RHODE ISLAND

In addition to the funding mechanisms described earlier, the Rhode Island Infrastructure Bank also issues Green Bonds. Since 2017, RIIB has issued > \$150 million in green bonds, ranging in value from < \$1 million to > \$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 improvement and climate resilience of wastewater lines and facilities ([RIIB, 2020](#)).

LOUISIANA

In 2018 the Louisiana Community Development Authority (LCDA) 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 (GOMESA), 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 (CPRA) is studying the feasibility of green bonds to support wetland restoration ([EDF, 2020](#)).

NEW ORLEANS

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 EIBs to support green infrastructure. \$30 million is anticipated to be raised. One aspect of the bond funds is to allow the city to offer Green Mortgages to homeowners and developers that require installation of stormwater measures. 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 (aka greenhouse gas or GHG) that uses market mechanisms to pass the cost of emitting on to emitters ("polluter pays"). Its 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, the State of Virginia enacted the Community Flood Preparedness Fund (part of the Clean Energy and Community Flood Preparedness Act) under its Department of Conservation and Recreation (DCR). 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 will target low-income areas ([Pew, 2020](#)). First-year revenue estimates are 45 to 100 million dollars per year starting in 2021 ([Rankin, 2020](#)).

LOUISIANA

In 2017 the Louisiana Legislature passed [HB 423](#) authorizing the Louisiana Department of Environmental Quality (LDEQ) 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 is actively developing the program which is yet to generate funds ([LDEQ, 2019](#)).

In August 2020 Governor John Bel Edwards, in an effort to achieve zero emissions by 2050, signed [Executive Order JBE 2020-18](#) to launch a [Climate Initiatives Task Force](#) of experts and stakeholders tasked 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 to fund water quantity and quality issues within jurisdictional boundaries. A challenge is that tax-exempt entities, such as properties owned by churches, schools, and government, may be exempt, even though they may contribute significantly to runoff.

BAYOU VERMILION DISTRICT

The Lafayette Parish Bayou Vermilion District (BVD) serves as an established Louisiana example of an 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 \$2.1m 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, the public must be educated to understand 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, in 2000, provided 1/10 cent and was used to develop several well-promoted public projects, and as 50/50 match funds for projects on private property. The second, in 2012, which added 4/10 cent, passed with 68% of the vote ([City of St. Peters, n.d.](#)). 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 (CBP3)

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

MILWAUKEE, WI

In 2019, the Milwaukee Metropolitan Sewerage District (MMSD) released an RFP 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 ([AFM, 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 ([WCPA, n.d.](#)). Whether created to serve a region or the state, this tool provides another vehicle for conservation easements, and nonprofit land trust organizations offer partnership and fundraising opportunities to align and leverage dollars and systems.

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 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

Utilizing 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 ([LTL, n.d.](#)). The organization currently manages 20 conservation projects on a total of more than 7,000 acres spread around Southeast Louisiana.

BROWNFIELDS PROGRAM

LDEQ 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 [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 ([Memphis 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 make more transparent the risks faced by owners of commercial and residential real estate. In October 2021 the National Flood Insurance Program (NFIP) 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, “*disaster resistant buildings that meet the 2018 International Residential Code and 2018 International Building Code led to a national benefit of \$11 saved for every \$1 invested in comparison to older generations of code*” ([FEMA, n.d.](#)).

Adopting higher building standards only reduces risk for newly constructed buildings or 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 avoided 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/STORMWATER INTERESTS

A statewide gap analysis ([LWI, 2019](#)) revealed that no existing public entities currently have the multijurisdictional authority needed to administer regional watershed management. Additionally, some entities have overlapping authority and geographic boundaries, making it unclear which have jurisdiction over certain elements of water management. In some states, non-profit organizations assume various stormwater/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 non-profit focused on growth, development, and infrastructure) partnered with Flood Defense New Jersey (a coalition of state and local non-profit organizations organized around flood and pollution mitigation) to take a lead role in stormwater management through the New Jersey Stormwater Utility Resource Center ([SURC, 2020](#)) to support local governments in creating stormwater Utilities (as authorized by the state’s 2019 [Stormwater Utility Law](#)).



*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. Myriad requirements of public and private sources require regions to possess a suite of legal authorities and organizational capacities. In the digital age, being prepared for funding involves a new set of strengths and expertise within reach of any size community. Web-based applications and resources offer open access to funds and supportive tools and resources to guide novice users, opening up 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 ([CEO, 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.
- Utilize 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
- Schools as learning and volunteer hubs, [future water leaders](#)
- 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 (all living things), which, though often freely extracted in ways that deplete and damage vital resources, typically are 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](#) (BCA). 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

NBS/GI 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 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 where their [Engineering with Nature](#) (EWN) 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 spawns 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 & 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](#) which encompasses 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 & Mendoza 2017](#)).

The seven sectors: Agriculture & Fisheries, Coast & Environment, Ecotourism & Recreation, Energy & Industry, Law & Policy, Maritime & 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 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 on its large-scale use. These two challenges: to recognize and learn to live with water's cycles and roles, and to measure and value its use, are at the heart of gaps in our funding mechanisms and stewardship of this precious resource.



Suggested Reading

- Funding
 - *2020 Louisiana Water & 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
 - [Black & Veatch](#)
 - 2018 Stormwater Utility Survey
 - [Headwaters Economics](#) 2020
 - Building for the Future: Five Midwestern Communities Reduce Flood-risk
 - [Bureau of Governmental Research](#) 2017
 - Do Stormwater Fees Make Sense for New Orleans?
- Equity
 - *[An Equitable Water Future: Milwaukee](#) [US Water Alliance](#), 2020*
- National Overview
 - *[Recovering Stronger: Transforming Water Management Post COVID-19](#) [US Water Alliance](#), 2021*
 - *[The Economic Benefits of Investing in Water Infrastructure: How a Failure to Act Would Affect the US Economic Recovery](#) [ASCE](#), 2020*



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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 Haz. Mit. & Climate Adaptation Plans
Funding Source(s)	User Fees	Property tax; enabled to issue bonds; business-type activities	\$2.4B 2018 Environmental Bond; Carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative
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.	Utilizing carbon auction (cap and trade) program (multi-state coalition). Mandatory participation in a cross-discipline education program is a prerequisite for funding. Integrated Haz. Mit. & Climate Adaptation Plans
APPLICABLE TO LA	LA	Exemplary program in Louisiana.	Community resilience-building framework and funding system for plans and actions. Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.
Effective website and/or funding portal?		Yes , but not for funding opportunities.	
Establishment Legislation	LA R.S. 38:3071-3084	LA R.S. 33:9201	Executive Order No.569; H.4835 (2018); Sec 22 Carbon dioxide cap and trade program
Equity Plan for allocation			
Date Established	1974	1984	2016
Land Area	88.65 mi ²	55.65 mi ²	10,565 mi ²
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) - Community Based Green Infrastructure (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	Partially funded through a tiered stormwater fee for residential and commercial properties. carbon legislation introduced 2020
Recurring/Consistent?	Varies	Yes	Yes	Yes
Operational Best Practices	Regional plan for multiple counties in 3 states. Cost benefit analysis includes Resilience and Environmental Value, Community Dev. & Economic Revitalization	CBP3 using performance-based pricing to construct total of 20MG capacity of green infrastructure stormwater projects in 3 years; accelerating pace of construction via up-front private capital. Public interface via Fresh Coast Resource Center	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 to 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?	Yes , but not for funding opportunities	Yes		
Establishment Legislation	Established through a HUD grant.	MMSD contract	Municipal Ordinance	Municipal Ordinance
Equity Plan for allocation	Yes. 51 percent of all NDRC funds will be spent on activities benefitting LMI persons.	2020 Equity Report , 25% DBE		
Date Established	2011, through HUD funded project	2019	2017	Stormwater fee established 2009 by ordinance
Land Area	3013 mi ²	348 mi ²	4.7 mi ²	526 mi ²
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 non-profit 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)	Private/Philanthropic program providing guidance/support. Carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative & raised \$80m to fund mitigation/restoration.	Bonds, grants, public & private capital, carbon auctions. Member of 11 state Regional Greenhouse Gas Initiative.	Sales tax, bonds
Recurring/Consistent?	Varies	Varies	Varies
Operational Best Practices	Utilizing 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. Utilizing 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 non-profit for state-wide coordination among watersheds and educational messaging. Carbon pricing revenue aligns with Gov. Edwards Climate Initiatives Task Force priorities.	Potential to build on our strengths by expanding the mission/roles of LA's recently enacted infrastructure bank. 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?	Yes	Yes	
Establishment Legislation	n/a; in support of NJ S1073 (enacted 2019)	State Law	Proposition P (2012)
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 ²	1,212 mi ²	22.41 mi ²
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.	Member of 11 state Regional Greenhouse Gas Initiative, \$100m in expected first year revenue from carbon auctions.
Recurring/Consistent?	Yes	Yes	Yes
Operational Best Practices	Have a Texas Water Plan, finance board, innovation center, and recently initiated river basin flood management system similar to LWI. Legislatively directed to finance \$27b in state Water Plan projects over the next 50 years.	Successful implementation of stormwater fees in combination with other local and federal sources, buyouts	Utilizing 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?	Yes		
Establishment Legislation	Senate Bill 7 of the 86th Texas Legislature	Municipal Code 11-A	2020 Fund Draft; The Clean Energy and Community Flood Preparedness Act 2020
Equity Plan for allocation			Yes, 25% of budget for low-income areas
Date Established	1957 (2019)	Stormwater fee established 1986 by ordinance	HB 981 2020, Statutory Req. for Fund, 10.1-603.25
Land Area	268,597 mi ²	187 mi ²	39,490 mi ²
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 (MGD = MILLION GALLONS PER DAY)

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 (PMG) 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	275210	\$2.75m
Ag/Livestock/Aqua	1546	564290	\$5.64m
Industrial/Power Gen	6420	2343300	\$23.43m

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