

Using a Stormwater Fee to Finance More Equitable, Sustainable, and Innovative Urban Water Management

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Introduction

New Orleans is ready to renew its approach to stormwater management. Extraordinary flooding in and near the city during the 2017 hurricane season has heightened citizens' awareness of the inadequacy of the city's existing drainage system. Improvements and even ordinary maintenance have been put off for decades, due in no small part to a gross lack of funding. The results of that neglect have become painfully clear.

A root cause analysis of flood events in July and August 2017 led by ABS Group found that a lack of dedicated maintenance funding was a root cause for system failure on both sides of the bifurcated drainage network, which includes catch basins, pipes, maintained by the city Department of Public Work as well as larger culverts, pumps and canals managed by Sewerage and Water Board of New Orleans.¹ Keith Reidling of Rafetelis consulting firm told the Sewerage and Water Board Task Force established in 2018 by Louisiana House Resolution 193 that approximately \$50 million annually was needed to rehabilitate the drainage system.² While that number is staggering, it does not reflect "green infrastructure" projects that intercept and absorb stormwater before it enters the drainage system – also a subject of much discussion by the task force and city administration.

New Orleans will not get the drainage system it's residents need merely by funding the status quo. This demand for comprehensive stormwater management can no longer be satisfied by pumping alone, given the availability of newer

methods that are cost-effective and deliver a broad array of co-benefits to city residents. These documented benefits include cleaner air and waterways, fewer urban heat islands, and more attractive streetscapes that increase land values.³

The Water Collaborative of Greater New Orleans proposes the creation of a new user fee that not only funds the existing drainage system but also comprehensively improves the city's ability to handle stormwater. The resulting revenues should be additive to existing millages, but this approach is not just another way to pay bills and avoid disaster; a thoughtfully developed stormwater fee program can accomplish vastly more.

The research provided below is intended to guide policymakers and community stakeholders in developing or evaluating proposals for a stormwater fee in Orleans Parish. Any comprehensive proposal will address allowable expenditures, rate-setting and -review, and program administration.

The fee program should be structured to increase the use of green infrastructure, which provides effective stormwater control at a lower cost while simultaneously improving quality of life. The program can and should be designed to increase equity among citizens while simultaneously reducing the risks of property damage and economic loss associated with flooding. Administration of the fee should be fair and sufficiently transparent to earn public confidence.

A well-designed stormwater fee program is an investment that pays considerable dividends in terms of safety, economics and quality of life.

¹ ABS Group, Cara Stone, LLP and Gaea Consultants, "Presentation: City of New Orleans Stormwater Drainage System Root Cause Analysis of July-August 2017 Flooding," September, 2018.

² See [Oct. 3 Minutes: Sewerage and Water Board Task Force](https://roadwork.nola.gov/swb-task-force/meeting-minutes-and-agendas/) <https://roadwork.nola.gov/swb-task-force/meeting-minutes-and-agendas/>.

³ U.S. Environmental Protection Agency Office of Oceans, Wetlands and Watersheds, [Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater](#), August, 2010.

Flooding Is Bad, and Getting Worse

Already one of the rainiest cities in the U.S., New Orleans is due for increasing precipitation in the foreseeable future. The city's average rainfall is often reported at 64 inches per year, but that statistic may already be outdated. More than half that amount of rain fell on the city between June and August 2017.⁴ Annual totals exceeded 70 inches in 2015, 2017 and 2017.⁵ Floods that are characterized as 100-year events are happening with such increasing frequency they may soon be considered the norm.

As climate change increases temperatures in humid areas, thunderstorms that cause flash flooding will become more frequent and intense.⁶ Greater surface temperatures in the Gulf of Mexico will increase evaporation. At higher temperatures, the atmosphere will have increased capacity to hold water vapor, leading to greater volumes of rainfall.⁷

As a result, the probability of New Orleans experiencing severe flooding doubles, quickly causing billions of dollars in damage.⁸ Sudden and destructive floods like those during 2017, characterized by various authorities as 50- to 100-year events, are happening more frequently. The city's drainage system is unable to keep pace with these events.

⁴ Jennifer Larino, "[This summer is officially the rainiest on record for New Orleans.](#)" *nola.com / The Times Picayune*, Aug. 28, 2017.

⁵ Jennifer Larino, "[A look back at the 20 rainiest years in New Orleans history.](#)" *nola.com / The Times Picayune*, Jan. 12, 2018.

⁶ Andreas F. Prein et al., "[The Future Intensification of Hourly Precipitation Extremes.](#)" *Nature Climate Change* (2016): 48.

⁷ Ibid.

⁸ Henry Fountain, "[Scientists See Push From Climate Change in Louisiana Flooding.](#)" *The New York Times*, Sept. 7, 2016.

The Drainage System Has Not Kept Up

New Orleans' drainage system has substantial and undisputed room for improvement. The city's drainage infrastructure has been neglected for decades, due in large part to inadequate funding. Year after year, a shortage of funds has led the Sewerage and Water Board to defer both regular maintenance and capital improvements.⁹ The result of this ongoing funding deficit is a grossly under-maintained drainage system, with insufficient new infrastructure to serve emerging needs.

Compared to funding mechanisms for the S&WB's water and sewer operations, which allow for increases in water and sewer fees to offset rising costs, the funding for drainage is less robust. The S&WB's drainage operations are funded almost entirely from three dedicated ad valorem property taxes. In 2017, these taxes generate approximately \$54 million, providing the lion's share of the S&WB's projected \$55.3 million in drainage revenues.¹⁰ In the fall of 2018, the agency completely depleted its cash reserve for drainage and was forced to "borrow" ratepayer dollars from its water and sewer operations to keep its share of the stormwater system functioning.¹¹ Soon thereafter the board's Finance Committee contemplated a \$40 million bond issuance for "critical" and "urgent" drainage upgrades, but such a one-time cash infusion will

⁹ Bureau of Governmental Research, [Beneath the Surface: a Primer on Stormwater Fees in New Orleans](#), February 2017, p. 6.

¹⁰ Ibid

¹¹ Jeff Adelson, "[New Orleans S&WB drainage system out of cash, will have to rely on water and sewer funds.](#)" *New Orleans Advocate*, Nov. 7, 2018.

not close the operations and maintenance funding gap.¹²

Cost burdens on the city's drainage system will increase substantially over the next several years. Starting in 2019, the S&WB must begin paying its share of the Southeast Louisiana Urban Flood Control Project (often referred to as SELA). These payments are expected to increase to \$8.8 million per year by 2022 and remain at that level for the duration of the 30-year payment plan. Existing revenues may cover only half of these expenses. By the S&WB's own estimates, the city's drainage system, inclusive of assets managed by the Department of Public Works, needs another \$54.5 million per year in addition to its current revenue.¹³

Augmenting the conventional drainage network with green infrastructure designed to absorb or slow runoff as described below is often more cost-effective than expanding drainage capacity to reduce recurrent street flooding, but it too requires both capital dollars and operations and maintenance.

Closing the Gap with a Stormwater Fee

New Orleans can follow hundreds of communities across the country and close that funding deficit by implementing a user fee that specifically funds stormwater management.

A stormwater fee is a discrete charge used to offset the costs of municipal stormwater management associated with the runoff generated from a particular piece of real property. Stormwater fees are becoming an increasingly common method of funding stormwater infrastructure. Typically a

jurisdiction will establish a stormwater utility to collect and expend these fees. As of 2016, there were more than 1,600 stormwater utilities in effect throughout the United States, mostly in coastal communities and inland regions of higher population density.¹⁴ The number of jurisdictions charging stormwater fees increases every year.

As with water and sewer utilities, the rate-approval process for stormwater utilities varies from place to place. It may be subject to approval by an oversight board, local council or utility regulatory agency. Fees may be collected via a monthly bill or annual assessment. Some jurisdictions dedicate fee income to a specific set of projects while continuing to rely on taxes and other sources to fund aspects of stormwater management.

Similarly, different jurisdictions use different ways of determining the amount charged a given property. Common determinants used to calculate a fee are the size of the parcel, the relative areas of pervious and impervious surface within the parcel, and whether the parcel is used for residential or commercial purposes.¹⁵

Ideally, the chosen method used to determine the fee for a given property uses parcel-specific data to produce a fee amount that is closely related to the actual burden the property places on the drainage system. Three such methods are:

- The **Intensity of Development** method, which uses the ratio of a property's impervious area to its total area;
- The **Equivalent Hydraulic Area** method, which applies a higher rate to a property's impervious area and a lower rate to its

¹² See records of [Special Meeting of the Sewerage and Water Board Finance Committee](#), Dec. 3, 2018.

¹³ Bureau of Governmental Research, [Beneath the Surface: a Primer on Stormwater Fees in New Orleans](#), February 2017, p. 7.

¹⁴ C. Warren Campbell, Randel L. Dymond, Kandace Key and Amanda Dritschel, [Western Kentucky University Stormwater Utility Survey 2017](#).

¹⁵ C. Warren Campbell, Randel L. Dymond, Kandace Key and Amanda Dritschel, [Western Kentucky University Stormwater Utility Survey 2017](#).

pervious area, then sums those two amounts to get the final fee; and

- The **Runoff Factor** method, which calculates the property's actual runoff as accurately as possible using data such as pervious and impervious area, slope, soil type or storm models.¹⁶

By maintaining a close relationship between the property's actual runoff and the fee amount, all these methods result in a fee that is higher for properties that produce more runoff and lower for those that produce less.

Determining the fee based on this information has several advantages, the most intuitive being fairness. Properties creating a greater demand on the drainage system should have to pay a greater share of drainage costs.

Binding the fee to runoff amounts also gives all fee payers an incentive to improve their own on-site stormwater management. These improvements will reduce the runoff produced and thus the resulting fee. A formula that accounts for impervious surface area encourages fee payers to reduce impervious surfaces. Removing unneeded pavement or accessory dilapidated structures would result in less impervious surfaces on the property and a lower fee for the owner.

Compared to a fee calculation related to actual runoff, the city's current method of funding via millage seems arbitrary. Since the drainage system's funding is determined by property values, there is no direct connection with any property's actual burden on the drainage system. The cost burden is not distributed fairly, and property

owners are offered no incentive to control their own runoff.

Furthermore, under the current funding scheme, tax-exempt properties make no contribution to drainage funding. Many of these properties are large institutional facilities, such as university campuses and governmental facilities that generate large amounts of runoff. Many of these institutional property owners have the resources and real estate necessary to implement transformative stormwater management on-site. Yet, under the current funding scheme, these property owners have a greater incentive to keep burdening the drainage system for free while other nonexempt property owners bear the cost for stormwater management.

Some communities use calculations that have little or no relation to actual runoff. Some of these calculations include a flat per-parcel fee, a system of tiered fees, a local average of per-property runoff, the number and size of water meters or the number of parking spaces.¹⁷ In some cases, the motivation for charging residential parcels a flat rate may be to simply rollout and public acceptance. However, these methods are typically used by communities that lack the administrative capacity required to use a more sophisticated method. Certainly, most lack the unique drainage challenges found in Southeast Louisiana. New Orleans has resources at its disposal, such as GIS data and existing property records, that would allow the city to make a fairer calculation based on parcel-specific data without taking on an excessive administrative burden.

In the course of designing a stormwater fee system, keeping fairness in mind ultimately makes for a more durable funding mechanism.

¹⁶ Bureau of Governmental Research, [*Beneath the Surface: a Primer on Stormwater Fees in New Orleans*](#), February 2017, p. 15-16.

¹⁷ C. Warren Campbell, Randel L. Dymond and Amanda Dritschel, [*Western Kentucky University Stormwater Utility Survey 2016*](#), p. 8.

Stormwater fees are sometimes challenged on legal grounds as impermissible taxation, but a fee formula with a close nexus to actual runoff is more likely to survive this challenge.¹⁸

The more visibly fair a stormwater fee is, the more likely it is to earn popular acceptance and even support. Transparency is key: The method for calculating the fee must be clear and basically comprehensible, and the administrative system that implements the fee must be accessible, evenhanded and responsive to the fee payers who interact with it.

To maintain public confidence, the expenditure of fee revenue should be equally transparent. Fee payers should be able to grasp the connection between their stormwater fees, the projects they fund and the resulting improvements in drainage.

Designing a Stormwater Fee System with Equity in Mind

Fair pricing for stormwater management is only one element in the much broader conversation about equity in city infrastructure and services. The *2017 EquityNewOrleans Road Map* documented social and economic disparities in New Orleans and challenged city government to improve policies, programs and service delivery in ways that alleviate disparate hardship and create opportunity for historically marginalized communities.¹⁹ From assessment to expenditure, a well-designed stormwater fee system can, and therefore should, increase equity within a community.

The idea of a user fee that promotes equity may seem counterintuitive at first. If bluntly designed, a stormwater fee could be regressive, imposing a greater relative financial burden on lower-income residents.

But in fact, every step in the design and implementation of a stormwater fee is an opportunity to increase equity. Funding drainage improvements can have the most beneficial effects on disadvantaged communities that are most harmed by flooding. Additionally, prioritizing funding for green infrastructure projects leads to aesthetic, environmental and public health co-benefits. Public utilities are also local employers, as are many of the contractors they work with, and as such they tend to offer desirable employment that pays a living wage.²⁰

The challenge of assessing a stormwater fee that distributes cost burdens equitably has inspired some creative and effective solutions. One simple solution is to offer need-based stormwater fee discounts. For example, in Jacksonville, Florida, property owners with an income below 150% of the federal poverty level are exempt from paying the fee. Philadelphia offers a fee reduction for low-income seniors, and Baltimore makes a hardship exception for certain low-income residents.²¹

Baltimore also cleverly uses its stormwater fee credit program to create opportunities for community contribution. Under this program, residents can reduce their stormwater fees by participating in organized public events that

¹⁸ Bureau of Governmental Research, *Beneath the Surface: a Primer on Stormwater Fees in New Orleans*, February 2017, p. 10.

¹⁹ City of New Orleans, *EquityNewOrleans Road Map*, April 2017.

²⁰ US Water Alliance, *An Equitable Water Future: A National Briefing Paper*, June 2017, p. 35.

²¹ Mandy DeRoche, "A Stormwater Fee, with Strong and Equitable Credits for Green Infrastructure, Could Benefit New York City as a Whole and Environmental Justice Communities such as the South Bronx," *Environmental Law in New York*, vol. 25, no. 1, January 2014.

improve stormwater management, such as tree plantings, neighborhood cleanups and water body cleanups. Organizers of these activities register them with the city's Department of Public Works; then each volunteer's hours spent contributing to the activities earn them credits toward a discount on their stormwater fee.

Many activities that qualify for credits in the Baltimore program require only an investment of time and effort by the community's members, with little or no capital expense. Concurrently, such events build community and give residents an opportunity to contribute to their neighborhood's resilience.²²

Portland, Oregon, promotes its own stormwater fee credit program, known as the Clean River Rewards program, as a means for residents reduce their utility expenses.²³ This works in tandem with Portland Water Bureau's direct financial assistance programs for lower-income residents as well as its Water Efficiency Program, which provides free water conservation kits to reduce utility bills.

Credits can also create incentives for neighborhood institutions to conduct education and outreach programs. For example, the credit program in Lancaster, Pa., offers credits to schools that provide classroom instruction on stormwater management.²⁴

In New Orleans, such credits do not need to be limited to schools – they could be extended to any

neighborhood organization that arranges an education and outreach program, like a church or social club, so long as the organization owns real property subject to fee. Since flooding in 2017, many neighborhood institutions are giving more thought to stormwater management. They may hold an untapped reserve of new interest in education and outreach programs. Bearing equity in mind, community partners may be important allies in reaching low- and fixed-income households with the tools they need to reduce runoff and thereby minimize the cost burden of a stormwater user fee.

Using Credits to Empower Fee Payers and Promote Beneficial Behavior Change

Equity is further increased by giving fee payers some power over the amount of their fee, in exchange for their contribution to the management of their property's runoff. This can be done by implementing a well-designed credit system.

Credits incentivize change by offering fee payers a discount in exchange for making improvements that decrease runoff from their properties. Improvements like installation of pervious pavement, rain gardens and detention basins often qualify for credits in many stormwater utility districts.²⁵ Creditable improvements need not be costly or elaborate. Low-cost improvements like rain barrels and cisterns can put fee discounts within the reach of most households.

In Portland, residents can get credit for all of their on-site stormwater charges, which make up 35% of the total fee, by using their own on-site

²² Baltimore City Department of Public Works, "[Reducing Your Stormwater Fee](https://publicworks.baltimorecity.gov/stormwater-fee/reducing-stormwater-fee)," <https://publicworks.baltimorecity.gov/stormwater-fee/reducing-stormwater-fee>.

²³ City of Portland Environmental Services, "[Stormwater Discount Program](https://www.portlandoregon.gov/bes/41976)," <https://www.portlandoregon.gov/bes/41976>.

²⁴ City of Lancaster, "[Stormwater Management](http://cityoflanasterpa.com/resident/stormwater-management)," <http://cityoflanasterpa.com/resident/stormwater-management>.

²⁵ Bureau of Governmental Research, [*Beneath the Surface: a Primer on Stormwater Fees in New Orleans*](#), February 2017, p. 18.

stormwater management.²⁶ Baltimore offers credits for improving stormwater management both on- and off-site,²⁷ and El Paso, Texas, offers a 25% credit for nonresidential properties with certified on-site stormwater retention ponds.

Philadelphia Water Department provides parcel-specific calculations and credits (as well as an appeals process) to commercial stormwater customers while charging all residential stormwater customers a flat rate.²⁸ This was deemed suitable because the city's housing stock of mostly row houses is relatively standardized in both gross and impervious surface area (therefore most homes generate a similar amount of stormwater runoff). Nevertheless, Philadelphia offers subsidized pricing on landscaping products that improve stormwater management and free rain barrels through its Rain Check program.²⁹ This demonstrates public willingness to contribute to stormwater solutions and water quality improvements.

The District of Columbia's credit system allows fee payers to sell and trade credits, turning one's own on-site stormwater management into a marketable commodity. Under D.C.'s Stormwater Retention Credit Trading Program, green infrastructure measures taken voluntarily or that exceed regulatory requirements can earn marketable credits. Property owners can offer

these credits for sale in an online market hosted by the Department of Energy and Environment.³⁰ While the locality acknowledges "relatively small, single-family homes are unlikely to have opportunities for cost-effective [credit] generating," they offer grants to start-up businesses that will aggregate multiple interventions to generate credits.³¹ An aggregator might, for example, handle the installation of retention features like rain gardens on numerous single- and multiple-family parcels – realizing some economy of scale – then bundle the resulting retention volume into marketable credits.

In these ways, a well-designed stormwater fee program can drive beneficial behavior change that improves stormwater management citywide. Incentives for fee payers and carefully chosen public projects funded by fee revenues will increase both private and public spending on effective drainage infrastructure.

Reaping the Benefits of Green Infrastructure

For New Orleans, the lion's share of untapped benefits lies in directing much of this new spending toward green infrastructure. After more than a century of reliance on pumped drainage, the city now stands to gain new value by making green infrastructure a foundational component of its drainage system on par with traditional pumping.

²⁶ City of Portland Environmental Services, "[Stormwater Discount Program](https://www.portlandoregon.gov/bes/41976)," <https://www.portlandoregon.gov/bes/41976>.

²⁷ Baltimore City Department of Public Works, "[Reducing Your Stormwater Fee](https://publicworks.baltimorecity.gov/stormwater-fee/reducing-stormwater-fee)," <https://publicworks.baltimorecity.gov/stormwater-fee/reducing-stormwater-fee>.

²⁸ Joanne Dahme, "Presentation: Philadelphia Water Department Water, Sewer & Stormwater Rate Board," November, 2018. <https://roadwork.nola.gov/roadwork/media/Documents/SWB%20Task%20Force/NOLA-Webiner11-30-18.pdf>

²⁹ City of Philadelphia, "[Residential Stormwater Billing](http://www.phila.gov/water/wu/stormwater/Pages/ResidentialSWBilling.aspx)," <http://www.phila.gov/water/wu/stormwater/Pages/ResidentialSWBilling.aspx>.

³⁰ District of Columbia Department of Energy & Environment, "[Stormwater Retention Credit Trading Program](https://doee.dc.gov/src)," <https://doee.dc.gov/src>.

³¹ See District of Columbia Department of Energy & Environment, "[FAQ: Generating and Selling SRCs](https://doee.dc.gov/node/1303751)," and "[SRC Aggregator Startup Grants](https://doee.dc.gov/node/1282966)" <https://doee.dc.gov/node/1303751> and <https://doee.dc.gov/node/1282966>

In a broad sense, the term “green infrastructure” refers to drainage methods that control stormwater where it falls or nearby, often using natural or restored landscape features. Green infrastructure contrasts with traditional piping and pumping, which is often referred to as gray infrastructure. Rather than diverting stormwater into the gray infrastructure system as quickly as possible, green infrastructure slows the dispersal of stormwater, stores it temporarily and allows more of it to be absorbed by soil and plants.

Rain gardens are some of the most visible examples of green infrastructure, featuring areas of unpaved land that is graded to slow or retain stormwater and landscaped with hardy, water-loving native plants. Bioswales are landscape installations designed to retain water with a focus on filtering out pollutants as the water drains away. But in the broadest sense of the term, any practice that manages stormwater on-site, such as a cistern or rain barrel, can be considered green infrastructure, as can permeable alternatives to traditional pavement that allow stormwater to seep through to the soil below.

The New Orleans building code currently requires some onsite rainwater storage at new developments with 5000 or more square feet of impervious surfaces (e.g., roofs and pavement). This policy has helped drive the use of green infrastructure by the private sector; however, it does not apply to already developed parcels, leaving acres of asphalt unaffected. Similarly, the city has large municipal green infrastructure projects underway using federal grants, but no dedicated, local funding source for green infrastructure maintenance or expansion.

It’s important to understand that green infrastructure does not and cannot replace gray infrastructure. Some pumping will always be necessary in New Orleans, as the city receives

more rainfall than its land can absorb by itself. Removing the excess stormwater requires moving it over natural ridges, then over or through the levee system and into surrounding water that sits higher than much of the land within the city.

At the same time, pumping alone cannot provide the best possible stormwater management. Instead, gray and green infrastructure must work together. This dual-method approach to stormwater management has become more prevalent over the past decade in many communities.³²

During periods of heavy rainfall, green infrastructure slows the influx of stormwater into the already overburdened drainage system. Less water enters the drainage system, and the S&WB has more time to pump it – all of which translates to better stormwater control and cost savings.³³

Green infrastructure is most effective in controlling ordinary urban flooding, which is more frequent yet less intense than the more destructive flooding associated with major events like hurricanes. Perhaps surprisingly, this ordinary urban flooding causes some of the most expensive flood damage. Most of the cost of flood damage over the next 50 years is expected to come not from outstanding events like hurricanes, but from more garden-variety, thunderstorm-generated flash flooding.³⁴ The Federal Emergency Management Agency estimates that as much as 25% of flood-related economic losses result from

³² US Water Alliance, [*An Equitable Water Future: A National Briefing Paper*](#), June 2017, p. 42.

³³ Richard Rainey, “Overcoming fear of water in New Orleans, one plot, one class at a time,” [nola.com / The Times Picayune](#), June 13, 2014.

³⁴ Bob Marshall, “New research: Expect more intense rainstorms and flooding in southern Louisiana,” [The Lens](#), Dec. 13, 2016.

ordinary urban flooding in areas outside the floodplain.³⁵

The Greater New Orleans Urban Water Plan estimates that over a 50-year span, rainwater flooding in the three-parish study area will cause damage totaling \$8 billion.³⁶ Cost estimates for each five-year flood event – including property damage, lost productivity and lost wages – come in at more than \$942 million per event.³⁷ Flooding imposes other costs associated with disrupted business, delayed transportation, reduced property values and lost tax revenues.

This costly urban flooding is the type of flood event against which green infrastructure is particularly effective. A well-designed stormwater fee program should take advantage of green infrastructure's marked cost-effectiveness to protect the community from the damage associated with the most common flooding events.

Existing projects in other cities demonstrate green infrastructure's cost-saving potential in urban settings. Impressive savings, for example, were realized in Philadelphia after the city began to require properties to retain the first inch of rainfall on-site. After enforcing the new stormwater regulations effectively for two years, the city's water department estimates it now saves about \$340 million in costs related to stormwater

storage, not including costs related to operations and maintenance.³⁸

Communities like Lenexa, Kan., and Stafford County, Va., have successfully supplemented traditional flood protection systems with green infrastructure like rain gardens and street bioswales. These projects now reduce flooding during peak rain events. Chicago's Green Alley Program, which began as a response to complaints from property owners about basement flooding, has provided better flood prevention and cost savings by replacing miles of impervious pavement in alleys with newer, porous surfaces.³⁹

Closer to home and on a smaller scale, Episcopal School of Baton Rouge successfully resolved persistent flooding in the school's quadrangle by installing rain gardens and bioswales. Design and construction of the project cost just over one-fifth of estimates the school received to have the site repiped with a gray infrastructure system.⁴⁰

The relative simplicity and lower cost of green infrastructure puts it within the reach of individual homeowners. Projects as simple and inexpensive as a rain barrel can improve drainage at minimal expense, and with a little education and outreach, a home gardener can learn how to turn their backyard garden into a rain garden. These projects are capable of being installed by a

³⁵ American Rivers, Water Environment Federation, American Society of Landscape Architects, and ECONorthwest, [*Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide*](#), April 2012, p. 22.

³⁶ Waggonner & Ball Architects, [*Greater New Orleans Urban Water Plan: Implementation*](#), September 2013, p. 34.

³⁷ Waggonner & Ball Architects, [*Greater New Orleans Urban Water Plan: Implementation*](#), September 2013, p. 49.

³⁸ U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds, [*Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure*](#), 2010, p. 9.

³⁹ U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds, [*Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure*](#), 2010, p. 10.

⁴⁰ American Rivers, Water Environment Federation, American Society of Landscape Architects, and ECONorthwest, [*Banking on Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide*](#), April 2012, p. 10.

do-it-yourselfer, without the labor, materials and professional expertise usually required to install subsurface drainage.

Reducing Costs by Reducing Soil Subsidence

Well-designed drainage systems, and particularly green infrastructure, can significantly reduce soil subsidence and the costly damage it can cause.

Subsidence is the collapsing and sinking of soil. It's a complicated phenomenon, and within this region it results from a number of contributors. A recent study by the Center for GeoInformatics at LSU and NASA's Jet Propulsion Laboratory revealed that the most likely drivers of subsidence in the New Orleans area are human causes – namely, groundwater extraction and the pumping of surface water. The study also found that subsidence in the region is happening faster than it once did – as rapidly as two inches per year in industrial areas near the river.⁴¹

New Orleans' outmoded strategy of aggressively pumping stormwater is a significant contributor to subsidence.⁴² Draining stormwater as quickly as possible causes organic matter within the soil to dry out, oxidize and collapse. This in turn causes the surrounding soil to sink, damaging nearby pipes and structures. Impervious surfaces, such as

traditionally constructed buildings and pavement, contribute to the problem by diverting stormwater into the drainage system instead of allowing it to infiltrate naturally into the soil.

In New Orleans, subsidence is notorious for warping buildings, cracking pipes and buckling streets and sidewalks. Subsidence is expected to cause an estimated \$2.1 billion in damage to private property over the next 50 years, according to the Urban Water Plan.⁴³

In addition, subsidence will continue to inflict significant damage to public infrastructure, particularly to streets and underground utilities. Replacing a street in New Orleans costs approximately \$7 million per mile – several times more than the cost paid in other urban areas. The Department of Public Works attributes the exorbitant cost to the additional subsurface repair work necessitated by soil subsidence.⁴⁴

While green infrastructure cannot stop or reverse soil subsidence, it can slow it substantially. In particular, removing impervious surfaces or replacing them with porous alternatives allows water to rehydrate the soil beneath, slowing the decay of organic matter. Bioswales, rain gardens and subsurface storage chambers can do the same thing. Water that would have otherwise been flushed into Lake Pontchartrain is instead allowed to seep into the ground, where it can slow the pace of soil collapse.

Furthermore, by reducing the peak volume of runoff entering the drainage network during a rain event, green infrastructure can help change

⁴¹ Cathleen E. Jones, Karen An, Ronald G. Blom, Joshua D. Kent, Erik R. Ivins, and David Bekaert, "[Anthropogenic and geologic influences on subsidence in the vicinity of New Orleans, Louisiana](#)," *Journal of Geophysical Research Solid Earth*, vol. 121 issue 5, May 16, 2016, pp. 3867–3887; LSU Media Center, "[New Study Maps Rate of New Orleans Sinking](#)," May 16, 2016.

⁴² Waggonner & Ball Architects, [Greater New Orleans Urban Water Plan: Implementation](#), September 2013, p. 25; Bob Marshall, "[Special report: How New Orleans is making a 'serious problem' worse with its levees, pumping stations](#)," *The New Orleans Advocate*, March 5, 2015.

⁴³ Waggonner & Ball Architects, [Greater New Orleans Urban Water Plan: Implementation](#), September 2013, p. 34; p. 39.

⁴⁴ Bob Marshall, "[Special report: How New Orleans is making a 'serious problem' worse with its levees, pumping stations](#)," *The New Orleans Advocate*, March 5, 2015.

the way we manage the pumped drainage network. Presently, many canals and culverts are routinely pumped to very low levels. This practice actually draws groundwater into drainage network, dewatering soils. The less groundwater we pump, the healthier our soils will be – all while saving money on electricity or fuel.

The result of slower subsidence is lessened damage and reduced costs of replacement and repair. These avoided costs make it worthwhile to spend stormwater fee revenue on green infrastructure and to offer fee credits that promote the private use of green infrastructure. A well-designed credit system could avoid substantial future expenses in exchange for a relatively minor reduction in current revenue.

Earning Flood Insurance Discounts with Stormwater-Fee-Funded Projects

Projects funded by a stormwater fee can also qualify New Orleans residents for larger flood insurance discounts, making flood insurance affordable for many more homeowners.

New Orleans flood insurance policyholders already receive a discount on premiums thanks to the city's participation in FEMA's Community Rating System. Under the CRS program, communities qualify for discounts by conducting activities that serve the program's goals of reducing and avoiding flood damage to insurable property, strengthening and supporting the insurance aspects of the National Flood Insurance Program, and fostering comprehensive floodplain management.

CRS discounts are determined by a point system. Communities earn these points by conducting and documenting qualifying activities, according to the system set out in FEMA's *National Flood*

Insurance Community Rating System Coordinator's Manual. The community's total points determine its CRS class on a scale of 10 to 1, which itself dictates the corresponding discount.

The city's current CRS score has room for improvement. As of New Orleans' most recent CRS review in 2014, the city is in Class 8, qualifying properties inside the Special Flood Hazard Area, or SFHA, for a 10% discount and those outside it for a 5% discount.⁴⁵ (For nearby comparison, St. Tammany Parish is a Class 7 community earning a 15% discount inside the SFHA, and Jefferson Parish is in Class 6 earning a 20% discount.⁴⁶)

Advancement to Class 7 would give property owners inside the SFHA an additional 5% discount and make flood insurance that much more affordable for a large number of New Orleans property owners.⁴⁷

Many other CRS communities have successfully directed their stormwater fee revenue toward projects that increased their CRS discounts. Miami-Dade County attributes significant reductions in flood insurance rates to drainage projects that it funded through its stormwater fee. Properties within flood zones in unincorporated parts of the county qualify for a 25% discount on premiums. Certain properties outside of flood zones can qualify for a 10% discount.⁴⁸

⁴⁵ Community Rating System Verification Report, City of New Orleans/Orleans Parish, Feb. 11, 2014.

⁴⁶ FEMA, "[Community Rating System](#)," *October 2016 NFIP Flood Insurance Manual, Change Package*, October 1, 2016.

⁴⁷ Bob Marshall, "[Here's a FEMA map that actually delivers good news for New Orleans](#)," *The Lens*, March 28, 2016.

⁴⁸ Miami-Dade County, "[Flood Insurance](#)," <http://www.miamidade.gov/environment/flood-insurance.asp>.

In South Carolina, Beaufort County secured CRS discounts through public works funded by its stormwater fee. The county directed revenue from the fee specifically toward drainage projects, stormwater management studies, educational outreach, and development of regulations that would qualify for flood insurance discounts. In 2012, these discounts reduced insurance premiums for policyholders in unincorporated areas of the county by a total of \$1.9 million per year.⁴⁹

The city of Santa Cruz, Calif., used funding from its stormwater fee to make levee improvements that qualified it for a change in its FEMA flood zone designation in 2002, from zone A-11 to zone A-99. As a result, flood insurance rates in the affected area dropped by about 40-50%. Discounts secured through CRS secured an additional 5% reduction in insurance rates.⁵⁰

Promoting Equity Through Green Infrastructure Investments

Given the disproportionate harm that flooding can inflict on lower-income residents, any improvement in drainage that results from a stormwater fee has the potential to reduce disparities.

Communities that are already burdened with economic, health and environmental challenges are especially vulnerable to the harm caused by

flooding.⁵¹ Lower-income households are often found in areas particularly prone to flooding. The same areas often have high proportions of impervious surfaces, distributed among pavement and dense or even abandoned buildings.⁵² Poorer residents are less likely to have access to reliable transportation, significantly limiting their evacuation options in the most severe floods. With FEMA's recently redrawn flood zone maps, property owners with limited financial resources will feel strong economic pressure to underinsure their properties.

These factors tend to have disproportionately negative effects on communities of color, lower-income residents, children and the elderly, compounding the effects of other factors such as poverty and unemployment. The same communities are less likely to receive the assistance they need for recovery following a significant flooding event.⁵³

These same vulnerabilities put these communities in an even better position to gain value from the many co-benefits provided by green infrastructure. Green infrastructure can offer a host of environmental, public health and aesthetic benefits in disadvantaged communities at the same time it helps reduce flooding.

In communities that are burdened by more than their fair share of environmental harms, green infrastructure has been shown to improve air quality. Tree plantings in particular can lead to a significant reduction in ozone and asthma-causing

⁴⁹ Casey Conley, "[Of stormwater fees and flood insurance rates.](#)" *The Beaufort Gazette*, Aug. 9, 2012,

⁵⁰ City of Santa Cruz Public Works Department, "[Flood Insurance Premium Reduction.](#)" <http://www.cityofsantacruz.com/government/city-departments/public-works/stormwater/flood-insurance-premium-reduction>; "[Stormwater Management Utility Questions and Answers.](#)" <http://www.cityofsantacruz.com/home/showdocument?id=4412>

⁵¹ US Water Alliance, *[An Equitable Water Future: A National Briefing Paper](#)*, June 2017, pp. 11 and 49.

⁵² U.S. Environmental Protection Agency Environmental Financial Advisory Board, *[Developing Dedicated Stormwater Resources](#)*, Feb. 26, 2016, p. 2.

⁵³ US Water Alliance, *[An Equitable Water Future: A National Briefing Paper](#)*, June 2017, p. 11 and 15.

pollutants.⁵⁴ Using stormwater fee revenue for targeted direct investments in communities that currently lack green infrastructure will deliver benefits for residents.

Using stormwater fee revenue to incentivize residents' own use of green infrastructure through grants, stipends, technical assistance or rebates has proved a popular strategy and one that works in tandem with the use of credits as described above. The Community Adaptation Program now being administered by New Orleans Redevelopment Authority provides a scale-able model for direct investment of public dollars on private land to create public benefit in the form of reduced runoff and flood risk. Funded by the National Disaster Resilience Competition administered by the Department of Housing and Urban Development, the \$10 million program is limited to Gentilly homeowners earning 80 percent or less of area median household income.⁵⁵ Participating homeowners can receive up to \$25,000 in green infrastructure improvements to their property.⁵⁶ Building on the lessons learned from this program to implement a citywide subsidized retrofit program for low- and moderate- income homeowners, funded with revenue from a stormwater utility fee, could help alleviate financial hardship to those households. It's a particularly logical strategy if the city opts to implement a modest initial fee that increases over time, in which case cost-saving retrofits can precede rate hikes.

Job Creation in the Stormwater Management Industry

The inherently place-based job creation that comes with the spending of stormwater fee revenues is another means of yielding equitable outcomes. The water management industry is already established and growing within the Greater New Orleans region. Cultivating this industry into the long-term employment creator it has the potential to become will depend on adequate revenue to public agencies for public-benefit projects.

Southeast Louisiana's water management cluster has a proven track record of job creation. Between 2010 and 2016, regional water management employment increased by over 12,000 jobs.⁵⁷ Within the Greater New Orleans area, employment in water management is expected to grow 23% over the next decade.⁵⁸ Given adequate funding, implementation of the Urban Water Plan is expected to support between 44,040 and 101,790 jobs.⁵⁹

In addition to the sheer numbers of jobs, water management provides higher-quality employment. Most of the jobs created in water management are middle- to high-skill jobs, requiring at least some postsecondary education.⁶⁰ Industry wages keep pace with these education requirements: The average compensation for a water management job in this region exceeded

⁵⁴ Mandy DeRoche, "[A Stormwater Fee, with Strong and Equitable Credits for Green Infrastructure, Could Benefit New York City as a Whole and Environmental Justice Communities such as the South Bronx.](#)" *Environmental Law in New York*, vol. 25, no. 1, January 2014.

⁵⁵ New Orleans Redevelopment Authority, [Community Adaptation Program Fact Sheet](#). Feb., 2019.

⁵⁶ New Orleans Redevelopment Authority, "[Community Adaptation Program.](#)" <http://www.noraworks.org/cap>

⁵⁷ The Data Center, [The Coastal Index: Tracking development of the water management cluster in Southeast Louisiana](#), June 2017, p. 36.

⁵⁸ Greater New Orleans Inc., [State of the Sector: Water Management 2016](#), p. 3.

⁵⁹ Waggoner & Ball Architects, [Greater New Orleans Urban Water Plan: Implementation](#), September 2013, p. 48.

⁶⁰ Greater New Orleans Inc., [State of the Sector: Water Management 2016](#), p. 6.

\$73,000 in 2016.⁶¹ Compensation for water management work has been increasing locally at a faster rate than it has in comparable metro areas.⁶²

Green infrastructure construction and maintenance can provide living wage jobs that require only a high school education plus some technical training. In this way, the green infrastructure industry can open the door to more stable, better-paying employment for more vulnerable populations.⁶³

The revenues available from a stormwater fee can help nurture the local water management industry into a thriving economic cluster. In recent years, demand and funding for water management expertise has converged within this region in a way that could make the sector a permanent and prosperous feature in the local economic landscape.⁶⁴

Statewide, the recently approved 2017 Coastal Master Plan calls for expenditures of \$50 billion over the plan's 50-year term, relying heavily on federal funds designated for coastal restoration and on penalties paid for the Deepwater Horizon oil spill.⁶⁵ The City of New Orleans catalyzed growth in the urban water management industry

locally by securing a one-time HUD grant of \$140 million for the Gentilly Resilience District and using FEMA Hazard Mitigation Grants toward nearly \$100 million in municipal green infrastructure. The first of those projects will begin construction this year. However, the absence of an adequate, reliable funding for continued investment at the scale envisioned in the Urban Water Plan augers in favor of establishing local revenues to complement less reliable state and federal sources.

Conclusion

New Orleans is vividly aware of its need for a new approach to stormwater management. The city's long-growing demand for functional drainage and its painful dissatisfaction after decades of infrastructure neglect and organizational complacency have primed it to accept fundamental change. Given public confidence that new revenues would translate to effective flood risk reduction, the support is in place to make a well-designed stormwater fee program successful.

But to merely shore up the status quo would waste the opportunity created by this extraordinary rise in public interest and political resolve. New Orleans is ready to do what it has known for years it must do: adopt stormwater management methods that exceed traditional pumping and piping. Continuing to rely solely on gray infrastructure would be a failure to use all prudent methods at the city's disposal. To provide comprehensive stormwater management, the city must incorporate green infrastructure as a fundamental element of its stormwater management program, on a par with existing gray infrastructure.

⁶¹ The Data Center, [*The Coastal Index: Tracking development of the water management cluster in Southeast Louisiana*](#), June 2017, p. 37.

⁶² The Data Center, [*The Coastal Index: Tracking development of the water management cluster in Southeast Louisiana*](#), June 2017, p. 37.

⁶³ US Water Alliance, [*An Equitable Water Future: A National Briefing Paper*](#), June 2017, p. 42.

⁶⁴ The Data Center, [*The Coastal Index: Tracking development of the water management cluster in Southeast Louisiana*](#), June 2017, p. 43.

⁶⁵ Mark Schleifstein, ["\\$50 billion plan to save Louisiana coast approved by Legislature," nola.com / The Times Picayune](#), June 2, 2017. See also The Data Center, [*The Coastal Index: Tracking development of the water management cluster in Southeast Louisiana*](#), June 2017, p. 57; Coastal Protection and Restoration Authority, [*Integrated Ecosystem Restoration & Hurricane Protection in Coastal Louisiana: Fiscal Year 2018 Annual Plan*](#), pp. 4-6.

For these reasons, the Water Collaborative of Greater New Orleans recommends implementing a stormwater fee program that features a well-funded green infrastructure component designed to engage citizens in effective and beneficial stormwater management. A well-planned green infrastructure component will deliver better stormwater control at the same time it confers co-benefits in economics, aesthetics, well-being, and equity throughout the city.