WATER LOG

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Green Stormwater Infrastructure

Inside This Issue . . .

Cover photograph
Railroad Park, Birmingham AL, credit: Nicolas Henderson

Table of Contents photograph
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• UPCOMING EVENTS •

Accelerating Solutions for a Resilient Coast

March 22 & 23, 2022
Virtual Conference

https://bit.ly/asfarc22

Gulf of Mexico Conference (GoMCon)

April 25 – 28, 2022
Baton Rouge, LA

https://bit.ly/gomcon22

2022 National Watershed and Stormwater Conference

April 26 – 29, 2022
St. Petersburg, FL

https://www.cwp.org/2022-conference-registration

Municipal Wet Weather Stormwater Conference

May 2 – 4, 2022
Asheville, NC

https://whova.com/web/mscon_202205

Intro to Green Stormwater Infrastructure

Kristina Alexander

Water always wins. That's a simple truth regarding flooding. Green Stormwater Infrastructure (GSI) is designed to help balance the odds by using systems that recreate natural processes to reduce stormwater runoff. GSI is based on the fact that nature is the best way to "control" water. However, it takes a lot of undeveloped space to replicate natural systems (such as marshes), something by definition that urban areas do not have. Therefore, science must step in to develop substitutes. And law must make it happen.

Green Stormwater Infrastructure, Generally

Green stormwater infrastructure is said to do three things to runoff from rainstorms: slow it down, spread it out, and clean it up. Think of the difference of how water travels down a paved driveway versus how it moves across the grass-covered yard next to the driveway. By slowing the speed of the water as it goes downhill, GSI makes it less likely the water causes flooding or erosion. It also offers the chance for the water to be absorbed into the earth, rather than shunted downstream. The absorption helps clean the water before it enters a stream, river, or lake.

The fact that GSI reduces water pollution gives it an advantage over impervious stormwater infrastructure made of concrete, sometimes called gray infrastructure. The term impervious is used to describe surfaces such as concrete and asphalt that do not absorb water. Typical forms of gray infrastructure used to address stormwater runoff include concrete detention/retention facilities designed to hold water. Frequently, these detention/retention structures are built below the surface. Concrete culverts are another form of gray infrastructure.

Green infrastructure mimics the natural environment, and therefore, GSI can be an attractive element to any development. However, GSI can have higher construction costs than gray infrastructure, and the costs for long-term maintenance of the facilities tend to shift from the developer to the municipality. These are two major reasons GSI is not used more often. Another reason may be that municipalities are unaware of minor changes to ordinances that can make a measurable impact on stormwater runoff. This article gives examples of low-cost changes to implement GSI.

Why Stormwater Management Is Important

While both green and gray infrastructure can reduce water quantity from runoff, only green infrastructure effortlessly improves water quality, a step that helps cities comply with federal law. Cities are required by the federal Clean Water Act (CWA) to reduce pollutants from stormwater that enters waterbodies.[1] Stormwater is a problem because as it runs across roofs, through parking lots, and down streets, it picks up oil, pesticides, and other chemicals which are then washed into waterways.

Application of the CWA rule was divided into two stages. Phase I, in 1990, required cities to get permits if they had municipal separate storm sewer systems (MS4) serving 100,000 people or more. An MS4 is a facility that processes wastewater from homes and businesses, but not stormwater. The permitting rule does not apply to so-call "combined systems" in which stormwater and home and business wastewater are treated. Phase I also requires permits for construction activities that disturb five acres or more, as well as for certain industries. Regulations issued in 1999, known as the Phase II rules, applied the permit requirement to MS4s in smaller cities identified as "urbanized areas."[2] The Phase II rules also extended the permit requirement to construction activities to sites of one acre or more. Thus, for small towns and those with combined water treatment systems, stormwater ordinances are primarily aimed at the construction phase of projects.

Stormwater Ordinances

Requirements for managing stormwater conditions at construction sites are found in city ordinances. A typical provision for a stormwater ordinance for new construction will have language similar to that found in these two examples:

> Plans and supporting documentation shall be certified by a registered professional engineer licensed by the state that … the post-development runoff rate does not exceed the pre-development runoff rate. (Mobile (AL) Municipal Ordinances § 17-7(c).)

> The stormwater management facility will be designed so that, except in unusual circumstances, the rate of runoff of surface water from the site … will not exceed the rate of

> runoff from the site in its undeveloped or natural condition as generated by the 2-, 10-, 25-, and 100-year storm events (Oxford (MS) Municipal Ordinances § 98-118(b).)

The "storm events" referred to in the second example are common data points in stormwater ordinances. Rainfall rates for storms are based on an area's historical rainfall and defined in terms of frequency and intensity. For example, a stormwater code may require a project to be built so that rain from a 100-year storm will not amount to excessive runoff. A 100-year storm is one that has a 1 percent chance of occurring in a year. It does not mean that after a big storm it will be 99 years until the next big storm. In fact, with the climate's changing patterns, some municipalities have had 1,000-year storms twice in 5 years, despite the odds of one such storm occurring in a year being 0.1 percent.[3]

Specific information for storm events is found in a database called Atlas 14[4] produced by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. For example, the Atlas 14 database shows that for Gulfport, Mississippi, a 2-year 24-hour storm yields an average rainfall of 5.85 inches, versus a 25-year 24-hour storm, which produces 11 inches of rain. In Tuscaloosa, Alabama, a 2-yr storm brings 4.09 inches of rain, and a 25-year 24-hour storm, 7.19 inches. Sometimes the rainfall amounts are specified within the ordinances, as done by Oxford, Mississippi:

> The 24-hour duration precipitation frequency values to be used … are 4.25 inches for the two-year storm, 5.21 inches for the ten-year storm, 7.01 inches for the 25-year storm, and 8.75 inches for the 100-year storm. (§ 98-118(b).)

Ordinances require developers to accommodate specific rainfalls to avoid causing flooding when they add impervious surfaces, as shown by these provisions from the northern Gulf Coast:

> All stormwater detention structures must attenuate the post-development peak flow rates from the 2-year, 5-year, 10-year, 25-year, 50-year and 100-year, 24-hour design storms to release a graduated discharge at or below predevelopment peak flow rates. (Daphne (AL) Municipal Ordinances §18-4(B)(2).)

> Projects shall be designed so that post-development peak discharge for the 10-, 25- and 100-year frequency storm events will not exceed the pre-development peak discharge rates … to the maximum extent practical…. (D'Iberville (MS) Municipal Ordinances § 13-86(a).)

Or they might apply to particular design features, rather than to the development as a whole. Take, for example, this language from the ordinances of Orange Beach, Alabama:

> Swales shall be designed to percolate 80 percent of the runoff from a 3-year, 1-hour design storm within 72 hours after a storm event, assuming average antecedent conditions. (§ 42-312(L)(12).)

Zoning and GSI

Zoning codes dictate the appearance of areas, such as by capping the amount of impervious surface at a site. For example, a residentially-zoned area usually will require more green space than will the business center of a town. Such requirements can influence stormwater runoff.

Common examples of where zoning ordinances influence GSI are in landscaping and parking lot requirements where natural areas may be required for aesthetic reasons. Those aesthetic goals will also have a green benefit. In fact some municipalities, such as Biloxi, Mississippi, state in their ordinances that a purpose of landscaping is to "reduc[e] stormwater runoff and the costs associated therewith." (Biloxi (MS) Zoning Ordinances 23-6-3(B).)

As an example of how zoning can establish GSI, consider this parking requirement from the zoning ordinances of Cape Coral, Florida:

> Clearly identified, unpaved parking that is graded and covered with sod to provide a surface that is durable and stable, and which will assist in managing stormwater, dust, and erosion may be permitted for up to 50% of the off-street parking requirements for the following uses: 1. Agriculture or farming uses; 2. Cemeteries; 3. Funeral homes, mortuaries, and crematoria; 4. Places of worship; 5. Religious facilities; or 6. Parks and recreation facilities owned by the government. (§ 6.8.1(E))

In this way, the city offers a way to help address parking needs while reducing the amount of impervious pavement. It is a low-tech form of GSI.

A zoning requirement to have landscaped islands in parking lots will succeed in reducing runoff provided there are not large, uninterrupted expanses of impervious surfaces, i.e. a lot of concrete with nowhere for the water to be absorbed. If water drains across a large impervious area, it will move faster, making it more likely to scour or erode a natural area once it gets there. Landscape islands in parking

lots are a way to interrupt large impervious areas. But if curbs surround those islands, much of the green benefit will be lost as the water will flow around the islands rather than be absorbed within them.

To see how curb requirements in a zoning code can influence stormwater reduction, consider Biloxi's ordinance:

> All planting areas shall be protected from vehicle damage by the installation of curbing, wheel stops, or other comparable methods. This standard shall not prohibit the use of planting areas as on-site stormwater management devices. (§ 23-6-3(D)(2)(c).)

This could be read as requiring continuous strips of curbs, installed without regard to water flow. In comparison, consider this language from Orange Beach's zoning code directing curbing to be designed in consideration of stormwater:

> Protective curbing around landscaped area will leave openings for the flow of water onto unpaved areas. (§ 8.010407.)

The language in the Orange Beach provision protects the plants from being run over while still allowing landscaping to absorb stormwater runoff.

Raingardens and Other Green Retention Structures

Many municipalities have ordinances requiring natural detention or retention facilities, however, they may be required only within certain types of zoning. For example, Gulfport, Mississippi includes this GSI practice within its zoning code for areas zoned "Natural or Rural":

> Any required stormwater detention areas shall be naturalistically shaped and disposed, and shall be planted with native wetland species. (§ 3.5.2 (d)-(e).)

Applying this good idea to more zoning classifications would increase a city's ability to manage stormwater runoff.

A highly effective type of a GSI retention facility is a raingarden. A raingarden retains water by being built in a depression lower than the surrounding area: picture a bowl-shaped flowerbed. It has several feet of gravel and rocks below the depressed surface for water to percolate into. And it has plants chosen for the raingarden to tolerate the sometimes lingering water (in gardening terms, having wet feet). The idea is that stormwater runoff will channel into the depressed area where it will slowly percolate into the ground.

A study of stormwater requirements in six southern cities of the United States, including Biloxi and Orange Beach, found that raingardens substantially reduced stormwater runoff.[5] However, raingardens require some technical knowledge for design and placement, and require continued maintenance. A simpler alternative to a raingarden is to establish required infiltration rates for all landscaped areas. For example, an ordinance could require landscaped parking islands to have an infiltration rate of X inches per hour for a 2-year 24-hour storm. This could still allow turf, which is relatively easy to maintain. The turf would be the top layer over soil and a soil barrier; at the bottom, a thick layer of gravel to improve water infiltration. This is akin to a "dry well," a hole filled with rocks below the planting layer. Alternatively, ordinances could require the use of plants that absorb more water than turf does.[6] This meets the goal of improving water retention without changing the percentage of landscaped areas or requiring more technically challenging structures. And it would reduce the times parking spaces are unusable due to flooding.

Conclusion

The most efficient solution to reducing stormwater runoff may be the one that improves water quality as well. But green stormwater infrastructure requires a blending of science, law, and economics. Cities could look to their zoning codes as a place to implement GSI practices without adding a regulatory burden to development.

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Endnotes

1. 33 U.S.C. § 1342. The permit is known as a National Pollutant Discharge Elimination System (NPDES) permit.
2. "Urbanized area" is defined by the U.S. Census Bureau as any densely populated area of 50,000 people or more. U.S. Census Bureau, *Classification and Urban Area Criteria*.
3. *See* Tom DiLiberto, *Torrential Rains Bring Epic Flash Floods in Maryland in Late May 2018*, NOAA Climate (May 31, 2018) (describing two 1,000-year or greater storms that flooded Ellicott City, MD in 2016 and 2018).
4. NOAA, *Atlas 14 Point Precipitation Frequency Estimates*.
5. L. Abera, et al., *Evaluating the Effect of City Ordinances on the Implementation and Performance of Green Stormwater Infrastructure (GSI)*, Environmental Challenges 4 (2021), p. 6.
6. *See, e.g.* Ethan M. Dropkin, et al., *Woody Shrubs for Stormwater Retention Practices*, Cornell University.

Coastal Resilience in the Northern Gulf of Mexico: Moving Beyond the Hype

Renee Collini

Guest Expert

The Hype… and the Challenge

Coastal resilience is a phrase that has saturated community planning and decision-making. It does not have a single definition, however, coastal resilience is generally thought of as the ability of a community or individual to recover quickly from a disturbance or disaster. Federal, state, and local organizations and agencies are thinking and talking about coastal resilience more than ever before. Being resilient has become a badge of honor and an ever-present metric for new projects or efforts. Capital improvement projects, vulnerability assessments, and strategic planning all now are being undertaken with coastal resilience as a central or critical component.

Millions of dollars are being invested in the pursuit of coastal resilience; yet, for all its omnipresence, what it means to be resilient and how to work towards resilience is not well understood. This is in part because there is no one single way to be resilient or to pursue resilience. Coastal resilience for each person, community, and state is unique. The challenges, external and internal, will never be the same in any two situations, and therefore, strategies for becoming more resilient must be uniquely designed for the community in order to be successful.

Given the push for coastal resilience but the lack of clarity of how to achieve this goal, for some planners and other coastal decision-makers pursuing coastal resilience can be a source of frustration. It can be difficult to know what goals or activities to pursue, to determine a pathway for achieving those goals, or to identify what actions can be helpful.

However, increasing resilience along the coast has the potential to save billions of dollars in damages, prevent loss of life, enhance coastal ecosystems, and strengthen economic security. Additionally, planning for coastal resilience gives us an opportunity to examine our communities as they currently are, including issues around socioeconomics, and reimagine and invest to achieve the communities that we want.

Coastal resilience deserves the hype and fortunately there are lots of things states, counties, cities, and individuals can do to pursue coastal resilience. There are also lots of opportunities to learn from others who have forged ahead already.

Quick Note On Sea-Level Rise

Addressing the risks from flooding is a fundamental part of coastal resilience which means that sea-level rise and coastal resilience are hand in hand.

We know that seas are rising, recently have started rising faster, and will continue to rise. A critical take away regarding sea-level rise is that it **exacerbates existing hazards**. For example, **high tide** has always served as a boundary between buildable land and the ocean. Most construction avoids the space that falls between high and low tides, leaving it for coastal ecosystems like marshes and beaches. However, sea-level rise has caused high tide to creep up, placing infrastructure and public and private property into the ocean's domain. Similar changes can be seen with other hazards, such as erosion occurring in new places, storm surge being deeper and flooding more inland areas, and rainwater not draining effectively. These all lead to new challenges when it comes to addressing future flooding.

Addressing sea-level rise is particularly critical in the northern Gulf of Mexico where we are seeing some of the highest acceleration, or increase in the rate, of sea-level rise. As the area is already projected to experience 25-30% greater amounts of sea-level rise than the global average, we do not have the luxury of not preparing for the coming changes.

Credit: City of Foley, AL

Preserved area in Foley, AL

Using Green Infrastructure to Reduce Flood Risk

Green infrastructure is another term that has become very common. Green infrastructure refers to any use of natural systems such as wetlands, restored floodplains, or rain gardens to act in tandem with gray infrastructure such as culverts or hardened stormwater outfalls. Leaders in Foley, Alabama, a small but rapidly growing city of around 20,000 people, have had to think strategically about its land use as it quickly is moving from an agricultural area to a more suburban community. Green infrastructure played a part. Foley does not have a lot of direct exposure to the coastline; its flood pressures come from development reducing water storage capacity, increases in intense rainfall events, and higher sea levels reducing the ability of its storm system to drain efficiently. This is like many communities in coastal counties that are near the Gulf but not located directly on the shoreline.

A key strategy for Foley has been to identify areas where its stormwater system is already unable to keep up and then use green infrastructure to enhance stormwater storage capacity upstream from the trouble spots. A common approach by Foley is to restore floodplains around streams that convey stormwater. These restored floodplains add a greater area in which the water can be temporarily stored during rain events and a wide array of natural plants that absorb and filter the water before it slowly moves downstream. This decreases the water's quantity and speed in the streams.

Foley has already done this once near its town center, and the downstream area which previously flooded frequently has not flooded since the restoration was completed. Further, the restored floodplain is so robust and contains so many rare and beautiful plants and wildlife, the city is developing a way for residents to view the area and learn more about green infrastructure. This highlights one of the many benefits of using green infrastructure: unlike traditional methods, the infrastructure itself can become an amenity for the community.

The Big Picture – Piecing Many Small Projects Together

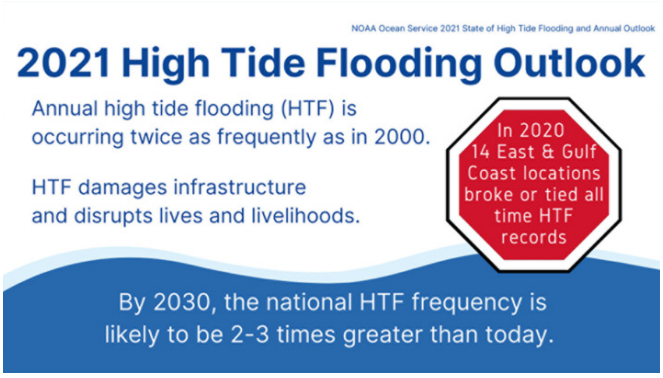
Coastal communities often do not have large sums of money at their disposal for tackling resilience. This means that they must get creative with smaller amounts of funds, take small, but critical, steps forward, and be ready to leverage large pots of money when they become available. In Dauphin Island, Alabama, the town has been working to increase its resilience since 2005. Hurricane Katrina had many devastating impacts, one of which was a dramatic decrease in the housing stock

along the coast. For Dauphin Island, this translated directly to lost revenue due to a decrease in tourism. Vacationers that rent beautiful homes on the picturesque sand beaches of the West End of Dauphin Island are a critical source of revenue. But the housing stock on the West End was reduced to 10% of what it was pre-Katrina. Additionally, the island was physically cut in half – fortunately, not in an area that was habited – but it made starkly clear the vulnerabilities of the island and the realization that a next big hurricane could mean a cut in the island in a much worse location.

However, Dauphin Island is more than just its vulnerabilities. The east end of the barrier island on which the Town of Dauphin Island rests is home to a maritime forest, natural safe harbors, and in some places stark elevation gains. These features represent capacity and opportunities for increasing the town's resilience. Shortly after Hurricane Katrina, the town undertook two separate, but related, planning efforts using small grants. The Comprehensive Plan and the Strategic Plan were compiled by engaging with residents and other stakeholders to understand and then clearly communicate the vision of what they wanted Dauphin Island to be and how to get there. This included identifying specific areas where more studies and information were needed, opportunities for economic diversification to reduce the reliance on the vulnerable West End, and areas where coastal habitats such as dunes and marshes could be restored to strengthen the island's flood protection.

Once the plans were made, the town partnered with different organizations and leveraged available funding opportunities to implement them. This has led to a large-scale restoration study to understand how best to expand the natural resources of the island. The study provided clear guidance on which restoration activities would be the most successful at protecting Dauphin Island from hurricanes both now and into the future based on sea-level rise. Dauphin Island leveraged this study to successfully compete for funding to implement these restorations efforts. Further, the town has begun to invest in rejuvenating a historic working waterfront. This provides more economic opportunity for the island, while maintaining the small-town charm that makes it unique and true to its roots as a fishing village. Finally, it has also begun additional studies and explorations on how best to protect some of the most critical infrastructure for the island including the causeway, the only road to the island.

By using small grants and continuing to take small steps forward one at a time, Dauphin Island is now much more resilient than it was, and as it continues implementing these plans and responding to the new information gained from those studies, it will only continue to become more resilient. This does not happen by accident though – it takes dedicated professionals, leaders, and communities working together to participate in and support the process. It also is not always easy; stakeholders have different ideas of how a community should look and function. However, proactively having these conversations through careful planning efforts allows for compromise and consensus building to occur which generates more productive outcomes.



Credit: PLACE:SLR

Lessons Learned, Best Practices, and Resources

Dauphin Island and Foley are a just two illustrative examples from the northern Gulf Coast. There are many other communities who have been making productive strides in our region. We at the Program for Local Adaptation to Climate Effects (PLACE) have created short case study videos (~5 min long) telling how Ocean Springs, Mississippi is working to increase the resilience of its small businesses, and how Magnolia Springs, Alabama is using green infrastructure to address pollution and flood challenges. We also have stories of how Biloxi, Mississippi is collecting the data needed to improve flood response and planning and how Fairhope, Alabama is doing the same thing for its gullies and stream systems. All those stories and more are found at http://bit.ly/Future-Flooding.

There are some best practices across these communities and others that I have worked with:

- Planning and assessments – These communities invested small amounts of money to understand not only what their vulnerabilities were but to identify

key actions that would directly reduce their vulnerability. This allowed them to successfully pursue additional funds and strategically expend time, energy, and money.

- Continual movement – Successful communities do not treat resilience as if it is an endpoint destination or can be achieved in a single action, they understand that resilience is about the process.
- Community involvement – Increasing the resilience of a community takes a long time and requires change, both of which are generally hard to come by. Involving the community and taking the time to get its input and come to consensus on how best to move forward provides longer lived support and understanding for different efforts. Studies have shown that communities that are engaged and aware are more likely to successfully undertake actions to increase resilience.
- Dedicated champions – Often at the core of these efforts are a few people who have worked hard over the years to help communicate the big picture and the benefits of each step along with way.
- Resilience is not separate – The most successful communities do not pursue resilience as a separate action but instead find ways to integrate a resilience mindset into their day-to-day activities.

There are lots of other things to be learned, and I encourage community leaders to participate in the Gulf of Mexico Climate and Resilience Community of Practice to find a network of other Gulf cities, towns, and counties learning together. Additionally, the Program for Local Adaptation to Climate Effects: Sea-Level Rise is a network focused on coastal flood resilience in Alabama, Mississippi, and northwest Florida intended to support communities on these topics.

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In Sum.

A Summation of the Facts and Figures of Interest in this Edition

★ *Increase in sea-level rise in the northern Gulf of Mexico above the global average:*	25-30%
★ *Inches of rain in Tuscaloosa, AL for a 25-yr 24-hour storm:*	7.19
★ *Inches of rain in Gulfport, MS for a 25-yr 24-hour storm:*	11
★ *Percent of live oaks left standing in Dade County, FL following Hurricane Andrew:*	78%
★ *Percent of other native trees:*	66%

Flood Damage and the Mississippi Tort Claims Act: Wading Through the "Quagmire of Confusion"

Davis C. Delich

Introduction

Recent cases suggest that Mississippi state and local governments are vulnerable to flood damage claims. As several members of the Mississippi Supreme Court have acknowledged, however, this area of law lacks perfect clarity and stability. Beginning in 2018, the Court has tried to contain a tightening policy restricting the liability of state and local governments. Government officials and property owners alike will be watching closely to see when and how the law develops in this area. This article will discuss the underlying law and recent cases relating to government liability due to flooding in Mississippi.

The Mississippi Tort Claims Act (MTCA)

For much of the state's history, it was nearly impossible to sue Mississippi state and local governments for damages (i.e., for money). This policy followed from the common law doctrine known as sovereign immunity, which means governments and government entities cannot be sued for civil claims. But in 1982, the Mississippi Supreme Court announced "the abolition" of state sovereign immunity, which the court described as "out of date in modern society and modern legal concepts." Still, despite that sweeping language, the Court left room for the state legislature to craft a more limited doctrine of state immunity. The Mississippi legislature responded by enacting the Mississippi Tort Claims Act (MTCA). It applies to "torts," a type of action causing harm or injury that is known as a civil offense rather than criminal.

The "Bedeviling" Discretionary Function Immunit

The MTCA broadly waives sovereign immunity in Section 11-46-5 of the Mississippi Code, meaning the state and its "political subdivisions" *can* be sued, they are no longer immune from suit. But a subsequent provision, Section 11–46–9(1), provides an extensive list of exemptions for when suit cannot occur. These exemptions re-establish immunity under certain circumstances. Of the exemptions, few if any have been more consequential than exemption (d), which affords so-called "discretionary function" immunity. It prevents bringing legal claims against a governmental entity "based upon the exercise or performance or the failure to exercise or perform a discretionary function or duty on the part of a governmental entity or employee thereof, whether or not the discretion be abused…."

What is a "discretionary function"? This is a key question which Mississippi jurists have labored to answer. Generally, the purpose of making a government liable only for discretionary functions is to insulate it from liability for the activities it has to do, those that are compulsory and/or required by law, while making government liable for the ones that were optional, the ones it chose to do. The distinction is seldom straightforward.

Typically, when trying to make legal rules out of vague terms like "discretionary function," courts will adopt "tests." Yet discretionary function immunity has proven to be an elusive concept. In 1999 the Mississippi Supreme Court adopted a federal test based on analogous language in the Federal Tort Claims Act; abandoned that approach in a 2014 case; then returned to the *same* federal approach four years later, in 2018. That test, known as the public policy function test (PPFT), offers the current Mississippi approach to discretionary function immunity. Under the PPFT, a government entity may *not* be sued where both: (1) the challenged act or omission involves an element of choice or judgment, and (2) "that choice or judgment involved social, economic, or political policy considerations."[1]

A Basic Illustration

The basic idea of discretionary function immunity is simple enough. Political officials must constantly balance social and political variables, and adding legal calculations might unduly complicate their decision making. As the Mississippi Supreme Court explained in *Wilcher v. Lincoln County Bd. of Supervisors*, the courts try to avoid second-guessing the policy decisions made by the executive branch.

To illustrate, consider two hypotheticals where a fictional Property Owner sues Example City over a dam and reservoir project after his property was damaged by flooding:

A. GOVERNMENT IS IMMUNE FROM SUIT. Property Owner alleges that Example City should have spent an additional $10 million on its recent dam and reservoir project.
B. GOVERNMENT IS NOT IMMUNE. Property Owner alleges that Example City's employee should have followed a required basic industry procedure in maintaining or operating the recent dam and reservoir project.

Under a simplified version of the PPFT, to determine whether a discretionary function was performed, one could ask: which is the type of activity for the Example City Mayor to make part of her campaign: a dam and reservoir project or the maintenance procedures for the dam? Spending millions of dollars on a project is an inherently economic decision and a political one, therefore both fall under part two of the PPFT. Hence, that sort of decision (shown in hypothetical A) could not be challenged in a lawsuit. On the other hand, "basic maintenance decisions," the Court has repeated, "do not involve policy considerations,"[3] excusing Example City from suit under hypothetical B. Additionally, it could be argued that hypothetical B not only did not involve policy, but that it did not involve choice, and so would not be considered discretionary.

Still, the Mississippi Supreme Court has held that "merely saying that maintenance costs money does not make the failure to provide it an 'economic policy' decision."[4] So where can the line be drawn? Even when the Court returned to this test in 2018, it "admit[ted] the public-policy function test is not perfect," and acknowledged that earlier Mississippi cases had "stretched the bounds of 'policy' beyond credulity."[5] Recent flood damage cases, however, have been handled fairly consistently: the liability floodgates appear to be open.

Assumption of the Duty to Operate and Maintain

The Court's 2018 return to the PPFT was an effort to correct course. Nevertheless, within months, Justice Kitchens would describe the case law as a "quagmire of confusion."[6] In 2020 Justice Coleman lamented that the Court's "wide-ranging" decisions "fail to offer judges and lawyers practicing in Mississippi a reliable and understandable explanation" of what he called the "bedeviling" discretionary function exemption.[7]

In the 2019 case *Moses v. Rankin County*, several homes in a housing subdivision were flooded and damaged following severe rain.[8] Affected homeowners sued the county to recover for their losses. The homeowners alleged that the county's failure to properly maintain an adjacent creek caused the flood damage, to which the county responded by asserting discretionary function immunity. In turn, the homeowners claimed the facts were similar to a mid-century U.S. Supreme Court case in which the U.S. Coast Guard was sued for marine cargo losses that allegedly resulted from its negligent operation of a lighthouse.[9] In that case the U.S. Supreme Court kept it simple, reasoning that the Coast Guard was not required to undertake lighthouse maintenance, but once it did so, it could be liable for resulting injuries.

The Mississippi Supreme Court agreed with the homeowners. It held that because the county "undertook the duty to inspect and maintain" the creek, the county was then "obligated to use due care to make certain that [the creek] was properly maintained." The case was returned to the trial court. While the homeowners would still have to prove their case, the homeowners were allowed to continue their lawsuit against the county.

Expanding the Scope of the Duty to Maintain

In *Williams v. City of Batesville*, the Mississippi Supreme Court appears to have extended the *Moses* holding.[10] There, a homeowner notified the city that her property was being flooded by a sewage backup. The city tried several solutions over the next year. After those measures consistently failed, it eventually decided to install a $10,000 pump station near the homeowner's property. The homeowner alleged that the city was negligent for waiting a year to install the pump station, asserting that the basis for her loss was "the complete initial failure and subsequent failures of the City to properly maintain its sewage lines." In turn, the city argued that its

decision of whether and when to pay $10,000 for a pump station was shielded by discretionary function immunity.

The Court disagreed with the city, finding that no discretionary function had occurred: "merely saying maintenance costs money does not make the failure to provide it an 'economic policy' decision." Notwithstanding the pump station's price tag and the fact that it was hard infrastructure, the Court held that the city's decision-making process was not immune from the negligence suit because the disputed issue was the city's basic maintenance decision, which did not involve public policy. The case was remanded for the homeowner to continue pursuing her claims.

Finding the Challenged Act or Omission

A 2021 Mississippi appellate court case, *Hood v. City of Pearl*, demonstrates the importance of correctly identifying the allegedly tortious act that is the reason for the claim, before turning to the PPFT to assess whether immunity applies.[11] In *Hood* a house was flooded after a heavy rainfall. The homeowners sued the city for negligence. The trial court ruled for the city, finding that the homeowners' lawsuit was barred by discretionary function immunity. But the Mississippi Court of Appeals disagreed, and it reversed the trial court. It found that the lower court had "mischaracterized" the homeowners' complaint. The trial court read the complaint as having challenged the city's decision to approve recent development projects that allegedly contributed to the flooding. While the Court of Appeals agreed that development approval decisions would be immune from suit, it found that the bases of this suit were other "tortious activities" – namely, maintenance or a lack thereof – that were *not* immune from suit.

In *Moses*, the Supreme Court applied an assumption-of-duty approach to discretionary function immunity. This approach appears frequently in flooding cases. It means that once a city or county undertakes a flood-mitigation responsibility, it also assumes legal liability for inspection and maintenance. To the extent that a maintenance decision is cost-intensive, implicating economic concerns, the *Williams* decision could be read as extending the scope of what constitutes a nondiscretionary "maintenance" decision by subjecting a city's cost-benefit analysis – of expenditures for actual infrastructure improvements – to the court's second-guessing. Or the *Williams* decision could be read as consistent with *Moses*'s holding that a government entity, once it undertakes maintenance, has an obligation for damages caused by that effort. Given the razor-thin distinctions employed with this "bedeviling" rule, the precise nature of the challenged government action is a critical detail.

Conclusion: A Contested Area of Law

In a 2020 case challenging the safety of state traffic signage, the Mississippi Supreme Court held that the placement of traffic-control devices involves "economic, political, or social concerns," and is therefore immune from suit, but that the actions of individual flagmen (i.e., on-site state traffic employees) are *not* immune.[12] This distinction, the court reasoned, comes from the purpose of the PPFT, described there as the effort "to discern between actual policy decisions of government made by policymakers versus simple acts of negligence by government employees or agents." The important question, according to the Court, is whether the challenged decision was made by a policymaker considering social, economic, or political concerns. The essential questions raised in flooding cases have been (1) whether the city or county assumed responsibility for the relevant area, and (2) whether the allegedly negligent act or omission can fairly be described as "maintenance."

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3. Moses v. Rankin Cnty., 285 So. 3d 620, 625-26 (Miss. 2019).
4. Williams v. City of Batesville, 313 So. 3d 479, 485 (Miss. 2021) (citations and internal quotations marks omitted).
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7. Smith v. Mississippi Transportation Comm'n, 292 So. 3d 231, 235 (Miss. 2020).
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The Value of Living Traditions Within the Context of Green Infrastructure

Stephen Deal

Credit: K. Alexander

Live oaks in Biloxi, MS

If cities are to succeed going into the future, it is necessary to find meaningful points of convergence between new technological paradigms such as green infrastructure and the living traditions that inform community life and collective well-being. One lesson planners have learned over the decades is that place-based planning is not simply a matter of the right regulations or the proper amount of political will. It is necessary to have cultural buy-in and understand the social practices embedded within a region that give rise to sustainable communities. The best building practices are ones embedded within the very fabric of a culture and form a living tradition that can be passed from generation to generation. These building practices are not simply superficial notions pertaining to aesthetics, they represent lessons learned over time about how to best build within the constraints of a specific natural environment.

Living Traditions and the Natural Environment

A living tradition can be difficult to identify, as it varies greatly from region to region. In the context of urban design a living tradition is the inherited architecture of a city or region that serves as the basis for experimentation and embellishment within a region.[1] One architect described what living traditions mean in the context of urban design: "historic places possess

physical traces of human intentions, that if properly revealed and celebrated, can become important points of reference in a project.'"[2] These "physical traces of human intentions" are not simply confined to the built environment, they can be witnessed in the urban landscape, such as in city parks and the tree canopy. An object that has stood the test of time, whether it is a building or a tree, suggests a certain degree of permanence or worth that makes it worthy of preservation and emulation.

In green infrastructure, a similar concept can be seen at play. By installing a green infrastructure project, a city acknowledges its symbiotic relationship to environmental forces such as rain.[3] The recycling and retention of rainwater, once hidden by culverts and pipes, is now celebrated and made visible for all to see, which means local residents are more inclined to value and maintain stormwater infrastructure going forward. While green infrastructure has gained wider circulation since the early 2000s, when stormwater best management practices first gained traction, the practice still has an aura of novelty to it. If green infrastructure is to gain acceptance in a culture it must tap into and take advantage of the living traditions of the built environment.

One of the most important figures for applying living traditions to modern problems of sustainability is architect Steve Mouzon.[4] Employing the term "original green," Mr. Mouzon believes that communities should be sustainable without heavy reliance on machines and technology.[5] He describes a sustainable city as being four things: nourishing, accessible, serviceable, and secure. A nourishing city is one that can take care of its food needs; an accessible city develops many ways to get around; a serviceable city can provide for basic needs within walking distance; and a secure city is one that is adequately prepared for future uncertainty.[6] The most important concept, however, is that great places must be capable of being loved over time to endure.

Original Green Ideas in Practice

The U.S. Environmental Protection Agency identifies 11 basic green infrastructure techniques cities can use. Of these techniques, two of them have been used extensively in the historic architecture of the Gulf of Mexico: the urban tree canopy and rainwater harvesting.[7]

Many Gulf of Mexico communities are defined by beautiful tree canopies. Chief among the urban canopy trees is the live oak. Though live oaks are prized for their size and charm, the tree's beauty conceals a number of important ecosystem services. Live oaks are critical to the Gulf of Mexico region's ecology, and they are known to support many living things. Three common epiphytes – Spanish moss, ball moss, and resurrection ferns – rely on the shelter of the live oak for survival.[8] Also, live oaks are generally resistant to hurricane damage. Following Hurricane Andrew in Miami, a survey of Dade County homeowners revealed 78 percent of the live oaks documented in the study were still standing, which exceeded the standing rate of native trees at 66 percent.[9]

Street trees are also a critical component of a city's green infrastructure toolbox. For example, a tree with a 25-foot diameter canopy can manage 1 inch of rainfall from 2,400 sq. ft. of impervious surface.[10] Streets trees also promote infiltration to the groundwater table and can improve water quality by filtering pollutants. They reduce the amount of impervious surface within the urban streetscape. Street trees also have significant impacts on reducing urban air pollution and ameliorating the heat island effect.

Urban trees may also act as one of Mr. Mouzon's four foundational attributes, namely nourishing. A robust urban tree presence can serve as a sustainable food supply through the planting and preservation of fruit trees. In Boston, an organization known as the League of Urban Canners manages a number of historic fruit trees in the area.[11] Many of these fruit trees were leftovers from old orchards, which were integrated into city parks and streets as the region continued to urbanize. By obtaining permission from the owners of the trees, the organization has been able to harvest the fruit to make a wide variety of ciders, jams, and preserves that are easy to procure and locally sourced. Whether it is as food, a green infrastructure component, or simply as a city beautification measure, the city street tree is a critical component of original green planning.

A second green infrastructure technique employed in the Gulf of Mexico region is rainwater harvesting. Prior to city water systems, cisterns were ideally suited for providing potable water, as rainwater from the roof was diverted and stored into large, cypress cisterns. The high-water table in places like coastal Louisiana made well water less than ideal for drinking purposes, so many people opted to collect rainwater.[12] In New Orleans in 1909 there were 23 cistern builders listed in the city directory, and many of the large homes in and around the city were known to have two or three cisterns on site. A typical cypress cistern barrel was around 10 x 8 feet and its large size meant it often became a significant decorative element of many homes. A cistern business established in 2012 reintroduces the tradition.[13]

Many of the older cisterns also have a long shelf life and can be easily restored and brought back into use.

Building a Legacy for Environmental Resilience

While city governments are not the progenitors of generational norms and values, they can through regulations and policy acknowledge and give license to certain historic traditions that have value in modern day society. In Raleigh, North Carolina, one important aspect of the city's historic identity is its many oaks trees, which has resulted in the city being known as the City of Oaks. To preserve this historic legacy, local government officials have included significant funds for tree replacement in their capital budget.[14] This means that tree expenditures are given equal weight and consideration alongside road repairs and water line replacement and that trees are considered a critical part of the city's urban fabric.

Cities can also partner with state and national forest organizations to recognize champion trees. In the Gulf of Mexico region, there is a long tradition of tree recognition and conservation. In the early 20th century, Dr. Edwin Lewis Stephens of the Southwest Louisiana Institute became the founder of the Live Oak Society.[15] This organization is unique as all the group's members are trees, with the exception of the chair who serves as record keeper and promoter for the live oaks. Each oak is treated as a unique specimen with its own story. For example, six champion live oaks of Louisiana often have a historic and cultural value beyond their large size and beauty. These trees have names, and their old age means they can be traced to past historic figures and events of note.

A necessary prerequisite for fostering environmental traditions that endure are deep roots in a place. With this in mind, cities should reach out to neighborhoods and civic groups to find people who can promote the value of green infrastructure practices. For example, in Portland, Oregon, local leadership was instrumental in installing two stormwater curb extensions in 2003.[16] These curb extensions capture runoff from 9,300 sq. ft. of paved surface. One key component of the project's success was the lead project designer, Kevin Perry, who was a neighborhood resident as well. He understood the neighborhood's character and opted to install the project on a low-volume, leafy residential street. A suitable site, coupled with Mr. Perry's neighborhood connections and extensive green infrastructure knowledge meant that the project had a mentor and booster, someone who could guide and monitor the project.

Conclusion

Thus, establishing living traditions in community design becomes more important. Policies and regulations, if they are too abstracted from the currents of everyday life in a region, lose their meaning and purpose over time. Time gives people insight into the building principles that will best endure. As the principles of green infrastructure are fairly new and novel, they will gain wide acceptance if built upon time-tested techniques. By taking advantage of a region's living traditions, one sets the foundation not only for more sustainable design, but for the incorporation of new techniques into the cultural fabric.

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