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A Case Study in Using Disaster Recovery Funds to Rebuild More Resiliently

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Authors' Note

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Introduction

A decade after Hurricane Katrina ravaged the Gulf Coast, the City of New Orleans and other communities in the region are still recovering from the storm. The challenges New Orleans experienced following Hurricane Katrina highlight the profound difficulties communities can face when attempting to use federal disaster relief funding to rebuild more resiliently after climate-related disasters. In the decade since Hurricane Katrina swept ashore, Louisiana has relied on billions of federal dollars to rebuild, and a significant portion of those funds have flowed to assist with recovery efforts in New Orleans. Because of the scale of the devastation, the city is still in the process of deploying these funds to rebuild whole public systems, including schools, roads, bridges, and hospitals. Rather than simply rebuild New Orleans as it was, however, citizens and officials created action plans for profoundly changing the design and function of the city's public schools and water systems, for example, to create a more resilient city. The obstacles the city encountered in deploying federal dollars bring to light the challenges faced by all communities that seek to rebuild more resiliently in the aftermath of a disaster.[1]

Like Louisiana and New Orleans, many states and communities receive billions of dollars in federal disaster-recovery funding to repair and rebuild damaged infrastructure after major disasters.[2] The scale of the funding dwarfs the local money communities would otherwise tap for capital projects. As a result, disaster recovery can shape a region's physical identity, infrastructure, quality of life, and

1 For a more detailed discussion of the challenges Vermont faced in rebuilding to be more resilient to climate change after Hurricane Irene, see Justin Clancy & Jessica Grannis, Lessons Learned from Irene: Climate Change, Federal Disaster Relief and Barriers to Adaptive Reconstruction (Georgetown Climate Center, Dec. 2013), available at: http://www.georgetownclimate.org/lessons-learned-from-irene-climate-change-federal-disaster-relief-and-barriers-to-adaptive-reconstru and http://www.georgetownclimate.org/sites/www.georgetownclimate.org/files/Lessons Learned From Irene - Finalv2.pdf. For a more detailed discussion of the changes made to the Stafford Act after Hurricane Sandy see Nicole Smith & Jessica Grannis, Understanding the Adaptation Provisions of the Sandy Disaster Relief Appropriations Act (H.R. 152) (Georgetown Climate Center, May 2013), available at: http://www.georgetownclimate.org/understanding-the-adaptation-provisions-of-the-sandy-disaster-relief-appropriations-act-hr-152.

2 The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Pub. L. 100-707, codified at 42 U.S.C. §5121 et seq. ("Stafford Act"). Under the Stafford Act, there are two types of presidential declarations that authorize federal supplemental assistance: (1) Emergency declarations to protect property and public health and safety; and (2) Declarations to lessen or avert the threat of a major disaster or catastrophe. In this case study we focus on two disaster relief programs authorized by the Stafford Act: the Public Assistance (PA) program and Hazard Mitigation Grant Program (HMGP) – and the city's efforts to deploy funds from these programs to rebuild public infrastructure differently after the storm. Disaster relief funding is also often made available to repair and rebuild housing, businesses, and other assets through other programs (the Individual Assistance, Community Development Block Grant Program Disaster Recovery (CDBG-DR) program administered by the US Department of Housing and Urban Development (HUD), and others) but, for purposes of this case study, we focus on New Orleans' challenges deploying FEMA administered funds (through the PA program and HMGP) to rebuild public infrastructure. For purposes of this report, we refer to the variety of programs used to support disaster relief and recovery interchangeably as "disaster relief programs" and "disaster recovery programs."

services for generations. Faced with a changing climate, it is imperative that the laws, regulations, and procedures that control these federal disaster relief funds empower communities to redesign and reconstruct their public systems to be more resilient rather than force communities to build back in their pre-disaster footprint. Currently, federal disaster relief programs provide a critical financial resource, but changes are required if these funds are to be effectively used to help communities rebuild in a way that makes them stronger in the face of future threats.

After Katrina, public officials sought to use disaster recovery dollars to transform New Orleans' decaying public systems—schools and stormwater systems—to ensure that the city could better withstand future storms and provide critical public services. In rebuilding New Orleans' public school system, the Orleans Parish School Board and the Recovery School District worked for years to create the *School Facilities Master Plan for Orleans Parish* (*Schools Master Plan*)[3] to establish a blueprint for transforming an antiquated collection of sometimes academically underperforming—and, given demographic shifts, often-oversized—schools into a coordinated network of energy efficient, modern facilities. The *Schools Master Plan* also outlined a vision for redesigning and relocating schools to support the city's changed post-Katrina demographics and to carry out critically important educational reforms aimed at addressing the system's habitual underperformance.

To rebuild New Orleans' stormwater system, the State of Louisiana and the city developed the *Greater New Orleans Urban Water Plan* and the *New Orleans Stormwater Management Capital Improvements Plan* to identify strategies for using green infrastructure to safely retain and absorb rainwater. The plans called for the use of natural systems to manage stormwater by greening public rights-of-way, parklands, vacant lots, and other spaces with rain gardens, bioswales, permeable pavements, and storage basins. These types of strategies can reduce subsidence, which compounds the risk of flooding in a city that is effectively a levee-ringed bowl receiving more than five feet of annual precipitation.

In the wake of more recent disasters, the Obama Administration has championed similar holistic approaches to disaster recovery emphasizing resilience to long-term climate change and the use of natural systems to reduce flood risks (through the Sandy Recovery Task Force; State, Local, and Tribal Leaders Task Force; and National Disaster Resilience Competition, among other initiatives.) But the reality is that the agencies that implement these programs are still struggling with how to integrate resilience into how they implement the specific statutes that govern individual disaster recovery programs.

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3 See Orleans Parish School Board (OPSB) and Louisiana Recovery School District Authority (RSD), School Facilities Master Plan for Orleans Parish iv (2008), available at: http://www.coweninstitute.com/wp-content/uploads/2011/03/School-Facilities-Master-Plan-Part-1-of-2.pdf ("Schools Master Plan"). The Orleans Parish School Board and the RSD amended the Schools Master Plan in 2011 after negotiating a $1.8 billion lump-sum federal disaster-relief award in 2010. See La. Dept. of Education, School Facilities Master Plan Data Sheet at 1, available at: http://www.louisianabelieves.com/docs/default-source/katrina/final-louisana-believes-v4-facilities-plan1846e85b8c9b66d6b292ff0000215f92.pdf?sfvrsn=2.

This case study examines state and local officials' efforts to use disaster relief funding to rebuild New Orleans' public schools and stormwater systems to be more resilient and sustainable. The purpose of this case study is to use the example of New Orleans' recover process to identify programs that may still need reforms to help states and communities rebuild in a holistic way to meet multiple community recovery goals. Specifically, this study details the major barriers that New Orleans encountered when trying to use disaster relief funds for these goals. It also explores federal, state, and local efforts to overcome these barriers—some successful, others not. The study highlights 2013 amendments made to the statute that governs disaster recovery—the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act)—that were intended to eliminate some of the obstacles identified during the post-Katrina rebuilding process. We also examine policy changes that the Federal Emergency Management Agency (FEMA) has initiated to make some of the disaster relief programs it administers more flexible. While some of these reforms may create an easier path to resilience for communities in the future, other statutory and bureaucratic issues remain. Indeed, despite significant efforts in the years since Hurricane Sandy, East Coast communities are encountering many of the same obstacles that New Orleans faced as it sought to rebuild more resiliently, according to a recent report by the U.S. Government Accountability Office.[4] Absent further reform, these obstacles will continue to bedevil efforts to rebuild communities more sustainably in the wake of future disasters.

4 U.S. Government Accountability Office (GAO), Hurricane Sandy: An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters 52, GAO Publication No. GAO-15-515 (July 30, 2015) (hereinafter "GAO Resiliency Strategy Report"), available at http://www.gao.gov/prodcuts/GAO-15-515. Among the lingering obstacles the GAO identified for officials in Sandy-affected states were: the complexity of many of FEMA's post-disaster programs; turnover among FEMA staff that caused inconsistency and delays in processing local requests; limits on grant-recipient eligibility; sometimes limited FEMA support for resiliency efforts; one-size-fits-all national regulations that failed to account for local conditions; failure to account for the ancillary environmental benefits of some resiliency measures when analysing the return on investment; and the significant local time and resources required to plan and present projects under FEMA regulations. Id. at 7-25, 27-28, 42, 54. We discuss these challenges in greater detail below. In response to the GAO report, FEMA acknowledged many of the problems identified and indicated that the agency is working to address some of them. Id. at 54.

Background

The Devastation Wrought by Hurricane Katrina

In the early hours of the morning on August 29, 2005, as Hurricane Katrina neared landfall on the Louisiana Coast, the levees protecting New Orleans began to fail.[5] As the hurricane marched north, levees throughout the region overtopped or failed, eventually inundating approximately 80 percent of New Orleans in one of the worst natural disasters to ever strike a major American city.[6] Flooding depths varied greatly, ranging from a foot in some areas to more than ten feet in others.[7] In most areas, the flooding persisted for two to three weeks.[8] The destruction was widespread. Flooding damaged approximately 134,000 housing units—some 70 percent of the city's occupied residences[9]—and ravaged much of the city's 1,547 miles of roadways and 8.2 million linear feet of subsurface drainage.[10] The storm also caused hundreds of millions of dollars in damages to the city's public school system, which had 122 campuses at the time.

These impacts had a profound effect on New Orleans' residents and demographics. The city's population was more than halved, dropping from 484,674 in 2000 to 208,548 by July 2006.[11] By 2013, the population had climbed back to an estimated 378,715—approximately 78 percent of New Orleans' 2000 population.[12] At that time, just over half of New Orleans' neighborhoods had recovered 90 percent of their pre-storm populations; thirteen neighborhoods that experienced little to no flooding actually had higher populations than they did before Katrina.[13] Conversely, many of the

5 Dan Swenson, Anatomy of a Flood: How New Orleans Flooded During Hurricane Katrina, NOLA.com/Times Picayune (Aug. 12, 2015), http://www.nola.com/katrina/index.ssf/2015/08/katrina_flooding_map.html#incart_most_shared-katrina.

6 Allison Plyer, Facts for Features: Katrina Impact, The Data Center, August 28, 2014, http://www.datacenterresearch.org/data-resources/katrina/facts-for-impact/.

7 FEMA, Mitigation Assessment Team Report, Hurricane Katrina in the Gulf Coast 8-4 (2006), available at http://www.fema.gov/media-library-data/20130726-1520-20490-4521/549_ch8.pdf.

8 Id. 8-4.

9 Plyer.

10 City of New Orleans, FEMA-Funded Recovery Roads Program, http://recoveryroads.nola.gov/PROGRAM.aspx (listing total network mileage and footage). It is important to note that the green infrastructure approaches discussed in this report would not protect against the large-scale flooding that occured in New Orleans because of the failure of levees, which are not owned or operated by FEMA. Green infrastructure is more appropriate for frequent, less-intense 2- or 5-year storm events. We simply discuss these impacts to document the large-scale recovery that was needed throughout Gulf-coast communities as a result of Katrina.

11 U.S. Census Bureau, Population Estimates Program 2009, https://www.census.gov/popest/data/historical/2000s/vintage_2009/city.html

12 U.S. Census Bureau, Population Estimates Program 2013, http://factfinder.census.gov/faces/tableservices/js/sf/pages/productview.xhtml?src=blank.

13 Elaine Ortiz, Greater New Orleans Community Data Center, Neighborhood Growth Rates: Growth in New Orleans Neighborhoods Continues in 2013 I (2013), available at: https://gnocde.s3.amazonaws.com/reports/GNOCDC_NeighborhoodGrowthRates.pdf. The Data Center relied on active postal addresses in making its estimates.

neighborhoods that sustained the deepest, most prolonged flooding had less than 75 percent of their pre-storm populations.[14]

Faced with dramatic shifts in the composition of their communities and possessing a heightened awareness of the risks posed by severe storms, New Orleanians have engaged in years of comprehensive and innovative planning to rebuild and improve all aspects of the city. Many of the most forward-looking plans emerged within the city's efforts to rebuild its antiquated school and stormwater systems. In both cases, stakeholders conceived of the systems' individual assets as unitary systems that needed to adapt both to changed community needs and future threats. New Orleans' experience, both its successes and the obstacles it encountered, is instructive for other disaster-affected communities that seek to boost long-term resilience while tapping federal disaster-relief funds during future recoveries.

Federal Disaster Relief Generally

To rebuild after Katrina, the state of Louisiana has relied on significant federal funding, a large portion of which was dedicated to battered New Orleans. Louisiana's and New Orleans' efforts to reconstruct the city's public school and stormwater systems offer a unique opportunity to critically evaluate the extent to which two major sources of federal disaster relief funding support community efforts to rebuild more resiliently after major disasters.[15] These programs, both of which are administered by FEMA, are:[16]

- Public Assistance Grants (PA),[17] authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the Stafford Act)[18] and
- The Hazard Mitigation Grant Program (HMGP), also authorized by Title IV of the Stafford Act.[19]

In the aftermath of a presidentially declared disaster such as Hurricane Katrina, the PA program is among the largest sources of federal funding available to help rebuild damaged public facilities and infrastructure. The PA program provides federal grants to help cover the cost of emergency and

14 See id. at 3 (Map 2 - Percent of June 2005 residential addresses receiving mail in June 2013).

15 The GAO has identified disasters and the environment as "a key source of federal fiscal exposure." GAO Resiliency Strategy Report at 7. Between 2004 and 2013, FEMA obligated more than $95 billion in federal assistance following major disasters.

16 A third major source of funding typically comes from the Disaster Recovery Community Development Block Grants (CDBG-DR), which are allocated by the Department of Housing and Urban Development (HUD) under Title I of the Housing and Community Development Act of 1974. 42 U.S.C. § 5306(c)(4) (1999). This report does not analyze Louisiana's deployment of CDBG-DR program funding after Katrina. Separately, insured property owners also receive direct payments under the National Flood Insurance Program, which is not discussed here.

17 42 U.S.C. § 5172, 5189f (2013); 44 CFR 206.200- 206.349.

18 The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Pub. L. 100-707, 42 U.S.C. §§ 5121–5207 (2006), signed into law November 23, 1988, establishes the system by which a presidential disaster is declared and federal financial aid and other forms of assistance from FEMA, HUD, and other agencies are triggered. This trio of federal disaster relief funding programs are referred to throughout this case study alternatively as "disaster recovery funding," "disaster recovery funds," or just "disaster funds."

19 42 U.S.C. §5170c; 44 CFR 206.430-206.440.

permanent efforts to repair, restore, or replace publicly owned facilities and some private, nonprofit facilities that serve a public function.[20] The program generally reimburses up to 75 percent of eligible costs, although where and how communities choose to rebuild can significantly reduce the amount they receive.

While PA focuses on restoration of public facilities after a disaster, HMGP, on the other hand, is aimed at avoiding future damages. To that end, the HMGP is designed to fund activities that reduce long-term threats to people and property from natural disasters.[21] HMGP funds can support any number of mitigation activities, from building retrofits to stormwater management systems and roadway elevation.

It is important to note that the uses of disaster recovery funds are in many ways limited by the statutes creating each program. In the case of the HMGP and PA program, the Stafford Act restricts the projects that FEMA can fund with these sources. FEMA must allocate these funds to projects that will cost-effectively reduce future risk. In doing so, FEMA must balance a community's recovery needs with the agency's fiscal responsibilities to US taxpayers.

PA and HMGP constituted a large source of federal post-disaster funding to Louisiana after Hurricanes Katrina and Rita.[22] To date, FEMA has obligated approximately $11.6 billion in PA grants among eligible state and local governmental entities in Louisiana, including more than $3.5 billion to applicants in Orleans Parish and nearly $1.5 billion to the Recovery School District, which had projects statewide but primarily in New Orleans.[23] Orleans Parish also was slated to receive more than $300 million in HMGP grants.

Despite this large influx of disaster recovery dollars, New Orleans faced significant challenges applying disaster relief funds to rebuild in a thoughtful and resilient manner. The process required extensive negotiations between communities and FEMA. In some cases, targeted Congressional interventions proved necessary because of inherent limitations of the Stafford Act. Ultimately, the post-Katrina experience helped drive statutory reforms—at least to the PA program—that may benefit communities seeking to rebuild more resiliently after catastrophe. These amendments did not alter the HMGP program. However, FEMA has worked hard to implement policy changes that may make obtaining funding for innovative projects, such as green infrastructure, at least slightly easier in the future.

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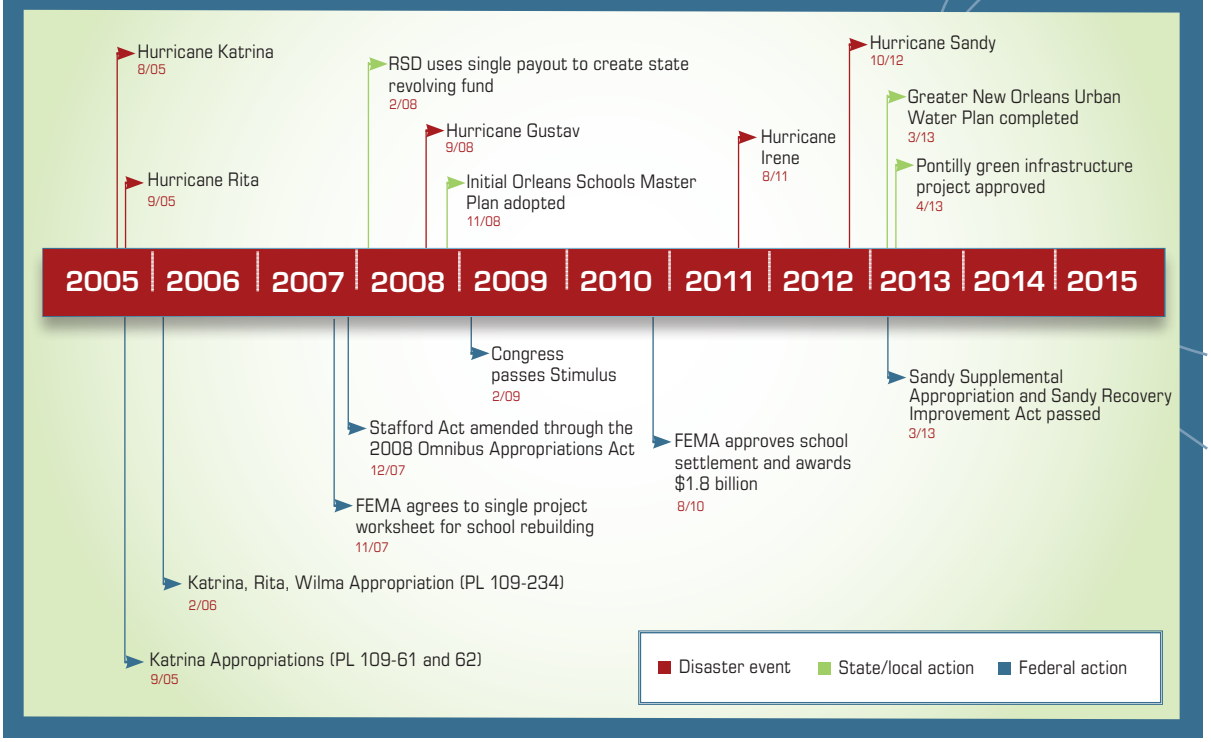
20 42 U.S.C. § 5172(a)(1)(A).

21 42 U.S.C. § 5170c(a) ("The President may contribute up to 75 percent of the cost of hazard mitigation measures which the President has determined are cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster.").

22 LA. Governor's Office of Homeland Security and Emergency Preparedness, State of Louisiana Hazard Mitigation Plan Update, Vol. I, at 200 (2008), available at: http://gohsep.la.gov/mitigation/statehazmitplan_08/volI/SHMPVolI_FINAL_041408.pdf.

23 FEMA, FEMA Public Assistance Funded Projects Summary - Open Government Initiative, https://www.fema.gov/media-library/assets/documents/28344 (last accessed May 26, 2015).

FIGURE 1: *New Orleans Post-Katrina Recovery: Timeline of Events*



Reimagining New Orleans' Public School System

Hurricane Katrina inundated and destroyed the vast majority of the New Orleans public school system, which at that time served over 65,000 students in 330 buildings on 122 separate campuses throughout the city.[24] The price tag to rebuild the battered system topped $1 billion when combined with hundreds of millions of dollars in deferred maintenance.[25]

Even before Katrina's physical devastation, the New Orleans public school system was embroiled in a growing public debate about how the system should be changed to overcome systemic shortcomings. For years, the city's school system was among the worst performing in the nation, with less than half of all students passing state standardized tests and the majority of its campuses considered to be failing schools based on performance scores maintained by the Louisiana Department of Education.[26]

In 2003, a voter-approved state constitutional amendment paved the way for the eventual takeover of much of New Orleans' troubled school system. The Louisiana Recovery School District (RSD) was established as a special district within the Louisiana Department of Education.[27] After Katrina, in mid-November 2005, the Louisiana legislature redefined the metrics by which schools and districts could be deemed failing and subject to takeover.[28] Lawmakers granted the RSD authority to take control of and manage poor-performing schools throughout Louisiana.[29] By November 2005, 114 of 131 New Orleans' schools were transferred to RSD's control. RSD was given the right to manage and operate all of the property belonging to the schools it took over.[30] These rights and responsibilities included the authority to rebuild or renovate as necessary, but not to sell.[31]

After Katrina, merely replicating the pre-storm New Orleans public school system was not an option. By 1998, the average school building in the New Orleans system was sixty years old—43 percent older than the national average.[32] School buildings were also sized to accommodate a much larger population of children than existed after the storm, and buildings were situated among city

24 See Schools Master Plan at 5, 27.
25 Id. at 35.
26 See Cowen Institute for Public Education Initiatives, Transforming Public Education in New Orleans: The Recovery Schol District 4-7 (2011), available at: http://www.coweninstitute.com/wp-content/uploads/2011/12/History-of-the-RSD-Report-2011.pdf (hereinafter "Cowen Report"); see also National Center for Education Statistics, Dropout Rates in the United States: 2004 (2006), available at: http://nces.ed.gov/pubs2007/2007024.pdf; Louisiana Dep't of Ed., 2004–05 District Accountability Report, available at: http://www.doe.state.la.us/topics/leap_gee annual_report.html.
27 Cowen Report at 5.
28 See 2005 La. Acts no. 35.
29 Cowen Report at 6.
30 Id.
31 Id.
32 Schools Master Plan at 28.

neighborhoods based more on earlier policies of segregation than on any correlation to existing student needs.[33] The city's population patterns and composition also had shifted, with implications for public services. Of relevance to the city school system, the percentage of households with children under 18 fell from 30 percent to 21 percent in the City of New Orleans and from 34 percent to 26 percent in the New Orleans Metro Area between 2000 and 2013.[34] The total number of children under 18 in the city decreased by 51,563, or about 40 percent, from 2000 to 2013.[35]

After Katrina, the goal was to rebuild a workable school system as expeditiously as possible while seizing upon the opportunity to reengineer the system to be more equitable, resilient, and responsive to the changed needs of the city and its children.[36] As stated by Paul Vallas, former RSD superintendent, Hurricane Katrina presented "an opportunity to build—not rebuild, but build—a new school system."[37] To realize this goal, local, state, and federal officials embarked on a four-year process that not only redesigned the New Orleans public school system but also rewrote key attributes of the PA Program. Put simply by a U.S. Government Accountability Office report, "the Stafford Act was not designed for the level of project reconfiguration necessary for post-Katrina rebuilding."[38] A project-based reimbursement system initially forced state and local officials to focus efforts too narrowly. Weighing the trade-offs of repairing, improving, or altering individual assets rather than planning for a coordinated reconstruction based on a holistic approach potentially wasted resources. And reduced reimbursement rates for improvements and "alternate projects" (also known as "in-lieu projects," defined below) provided a financial disincentive for rebuilding projects aimed at better preparing the city for new needs and future storms.

33 Id. (Segregation-oriented building policies led to the duplication of school facilities in close proximity.).

34 Nihal Shrinath, Vicki Mack and Allison Plyer, The Data Center, Who Lives in New Orleans and Metro Parishes Now? 7 (2014), available at: https://gnocdc.s3.amazonaws.com/reports/TheDataCenter_WhoLivesInNewOrleansAndMetroParishesNow.pdf.

35 Id. at 8.

36 Interview with Ramsey Green, former deputy superintendent, Louisiana Recovery School District (February 3, 2014). Mr. Green managed the reconstruction of the district's school facilities, financing, and general operations.

37 Cowen Report at 10.

38 See, e.g., U.S. Government Accountability Office (GAO), FEMA's Public Assistance Grant Program Experienced Challenges with Gulf Coast Rebuilding: Report to Committee on Homeland Security and Government Affairs, U.S. Senate 22, GAO Publication No. GAO-09-129 (2008) (hereinafter "GAO Report"), available at: http://www.gao.gov/assets/290/284493.pdf. The GAO identified numerous challenges that RSD and other PA applicants experienced in using PA funding for large-scale redevelopments: (1) applicants experienced difficulty in determining the amount of damage that was actually disaster-related; (2) the PA program had limited flexibility in allowing reimbursement for improvements or alternate projects that would better meet changed post-disaster needs of the City; (3) project costs were narrowly construed and resulted in excessive paperwork and duplication of effort; and (4) PA applicants had limited ability to initiate projects before being reimbursed with PA awards.

The PA Program

Authorized by the Stafford Act, the PA program reimburses disaster-affected communities a portion of the costs to implement temporary emergency measures[39] and for the permanent repair, restoration, or replacement of damaged public facilities.[40]

At the time of Katrina, the Stafford Act set the minimum federal cost share for temporary measures at 75 percent of the actual cost of work and services to "save lives and protect property," including "the provision of temporary facilities for schools."[41] For permanent measures, the Stafford Act also authorized FEMA to reimburse a minimum of 75 percent of the cost for eligible work for restoration, reconstruction, or replacement.[42] As they are today, reimbursement amounts for permanent work were based on the level of damage to an asset based on its condition immediately before a disaster.[43] The PA program prioritized repair of damaged facilities. Under FEMA regulations, a facility was considered able to be repaired when the damages were less than 50 percent of the cost of replacement.[44] If a damaged facility was not able to be repaired, it could be replaced in the same location.[45] Finally, relocation would be allowed at the discretion of the FEMA Administrator, but only if the facility was subject to repetitive heavy damage and relocation was cost effective.[46]

Regulations generally imposed limits on applicants' ability to "improve" an asset except when required to comply with federal or state codes.[47] Thus, when state or local building codes required

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39 42 U.S.C. § 5170b (2013).

40 42 U.S.C. § 5172 (2013).

41 42 U.S.C. § 5170b(a)(3)(D)(2005); 42 U.S.C. § 5170b(b) (2005) ("The Federal share of assistance under this section shall be not less than 75 percent of the eligible cost of such assistance.").

42 42 U.S.C. § 5172(b)(1) (2005). Under FEMA's own regulations, FEMA could approve an increase in the federal cost share to 90 percent for "extraordinary" disasters. The federal cost share can be increased when the amount the federal government pays toward recovery in the impacted state would meet or exceed a qualifying per capita dollar amount threshold and includes consideration of other major disaster declarations in the state during the preceding twelve-month period. 44 CFR 206.47(b)(4) and (c). At the time of Hurricane Katrina, the per capita threshold for adjusting the 25 percent state cost-share was the total disaster damages to the state equal to or exceeding $100 per capita of state population, adjusted for inflation. The current threshold is $133 per capita based on an affected state's population. See also 44 CFR 206.47(d), which allows the federal share to be adjusted to 100 percent but only for essential assistance to meet immediate threats to life and property or debris removal and only for a limited period. To qualify as "extraordinary," the total reimbursable damages in a given state during a 12-month period must exceed a specified per capita amount based on the state's population.

43 If an asset is less than 50 percent damaged, FEMA can only reimburse applicants for the costs to "repair" eligible damage. If an asset is more than 50 percent damaged, FEMA can reimburse applicants for the costs to "replace" the asset. FEMA will authorize reimbursement for a restoration or replacement project, in lieu of damage repairs, when disaster damages exceed 50 percent of the cost of replacing a facility to its pre-disaster condition or it is not feasible to repair the facility so that it can perform the function for which it was being used before the disaster. See 44 CFR §206.226(f); see also FEMA, Public Assistance Guide (2007), Ch. 2, available at: http://www.fema.gov/public-assistance-policy-and-guidance/public-assistance-guide ("PA Guide").

44 44 C.F.R § 206.226 (2012).

45 Id. § 206.226(f)(2).

46 Id. § 206.226(g). The cost-effectiveness or benefits of relocation are measured in terms of the damage prevented by moving away from the hazardous location. FEMA operates under a presumption that relocation is only "cost effective if the damage is severe enough that the facility qualifies for replacement (greater than 50 percent damaged)." See PA Guide at Ch. 2.

47 44 C.F.R. § 206.203(d)(1); see also PA Guide at 36. Typically approved alterations that would still allow for complete replacement cost reimbursement include changes in design needed to meet updated building codes, 44 C.F.R. § 206.226(d)(1)-(5), or preapproved cost-saving hazard mitigation measures. 42 U.S.C. § 5172(e); 44 CFR § 206.226 (e).

that a structure be elevated above the floodplain, FEMA would consider the retrofit a covered expense under the PA. But when communities voluntarily chose to rebuild in other ways that provided better protection against future damages, they would have to cover the additional costs on their own.

The recovery process for the New Orleans public school system began with the formulation of individual "project worksheets" for each damaged school after meetings with FEMA officials. The project worksheets document damage to a facility, the scope of work for repairing or rebuilding the facility, and cost estimates.[48] At the time of the storm, FEMA rules required reimbursement on a project-by-project basis.[49] Although a "project" could ostensibly include a single asset or multiple damaged sites, the focus on discrete projects limited the community's ability to take a holistic, community-wide approach to rebuilding. For example, multiple sites could be considered as a single "project," but only where the sites shared common project management aspects, such as similar construction expenses, shared boundaries, or the same contractor.[50]

In situations where communities decided that repairing or replacing a damaged asset to its pre-disaster design or in its pre-disaster location was not in the public interest, the Stafford Act allowed the communities to pursue an "alternate" or "in lieu" project.[51] Communities could, for example, elect to build or repair different public facilities or fund hazard mitigation measures needed to protect government facilities or services inside the disaster area.[52] But at the time of Hurricane Katrina, this flexibility came with a particularly high cost: Reimbursement for alternate projects was reduced by 25 percent of the amount that the federal government would otherwise have reimbursed if an asset were rebuilt to its pre-disaster design or function.[53]

The other challenge states and communities faced was that obligated funds were not immediately available to state and local governments.[54] FEMA obligates PA funds based on cost estimates, then

48 State and local governments are applicants that are eligible to receive Public Assistance grants. Once they obtain assistance from the PA program, the state and local government entity becomes a "grantee" or "subgrantee." The terms applicant and grantee are used interchangeably by FEMA and in this report. Pa Guide at Ch. 2. For each applicant, an expert in the PA program from either the affected state or FEMA is designated as a customer service representative, or Public Assistance Coordination Crew Leader. Id. at Ch. 1.

49 Department of Homeland Security Office of Inspector General. Assessment of FEMA's Public Assistance Program Policies and Procedures 18 (Dec. 2009) ("DHS PA Assessment") ("The current [project worksheet] process provides for final grant settlements on a project-by-project basis."), available at: https://www.oig.dhs.gov/assets/Mgmt/OIG_10-26_Dec09.pdf.

50 See FEMA, PA Guide at Ch. 3.

51 42 U.S.C. § 5172(c).

52 42 U.S.C. § 5172(c)(1)(C).

53 See 42 U.S.C. § 5172(c)(1)(A)(" In any case in which a State or local government determines that the public welfare would not best be served by repairing, restoring, reconstructing, or replacing any public facility owned or controlled by the State or local government, the State or local government may elect to receive, in lieu of a contribution under subsection (a)(1)(A) of this section, a contribution in an amount equal to 75 percent of the Federal share of the Federal estimate of the cost of repairing, restoring, reconstructing, or replacing the facility and of management expenses."); 44 CFR §206.203(d)(2); but see §206.203(d)(2)(iii) ("If soil instability at the alternate project site makes the repair, restoration or replacement of a state or local government-owned or -controlled facility infeasible, the Federal funding for such an alternate project will be 90 percent of the Federal share of the approved Federal estimate of eligible costs.").

54 Once FEMA approves a project worksheet, federal disaster funding is considered "obligated" based upon the estimated costs submitted by the applicant.

communities must seek reimbursement based on the actual costs they incur conducting approved work.[55] This means that communities must often front the funding necessary to begin rebuilding projects and wait for FEMA to reimburse them.

As discussed more extensively below, targeted amendments to the Stafford Act in the months and years after the storm partially alleviated some of these funding challenges. For example, because of the enormity of the damage caused by Hurricanes Katrina and Rita, Congress authorized the federal government to assume 100 percent of the cost to rebuild public assets to their pre-disaster design or function. These amendments applied only to Louisiana and other states affected by Katrina and Rita.[56] Congress also subsequently reduced the deduction from the federal share for in-lieu projects under the PA program from 25 percent to 10 percent.[57] This amendment was applicable to all future disasters.

After Hurricane Sandy, Congress also authorized FEMA to develop an entirely new "alternative procedure" that would allow applicants to pursue in lieu projects without any penalty provided they agreed to certain conditions, which are discussed more fully below.[58] The alternative procedure offers communities many of the advantages of the small project streamline process. For purposes of this case study, we refer to FEMA's pre-Sandy reimbursement process as "the standard PA program," which we contrast to the more flexible alternative procedures allowed by the Sandy Recovery Improvement Act.

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55 PA Guide at 95, 109. For large projects—over the Stafford Act's inflation-adjusted threshold—grantees are reimbursed based upon actual costs expended. In 2005, the threshold for a large project was just $55,000. FEMA, Notice of Adjustment of Disaster Grant Amounts (October 19, 2004), 69 FR 61515 (eff. October 1, 2004). For smaller projects, FEMA offered a streamlined process whereby FEMA makes payment of funds on an approved project worksheet immediately available. Additionally, grantees are allowed to keep excess funds when the actual costs of the work are less than the estimates. (For both large and small projects, communities could request that FEMA provide additional funding when costs exceeded initial obligation estimates.) See 42 U.S.C. § 5189; 4 CFR § 206.205(a); and FEMA, Determination on the Public Assistance Simplified Procedures Thresholds: FY2014 Report to Congress App. 2, at 32 (January 29, 2014) ("PA Threshold Report"), available at: http://www.fema.gov/media-library-data/1391095896799-50f74acda8e6de05dac297db1aad5669/FY14%20Public%20Assistance%20Simplified%20Procedures%20Thresholds.pdf

56 See U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007, Pub. L. No. 110-28, § 4501, 121 Stat. 112, 156 (May 25, 2007); 72 Fed. Reg. 34,703 (June 25, 2007). This amendment also removed a requirement that funding gaps for alternate projects be covered exclusively by local governments. The change enabled eligible PA recipients to use other non-local sources, such as disaster recovery Community Development Block Grants from HUD, to fill gaps in total project construction costs.

57 Section 609 of the Security and Accountability For Every Port Act of 2006 (SAFE), Pub. L. 109-347, amended section 406 (c)(1) of the Stafford Act (42 U.S.C. 5172(c)(1)(A)) to boost the federal contribution toward alternate projects from 75 to 90 percent of the estimated total cost; 73 FR 20551 (April 16, 2008). For non-profit facilities, the reduction remains 25 percent.

58 Sandy Recovery Improvement Act (SRIA), Pub. L. 113-2.

Using FEMA's Public Assistance Program to Fund a Reimagined School System

Officials employed a two-fold strategy to rebuild the city's public school system: First, they devised an interim plan to open enough schools in time to resume partial operations by 2006. Second, they worked with FEMA for years to rebuild the entire system of city schools as a single project instead of waging a building-by-building reconstruction process.[59] RSD and the Orleans Parish School Board (OPSB) faced barriers using PA funding for both their short- and long-term strategies.

Getting Students Back in the Classroom

The first challenge RSD encountered was in obtaining reimbursement for its short-term plans to build temporary campuses. Their strategy was to construct nine "modular campuses" throughout the city that would provide a temporary but indefinite system of school buildings while a permanent rebuilding strategy was developed.[60] Lacking resources to complete construction, RSD requested that FEMA pay for the modular campuses as "emergency protective measures." FEMA initially declined.

As is the case today, the Stafford Act allowed for temporary school facilities as emergency measures.[61] But at the time Katrina struck New Orleans, FEMA's policy required that the "capacity of temporary facilities ... be *comparable* to the pre-disaster capacity of *the facility* that housed the displaced services."[62] Interpreted narrowly, the policy could have been construed to require that temporary facilities mimic the location and capacity of the unusable public facilities they replace, limiting flexibility in extreme disasters. The policy also expressly limited temporary assistance to *six months*, based on regulatory time limits for emergency work completion.[63] The FEMA regional director could, at the request of the state governor, extend the deadline by another six months.[64] But it appears that, at least in New Orleans, FEMA officials attempted initially to apply the six-month

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59 Interview with Ramsey Green.

60 Id.; see also Louisiana Legislative Auditor, A Compliance Audit Report on the Recovery School District's Modular Campus Construction Program 5 (April 3, 2013) (hereinafter "Modular Audit"), available at: http://www.lla.state.la.us/PublicReports.nsf/D37141BC3E866E5586257B42006D57FE/$FILE/00031562.pdf.

61 44 CFR §206.225; see also Interview with Ramsey Green. Eligible activities for PA reimbursement are classified as Categories A-G. Emergency Protective Measures are catalogued as Category B. Other activities are: Debris Removal (Category A); Road Systems and Bridges (Category C); Water Control Facilities (Category D); Buildings, Contents, and Equipment (Category E); Utilities (Category F); and Parks, Recreational, and Other (Category G).

62 FEMA, Provision of Temporary Relocation Facilities at 2, §(7)(2), PA Policy No. 9523.3 (July 16, 1998) (hereafter "FEMA Old Policy"), available at: https://www.fema.gov/media-library/assets/documents/28874?fromSearch=fromsearch&id=6397 [emphasis added].

63 Id. at 3, § (7)(C)(1)(citing emergency time limit in 44 CFR § 206.204(c).

64 Id. at § (7)(c)(5). The 12-month period could only be extended if construction had begun within 12 months of the declaration of disaster.

limit.[65] After the end of the time limit for temporary assistance, FEMA would require applicants to pay for continued use of a facility based on its fair-market value.[66]

The modular campuses were outside this regulatory box on all counts, and FEMA turned down the request in November 2005 for temporary school buildings.[67] School officials needed modular campuses to function indefinitely with flexible capacity and location given the magnitude of Katrina's devastation and uncertainty over where and when the city would repopulate.

After almost a year of negotiating, however, FEMA eventually agreed, awarding millions of dollars to reimburse the cost of constructing the modular school facilities. FEMA allowed the temporary facilities to operate throughout the city's process of rebuilding a permanent school system, which greatly exceeded the six months allowed under FEMA's guidance.[68]

A Permanent Home for New Orleans' Students

Even after receiving funding for modular campuses, plans to rebuild a permanent school system were delayed for over two years. Some of the difficulties were administrative, while others stemmed from statutory or regulatory obstacles.

As noted in Congressional reports, the sheer volume of properties requiring damage and repair assessments overwhelmed FEMA. FEMA and school officials lacked the manpower and resources to expeditiously conduct the data-intensive assessments required by the PA program.[69] Frequent communication disconnects and inconsistent decision-making on FEMA's part also exacerbated delays. For example, in some instances FEMA's determination to pay to replace a facility came after school officials already paid for architectural plans to merely repair the facility, resulting in wasted time and expenditures.[70] In other instances, initial FEMA declarations that facilities were not eligible for replacement would be reversed upon appeal based upon reassessment of FEMA's damage estimate

65 See FEMA, PA Policy Guidance Protocol 9523.3, Provision of Temporary Relocation Facilities (July 16, 1998) (hereinafter "1998 PA Temp Policy"), available at: http://www.fema.gov/media-library-data/20130726-1851-25045-7256/rr9523.3_provision_of_temporary_relocation_facilities__7.16.98_.pdf (citing 44 CFR §206.204(c))see also, Interview with Ramsey Green. The policy did provide for extensions of up to six months, for a total of 12 months, based on extenuating circumstances. The policy also allowed for the FEMA regional director to allow extensions beyond the 12-month time limit when construction began within the 12 months. Id. at (C)(4) and (5). FEMA rewrote the protocol in 2010. See FEMA, Recovery Policy: Provision of Temporary Relocation Facilities (December 14, 2010), Recovery Policy No. 9523.3, https://www.fema.gov/9500-series-policy-publications/95233-provision-temporary-relocation-facilities. As discussed in greater detail below, the new policy explicitly permits longer time limits "established according to the particular requirements of the restoration project." Id.

66 1998 PA Temp Policy at 4, §(D)(3)("FEMA will require that it be compensated when the authorized temporary relocation time period has ended or the facility is no longer needed by the applicant for the authorized temporary relocation purpose (i.e., the approved scope of work), whoever occurs first.").

67 Modular Audit at A.3 (RSD response to auditor's report).

68 FEMA, FEMA Helps Recovery School District Build Temporary Schools (March 8, 2007), https://www.fema.gov/news-release/2007/03/08/fema-helps-recovery-school-district-build-temporary-schools ("The modular schools sites built with these funds will remain as temporary school facilities until the permanent schools are repaired or replaced.").

69 See GAO Report at 22, 24. In testimony before Congress, then-administrator for Gulf Coast Recovery James Stark noted that more than 46,000 Project Worksheets had been completed for Louisiana projects related to hurricanes Katrina and Rita as of February 2009. House Transportation and Infrastructure Committee, Testimony of James Stark, Post Katrina Disaster Response and Recovery: Evaluating FEMA's Continuing Efforts in the Gulf Coast and Response to Recent Disasters, (February 25, 2009).

70 GAO Report at 24; see also Interview with Ramsey Green.

by RSD-hired engineers.[71] Finally, RSD's limited resources, paired with PA's reimbursement rather than advance payment structure, created a "chicken-or-the-egg" problem for the district's recovery efforts. In all, the manner in which the PA process was administered was incompatible with the goal of creating a new, more resilient public school system.[72]

The Stafford Act and the FEMA regulations governing the PA program also presented systemic challenges to rebuilding a more resilient New Orleans's school system. First, disaster-affected communities had to bear a large portion of the cost to repair or replace their facilities. Federal funds were limited to 75 percent of the total cost to repair or replace a public facility, leaving local communities to come up with the rest. For in-lieu projects, local communities' costs were even higher because of the then-25 percent penalty.

Second, the PA program's focus on individual structures or facilities—generally with the expectation of returning them to their original location and configuration—discouraged communities from using federal funding to rebuild in a way that accounted for changed conditions or that reduced future hazards. Moreover, FEMA guidelines and its project-by-project approach made it difficult—or even impossible—to fold multiple assets into a single project based on shared community functions, such as education. As a result, New Orleans was not initially allowed to treat all its damaged schools as a single "project" for purposes of reimbursement, limiting the ability to rebuild schools how and where they were needed based upon changed demographics.[73]

Even before Katrina, the location of school buildings throughout the city failed to align with the modern size and distribution of the student population. After the storm, the misalignment became even more pronounced. When siting and designing schools, officials needed the flexibility to accommodate the unknowns associated with New Orleans' uneven repopulation. School officials also wanted to select facilities for rebuilding based, in part, on how much FEMA might provide to build back the entire system, while FEMA held that it could not make that determination until officials presented their reconstruction plans for the entire school system on a campus-by-campus basis.[74] As part of these efforts, officials wanted to coordinate rebuilding through an integrated

71 Interview with Ramsey Green. GAO investigators reported a similar lack of consistency in some communities' interactions with FEMA following Hurricane Sandy. There, frequent turnover in FEMA staff and varied interpretations of guidance led to inconsistent determinations both within specific projects and across the agency as a whole. GAO Resiliency Strategy Report at 25, 27.

72 See, generally, Sarah Laskow, DC: A Flood of Money Slow to Fix New Orleans Schools, The American Independent (Aug. 30, 2010), http://americanindependent.com/136892/a-flood-of-money-slow-to-fix-new-orleans-schools.

73 The Sandy Recovery Improvement Act, discussed below, called for substantial changes to these rules and led to the implementation of a completely new set of alternative procedures for some PA projects. SRIA at Div. B, § 1102(2) (codified at 42 U.S.C. § 5189f(e)(1)(C)("consolidating, to the extent determined appropriate by the Administrator, the facilities of a State, tribal or local government, or owner or operator of a private nonprofit facility as a single project based upon the estimates adopted under the procedures.")) However, FEMA's implementation of the alternative procedures applies only to disasters declared after May 19, 2013, and thus will not benefit New Orleans' continuing recovery.

74 GAO Report at 22.

planning process, attempting, for example, to design and locate school campuses in coordination with libraries, parks, and other community amenities to meet safety and academic goals.

Third, officials' efforts to rebuild the school system greatly exceeded FEMA's large-project threshold. Under the rules for larger projects, FEMA project officers needed to perform project cost estimates; awards could not be based on estimates performed by the communities themselves.[75] FEMA's damage assessments were then compared with the assessments done by state and local entities, slowing the process. And any projects costing more than $1 million were subjected to additional scrutiny not only by FEMA, but also by FEMA's superiors within the Department of Homeland Security and the Office of Management and Budget. For these projects, known as FEMA's "million dollar queue,"[76] Congressional notification also was required.

A Path Forward for New Orleans

Beginning in late 2007, Congress and FEMA moved to clear some of the roadblocks. The changes would ultimately allow for a disaster-recovery process that better reflected the scale and challenges of rebuilding a complete system of public infrastructure. First, in November 2007, FEMA agreed that the replacement of building contents within the school system could be consolidated into a single project worksheet in lieu of several hundred individual funding applications. The decision provided a $50 million lump-sum infusion of capital funding at a single time.[77] Then, in December 2007, President George W. Bush signed into law the 2008 Omnibus Appropriations Act. The Act included language crafted by Louisiana Senator Mary Landrieu to waive, for states affected by hurricanes Katrina and Rita, the 25 percent deduction imposed on in-lieu projects. The Act also allowed FEMA to approve a single payout for the permanent construction of a new school system, rather than make individual payments for each building in the system.[78]

These administrative and legal revisions were pivotal for New Orleans' recovery efforts. By February 2008, with the guarantee of a significant single payout, school officials were able to begin paying back more than $100 million owed to vendors for earlier assessments and construction costs. Based on the

75 Department of Homeland Security Office of Inspector General. Assessment of FEMA's Public Assistance Program Policies and Procedures 3 (Dec. 2009); In to the Sandy Recovery Improvement Act of 2013, Pub. L. 113-2, FEMA raised the threshold large projects to $120,000, which will be adjusted annually based on the Consumer Price Index. See PA Threshold Report.

76 See FEMA, Strategic Funds Management – Implementation Procedures for the Public Assistance Program 3-4 (Dec. 21, 2012); see also John Moreno Gonzalez, Effort to Cut FEMA Red Tape Knocked Back, USA Today, Dec. 18, 2007, http://usatoday30.usatoday.com/news/nation/2007-12-18-4152880462_x.html (By December 2007, "1,029 hurricane rebuilding projects in Louisiana, Mississippi and Alabama with a combined value of $5.3 billion [were] put in the queue.").

77 New Orleans Recovery School District. Operating and Capital Budget Presentation to the Louisiana State Board of Elementary and Secondary Education (BESE) 9 (Feb. 2008).

78 Pub. L. No. 110-161, § 552, states, in relevant part: "Notwithstanding any other provision of law, the Secretary of Homeland Security shall, under the Federal Emergency Management Agency Public Assistance Program, provide a single payment for any eligible costs for local educational agencies impacted by Hurricanes Katrina or Rita within 30 days of such request." The law also narrowed the deduction in PA funding based on eligible flood insurance claims from being imposed on each building to applying a single deduction for each school campus, which added an additional $58.4 million in FEMA payouts towards contents and capital.

2008 Appropriations Act, FEMA obligated $67 million as a consolidated payout for rebuilding four of the District's school campuses. In turn, this payment secured a $50 million revolving loan fund created by the state to provide RSD with financing to begin system-wide construction. The money used to start construction would then be reimbursed by future FEMA consolidated payouts.[79]

This advance revolving loan, and its replenishment by FEMA's first consolidated payout of $67 million, enabled expedited damage cost assessments and rebuilding plans for the entire school system. In particular, FEMA and RSD created the "Quick Start Initiative" in 2007 to *jointly* conduct damage and cost estimating processes and consolidate over 100 separate PA project applications into a single $147.8 million project to construct four new, permanent schools.[80] Building on the success of these early joint assessments, RSD and FEMA were positioned to expedite the ultimate goal of arriving at a cost and final payout for rebuilding the entire New Orleans school system.

Within this new streamlined process, officials set out to completely recreate the school system, commencing a comprehensive, citizen-based master planning process. RSD partnered with other state and local officials, educators, administrators, parents, and other community stakeholders in a year-long process to develop the *Schools Master Plan*. The plan provided a roadmap for consolidating the city's school system to reflect changing post-disaster conditions and citizen recovery goals,[81] while assuring a school system design and function that would be "both innovative and transformative for students."[82] Based on the *Schools Master Plan*, school officials and FEMA agreed after negotiation for the final plan to serve as the basis for awarding a lump sum for the planned 84-campus system.[83]

It would be another two years before Congress actually appropriated sufficient funding to meet the single payout award to which FEMA and RSD had agreed. After the passage of the American Recovery and Reinvestment Act of 2009 (also known as the "Stimulus"), which placed an emphasis on funding "shovel-ready" projects, Congressional leaders, the White House, FEMA, and school officials in New Orleans negotiated the eventual award of nearly $1.8 billion toward construction of

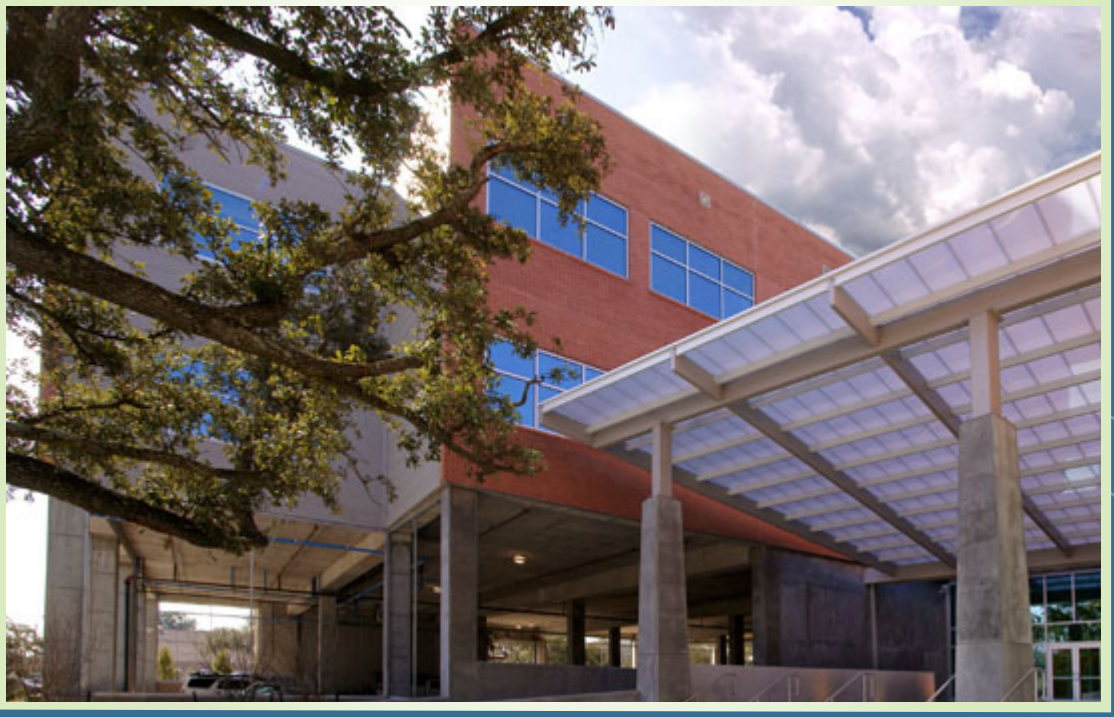
79 See Letter to Colonel Thomas Kirkpatrick, State Coordinating Officer, State of Louisiana Governor's Office of Homeland Security and Emergency Preparedness from Ramsey Green, Budget Director, Recovery School District. "Re: Request to implement the Recovery School District's $50 million Revolving Fund." (Feb. 5, 2008). Prior to the creation of the advance fund, RSD had fronted approximately $20 million of its operating budget to cover construction costs from 2006.

80 FEMA, FEMA Provides Millions for Recovery School District's Quick Start Schools (2009), http://www.fema.gov/news-release/2009/05/16/fema-provId.es-millions-recovery-school-districts-quick-start-schools (last visited April 23, 2015).

81 Many of these citizen recovery goals were captured in another citizen-based planning project known as the Unified New Orleans Plan. See The Unified New Orleans Plan: Citywide Strategic Recovery and Redevelopment Plan (2007), available at: http://quake.abag.ca.gov/wp-content/documents/resilience/New percent20Orleans-FINAL-PLAN-April-2007.pdf.

82 Schools Master Plan at 14, iv.

83 The Schools Master Plan developed in 2008 recommended 67 sites for pre-K-through-8th grade schools and 17 sites for grades 9 through 12. Id. at vi.



The Lake Area High School in New Orleans (shown above) was rebuilt after Katrina as a LEED-certified school with classrooms located on the upper levels to protect against future flooding. The school experienced 8-feet of flooding during Katrina, and notches are placed on the entry columns to mark the level of flood waters.

Source: The Center for Green Schools

the newly conceived public school system in August 2010.[84] In announcing the award, US Senator Mary Landrieu offered: "This is one of the great victories in our fight for a smarter recovery. . . . I hope this will serve as the model for many communities rebuilding after catastrophic tragedies."[85] The approach, however, did not immediately serve as a model. New Orleans was one of the only systems during the Katrina recovery to utilize the single-payment provision provided by the 2008 Appropriations Act. Moreover, subsequent efforts to legislate single payouts for water, street, and other large classes of damaged infrastructure under the PA program were not successful until after Hurricane Sandy struck the United States in October 2012.

84 Press Release, Secretary Arne Duncan, Dept. of Ed., Helping New Orleans Rebuild its Schools (Aug. 28, 2010), available at: http://www.whitehouse.gov/blog/2010/08/27/helping-new-orleans-rebuild-its-schools; see also Laskow ("'[M]y administration announced a final agreement on $1.8 billion dollars for Orleans Parish schools—money that had been locked up for years—so folks here could determine how best to restore the school system,' [President Obama] said.."); see also, Cindy Chang, $1.8 Billion from FEMA for Hurricane Katrina school rebuilding is 'worth the wait,' Sen. Mary Landrieu says, The Times-Picayune (Aug. 26, 2010), http://www.nola.com/katrina/index.ssf/2010/08/18_billion_from_fema_for_hurri.html ("'It was [Senator Landrieu's] sheer determination and untiring efforts that enabled us to secure this settlement, along with the flexibility to spend the money in a way that will allow us to build public schools that will serve the needs of all the children in our City," [Paul] Vallas said.").

85 See Chang.

Construction based on the *School Master Plan* continues as of this writing, but was modified based upon shifting demographics.[86] The school sites will be significantly reduced from the more than 120 the city had before Katrina to 81.[87] At many sites, damaged structures were demolished and the land will be preserved as vacant parcels for potential future development.[88] As envisioned by the plan, many of the new school facilities will be smaller—limited to 600-900 students—and designed to achieve a minimum of LEED Silver Certification.[89] When feasible, new facilities will be located away from repetitive natural hazard and flood-risk areas, situated close to reliable transportation systems, and built in coordination with other public assets such as libraries and parks.[90] School properties not being rebuilt from the 122 pre-Katrina campuses are being preserved as vacant parcels for future development and in some instances being sold for private development.

As students enter the 2015-2016 school year, there are 82 operating public schools in the city, including 75 charter schools, which are publicly funded and operated by private organizations but are accountable to state established education goals and testing, and evaluated for purposes of maintaing their charter by state and local officials. RSD and state officials retain control over 62 of the city's 82 operating public schools.[91] Down from a pre-Katrina enrollment of 65,610 students, there are approximately 44,000 students in New Orleans' schools.[92] In addition, many New Orleanians put their children into parochial or private schools or schools in neighboring parishes.

The difficulties that RSD and other state and local governments experienced using FEMA funds to rebuild public systems after Katrina revealed key incongruities between the Stafford Act and the scale of recovery needed after the type of major disasters that will become more frequent with climate change. The PA program, as structured and administered at the time of the storm, was better tailored for smaller, more localized incidents than for large-scale, regional catastrophes. In response to the troubling realization that one of the federal government's largest sources of assistance for communities after major disasters was incompatible with communities' actual post-disaster needs,

86 See Orleans Parish School Board Superintendent's Report (May 2015), available at: http://lrsd.entest.org/SFMP%20Reports/Superintendent%20Report%20%20May%202015.pdf. The School Master Plan is required to be reviewed and adjusted every two years based on enrollment projections, resettlement patterns, and large-scale housing projects. Based on this data, the Master Plan was revised to include 81 schools, including 35 new schools, to serve approximately 55,000 public school students – the estimated citywide enrollment by 2017. Recovery School District, http://rsdla.net/apps/pages/index.jsp?uREC_ID=195282&type=d; see also, Cowen Institute for Public Education Initiatives, New Orleans Public School Facilities Update at 5 (Tulane University, June 2013) available at: http://www.coweninstitute.com/wp-content/uploads/2013/07/Facilities-Update.07.03.13-Final1.pdf.

87 Recovery School District Master Plan Amendments.

88 Id.

89 LEED is short for the Leadership in Energy and Environmental Design is a green building certification program, which was developed by the US Green Building Council (USGBC). Buildings receive certifications (e.g., silver, gold, platinum) based upon points earned for using environmental materials, installing energy or water efficiency improvements, among other "green" amenities. USGBC, LEED description, available at: http://www.usgbc.org/leed#overview.

90 School Master Plan at vi and 3.

91 See Louisiana Board of Elementary and Secondary Education (BESE) and Louisiana Department of Education, New Orleans Public Schools Governance 2014-2015 School-Year, available at: http://www.louisianabelieves.com/docs/default-source/katrina/nola-governance-chart-042915.pdf?sfvrsn=2.

92 Louisiana Department of Education, Ten Years After Hurricane Katrina: The New Orleans Education Landscape Today, available at https://www.louisianabelieves.com/resources/about-us/10-years-after-hurricane-katrina.

Congress ultimately amended the Stafford Act to better align FEMA assistance with the scale of disasters and to help ensure the long-term viability of post-disaster investments.[93]

Changes to the PA Program After Hurricane Sandy

Recent reforms to FEMA's major disaster relief programs were driven, in part, by New Orleans' recovery struggles. In the aftermath of Katrina and ensuing years, federal officials and Congress reacted to the immense difficulties posed by the storm's unprecedented devastation with targeted programmatic amendments. After Hurricane Sandy, when Congress amended certain critical aspects of the PA program in a bid to streamline and make it more flexible, it did so with the Katrina experience clearly in mind.

Temporary Assistance

FEMA has independently recognized the potential need for longer-term "temporary" solutions, such as modular school facilities, following major disasters.[94] In 2010, FEMA reissued its policy on *Provision of Temporary Relocation Facilities* with revised language that, in theory, more clearly accommodates the type of flexible, longer-term (though temporary) solution RSD was initially denied. The new policy states simply that the "capacity of temporary facilities must not exceed the pre-disaster capacity of the facility that housed the displaced services."[95] The new policy also refers to the six-month limitation on assistance for temporary facilities, but expressly contemplates that the project may be extended where appropriate based on the particular requirements of the project.[96] The policy is applicable to all major disasters and emergencies after December 14, 2010.[97]

Permanent Reconstruction

Influenced by the challenges observed and solutions identified in using PA funds to rebuild the New Orleans public school system, Congress made significant changes to the Stafford Act after

93 See The Sandy Recovery Improvement Act of 2013, Section 1102, Pub. L. No. 113-2, 127 Stat. 40. Congress similarly amended the Stafford Act for purposes of allocating federal assistance to recovery projects in the aftermath of Superstorm Sandy. Under the act, Congress retained the historic cost-share range of 75 percent-90 percent for eligible projects but eliminated the additional deduction for "alternative projects." Thus, even if an "alternative project" differs from a pre-disaster design or function, there is no longer a penalty subtracted from the amount that FEMA will obligate.

94 FEMA, Provision of Temporary Relocation Facilities, PA Policy No. 9523.3 (December 2010), (hereafter "FEMA New Policy," https://www.fema.gov/9500-series-policy-publications/95233-provision-temporary-relocation-facilities.

95 FEMA New Policy at 3, § (7)(B)(4) (emphasis added).

96 Id. at §(7)(C)(1). The policy also notes that with proper documentation, "FEMA may grant extensions for the projected duration of the construction work." Id. at § (7)(C)(4).

97 FEMA New Policy at 3, § (7)(B)(4).

Hurricane Sandy.[98] In particular, the Sandy Recovery Improvement Act of 2013 (SRIA)[99] empowered FEMA to create "alternative procedures" for PA grants. FEMA implemented these alternative procedures for permanent reconstruction projects in May 2013 and updated them in December 2013.[100] The procedures address many of the PA program's perceived failings following Katrina. But they come with a tradeoff: If a grantee elects the alternative procedure, PA payouts are limited to initial cost estimates and the grantee agrees to shoulder any cost overruns.[101]

The alternative procedures address many of the problems the RSD encountered when rebuilding New Orleans' school system:

1. Where FEMA generally made final reimbursement awards based on actual costs under the standard program, communities can now choose a lump-sum PA grant based on up-front estimates of total anticipated funding eligibility.[102] This change, combined with a preapproval for cost estimates, allows for more certainty about the total amount of funds FEMA will commit and places the funding more quickly in hand.

2. The alternative procedure now allows communities to combine multiple projects into a single award and permits them to redesign or re-designate replacement facilities for new uses, promoting greater flexibility.[103] Unlike FEMA's guidance under the standard PA program, the alternative procedure does not limit combined projects solely to those that share similarities such as a single site, type of damage to a particular public system, or contractor.[104] Instead, under the alternative procedures, communities can combine projects across all categories and shift funds among different sites.[105] Not only can communities combine projects, they are free to completely reimagine facilities to serve fundamentally

98 Jared T. Brown, CRS, Analysis of the Sandy Recovery Improvement Act of 2013 1 (March 11, 2013) (hereinafter "CRS Sandy Act Report", available at: https://www.fas.org/sgp/crs/misc/R42991.pdf ("Generally, concerns were raised that the recovery from Hurricane Sandy would be plagued by perceived delays and bureaucratic burdens that inhibited recovery following Hurricane Katrina.").

99 Sandy Recovery Improvement Act of 2013 (SRIA), Pub. L. No. 113-2, § 428(e)(1)(c). For a broader discussion of reforms made to the Stafford Act by the SRIA, see Nicole Smith and Jessica Grannis, Georgetown Climate Center, Understanding the Adaptation Provisions of the Sandy Disaster Relief Appropriations Act (Discussion Draft May 2013), available at: http://www.georgetownclimate.org/sites/www.georgetownclimate.org/files/GCC_Sandy_Relief_Act_Analysis.pdf.

100 FEMA, Public Assistance Alternative Procedures Pilot Program Guide for Permanent Work:Version 2 (December 19, 2013) ("Alternative Procedures Guide"), available at: http://www.fema.gov/media-library-data/1391185442173-787f88cc4ad32d9fd842462d40e2fd8b/PA_Alternative_Procedures_Pilot_Program_Guide_for_Permanent_Work_V2 percent20 percent282 percent29.pdf.

101 Id. at 4-5 ("The "consolidated subgrant may restore the pre-disaster condition, function, and capacity of some or all of the separate sites or facilities contained within the consolidated subgrant, or it may reflect a fundamentally different concept.").

102 Id. at 5 ("FEMA will approve funding for large, uncompleted, permanent work subgrants on the basis of the fixed estimate. This procedure varies from that described in 44 CFR § 206.203(c), which provides for funding the actual cost of completing the eligible scope of work.").

103 Id. at 9.

104 See PA Guide Ch. 3, Table 7 ("Combining Work") (showing standard methods for combining projects under the standard PA program).

105 Alternative Procedures Guide at 9.

different purposes.[106] These changes authorize precisely the type of holistic approach that RSD needed to be able to realign New Orleans' schools.

3. Under the alternative procedures, grantees will no longer be penalized with less PA funding when they opt to pursue an alternate design, location, or function when rebuilding damaged infrastructure. Under the Stafford Act, a grantee in the standard PA program could pursue an alternate project but, in the case of a public facility, funding was capped at 90 percent of the federal share of the estimated repair or replacement costs.[107] The penalty, which was even larger when Katrina struck, proved a disincentive for applicants who sought to build back differently—often more resiliently—following a disaster. Now, under the alternative procedures, the penalty is no longer required, although it continues to apply to alternate projects carried out under the PA standard procedures.[108]

4. The new program encourages cost control and resiliency. When the actual costs of rebuilding are lower than the FEMA-approved estimate on the project worksheet, communities opting for the alternative procedures can now use excess funds for cost-effective hazard-mitigation activities.[109] And communities can use the hazard-mitigation funds to improve the resilience of any facility—even undamaged ones—so long as the facility would otherwise be eligible under the PA program.[110]

5. The estimate procedure is now more flexible, as well. Communities can submit cost-estimates from approved engineers. Ultimately this may speed the process to assess disaster damage, as FEMA just needs to validate the engineer's estimates.

For all the changes post-Sandy reforms brought about, obstacles to using PA funds to build back resiliently after major disasters remain:

1. The alternative procedures do not come without a risk to communities. Under the alternative procedures, communities are solely responsible for covering cost overruns.[111] Given the volatility of post-disaster construction markets, accurate estimates may be difficult to obtain.

2. Tight timeframes apply to many of the alternative procedures. To participate in the alternative procedures program, FEMA and communities must agree on the cost estimate within nine months of a disaster declaration, although an extension may be available for "complex or catastrophic disasters."[112] If FEMA and the community cannot reach an agreement, standard PA procedures apply. Communities must also be prepared to decide which projects they want

106 Id.
107 44 CFR § 206.203(d)(2)(ii).
108 Alternative Procedures Guide at 12.
109 Id.
110 Id.
111 Compare 44 CFR § 206.204(e) (standard program) with Alternative Procedures Guide at 6. Unlike the standard program, FEMA will not authorize additional funding under the alternative procedures when costs exceed estimates.
112 Alternative Procedures Guide at 6.

to consolidate within 12 months of a disaster declaration.[113] Meeting this deadline might have proved difficult, for example, after Katrina in New Orleans, where planners sought significant community engagement in their reconstruction efforts.

3. Damage assessments still require significant resources, particularly after catastrophic events. Total available funding—even for combined alternate projects—is necessarily based on the aggregate estimate of eligible costs for each individual damaged site.

Ultimately the story of the rebuilding of the New Orleans public school system demonstrates the importance of a shared federal and local vision of how to recover after a disaster. Federal agencies and local partners must have the common goal of rebuilding more sustainably and resiliently in the face of future disasters. More than any statutory reforms, the ability to reconfigure entire systems of devastated public facilities continues to turn on the dispatch and consistency of FEMA guidance, damage assessments, and countless project-based funding decisions. In recent years, the federal government and FEMA have made major strides, including the alternative procedures for the PA program and the revised Federal Flood Risk Management Standard aimed at boosting resiliency for federal investments.[114] But if long-term resiliency as a shared recovery goal is to be realized, it must permeate the whole federal disaster-recovery playbook from start to finish. More remains to be done to make integration of resilience a reality across all disaster recovery programs.

113 Id. at 9.

114 See Executive Order No. 13690, Establishing a Federal Flood Risk Management Standard (FFRMS) and a Process for Further Soliciting and Considering Stakeholder Input (January 30, 2015), https://www.whitehouse.gov/the-press-office/2015/01/30/executive-order-establishing-federal-flood-risk-management-standard-and-. The FFRMS directs federal agencies to adopt new flood elevation standards for siting and constructing federally funded facilities. The new rules will apply to FEMA's hazard-mitigation programs.

Greening of New Orleans' Management of Stormwater

Following Katrina, New Orleans also faced challenges in using disaster recovery funds to "green" its approach to stormwater management. Reducing risks of flooding in coastal and deltaic communities, such as the Greater New Orleans region, will require sustainable means of managing rainwater, maintaining levees, and replenishing wetlands. These interconnected "lines of defense" will be essential for protecting urban areas such as New Orleans, which is situated mostly below sea level,[115] receives abundant rainfall, and is subsiding.

In New Orleans, the need for reliable levees and restored wetlands is well known and already benefitting from significant public investments and long-term planning. Similarly, for over a century, New Orleans has aggressively managed stormwater through traditional means. The city, for example, maintains one of the world's largest stormwater pumping systems to drain its average 64 inches of annual rainfall,[116] in a metropolitan area that is subsiding at an accelerating rate of nearly one-third inch annually.[117]

The irony of the threat from New Orleans' accelerating soil instability is that it partly stems from having been too effective at draining stormwater from the hydrologic bowl that comprises most of the city's landmass (and also from oil extraction in the region). As the city's sprawling network of pipes, canals, and pumps drains stormwater, it is starving the understory of clay-peat soils of the

115 The average elevation of the Greater New Orleans Metropolitan Area is 5.9' below sea level. See Waggonner & Ball Architects, Greater New Orleans Urban Water Plan: Vision 43 (Sep. 2013) (hereinafter "Urban Water Plan"). The Greater New Orleans Urban Water Plan is a series of reports commissioned by the State of Louisiana's Office of Community Development and conducted by a team of local and international water management experts to examine the existing water system of the Greater New Orleans region, including the east banks of Orleans and Jefferson Parishes and St. Bernard Parish, and recommend planning, engineering, design, governance, and implementation strategies for assuring more resilient and reliable storm water management and flood risk reduction. Available at: http://livingwithwater.com/reports/.

116 See NOAA, Extremes in U.S. Climate, http://www.ncdc.noaa.gov/extremes/extreme-us-climates.php]. Between 1978-2008, the communities in the contiguous 48 states with the highest average precipitation are: 1) Astoria, OR (67.3"), 2) Mobile, AL (66.29"), 3) Pensacola, FL (64.28"), New Orleans, LA (64.16"), 5) Tallahassee, FL (63.21").

117 See New Orleans Department of Public Works, City of New Orleans Draft Stormwater Management Capital Improvements Plan (2011) (Hereinafter "Stormwater Improvement Plan") (citing Dixon, T.H., et al. Subsidence and flooding in New Orleans, Nature, 2006: 587-588, and URS, A Century of Subsidence: Change in New Orleans DEMs relative to MGL 1895 to 1999/2002. Poster, Federal Emergency Management Agency, Baton Rouge, 2006); see also NASA Subsidence in New Orleans, Earth Observatory (June 3, 2006), http://earthobservatory.nasa.gov/IOTD/view.php?id=6623.

groundwater necessary to remain stable under the weight of structures.[118] This resulting instability often leads to ruptured subsurface drainage pipes, which, in turn, worsens rain-related neighborhood-scale flooding and further compromises the city's infrastructure, streets, and buildings. In all, local officials estimate that soil subsidence will cause over $2.2 billion in infrastructure damage over the next fifty years.[119] Increased subsidence is undermining an already fragile drainage system. Officials estimate the system needs nearly $4.7 billion in pipe improvements to achieve a relatively standard level of stormwater protection that limits standing water to 6 inches or less during a ten-year rainfall event (8.5 inches of rain in 24 hours).[120]

Given this threat, local governments throughout the greater New Orleans area are exploring options for better managing stormwater as part of their broader multiple-lines-of-defense strategy to reduce flood risks. To achieve this, local communities are charting opportunities to augment the area's traditional "pipe and pump" drainage system with more sustainable methods for safely storing and absorbing rainwater by greening public rights-of-way, parklands, vacant lots, and other spaces with rain gardens, bioswales, permeable pavements, and storage basins. For purposes of this report, these "green" methods of managing stormwater will be collectively referred to as "green infrastructure." Depending on site-specific conditions, green infrastructure may be able to effectively handle the first inch of rainfall and is often proposed for urban areas to address localized flooding from inadequate drainage.[121]

After Hurricanes Katrina and Rita, city officials explored using HMGP funding to finance the construction of green infrastructure systems. In 2011, New Orleans secured an additional $247 million in additional post-Katrina HMGP funding for "hundreds of millions of dollars of drainage and stormwater flood mitigation projects."[122] However, New Orleans has been largely unsuccessful at demonstrating the cost-effectiveness of green infrastructure under FEMA's rigid benefit-cost analysis (BCA). As a result, to date, the use of HMGP has only been preliminarily approved by FEMA for use in one green infrastructure project under design in New Orleans. Many more envisioned green infrastructure projects intended to reduce flooding and subsidence in Greater New Orleans will most likely require other sources of funding or additional analysis to be implemented.

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118 See Roelof J. Stuurman & Jelle T. Buma, Deltares, Greater New Orleans Urban Water Plan: A Groundwater Monitoring Network for Greater New Orleans (October 2013) at 43-45, available at: http://livingwithwater.com/reports/ (Groundwater Monitoring Plan).

119 Id. at 67. (Soils underlying New Orleans compress and otherwise fluctuate ("shrink-swell") from erratic groundwater levels).

120 See Stormwater Improvement Plan § 1, 2-3; see also Louis L. Jackson and Jessica Watts, Presentation of City of New Orleans Stormwater Capital Improvements Plan to DPW (Sep. 9, 2011) ($4.7 billion in pipe repairs is equivalent to adding approximately 775 miles of new pipe throughout the City).

121 See, generally, EPA, Green Infrastructure Permitting and Enforcement Series: Fact Sheet Four 4-6, available at: http://water.epa.gov/infrastructure/greeninfrastructure/upload/EPA-Green-Infrastructure-Factsheet-4-061212-PJ.pdf.

122 Mayor Mitchell J. Landrieu, Mayor of New Orleans. Letter to Louisiana Governor Bobby Jindal (Feb.17, 2011); see also, Louisiana Gets Another $390M in FEMA Aid, New Orleans City Business (Nov. 15, 2011) http://neworleanscitybusiness.com/blog/2011/11/15/louisiana-gets-another-390m-in-fema-aid. (FEMA increased Louisiana's HMGP award in 2011 by $390 million. HMGP funds are calculated as a percentage of overall damage, and the original calculation made eighteen months after the storm underestimated the disaster's overall cost.)

FEMA Hazard Mitigation Grants

HMGP funding is administered by FEMA pursuant to Section 404 of the Stafford Act, which was created to help communities mitigate impacts from future disasters.[123] To this end, the program supports a variety of mitigation activities, including long-term community planning, property buyouts, structural elevation, stormwater infrastructure construction, and other projects.[124] Funding levels for eligible states and communities are calculated using a statutory formula that takes into account the total amount of assistance to public bodies and individuals within a community in connection with the presidential disaster declaration.[125]

As with all of FEMA's hazard-mitigation assistance programs, HMGP applicants must demonstrate that a proposed project is "cost effective."[126] Cost effectiveness is determined by a benefit-cost analysis (BCA), where the applicant must show the project has a benefit-to-cost ratio (BCR) of greater than or equal to 1.[127] In other words, applicants must show that investment will result in a dollar or more in benefits or losses avoided for every dollar spent on a project.[128]

The benefits of any proposed project are the estimated losses that can be avoided if the project is constructed. The losses can include the projected damage to and the lost use of flood-impacted buildings, building contents, and other assets such as roads. The magnitude of the loss to be addressed is estimated based on the types of buildings and assets, the flood depths from prior flood events, and the recurrence of flooding, deducted by the amount of damages that would still occur even with

123 42 U.S.C. § 5170c; see also La. Governor's Office of Homeland Security and Emergency Preparedness, Hazard Mitigation Grant Program FAQs, available at: http://www.gohsep.la.gov/mitigation/hmgpfaqs.htm (last visited May 30, 2013).

124 After a disaster, the federal government makes available HMGP funds in an amount calculated as a sliding percentage of the total estimated federal assistance to be provided in connection with the declaration.

125 The amount of HMGP allocated is based upon the estimated total of Federal assistance (PA funding, emergency measures, homeowner assistance, etc.), subject to the sliding scale formula outlined in 44 CFR Section 206.432(b) that FEMA provides pursuant to any Presidential major disaster declaration. The formula provides for up to 15% of the first $2 billion of estimated aggregate amounts of disaster assistance, up to 10% for amounts between $2 billion and $10 billion, and up to 7.5% for amounts between $10 billion and $35.333 billion. For States with FEMA-approved "Enhanced State Mitigation Plan," in place and approved before a disaster declaration, the eligible assistance is up to 20% for estimated aggregate amounts of disaster assistance not to exceed $35.333 billion. For a list of eligible HMGP activities see BCA Reference Guide 3-4, 3-5 (June 2009), available at: http://www.fema.gov/media-library-data/1396550224865-548160e5f22dabb793d8a045fa89f5fe/bca_reference_guide_508_final.pdf.

126 42 U.S.C. § 5170c(a)("The President may contribute up to 75 percent of the cost of hazard mitigation measures which the President has determined are cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster.") In some instances FEMA has precalculated benefits for certain types of activities. For some project types or projects within a specific risk area and under a certain cost, the project is considered presumptively cost-effective per FEMA policies. However, FEMA has yet to develop precalculated benefits for green infrastructure projects.

127 See FEMA, Procedures for Developing Scopes of Work for a Drainage/Stormwater Management Project (Jan. 2005) ("Stormwater Project Manual"), available at http://www.fema.gov/media-library-data/20130726-1516-20490-3034/drainage_project_sow.pdf. To calculate the time-value of money, the BCA must include a 7 percent discount rate as required by Office of Management and Budget Circular A-94, available at: https://www.whitehouse.gov/omb/circulars_a094.

128 Stormwater Project Manual at 29 (noting that BCAs must take into account net societal benefits, not just savings to the National Flood Insurance Program as well as all costs of a proposed project, not just those to the NFIP); see also FEMA, Selecting Appropriate Mitigation Measures for Floodprone Structures D-1 (2007), available at http://www.fema.gov/library/viewRecord.do?Id.=2737.

mitigation. These benefits are then compared to the costs of the project, including construction and maintenance costs and the effective lifespan of the project.[129]

For typical flood-mitigation projects (acquisition and elevation), FEMA provides an "off-the-shelf" BCA tool to calculate the BCR of the project. The BCA tool uses flood hazard data generated by Hydraulics and Hydrology (H&H) studies that are used to produce Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) developed by FEMA pursuant the NFIP. FIRMs and FISs include information about flood depths for areas at risk of flooding during the 100-year flood event (the Special Flood Hazard Areas (SFHAs), or areas with a 1 percent annual-risk of flooding) and the structures located within these areas.[130] These data are useful for showing that a traditional flood mitigation project is buying down risk to the NFIP.

However, this tool is not as well-suited for most stormwater management projects, which typically aim to reduce damage from higher-frequency, lower-damage events (e.g., 2-year or 5-year storm event). Although some H&H studies include data for higher frequency events, these data may not be available for all areas that flood from inadequate drainage and may have to be specifically developed by the project proponent. For this reason, FEMA allows applicants to use a BCA method known as the Damage Frequency Assessment (DFA) Module for stormwater projects.[131] (The DFA was known as the Limited-Data Module (LD) at the time of Hurricane Katrina; for purposes of simplicity we refer to this tool as the LD/DFA Module throughout.)[132] This method of showing cost effectiveness is generally considered more flexible because it allows applicants to use a wide range of data from different sources.[133] Applicants can, for example, use approximation methods to determine projected damages and losses in high-, moderate-, and low-frequency events based on previous costs to repair public infrastructure and private homes, insurance claims, and estimates for deaths and injuries in the project area.[134]

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129 BCA Reference Guide at 3-4, A-8, B-1. Estimated flood recurrences are typically based on flood hazard data from a local FEMA Flood Insurance Study (FIS), hydrologic and hydraulic (H&H) studies, or—if using the more flexible DFA module—available historical damage data and prior NFIP flood insurance claims for at least two—and sometimes three—past events.

130 The 100-year flood is a commonly accepted shorthand to refer to a flood that has a 1-in-100 (1 percent) probability of occurring in any given year. The 50-year flood has a 1-in-50 probability of occurring in any given year, which corresponds to twice the likelihood of the 100-year flood and therefore represents a 2 percent annual probability. The 500-year flood is the flood that has 1-in-500 chance of occurring in any given year and therefore represents a 0.2 percent annual likelihood. See discussion of flood recurrence intervals at USGS, Floods: Recurrence Intervals and 100-Year Floods, available at: http://water.usgs.gov/edu/100yearflood.html

131 See FEMA, Benefit-Cost Analysis Reengineering & Damage-Frequency Assessment Methodology Report, Version 4.5 (May 2009) (hereafter "BCAR"), available at: http://www.fema.gov/media-library-data/20130726-1736-25045-5516/dfamethodology.pdf. For projects using HMGP awarded pursuant to Hurricane Katrina, the precursor to the DFA was employed known as the FEMA Limited Data Module for Benefit-Cost Analysis (LD Module). As applied to proposed projects in New Orleans, the data and methodology employed was similar to what would have been done using the current DFA module.

132 BCA Reference Guide 3-4. Applicants can use FEMA's DFA Module "as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a result of the events."

133 BCAR; see also FEMA, BCA Checklist, Appendix II (June 2006), available at: http://www.fema.gov/media-library-data/20130726-1524-20490-6194/2006_bca_checklist.pdf.

134 Stormwater Project Manual at 23, 28-30, 32.

Although FEMA has heralded the use of HMGP funds to construct green infrastructure, the current BCA process poses inherent obstacles to these types of projects.[135] The barriers to showing the cost effectiveness of green infrastructure projects derive from three limitations: (1) the nature and quantity of data required by the software tools and FEMA guidance, which dictate the BCA process; (2) the metrics FEMA uses for establishing the flood-risk-reduction benefits of a project; and (3) the fact that the BCA fails to capture the ancillary benefits of green infrastructure, including improvements in water quality and reductions in subsidence.[136] However, FEMA is actively working to develop data for quantifying the benefits of green infrastructure and to train state and local officials on how to conduct BCA for these green infrastructure projects. In doing so, FEMA is working within the confines of the Stafford Act, which requires that hazard mitigation projects cost-effectively reduce the risks of future impacts.

Data Availability

FEMA's traditional BCA tool requires certain data to quantify project benefits, which can often be unavailable or difficult to capture for green infrastructure projects. For example, green infrastructure is typically used to alleviate localized flooding from areas of poor drainage that flood during higher frequency/lower volume flood events (2-year or 5-year storm events). These higher-frequency storms are not reflected on the primary tools that FEMA uses for assessing flood risks for purposes of BCA—FIRMs and FISs—which only capture flood risks from lower frequency events (such as the 100-year and 500-year flood).[137] Moreover, FEMA typically does not even prepare flood hazard data for drainage areas of less than a square mile.[138]

For more typical mitigation activities, such as acquisitions or elevation, FEMA data to support BCA is readily available. These projects usually take place within the SFHAs delineated on the communities FIRM. Pursuant to the NFIP, participating communities must, among other things, regulate land use, require building permits, and obtain information regarding the elevation of the lowest level of new or substantially altered structures.[139] Additionally, homeowners with federally backed mortgages in SFHAs must also buy flood insurance. Both requirements generate valuable information regarding

135 See May 12, 2010, Memorandum of Agreement Between the Department of Homeland Security, Federal Emergency Management Agency, and the Environmental Protection Agency, available at: http://www.fema.gov/pdf/rebuild/ltrc/moa_fema_epa.pdf (agreement reached "to formalize efforts to explore opportunities to incorporate sustainability and smart growth practices into communities' hazard mitigation planning and long term disaster recovery efforts," including "green infrastructure . . . to rebuild and accommodate growth in appropriate places").

136 Separately, stormwater projects, including green infrastructure, are sometimes less politically appealing than acquisitions and structural interventions, the benefits of which are easily calculable and often immediately apparent. According to former FEMA Region 6 HMGP supervisor Jamelyn Trucks, green infrastructure and other stormwater projects are often not as enticing because of the lengthier time required for implementation and the administrative burden of developing and documenting project benefits.

137 See, generally, EPA, Green Infrastructure Permitting and Enforcement Series: Fact Sheet Four 4-6, available at: http://water.epa.gov/infrastructure/greeninfrastructure/upload/EPA-Green-Infrastructure-Factsheet-4-061212-PJ.pdf; see also, BCA Reference Guide at viii.

138 Stormwater Project Manualat 16.

139 44 CFR § 60.3

the nature of floodplain development and assure a comprehensive claims record, which in turn can be used to support calculations of potential future damage avoided through the LD/DFA module.

These data, however, are often unavailable in areas suffering from localized flooding (outside SFHAs) where green infrastructure projects are often proposed. As a result, local applicants often struggle to compile the necessary data to satisfy FEMA's BCA.[140] This is because outside of SFHAs, far fewer homeowners buy flood insurance because they are not subject to purchase requirements. Thus, these areas often have much more limited historical claims data, an easy data source with which to support grant applications. Even inside SFHAs, data are often unavailable for damage resulting from lower-frequency storms because homeowners carrying flood insurance often will not submit claims for limited damages.[141] Although these are not the only data that can be used to satisfy BCA, they are often the most readily available. As such, the LD/DFA method can be of diminished value when attempting to score green infrastructure. Project proponents must look to and quantify other types of potential avoided losses that can be documented through an engineering report, such as street or business closures from frequent flooding or lost revenues. Further, even when historical damage can be identified, not all historical damage is relevant to the BCA calculation: Only those losses that might have been avoided by the proposed mitigation action will count.[142]

Flood-Control Metrics

To the further detriment of green infrastructure projects, common flood-control metrics are also distinctly advantageous to pipe-based and other *structural* solutions, including floodproofing and elevation. For example, in determining the benefit of hard infrastructure solutions (pipes, pumps, etc.) or elevation, the degree to which estimated losses can be mitigated can be demonstrated based on rather straightforward calculations of the volume of water evacuated by a pipe or the height a building is elevated above documented historic flood elevations.[143] The benefits of green infrastructure installations, however, tend to be more diffuse and difficult to quantify. First, given the limited damage a small area might experience from the type of flooding being addressed, data more often

140 Sandy-affected communities also reported similar difficulties in obtaining the type of data FEMA requires as part of its BCA. GAO Resiliency Strategy Report at 42. Eleven of 13 states that responded to a GAO survey regarding resiliency in Sandy recovery indicated that local applicants had difficulty gathering the extensive data FEMA requires for the BCA. Id.

141 Interview with Jamelyn Trucks, former FEMA Region 6 HMGP Supervisor (March 10, 2013). Ms. Trucks oversaw review of project applications submitted by the City of New Orleans to use its allocation of HMGP.

142 When comparing green and "gray" infrastructure projects in areas subject to both nuisance and major fooding, FEMA's BCA may create a bias in favor of larger projects that address not only localized nuisance flooding but also damages from major events such as the 100-year storm. This is particularly true when the cost of implementing the projects are similar. In situations where the proposed green infrastructure project addresses only nuisance flooding, the lingering threat of major damage may effectively swamp the economic benefits of projects aimed at more frequent, though decidedly less damaging events. See, e.g., BCAR at 33. After-mitigation damages are reduced to zero only up to a project's estimated level of protection. Beyond the project's level of protection, damages again will be incurred. In 2009, FEMA proposed more specific guidance to assist applicants in assessing after-mitigation damage. Under the guidance, after-mitigation damage of a flood-control drainage project would be pegged at the same level as before-mitigation damages at or beyond the project's level of protection. Id. at 34. The phenomenon may skew priorities in favor of structural gray infrastructure approaches that tackle both large- and small-scale events, especially if costs are similar.

143 Stormwater Project Manual at 15-18.

must be gathered from a larger geographical area to justify project costs. Success depends on the ability to derive actionable loss data from enough buildings and other assets in that area. Second, because green infrastructure involves the slow absorption of storm water into substrates that can vary greatly from location to location, calculating a green infrastructure project's hydrological and hydraulic impact can pose an engineering challenge. Each application requires in-depth engineering analyses to account for variables such as soil composition.[144]

Ancillary Benefits

Finally, FEMA's BCA, especially at the time of Hurricane Katrina, did not account for the full range of ancillary benefits of green infrastructure, some of which have direct bearing on flood-mitigation efforts.[145] For example, green infrastructure offers a variety of ecosystem services, including the abatement of soil subsidence[146] and the reduction of polluted stormwater runoff. These types of benefits are problematic for FEMA's BCA because they can be difficult to quantify. Additionally in some instances, applicants cannot count these indirect or secondary benefits, such as compliance with water quality regulations.[147] Indeed, projects whose exclusive focus is to construct "water quality infrastructure" or that "primarily address ecological… issues" are explicitly listed as "ineligible" activities in FEMA's Hazard Mitigation Assistance Guidance.[148] And, neither the vegetation installed to absorb stormwater, nor the irrigation needed to keep it alive, are eligible uses of HMGP funding.[149] Although it could be argued that these types of activities do not fall under the primary purpose of the HMGP — to mitigate future hazards — taking a siloed approach to disaster recovery programs limits the flexibility of local governments to deploy these resources in ways that meet multiple community recovery objectives and provide multiple benefits.

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144 Id. at 17 ("The following data should be submitted with the application . . . [a]n analysis of the project's effects on flood hazards. This analysis must include hydrologic and hydraulic analyses identifying the extent to which flood hazards are reduced.")

145 This was also the case following Hurricane Sandy, after which state and local officials reported that they experienced difficulty in accounting for benefits of proposed projects, including property acquisitions that resulted in preserved green space. GAO Resiliency Strategy Report at 28. As discussed below, FEMA had made some progress in this regard by issuing new policy guidance discussing additional environmental benefits that could be considered in the BCA. Id.

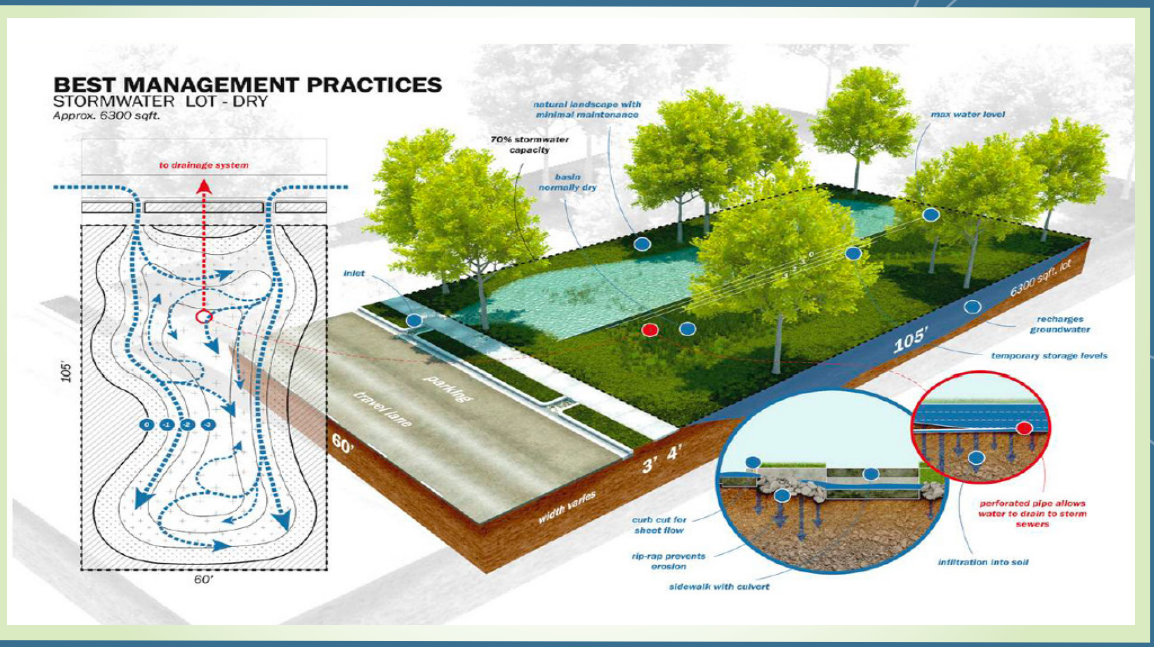
146 Id.

147 Id.

148 See FEMA, Hazard Mitigation Assistance Guidance 43 (February 2015), available at: http://www.fema.gov/media-library-data/1424983165449-38f5dfc69c0bd4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf. (Hereinafter "HMA Guidance"). While FEMA issued a mitigation policy allowing for the inclusion of environmental benefits in the BCA for acquisition projects, this policy does not necessarily capture the potential benefits of "engineered" green infrastructure improvements, such as planting or infiltration columns. See FEMA, Mitigation Policy FP-108-024-01, Consideration of Environmental Benefits in the Evaluation of Acquisition Projects under the Hazard Mitigation Assistance (HMA) Programs (Jun. 18, 2013), available at: http://www.fema.gov/media-library-data/20130726-1920-25045-4319/environmental_benefits_policy_june_18_2013_mitigation_policy_fp_108_024_01.pdf. It should be noted that although engineered green infrastructure may increase flood-control capacity and associated benefits, these efforts also incur additional costs to be included in the BCA, as well.

149 Hazard Mitigation Assistance Guidance at 43.

FIGURE 2: *Using Vacant Lots for Drainage*



Vacant lots in a neighborhood can be redeveloped in a cost effective and sustainable manner to improve drainage for surrounding properties.

Source: Dana Brown & Associates, Inc.; Pontilly Stormwater HMGP, New Orleans, LA

The Challenges of Using HMGP for Green Infrastructure in New Orleans

New Orleans' experience with two proposed green infrastructure projects highlights the difficulties inherent in attempting to satisfy FEMA's BCA for green infrastructure projects. Even using the ostensibly flexible LD/DFA Module,[150] New Orleans was able to direct HMGP funding to only one green infrastructure project: the *Pontilly Hazard Mitigation Grant Program Project*.

The Pontilly green infrastructure projects were designed to reduce flood losses in the neighborhoods of Pontchartrain Park and Gentilly Woods (collectively referred to as "Pontilly"), which experienced significant flooding during Katrina. The Pontilly neighborhoods span 850-acres and encompass 2,177 homes. After Katrina, many residents were displaced and damaged homes were bought out. As a result, these neighborhoods had a checkerboard of vacant lots. The New Orleans Redevelopment

150 NORA employed the LD Module in effect in 2005 because the project was Katrina-related. Interview with Jamelyn Trucks. As discussed below, the difficulties encountered remain the same under the DFA.

Authority (NORA)[151] sought to use $15 million in HMGP funding to develop a plan for placing green infrastructure on vacant lots to manage stormwater runoff and mitigate flooding.[152]

The Pontilly project involves the adaptive reuse of dozens of blighted properties and vacant lots in a coordinated fashion. Once complete, a series of small green infrastructure projects will be installed across the neighborhood. Stormwater retention areas, rainwater parks, bioswales, permeable pavement, and other treatments will be built into street curbs, vacant lots, medians, and other public spaces. The improvements were designed to work together as a single system to intercept stormwater, reducing runoff volume and peak floodwater elevations (*see, for example, Figure 2).*[153] In addition to reducing flood risks, the projects will provide many other environmental benefits. The projects will stabilize groundwater and soil subsidence, provide a lower-cost alternative to improving existing subsurface drainage infrastructure, improve air and water quality, reduce urban heat islands, and create community recreational amenities and open space.[154] These benefits are not typically associated with pipe-based flood control options.

NORA's experience in preparing the Pontilly project for FEMA approval demonstrates that communities seeking to use HMGP for green infrastructure projects must not only design the right type of project, but they must also identify and document the type of data that can be used to demonstrate the flood-risk-reduction benefits of these types of projects. NORA worked for six years to ensure the project would achieve a sufficient BCA score to receive HMGP funding. The biggest challenge NORA faced was demonstrating that the Pontilly project provided a quantifiable level of benefits that could meet FEMA's BCA criteria.[155] The Pontilly project possesses a number of unique attributes that allowed it to meet the BCA requirements, however these attributes are lacking in many other green infrastructure projects. First, NORA proposed a project that aimed to reduce flood damages over a larger area, enabling it to aggregate the numerous small benefits that would accrue from reducing flooding from routine storms. Given the cost of the proposed project, NORA needed a large number of acres of land with built structures from which to extrapolate a sufficient collective amount of property damage that could be avoided with the system of retention and detention systems. Second, the Pontilly project's planners were able to direct significant resources to the collection

151 NORA is a local governmental entity separate from the City of New Orleans with legislative authority to plan and implement comprehensive neighborhood revitalization plans. NORA partnered with a local non-profit the Pontilly Disaster Collaborative to develop the Pontilly green infrastructure plan.

152 Nat Lab, Green Vacant Lots: Planning and Implementation Strategies, A Case Study of New Orleans, LA 85- 87, a report prepared for The Nature Conservancy as part of the Nat Lab Collaboration (Dec. 2012), available at: http://docs.nrdc.org/water/files/wat_13022701a.pdf.

153 See generally, New Orleans Redevelopment Authority, Pontilly Water Mitigation: Vacant Lot Interventions at 1 (2013) (hereinafter referred to "Pontilly Water Mitigation Interventions"); Dana Nunez Brown, ASLA, AICP, LEED AP, Jessica L. Watts, P.E., CFM, D.WRE, Efficacy and Return on Investment of Stormwater Management Retrofits at Neighborhood Scale, presentation to Southeast Stormwater Association Conference (Oct. 25, 2013), available at: http://www.seswa.org/assets/Services/Annual-Conference/2013/21 percent20- percent20brown percent20watts.pdf); and New Orleans Redevelopment Authority, Flood Design Best Practice Survey Pontilly Stormwater Hazard Mitigation Grant Program, New Orleans, LA. (2013), available at: http://postsandyinitiative.org/wp-content/uploads/2013/03/Best-Practice-Photos-Pontilly-Pics.pdf.

154 Pontilly Water Mitigation Interventions at 2, 9–14.

155 Interview with Jamelyn Trucks.

of supporting data. Teams took physical measurements of thousands of structures to calculate the damage that might be avoided by reducing flooding even by just a few inches. Third, the Pontilly project was proposed for an area that had several high-volume, high-value roads. Planners were thus able to estimate the costs of repairs and lost use from flooding that could be avoided by installing the proposed green infrastructure.

In the end, FEMA allowed NORA to use the LD Module to estimate the benefits of the project because the target area had limited quantitative data on flood hazards, such as information regarding flood depths. NORA used documentation from nearly 2,000 NFIP claims over thirteen years from properties that were flooded by events well below the 100-year flood benchmark coupled with estimated damage calculations based on the square footage of existing properties in the project area. Using these data, NORA was able to make the case that its planned green infrastructure solutions provided sufficient flood-risk-reduction benefit for the Pontilly area.[156]

NORA and its water management experts presented an innovative strategy for reducing flood risk for 2,177 properties by using water-retention techniques over 850-acres. When individual green infrastructure improvements were combined, NORA was able to demonstrate that the combined improvements were capable of reducing floodwater depths by 2.93 inches during 2-year storms and 4.94 inches during 5-year storms. NORA estimated that these reductions in flood depths would save nearly $12.4 million in annualized damages based on historical NFIP flood claims data.[157] Local officials also were able to show that the project would reduce losses by avoiding the flood-related closure of a major road artery. Using traffic studies and repair costs for roadways within the studied area, officials were able to show that roadway flooding could cause nearly $23 million in additional economic losses from traffic delays, detours, and related personnel costs; losses which could be avoided by the project.[158] In all, NORA was able to demonstrate that the proposed project would yield a preliminary structural benefit-cost ratio of 1.57.[159]

New Orleans officials expect to break ground on the Pontilly project in March 2016 after all construction and funding paperwork is finalized. The project will join numerous pilot rain gardens that have been installed in Gentilly Woods and other neighborhoods across the city as communities seek more sustainable ways to manage the increased stormwater that will come from climate change.[160]

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156 Stormwater Project Manual at 26-27; see also, NORA, Report of Benefit-Cost Analysis for Pontchartrain Park & Gentilly Stormwater Mitigation Project, FEMA-1603-DR-LA, (Nov. 18, 2008).

157 Id.; see also Nunez Brown, "Efficacy and Return on Investment of Stormwater Management Retrofits at Neighborhood Scale."

158 Stormwater Project Manual at 26-27.

159 See Nunez Brown, Efficacy and Return on Investment of Stormwater Management Retrofits at Neighborhood Scale."

160 Mark Schleifstein, EPA Administrator Gina McCarthy joins Mayor Mitch Landrieu in dedicating rain garden, discussing climate change, NOLA.com/The Times Picayune (Feb. 6 2014), available at: http://www.nola.com/environment/index.ssf/2014/02/epa_administrator_gina_mccarth_1.html (discussing HUD-funded rain garden in Gentilly Woods).

FIGURE 3: *Proposed Lafitte Blueway*

The Lafitte Blueway was proposed to recharge groundwater, provide a new habitat for wildlife within New Orleans, offer recreational opportunities, and restore the historical connection between Bayou St. John and the French Quarter.

Source: Waggonner & Ball, Greater New Orleans Urban Water Plan

Ongoing assessments of stormwater management challenges and opportunities in Greater New Orleans have revealed numerous areas that would benefit from green infrastructure solutions.[161] Yet to date, Pontilly remains the only HMGP-funded green infrastructure project slated for construction in the area.

Among other green infrastructure projects, local officials could not sufficiently demonstrate a high enough BCR to justify a recently proposed series of flood-protection interventions for a 1,375-acre basin in the middle of New Orleans—the Lafitte Corridor. The area surrounding the Lafitte Corridor is home to over 13,500 residents across several neighborhoods that are over 200 years old. The area is bisected by a 3.1-mile long stretch of vacant green space.[162] The corridor is an artificial ridge in a low-lying area that used to be swamp. It serves as a common boundary for three urban drainage basins. Neighborhoods within these basins can experience significant flooding during intense rain

161 See, generally, Groundwater Monitoring Plan.

162 See City of New Orleans, Lafitte Greenway Master Plan at Part 1, pp. 2-15 (2013) available at: http://lafittecorridor-connection.com/documents/Greenway-Park-Plan_part1_revised.pdf. The Corridor was long ago a shipping channel linking Lake Pontchartrain and the French Quarter.

events. Standing waters exceed a foot in some locales during 10-year storm events (approximately 8.2 inches in 24-hours).[163] Indeed, there have been dozens of NFIP repetitive-loss claims in the area from such flooding, unrelated to the ravages of Katrina and other tropical storms.[164]

At present, the city is using over $8 million in Katrina-related CDBG-DR funding to transform the corridor into a 2.6-mile long, multi-use linear park referred to as the Lafitte Greenway.[165] As part of this development, the city explored the possibility of using a portion of its HMGP funding to incorporate green stormwater management features converting the Greenway into a "Blueway" (*see* Figure 3). [166] Although flooding in the neighborhoods surrounding the Greenway is frequent and damaging, the project could not achieve an adequate BCR. This was in part because of insufficient historic NFIP claims data.[167] The city was also unable to show that the project would reduce flooding and closures of as many major roads. Absent these data, thousands of properties within an even larger impact area than Pontilly would have to be considered to estimate losses avoided. Complex soil and hydrological testing might have been needed to ascertain the volume and rate at which stormwater would be absorbed by the project.[168] Concerned about the anticipated time and costs associated with amassing such data without any assurance that it would meet BCA criteria, local officials, for now, have shelved the Blueway project.

Current Status of HMGP

Since Katrina, FEMA has used existing authority to adapt the HMGP program to better accommodate resiliency projects. For example, FEMA is allowing applicants to take a phased approach to project design to help ease the BCA process—requiring lesser documentation for the first phase of project design and only requiring detailed documentation after an H&H study can be completed. As described above, FEMA is also conducting studies on how to better quantify the ecosystem benefits of nature-based projects and providing training to state and local applicants on how to conduct BCA for these types of projects. The agency has also taken steps toward recognizing the value of ecosystem services by incorporating pre-calculated green-space environmental benefits

163 See Bosch Slabbers, Landscape + Urban Design, Waggonner & Ball Architects, Greater New Orleans Urban Water Plan: Lafitte Blueway – Transforming the Lafitte Corridor 10 (October 2013),available at: https://www.dropbox.com/s/u48838i6br1opgx/GNO percent20Urban percent20Water percent20Plan_Lafitte percent20Blueway_30Oct2013.pdf(hereinafter "Blueway Plan"); see also, New Orleans Department of Public Works, City of New Orleans Draft Stormwater Management Capital Improvements Plan (2011) (hereinafter "City Stormwater Improvement Plan"). The study examines estimated flood depths throughout the City during two-year (5.6 inches in 24 hrs) and ten-year rain events based on existing drainage system capacity and assuming no leakages or other performance failures. The Study recommends that the City maintain a drainage system capable of limiting localized flooding to six-inches during the peak of a ten-year storm. At present, the Study estimates that 18 percent of City streets would exceed 6 inches of rain during a two-year storm and 37 percent of City streets would exceed 6 inches of standing rain during a 10-year event.

164 Blueway Plan at 10.

165 See City of New Orleans DPW, Project Description for Lafitte Greenway Bicycle and Pedestrian Path.

166 Blueway Plan.

167 Interview with Jamelyn Trucks; see also Lafitte Greenway Master Plan, Part 1. ("Drainage Analysis").

168 Interview with Jamelyn Trucks.

into the BCA for acquisition projects in an agency mitigation policy[169] and incorporating a fixed environmental benefit calculation for open space created through acquisition and demolition projects in its 2015 Hazard Mitigation Assistance Guidance.[170] The benefits seek to capture at least a small portion of the ecosystem services green infrastructure planners tap to mitigate flood risks. [171]

But for all the advances, significant obstacles still exist to realizing the full promise of using federal disaster relief to rebuild more resiliently using green infrastructure. First, while open-space benefits represent an important step, the value does not necessarily capture the full range of services green infrastructure can provide. Water-flow volume, surface-area evacuation rate, public expenditures avoided, and other such metrics are understandable gauges in evaluating flood-risk-reduction benefits. Green infrastructure projects can also provide a myriad of community benefits—preventing subsidence, reducing air and water pollution, and creating habitat and open space—which are not accounted for in FEMA's BCA. One senior FEMA official recently explained his view to GAO investigators, that under current law, it would be inappropriate to count environmental benefits that did not directly relate to protecting against future weather-related damages were counted.[172]

Second, local officials continue to struggle to obtain necessary data to meet FEMA BCA requirements for green infrastructure projects. Easily accessible data on low-frequency events that are captured on FIRMs and in FISs are often unavailable for areas experiencing localized flooding from inadequate or nonexistent drainage. As a result, applicants must use the LD/DFA module that has the same limitations that dogged New Orleans' post-Katrina recovery. Applicants may have to amass data that is sometimes difficult to obtain regarding historical events and associated damages. Flood-insurance claims data might represent a particularly valuable source of credible data on historical damages, but many homeowners in areas targeted for green infrastructure forego flood insurance, in part because the NFIP does not require these homeowners to purchase insurance. Without these easily accessible data, applicants may need to do costly and time-consuming H&H studies or other analyses of business or street closures to quantify the benefits of green infrastructure projects. State and local applicants often struggle with how to do these types of analyses. So long as this remains the case, HMGP funding will remain a difficult to tap for green infrastructure.[173]

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169 FEMA, Consideration of Environmental Benefits in the Evaluation of Acquisition Projects Under the Hazard Mitigation Assistance (HMA) Programs (June 18, 2013), Mitigation Policy No. FP-108-024-01 (hereafter "Environmental Policy"), available at: http://www.fema.gov/media-library-data/20130726-1920-25045-4319/environmental_benefits_policy_june_18_2013_mitigation_policy_fp_108_024_01.pdf.

170 HMA Guidance.

171 Environmental Policy.

172 GAO Resiliency Strategy Report at 28. It is notable that one of the environmental benefits of green infrastructure is groundwater recharge that may reduce subsidence, which could, in turn, reduce exposure to future weather damage. The failure to account for reductions in subsidence highlights another difficulty disaster-affected communities have reported: frustration with FEMA guidance and regulations that fail to account for local conditions. See GAO Resiliency Strategy Report at 27. While subsidence reduction might not be an ancillary benefit that effectively reduces weather-damage exposure everywhere, in areas, such as New Orleans, slowing the sinking of landmasses might significantly reduce the risk of inundation.

173 In 1996, FEMA has implemented the Five Percent Initiative, which allows applicants for HMGP awards to allocate 5 percent of total HMGP funding to projects for which a traditional benefit-cost analysis is difficult or impossible to conduct. See HMA Guidance at 65. This initiative, however, cannot be used for projects that are susceptible to FEMA-

Conclusion

Following major disasters, affected regions are often recipients of billions of dollars in federal assistance to help them with the long and difficult task of rebuilding. FEMA PA and HMGP grants comprise a significant portion of those funds. The structure and administration of these programs, however, often make it difficult for communities to construct a new built environment that will be more resilient to future impacts, especially given climate-change projections. To address these failings, the PA program and HMGP should be adapted to allow communities to use these funds to build new, integrated infrastructure and construct lower-impact, and more efficient flood protection solutions.

New Orleans' rebirth following Hurricane Katrina reveals both reasons for optimism and causes for concern regarding disaster-recovery programs that are still better tailored for smaller-scale events and tend to favor rote reconstruction rather than forward-thinking changes with long-term resilience and sustainability in mind. The lengthy and complicated ordeal New Orleans faced when rebuilding its public school system and the lessons learned from other disasters motivated major reforms to the Stafford Act and provided important lessons about how FEMA and its state and local partners can better collaborate to reconstruct systems of interconnected public assets. Whether FEMA's PA process becomes a reliable driver of more sustainable redevelopment will depend largely on FEMA's implementation of the alternative procedures authorized by SRIA and the extent to which communities find ease and support in pursuing resilient rebuilding.

Meanwhile, New Orleans' struggles to use HMGP grants to fund green infrastructure reveals the need for additional reforms to FEMA regulations, guidance, and policies. In particular, federal agencies must reform their BCA methods to capture the full range of benefits from low-impact stormwater interventions such as green infrastructure. While high-level federal policy statements in support of green infrastructure are encouraging, New Orleans' challenges meeting FEMA's BCA reveals a bureaucratic process that still favors gray solutions over green. The two green infrastructure projects discussed in this paper—one in progress, the other permanently stalled—provide valuable guidance to FEMA in how to adjust its HMGP cost-benefit calculus to more fully embrace the sustainability and community revitalization values that run with nature-based solutions.

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approved benefit-cost analysis but fail to meet the threshold ratio. Id. Generally, applicants seek funding under the Five Percent Initiative for projects such as planning and mapping.

The challenge and opportunity of channeling federal disaster recovery funds toward sustainable community development cannot be overstated. Amid public financial constraints across the nation, disaster relief funds are a potent source of money for major infrastructure projects. How these funds are deployed can define a community for a generation or more. If regulations and procedures are properly crafted to encourage innovation and resilience, the nation's limited pool of disaster recovery funds can be better deployed to help communities cultivate a more sustainable future as they rise up from catastrophe.

The nonpartisan Georgetown Climate Center seeks to advance effective climate, energy, and transportation policies in the United States—policies that reduce greenhouse gas emissions, save energy, and help communities adapt to climate change.

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