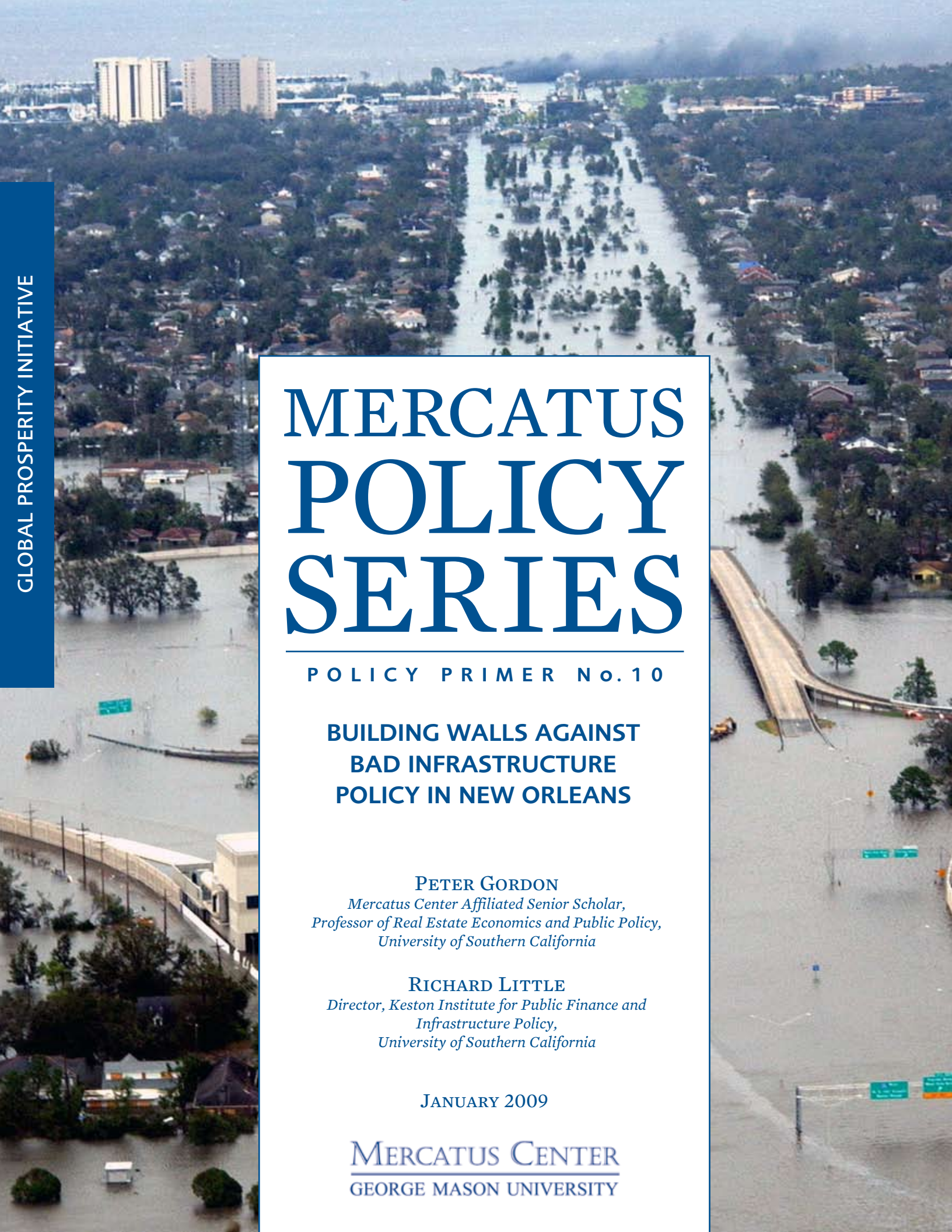

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BUILDING WALLS AGAINST BAD INFRASTRUCTURE POLICY IN NEW ORLEANS

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MERCATUS CENTER
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BUILDING WALLS AGAINST BAD INFRASTRUCTURE POLICY IN NEW ORLEANS

Peter Gordon and Richard Little

EXECUTIVE SUMMARY

Flood protection is often presumed to be both a public good and a federal responsibility. Unfortunately, the true costs of publicly funded relief efforts are often disguised. Moreover, reliance on government protection can create false impressions that individual risks have been minimized, thus encouraging more personal and business investment in disaster-prone regions. Reimbursing these losses with federal funds after a disaster perpetuates a cycle in which resources spent to protect communities from flood damage can instead lead to greater vulnerability, necessitating further spending to compensate for the higher losses.

As New Orleans rebuilds from the damage of Hurricane Katrina, local and national policy makers are attempting to ensure the levees are rebuilt better and stronger. While such efforts to ensure more reliable flood protection are certainly understandable given the region's history, they should not preclude serious consideration of the implications of excessive reliance on structural controls. More comprehensive approaches will provide decision makers at all levels—from elected officials to individual homeowners—with incentives to manage flood risk effectively.

This Policy Primer offers guidance for developing more rational government policies for flood protection, approaches that could be less costly and place fewer people and their livelihoods at risk. The rebuilding process in New Orleans allows local areas to explore new options for levee development and management beyond the conventional reliance on federal agencies. Institutional flexibility will help ensure that the most appropriate arrangements emerge.

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BUILDING WALLS AGAINST BAD INFRASTRUCTURE POLICY IN NEW ORLEANS[1]

I Introduction

The United States has always been exposed to natural hazards—floods, earthquakes, hurricanes, tornadoes, and ice storms—due to its diverse and vast geography. The intensity, damage potential, and frequency of these disasters are as varied as the landscapes they visit. However, over the past fifteen years, the cost of natural disasters, not only in the United States but around the world, has noticeably escalated. Comparing the inflation-adjusted economic losses due to natural disasters worldwide from 1950 to 2000 reveals huge increases: $53.6 billion in the 1950s, $93.3 billion in the '60s; $161.7 billion in the '70s; $262.9 billion in the '80s; and $778.3 billion in the '90s. This decade has already seen $420.6 billion in losses, principally due to the record losses in the 2004 and 2005 hurricane seasons.

The key driver of these rising numbers is increased development in hazard-prone areas, which puts more property and investment at risk.[2] So who bears these rising costs? In the United States, although private insurance underwrites much of the cost of natural hazard events, an event's escalation to "disaster" status entails the federal government stepping in to provide assistance. Such aid amounts to *de facto* property and casualty insurance to which all U.S. taxpayers contribute. Unfortunately, the true costs of publicly funded disaster assistance are often disguised, and reliance on government protection can lead people to underestimate their risk.

This is particularly true of areas that can be "protected" by publicly funded flood works. The expectation of total protection and the illusion that individual risk has been minimized or even eliminated can actually encourage more personal and business investment. Arguably, the federal flood protection program facilitates losses that would not otherwise occur and creates "moral hazard," leaving people less likely to purchase insurance or take other mitigating actions on the assumption that someone else will cover their losses. Using federal funds to reimburse these losses after a disaster is not sustainable policy, as it perpetuates a cycle in which resources spent to protect communities from flood damage can instead lead to greater vulnerability, necessitating further spending to compensate for the higher losses. Decision makers should seek to identify the causes of this incongruity and prepare for the challenge of moving beyond it.

Despite their inadequacies in the face of Hurricane Katrina, federal flood protection and disaster assistance policies remain unchanged today. Although the events of August 2005 cannot be undone, there are alternative approaches that would provide decision makers at all levels—from elected officials to individual homeowners—with incentives to base decisions on risk. This paper offers guidance for developing more rational government policies for flood protection—policies that stop subsidizing risky behavior.

However, prior to looking at possible options for the future, it is useful to consider New Orleans's long flooding history and the measures taken to protect the city and its residents; the events of August 2005; the potential of engineered systems to fail; and how to manage the risk of such failures. To do this, we first briefly review flood protection efforts in New Orleans, the role of technology and flood protection, and the ways in which organiza-

1. The authors thank Professor Ketra A. Schmitt, Faculty of Engineering and Computer Sciences, Concordia University, for helpful comments. She is not responsible for any errors or omissions.

2. See Jerry T. Mitchell and Deborah S.K. Thomas, "Trends in Disaster Losses," in *American Hazardscapes: The Regionalization of Hazards and Disasters*, Susan L. Cutter, ed. (Washington, DC: Joseph Henry Press, 2001), 112; and Christy G. Black, *Subsidizing Disaster*, National Center for Policy Analysis, Brief Analysis no. 525, September 7, 2005.

tions learn from technological and institutional failures. Next, the paper discusses risks and hazards and the institutional options for management and mitigation. The paper concludes that institutional flexibility and open-endedness are required so that the most appropriate institutional arrangements can emerge.

2 The Mississippi River and New Orleans: A Short History of the Levees

New Orleans and the Mississippi River Valley have long been involved in the politics of flood protection and land reclamation. During the latter part of the nineteenth century, a levee construction program along the length of the Mississippi River enabled the cultivation and habitation of tens of thousands of acres of land. When these levees failed along their length during the catastrophic flood of 1927, hundreds died and hundreds of thousands lost their homes. Property damage from that flood has been estimated at almost $400 million (more than $4 billion in 2007 dollars).[3] A recent study projects that if the 1927 flood occurred today, losses would approach $160 billion.[4]

Established by the French as a deep water port in 1718, New Orleans remains important today as a major international port and center of oil and natural gas operations in the Gulf of Mexico. From its inception, New Orleans was subject to Mississippi River flooding and periodic hurricanes. Since most of the city lies just a few feet above sea level, flooding also occurs during the intense spring and summer rainfalls. For many years, development was confined to the higher areas near the Mississippi River levees. However, in the latter part of the nineteenth century, development began to expand into the swampy areas closer to Lake Pontchartrain, necessitating construction of additional levees and a drainage system for the city's lower-lying areas. Further development of this land occurred after World War I and again following World War II, when the Lakeview, City Park, Filmore, Gentilly, and Pontchartrain Park areas behind the lakefront emerged as desirable residential communities.[5]

Recognizing the drainage problems facing a city with so much land lying near or below sea level, the Louisiana legislature established the New Orleans Sewerage and Water Board (S&WB) in 1899 to construct and operate water, sewerage, and drainage works to be funded by a voter-approved property tax. The S&WB merged with the existing Drainage Commission in 1903 and began building drainage canals and pumping stations throughout the city (see figure 1). Not surprisingly, this set off a building boom that not only rapidly increased land values but also exacerbated the drainage problem by dramatically increasing the amount of impervious surfaces such as roads and roofs. Today the S&WB is responsible for draining 95.3 square miles of New Orleans and neighboring Jefferson Parish. Figure 2 shows the general layout of the existing drainage system.

The aggregate pump capacity could have cleared the city of flood waters in less than three days if the levees had simply been overtopped without failing.

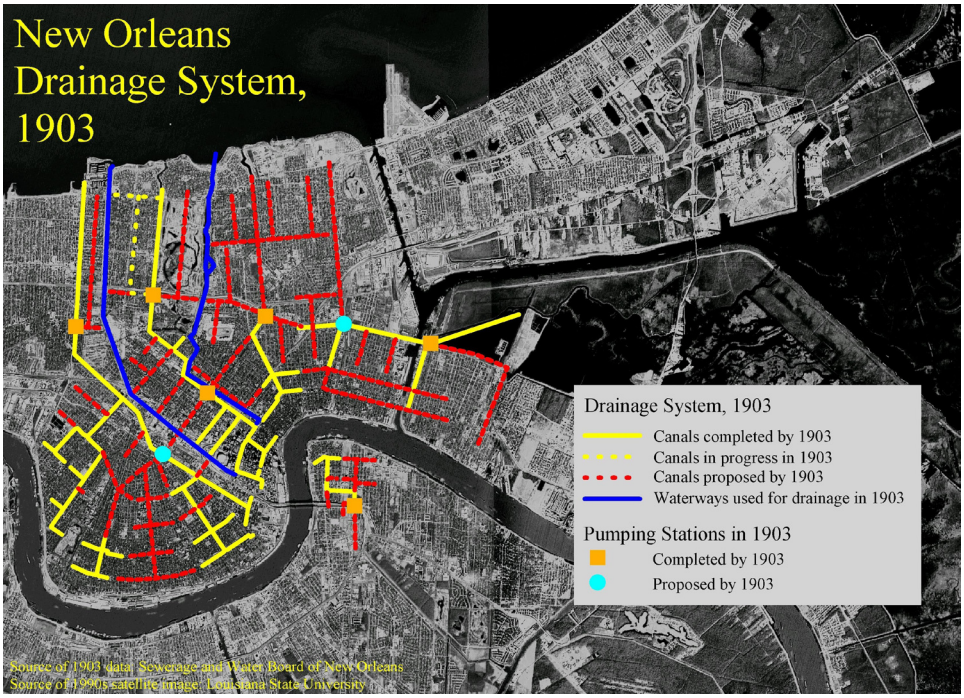
The Louisiana legislature similarly established the Orleans Levee District in 1890. The district is responsible "for the operation and maintenance of levees, embankments, seawalls, jetties, breakwaters, water basins, and other hurricane and flood-protection improvements surrounding the City of New Orleans, including the southern shores of Lake Pontchartrain and along the Mississippi River." At the federal level, the U.S. Army Corps of Engineers (USACE) became heavily involved with the city's drainage canals in 1955 following congressional studies that later led to the authorization of the Lake Pontchartrain and Vicinity Hurricane Protection Project (LP&VHPP) in 1965. The USACE was charged with designing and building improved levees, the Orleans and Jefferson Parish Levee Districts with levee maintenance, and the S&WB with operation and maintenance of the pumping stations. To protect the city from a Lake Pontchartrain storm surge, the USACE initially prepared designs for floodgates on the drainage canals near where

3. Robert Muir-Wood, "Mississippi River Rages," *Risk & Insurance*, April 15, 2004.

4. "Study: 1927 Mississippi Flood Would Cost Up To $160 Billion," *Insurance Journal*, May 18, 2007, http://www.insurancejournal.com/news/national/2007/05/18/79826.htm.

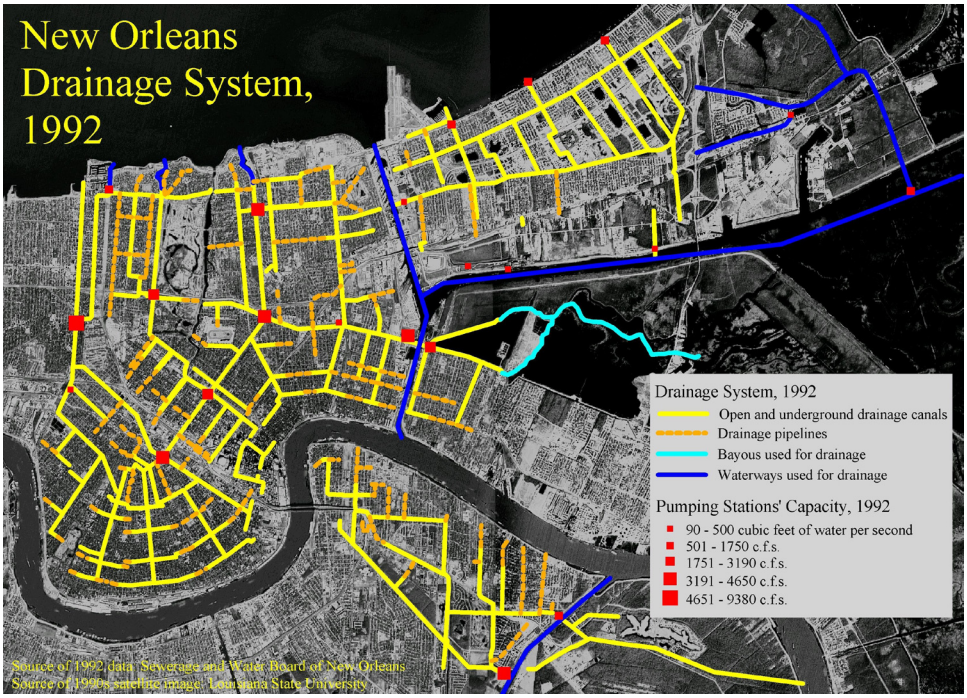
5. See David J. Rogers, "History of the New Orleans Flood Protection System," in *Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005*, Independent Levee Investigation Team, May 2006, http://www.ce.berkeley.edu/~new_orleans. Despite the many floods that have occurred along the Mississippi River over the past two hundred years and New Orleans's long flooding history, high river flows have not caused significant flooding since 1859. Since that time, almost all significant floods have been a result of hurricanes, with storm surges in Lake Pontchartrain causing water to spill back into the city from overtopped levees along the lakeshore or through the city's many drainage canals.

FIGURE 1: PRINCIPAL ELEMENTS OF THE NEW ORLEANS DRAINAGE SYSTEM INFRASTRUCTURE AS IT EXISTED IN 1903



Source: Campanella, R. (2002). Time and Place in New Orleans: Past Geographies in the Present Day, Pelican Publishing. Gretna, LA.

FIGURE 2: PRINCIPAL ELEMENTS OF THE PRE-KATRINA DRAINAGE SYSTEM INFRASTRUCTURE AS IT EXISTED IN 1992



Source: Campanella, R. (2002). Time and Place in New Orleans: Past Geographies in the Present Day, Pelican Publishing. Gretna, LA.

they entered the lake. However, a judicial ruling in 1977 precluded this option on environmental grounds, leaving the USACE no choice but to abandon flood gates and begin planning to raise the height of the levees. Raising the levees by adding soil was not feasible in many locations because residential development had encroached on the landside of many levees, effectively preventing any lateral expansion (see figure 3).

Nature tested the effectiveness of these flood protection efforts on August 29, 2005, when a storm surge in Lake Pontchartrain, driven by Hurricane Katrina, entered the city's drainage canals and caused water levels to rise to more than seven feet above Mean Gulf Level (MGL),[7] a height never before reached. Multiple levee and floodwall failures as a result of overtopping and poor design and construction allowed water from Lake Pontchartrain

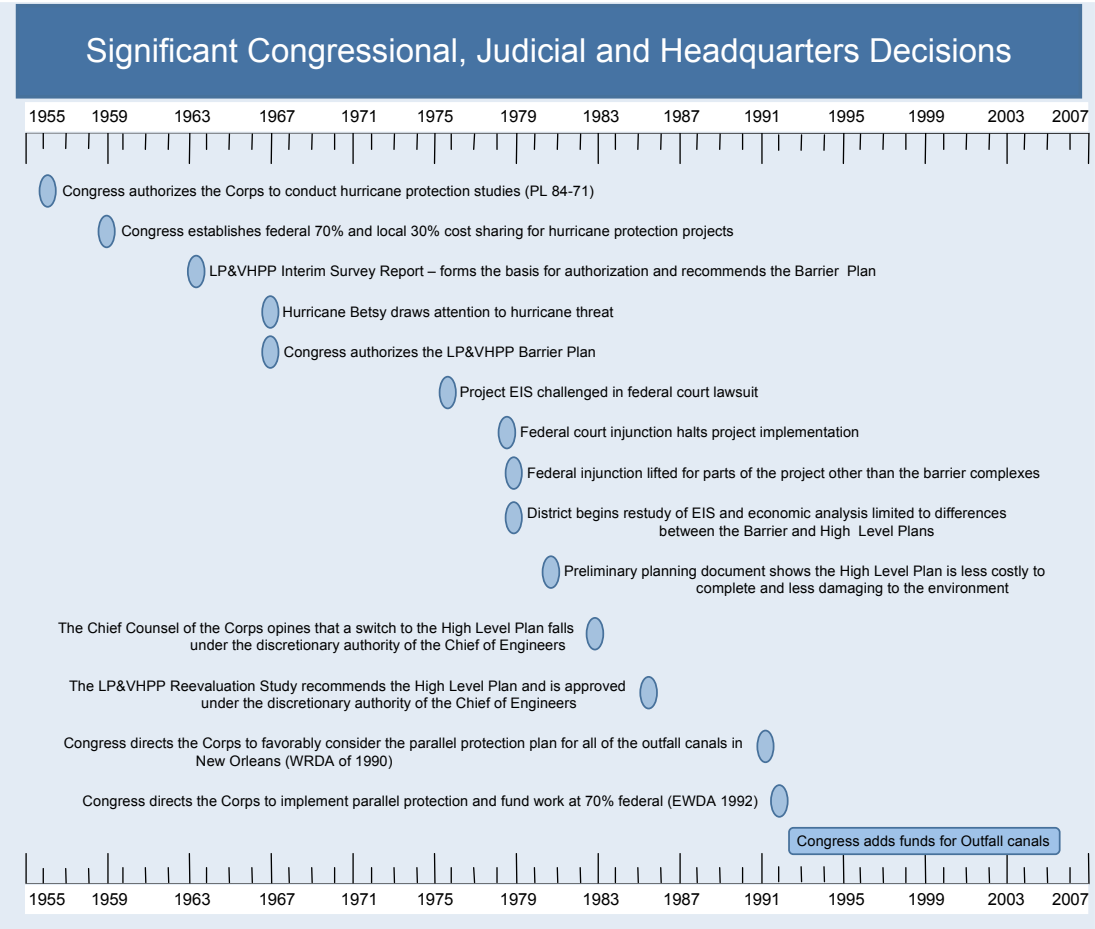
FIGURE 3: VIEW ALONG THE EAST SIDE OF THE LONDON AVENUE CANAL NEAR ROBERT E. LEE BOULEVARD SHOWING THE ENCROACHMENT OF HOMES AGAINST THE SLOPE OF THE LEVEE, A SITUATION COMMON ACROSS NEW ORLEANS.[6]

As a result, the USACE began building a series of floodwalls on top of the existing levees. The LP&VHPP, which Congress authorized following Hurricane Betsy in 1965, was still not complete when Hurricane Katrina struck in 2005. The decision chronology related to the LP&VHPP is shown in figure 4.

and Lake Borgne to enter the city and cause widespread flooding. When floodwaters inundated the S&WB drainage pumps' electrical generators, New Orleans lost any ability to counter the flooding, which continued to rise until water levels equalized several days later.

6. Photo courtesy of C.M. Watkins.
7. The mean water level in the Gulf of Mexico.

FIGURE 4: SIGNIFICANT CONGRESSIONAL, JUDICIAL, AND USACE DECISIONS RELATED TO THE LP & VHPP



Source: Woolley, D. and L. Shabman. Decision-Making Chronology for the Lake Pontchartrain & Vicinity Hurricane Protection Project. Final Report for the Headquarters, U.S. Army Corps of Engineers; Submitted to the Institute for Water Resources of the U.S. Army Corps of Engineers, March 2008.

3 Technology and Flood Protection

The measures employed in New Orleans represent the classic approach to flood protection, which has been to provide structural controls such as dams to hold back heavy rainfall or snowmelt, levees to keep swollen rivers and canals within a predetermined channel, and floodwalls and gates to protect isolated pockets of habitation or development. The reliability of the protection depends largely on the designers' foresight to choose both a design event of sufficient magnitude that the likelihood of it being exceeded is acceptably low and physical infrastructure of sufficiently high construction quality that it does not fail in use. For the most part, meeting both of these conditions has kept flood-prone communities in the United States out of harm's way. However, as the many post-Katrina reports have shown, the levee system protecting New Orleans failed against these criteria.[8] It was not designed to withstand the effects of a major hurricane (a highly likely event), was built to an

8. See for example, *Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005*, Independent Levee Investigation Team, May 2006, http://www.ce.berkeley.edu/~new_orleans; and *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System*, Interagency Performance Evaluation Task Force, March 26, 2007, https://ipet.wes.army.mil.

insufficient height due to use of the wrong datum, and was poorly constructed and maintained.[9] In the aftermath of Katrina, the USACE moved rapidly to rebuild and restore the levees to provide the level of protection Congress authorized in 1965.[10] Work is also underway to provide a level of protection sufficient to sustain a one-hundred-year flood event—a flood that has a one percent chance of occurring in a given year—within the city. Although efforts to ensure more reliable flood protection are understandable given the history along the Mississippi River and in New Orleans, they should not preclude reevaluating the implications of employing this approach alone and whether it is the most effective strategy for reducing risk.

4 Failures of Protective Technologies

History is littered with accounts of allegedly foolproof or failsafe systems that failed spectacularly when stressed. The "unsinkable" *Titanic* and the "impregnable" Maginot Line added new terms to the lexicon of disaster. Their designers assumed a seemingly rational hazard scenario, yet both systems failed utterly in practice. The damage limits for the *Titanic* turned out to have no basis in reality—a design that allowed only a certain number of compartments to be compromised could not withstand an iceberg. In World War II, the Germans simply chose not to confront the extremely formidable defenses on the French border and attacked through lightly defended Belgium instead. Despite historical experience, people continue to rely excessively on protective technology when the potential for the loss of life and property is high. The Kaprun tunnel fire in Austria that claimed 155 lives in 2000 started in a train believed to be fireproof. An assessment of the event noted:

> In November 2000, a supposedly "fireproof" train in a tunnel in the Austrian Alps caught fire and led to the deaths of 155 people. While many factors contributed to the disaster, one of them was thinking that a vehicle can be fireproof.[11]

Not surprisingly perhaps, attitudes toward flood protection are not much different. John Barry noted this mindset at the Mississippi River Commission, charged with flood protection on the river since the Civil War, in *Rising Tide*:

> The Mississippi River Commission never became a scientific enterprise. It was a bureaucracy. The natural process of a bureaucracy, by contrast, tends to compromise competing ideas. The bureaucracy then adopts the compromise as truth and incorporates it into being . . . . The commission took positions and the positions became increasingly petrified and rigid.[12]

In a similar vein, the Standard Project Hurricane (SPH), the key parameter in the design of the New Orleans Flood Defense System (NOFDS), also came to be considered a maximum possible event, something it definitely was not.

> The Standard Project Hurricane wind field and parameters represent a "standard" against which the degree of protection finally selected for a hurricane protection project may be judged and compared with protection provided at projects in other localities.[13]
>
> The project is designed to protect against the Standard Project Hurricane moving on the most critical track. Only a combination of hydrologic

9. Carl Southwell and Detlof von Winterfeldt, "A Decision Analysis of Options to Rebuild the New Orleans Flood Control System," in Harry W. Richardson, et al. (eds.) *Natural Disaster Analysis after Hurricane Katrina: Risk Assessment, Economic Impacts and Social Implications* (Cheltenham, UK: Edward Elgar Publishing, Ltd., 2008). The likelihood of a major hurricane (category 3 and above) passing within seventy-five miles of New Orleans is about 3.2 percent per year, or about once every thirty years.
10. The levees were restored to pre-Katrina levels of protection by the beginning of the 2006 hurricane season. The Hurricane and Storm Damage Risk Reduction System (HSDRRS), which will provide a 100-year level of protection, is scheduled to be completed by 2011.
11. Ricky Carvel, "The History and Future of Fire Tests," *Tunnels & Tunnelling International*, November 2002: 34–35.
12. John Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (New York: Touchstone, 1997).
13. Howard Graham and Dwight Nunn, "Meteorological Considerations Pertinent to Standard Project Hurricane, Atlantic and Gulf Coasts of the United States," U.S. Weather Bureau Report 33 (1959).

> and meteorological circumstances anomalous to the region could produce higher stages. The probability of such a combination of occurring is, for all practical purposes, nil.[14]
>
> The SPH is a steady state hurricane having a severe combination of values of meteorological parameters that will give high sustained wind speeds reasonably characteristic of a specified coastal location. By reasonably characteristic is meant that only a few hurricanes of record over a large region have had more extreme values of the meteorological parameters.[15]
>
> The SPH was expected to have a frequency of occurrence of once in about 200 years, and represented the most severe combination of meteorological conditions considered reasonably characteristic for the region.[16]

Over time the SPH went from being a general indicator of threat levels to a guarantee of safety. The methods used to define the SPH were buried, along with their potential flaws and questionable assumptions. Because it became the gold standard of flood system performance, the SPH effectively prevented up-to-date analysis of the true risks of catastrophic flooding of the NOFDS.[17]

5 Learning from Failure

Observation of past failures and assessments of their causes have led to continuous improvements in hazard-mitigation strategies, such as hazard-resistant structure design and better techniques and materials.[18] The numerous post-Katrina assessments are cases in point. However, the traditional forensic approach suffers from its emphasis on identifying causes and determining who was at fault rather than preventing future failures. This problem is not confined to the field of disaster mitigation. For example, in 2000 the Institute of Medicine's landmark study of errors in the health-care industry noted major conceptual concerns with commonly used forensic techniques in medicine:

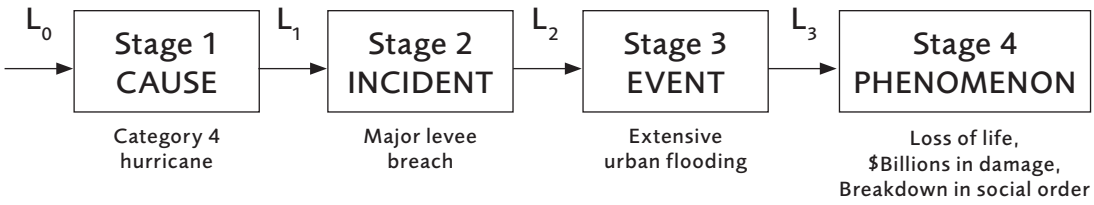
> The complex coincidences that cause systems to fail could rarely have been foreseen by the people involved. As a result, they are reviewed only in hindsight; however, knowing the outcome of an event influences how we assess past events. *Hindsight bias* means that things that were not seen or understood at the time of the accident seem obvious in retrospect. Hindsight bias also misleads a reviewer into simplifying the causes of an accident, highlighting a single element as the cause and overlooking its multiple contributing factors. Given that the information about an accident is spread over many participants, none of whom may have complete information, hindsight bias makes it easy to arrive at a simple solution or to blame an individual, but difficult to determine what really went wrong.[19]

Trevor Kletz, in a study of industrial accidents, also cautions about too much emphasis on causes:

> If we talk about causes, we may be tempted to list those we can do nothing about. For example, a source of ignition is often said to be the cause of a fire. But when flammable vapor and air are mixed in the flammable range, experience shows that a source of ignition is liable to turn up, even though

14. U.S. Army Corps of Engineers, *Final Environmental Statement, Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project I-2* (New Orleans, LA: 1974).
15. National Weather Service, *Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States*, NOAA Tech. Report NWS 23 (Charleston, SC: 1979).
16. Government Accountability Office, *Army Corps of Engineers, History of the Lake Pontchartrain and Vicinity Hurricane Protection Project*, GAO-06-244T (Washington, DC: U.S. Government Printing Office, 2005).
17. "Organized for Failure," in *Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005*.
18. Henry Petroski, *To Engineer is Human: The Role of Failure in Successful Design* (New York: Vintage Books, 1992); Henry Petroski, *Design Paradigms: Case Histories of Error and Judgment in Engineering* (Cambridge, UK: Cambridge University, 1994); National Research Council, *Practical Lessons from the Loma Prieta Earthquake* (Washington, DC: National Academy Press, 1994); Dennis Mileti, *Disaster by Design: A Reassessment of Natural Hazards in the United States* (Washington, DC: Joseph Henry, 1999).
19. Institute of Medicine, *To Err is Human: Building a Safer Health System* (Washington, DC: National Academy Press, 2000).

FIGURE 5: THIS EVENT CHAIN LEADING UP TO THE FLOODING OF NEW ORLEANS CAN BE MISLEADING IN THAT THE ROOT CAUSES WERE MUCH DEEPER.



> we have done everything possible to remove known sources of ignition. The only really effective way of preventing an ignition is to prevent leaks of flammable vapor. Instead of asking, What is the cause of this fire? we should ask, What is the most effective way of preventing another similar fire? [sic] We may then think of ways of preventing leaks.[20]

In the case of New Orleans, as indicated in figure 5, hindsight bias could direct focus to just the levee breach or the hurricane itself, both of which were merely events in a chain leading up to the flooding. The root cause of the destruction of much of New Orleans, however, was far deeper, springing both from technical factors such as incorrect design basis and institutional problems such as inadequate funding, poor maintenance, and over development of particularly vulnerable areas.

This suggests that policy makers should carefully consider the recommendations of the various post-Katrina assessment teams so that proposed solutions and future approaches address all contributing factors, not merely the obvious technical ones. For example, in Katrina's aftermath, there has been much public demand to "get the engineering right," as though that were the only problem. Certainly the connection between poor design, construction, maintenance, and the breach of the levees is valid, but it gets caught in Kletz's "obvious cause" trap, rather than considering the whole picture. Instead of only asking, How can we design levees so they will not breach or collapse if subjected to a storm of Katrina's intensity? perhaps the more appropriate question is, How can we protect the people of New Orleans from future floods at a reasonable cost? The answer to the second question lies at least as much with institutions, governance, and finance as with structural design and levee maintenance.

Institutional problems were apparent in the forty years leading up to Hurricane Katrina. Beginning with the congressional authorization of the Lake Pontchartrain and Vicinity Hurricane Protection Plan (LP&VHPP) in 1965, even a cursory analysis shows a project destined to fail at some point. Federal appropriations and the USACE construction schedules never reflected a high priority for completing the work. Without sufficient funds and a sense of urgency from the responsible government agencies, construction lagged behind schedule, causing further cost escalation and thus wider funding shortfalls. Local cost sharing was slow to materialize and even in-kind contributions for maintenance were not made. For example, following Katrina, the Orleans Levee Board was roundly criticized for spending most of its time on commercial real estate ventures rather than its core levee maintenance mission. In addition, as noted earlier, encroachment near the floodwalls by local property owners made critical remedial work identified by the USACE difficult or impossible to undertake. Despite these seemingly obvious omissions and shortfalls, everyone involved in the project, from the U.S. Congress, the USACE, the Levee Districts, city government, and individual homeowners, acted as if a fail-safe flood protection system were in place. Although such behavior is certainly not unique, as the earlier examples indicated, reliance on "fantasy plans" had particularly devastating consequences in New Orleans.[21]

6 Risk and Hazards

In the aftermath of Katrina, it is important to analyze whether and how these institutional problems that contributed to such a disastrous outcome could have

20. Trevor Kletz, *Learning From Accidents* (Oxford, UK: Gulf Professional, 2001).
21. Lee Ben Clarke, *Mission Improbable: Using Fantasy Documents to Tame Disaster* (Chicago: University of Chicago Press, 1999).

been effectively addressed. Understanding risk is critical to coming up with reality-based solutions. Risk is a useful analytical concept that gives meaning to uncertainties that pose a danger to people or property.[22] Risk is often expressed as a combination of the likelihood of an adverse event; the vulnerability of people, places, and things to that event; and the consequences should that event occur. Mathematically, risk *R* can be defined as the probability of an adverse event (threat and vulnerability) P multiplied by the consequences of that event *C*, or $R = P \times C$. For example, in the case of rising sea level, the risk is greater for people living in coastal areas than for those at higher elevations because coastal populations are more vulnerable to lowland flooding and will suffer greater consequences if flooding occurs.

An inherent shortcoming of this simple way of calculating risk is that vastly different classes of events can have apparently similar risk levels. For example, from an arithmetical standpoint, a catastrophic event with extremely low probability can be interpreted to have a similar level of risk as a relatively frequent event with far lower consequences. Although it is compelling to believe that designing for some maximum probable event (or Standard Project Hurricane) fully addresses the risk issue, the experience with Katrina demonstrated that this may not be the case. In addition, assuming that people in a hazardous area are protected from a maximum probable event when they are not could increase vulnerability (and hence risk) if more people locate there.

A more formal process of risk assessment and management can help illuminate and resolve these uncertainties. Three questions classically define risk assessment:

1. What can go wrong?
2. What is the likelihood that it could go wrong?
3. What are the consequences of failure?[23]

Based on the findings of the post-Katrina assessments, a summary of the answers to these questions could be:

> In the event of a stronger than usual but not uncommon intensity hurricane, it is highly likely that the levees will be breached or otherwise fail in a number of locations, resulting in the deaths of hundreds to thousands of mostly poor people as well as billions of dollars in damage.

It is interesting to speculate about whether broad dissemination of this perfunctory statement of risk in advance of Katrina would have affected development patterns in the city, especially in the most vulnerable areas. However, offering such a pessimistic forecast is not the only way to preclude all activity in vulnerable areas. Risk can be managed quite effectively under the appropriate conditions. Risk management is the process of integrating the results of risk assessment with other information such as political, social, economic, and engineering considerations—not just engineering problems—to arrive at decisions about the need and methods for risk reduction. Risk management seeks answers to a second set of questions:

1. What can be done and what options are available?
2. What are the associated trade-offs in terms of costs, benefits, and risks?
3. How do current management decisions affect future options?[24]

The answers to these three questions and how they can influence governance and decision making in and about New Orleans will occupy the remainder of this paper.

7 What can be done and what options are available?

Options for managing flood risk can be grouped into five general categories:

1. Avoid the risk by locating somewhere else. In the case of flood protection, living outside the flood-prone area is perhaps the wisest choice, though certainly not an option for many of the people who were already living in New Orleans in August 2005. However, as redevelopment occurs, land assemblage activities such as those underway by the New Orleans Redevelopment Authority

22. National Research Council, *Understanding Risk: Informing Decisions in a Democratic Society* (Washington, DC: National Academy Press, 1996).
23. Stanley Kaplan and B. John Garrick, "On the Quantitative Assessment of Risk," *Risk Analysis* 1, no. 1 (1981): 11–27.
24. Yacov Y. Haimes, "Total Risk Management," *Risk Analysis* 11, no. 2 (1991): 169–71.

(NORA) could be used to encourage residents to return to parts of the city with a lower flood risk and to residences elevated above expected flood levels.

2. Reduce the risk by taking countermeasures. Typically, these might include advance warning and evacuation, flood-protection works such as levees and floodwalls, hazard-resistant structures, and rapid response and recovery mechanisms so that the city can recover quickly. Most of these components were thought to be in place in August 2005. However, the floodworks proved to cause the flooding rather than prevent it, and multiple avoidable problems at all levels of government delayed response and recovery operations.

3. Spread the risk by choosing multiple redundant locations for certain protective measures. For example, it would have been wise to locate at least some of the special generating capacity for the S&WB's drainage pumps outside the flood zone. Similarly, stockpiling emergency supplies where local community action groups could have accessed them might have helped alleviate the survivors' suffering.

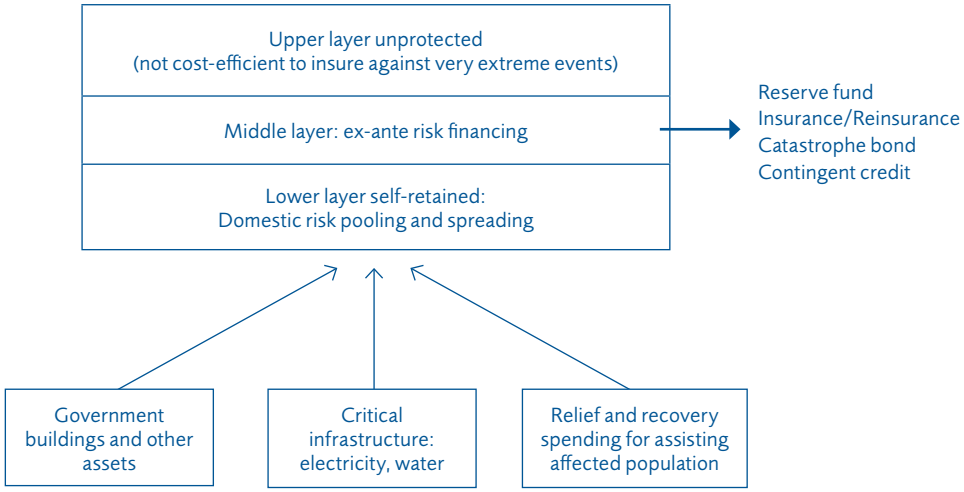
4. Transfer the risk through insurance or other related methods. The relevance of this option will depend to some degree on the continued viability of the National Flood Insurance Program (NFIP). Insurance can be an effective risk management tool, but only when rates reflect true risk. The NFIP was established because the commercial insurance industry was unwilling to underwrite flood-hazard risk at rates that homeowners were willing to pay. Thus, flood losses were not covered, and a government program attempted to fill the gap. Subsidized risk pools such as the NFIP may actually increase risk because they disconnect locational decisions from their potential consequences.[25] Catastrophe bonds, either private (insurance industry) or sovereign (local, state, federal), may be an option to supplement traditional insurance or reinsurance.[26] If a catastrophe takes place and specified trigger conditions are met, the principal on the catastrophe bonds bond is forgiven. If the catastrophe bond is not triggered by the hazard of concern, the principal is returned to the issuer upon maturity. If, however, the bond is triggered, part or all of its assets will be made available to the sponsor to cover its liabilities. For example, as part of a comprehensive financial disaster risk-management strategy, Mexico recently issued a $160 million catastrophe bond to cover losses in the event of an earthquake greater than a pre-specified magnitude that would constitute a national emergency.[27] In New Orleans, the trigger could be a levee breach followed by a presidential disaster declaration.

5. Retain the risk. In light of the preceding points, property owners, neighborhoods, the City of New Orleans, and even the entire state of Louisiana may have no choice but to accept a portion of the consequences of the multiple hazards they face. Some of this risk retention is reflected in the local cost-sharing formula for USACE projects: Louisiana must contribute 30 percent of the funding for the one-hundred-year flood protection system currently under construction. Figure 6 illustrates how the various elements of a financial disaster risk-management program can be structured. Below a pre-determined level, the cost of a disaster event would be managed locally. Above a particular threshold, various forms of private involvement would come into play through insurance/reinsurance or catastrophe bonds. At a further trigger point, the cost of insurance compared to the likelihood of a very extreme event becomes overly burdensome and a decision to accept the consequences must be made. Although governmental bodies routinely make these decisions, they are made implicitly, leaving the general public with the impression that they are protected from all levels of catastrophe, when in fact, they are not.

As discussed below, the first, fourth, and fifth options offer New Orleans the greatest opportunity to explore alternative approaches for delivering effective and equitable flood protection as the city rebuilds.

25. Daniel Sutter, *Ensuring Disaster: State Insurance Regulation, Coastal Development, and Hurricanes* (Arlington, VA: Mercatus Center at George Mason University, 2008), http://www.mercatus.org/uploadedFiles/Mercatus/Publications/20070912_ensuring_disaster.pdf.
26. Mike Anderson and Oliver Suess, "The Allure of Catastrophe Bonds," *International Herald Tribune*, July 13, 2006.
27. "S&P Rates Mexican Quake Cat Bond Managed by Swiss Re 'BB+,'" *Insurance Journal*, May 22, 2006, http://www.insurancejournal.com/news/international/2006/05/22/68654.htm.

FIGURE 6: A STRUCTURE FOR FINANCIALLY MANAGING THE PUBLIC SECTOR'S DISASTER RISK LIABILITIES



Source: Victor Cardenas, Stefan Hochrainer, Reinhard Mechler, Georg Pflug, and Joanne Linnerooth-Bayer, "Sovereign Financial Disaster Risk Management: The Case of Mexico," Environmental Hazards *7 (2007): 40–53.*

8 What are the associated trade-offs in terms of all costs, benefits, and risks?

Benefit/cost (B/C) analysis was practically invented to do the type of trade-off analysis inherent in large flood-control projects. A simplified B/C analysis would determine that *$X* in capital outlays and *$Y* for annual operating and maintenance expenses would generate *$Z* in benefits. If the net present value of the annualized equivalent of *Z* is greater than *X + Y*, the project has a favorable cost-benefit structure and is justified. However, this analytical procedure makes no effort to distinguish between who bears the costs and who reaps the benefits. For example, although all U.S. taxpayers underwrite a portion of the federal share of the costs of flood control, the benefits accrue locally. Although often labeled National Economic Development benefits, they usually reach a far narrower audience. The equity of federal water development has been debated for years and will not be resolved here. However, from the standpoint of managing risk equitably, much better alignment of who benefits and who pays is certainly possible.

Levee investment choices involve comparisons and trade-offs of the costs and benefits of building various levels of protection, typically specified as protection against an x-year versus a y-year event.[28] But this choice has an implicit spatial dimension: Are protected lands made suitable for agricultural or residential (or other) uses? These options belong in the cost-benefit analyses. Such studies would consider what benefits (revenues) residential development would contribute. Analysts could use local hydrological data to estimate the amount of water stored as a function of levee height and the area of possible flooding. Waterfront and/or low-lying property can be secured for community development, but at an incremental cost. If so, then transactions between levee and floodwall providers and interested consumers (developers) are plausible. Efficiency as well as equity considerations dictate that the incremental costs are charged to those who stand to gain.

28. See, for example, Douglas L. Johnson, "Risk is Not a Four-Letter Word: Ten Years of Success Using a Risk-Based Dam Safety Approach in Washington" (presented at Dam Safety 2000, Providence, RI: September 30, 2000). These comparisons and trade-offs are specified along with associated levels of risk in risk-based analysis.

To date, we have seen few serious discussions of this aspect of post-Katrina redevelopment. Very few of them address the question of the extent and the means by which market discipline can be brought to bear.

9 What is the impact of current flood management practices on future development options?

The Mississippi River Valley historically has been a focal point of man's efforts to harness nature to his purpose. The USACE and its predecessors were charged with controlling the periodic and damaging floods that occurred on the Mississippi River and its tributaries. New Orleans, subject to both river flooding and hurricane storm surge, has also seen the almost continuous installation of floodworks over its two-hundred-year history.[29] The decision to encourage the growth of a major city and build flood works to enable that growth precluded other approaches. Once the size of the population and the value of the constructed environment achieved certain thresholds, there was little to do but to keep investing in large protective flood-control structures. However, as demonstrated by Hurricane Katrina, these large investments were not sufficient to avoid disaster. Rebuilding the levees and then rebuilding the city—absent other changes to land use, cost allocation, and other factors—will only perpetuate this cycle.

Now, New Orleans and the nation face new decisions that will affect the city and its residents far into the future—either to continue with the failed policies of the past or to seek a more harmonious and equitable balance with the forces of nature, the desires of individuals, and basic economics. Hurricane Katrina has shown us what can happen when a city relies solely on structural measures to provide flood control. Structural controls, once in place, leave little choice but to continue the cycle of protection, failure, destruction, and rebuilding that fails to provide a long-term solution. It is time to consider other approaches that could be less costly and place fewer people, as well as their livelihoods and possessions, at risk.

10 Post-Katrina New Orleans

Post-Katrina, many have come forward with visions for the new New Orleans, but they have involved a mostly unimaginative set of institutional discussions. In contrast, we suggest that the scale of reforms necessary for change in New Orleans will require a radical rethinking of institutional relationships. The utter failure of existing institutions creates an opportunity for real reforms. Some of this type of institutional change is already taking place in New Orleans. For example, the decision to allow many more charter schools in New Orleans in 2005 was not based on a policy evaluation; rather, it was forced by necessity because the established, but troubled, school district received a knockout blow from the storm.[30] Interestingly, in 1982, economist Mancur Olson noted that many social and economic problems develop with the passage of time via the ossification of institutional arrangements; the selection of improved spontaneous orders is stymied. It takes natural or man-made calamities to shake up these arrangements and allow real reform. Olson's analysis seemingly anticipates the New Orleans school reforms, which involved a local institution particularly vulnerable to a localized disaster. Levees and ports, on the other hand, also provide regional and national services and involve state and national policy, further complicating the institutional environment.

Most discussions of restoring New Orleans have considered how pre-Katrina institutions would do it. This is not surprising. Conventional public discourse instinctively looks to known leaders to "do something," and these decision makers operate through well-developed networks and channels. When Congress allocated $200 billion of relief funds, it was presumed that existing agencies—the Army Corps of Engineers, the U.S. Department of Housing and Urban Development (HUD), and their counterpart state and local agencies—would administer them. Such standard responses are inadequate in a case as extreme as post-Katrina New Orleans.

The institutional status quo involves many well-known problems. In housing markets, for example, it is increasingly recognized that U.S. subdivision requirements are

29. Southwell and von Wintefeldt report, "the New Orleans area had experienced two near misses of category three hurricanes, Betsy in 1965 and Camille in 1969 which suggested that the probability of a category three or more severe hurricane (which would induce a 'one-hundred-year' flood event) was much higher than one in one hundred years." Southwell and von Wintefeldt, "A Decision Analysis of Options to Rebuild the New Orleans Flood Control System," 35.

30. See Adam Nossiter, "Changes at New Orleans Schools Bring Gains in Test Scores," *New York Times*, May 7, 2008. There is already evidence of test score success from this reform.

excessive. HUD recently reported that "the estimated average cost of excessive regulation for one dwelling unit was $11,910, or 4.8 percent of the average cost of a new home in 2004."[31] Many now see this as contributing to the "housing affordability crisis" and propose new policies, in this case requirements that new developments include "affordable" units, to alleviate the problems caused by previous policies. But both the regulations and the dysfunctional policies survive. In fact, they are practically enshrined by the nature of the proposed remedies, most of which involve requirements that new residential developments include a specified amount of affordable units. In reality, these policies exacerbate the problem because they are a tax on new units. This example highlights the idea that where policy flexibility and the ability to change bad policies are missing, things get worse.

Some will rationalize that the United States is wealthy enough to tolerate the costliness of these sorts of approaches. Unfortunately, it may take disruptions as extreme as Katrina to prompt a reassessment. New York City received a shock on 9/11, but the area was a comparative economic powerhouse and could handle the blow—despite policy missteps. This is not true of New Orleans.

To be sure, there is evidence that some small reforms have performed as hoped. A degree of occupational licensing deregulation was implemented in Florida and New Orleans immediately after Katrina. In Florida, research indicates that, contrary to fears that relaxing regulations and restrictions would leave consumers exposed and vulnerable, people in the affected areas have been able to choose what worked for them and were not adversely affected.[32]

11 The Case Before Us: The Options for New Orleans

The following discussion explores some options for varying levels of personal economic decisions and political oversight. The division between government regulation and market choice need not be a fixed boundary.

Levees, because of their broad flood protection mission, are often thought to be classic public goods—meaning it is impossible to exclude people from using the good and that one person's use of the good does not preclude another person from using it as well—and therefore the responsibility of the public sector to construct and maintain. But the discussion of public goods has recently become more complex (and more interesting) for two reasons. First, it is recognized that many *local* public goods have a spatial ambit: excludability ceases to be an overwhelming problem and benefits are capitalized (priced) in land markets. As such, there are market signals that private developers can (and often do) respond to when providing local public goods and facilities.[33] Second, public authorities have started looking to private capital markets to fund projects that had, in most of the twentieth century, been mostly funded by taxpayers. Rights to own and operate proposed and existing projects are made available, but because many of these arrangements involve private equity and commercial debt, there is less transparency than in a public debt offering where an Official Statement is required.[34]

The New Orleans school reforms cited earlier were mostly a local matter, but the complex relationship between the levees and ports suggests they require local, state, and federal participation. We have already discussed how participation of multiple levels of administration hides the true social costs from local officials, investors, and residents, causing them to overinvest in and overpopulate vulnerable areas. In the same vein, this prompts underinvestment in local mitigation measures and private insurance.

A recent National Research Council report on post-Katrina levee-restoration challenges recognizes some of this oversight complexity. It states, "conflicting stakeholder interests represent one of the greatest barriers to robust coastal restoration efforts in Louisiana."[35] Such stakeholder discussions emphasize the political context

31. "Are Subdivision Requirements Excessive?" *Research Works* 5, no. 4 (April 2008), http://www.huduser.org/periodicals/ResearchWorks/april_08/RW_vol5num4t1.html.
32. David Skarbeck, "Occupational Licensing and Asymmetric Information: Post-Hurricane Evidence from Florida," *Cato Journal* 28, no. 1 (2008): 73–82.
33. Fred E. Foldvary, *Private Goods and Public Communities* (Aldershot, UK: Edward Elgar Publishing, Ltd., 1994).
34. A document or documents prepared by or on behalf of the issuer of municipal securities in connection with a primary offering that discloses material information on the offering of such securities.
35. National Research Council, *Understanding Risk*.

of the levee restoration. Yet, the economic context cannot be ignored and economic oversight must be provided concurrently with political oversight. There are four hypothetical scenarios for levee ownership and maintenance. Decision makers should carefully weigh the pros and cons of each when considering reforms to the institutional status quo.

In figure 7, quadrant I depicts the status quo, but it merits further discussion. Without major changes in property ownership or responsibilities, new finance options can and should be considered. One of these involves the previously described catastrophe bonds that could be issued by the levee authorities or other joint powers umbrella organizations to offset the risk of levee failure.

To the extent that individuals trust the levee administration and performance, they demand a lower risk premium and bonds command higher prices. Catastrophe bonds are essentially forms of self-insurance and bring some market discipline to levee reconstruction and maintenance. For example, market participants' willingness to purchase levee catastrophe bonds would indicate the degree to which people believed the land "protected" by the levees was viable for private development. If people chose not to purchase these bonds, the cost of public subsidy to support development would be transparent and the policy implications of subsidy at least open to debate. Again, in the alternative case of publicly issued debt, the required Official Statement would illuminate some of these issues.

FIGURE 7: ALLOCATIONS OF RESPONSIBILITY BETWEEN PUBLIC AND PRIVATE GOVERNANCE

		Levees	
		Publicly Owned and Operated	Privately Owned and Operated
Local Communities	Conventional Governance and Planning	I	III
	Private Governance and Planning	II	IV

Quadrant II represents an arrangement that retains the suggested modifications to public levee finance discussed above, but also involves private communities and public/private partnerships such as Business Improvement Districts (BIDs) in decision making.

The Community Associations Institute reports there were 295,700 private community associations—over half of them in planned communities—in the United States in 2007; these included 23.8 million housing units and were home to 58.8 million people. The phenomenon is thought to involve approximately 20 percent of the value of all U.S. residential real estate.[36] These associations are essentially private local governments, delivering a variety of common services, facilities, and areas. They also have the contractual power to assess fees that amount to private taxation. Developers design "constitutions," called Covenants, Conditions, and Restrictions that govern the associations. Competing developers offer desired protections in exchange for rights surrendered. The popularity of this approach is easy to understand: Robert Nelson has argued that it is in part due to more flexibility and responsiveness than can be expected from most conventional municipal governments.[37]

Along with the increasing numbers of private communities, there are as many as 1,500 BIDs in North America, and that number continues to grow.[38] BIDs refer to geographically defined zones empowered to assess and collect taxes and fees from area businesses. In return, the BID provides various services, including sanitation,

36. Community Associations Institute, "Industry Data, National Statistics," http://www.caionline.org/about/facts.cfm.

37. See William A. Fischel, *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance and Land Use Policies* (Cambridge, MA: Harvard University Press, 2001); and William A. Fischel, "Revolution or Evolution?" *Regulation* 27, no. 2 (2004). In 2001 William Fischel argued that "homevoter" cities, typically small suburban cities, are unique in that their raison d'etre is protecting home values. In 2004 Fischel also claimed that most homeowners want the protections offered by the homevoter city as well as the homeowners' association; they are complements. Nelson replied that private governments are less constrained; they do not, for example, have to abide by one man, one vote. All governance systems involve politics and its problems. The move to small cities and private communities suggests that politics is more widely accepted at the more local level.

38. Robert H. Nelson, Kyle R. McKenzie, and Eileen Norcross, *Lessons From Business Improvement Districts: Building on Past Successes* (Arlington, VA: The Mercatus Center at George Mason University, 2008). See also Leah Brooks, "Volunteering to be Taxed: Business Improvement Districts and the Extra-Governmental Provision of Public Safety," *Journal of Public Economics* 92, no. 1-2 (2008): 388–406.

street cleaning, street improvements, security, and area marketing. The model is flexible and could include other services, depending on local conditions.

Robert Nelson has recommended that established neighborhoods be given the option of privatizing.[39] Another option Nelson, Kyle McKenzie, and Eileen Norcross propose is to create Residential Improvement Districts (RIDs), which are simply residential neighborhoods that form an arrangement analogous to a Business Improvement District. A recent report that involved one of the authors suggested this approach may be appropriate for post-Katrina New Orleans.[40] In fact, New Orleans has one of the oldest BIDs in the United States, suggesting it may be a good place to experiment with RIDs. For the purposes of this discussion, we look at private governance for any communities in low-lying areas that would be habitable only if well protected by levees. If one authority represented all of the low-lying communities involved, there would be no free riding.

Developers of planned communities fund local infrastructure construction mostly within these communities and, in return, have achieved land design flexibilities and savings. Local governments benefit from cost savings whenever infrastructure is privatized, but they also charge developers exactions and impact fees for any public infrastructure those governments provide.[41] Nelson sees these arrangements as thinly veiled transactions, sanctioned via odd legalese like "a nexus of development." Explicit transacting for augmented levee services would be no different and arguably, with closer links between services, costs, and benefits, there would be greater interest and involvement from residents and neighborhoods with the performance of the infrastructure and the institutional entity charged with its maintenance. This brings up the distinction between inter- and intra-neighborhood services. But that distinction is also a matter of local circumstances. Any number of BIDs and RIDs have the option of forming consortia whereby they agree to provide or contract for services as a group.

Quadrant III introduces private levee ownership and management combined with conventional governance and planning. Private levee finance could be modeled on private highway finance. Modern tolling technology makes it simple to sell highway access. There is never the presumption that private groups would want to manage all of any single highway or any highway system. Rather, they may find owning and managing potentially profitable links appealing. Similarly, levee services could be transacted if private investors became involved. Unlike the situation discussed for Quadrant I, a proprietary organization could operate and maintain the levees if there were a contracted flow of rent payments.

To do this, companies would submit bids to a local government agency. This has been accomplished to some degree in Great Britain. In these cases, a private consortium received a long-term concession to build, operate, and maintain a series of coastal flood-defense works in exchange for availability fee payments. Ownership of the facilities and liability for their failure rests with the government.

Private insurers could also get directly involved; they or their surrogates could own and manage the levees, and they would offer to insure protected properties on terms over which they have some control. To allow innovation, however, states would have to free insurers from the usual regulations. Also, private insurers would have to operate without competition from state insurers.

Quadrant IV combines two of the innovations already discussed.[42] Private levee providers would negotiate with private governments (homeowners associations), or developers or consortia thereof. The latter owe their

39. Robert H. Nelson, *Private Neighborhoods and the Transformation of Local Government* (Washington, DC: Urban Institute, 2005).

40. Sanford Ikeda and Peter Gordon, *Power to the Neighborhoods: The Devolution of Authority in Post-Katrina New Orleans* (Arlington, VA: Mercatus Center at George Mason University, 2007); Huanghai Li, "Satisfaction with Local 'Public Goods' and Services: The Effects of Income and Privatization in Southern California" (PhD dissertation, University of Southern California, 2008). Huanghai Li's recently reported research finds that in Los Angeles, below-median-income households report the greatest improvement in services when comparing those provided by associations and by conventional governments.

41. Eran Ben-Joseph, "Land Use and Design Innovations in Private Communities," *Land Lines* 16, no. 4 (2004); Alan A. Altshuler and Jose A. Gomez-Ibanez, *Regulation for Revenue: The Political Economy of Land Use Exactions* (Washington, DC: The Brookings Institution; Cambridge, MA: The Lincoln Institute of Land Policy, 2003).

42. The discussion between Robert Nelson, "The Private Neighborhood," and William Fischel, "Revolution or Evolution?"—both in *Regulation* 27, no. 2 (Summer, 2004): 40–46 and 48–53—probes whether HOAs and "homevoter" cities are close substitutes. Charles M. Tiebout, "A Pure Theory of Local Public Expenditures," *Journal of Political Economy* 64 (1956): 416–24 is widely regarded as the seminal paper in the study of local public finance.

existence and their economic prospects to reliable levees and, therefore, the management entity tasked with ensuring levee performance—giving them a real stake in the performance of levees that abut their communities.

This case is intriguing because private entities are on both sides of the negotiating table: community property owners on one side and infrastructure contractors on the other. The analyses of Charles Tiebout, Nelson, and Fischel all suggest that this would result in both more efficient levels of private development *and* public services provision.[43] This supports a hypothesis that some New Orleans communities might be better off providing their own flood protection. Well-conceived investments can add value to the neighborhood and property owners' involvement in can help ensure a good result. If these communities were able to raise the funds to contract on their own for levee maintenance, they should not be prohibited from doing so. They would be free to add additional value to their land, and the wealth created could more than cover the associated private costs. This is the standard basis for bargaining and contracting. It suggests that New Orleans may have more options available than the pre-Katrina flood protection model. If, however, flood protection from the federal government is decreed as the sole option, this opportunity is foregone. The thrust of our whole discussion has been to compare the potency of private wealth creation to that provided by government provision of levee services and to question whether a one-size-fits-all approach can possibly be best for all of the affected neighborhoods of New Orleans.

The important questions are the extent to which such policies could add value and whether experimentation will be allowed to proceed. Foldvary has pointed out that voluntary contracts are more likely to be positive-sum, as opposed to zero-sum or even negative-sum.[44] These sorts of negotiations would occur unless they were pre-empted by law or unless positive-sum gains were absent—and it is impossible to know if positive-sum gains would really be absent until political pre-emption is withdrawn.[45]

12 Conclusions

Public provision of "public goods" does not necessarily crowd out private provision. Public provision can fail and voluntary private provision can fill the gap. Wal-Mart's actions in light of FEMA's post-Katrina failure are now well known.[46] Indeed, Emily Chamlee-Wright documents a variety of similar activities that can be characterized as bottom-up successes in light of top-down failures.[47] The experiences of Katrina demonstrate that policy makers ought to leave more room for such bottom-up successes.

This brings us to the question of which of our four quadrants is best. No one knows and one size never fits all. Learning through trial and error must occur—and it must be tolerated. This means that the important details will not be known until pre-emption is identified and scaled back. Appropriate contractual norms and arrangements are likely to emerge only in a more open regulatory setting.[48] But can the political will be mustered to allow some open-endedness and tolerance for trial and error?

Generally speaking, and in the absence of a serious commitment to reform, the answer is "no." Lease deals for turnpikes and highways have been discussed in various

43. And these are denoted as "public" only because that is the traditional use, not because they are necessarily outside of the exchange economy.
44. These are perhaps better known as "win-win," "win-lose," and "lose-lose," respectively. Fred E. Foldvary, "Infrastructure: Private and Governmental Funding and Provision," *Economic Affairs* 25, no. 4 (2005): 11–15.
45. See Richard Slawsky, "Mission Critical: Michoud Workers Protect Shuttle by Riding Out Storm at Facility," *New Orleans CityBusiness*, December 26, 2005, http://www.neworleanscitybusiness.com/viewStory.cfm?recID=14289. Private employees at NASA's Michoud Assembly Facility kept the plant's pumps and generators running in the face of rising floodwaters and were credited with preventing serious damage to the facility, a major regional employer.
46. David Boaz, "Catastrophe in Big Easy Demonstrates Big Government's Failure," September 19, 2005, http://www.cato.org/pub_display.php?pub_id=4819; and Steven Horwitz, *Making Hurricane Response More Effective: Lessons from the Private Sector and the Coast Guard during Katrina* (Arlington, VA: Mercatus Center at George Mason University, 2007).
47. Peter Boettke et al., "The Political, Economic and Social Aspects of Katrina," *Southern Economic Journal* 74, no. 2 (2007).
48. Regardless of the arrangement, the idea of land owners financing their own flood control benefits is well-established. Misczynski reports: "The earliest special assessment occurred in the Romney Marsh case of 1250, in which a local ordinance allowed authorities to assess residents for repairs made to sea walls. Assessments were in proportion to the acreage benefited. Thus the practice of estimating benefits by rule-of-thumb proxy has deep roots." Dean J. Misczynski, "Special Assessments," in *Windfalls and Wipeouts: Land Value Capture and Compensation*, David Hagman and Dean Misczynski, eds. (Chicago: American Society of Planning Officials, 1978), 312.

states, but the challenge of finding arrangements that are both attractive to investors and politically acceptable have stymied these efforts.

A private-private arrangement for flood protection would also have an uphill battle—like the continuing controversy with respect to highways—but probably will be more intense given the potential for catastrophic human and economic losses.[49] As Katrina so aptly demonstrated, flood control is not child's play. But trusted institutions with decades of experience make mistakes and maintaining the status quo involves serious problems. Institutional openness can be an antidote to the severe and unavoidable productivity shocks of natural disasters.

Negotiating appropriate levels of protection tied to engineering and management solutions requires technical expertise that can raise the transaction costs to such a level that the arrangement is no longer financially attractive. From the perspective of a private services provider, dealing with an uninformed customer is not desirable. Questions of whether such an arrangement adequately protects the public interest, which party is liable for what, and the reasonableness of the fee structure are all issues that have arisen in recent discussions of the private provision of transportation infrastructure.[50] Attitudes in the United States in 2008 are deeply conflicted in this regard. Although many brand the public sector as inefficient at best, and lazy, corrupt, and stupid at worst, there is an identifiable bias toward public provision of vital services when safety and security are at stake. The creation of the Transportation Security Administration in the aftermath of the 9/11 attacks is a case in point. However, the long-time federal presence in New Orleans as the *de facto* provider of flood protection—but one with little or no input into local planning or public finance decisions—complicates the development of workable solutions. As has been discussed throughout this paper, an effective flood protection system entails more than just the physical floodworks. If the USACE is to play the major role in flood protection, then perhaps it should have more input into the non-engineering decisions that affect flood risk. On the other hand, if the USACE is to function only as a turn-key contractor for flood protection, it (and by extension, all U.S. taxpayers) should be reimbursed by local beneficiaries of the services they provide.

The challenge in New Orleans, and the United States as well, is whether there is sufficient will to explore options that extend beyond the national socialization of local risk to better align the costs of flood protection with those who receive its benefits. The blurring lines between the public and private sectors that have emerged during the fall 2008 financial crisis point toward the possibility for new relationships and models for the provision of these services. The federal government could increasingly play the role of equity investor as opposed to being merely an underwriter for infrastructure improvements. Returns on such investment could be returned to the Treasury and be available for similar investments elsewhere.

Flood protection is routinely thought of as both a public good and a federal responsibility. But this can lead to problems. First, the true costs of publicly funded relief efforts are often obscured. Second, reliance on government protection can easily foster false impressions that individual risks have been minimized, thus encouraging more personal and business investment in disaster-prone regions. And reimbursing these losses with federal funds after a disaster perpetuates the cycle in which resources spent to protect communities from flood damage can instead lead to greater vulnerability, necessitating further spending to compensate for the higher losses. What many refer to as the "law of unintended consequences" is really the result of not following incentive arrangements to their logical conclusions.

We have suggested that there are alternatives. Public and private responsibilities can be divided in various ways. As New Orleans rebuilds from the damage of Katrina, local and national policy makers are attempting to ensure the levees are rebuilt better and stronger. While such efforts to ensure more reliable flood protection are certainly understandable given the region's history, they should not preclude serious consideration of the implications of excessive reliance on business-as-usual practice. Openness to alternate approaches that pay attention to institutions and associated incentives can provide decision makers at all levels—from elected officials to individual homeowners—with opportunities to manage flood risk more effectively.

49. See abstracts of papers on this issue at http://www.innobriefs.com/abstracts/2007/nov07.html.

50. Iris N. Ortiz, Jeffrey N. Buxbaum, and Richard Little, *Protecting the Public Interest: The Role of Long-Term Concession Agreements for Providing Transportation Infrastructure* (Proceedings of the 84th Annual Meeting of the Transportation Research Board, Washington, DC: National Academies Press, 2008).

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