Increasing National Resilience to Hazards and Disasters: The Perspective from the Gulf Coast of Louisiana and Mississippi: Summary of a Workshop

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The Perspective from the Gulf Coast of Louisiana and Mississippi

SUMMARY OF A WORKSHOP

Steve Olson, *Rapporteur*

Committee on Increasing National Resilience to Hazards and Disasters

Committee on Science, Engineering, and Public Policy
And
Disasters Roundtable

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Cover: Photographs from the Louisiana and Mississippi Gulf Coast region document the history and progress of efforts by individuals, groups, and government to increase disaster resilience. Estuaries, bayous, neighborhoods, and the city infrastructure demonstrate achievements and challenges regarding greater resilience in the Gulf Coast region. Photographs by Neeraj Gorkhaly, used with permission. Cover design by Eric Edkin.

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Preface and Acknowledgments

Our committee traveled to the Gulf Coast as part of our information-gathering efforts for the National Research Council study on increasing national resilience to hazards and disasters. The goal of the study is to help increase the nation's resilience at federal, state, local, and community levels through actionable recommendations and guidance on the best approaches to reduce the adverse impacts from hazards and disasters. The Gulf Coast workshop in January 2011 was the first of three regional workshops the committee planned for the study—the other two were held in Iowa in March 2011 and in Southern California in May 2011. The selection of three distinct geographic locations for the committee's information-gathering meetings was intended to highlight approaches and challenges to increasing disaster resilience in regions that experience different kinds of hazards and disasters and have different demographic, economic, cultural, historical, and environmental foundations.

It was important to us that the committee's first regional workshop was in New Orleans and the Gulf Coast because of the region's experiences with disasters, and just as importantly, because of the understanding the communities there have of the meaning and practice of resilience. The workshop included the opportunity to spend an entire day in the field, starting in New Orleans and continuing along the Gulf Coast of Mississippi. The personal stories of individuals and the kinds of actions they were taking to try to build resilience in their communities gave the committee vivid insights about what is happening at the local level. The second day of the Gulf Coast meeting was an indoor workshop with panelists whose expertise covered the great range of topics and stakeholder groups important for the discussion of disaster resilience: Topics of discussion covered insurance, real estate, building codes, critical infrastructure, private-

sector issues, public health, the work of nongovernmental organizations, community and societal actions, and governance. The range of perspectives included those from individuals with training in social, behavioral, economic, and political sciences; public health; and the physical, technical, and engineering sciences. The discussions in the workshop on the second day of the meeting built directly upon the field experiences and conversations the committee had with people from the area on the previous day. The committee developed a set of guiding questions for each workshop panel group that were submitted to the panelists in advance of the meeting. The panelists were asked to consider the questions as a general framework for the panel sessions, but were not required to respond to each of the questions in their opening remarks or subsequent discussions. Emphasis was placed upon panelists sharing their experiences and expertise related to disaster resilience.

This workshop summary is a report of what occurred on both of those days and provides a rich foundation of information upon which the committee has planned its other workshops and has begun to develop its own consensus report for the study. The open and engaged ways in which the individuals in Louisiana and Mississippi shared their information with the committee were essential for the success of the meeting and some acknowledgments are in order.

From the perspective of the federal government, Senator Mary Landrieu has been a leading voice in Washington for the Gulf Coast recovery effort in the wake of hurricanes Katrina and Rita and the failures of the federal levee system. Although scheduling prevented her from attending our meeting in person, she took time to videotape her welcoming remarks to open our workshop. The city of New Orleans and Mayor Mitch Landrieu's office were also very supportive of our holding our workshop in the city.

Regarding the field day in New Orleans and Mississippi, Ronald Schumann III; Pam Jenkins; Doug Meffert; Tracy Nelson; Charles Allen III; Tap Bui; May Nguyen; community members of Village de L'Est and the owner of the café in which we held our discussion there; Tracie Sempier; Mayor Garcia and Fire Chief Smith of Waveland; and the Knight Nonprofit Center including Alice Graham, John Hosey, John Kelly, Rupert Lacy, Tom Lansford, Reilly Morse, Kimberly Nastasi, and Lori West all deserve our thanks for their time and the rich experiences and insights they shared. The workshop on the second day of the meeting was equally complete and we thank all of the speakers and panelists for their time and engagement: Craig Colten, Allison Plyer, Julie Rochman, Eric Nelson, Ommeed Sathe, Marcia St. Martin, Justin Augustine, Greg Grillo, Frank Wise, Earthea Nance, Bill Stallworth, Stephen Murphy, Charles Allen III, Natalie Jayroe, Steven Bingler, Mary Claire Landry, Pam Jenkins, Joseph Donchess, Knox Andress, Garcia Bodley, and Paul Byers.

Before and during the meeting, we received significant guidance and assistance from Laurie Johnson, Shirley Laska, Jonathan Thompson, Bill Howell, Bob Klemme, Commissioner Mike Chaney, and John Barry. Particular thanks

also go to our meeting facilitator, Ann Olsen. The study's sponsoring agencies, the U.S. Army Corps of Engineers, U.S. Department of Agriculture Forest Service, U.S. Department of Energy, U.S. Department of Commerce National Oceanographic and Atmospheric Administration, Department of Homeland Security and Federal Emergency Management Agency, Department of the Interior U.S. Geological Survey, National Aeronautics and Space Administration, and the Community and Regional Resilience Institute, were very supportive and helpful in providing introductions and recommendations to their numerous networks in the Gulf Coast area; their collaboration allowed the committee to engage in a short span of time with many people involved in increasing Gulf Coast disaster resilience. Finally, the National Research Council staff, Eric Edkin, Neeraj Gorkhaly, Lauren Alexander-Augustine, and Elizabeth Eide, worked to ensure the entire meeting would be successful.

The committee looks forward to continuing to build upon the experiences, lessons, opportunities, and challenges about which we learned in this Gulf Coast workshop. We hope that this workshop summary allows the reader to gain some sense of the constructive steps the people of the Gulf Coast are taking to increase their resilience to potential disasters in the future.

This report has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Academies' Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for quality and objectivity. The review comments and draft manuscript remain confidential to protect the integrity of the process.

We wish to thank the following individuals for their review of this report: Edward George, Harvard University; Jacqueline Merrill, Columbia University; Percy Pierre, Michigan State University; Judy Tanur, State University of New York; and Mary Lou Zoback, Risk Management Solutions.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the content of the report, nor did they see the final draft before its release. The review of this report was overseen by Stephen Fienberg, Carnegie Mellon University. Appointed by the National Academies, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the rapporteur and the institution.

Susan Cutter, Chair
May 2011

Contents

Overview

The Committee on Increasing National Resilience to Hazards and Disasters, which was established by the National Research Council to examine how the nation can increase resilience to hazards and disasters at the federal, state, local, and community levels, held the first of three site visits and workshops in New Orleans and along the Mississippi Gulf Coast on January 18–21, 2011. The purpose of the meeting was to review the effects of Hurricane Katrina and other natural and human-induced disasters on the Gulf Coast of Louisiana and Mississippi and to learn more about the resilience of those areas to future disasters.

This workshop summary has been prepared by the workshop rapporteur with the assistance of the committee's staff as a factual summary of what occurred during the site visits and at the subsequent workshop on critical aspects of resilience in New Orleans and the Mississippi Gulf Coast. The planning committee's role was limited to planning and convening the workshop. The statements made are those of the rapporteur or individual site visit or workshop participants and do not necessarily represent the views of all participants, the planning committee, or the National Academies.

For the purposes of its three regional meetings, the committee defined resilience as "the ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events." This definition raises fundamental questions for the committee to explore. For example: What makes a community resilient? How can resilience be measured? How can progress toward achieving resilience be assessed? What tools are most effective for enhancing resilience? These and other questions will be explored in the committee's final consensus report.

The statements in this summary report are drawn from the committee's

experiences during its field trip and from the remarks made by presenters and committee members at the workshop. They should not be interpreted as the final conclusions or recommendations of the committee, though the committee plans to draw on the material in this summary in preparing its final consensus report.

MEASURES OF RESILIENCE

New Orleans and the Mississippi Gulf Coast have had extensive experience with hurricanes. Yet, according to some measures, the resilience of these areas has declined in recent decades. Before Katrina, many areas of New Orleans were developed that were below sea level and vulnerable to flooding if levees were damaged or overtopped. Along the Mississippi Gulf Coast, much new development occurred in areas susceptible to storm surge. Many new houses were built on concrete slabs at ground level, rather than being elevated, and typically used materials that were susceptible to damage from flooding. The vulnerability of housing increased the importance of shelters, but in New Orleans shelters were often in distant locations, and throughout the region many shelters proved to be inadequate. Hurricane Katrina also revealed many breakdowns in coordination and communications among governmental and nongovernmental organizations.

A major effort to measure the socioeconomic and demographic conditions of New Orleans since Katrina has shown that the city has rebounded since the hurricane. Wages in the city have risen 14 percent since 2005 and today are nearly at the national average. The economy has been diversifying and has added more jobs that require high levels of education. A greater percentage of students attend schools that meet state standards of quality than before Katrina.

However, several indicators point to continuing difficulties for the city. Major industries, including tourism, oil and gas, and shipping have declined in recent years. Not enough money is available to repair all of the damage caused by the storm. Income disparities remain stark among ethnic and racial groups and large areas of the city—along with many areas along the Mississippi Gulf Coast—remain vulnerable to future hazards and disasters.

A TOUR OF NEW ORLEANS AND THE GULF COAST

During its bus and walking tour of New Orleans and the Mississippi Gulf Coast, the committee saw many areas that had only partially recovered from Hurricane Katrina. Many building lots in the Lower Ninth Ward of New Orleans, for example, remain empty, and the population of the Lower Ninth has dropped from more than 17,000 before Katrina to 4,000 at most. However, substantial recovery efforts are also under way in the Lower Ninth and in other areas of the city that were decimated by the hurricane.

Along the Gulf Coast, the committee saw many other examples of scattered redevelopment in the midst of widespread devastation. In the community

of Waveland, Mississippi, for example, most of the homes within a few blocks from the beach were destroyed, and only some have been rebuilt, reducing the population of the town by almost half. Rebuilding remains difficult today because of the cost of flood insurance.

During its trip, the committee met with representatives of a group of nonprofit organizations who emphasized the importance of nongovernmental organizations in creating resilience and responding to disasters. These organizations help affected households recover from a disaster, apply for aid, and prepare for future disasters. Representatives of these organizations also emphasized the importance of getting businesses back in operation to provide employment and goods and services for the people affected by a disaster.

INSURANCE AND REAL ESTATE

During the first of five discussion panels held at the workshop, some participants emphasized that durability needs to be an integral part of performance measures for structures. Building codes provide a basic level of durability, but they need to be enforced, and fortified standards may be required to provide necessary levels of protection. The best aspects of building codes in one jurisdiction need to be adopted in others. They also noted that mitigation is not necessarily expensive, and it saves money for everyone during a disaster. The panelists discussed the idea that encouraging people to adopt effective mitigation measures may be needed to address the affordability gap for mitigation.

CRITICAL INFRASTRUCTURE

In the panel on critical infrastructure, the committee heard from representatives of the water and sewer authority in New Orleans, public transportation in the city, the regional electricity and gas company, and a cell phone provider. The four representatives emphasized their interdependence, requiring coordination among different organizations. Utilities also need to be able to draw on other people and organizations within their industry from outside an affected area to help respond to a disaster. Finally, the representatives of the utilities emphasized the human resources aspects of their organizations. The employees of utilities are subject to the same disasters as other people in a region, and their needs have to be recognized and met.

GOVERNANCE

In the area of governance, presenters emphasized the need for collaborations within government and between the public and private sectors. Nongovernmental organizations can bring an energy and creativity to resilience planning and disaster recovery that government agencies cannot achieve. Government ought to

facilitate and not stymie the efforts of others to increase disaster resilience, they said. Government also has a responsibility to disseminate information about hazards and disasters so that people can be prepared and know what to do when a disaster occurs. Government officials themselves need education about hazard mitigation and risk management if they are to do their jobs effectively.

SOCIAL CAPITAL

The panel discussion on social capital—a term the committee used to refer to the "social infrastructure" of a community—raised an often overlooked point regarding disasters. Several participants noted that while disasters can be extremely destructive, they also can provide opportunities to create much higher levels of resilience than existed before a disaster. Infrastructure can be rebuilt to higher standards. The disruption of services can give organizations a chance to reassess the needs of their clients and how to meet those needs. This re-visioning of services often means moving toward greater flexibility and decentralization. Some nongovernmental organizations emerge from disasters stronger than before, often because they have strong leaders and ties to agencies and people outside an area. Resilience can even spread beyond the area where a disaster occurred, when other organizations emulate the steps being taken by organizations that are rebuilding after a disaster.

HEALTHY POPULATIONS AND RESPONSIVE INSTITUTIONS

Partnerships are essential among institutions that provide public health, medical, and mental health services, said presenters during the final discussion panel. Disasters often cause the dislocation of individuals and populations, requiring that systems be available to access information about individuals even when they are seeking services from a new organization. For example, health care providers need to quickly access medication, diagnoses, special medical needs, and other information to provide the best possible care, which requires that this information be available electronically. Health care providers may themselves require health and mental health services, again emphasizing the human dimension of resilience. Partnerships with multiple entities can provide redundancy and needed resources. A number of discussants noted that the federal and state governments have an important role to play in providing resources that transcend those available locally.

1

Introduction

Natural disasters are having an increasing effect on the lives of people in the United States and throughout the world. Every decade, property damage caused by natural disasters and hazards doubles or triples in the United States (USGS, 2007). More than half of the U.S. population lives within 50 miles of a coast (USGS, 2005), and all Americans are at risk from such hazards as fires, earthquakes, floods, and wind. The year 2010 saw 950 natural catastrophes around the world—the second highest annual total ever—with overall losses estimated at $130 billion (Munich Re, 2011).

The increasing impact of natural disasters and hazards points to the increasing importance of resilience at the individual, local, state, national, and global levels. Webster's Dictionary defines *resilience* as "the ability to recover easily from illness, change, or misfortune." To be resilient, an entity must be prepared for an event and must be able to respond effectively when an event occurs. Developing resilience is therefore a continuous process, while resilience itself is the outcome of that process.

To identify ways in which to increase the nation's resilience to natural disasters and hazards, the National Research Council formed the Committee on Increasing National Resilience to Hazards and Disasters (Appendix A) under the joint oversight of the Committee on Science, Engineering, and Public Policy and the Disasters Roundtable. The name of the study committee is meant to be expansive rather than restrictive. Thus, the term "national resilience" refers to resilience at the federal, state, and local levels. Also, while the committee is focused on hazards and disasters arising from natural processes, its purview includes events caused by humans, such as acts of terror, with effects comparable to those of major earthquakes, floods, storms, or fires.

The overarching goal of the committee is *to increase the nation's resilience at federal, state, local, and community levels through actionable recommendations and guidance on the best approaches to reduce adverse impacts from hazards and disasters*. Specifically, the committee seeks to

- Define "national resilience" and frame the primary issues related to increasing national resilience to hazards and disasters in the United States.
- Describe the state of knowledge about resilience to hazards and disasters in the United States.
- Provide goals, baseline conditions, or performance metrics for resilience at the U.S. national level.
- Outline additional information or data and gaps and obstacles to action that need to be addressed to increase resilience to hazards and disasters in the United States.
- Present conclusions and recommendations about the approaches that are needed to elevate national resilience to hazards and disasters in the United States.

At its first meeting in September 2010, the committee adopted a provisional definition of resilience:

The ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events.

This definition encompasses a very wide range of topics and considerations, including

- Improving coordination and organization among the various entities that have roles in all phases of disasters.
- Determining successful practices, as well as means to improve on these practices.
- The need to integrate information from the natural, physical, technical, economic, and social sciences.
- Measures of a community's ability to withstand disasters.
- Assessments of progress toward successful recovery from a disaster.
- Cross-cutting topics, such as critical infrastructure, insurance and reinsurance, and ways that hazards cascade into disasters or catastrophes.

Underlying these issues are several more fundamental questions: What makes a community resilient? How can resilience be measured? How can progress toward achieving resilience be assessed? What tools are most effective for enhancing resilience?

Also at its September 2010 meeting, the committee made plans to conduct regional workshops in three locations—the coast of the Gulf of Mexico, the Midwest, and Southern California. The first of those workshops was held in New Orleans and along the Mississippi Gulf Coast on January 18–21, 2011, and focused on addressing the points of the statement of task through examination of the effects of hurricanes, including Hurricane Katrina, and human-induced disasters on the Gulf Coast and the resilience of areas near the coast to future disasters (Appendix B). Experts who provided input to the committee at the meeting represented a wide range of perspectives on disaster resilience, including physical and engineering sciences, social sciences, local and state government, the private sector, public health, and community-based organizations (Appendix C).

This report summarizes the presentations and discussions that occurred during the workshop. After this introductory chapter, Chapter 2 provides two complementary perspectives on New Orleans before and after Katrina. Chapter 3 summarizes what the committee saw and heard on a day-long tour of New Orleans and the Mississippi Gulf Coast to gather information relevant to the committee's charge. Chapters 4 through 8 summarize the presentations and discussions that occurred as part of workshop panels on five key themes: (1) insurance and real estate, (2) critical infrastructure, (3) governance, (4) social capital, and (5) healthy populations and responsive institutions. A final chapter summarizes the observations made in the open discussion during the final session of the workshop.

A national strategy to increase resilience to hazards and disasters can take advantage of substantial assets in the United States. The nation has a rich body of technical, natural, and social science knowledge about disasters, disaster causation, cascading effects, preparedness and planning, response, recovery, and mitigation. Both the workshop on the Gulf Coast and the committee's overall study seek to build on this knowledge to increase public safety, sustain economic productivity, and protect the human and natural environment.

Statement to the Committee from Senator Mary Landrieu

At the beginning of the committee's workshop, Senator Mary Landrieu, who in 1996 became the first woman from Louisiana elected to a full term in the U.S. Senate, spoke to the committee in a videotaped presentation about its project. Her remarks below have been slightly shortened. The complete video of Senator Landrieu's remarks is available on the study's Web site at *http://www.dels.nas.edu/global/dr/Collaborative-Projects.*

I'd like to commend you for undertaking this research that is so critical to our nation's future, and frankly of such interest to the world. Increasing our resilience

to disasters through solid science, targeted investments, and community and political will, will ultimately save countless human lives and billions of dollars.

I'm so pleased that the National Academy of Sciences has chosen to hold its first regional workshop with this important study in Louisiana. Louisiana has benefited from the wise counsel of the National Academy of Sciences on issues such as coastal restoration, flood mapping, flood protection, and levee construction.

Gathering in New Orleans allows the Academy to hear directly from people who have experienced disasters firsthand. Frankly, and unfortunately, I guess, there are no better experts than those who have lost their homes and suffered through the tragedies of so many hurricanes and floods, and then the oil spill in our part of the country. The stories you will hear are about survival, hope, and a never-ending well of resilience.

In the aftermath of the federal levee failure during Hurricane Katrina, the flooding and widespread destruction brought by Rita, Gustav, and Ike, and the massive oil spill that followed the explosion of the Deepwater Horizon oil rig last year, we have overcome many significant challenges and learned a great deal about ourselves in the process. We're happy to share what we have learned with you.

Significant hurdles lie ahead for the people of the Gulf Coast as we continue to recover from these events, but the people of this region press on, sustained by their unwavering determination to rebuild homes, lives, and livelihoods—a commitment to our communities. We are blessed with an immense and wonderful culture and a great plethora of natural resources.

We also know in our hearts and in our minds that people can live safely at or below sea level. We have to have the right science, the right engineering, and the right commitment to make that possible. We've dedicated ourselves not only to rebuilding, but to building smarter and stronger; not to rebuild what we were but to build what we dreamed we can be.

Restoring our fragile coastline, bolstering emergency plans and capabilities, and improving offshore drilling so that we can do it safely and securely are all important goals of ours. In addition to becoming more resilient, we're also creating communities that are more sustainable by making them safer, healthier, more livable, and more economically vibrant.

In New Orleans alone, we've rescued a failing public school system; developed the largest per capita presence of charter schools anywhere in the country having tremendous success; and embarked upon a comprehensive reconstruction program to offer state of the art facilities to our children. The region has developed a network of community healthcare clinics better than the healthcare system that existed before, offering preventive care and mental health services throughout the city.

Governments must do a better job of communicating disaster risk, training, and exercising for emergencies. Adopting and enforcing building codes, investing in hazard mitigation, and leveraging the skills and resources of community nonprofits and the private sector are only a few things that we must continue to do.

Households, in turn, and individuals must do their best to plan ahead, maintain their property, prepare a supply kit, heed local evacuation orders, and purchase reasonable levels of insurance.

Improving resilience to disasters must not be an afterthought, nor is this merely an academic exercise. It is my sincere hope that this study will increase the urgency around this important issue and help transform it into a national priority.

We also can look to other nations. The Netherlands is one. I've made three trips to the Netherlands to think about how they operate using water—not running from it but learning to live with it. We are a water city in New Orleans. We hope to incorporate many of the lessons we've already learned in the Netherlands and from some of our partners around the world. I know that your eyes will be national, but international opportunities are there as well, for what we can do better here in the Gulf of Mexico.

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New Orleans Before and After Katrina

Two speakers at the workshop provided historical perspectives on the experiences of New Orleans with hurricanes. Craig Colten, the Carl O. Sauer Professor of Geography at Louisiana State University, compared the experiences of New Orleans during Hurricane Betsy in 1965 and Hurricane Katrina in 2005 to track the evolution of resilience in the city over the past half century. Allison Plyer, co-deputy director of the Greater New Orleans Community Data Center, provided a statistical analysis of the New Orleans Metropolitan Area since Katrina to highlight both the accomplishments and the challenges of the post-Katrina period.

FORGETTING THE UNFORGETTABLE: CRAIG COLTEN

On September 9, 1965, Hurricane Betsy struck New Orleans with winds over 100 miles per hour. At the time, except for the shore of Lake Pontchartrain, only modest barriers protected shorelines from flooding, and the city had more residents than it does today. The storm, which inundated less than half the urban area of New Orleans, caused considerable but not overwhelming damage to residences, and the state of Louisiana suffered just over 80 deaths (Colten and Sumpter, 2008).

Almost exactly 40 years later, the city had a much more formidable hurricane protection levee system, and the population of the city had fallen from 627,000 residents in 1965 to circa 437,000 residents just before Katrina (Kates et al., 2006; Williamson, 2010). Yet a staggering number of homes were seriously flooded or destroyed, and the storm caused more than 1,500 deaths throughout Louisiana (Kates et al., 2006).

After Hurricane Betsy, Louisiana Governor John McKeithen pledged that "nothing like this will happen again" and asserted that his administration would "establish procedures that will someday in the near future make a repeat of this disaster impossible." Forty years later a storm of lesser magnitude caused far worse damage and fatalities. "Had the lessons of Betsy been retained?" asked Colten during his presentation. "Had they been woven into hurricane preparations and used to make the city more resilient?" The answer has to be no. Resilience eroded in the city of New Orleans between the two events, Colten said. The city did not retain the lessons of past hurricanes, and it did not plan or prepare adequately for future events. This erosion of resilience has implications for any other city that faces repeated disruptive events.

Resilience Defined

Colten defined resilience as the ability of a community to rebound after an extreme or stressful event to either the same condition or to a functional state. This definition can apply to either ecological or human communities, he observed. But human communities have the ability to learn, adapt, and adjust to subsequent disruptive events, so long as they retain lessons learned in previous events and use those lessons to adapt to future events.

Given this definition, the term *resilience* implies a community that anticipates problems, reduces vulnerabilities, responds effectively to an emergency, and recovers rapidly to a safer and fairer functional state. To achieve resilience, communities need to make deliberate efforts to infuse preparations with historical perspectives and to convey lessons to each generation of leaders, Colten said. They need to preserve, nurture, integrate, and perpetuate social memories of past events and use these memories as growth points for the renewal and reorganization of socioecological systems (Adger, 2000).

Changes Between 1965 and 2005

One area where there was significant improvement between the two hurricanes was in storm forecasting. The forecasting tools in 1965 included early radar systems, hurricane hunter flights, and networks of ship reports. Two days before the landfall of Betsy, the city of New Orleans and federal officials had already launched full preparation for the hurricane. A day before landfall the warning area extended from Texas to Florida.

In 2005 the National Hurricane Center produced a nearly perfect track for the hurricane 72 hours before landfall (e.g., *http://www.ncdc.noaa.gov/special-reports/katrina.html*; accessed May 30, 2011). This emphatic warning provided impetus for the evacuation of able-bodied people and the provisioning of shelters, although many people with special needs still did not have enough time to evacuate from the city.

Colten identified four key elements that have been involved in the loss of resilience between the two hurricanes: (1) flood-proof architecture, (2) protective structures and land use, (3) local evacuation and multiple shelters, and (4) the coordination of the organizational response. Colten offered a historical context to understand these factors before Hurricane Betsy and between Betsy and Katrina.

Architecture

From the colonial era into the 1920s, Colten noted that many New Orleans homes were elevated above the floodplain. This was usually done to make them cooler in the summertime, but it also provided protection against floods. Early construction also often relied on waterproof materials such as cypress and tile, which provided some degree of resilience even when structures were not elevated.

After World War II, houses built on concrete slabs raised just a few inches above ground level largely replaced raised houses in the city limits. The city planning office noted that this slab on-grade housing was a mistake after the hurricane of 1947, but no steps were taken to restore safe construction. These houses became the dominant type of construction and were allowed by building codes (Colten and Sumpter, 2008).

Land Use

After New Orleans was founded in 1718, early settlement clustered on the narrow high ground of natural levees near the river, which provided the only solid footing and were the last areas to flood and the first to drain after flooding (Figure 2-1). As the city grew during the 19th century, it spread along the high ground, avoiding more flood-prone areas (Kates et al., 2006).

In the 20th century, housing extended into more susceptible areas as New Orleans became one of the largest cities in the United States. After a devastating hurricane in 1915 drove storm surge beyond the lakefront and into the sprawling city, the city turned to structural protection. It built a 9.5-foot seawall on the lakefront, which was completed in 1934, to keep water out of the city's "back door." With that barrier in place, the city expanded toward the lakefront during the economic boom of the 1920s, facilitated by public works programs that drained low-lying areas and provided water and sewer lines. By the beginning of the Great Depression, the neighborhoods of Lakeview and Gentilly were developed, and the inhabitants believed them to be safe despite their low elevations (Kates et al., 2006; see maps in Appendix D for locations of New Orleans neighborhoods).

A 1947 hurricane rekindled concern, Colten indicated, but the lakefront levees provided good protection, and developers felt it was safe to extend urban sprawl. The U.S. Army Corps of Engineers built the Jefferson Parish lakefront levee along with other levees to protect urban areas and waterways.

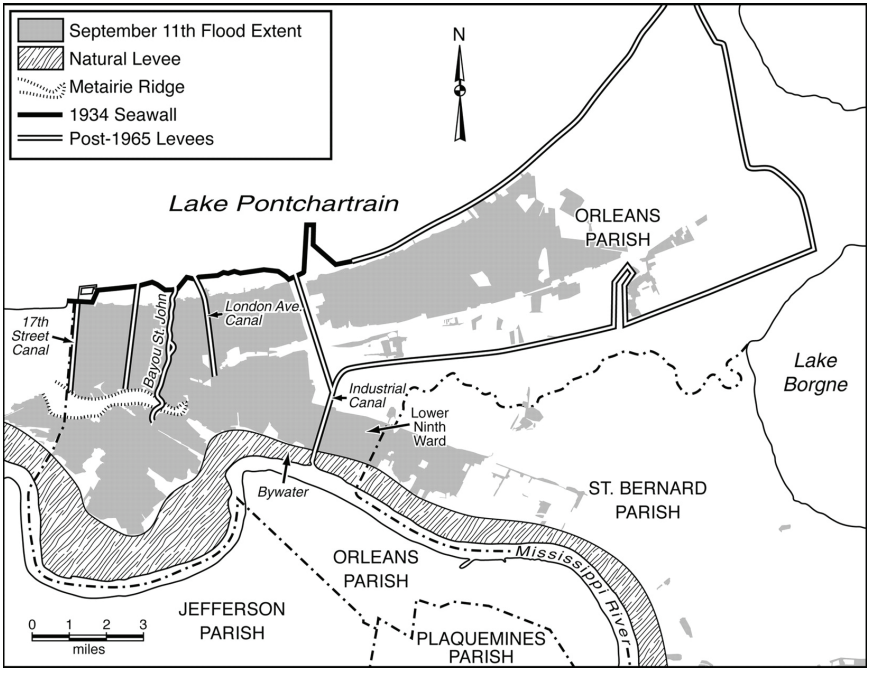

FIGURE 2-1 Development occurred in areas protected by an expanding levee network between 1900 and 2005. For additional maps, see Appendix D. SOURCE: Kates et al., 2006.

Following Hurricane Betsy, the city and state appealed for enhanced structural protection to what was then a modest system. The Corps of Engineers provided a plan to Congress in July 1965 for new levees, and the plan was approved. Progress fell chronically behind schedule and the plan had not been finished in 2005, though it had originally been scheduled for completion in 1978 (USGAO, 2005; Colten and Sumpter, 2008).

Many of the new levees protected uninhabited areas, which meant that their cost could be justified only if these areas were developed. With new levees in place, urban growth largely ignored prior floods. The levees excluded the entire city from the 100-year floodplain,[1] though 67 percent of the city's homeowners had flood insurance to guard against freshwater floods (Colten, 2005; Meitrodt and Mowbray, 2006).

[1] A 100-year floodplain is the area that will be inundated by a flood having a 1 percent chance of being equaled or exceeded in any given year. See http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/flood_zones.shtm (accessed May 30, 2011).

As levees were extended following Betsy, many new subdivisions were platted in areas that were flooded in 1965. For example, 22,000 new homes were built in New Orleans East between the 1960 and 1980 censuses, representing a massive expansion of housing in areas below sea level. Jefferson Parish underwent dramatic growth during this period, with the population more than doubling. Metropolitan New Orleans added 150,000 housing units between 1965 and 1985, most of them in areas behind new but uncompleted levees (Colten and Sumpter, 2008).

Another consequence of the widespread construction of levees was subsidence of the land. When the areas behind levees were drained, the land compacted and lowered, increasing the susceptibility of housing to extreme damage if the levees failed or were overtopped.

Evacuation

During the 1965 hurricane, planning emphasized local evacuations. More than 180 shelters were available and easily accessible, so people could evacuate within minutes. Many sturdy two-story neighborhood schools were designated as shelters, providing safety, cooking facilities, and toilets. Other shelters included military bases that provided for basic needs. The state plan had enough food to provide for more than 400,000 people for 2 weeks before the storm, and cots were set up before the storm arrived (Colten and Sumpter, 2008).

On the eve of Hurricane Betsy, warnings were sent out to people living in lower coastal parishes, and city residents were urged by radio, television, and newspapers to relocate to shelters. Evacuation routes marked in previous years showed the way, and more than 300,000 people evacuated low-lying coastal areas in Louisiana (Goudeau and Conner, 1967). Many walked or took public transit, so they were not dependent on private cars.

After Betsy, development outpaced available levels of protection. With the new levees, deep submersion of the city was possible, so it was no longer possible to evacuate locally. People would need to evacuate long distances, which meant that evacuations would rely largely on private automobiles. But many people had no access to private transportation. Also, many public facilities—such as hospitals, jails, and nursing homes—opted not to evacuate given the expense of doing so.

Although at least 800,000 people left the urban area in 2005 (*http://www.dhs.gov/xfoia/archives/gc_1157649340100.shtm*; accessed May 30, 2011), some 100,000 remained behind (Heitman, 2010), and there were inadequate provisions for those who did not evacuate. Some people were stranded in their homes. Others fled to neighborhood schools and broke into the buildings. Others went to the convention center after the storm, seeking rescue or supplies. Approximately 10,000 people congregated at the Superdome (Filosa, 2005), and people were told to bring 3 days' worth of their own food. Then the roof of the Superdome failed during the storm.

Response

The primary planning for the response to Hurricane Betsy was done by the Department of Civil Defense, which maintained lists of shelters and coordinated response planning. The military also played an important role, with the Coast Guard performing rescues and the National Guard providing security, and local governments providing an array of police, fire, and other services. Though there was some criticism after Betsy about the need for greater coordination, there was a remarkable lack of bickering across levels of government, said Colten.

During Katrina, the National Weather Service did an admirable job of forecasting the storm, and the city declared a mandatory evacuation with reasonable lead times. But the failure of the levees disrupted response procedures and interfered with communications. While the Coast Guard and the fire department were among the few organizations that received praise, the storm became a major social calamity, Colten indicated. The scale of the event exceeded the ability of organizations to respond at an appropriate scale. This failure at all levels led to finger pointing rather than a sense of shared responsibility, as after Betsy.

Changes Since Katrina

In general, said Colten, the lessons that should have been learned from Betsy and other hurricanes were not heeded before Katrina, and many of these lessons still are not being heeded. Although the levees are under repair and new surge barriers are in place, the city's footprint has not been fundamentally reduced, even though the corps no longer considers the levees around New Orleans to provide protection against a 100-year flood event. Today, many houses in New Orleans are below sea level, and even some of the houses built after Katrina are ill suited for high water, said Colten.

After a protracted public process, New Orleans adopted a plan that opens the entire city to redevelopment while targeting certain areas for rebuilding, renewal, and redevelopment. Building can occur in most of the areas that were flooded and remain susceptible to future floods.

Great improvements have occurred in preparing for the evacuation of the infirm, as demonstrated by the much more successful evacuation carried out before Hurricane Gustav in 2008, and plans have been made for the establishment of more local shelters. Nonetheless, long-distance evacuation remains the major response plan.

A congressional select committee concluded that many failures in the emergency response during Katrina were attributable to inadequate cooperation and communication among government bodies responsible for preparation and response. Despite the emergence of spontaneous groups such as Common Ground to fill this void, merging their efforts with those of existing agencies and nongovernmental organizations remains problematic, Colten indicated.

Resilience as a concept is gaining widespread application. But after a calamity, immediate and deliberate steps need to be taken to identify and archive effective resilience techniques, Colten said. Social memories need to be perpetuated at all levels and all stages to enhance emergency response, recovery, and long-term reconstruction. Today, memories of Katrina remain strong, which has motivated change. Will these memories still be motivating similar behaviors when the next major hurricane strikes New Orleans?

THE NEW ORLEANS INDEX AT FIVE: ALLISON PLYER

The New Orleans Metropolitan Area has sustained three major shocks in the last five years: (1) Hurricane Katrina, (2) the economic recession that started in 2008, and (3) the oil spill caused by the explosion of the Deepwater Horizon drilling rig in 2010. Yet New Orleans is rebounding from all of these events, said Allison Plyer, co-deputy director of the Greater New Orleans Community Data Center. It has become more resilient and is better positioned to not only adapt but transform itself in the future. Plyer added that key economic, social, and environmental trends in the New Orleans Metropolitan Area remain troubling and are testing the region's path to prosperity.

The Greater New Orleans Community Data Center publishes the *New Orleans Index* with the Brookings Institution, which began publishing the index after Hurricane Katrina. For the fifth anniversary edition of the index, the Community Data Center and the Brookings Institution examined trends in the New Orleans Metropolitan Area across the past 30 years to look more deeply at issues of resilience. The resulting analysis, along with seven essays on aspects of resilience and recovery by local scholars, are being included in a book published by the Brookings Institution Press (see also Liu and Plyer, 2010)[2].

Measures of Prosperity

The New Orleans Index looks at four dimensions of prosperity: (1) economic growth, (2) inclusive growth, (3) sustainable growth, and (4) quality of life. The metropolitan area includes the seven parishes of Orleans, Jefferson, St. Bernard, St. Charles, Plaquemines, St. John, and St. Tammany, though in some cases the analysis includes the three additional parishes of St. James, Tangipahoa, and Washington. The index also compares the New Orleans region to 57 "weak city"

[2] Allison Plyer's remarks are sourced from a report of the Brookings Institution and the Greater New Orleans Community Data Center called "The New Orleans Index at Five: From Recovery to Transformation," released in August 2010 [http://www.brookings.edu/reports/2007/08neworleansindex.aspx]; the Power Point presented by Ms. Plyer derives from that report and can be found here: *https://gnocdc.s3.amazonaws.com/NOIat5/NOLArecoveryBriefing.ppt*. Both links accessed May 30, 2011.

metropolitan regions—older industrial cities that, like New Orleans, have experienced decades of relative economic decline.

Employment data for New Orleans show a great deal of variation in the last 5 years (Figure 2-2). It lost jobs immediately after Katrina, gained jobs during the initial stages of recovery, and then lost jobs again during the recession. However, New Orleans shed fewer jobs when the recession hit, losing only 1.4 percent of all jobs between 2008 and 2009 compared with 4.3 percent nationally. Post-Katrina rebuilding and the relative strength of the oil and gas industry helped the area weather the recession better than the norm (Liu and Plyer, 2010).

The index looks specifically at "regional export industries" that serve customers outside the region. As a broad rule of thumb, every export industry job supports about two local serving jobs. For example, one job in the oil and gas industry might support the equivalent of two dry-cleaning jobs, with export industry jobs typically paying higher wages than local serving jobs, Plyer said.

The economy of the New Orleans Metropolitan Area has been diversifying (Figure 2-3). Among regional export industries, jobs in the oil and gas industry, shipping, and ship building have dropped since 1980, as have jobs in tourism

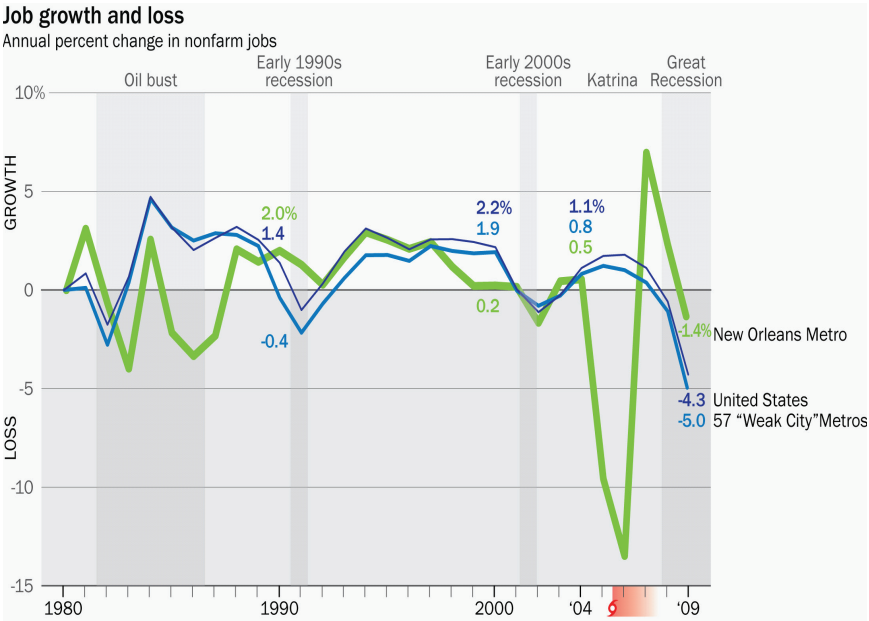

FIGURE 2-2 Job growth and loss in New Orleans (green line) rebounded after Katrina and did not decline as much in the recent recession as the national average. SOURCE: Liu and Plyer, 2010.

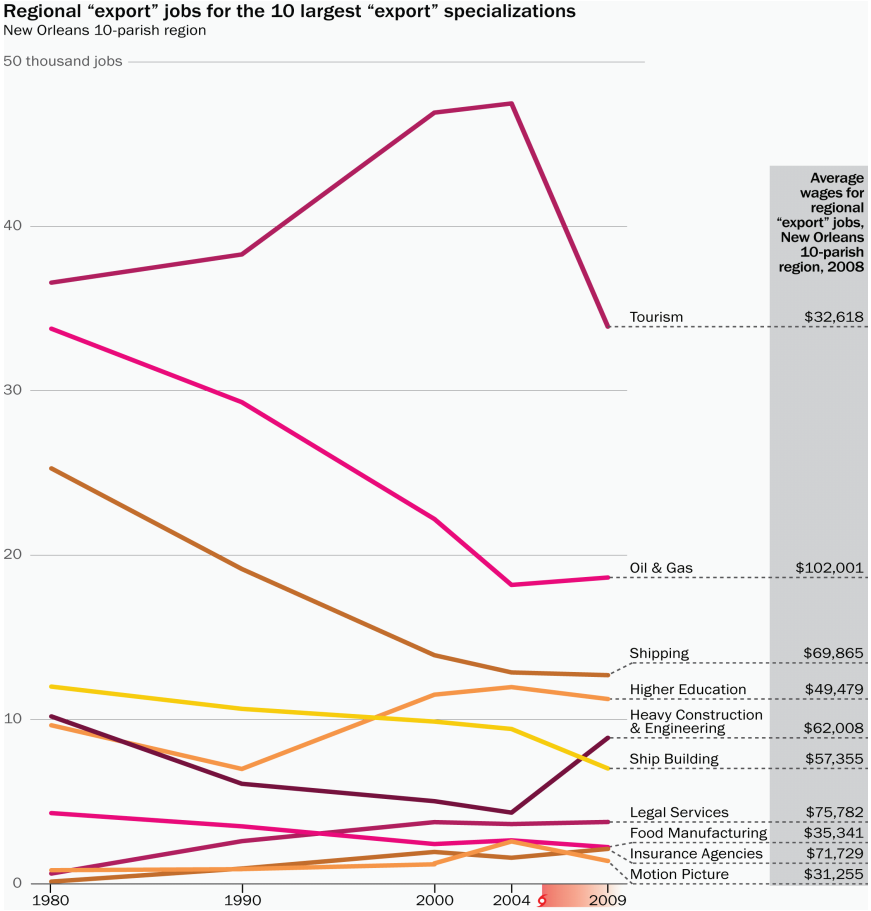

FIGURE 2-3 Regional export jobs for the 10 largest export specializations have declined in traditional industries but are expanding in knowledge-based industries. SOURCE: Liu and Plyer, 2010.

since Katrina. In contrast, jobs in knowledge-based industries, such as higher education, legal services serving clients outside the region, and insurance, have increased in number. In 2009, for example, jobs in higher education became the fourth largest economic driver in the metropolitan area, exceeding shipbuilding, heavy construction, and engineering (Liu and Plyer, 2010).

Wages in the New Orleans Metropolitan Area have grown by nearly 14 percent in the last 5 years—to about $45,000 in 2008 inflation-adjusted dollars—approaching the national average for the first time since the mid-1980s

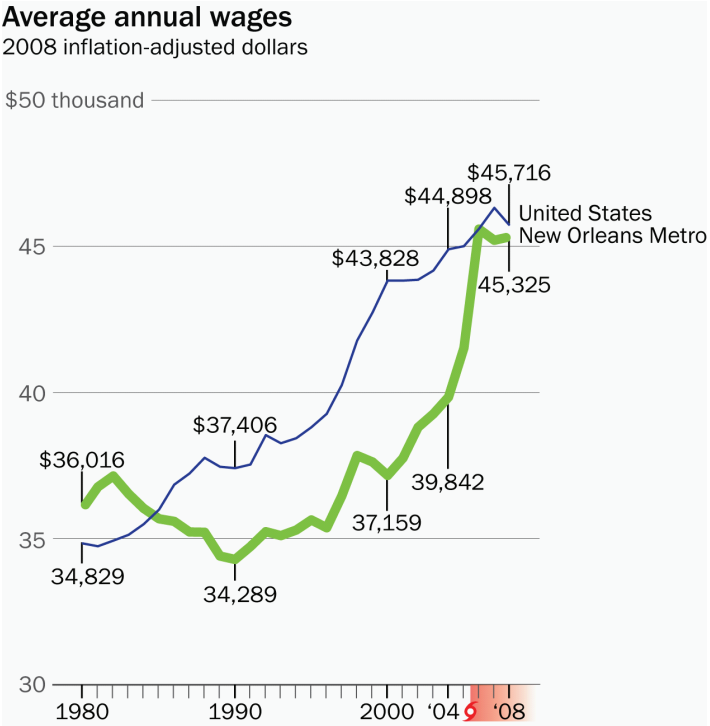

FIGURE 2-4 Wages in New Orleans surged 14 percent after Katrina but have stagnated since 2006. SOURCE: Liu and Plyer, 2010.

(Figure 2-4). This increase in wages started before Katrina as knowledge-based industries grew, and accelerated after the storm. The median household income also grew by 4 percent from 1999 to 2008 while national median household incomes declined. These changes are due to some extent to the loss of lower-paying jobs among people who could not afford to return to the New Orleans area after the storm. However, tracking where people have moved and what has happened to them after Katrina has been difficult, so the effects of demographic changes on average incomes are very difficult to determine.

The rate at which New Orleanians are creating new businesses is higher than the national average, after lagging behind the national average before Katrina. The number of arts and culture organizations in the city also grew from 2004 to 2007, from 81 to 86, despite the city's smaller population after Katrina (Liu and Plyer, 2010).

A greater share of students attend schools that meet state standards of quality—59 percent compared with 30 percent in 2004—which is also a trend

that accelerated after Katrina. Furthermore, these gains have occurred across all of the parishes (Liu and Plyer, 2010).

Resilience Factors

Plyer analyzed five factors that help determine resilience: (1) a strong and diverse regional economy, (2) large shares of skilled and educated workers, (3) wealth that can be deployed in strategic ways to adapt when a shock hits, (4) strong social capital, and (5) community competence.

Of these five, New Orleans has exhibited particular strength in the last three since Katrina, she said. For example, it has experienced a significant increase in community participation. More New Orleanians are involved in shaping public policies. New Orleanians are "more likely than residents of other cities to attend public meetings. . . . Individuals and groups have become more strategic and sophisticated . . . and there is greater cooperation between organizations, including the emergence of new umbrella groups" (Liu and Plyer, 2010).

The recovery has seen the rise of sophisticated resident and community groups. These groups are pursuing holistic strategies to revive entire neighborhoods and are engaging in effective policy advocacy to pursue economically integrated housing and neighborhoods, Plyer indicated. The federal government has "taken steps to overhaul the troubled housing authority," and low-income households are being provided with quality, permanent, and affordable housing (Liu and Plyer, 2010).

After years of meetings, New Orleanians have an approved master plan designed to guide the city toward a modern and secure future that also recognizes the culture and history of the city (see *http://www.nolamasterplan.org/*; accessed May 30, 2011). The plan provides for predictable development and formalizes the community participation process. "Citizens and civic leaders have also advocated for and won critical governance reforms, such as the consolidation of the levee boards, the merger of the city's seven property assessors into one office, [and] the creation of the Office of the Inspector General. . . ." (Liu and Plyer, 2010).

In the area of education, the majority of the schools in the New Orleans school district were converted to charter schools after Katrina. Many school facilities have been upgraded, and new teachers have been recruited. A higher percentage of eighth and fourth graders are proficient in mathematics and English today than before the storm (Liu and Plyer, 2010).

In health care, the metropolitan area now "provides access to primary care and outpatient mental health services at 93 sites across four parishes. . . . Emergency room visits have declined as patients have increased their visits for preventive care" through this new system of health care delivery (Liu and Plyer, 2010).

In the criminal justice area, programs have begun to offer alternatives to incarceration. New legislation establishes an independent police monitor as part

of the Inspector General's Office and new interagency partnerships across the criminal justice system (Liu and Plyer, 2010).

With respect to the coastal wetlands, acknowledged as important for flood protection, the state created the Coastal Protection and Restoration Authority. A plan for coastal restoration has also been passed by the state, and the need for better land-use and land-use management plans has been recognized, including the adoption of a statewide building code (Liu and Plyer, 2010). At the federal level, the Obama administration released a roadmap to guide federal efforts to restore coastal ecosystems of Louisiana and Mississippi (see *http://www.whitehouse.gov/administration/eop/ ceq/initiatives/gulfcoast/roadmap*; accessed May 30, 2011).

All of these reforms "need a lot more work," said Plyer, but many were "essentially unimaginable before the storm."

Remaining Obstacles

Despite this progress, several indicators point to continuing difficulties as New Orleans seeks to recover from Katrina. First, money remains a serious constraint. Hurricanes Katrina and Rita combined caused an estimated $150 billion in damages across the Gulf Coast. The federal government spent an estimated $126 billion on the recovery effort, but much of that money went to such short-term measures as emergency rescue operations and short-term housing. Only about $45 billion of that money went to rebuilding. Private insurance provided about $30 billion for reconstruction, and philanthropies provided about $6 billion—three times as much as for any other event in history. Even with expenditures of that magnitude, a gap of about $70 billion remains (Ahlers et al., 2008). "We are going to see the effects of Katrina in our communities for probably our lifetime because there's not enough money to rebuild."

Furthermore, major industries, including oil and gas, and shipping, have all declined since 1980. To some extent, a rise in tourism made up for the loss of jobs in oil and gas, but the number of tourism jobs is now lower than in 1980. The Deepwater Horizon disaster reinforced how vulnerable many industries in the region are to water-related disasters, though the 2010 oil spill provides an opportunity to use some of the funds from BP (British Petroleum) to clean up and restore the wetlands that protect the city.

Also, New Orleans may have lost educated workers after the storm. In 2008 the share of college-educated workers in New Orleans remained unchanged from 2000 at about 23 percent, but this number grew nationally (Liu and Plyer, 2010).

Income disparities remain stark among whites, Hispanics, and African Americans in New Orleans. Black and Hispanic household incomes are 45 and 25 percent lower than for whites, respectively. The New Orleans African American population has even lower household incomes than the national average for African Americans. The suburban parishes now house the majority of the metro-

politan area's poor (Liu and Plyer, 2010). This trend started before Katrina and is consistent with the national trend of the suburbanization of poverty.

Despite the growth in average wages and median household incomes in the metropolitan area, "renters in the city and suburbs still pay too much of their earnings toward housing" (Liu and Plyer, 2010). In Orleans Parish, 58 percent of renters, and 45 percent of renters in the metropolitan area, pay more than 35 percent of their pretax household income toward housing, compared with 41 percent of renters nationally. Homeowners in New Orleans also bear a higher cost burden than is the average nationwide (Liu and Plyer, 2010).

"Violent crimes and property crimes have risen" since Katrina "and remain above national rates," (Liu and Plyer, 2010) though they are lower than they were in 1990. The rates for both types of crimes in Orleans Parish are about double the national rates, Plyer said.

Meanwhile, coastal wetlands have continued to erode. More than 23 percent of the land around the New Orleans Metropolitan Area has been lost since measurements began in 1956; the impact of the oil disaster on the wetlands has not yet been measured (Liu and Plyer, 2010).

Principles for Recovery

Much of the recovery since Katrina has been aimed at bringing the city back to where it was before the disaster. But that is not enough, Plyer said. The goal must be transformation, not just preserving the status quo. In this regard, she identified three key principles for continuing the recovery.

The first is to sustain and build on post-Katrina reforms. Specific ideas suggested in Liu and Plyer (2010) include

- Increasing the pool of qualified teachers.
- Providing "sustained gap funding for community-based health centers."
- Building "capacity within local government to drive . . . improvements" among criminal justice agencies.
- Not rescinding or reallocating unspent hurricane recovery dollars and rather using those funds to address unmet housing needs, neighborhood rehabilitation, and community capacity.

The second principle is to embrace new opportunities presented by the recession and oil spill. Liu and Plyer (2010) suggest

- Investment in the restoration of coastal wetlands, and advancing the approach to live with water.
- Diversification of the economy, including the energy sector.
- Challenging entrepreneurs to generate creative business ideas that strengthen legacy industries.

- Expanding international export capacity through port modernization and multimodal freight strategies.
- "Increasing the capacity of small businesses, especially minority- and women-owned businesses," to participate in growth sectors.

The third principle is to strengthen "regional resilience to minimize future shocks and shape the future course" of events (Liu and Plyer, 2010). In this area, Liu and Plyer (2010) suggest that New Orleans should

- Diversify its economy and increase skills.
- "Expand local 'wealth' (e.g., tax base, private investment, philanthropy) to match outside resources."
- "Continue to nurture an open society where engagement, networks, partnerships, and collaborations can evolve organically."
- "Help maintain citizen participation as the community transitions from 'crisis' to implementation."

Becoming resilient is a marathon and not a sprint, Plyer concluded.

Discussion

During the discussion period, Plyer was asked about her vision for New Orleans in 2050. She responded that New Orleans has tremendous potential to lead in such areas as renewable energies, for example, by redeploying scientists and engineers involved in the oil and gas industries. Sectors of the U.S. economy, such as the military, and entire countries, such as China, have made a commitment to renewable energy, so a market exists. New Orleans culture has not emphasized innovation in the past, but the numbers of entrepreneurs in the city have grown since Katrina. "It's a matter of industry, will, and intention."

New Orleans also has the unique advantage of the Mississippi River, which it could use to increase its role in an export economy. The United States has many products that could be sold abroad, and the country needs to reverse its trade imbalances. New Orleans exists because of its port, and reforms to the port's governance and infrastructure could make the city a vibrant place. "We have allowed other ports to greatly supersede our capacity, like Mobile, Houston, et cetera, but they don't have the Mississippi River."

Finally, many new people are moving to New Orleans, which is changing the city's culture. "We enjoy Mardi Gras, but we're going to keep pushing to make it a modern city with a vibrant and future-oriented economy." Issues of inclusion and equity also need to be addressed as the city's culture changes, "because we can't be prosperous unless everybody is prosperous." Changing the culture is a lot of hard work, but the city already has a culture unlike that of any other city. Building on that culture could create a new future for the city.

In response to a question about the privatization of governmental services, Plyer responded that more evidence is needed to make generalizations that apply across sectors. In some cases the privatization of services in New Orleans after Katrina has had benefits, but in other cases the privatization of services has been tremendously inefficient. It "bends both ways."

Plyer also said that people in every neighborhood in the city tend to express the opinion that other neighborhoods are receiving more money than is their neighborhood. However, tracking the exact expenditures of recovery funds is very difficult. "Can we say for sure that Lower Nine is getting less than Lakeview? I don't know that there are any numbers that could show that. What we encourage folks to do is really to continue to build their capacity to advocate for what they need in their neighborhood."

Finally, in response to a question about climate change, Plyer observed that the U.S. Army Corps of Engineers has been commissioned to build levees that will protect the city against a 100-year storm. But that level of protection will not be adequate in the future. Many people in the city have become interested in the flood protection measures being built in the Netherlands, where protection against an 11,000-year storm is the goal. Pursuing such a goal for New Orleans would require a tremendous effort. "It's not going to happen overnight, but the folks who understand what it's going to take for the city to be sustainable will not give up that fight, because folks are not fooled into thinking that the levees will be sufficient."

3

A Tour of New Orleans and the Mississippi Gulf Coast

On the first full day of the workshop in New Orleans, committee members took a bus and walking tour of New Orleans and the Mississippi Gulf Coast. Led by Ronald Schumann III, a graduate student in geography at the University of South Carolina who grew up in the New Orleans area and became a licensed New Orleans tour guide, the committee stopped in four locations in Louisiana and Mississippi to talk with residents, government officials, and directors of nonprofit organizations. Other local experts joined the committee on the bus for discrete portions of their tour, including, in New Orleans, Pam Jenkins, professor of criminal justice and women's studies at the University of New Orleans; Doug Meffert, the Eugenie Schwartz Professor of River and Coastal Studies at Tulane University; Charles Allen III, director of the Office of Coastal and Environmental Affairs in New Orleans; and Tracy Nelson, director of the Center for Sustainable Engagement and Development. In Mississippi, the committee was joined by Tracie Sempier, coastal storms outreach coordinator for the Mississippi-Alabama Sea Grant Consortium.

This chapter describes what the committee saw and heard during its tour that illustrated some of the issues associated with resilience to hazards and disasters in New Orleans and along the Mississippi Gulf Coast.

THE NINTH WARD AND THE CENTER FOR SUSTAINABLE ENGAGEMENT AND DEVELOPMENT

Starting from the French Quarter, the committee traveled east through the neighborhoods of Tremé and Marigny to the Ninth Ward. In New Orleans, more disadvantaged groups tend to occupy neighborhoods at lower elevations, and

the Ninth Ward is one such neighborhood. Developed mostly between 1920 and 1970, the Ninth Ward, which is divided by the Industrial Canal into the Lower Ninth Ward and the Upper Ninth Ward, sits on drained swampland. Originally the most ethnically diverse neighborhood in the city, it became the least diverse after the 1960s. Pre-Katrina residents were primarily poor and working-class African Americans with a high rate of home ownership.

During Katrina, two sections of floodwall fronting the Lower Ninth Ward gave way, and a powerful surge of water, along with an illegally moored barge, flowed into the Lower Ninth. The neighborhood also suffered flooding from levee overtopping in neighboring St. Bernard Parish.

Many of the houses in the Lower Ninth Ward were destroyed in the flood (Figure 3-1). Today, many lots are empty or contain only a bare concrete slab. Many of the remaining houses are boarded up, some with a hole chopped in the roof where rescuers looked for survivors. The population has dropped from more than 17,000 before Katrina to 4,000 at most in the Lower Ninth Ward. People come into the ward to work on their property during the day, but they leave at night. Many former schools in the neighborhood also are closed, reflecting the reduction in student numbers and the conversion of many schools in New Orleans

FIGURE 3-1 Many homes in the Lower Ninth Ward of New Orleans were destroyed by flooding caused by Hurricane Katrina. Picture by Neeraj P. Gorkhaly

to charter schools. However, two-thirds of the congregations in the Lower Ninth Ward have returned to the area, and faith-based organizations have played a major role in the neighborhood's revival.

Several substantial recovery efforts are under way in the Ninth Ward. For example, the committee stopped at the Center for Sustainable Engagement and Development in the Holy Cross neighborhood, which is just south of the Lower Ninth Ward between the Industrial Canal and St. Bernard Parish. (The Holy Cross neighborhood is sometimes considered part of the Ninth Ward and sometimes treated as a separate neighborhood.) The Holy Cross neighborhood was built partly on the natural levee next to the Mississippi River, and its greater elevation gave it more resilience than the Lower Ninth Ward. The percentage of residents who have returned to the Holy Cross neighborhood is higher than in the Lower Ninth Ward—perhaps half of the 6,000 people who lived in Holy Cross before Katrina have returned.

At the Center for Sustainable Engagement and Development, the committee talked with Charles Allen III, a former director of the center and former president of the neighborhood association (who also spoke to the committee during its formal workshop the next day). As director of the center, Allen helped organize an ambitious effort that produced a recovery plan for the Lower Ninth Ward emphasizing sustainable development and green architecture. "We're below sea level, so we were discounted," Allen said. "People thought the neighborhood would go back to nature. As residents, we said, 'Oh, no you don't. We'll recover this neighborhood.'"

In the Holy Cross and Lower Ninth Ward neighborhoods, homes are being rebuilt and elevated, said Allen. Many organizations and individuals have donated materials and time to the recovery effort. Key strategies have been to rely on energy-efficient materials, sustainable recovery efforts, and the entrepreneurial spirit of residents. Some older houses in the Ninth Ward were built with cypress, glazed brick, and tile, all of which can be dried out after a house is flooded, and similarly resilient building materials are being used in the recovery effort. The Holy Cross neighborhood has embraced carbon neutrality as a high ambition. The entire neighborhood cannot be redeveloped at once, Allen acknowledged, so planners have been looking at the use of some areas as urban farms while letting other areas go back to nature.

An important lesson of Katrina, Allen added, is that "the neighborhoods brought back New Orleans." Neighborhoods need the support of government, but in some cases "it may be necessary for government to step out of the way."

The current director of the center, Tracy Nelson, has a background in architecture, historical preservation, and sustainable development. She spoke to the committee about the use of funds allocated by Congress for historical buildings affected by hurricanes Katrina and Rita. She also pointed out that neighborhoods in New Orleans are culturally and architecturally distinct, and their cultural identities can be as important as their built environments. In rebuilding the Lower

Ninth Ward, she said, the cultural identity of the neighborhood should shape the built environment in a sustainable way.

In rebuilding neighborhoods, it also is necessary to take advantage of available resources. For example, research is under way to investigate the use of the Mississippi River for hydrokinetic energy through in-stream energy generation systems, said Doug Meffert, the Eugenie Schwartz Professor of River and Coastal Studies at Tulane University and deputy director for policy at the Tulane/Xavier Center for Bioenvironmental Research, who also spoke at the center. "We need to look at water as a strategic resource," he said. The New Orleans area "is surrounded by water, but we are not benefitting from it as much as we should." The committee also passed by a variety of homes constructed by the Make-It-Right Foundation (Figure 3-2). Supported by actor Brad Pitt, the foundation has enlisted architects nationwide in designing green homes to foster a return of residents to the Lower Ninth Ward. About 150 homes are being constructed most of them elevated above the ground. The houses generally cost more than $250,000 to build, but fundraising is being done to lower their selling price to around $150,000 for residents. Also, talks were under way with a developer

FIGURE 3-2 The Make-It-Right Foundation has been building homes in the Lower Ninth Ward to replace the more than 4,000 homes destroyed by Hurricane Katrina. Picture by Neeraj P. Gorkhaly

to bring a grocery store to the Ninth Ward, even though the ward did not have a grocery store before Katrina.

Before leaving the Lower Ninth Ward, the committee stopped to view the Bayou Bienvenue Restoration Project, which is a component of the neighborhood's sustainability plan and the state's coastal restoration plan. Large parts of New Orleans were built on coastal wetlands of cypress tupelo swamps. Bayou Bienvenue was one of the last such swamps left in the city, but it had been largely degraded because of saltwater allowed into the swamp through water engineering projects. Previously this bayou and its ecosystem had been cut off from neighborhoods because of high levee and flood walls; now a stair gives access to this rebounding wildlife area—a net improvement to quality of life and ecosystem and flood protection. The swamp is being restored in part through the release of treated wastewater, which is pushing off the saltwater and supplying nutrients for the swamp's plants and animals. (This project also was discussed in the committee's New Orleans workshop the day after the field trip.)

The committee also drove through the Upper Ninth Ward, which sustained extensive flooding from another floodwall breach along the Industrial Canal (Figure 3-3). The committee viewed the Musicians' Village, an area of new home development spearheaded by several prominent New Orleans musicians including Harry Connick, Jr., and Wynton Marsalis, and the New Orleans Area Habitat for Humanity. The colorful houses have furthered the recovery of the neighborhood. However, they were built using Chinese sheetrock that is highly susceptible to mold, which has forced many of the residents to move out of their homes while they are gutted and refurbished.

NEW ORLEANS EAST AND THE VIETNAMESE COMMUNITY

New Orleans East is a suburban "city within a city" developed during the oil boom of the 1970s and early 1980s. The area, which is bounded by Lake Pontchartrain to the north, the Industrial Canal to the west, the Intracoastal Waterway to the south, and swamp and marshland to the east, was built to compete against suburbanizing Jefferson Parish to the west of the city (see Appendix D for locations). The lowest elevation in New Orleans—12 feet below sea level—is located in New Orleans East. Many people who live in New Orleans East work in the seafood or oil industries, both of which were seriously affected by Hurricane Katrina and by the 2010 oil spill in the Gulf.

Most of the homes in New Orleans East were flooded by Katrina. Today, as in the Ninth Ward, the recovery has been very uneven from neighborhood to neighborhood and lot to lot. Some people had no choice but to come back and try to reclaim their homes. Others had the means to relocate elsewhere and have not returned to New Orleans. The current population of New Orleans East is about 56,000, compared with 96,000 before Katrina. The University of New Orleans, which is built on fill next to Lake Pontchartrain in New Orleans

FIGURE 3-3 Flooding caused by Hurricane Katrina extended from the shore of Lake Pontchartrain (at bottom of photograph) through the Ninth Ward. Source: NOAA *(http://www.katrina.noaa.gov/helicopter/helicopter.html*; accessed May 30, 2011)

East, has about two-thirds of the approximately 17,000 students it had before the storm.

New building codes were not issued until well after the hurricane, so people who rebuilt quickly were subject to pre-Katrina codes. Some people have elevated their rebuilt homes above ground level, while others have rebuilt on grade. Many of the latter homes appear to be as vulnerable to flooding as they were before, and even the elevated homes may be vulnerable to wind damage. In general, the aftermath of the hurricane was marked by a conflict between getting people back into their homes and neighborhoods quickly and doing the long-term planning to create better housing and more resilient neighborhoods.

On the eastern edge of New Orleans East is the community of Village de L'Est, which is home to a large Vietnamese population. About 8,000 Vietnamese residents live among the heavily African American and Hispanic populations of New Orleans East. Before Katrina these groups did not have extensive interactions. But after the hurricane they were united by a number of causes, including a successful fight against a proposed landfill to accept debris from the storm. About

40,000 Vietnamese altogether live on the Gulf Coast, drawn to the area partly because of its climatic and geographic similarities to Vietnam.

The committee met with six members of the Vietnamese community in New Orleans East, with Tap Bui, the health outreach coordinator and community organizer for the Community Development Corporation, Inc., acting as translator. The six community members included Ms. Kim, Mr. Loc, Ms. Sy, Mr. Thien, Mr. Thieu, and Mr. Trung. These individuals described their community as hard working and cohesive and said that the Vietnamese community viewed the destruction caused by Katrina as an opportunity to rebuild the community to be even stronger. The most important assets of the community, said one participant at the meeting, were a spirit of hope and a spirit of community.

The Vietnamese community has a history of deprivation and hardship, especially among those who were not able to leave Vietnam in 1975 but came in later years. Many experienced tremendous losses in Vietnam and had to continually learn how to rebuild their lives. For example, most community members were not experienced in carpentry, but over the years they have been forced to learn. As one participant at the meeting said, "We are all carpenters now." They said that they did not need much to survive—"just a roof and a light," as one person put it. Reconstruction of homes and property was easier in the United States than in Vietnam, they said, because they had the support of local communities and governments. Also, the Vietnamese community in New Orleans East was larger and more cohesive than Vietnamese communities elsewhere in the United States, which was an advantage during the recovery period.

A large majority of the Vietnamese residents in New Orleans East are Catholic and attend the Mary Queen of Vietnam Church, with most of the rest of the community adhering to Buddhism. During Katrina the church was led by the Rev. Vien The Nguyen, who traveled by boat immediately after the hurricane to check on community members. The first mass was held in the church in October 2005 with just 20 or so families, but news that the church was open and operating spread among the community, and by December more than 2,000 people were attending masses.

Before the hurricane, the church had evacuation plans to help get residents out of town. About a third of the Vietnamese community consists of elders, so they needed special care to evacuate or to stay in place. Immediately after the hurricane, community members contacted everyone in the community to check on them. More than 90 percent of the Vietnamese community has returned to New Orleans East—a higher percentage than for the other ethnic groups in the area.

The captain of a fishing boat present at the meeting said that fishermen in the area got some help from government to rebuild their boats. However, government assistance came slowly, and the fishermen needed to get back to work, so they often spent their own money on repairs. They might borrow money from friends for repairs, and then lend out money when they were back in business. Later government assistance did defray some of their expenses, and some boats

were more severely damaged and required larger investments to repair. They were pleased and in many cases somewhat surprised to get funds from the government to complete repairs on their homes and boats. They also said that rebuilding would not have been possible without the support of the local, state, and federal governments, including the Federal Emergency Management Agency (FEMA).

The community members observed that they have received important government support in such areas as education and health care. Nonetheless, the community remains vulnerable to future shocks, and security remains a concern. The oil spill of 2010 had a serious impact on the community by first shutting down the seafood industry and then surrounding the industry with uncertainty. The future cohesiveness of the community is also an issue. The interpreter at the meeting said that she was one of the few young people in the community who remains fluent in Vietnamese. Many young people have left the community and have not returned. The community center used to teach Vietnamese, but it no longer does so, though Vietnamese is still taught through the Buddhist temple.

WAVELAND AND THE MISSISSIPPI COAST

Leaving New Orleans East, the committee took the new Highway 10 bridge across the eastern part of Lake Pontchartrain, which was rebuilt to be 20 feet higher than the span damaged during Katrina, to the town of Slidell, Louisiana, on the north shore of the lake. Many pre-Katrina New Orleans residents have relocated to the North Shore, along with several corporations. Slidell is a bedroom community of New Orleans developed mostly since the 1960s and is near the John C. Stennis Space Center in Mississippi. Stennis is a research, development, and testing facility for the National Aeronautics and Space Administration and the National Oceanographic and Atmospheric Administration and the Mississippi coast's largest single employer. Only waterfront homes in Slidell and adjoining areas suffered from storm surge, though the entire community experienced wind damage.

As in other parts of Louisiana and Mississippi, signs appeared in North Shore communities after Katrina warning of retribution if people were caught looting. In many areas affected by Katrina, law enforcement and military personnel were quite visible after the storm, which brought stability but also changed the atmosphere from one of cooperation to conflict.

Leaving Highway 10, the committee traveled to the Gulf Coast town of Waveland, Mississippi, a working-class suburban community of about 10,000 residents before Katrina that grew following the opening of the Stennis Space Center. Waveland is located southeast of Bay St. Louis largely on a coastal ridge with elevations averaging 10 to 15 feet above sea level (see Appendix D for locations). The storm surge during Katrina was as high as 25 to 30 feet in the city. The hurricane destroyed or damaged approximately 90 percent of residences and 100 percent of businesses.

A railroad embankment several blocks from the beach in Waveland carries the tracks of the CSX railroad. In previous hurricanes, the embankment has acted as a levee for portions of the town north of the tracks. In Katrina, however, storm surge came across the tracks and also entered Waveland from Bay St. Louis and other waterways (Figure 3-4), eventually making its way 12 miles inland from the shore (Appendix D). Of the 23 fatalities in Waveland, almost all occurred north of the railroad tracks, including a family of four whose home was covered by water.

The committee stopped at the Waveland Community Civic Center, which was rebuilt following Katrina to be more resilient to floods and wind. During Katrina, the water level was 11 feet inside the building, which was built on ground measuring 15 feet above sea level. The committee talked with David Garcia, the mayor of Waveland. Garcia was fire chief when Katrina hit and was among a group of rescuers in the fire station. When the station began to flood, they relocated farther from shore to the town's wastewater plant, where they helped the employees of the plant evacuate. After that, said Garcia, "we became victims rather than responders" as they sought to ride out the storm in the plant.

FIGURE 3-4 Sea grass on light pole demonstrates height of the storm surge in a neighborhood adjacent to Bay St. Louis. Source: Hazard and Vulnerability Research Institute, University of South Carolina

Between the beach and the railroad tracks, the town was largely destroyed. "I was born and raised here, and I knew people who said that their homes were hurricane proof," said Garcia. "Those homes are gone." In fact, where homes did survive, it was usually because debris from demolished homes formed a barrier that protected intact homes from the waves. Almost a million and a half cubic yards of debris had been removed from the town as of March 2007.

The population of Waveland, at approximately 5,000 people today, is a little more than half of what it was before Katrina. One thing that has slowed recovery is that the town's old trees had wrapped their roots around buried utility and sewer lines. When the trees were blown down in the storm, they ripped out the utilities, which have had to be largely replaced.

Another major impediment to recovery has been the expense of flood insurance. About 90 percent of the town is in a flood zone. Waveland participates in the Community Rating System in the state of Mississippi, which results in a premium reduction for residents who apply for insurance or renew their policy. But insurance remains very expensive, and rebuilding has been further slowed by the mortgage crisis. Partly to encourage rebuilding, the town has established a business incubator to revive economic activity.

Garcia said that the town "wasn't prepared for a storm event of that magnitude." Because the railroad embankment had protected homes north of the tracks in previous storms, fewer people evacuated from that part of town, which contributed to the higher fatality rate there. Garcia said that before Katrina it would have been impossible to get the entire town to evacuate, but after Katrina people knew that water can get north of the tracks. "When they see [emergency personnel] leaving, they know we are serious."

A major problem in the immediate aftermath of the hurricane was knowing where people were and if they had evacuated or were buried in debris. Considerable effort went into tracking people down after the hurricane to determine whether they had survived.

Communications is an important part of emergency preparedness in Waveland today. As part of the Turn Around Don't Drown Program, the town sends mailings to everyone in town to warn them of flood hazards. The information packets are geographically coded, so those in the highest risk areas receive additional information about their high risk. Discussion of rising sea level or climate change can generate strongly negative reactions among many residents, so emergency planners tend to talk in terms of higher and more frequent storm surges.

Garcia noted that the focus of media attention and relief efforts has been on New Orleans since Katrina. Some have referred to Waveland and other communities along the beach in Mississippi as "the forgotten coast," even though the storm devastated those areas.

GULFPORT, BILOXI, AND THE KNIGHT NONPROFIT CENTER

After leaving Waveland, the committee made its way along the shoreline of Bay St. Louis, where vegetation is reclaiming subdivisions that were decimated by the storm. Some rebuilt homes have been elevated 40 or more feet above ground level, requiring a climb of several stories to enter the front door.

The committee then drove along the Gulf Coast through the towns of Henderson Point, Pass Christian, Long Beach, Gulfport, and Biloxi. Many structures were destroyed in the first few blocks from the beach, only some of which had been rebuilt (Figure 3-5). Along some parts of the coast, a 15- to 20-foot bluff saved many historic homes, though the storm surge washed through the first floor of most residences. Many homes rebuilt near the beach received approval before new base-flood elevations were adopted. Many of these slab on-grade homes lack even wet flood-proofing.

Gulfport is the second largest city in Mississippi and one of the fastest growing cities in the state. Originally established as a lumber port in 1902, the port today handles mostly bananas, agricultural products, and chemicals. Biloxi was the historical capital of French Louisiana in the early 1700s. Biloxi's

FIGURE 3-5 Many homes in the blocks in the Gulf Coast were destroyed. Source: NOAA (*http://www.katrina.noaa.gov/helicopter/helicopter.html*)

economic base has transitioned from lumber and canning to seafood, tourism, and gaming.

Casino gaming became legal in 1990 for the Mississippi coast so long as casino structures were built over water. During Katrina, many of the casinos were heavily damaged, including several casinos on barges that broke up, floated inland, and were stranded several blocks from the beach (Figure 3-6). Post-Katrina laws allow gaming establishments to be located within 1,000 feet of the shoreline.

The committee's final stop was at the Knight Nonprofit Center in Gulfport, near Highway 10 and approximately 5 miles from the beach. Many nonprofit organizations lost their offices during Katrina, and after the storm several nonprofit organizations and foundations formed a partnership to buy a building from Harrah's Casino, renaming it the John S. and James L. Knight Foundation Nonprofit Center. Today more than 25 nonprofit organizations have administrative offices in the building.

The committee met with representatives of several nonprofit organizations (Box 3-1) who described the many benefits the center offers to nonprofits: The

FIGURE 3-6 Part of the Grand Casino Biloxi, which was floating off the beach of Biloxi, was deposited on the other side of the coastal highway by Hurricane Katrina. Source: NOAA (*http://www.katrina.noaa.gov/helicopter/helicopter.html)*

BOX 3-1
Representatives of Nonprofit Organizations Who Met with the Committee at the Knight Nonprofit Center

- Alice Graham, Executive Director, Mississippi Coast Interfaith Disaster Task Force
- John Kelly, Chief Administrative Officer for the City of Gulfport
- Rupert Lacy, Director, Harrison County Emergency Management Agency
- Tom Lansford, Academic Dean and Professor, Political Science, University of Southern Mississippi, Gulf Coast
- Reilly Morse, Senior Attorney, Mississippi Center for Justice
- Kimberly Nastasi, Chief Executive Officer, Mississippi Gulf Coast Chamber of Commerce
- Tracie Sempier, Coastal Storms Outreach Coordinator, Mississippi-Alabama Sea Grant Consortium
- Lori West, Gulf Region Director, IRD, US Gulf Coast Community Resource Centers

building has abundant meeting space and parking for tenants and other users; tenants can share resources such as technology, office supplies, and phone lines and can share complementary expertise, as when one organization helps another write a grant; volunteers can work for more than one organization or can be referred from one nonprofit to another; and the rent at the building is much lower than it would be elsewhere, allowing organizations to do more with the resources available to them.

The building has abundant and comfortable space for meetings held not only by the tenants but also by outside users. Thus, the center can serve as a resource for other organizations. For example, the center has been used as the site of training to prepare individuals and organizations for future disasters.

The building is far enough away from the beach to be well protected in another hurricane. That knowledge provides organizations in the building with the confidence that they can respond immediately following a disaster rather than having to regroup in a disaster's aftermath. Also, because groups are located next to each other, they are more likely to cooperate immediately after a disaster rather than working in isolation or competitively.

The nonprofit organization representatives also discussed how communities may define resilience differently because of their history, resources, or social structure. For example, a community may see some aspects of resilience as more important than others. These differences must be acknowledged but also can be accommodated through cross-sector collaboration. After Katrina, for example, six counties in southern Mississippi cooperated in forming a VOAD—Voluntary

Organizations Active in Disaster. This VOAD has put systems and protocols in place so that it can respond quickly to future disasters.

Many individuals, organizations, and communities on the Gulf Coast had no experience seeking disaster benefits from government, the representatives said. Furthermore, people were not exposed to risk in an evenly distributed way. Residential areas are heavily segregated in many Gulf Coast communities, so different racial and ethnic groups were affected to different degrees by the storm. Also, some African American populations express a resignation that they will not have access to resources. The nonprofit representatives emphasized the importance of helping people understand that they have the right to receive resources and ask questions. Some communities, such as the Vietnamese community, also need access to disaster coordinators and help with self-advocacy. Without assistance, they said, more experienced or sophisticated groups or individuals will receive more assistance while others receive little or no assistance. An important role for nonprofit organizations after Katrina was to try to make the distribution of disaster benefits more equitable and accessible.

The representatives from the nonprofit organizations also said that Gulf Coast had an advantage over New Orleans in that neighborhoods were not flooded for weeks after the storm. People could return to their homes and businesses and begin to rebuild. Congress also appropriated unprecedented amounts of money for disaster relief and gave the states discretion in how to spend the funds. This funding led to major infrastructure improvements such as bridges and public facilities. However, many people needed help from nonprofits to apply for housing assistance. In this respect, one measure of resilience is the ability of communities to bring forces to bear to correct courses established by state or federal agencies.

A powerful impulse after a disaster is to rebuild, even in areas that are highly dangerous, the nonprofit representatives said. When government prohibits building in an area or offers buy-outs of private property, people can object, especially in regions that favor private property rights and small government. Yet government and the insurance market ultimately will determine whether people are able to build in a given place or not. Over time, private property can be taken off the market and gradually be converted to other uses.

One important issue for nonprofits, the representatives noted, is the provision of alternative housing after shelters have been closed but before people can return to their homes. For example, during Katrina, people were sheltered in schools, but they could not remain in schools for the long term. The creation of stand-alone shelters is expensive and subject to complicated and sometimes counterproductive governmental restrictions. For example, long-term shelters need showers, and government regulations influence which kinds of structures can have showers. Government-provided housing was not available to all people after Katrina, and such housing cannot be guaranteed after future disasters.

Another point the representatives from the nonprofit organizations raised is that a key aspect of resilience is the existence of networks that allow different parts

of a community, whether economic, social, political, or cultural, to interact with each other. Informal networks existed before Katrina, such as networks of law enforcement agencies. After Katrina, boundaries between institutions and jurisdictions disappeared for a period, producing an extraordinary level of collaboration. These networks need to be formalized through mechanisms such as VOADs to continue communications and collaboration. Catastrophes such as Katrina can obviate previous disaster planning because of the magnitude of their impacts, requiring as much collaboration as possible. Disaster relief also begins locally and ends locally, since people in the community look to local organizations for guidance, not to the state or federal government.

The post-Katrina period has seen the emergence of resilience entrepreneurs who can help establish networks and regularize emergency processes, the nonprofit organization representatives noted. These individuals can help drive cross-sector collaboration outside government. Citizen advisory groups and other mechanisms also exist for bringing people together.

The private sector plays a crucial role following a disaster in helping to get people back to work and making money. Small businesses may experience special difficulties in resuming operations, requiring that government and nonprofit organizations provide assistance. The panelists discussed the idea that, rather than closing areas to the public, government and nonprofits could work together to try to get them open and functioning again. A business continuity plan for a community is an important component of a disaster preparedness plan.

Several of the representatives of the nonprofit organizations emphasized the importance of education in resilience, from schoolchildren to people who have lived through multiple hurricanes. News people who report from the waterfront and the vows of elderly residents who have ridden out past hurricanes to remain in their homes can send the wrong messages. Public officials cannot risk putting anyone in danger. Education cannot be based just on fear but must empower individuals to care for themselves and others.

Better communications before a storm are essential, the panelists said. For example, an important advance would be to change the descriptions of storms, since wind speeds do not necessarily correlate with surge heights. For example, Hurricane Camille had stronger winds but a lower storm surge. More realistic warnings could generate more appropriate responses.

The panelists discussed the relevance of conveying postdisaster operations to people in a community before a disaster. For example, knowledge of the permissible and nonpermissible uses of disaster relief funds could contribute to ensuring the continued receipt of recovery funds. The provision of explicit and clear descriptions about eligible uses of funds was identified as a useful action that governments can take to support broad understanding of postdisaster operations.

The experience of Katrina taught several important lessons. For example, more hotels now allow pets, whereas during Katrina many people, including

many elderly people, did not want to leave their homes and leave their pets behind.

A major concern after disasters is the mental health of the people affected. Mississippi had a lack of mental health resources before the storm. Mental health providers and others, such as clergy, need skills in dealing with people after disasters.

4

Insurance and Real Estate

Before Hurricane Hugo hit South Carolina in 1989, the United States had not experienced a single disaster that cost the insurance industry more than $1 billion, said Howard Kunreuther, professor of decision sciences and business and public policy at the University of Pennsylvania's Wharton School of Business, who moderated the first panel of the workshop. Since then, as more and more development has occurred in hazard-prone areas, the cost of natural disasters has gone up "exponentially," with losses for 2000–2010 exceeding $800 billion (Kunreuther and Michel-Kerjan, 2009).

Despite the increased risk, many individuals, homeowners, and businesses are failing to protect themselves against hazards, even though such protection could be very cost effective. Most people do not buy flood insurance, and when they do buy it, they often cancel it several years later.

The members of the panel on insurance and real estate, Julie Rochman, Eric Nelson, and Ommeed Sathe (Appendixes B and C), were asked to consider four questions in the preparation of their remarks:

1. What are meaningful incentives to encourage property owners to adopt effective mitigation measures in existing homes?
2. What role can the private and public sectors play in assuring that homeowners, businesses, and communities are preparing for and recovering from natural disasters in the future? How can progress toward that goal be measured?
3. Does economic development in hazard-prone areas (coastal zone, floodplain, earthquake zone, et cetera) necessarily conflict with the resilience of those communities? What are some best practices (or examples) of resilient development?

4. What are the lessons that can be learned from the recovery process following Hurricane Katrina that can provide guidance in designing implementable strategies for making communities more resilient?

RESEARCH ON RESILIENCE: JULIE ROCHMAN

Just as tests of automobile safety are done so that people can make better choices about how to protect themselves and their families, testing of structures is under way. At a facility in South Carolina, the Institute for Business and Home Safety (IBHS) can simulate category 1, 2, and 3 hurricanes; wildfires; hail storms; and other natural disasters to measure the durability of buildings. "We don't believe any building can be considered high performance if durability is not a piece of the performance measure," said Julie Rochman, president and chief executive officer of IBHS.

Communities exist in structures—not just in homes but in businesses and public buildings as well. Thus, structural durability is essential to prevent a cascading chain of failure that can destroy any community, large or small. Resilient buildings are also better for the environment, because they do not have to be buried in landfills if they are destroyed by a natural disaster.

Hurricane Katrina affected 14 states and easily could have affected 20. In that respect, the Gulf Coast is a warning belt for much of the rest of the United States, since wind- and water-related damage can occur in many places other than the coast, Rochman said. Those who care about the built environment also care about the bayous, the wetlands, and the natural barriers near coasts, since these pieces of the natural environment scrub energy off storms before they hit structures. In this way, the natural environment and the built environment are intertwined.

Financial incentives are often necessary to help people adopt effective mitigation measures, Rochman said. If people have to pay for mitigation without any incentives, they will tend not to do it. These incentives should extend to everyone with a stake in structures, such as mortgage lenders, tax appraisers, and realtors. People need to learn to "value resiliency more than they do granite countertops and stainless steel appliances."

Building codes are compulsory standards, in contrast to voluntary incentives. However, most compulsory standards are written by a committee, which means that they inevitably carry "a tinge of politics." Engineering and building science need to inform building codes for standards to be effective.

Also, a building code is a *minimum* standard, Rochman emphasized. In contrast, fortified programs, whether for new or existing buildings, call for building codes to be augmented by voluntary construction standards. IBHS, for example, provides a relatively inexpensive set of things that homeowners can do to improve the durability of their homes. Many of these address the roof. Once a roof cover is compromised, "all sorts of bad things can happen to the structure." The measures

also concentrate on openings—windows, doors, and other openings that can literally blow a home apart. Finally, the provisions look at the load path of a structure to ensure that components are connected adequately.

Building to fortified codes in the Gulf Coast states would save anywhere from one-third to two-thirds of losses, according to Rochman. Given that the value of property vulnerable to hurricanes from Texas to Maine is an estimated $9 trillion, retrofitting is essential.

Consumers and policy makers need to understand that codes do not necessarily provide them with a superior level of protection in their homes and businesses. In places where building codes are lax or nonexistent, people might think that they are buying a structure that is safe. An irony is that homes are often purchased using 30-year mortgages, but the structures being built can stand for just a few years if a storm strikes. People in the United States tend to believe that they should live the way they want and where they want, said Rochman. When baby boomers move from Ohio to the Gulf Coast, they often put up wood frame houses like those in Ohio. But traditional houses in areas susceptible to hurricanes tend to be sturdier, just as homes in New England tend to lack north-facing windows and have pitched roofs. People should "build for where they live," she said. The design community needs to consider durability as part of a "vernacular architecture."

Many people believe their houses are resilient when in fact they are not. "We get calls from people all the time who say, 'Can you designate my house as fortified. My engineer told me I can withstand a category 5 in this thing. It's like a bunker.' We'll go look at it and it's built out of wonderful reinforced masonry with great anchored windows, but the roof isn't held on at all. There's no strapping tying the roof to the walls. We'll tell people and they're furious because they spent [so much] to make a resilient home." Communities, government, and the design and construction industries have not made durability a priority at every step of the process—in design, construction, rehabilitation, and renovation. Yet costs for everyone are substantially lower in disasters if resilience is built into structures from the beginning.

Rochman observed that one of the reasons for studying the durability of structures is to generate compelling videos to disseminate to consumers. IBHS has a video on YouTube that compares two identical homes subjected to a category 3 hurricane, one of which has several upgrades that cost a few thousand collars. "It's startling, and anybody can understand it."

The real estate industry could benefit from several practices common in the automobile industry. New cars have a sticker in their windows that provide the mileage, crash safety rating, cargo space in the trunk, and so on. A listing for a home says how many bedrooms and bathrooms it has, whether it has stainless steel appliances, and so on, but contains essentially no information about the structural integrity of that house. "It will not tell you anything about the roof. It won't tell you if it was built to code or if it's been added onto by Uncle Bob

instead of a licensed contractor." Appraisers and others who value mitigation need the education and data to provide that information to consumers in a digestible form. However, ratings are somewhat different for houses than cars, Rochman observed. "If you buy a Taurus in Seattle, [it is the same as if] you buy a Taurus in Miami," she said. However, most people don't remodel a Taurus by "cutting it in half and putting a bathroom in it." Ratings will also expire as people do things to maintain or renovate their property that render the initial rating meaningless.

Partnerships between the public and private sectors are essential to make a community more resilient. No one entity, whether the insurance industry or the government, can fund everything that needs to be done. Everyone who has a stake in the built environment has to participate.

Development in hazard-prone areas need not be a barrier to mitigation. "The city of New Orleans, I hope, is always going to be here," Rochman said. "There are economic imperatives that create coastal development. You can't just say, 'Move the cities.' We have to deal with it, and there are ways that we can do that by hardening structures against nature."

The formula for success is to implement workable and affordable retrofits for existing structures and design standards for new structures based on good science. "We can do better. We can break the cycle of destruction."

INSURANCE AVAILABILITY AND AFFORDABILITY: ERIC NELSON

Many communities are facing a crisis of insurance availability and affordability, said Eric Nelson, vice president for personal insurance operations at Travelers Insurance. Forging a partnership with business is the only way to resolve this issue.

Insurance companies spread risks over people or over time. As a result, when risks go up, insurance prices go up. During the 1990s, more than $1 trillion of condominiums were built on the Miami coast. "People want to enjoy the sun. Unfortunately, Miami is not the best spot when you're thinking about hurricane risk."

Travelers Insurance has partnered with organizations like IBHS to study ways of minimizing costs to consumers. One thing it has found is that the levels of damage to homes within a neighborhood or just a short distance away from each other can be very different. In one study, for example, homes built in accordance with the most recent building codes suffered about 35 percent less damage than homes not meeting those standards. "That translates into 35 percent lower insurance costs over time," said Nelson.

The best aspects of building codes in one jurisdiction need to be adopted in others. The insurance industry would prefer federal building codes but understands that such a goal is not realistic today. But building codes are developed and enforced very differently in different states.

After Katrina, Louisiana "did a great job" and adopted stronger building codes. Such codes would be beneficial in other states, but costs are involved in upgrading and enforcing building codes. In that regard, meaningful credits for mitigation have the potential to improve resilience. In Alabama, for example, Travelers Insurance offers a 35 percent discount for mitigation using fortified building standards. "We're trying to see how many consumers are going to take advantage of that program."

Circumstances for insurance companies can change drastically over time. For example, before Hurricane Katrina, insurance companies were required to have enough capital to cover one 100-year event. After Katrina, they had to have enough to cover two 100-year events. "That is a dramatic change," said Nelson, but such regulatory changes can be important if they are necessary for companies to be there after a storm.

Nelson asked whether homeowners should receive mitigation credits in the same way that they can receive credits for putting new windows in their homes. Nelson specifically cited the South Carolina Safe Home Program as an example for other states to follow on mitigation. Better disclosure and dissemination of information also can have a major influence on consumer decisions. As an example, he cited a smartphone application that allows people to locate their homes on flood maps. Consumers, as opposed to researchers or companies, can drive improvements if they receive the necessary information and education.

Finally, some people cannot afford the price of mitigation. Though wealthy people may live right on the beach, the people living a few blocks inland can have much more modest means, which translates to a gap in the ability to afford mitigation against potential disasters for homeowners. Nelson said that regulations should reflect those differences. Affordability vouchers may be a way to address the affordability gap for mitigation.

All states need a healthy and vibrant insurance market, Nelson said. Communities and states also need to think about where and why structures are built and enhance durability before a loss occurs. And consumers need to know about the perils they face through the provision of information that they can understand.

REEXAMINING RISK: OMMEED SATHE

It now costs more to build a new home in New Orleans than most buyers can afford to pay because of two factors, said Ommeed Sathe, director of real estate development for the New Orleans Redevelopment Authority. The cost of construction to meet new building codes has gone up. And after Katrina, the cost of homeowner's insurance in New Orleans went up by a factor of 5. That is the equivalent "of raising the cost of housing for every single family by $50,000." The combination of high construction costs and high insurance rates is ironic,

said Sathe, because the insurance industry could drop its rates if a large enough pool of new homes built to code existed.

Hurricane Katrina was not a wind event. Almost all of the losses were caused by levee failures and the resulting flooding. Yet flood insurance costs about the same now as before Katrina, while homeowner's insurance, which covers wind losses, has gone up by a factor of 5. In part, that reflects the "psychology" of the insurance industry, said Sathe. This "radical mispricing," said Sathe, reflects psychological "anchoring to the recent event, regardless of what the actuarial rates are."

Traditionally, the insurance industry has had to get a large enough pool to diversify losses over space or time. But when risks tend to cluster, as when multiple hurricanes hit the same areas, losses are not easy for conventional channels to handle. Are there other ways to bear and cover risks, Sathe asked. Similarly, are there better ways to price for risk and mitigation effectively?

Improvements that would benefit everyone from the insurance companies to homeowners to government are undercut by skewed incentives, said Sathe. For example, his agency has adopted a fortified standard plus an energy efficiency standard. But these improvements are not reflected in increased appraisals, which would enable higher mortgages. Instead, the improvements have to be subsidized until the data are available to allow market pricing to occur.

One challenge in changing incentives is the "invisibility" of insurance. Because homeowner's insurance is included in the mortgage payment, people tend not to pay much attention to it. Furthermore, what they pay for insurance is not connected to mitigation measures. Research by behavioral scientists could help reveal ways to increase the salience of insurance pricing. Sathe suggested that homeowners could receive a monthly insurance statement, like a utility bill, specifically spelling out what coverage they are getting to make them more aware.

Much of what it takes to fortify a house is relatively cheap, said Sathe, like thicker nails. "It would be one thing if these were $50,000 or $60,000 improvements. But if you're doing new construction, the cost of fortifying is $6,000." One reason the improvements do not occur is because of the culture of the design and construction industries. Tradesmen "do things the way their dad did it and their grandfather did it, and changing that is . . . a cultural shift." Also, much scientific and engineering knowledge is not transferred into the communities that have to effectuate that knowledge, whether it's the building permits department, the code inspectors, or local tradesmen. As an example, Sathe cited permeable concrete, which he described as a "much better product than regular concrete." Water can drain through it, and it is cheaper to pour. But no one in Louisiana was certified to pour permeable concrete until the Make-It-Right Foundation funded training sessions, after which the use of permeable concrete began to propagate naturally. Similarly, other improvements can trickle into a community if people become familiar with them and consumers start to demand them.

Communities are critical in setting standards, said Sathe. Federal standards are unlikely anytime soon, while local communities have immediate control over such basic factors as building codes, permitting, and enforcement. This is one of the ways in which something nebulous and fuzzy like social capital and community engagement has a real effect, said Sathe. Local communities also can deal with the realities of retrofits. For example, an improvement costing a couple of thousand dollars may not sound like a lot, but in New Orleans many people live from paycheck to paycheck and could not afford such an improvement. Banks may be able to finance such an improvement, but people in strained circumstances do not necessarily have the credit to qualify for financing. One way to finance such improvements might be through monthly charges such as those for utilities. Localities are well positioned to price capital improvements and have a vested interest in providing such improvements competitively.

ADDING ACCOUNTABILITY TO AVAILABILITY AND AFFORDABILITY

Later in the workshop, Michael Chaney, the insurance commissioner for the state of Mississippi, also addressed issues associated with insurance and building codes. All of the states along the Gulf Coast face a similar challenge, he said. Homeowners and business owners need insurance that is available, affordable, and accountable. "I say 'accountable' because it means if you have a valid claim, then the claim will be paid in the context of catastrophic events, whether hurricanes, earthquakes, or whatever."

Most people in Louisiana and Mississippi are experiencing sticker shock in buying insurance, and "there is no silver bullet to solve the problem." If people build along the coastline, they have to build to a high standard, said Chaney. Roofs need to withstand category 4 hurricane winds. The frame of a house needs to be attached to a conventional foundation or slab with metal straps. Shutters, windows, and doors need to be reinforced.

Mitigation also means not building in a floodplain. That is a problem for New Orleans, Chaney acknowledged, but proper land use generally means not building in wetlands.

Building codes also need to be enforced. Chaney is in an unusual position because he became state insurance commissioner after helping to write a new building code law for the state, so he became responsible for enforcing his own law. One response has been to train building inspectors in the enhanced codes adopted in the state. Compliance rates are about 30 percent for the state, and compliance is mandatory in the five counties closest to the Gulf. "You have stronger building codes and you enforce them—it's that simple." When complaints about enforcement arise, Chaney points out the many steps the state can take to ensure adherence to codes. "You enforce the code and you reduce your risk. And you try to price the risk to the premium that you've got to pay to have insurance."

5

Critical Infrastructure

During the 1993 flood on the Mississippi River, the Des Moines Water Plant flooded and was out of operation for weeks. "It shut down the city," said Gerald Galloway, Jr., the Glenn L. Martin Institute Professor of Engineering at the University of Maryland, College Park. "When a major part of the infrastructure that supports a community goes under, the community can go under at the same time."

In the second panel of the workshop, four representatives of major utilities, Marcia St. Martin, Justin Augustine, Greg Grillo, and Frank Wise (Appendixes B and C), discussed what is necessary to recover from a major disaster. As moderator, Galloway listed three categories of questions for the panelists to consider:

1. **Governance and Finance**: How is resilience viewed in your organization? Is disaster resilience a core component or objective of operations and planning in your organization?
2. **Lessons Learned**: What lessons were learned over the past decade about the resilience of your infrastructure in the face of natural or man-made disasters? Based on lessons from the past decade, what postdisaster performance standards and objectives have you established for your infrastructure? How do you propose to fund necessary upgrades?
3. **Interdependence**: To what extent does the full functioning of your infrastructure depend on the functionality of other kinds of infrastructure for normal operation? For survival during a disaster? For recovery after a disaster? Is there a "Lifelines Council" where these shared issues and vulnerabilities are being honestly discussed?

WATER AND SEWER SERVICES: MARCIA ST. MARTIN

The Sewerage and Water Board of New Orleans is responsible for providing drinking water, wastewater, and stormwater services for the city of New Orleans and parts of Jefferson, St. Bernard, and Plaquemines parishes, said its executive director, Marcia St. Martin. But because much of New Orleans is significantly below sea level, the agency faces distinct challenges and is well versed in the concepts of resilience and recovery.

Since Hurricane Katrina, the agency has been rebuilding its infrastructure to be more resilient. Following the storm, the wastewater treatment plant contained 18 feet of water, and the city cannot exist without viable wastewater treatment. The plant was dewatered within about 10 days of the closure of the federal levee system, and it was doing primary treatment 30 days after that. Since then, controls have been moved to a higher level, and berms now protect critical infrastructure around the plant. The plant is being rebuilt in such a way that employees will not have to be evacuated as they were during Katrina. And the agency is engaged in a wetlands assimilation project involving its wastewater treatment plant, in which ash and solids from the plant are being deposited into adjacent wetlands to enhance the levee. "It is a holistic process," said St. Martin.

The Sewerage and Water Board could not make these and other advances without partners. For example, protecting the city from an incoming storm surge is the responsibility of the U.S. Army Corps of Engineers, and the Sewerage and Water Board is working with the corps to rebuild infrastructures around the levee system. The agency is also responsible for the purification and distribution of drinking water, which requires electrical power. The agency has relied in part on a 1903 25-cycle power plant that is being rebuilt to be more sustainable and reliable.

A key component of infrastructure is not just the hard structures but its employees. A major challenge of Katrina was that 80 percent of the agency's team had lost their homes. The people who were on duty the day of the storm were suddenly homeless. "How do you provide for their mental stability, their financial stability? [How do you] plan for that in the future?"

The agency was able to bring in professionals from other parts of the water industry, and local jurisdictions provided assistance following Katrina. Employees from New Orleans also were able to continue working for New Orleans from surrounding jurisdictions. "We had some employees up to 6 months working in water utilities throughout North America."

Another important lesson of Katrina was learning how to respond to the financial impact of losing both a major portion of a customer base and strong bond ratings. The agency sought to keep in touch with its customers around the country who still owned abandoned homes. The agency also had to spend more than $1 billion in restoration and recovery without being able to draw on the

capital market, but disaster recovery through the Federal Emergency Management Agency (FEMA) generally involves a reimbursement process. Thus, it was not just the physical and human infrastructure but the financial infrastructure that had to be rebuilt.

Future climate change could pose severe challenges to the drinking water system, St. Martin said. If sea level or the volume of water coming down the Mississippi River changes, water quality, the ability to treat water, and the availability of water could all be affected. One way the agency has been preparing for the future is to increase its work with comparable agencies in other countries. Water industry engineers, researchers, and administrators from New Orleans have been working with their counterparts in the Netherlands as part of the rebuilding effort, just as the Dutch have come to New Orleans in the past to learn about living below sea level. "We are talking with the Dutch about how we can live with water, not hiding from water but incorporating water into our daily lives," said St. Martin.

PUBLIC TRANSPORTATION: JUSTIN AUGUSTINE

The business of public transportation is to move people. Doing so requires both equipment and people, observed Justin Augustine, chief executive officer of the New Orleans Regional Transit Authority and vice president of Veolia Transportation. Managers thus need to understand both the needs of employees and the deployment of resources to survive a disaster.

The physical infrastructure has two components: rolling stock and hard infrastructure. Most of these assets cannot be moved out of the city. Rolling stock needs to be moved to emergency locations. During Katrina, New Orleans lost 31 streetcars, which cost an average of $1.2 million per car to rebuild. It also lost 80 percent of its bus fleet. "That's not a capital cost you can replace very easily," said Augustine. "You have to understand where to locate those vehicles in case of a natural disaster."

In addition, the streetcar network is powered by an electrical grid. In an emergency, the streetcar system needs additional substations that are singly powered for emergency purposes. Public transportation is part of the emergency evacuation system in New Orleans. When government officials tell populations to evacuate, some people will not react, said Augustine. "We have to go and get these people and bring them to wherever the evacuation stations are."

Operating the public transportation requires people. But drivers and other employees have wives and children who also need to evacuate, and procedures need to be in place to accommodate that process. People are also needed to rebuild the physical infrastructure. Following the storm, Veolia Transportation was able to muster the capital expenditures to secure property, build temporary housing, and bring people in and make them feel comfortable. Augustine also

praised the contributions of the network of transport professionals in and around New Orleans and across the nation for providing assistance following Katrina. The network was "an absolutely great resource," he said.

As facilities have been rebuilt, resilience has been enhanced. For example, traditional bus pits extend 5 feet below a slab that, in the case of New Orleans, was already below sea level. New facilities are being built with portable lifts that can be quickly removed. Similarly, electrical panels have been raised above the surge height. Portable generators can be loaded onto truck beds and quickly moved. A mobile command center is located in a truck to ensure that communications and operations can continue during an emergency.

Finally, Katrina demonstrated that the transportation network needs to work with all its partners in the community to maintain effective operations. Today, representatives of public transportation work with local, state, and federal groups, meeting on a quarterly basis and practicing emergency responses.

ELECTRICITY AND GAS: GREG GRILLO

Entergy Corporation is an integrated energy company headquartered in New Orleans that employs nearly 15,000 people. It has about 2.7 million electric customers and 180,000 gas customers in the states of Louisiana, Arkansas, Mississippi, and Texas. It has 15,500 miles of transmission line, 100,000 miles of distribution line, 30 fossil fuel plants, and nine nuclear power plants.

Resilience is a core value of the company, said Greg Grillo, director of transmission project management construction and incident commander for Entergy. For each of the past 12 years, the Edison Electric Institute has presented the company with an award for its recovery efforts in an area where it operates or for helping others to recover.

Recovery is also an essential aspect of business continuity, which was a "huge challenge" with Katrina. Grillo clarified by saying, "We thought we had a good business continuity plan. We had a decent business continuity plan. I can tell you now we have a very good business continuity plan. We've learned a lot of lessons from Katrina."

As with other utilities, the human infrastructure is as important as the physical infrastructure. Many of Entergy's employees in New Orleans were without homes even as they were out working to restore service. Employees need to be empowered to make decisions and also feel that they are supported by upper management, said Grillo.

The dependability of other infrastructure functions is critical to the energy industry. Reliable poststorm communications are essential. Transportation systems are needed to recover quickly. Particular components of the infrastructure also require special attention. For example, Entergy is considering the use of steel

and concrete poles rather than wooden poles since the transmission infrastructure is so critical after a disaster.

With regard to guiding principles, the first such principle is the need for safety. "Safety will always trump speed," said Grillo. The second such principle is to prepare for the worst and hope for the best. Preparation requires weather monitoring and damage predictions to determine resource needs. It also requires planning and drills to prepare for different kinds of disasters in addition to hurricanes, such as ice storms or earthquakes.

Logistics are critical following any disaster, said Grillo, including backup plans if initial plans fail or need to be modified. This requires a clear command structure. It also requires the ability and willingness to make quick decisions and take risks. "There are always those Monday morning quarterbacks who will second guess what you did. We make the best decisions we can with the information we have at that time, and we think we've done a good job so far."

COMMUNICATIONS: FRANK WISE

Business continuity and disaster recovery are also part of Verizon's "DNA," said Frank Wise, executive network director for Verizon Wireless in Florida. "We aren't the cheapest provider out there from the wireless service perspective, so we pride ourselves on being the most reliable."

Wise agreed that logistics are critical, even before a disaster strikes. Critical elements of infrastructure need to be moved out of harm's way. Redundant systems and backup facilities need to be designed into infrastructure. Multiple providers of services and equipment ensure diversity if something goes wrong. For example, Verizon tries to have backup generators at its cell sites in case primary power is lost.

Many employees who are critical in a recovery effort can be emotionally wrought in an event as dramatic as Katrina. "Some of them were transfixed, watching the constant stream of media that portrayed this disaster almost to the point where it was hard for them to focus." Verizon brought in people from outside the area in the immediate aftermath of Hurricane Katrina to give its employees time to take care of their personal affairs before they returned to work.

Good communications among federal, state, and local authorities are essential during an emergency, Wise said, but during Katrina the chain of command sometimes broke down. Wise added that government entities also need to work well with each other to provide consistent and useful information that others can use to respond to an event and recover.

6

Governance

Preparing for disasters is a long-term process, which can conflict with the short-term perspectives that are common in government. How can preparations "outlast the 4-year terms of elected officials, the 2-year terms of elected officials, or the 30-second disasters that wreak havoc on our community?" asked Ellis Stanley, director of western emergency management services at Dewberry LLC, who moderated the third panel at the workshop. In addition, governance occurs at multiple levels, from the neighborhood to the federal level, requiring that the various elements of governance be integrated.

The questions that were raised for the consideration of the third panel, which included Charles Allen III, Bill Stallworth, Stephen Murphy, and Earthea Nance (Appendixes B and C), were somewhat more detailed than for the other panels:

1. Neighborhood Governance:

a. Who are the leaders of the self-organized communities (e.g., neighborhood, church, ethnic), how are they recognized, and how do they exert leadership?

b. What is the extent of communication, coordination, and planning between this local governance and the "official" local government?

c. What are examples of positive neighborhood leadership related to resilience to disasters in the Gulf Coast region? What are examples of challenges to increasing resilience faced by neighborhood governance?

2. City and County Governance:

a. Who is in charge of resilience in the city or county government, how do they promote resilience, and with what resources?

b. How do they interact with the other government bodies (neighborhood, city, county, state, and federal) and the private sector?

c. Is resilience considered during the city and county planning and prioritization processes?

d. What are examples of positive city and county leadership related to resilience to disasters? What are examples of challenges to increasing resilience faced by city and county governance?

3. State and Federal Governance:

a. How do the state and federal government contribute to the disaster resilience of communities?

b. What is the most important role of the state or federal government before, during, and after a disaster (besides sending money)?

c. What are the greatest barriers at the state and federal level to improving resilience to disasters?

4. General Governance Perspectives:

a. How do you emphasize, highlight, encourage, or promote the shared responsibility among governing bodies for increasing resilience (neighborhood, city, county, state, and federal; and from preparedness through response to recovery—full cycle)? What are the best approaches?

b. Once a "community" agrees to or adopts a goal of resilience, who sets "metrics" and determines appropriate roles for the different stakeholders sharing in the responsibilities?

c. What are the key connections between the private sector and the various governance bodies (neighborhood, city, county, state, and federal)?

WORKING CREATIVELY: CHARLES ALLEN III

Given the great needs and constrained resources available to recover from Katrina, government has had to do its work creatively, said Charles Allen, the director of the Office of Coastal and Environmental Affairs and an advisor to the mayor of New Orleans. Governments cannot do everything, but good things have happened in the community. Collaborations within government and public-private partnerships have been able to deliver on needs, despite an $80 million deficit in New Orleans.

In some cases, government also needs to support the work under way in communities without getting in the way of that work. As a former president of a neighborhood association in the Ninth Ward, he always appreciated government officials who would encourage and not block grassroots efforts. "They would try to support us every step of the way," he said.

At the same time, grassroots organizations need to recognize that there is a role for government. "We used to get all sorts of complaints about trash collection. I said, 'Board members, do you want to take on trash collection for the

Lower Ninth? We can't do that.'" A much better approach is to work through government processes while also attempting to reform those processes. Allen recounted the advice of a friend: "Let's stay in our lane, because the minute we get out of it, we're going to get hit, and it will be a disaster when we can't deliver on some of the high expectations that our residents and neighbors have for us."

The city of New Orleans is working to establish an Office of Neighborhoods that can leverage the good work that is being done in neighborhoods. The office also can keep neighborhoods engaged with what is happening in city hall. The office could provide "an eye-opening learning experience for how city hall works."

FROM CONTROL TO FACILITATION: BILL STALLWORTH

Bill Stallworth, a city councilman in East Biloxi, Mississippi, described the area that he represents as where "90 percent of the Asian population resides, 90 percent of the African American population resides, 90 percent of the Hispanic population resides, and 90 percent of the poor reside." East Biloxi was devastated by Katrina. A 30-foot storm surge swept across the peninsula, destroying half of the city's housing population and damaging everything else.

To aid in the recovery, Stallworth formed an organization that is now called the Hope Community Development Agency. Working with volunteers and other nonprofit agencies, it has rehabilitated more than 780 homes and has built 85 homes. The irony of East Biloxi is that it is surrounded by casinos, and when the neighborhood was destroyed there was an effort to convert it into condominiums and shops. "We had to work at curtailing that," said Stallworth. The nonprofit agency held a workshop and interviewed hundreds of others to determine what local people wanted for their community. The organization also devoted effort to communications to impress upon government officials what needed to happen and how much progress has been made.

Government can make a person's life easier, or it can make life a "living hell," said Stallworth. Government has an influence on almost every aspect of a person's life, from which hospital a person is born in to where that person will be buried. But government cannot do everything. It must learn not how to control things but how to facilitate. "How do we facilitate things getting done? That's where we need to be."

A great problem for community organizations, said Stallworth, is government bureaucrats who do not make decisions that need to be made, which is especially difficult when the bureaucrats are removed from the area where action needs to be taken. "They're so worried about losing a dime that they can't get a dollar out." Regulations exist to deal with people who abuse the system. Collaborative efforts are needed to overcome this government paralysis. "You have to form groups that are willing to go and knock on the door," said Stallworth.

BUILDING RESILIENCE AT THE INDIVIDUAL LEVEL: STEPHEN MURPHY

The New Orleans Office of Homeland Security and Emergency Preparedness works on emergency plans from the level of individuals to the entire city, said Stephen Murphy, the planning section chief of the agency. But the two levels are intimately connected, since resilient communities emerge from resilient individuals.

When preparing for disasters, knowing what to do when disaster strikes is the best defense, Murphy stated. Thus, to be prepared, people need to know what hazards exist and what to do when a disaster occurs. After Katrina, the city revamped its emergency plan, not only for hurricanes but for other threats. In the process, it drew on a wide variety of partnerships with the private sector, the public sector, other branches of government, faith-based organizations, community-based organizations, and other entities. The agency also reaches out to a very wide variety of organizations to provide information, including Voluntary Organizations Active in Disaster (VOADs), the American Red Cross, Catholic charities, senior centers, higher education institutions, federal agencies such as the U.S. Department of Agriculture and the National Aeronautics and Space Administration, the Federal Reserve Bank, and so on. Every year the content changes somewhat, but the underlying message is the same: "We're trying to get the word out in a constant manner so that it stays in the forefront of their minds," said Murphy.

One thing the agency has considered is the trigger mechanism for evacuation, since many people did not evacuate with Katrina. With Hurricane Gustav, 98 percent of the city was successfully evacuated, Murphy indicated. However, such evacuations are expensive, so the agency also has been studying the capabilities of the levee system and the possibility of retrofitting schools and other structures as shelters.

New Orleans received money through the Urban Area Security Initiative, which means that it has to meet certain federal requirements. For example, after September 11, 2001, the federal government instituted new initiatives, one of which calls for reconstituting business operations within 24 hours. Murphy said, "We've tried to educate our citizens and our businesses through our public-private partnerships to make them aware that this is a deliverable that the federal government has: . . . Let's think about how to improve your business continuity and your continuity of operations."

Preparedness needs to start at the level of individuals and families. "The first thing everybody thinks of in a disaster is, 'Where is my child, my wife, my husband? Where is my family? Where is my mother who's in a nursing home? What are they going to do?'" Educational platforms, meetings, and workshops can all build on this base to impart to citizens the knowledge of how to respond during and after a disaster.

BUILDING GOVERNANCE: EARTHEA NANCE

Earthea Nance, assistant professor of environmental planning and hazard mitigation at the University of New Orleans, has experienced three different perspectives on recovery in recent years. After Katrina, she founded a nonprofit environmental organization in the community looking at environmental issues. She then worked for 3 years as the director of disaster mitigation for the city of New Orleans. Most recently, she has been doing collaborative research at the University of New Orleans.

Many individuals, community organizations, businesses, and other groups have had to put their lives back together after Katrina, after other hurricanes with lesser effects, and after the Gulf oil spill. "It's heart wrenching to watch their efforts be blocked by what we call red tape," said Nance. People decide to move back into an area that may be affected by another storm. They sign up for programs that are available to them. But they are then stalled for years.

"How do we address this? Who is accountable for this?" asked Nance. "This is a question that has got to have some attention, because it's not enough to blame whoever the politician is at that moment when some of these issues continue no matter who is in charge."

A second problem with governance is what Nance called bureaucratic risk. This is when people at other levels of government or outside government decide that a particular government agency is so ineffective that they refuse to give money to it. In that case, other organizations can be created to avoid investing in the high-risk organization. "That's a problem. I don't know that anybody talks about it because it's kind of embarrassing, but it's a reality," Nance said. Building governance capacity is essential to avoid such outcomes.

Nance described one possible approach to these problems, which is a program funded by the Federal Emergency Management Agency (FEMA) to educate every elected official in Louisiana about hazard mitigation and risk management. "The idea would be to have elected officials sit in a room and listen to other elected officials who have successfully led their communities toward higher levels of resilience."

7

Social Capital

After Hurricane Katrina, many organizations received help from their counterparts outside of New Orleans and the Gulf Coast. But the influence extended both ways, said Susan Scrimshaw, president of the Sage Colleges, who moderated the fourth panel at the workshop. The experiences of organizations in and around New Orleans after Katrina helped precipitate change in similar organizations elsewhere. In this way, the social capital generated by Katrina generated additional capital elsewhere. The panelists included Mary Claire Landry, Pam Jenkins, Steven Bingler, and Natalie Jayroe (Appendixes B and C).

Scrimshaw listed five questions that the panelists were asked to consider:

1. What are the most critical social supports that people need to adapt to and recover from disasters, based on your experience?
2. How do you see community-based organizations best working with governmental organizations and the private sector to prepare for, respond to, and recover from disasters?
3. What are the unique strengths of the nongovernmental organizations (NGOs) in building and sustaining community resilience, and what do you need to support your work in this area? For example, what role can faith-based organizations play in rebuilding communities; what is the role of social media; and should resiliency and self-sufficiency be included in the process of formal education (primary, secondary, higher education)? How?
4. Based on your work, how resilient or compromised is the current social infrastructure within the Gulf region in terms of helping underserved communities to meet their most basic needs of shelter, food, health and safety? What role does culture play in resiliency?

5. What short-term (3–5 years) and long-term (20–30 years) recommendations would you make for improving social resilience and mitigating social vulnerabilities in the Gulf region? What do you anticipate will be the most significant roadblocks?

ADDING FLEXIBILITY TO ASSISTANCE PROGRAMS: MARY CLAIRE LANDRY

During Katrina, the Crescent House domestic violence shelter run by the Catholic Charities Archdiocese of New Orleans burned to the ground. That event was a great disaster, said Mary Claire Landry, who is director of domestic violence programs with the archdiocese, especially because people who are at risk for domestic violence and sexual assault are particularly vulnerable during a disaster. But the event also gave the shelter an opportunity to assess the needs of its clients and how to meet those needs. "It was an opportunity to change the paradigm around how we do our work."

The individuals who manage best during a disaster are those with a network of family and friends, said Landry. After Katrina, service providers, of necessity, became adept at helping people identify the resources available to them and connect with support systems that were already in place.

Consistent and accurate information also was critical. In the shelters that existed after Katrina, information was often conflicting and confusing. Having systems in place that can provide consistent information could make a huge difference for providers and the people they serve. Also, many people need help dealing with complex requests for information after a storm, such as how to fill out Federal Emergency Management Agency (FEMA) applications.

Following Katrina, government structures that were rigid and narrowly defined were a problem. Community-based organization helped challenge this rigidity. The same thing is happening with the Gulf oil spill, said Landry. Organizations outside government are challenging traditional visions of services.

Changing the delivery of services to be more flexible often means moving away from institutionalization of services. This has the additional benefit of aligning programs more closely with the needs of service recipients. People in underserved populations tend not to trust the government and often cannot work their way through the restrictions on assistance. "That's one of the things that have made us so flexible and resilient," said Landry. "We have changed how we deliver our services and . . . how we are able to maneuver through government regulations." Changes in New Orleans also have had a national impact as people in other places explore new and different ideas pioneered in the city after Katrina.

THE ROLE OF NONGOVERNMENTAL ORGANIZATIONS: PAM JENKINS

Nongovernmental organizations have played a central role in response and recovery in New Orleans and along the Gulf Coast, said Pam Jenkins, professor of criminal justice and women's studies at the University of New Orleans. The Lower Ninth Ward has been revived not by any one government agency but by community organizations that worked with residents. "There are important things to learn from NGOs that the government can use in planning and preparing for disasters," Jenkins said.

For the past 4 years, Jenkins has been studying resilient NGOs that not only survived the storm but thrived. The first characteristic of these organizations that she noted was their leadership. Effective leaders understood that when the disaster ended, things were not going to be the same. These leaders understood the new context and did not yearn to return to the way things were.

The budgets of some effective NGOs grew dramatically. In these cases, the organization had strong ties to agencies and people outside the area. They also were able to forge what Jenkins called authentic partnerships with the state and federal governments. "This isn't just a partnership on paper. This is a partnership where you meet every month, and during hurricane season you might meet more than that."

Jenkins also addressed the lack of knowledge about what happens after a disaster, which was so profound in New Orleans and the Gulf Coast after Katrina that people made poor decisions. In the aftermath of those decisions, groups got together and "mulled it over with their neighbors." They talked about what went wrong and how the response to a disaster could be improved in the future.

One size does not fit all when it comes to the provision of information. Social networks, for example, may work for some people but not all. Some people need personal help to complete paperwork or navigate a process. Also, information needs to be accurate and complete. In New Orleans, people tend to worry about hurricanes from May to the end of October and try to forget about them the rest of the year. But resilience and mitigation need to be part of everyday life all the time. "That changes what we do as organizations. It changes what we do as individuals," said Jenkins.

THE DECENTRALIZATION OF POWER IN NEW ORLEANS: STEPHEN BINGLER

Before Katrina, certain aspects of New Orleans were very centralized, said Steven Bingler, president of the architectural firm Concordia. The city had one central public hospital. Power was concentrated with the mayor. The school system was run largely through a single unified district.

Much of that centralization broke down following the storm. Katrina "spawned a democratic revolution in the city of New Orleans," said Bingler. The city now has 250 community organizations. "Most people before the storm were waiting for the mayor to tell everybody what to do. That clearly doesn't happen anymore." The city now has multiple community health clinics and medical homes. Many of the remaining schools have been converted to charter schools with their own school boards. "We were mired down before the storm. After the storm is when all the good stuff started happening."

Bingler also cited the example of bloggers after Katrina, who became a critical source of information. Since then, some bloggers have evolved into investigative reporters, helped in part by the New Orleans Coalition on Open Governance.

Sometimes people in New Orleans talk about planning fatigue, Bingler said. But then a meeting is called and 300 people show up. "There is no such thing as planning fatigue, I'm convinced, as long as you're making forward motion."

Systems thinking is much more prevalent in New Orleans now. For example, the remaining schools are being repurposed to serve the broader needs of the community. Auditoriums are available for community performances and cultural events. Gymnasiums are community fitness centers, and libraries are open to the public. Also, community services are being colocated with schools through a program called Nexus, so that schools can be centers for recovery. "We're getting multiuse 24/7," said Bingler.

Schools also are being hardened to withstand floods, and their energy efficiency is being raised to the Leadership in Energy and Environmental Design (LEED) silver level. The number of school sites has been reduced from 127 to 85 and those 85 have been located in such a way that every student in the city has a walk of no more than three-quarters of a mile to get to school. At the same time, the schools will be within walking distance for refuge. Though many of the schools are still being designed and built, people have on the whole been patient because they know that a plan is in place to produce improvements.

In its 30th anniversary issue, *Metropolis Magazine*, which is aimed at urban planners, named New Orleans as one of six game changers in approaching urban design. "If we're looking for big ideas, [one is] to think systemically. Think disaggregated rather than aggregated. Think deinstitutionalized rather than institutionalized. That is what's given New Orleans the strength to rebuild and to recover."

POSTDISASTER INNOVATIONS: NATALIE JAYROE

A few months after Katrina, Natalie Jayroe, who is president and chief executive officer of Second Harvest Food Bank of New Orleans and Acadiana, and her son were driving through New Orleans and surrounding parishes to survey the damage when they came to a roadblock in St. Bernard Parish. The traffic

lights and gas stations still were not working due to damage from the storm. But the roadblock was there not because of the damage but because of a St. Patrick's Day parade. As floats came down the street, they dispersed carrots, cabbages, and potatoes that people gathered up in wheelbarrows to take home and make into stew. "I was amazed that in the middle of this great tragedy the culture of this community was so strong, people were so determined to honor their traditions," said Jayroe.

Government experienced many failures during and after Katrina from the local to the federal level. But the spirit and courage of individual citizens and nongovernmental organizations, including many newcomers to New Orleans, compensated for these failures. Furthermore, the strength of neighborhoods "allowed us to do all kinds of amazing experiments that we would not have done had government been such a strong leader."

For example, the food system was so decimated after Katrina that food providers were able to sit down with their partners and talk about the basics. One result was a 4-year analysis of the food system in southern Louisiana. Also, a food policy advisory council has brought together government, nonprofit organizations, and for-profit partners to talk about food access. "That was an incredible opportunity," said Jayroe.

What neighborhoods need most from government and NGOs is the critical base of food, shelter, and safety. NGOs can complement government in providing this support. Government is often a blunt instrument, while NGOs can be more responsive to communities. "The NGOs in this country are unique in the world," said Jayroe, as is the individual and corporate philanthropy that supports many NGOs. A future challenge will be maintaining the energy and involvement of NGOs as the experience of Katrina fades. "We have to transition [to] a sustainable model that includes grassroots-oriented change."

8

Healthy Populations and Responsive Institutions

The previous panels demonstrated the importance of the human element in the functioning of critical infrastructure. The same observation applies in the area of public health, said Monica Schoch-Spana, senior associate with the Center for Biosecurity of the University of Pittsburgh Medical Center. The title of the final panel at the workshop—healthy populations and responsive institutions—captures this dependence on human resources. Public health, medical, and mental health institutions require well-trained people to help preserve the well-being of the population and meet their needs when they are ill or injured. The panelists included Paul Byers, Knox Andress, Joseph Donchess, and Garcia Bodley (Appendixes B and C).

Schoch-Spana reviewed the three questions the panelists had been asked to consider:

1. How have preexisting levels of health and illness in the Gulf Coast shaped the epidemiological outcomes of major disasters? What short- and long-term interventions in the health arena could enhance population resilience to future disasters?
2. What factors currently enable Gulf Coast health care facilities (from hospitals to long-term care facilities) to remain "online" in a disaster, maintain basic services, and respond to emergent health needs? How could the level of institutional resilience be improved?
3. What role does robust or intact medical, public health, and mental health infrastructure play in successful and prompt recovery from a major disaster in the Gulf Coast? How could or should the Gulf Coast enhance such infrastructure?

MEETING MEDICAL NEEDS AFTER A DISASTER: PAUL BYERS

Before Hurricane Katrina, the Mississippi State Department of Health felt that it was prepared for a hurricane. "Within a couple of days, it was glaringly obvious that we were not prepared to address many of the issues we were presented with," said Paul Byers, acting state epidemiologist with the Mississippi State Department of Health.

The epidemiology of diseases on the Mississippi Gulf Coast resembles that of the rest of the United States. People have chronic medical problems, including diabetes, end-stage renal disease that requires dialysis, and coronary artery disease. After a disaster, people need specialized medical care, even if the capacity of primary care centers and hospitals has been drastically reduced. Furthermore, the medical care system in Mississippi has many holes. Many people in the state are not only uninsured but also have no medical home, and many places lack an adequate supply of primary care physicians.

Mississippi had several special medical needs shelters in place before Katrina, but these facilities did not meet the needs of many people after the storm. They did not have enough food, water, or medications, and many had no references to their original prescriptions, making proper medicine dosage difficult to maintain. Even where they had generators, they did not have gas to run them. The state also planned to partner with schools, community health centers, and other local institutions to provide sheltering for people with special medical needs, but the infrastructure was not in place to do that.

After the storm, the state built up its infrastructure, including a permanent special-needs shelter with trained staff and backup power and supplies, and it was better prepared when Hurricane Gustav hit in September 2008. But problems still occurred because many people who were evacuated from the Gulf Coast did not know what medications they were taking. An electronic health information exchange is needed, said Byers, so that health care providers can quickly access medications, diagnoses, special medical needs, and other information to provide the best possible care. "That takes a lot of money and a lot of effort."

The Department of Health has the responsibility both to meet immediate medical needs in the first days to weeks after a medical or natural disaster and to meet long-term medical needs. To do so, said Byers, it needs to have partnerships with multiple entities to provide physical infrastructure and meet whatever needs exist. For example, the state now has special medical assessment teams that can be deployed to an area. A partnership with the University Medical Center in Jackson has resulted in portable facilities that can provide primary care and even surgery. Byers said that partnerships with the federal government are also necessary to access resources that transcend what is available locally.

DRAWING ON OUTSIDE RESOURCES: KNOX ANDRESS

Like Mississippi, Louisiana struggles with a wide variety of health needs. Ranked 49th in the nation in health outcomes, it has many people with chronic diseases such as diabetes and end-stage renal disease. "Folks are living longer, so how do you deal with [their] needs?" asked Knox Andress, the designated regional coordinator, Louisiana Region 7 Hospital Preparedness, Louisiana State University Health Sciences Center–Shreveport, and Louisiana Poison Center.

Considerable effort has been devoted to building sheltering and alternate care facility capacity. This has involved drawing on the resources of other states and other institutions. It also involves education to change the culture of preparedness. This education needs to be directed both toward health care providers and toward the people they serve. Particular populations need to be identified and then contacted to explain responses when a disaster occurs.

Changes in standards and regulations can help health care systems respond to a disaster. For example, changes to the Stafford Act could allow all health care facilities, regardless of whether they are for profit or not for profit, to get federal assistance when their buildings are damaged, said Andress. Coalitions among organizations can identify common needs and areas of overlap. And better data and communications structure can provide more real-time information in the aftermath of a disaster. For example, an at-risk registry in Louisiana provides information on people with special needs who might need to be evacuated.

ASSISTANCE FOR NURSING HOMES: JOSEPH DONCHESS

The summer before Katrina, the approach of Hurricane Ivan toward New Orleans triggered a widespread evacuation, including the evacuation of many nursing homes. At the time, Highway 10 was under construction, and it took 48 hours for some busloads of nursing home residents to get to Baton Rouge. "We had several losses of life of elderly patients on buses trying to get to their sheltering sites," said Joseph Donchess, executive director of the Louisiana Nursing Home Association.

The warning that Katrina was going to be a major event came two and a half days before landfall. The Louisiana Nursing Home Association immediately began calling not only its member facilities but also its nonmember facilities and impressing upon them the urgency to leave. But by then, many could not get buses to move their residents. The nursing homes had to hope they could shelter in place without harm.

"In fact, the storm did pass without great event," said Donchess. "Unfortunately the levees began to break, and it was a flooding situation. That's where we found ourselves after Hurricane Katrina."

Elderly patients can be traumatized when they are moved from one location to another, said Donchess. Changing their routines can have both psychological and physiological consequences. "I heard the story of an elderly priest who lived in Our Lady of Wisdom Nursing Home who was very vibrant and very active. When he had to move for Katrina to Texas and was gone for 6 months, he very quickly lost his lust for life, so to speak, and he became sicker as the days went by. He died within 6 months."

During Katrina, many nursing home patients were separated from their caregivers. "Nursing homes were literally forced to take their patients to the New Orleans Airport and simply drop them off. They ended up in Chicago, Salt Lake City, and other parts around the country." Many people in nursing homes cannot communicate effectively, so they cannot provide information about themselves to new caregivers. Today, about 85 percent of the association's nursing homes can transfer updated documents daily to a source outside the nursing home in case those documents are needed.

The staffs of nursing homes also have many needs during and after disasters. Many nursing home staff members are single mothers who were worried about their children during Katrina. Many needed mental health services in the aftermath of the storm.

After Katrina the Louisiana Nursing Home Association worked with the governor on a law that would ensure that nursing homes receive assistance during and after a disaster. With the new law, they can turn to the state for assistance, though they are still primarily responsible for the safety of their residents. Nursing homes have also worked with other organizations to receive grants for large generators, which would make it easier for the elderly to shelter in place. The association has a good relationship with the Public Service Commission, which would help ensure that hospitals, nursing homes, and other health care facilities receive priority attention if they lose power during a storm.

THE NEED FOR BEHAVIORAL HEALTH SERVICES: GARCIA BODLEY

Most emergency preparedness services have focused on medical needs, but behavioral health services, including mental health and substance abuse services, are also needed, according to Garcia Bodley, program director for the Louisiana Spirit Coastal Recovery Counseling Program. Her office has recently undergone changes to combine medical and behavior health services, though securing the necessary resources has been a challenge.

Disasters can increase the number of people who need such behavioral health services. An estimated 80 percent of the people who experience a disaster or some other trauma do not need intensive services, but the other 20 percent do. "That's our role," said Bodley, "to help people have the psychological and physical capability to bounce back after this type of experience."

The Louisiana Spirit Program is a crisis counseling program modeled after a federal program. Interventions include immediate crisis counseling services for people who are not accustomed to seeking mental health services. "We are careful about how we present our services—it is crisis counseling in terms of helping people to get an opportunity to express what's going on and to share their stories," said Bodley. Services for behavioral health providers are also important, including some form of alternative staffing or emotional support.

The program also works with local providers, because they are the ones who know and are responsible for services in their communities. It has links to more intensive providers of mental health services should an individual need more counseling or substance abuse services. Partnerships with faith-based and other community-based organizations also can be invaluable. Bodley noted that the Gulf oil spill has created an intensified need for domestic violence and substance abuse services, and increased numbers of suicides remains a concern.

9

Open Meeting Discussion

During the final session of the workshop, the committee, the presenters, and the attendees convened in a single large roundtable in which everyone was invited to comment on issues associated with national resilience to hazards and disasters. Below are examples of some of the points made by individual participants during this last session.

Preparing for Hazards and Disasters

- Reliability, durability, sustainability, and operational readiness can be seen as guiding principles for critical infrastructure.
- Resilience implies the existence of systems to maintain health, such as electronic medical records and accessible primary care.
- Metrics to gauge levels of resilience and progress toward preparedness goals could be helpful.
- Many public facilities exist that could be repurposed for disaster preparedness and recovery.
- Many kinds of disasters occur and many forms of resilience exist, including psychological resilience in the face of great uncertainty and stress or loss of community.

The Politics of Resilience

- The short-term perspectives associated with politics frequently make it difficult for politicians to address long-term issues, including many issues associated with resilience.

- It can be difficult for politicians to tell people who have lived in a location for decades that they cannot rebuild there. Politicians seek to manage risk, but they are subject to many constraints.
- Despite the great needs for expenditures on national resilience, state and federal budget deficits and popular calls for reductions in government spending point toward greater constraints on budgets in the future.

Self-Sufficiency in Disasters

- Many valuable responses to disasters are based on the initiative and resources of individuals and communities, not governments.
- Individuals and communities could benefit by being more self-sufficient to achieve desired levels of resilience (as the Vietnamese community has exemplified). Because some areas cannot be completely evacuated, people may need to be prepared to live through disasters.
- Despite the need for greater self-sufficiency, the resources of government are irreplaceable in many respects. Balance between nongovernmental and governmental solutions and between local and national solutions is important.
- Government has a responsibility to protect vulnerable populations and communities and help them become less vulnerable and more self-sufficient.
- Greater self-sufficiency may help free resources for people who need higher levels of outside care.
- A community can be resilient yet contain many individuals who are not resilient.

Creating a Culture of Resilience

- Government can help create a culture of resilience through education and the provision of appropriate resources.
- Multiple ways exist in which government can provide preparedness information.
- Education can benefit from the enhanced awareness of disasters made possible through modern communications.
- Training teenagers to provide assistance during disasters is a valuable way of enhancing knowledge about resilience in young people. Teenagers also can help educate younger children about resilience in disasters, including in families that do not speak English at home.
- Cultural change is possible. For example, the construction industry used to accept some loss of life as inevitable in its business but does not accept such losses today.

- Promoting healthier communities through education and clinical access may help to raise the overall resilience of those communities before, during, and after a disaster.

Toward Better Public Policy

- The question of who pays and who benefits from resilience is integral to improving public policy.
- Disasters are more usefully interpreted in terms of responsibility, not in terms of victimhood—who is responsible for recovery and in what ways?
- Even where entire communities need to be relocated, cultural traditions and community cohesiveness can remain intact.

The Future of Resilience

- Although Katrina was one of the largest and most catastrophic events ever to hit the United States, resilience is also important for the smaller and more frequent disasters that will occur in the future.
- In the future, many communities could be geographically far flung and linked by communication technologies. How will the nature of resilience to hazards and disasters change in such a world?
- The rise of sea level and other effects of climate change could radically change the susceptibility of many communities to hazards. What planning for the possibility of such changes is occurring today?
- A fundamental constraint in resilience is the inability to imagine every kind of disaster that could occur.
- Uncertainties associated with the natural world inevitably bring uncertainties to planning for resilience.

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Appendix A

Committee Biographical Information

Susan L. Cutter (Chair)
University of South Carolina

Susan L. Cutter, Chair, is a Carolina Distinguished Professor of Geography at the University of South Carolina, and director of the university's Hazards and Vulnerability Research Institute. Her primary research interests are in the area of vulnerability/resiliency science—what makes people and the places where they live vulnerable to extreme events and how vulnerability and resilience are measured, monitored, and assessed. She has authored or edited 12 books, and more than 100 peer-reviewed articles and book chapters. Dr. Cutter has also led postevent field studies of the role of geographic information technologies in rescue and relief operations in the September 11, 2001, World Trade Center attack and studies of evacuation behavior from Three Mile Island (1979), Hurricane Floyd (1999), and the Graniteville, South Carolina, train derailment and chlorine spill (2005). She led a Hurricane Katrina postevent field team to coastal Mississippi (2006) and since then has been studying the community differences in long-term recovery of the Mississippi coast. She has provided expert testimony to Congress on hazards and vulnerability and was a member of the U.S. Army Corps of Engineers Interagency Performance Evaluation Taskforce that evaluated the social impacts of the New Orleans and Southeast Louisiana Hurricane Protection System in response to Hurricane Katrina. She has authored a Trends and Outlook report for the U.S. Army Corps of Engineers on Natural and Human-Induced Disasters and other Factors Affecting Future Emergency Response and Hazard Management. Dr. Cutter serves on many national advisory boards and committees, including those of the National Research Council, American Association

for the Advancement of Science, National Science Foundation, Natural Hazards Center, and the H. John Heinz III Center for Science, Economics, and the Environment. She is a member of the International Council for Science's Integrated Research on Disaster Risk Scientific Committee. She is also a coordinating lead author of Chapter 5 of the Intergovernmental Panel on Climate Change (IPCC) Special Report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation." Dr. Cutter serves as co-executive editor of *Environment* and is an associate editor of *Weather, Climate, and Society*. She is a fellow of the American Association for the Advancement of Science and past president of the Association of American Geographers. Dr. Cutter is currently president of the Consortium of Social Science Associations. In 2006, Dr. Cutter was the recipient of the Decade of Behavior Research Award given by a multidisciplinary consortium of more than 50 national and international scientific organizations in the social and behavioral sciences. Dr. Cutter holds the Munich Re Foundation Chair (2009–2012) on Social Vulnerability through the United Nations University-Institute for Environment and Human Security, in Bonn, Germany. She received her B.A. from California State University, Hayward, and her M.A. and Ph.D. from the University of Chicago.

Joseph A. "Bud" Ahearn
CH2M HILL

Bud Ahearn (member, National Academy of Engineering) is a recently retired senior executive at CH2M HILL, where he was an executive leader in the engineering business lines of transportation, environment, water, industrial design, and related infrastructure. During his 18-year career at CH2M HILL, he served as vice chairman of the board with responsibilities for strategic planning, governmental affairs, strategic communications, and leadership development, and also served in several other capacities including Transportation Business Group president, eastern region manager, senior vice president, federal programs director, and principal-in-charge for two major transportation corridor projects in California. Before joining CH2M HILL, Mr. Ahearn had a distinguished military career spanning three decades; he achieved the rank of major general in the U.S. Air Force. During his 34 years with the Department of Defense, General Ahearn was responsible for shaping financial strategy, developing budgets, and executing infrastructure programs totaling more than $7 billion annually. As the senior civil engineer for the U.S. Air Force, he directed the operational readiness and natural disaster response of U.S. Air Force combat engineers and the development and operations of all U.S. air bases around the world. Dedicated to advancing engineering education and providing sustainable systems and services in the developing countries, he is a founding sponsor and governing board director of Engineers Without Borders—U.S.A. Committed to strengthening the engineering profession, he is an active distinguished member of the American Society of

Civil Engineers (ASCE), ASCE's Industry Leaders Council (ILC), the National Academy of Engineering (NAE), and the National Academy of Construction (NAC). In addition to numerous military awards, General Ahearn received the Air Force Order of the Sword, the highest honor the Noncommissioned Officer Corps of the U.S. Air Force can bestow; the University of Notre Dame College of Engineering Honor Award for professional achievement; and the Newman Medal from the Society of American Military Engineers (SAME) for outstanding military engineering achievement in Europe. He also received the SAME Golden Eagle award for lifetime achievement and was named an honorary member of the American Institute of Architects.

Bernard Amadei
University of Colorado at Boulder

Bernard Amadei (member, National Academy of Engineering) is professor of civil engineering at the University of Colorado at Boulder. His main research and teaching interests include rock mechanics and engineering geology, as well as sustainability and international development. At the university, he directs the Mortenson Center in Engineering for Developing Communities that has an overall mission to educate globally responsible engineering students and professionals to offer sustainable and appropriate solutions to the endemic problems faced by developing communities. His research at the University of Colorado has been multidisciplinary. He has also provided consulting services to various engineering companies and organizations around the world. The founding president of Engineers Without Borders—USA and co-founder of Engineers Without Borders—International, Dr. Amadei's goal is to promote sustainable development, appropriate technology, service learning, and system thinking in the curriculum and research of civil and environmental engineering programs at the University of Colorado at Boulder and other U.S. universities. He has co-authored several books and approximately 160 technical papers. Dr. Amadei is also a member of the National Academy of Engineering. He received his M.S. in civil engineering from the University of Toronto and his Ph.D. in civil engineering from the University of California, Berkeley.

Patrick Crawford
Feeding America

Patrick Crawford coordinates disaster preparedness and relief efforts for the Feeding America Network. His responsibilities include collaborating with national partners in the emergency management and nonprofit communities to ensure effective collection and distribution of donated food items following disaster. Mr. Crawford also directs internal operations during disaster by coordinating among several Feeding America departments, including Logistics, Food Sourc-

ing, Philanthropy, Communications, and Government Relations, and directly with more than 200 food banks throughout the network. Before joining Feeding America, Mr. Crawford served as the director of the Midwest region for James Lee Witt Associates (JLWA), a crisis and consequence management firm, where he led efforts in emergency preparedness, response, recovery, and mitigation and provided strategic counsel and government relations advice to mitigate future flood losses near the Mississippi and Missouri rivers. Mr. Crawford worked for more than 16 years with the Federal Emergency Management Agency (FEMA) in crisis and consequence management, including responses to floods, earthquakes, hurricanes, wildfires, and acts of terrorism. At FEMA he worked extensively in the Gulf region, following the catastrophic hurricanes Katrina and Rita, and in FEMA's Region 9 (covering California, Arizona, Nevada, Hawaii, and U.S. territories in the Pacific), where he worked directly with state and local governments to build emergency response, recovery, mitigation, and preparedness capacity. Mr. Crawford served as a captain in the U.S. Army Chemical Corps where his primary responsibility was to ensure unit readiness for nuclear, biological, and chemical defense activities. He received his B.A. in government from the University of Notre Dame and his M.A. in education from Loyola College of Maryland.

Gerald E. Galloway, Jr.
University of Maryland, College Park

Gerald E. Galloway, Jr. (member, National Academy of Engineering) is the Glenn L. Martin Institute Professor of Engineering and an affiliate professor of public policy at the University of Maryland, College Park. His 38-year career in the military included the position as commander of the U.S. Army Corps of Engineers District in Vicksburg, Mississippi, professor and founding head of the Department of Geography and Environmental Engineering, and dean of the Academic Board at the U.S. Military Academy. He was promoted to brigadier general in 1990 and retired from active duty in 1995. A civil engineer, public administrator, and geographer, Dr. Galloway's research now focuses on the development of U.S. national water policy in general and national floodplain management policy in particular. He is a member of the National Research Council's Water Science and Technology Board and the Disasters Roundtable. A member of the National Academy of Engineering, Dr. Galloway earned his M.S.E. at Princeton and his Ph.D. in geography (specializing in water resources) from the University of North Carolina at Chapel Hill.

Michael F. Goodchild
University of California, Santa Barbara

Michael F. Goodchild (member, National Academy of Sciences) is a professor of geography and director of the Center for Spatial Studies and Center for Spatially

Integrated Social Science at the University of California, Santa Barbara. He is also chair of the Executive Committee of the National Center for Geographic Information and Analysis and associate director of the Alexandria Digital Library. He taught at the University of Western Ontario for 19 years before moving to his present position in 1988. His research interests focus on the issues of geographic information, including accuracy and the modeling of uncertainty, the design of spatial decision support systems, the development of methods of spatial analysis, and data structures for global geographic information systems. He has explored using digital information gathered by remote sensing satellites to create spatial and environmental models of the planet, make maps, and create digital libraries of geographic information that can be widely accessed electronically. He has also developed mathematical models to help quantify the difference between these geographic measurements and the reality of the world outside, so that geographic information can be accurately used. His research also includes digital libraries and problems associated with search, retrieval, and use of geographic information over the Internet; the potential for novel kinds of fieldwork enabled by fully mobile, wirelessly connected, and even wearable information technology; and the role of geographic information technologies in science and policy making. He has received several awards and published numerous books and journal articles. A member of the National Academy of Sciences, he has served on numerous National Research Council studies and standing committees as both member and chair. He received a B.A. in physics from Cambridge University and a Ph.D. in geography from McMaster University.

Howard C. Kunreuther
University of Pennsylvania, Wharton School of Business

Howard Kunreuther is the Cecilia Yen Koo Professor of Decision Sciences and Public Policy at the Wharton School and co-director of the Wharton Risk Management and Decision Processes Center. He has a long-standing interest in ways that society can better manage low-probability/high-consequence events related to technological and natural hazards and has published widely in these areas. Dr. Kunreuther is a fellow of the American Association for the Advancement of Science (AAAS) and recently served as a member of the National Academy of Sciences Panel on Adaptation Strategies for Climate Change. He is a distinguished fellow of the Society for Risk Analysis, receiving the Society's Distinguished Achievement Award in 2001. He cochaired the World Economic Forum's Global Agenda Council on "Innovation and Leadership in Reducing Risks from Natural Disasters" and is a member of the World Economic Forum's Global Agenda Council on Humanitarian Assistance, and the Organization for Economic Cooperation and Development's High Level Advisory Board on Financial Management of Large-scale Catastrophes. His most recent books are *At War with the Weather* (with Erwann Michel-Kerjan, July 2009, MIT Press),

and *Learning from Catastrophes: Strategies for Reaction and Response* (with Michael Useem, December 2009, Wharton School Publishing). He received his A.B. in economics from Bates College and his Ph.D. in economics from the Massachusetts Institute of Technology.

Meredith Li-Vollmer
Public Health, Seattle and King County

Meredith Li-Vollmer is a risk communication specialist for Public Health, Seattle and King County, where she leads planning for communications during emergencies, with a particular focus on strengthening the capacity of public health to reach those most at risk during emergencies. In this role, she conducts audience research, directs public engagement projects, and develops strategies and materials for public outreach. In 2009 she directed a Public Engagement Project on Medical Service Prioritization During an Influenza Pandemic, funded by the Centers for Disease Control and Prevention (CDC), and presented the findings to a workshop of the Institute of Medicine. More recently, she led a local public engagement project on H1N1 vaccine. Dr. Li-Vollmer is also a researcher with the University of Washington Preparedness and Emergency Response Research Center and a clinical assistant professor at the University of Washington School of Public Health and Community Medicine. Her work has received multiple awards, including the Model Practice Award from the National Association of City and County Health Officials (NACCHO) and the Gold Award for Excellence from the National Public Health Information Coalition. Before joining Public Health, Seattle and King County, she taught communications at the University of Washington. She received her Ph.D. in communication from the University of Washington.

Monica Schoch-Spana
University of Pittsburgh Medical Center

Monica Schoch-Spana, a medical anthropologist, is a senior associate with the Center for Biosecurity of the University of Pittsburgh Medical Center (UPMC) and an assistant professor in the School of Medicine Division of Infectious Diseases. The Biosecurity Center works to affect policy and practice in ways that lessen the illness, death, and civil disruption that would follow large-scale epidemics, whether they occur naturally or result from the use of a biological weapon. She has led research, education, and advocacy efforts to encourage greater consideration by authorities of the general public's capacity to confront bioattacks and epidemics constructively. In 2009 she organized the national conference Resilient American Communities: Progress in Policy and Practice and chaired the Resilience Research Work Group. In 2006 she oversaw the Working Group on Citizen Engagement in Health Emergency Planning and was

the principal organizer for the U.S.-Canada summit on Disease, Disaster, and Democracy—The Public's Stake in Health Emergency Planning. In 2003 she organized the national meeting Leadership During Bioterrorism: The Public as an Asset, Not a Problem, and chaired the Working Group on "Governance Dilemmas" in Bioterrorism Response that issued consensus recommendations to mayors, governors, and top health officials nationwide in 2004. For more than 10 years, Schoch-Spana has briefed numerous federal, state, and local officials, as well as medical, public health, and public safety professionals on critical issues in biosecurity. National advisory roles include serving on the Steering Committee of the Disaster Roundtable of the National Research Council (NRC), the Institute of Medicine Standing Committee on Medical Readiness, and the NRC Committee to Review the Department of Homeland Security's Approach to Risk Analysis. She serves on the faculty for the National Consortium for the Study of Terrorism and Responses to Terrorism (START), a university-based center of excellence supported by the U.S. Department of Homeland Security. In 2003, Dr. Schoch-Spana helped establish the Biosecurity Center of UPMC; starting in 1998 she worked at the Johns Hopkins Center for Civilian Biodefense Strategies. She received her Ph.D. in cultural anthropology from Johns Hopkins University and B.A. from Bryn Mawr College.

Susan C. Scrimshaw
The Sage Colleges

Susan C. Scrimshaw (member, Institute of Medicine) is president of the Sage Colleges. She moved to Sage after serving as president of Simmons College. Dr. Scrimshaw was formerly dean of the University of Illinois at Chicago (UIC) School of Public Health and professor of community health sciences and anthropology at UIC. Under her leadership, the UIC School of Public Health established a wide range of community, regional, and national partnership initiatives, including addressing disparities in the delivery of health care, improving pregnancy outcomes, maternal and child health, healthy aging, violence prevention, cancer prevention, AIDS-STD prevention, and occupational and environmental health issues. While dean of the School of Public Health, she led the school in a national role in responding to the September 11, 2001, terrorist attacks. Her own interdisciplinary research has focused on gender, race, ethnicity, and culture, and their impact on public health and includes community participatory research methods, addressing health disparities, improving pregnancy outcomes, violence prevention, health literacy, and culturally appropriate delivery of health care. She has been frequently honored for her work in raising awareness of public health issues around the world, including minority populations in the United States. Her awards include a gold medal as a "Hero of Public Health" presented by the president of Mexico, and the Margaret Mead Award of the American Anthropological Association. She is the author of 5 books or monographs and 65 journal articles

and book chapters. She is past president of the Society for Medical Anthropology, a member and past chair of the Association of Schools of Public Health, and a member of the board of directors of the U.S.-Mexico Foundation for Science, which advocates for scientific collaboration between the two countries. She was a founding member of the task force on Community Preventive Services of the federal Centers for Disease Control and Prevention. In 2006, she was awarded the Illinois Public Health Association's highest honor, the Distinguished Service Award, in recognition of her service in research, teaching, and public health practice. She is a member of the governing council of the Institute of Medicine of the National Academies and has served on several of its panels and boards. She recently chaired the Institute of Medicine's Committee on Communication for Behavior Change in the 21st Century: Improving the Health of Diverse Populations. Dr. Scrimshaw is a fellow of the American Association of the Advancement of Science.

Ellis M. Stanley, Sr.
Dewberry

Ellis M. Stanley, Sr. is vice-president of Western Emergency Management Services at Dewberry LLC. Before joining Dewberry, Mr. Stanley served as general manager of the City of Los Angeles Emergency Preparedness Department, where he worked for 10 years. With 35 years of experience in the emergency management field, Mr. Stanley has worked at four national political conventions, the 1996 Olympic Games in Atlanta, and the 1994 papal visit and World Youth Conference in Denver. He has served as past president of the International Association of Emergency Managers and has led delegations of emergency management professionals to China, Japan, and other countries. A member of the National Research Council's Disasters Roundtable, he received his B.A. in political science from the University of North Carolina.

Gene Whitney
Congressional Research Service

Gene Whitney is energy research manager for the Congressional Research Service at the Library of Congress in Washington, D.C. Previously, he was assistant director for environment at the White House Office of Science and Technology Policy (OSTP). His work at OSTP focused on the science and technology policy aspects of earth sciences; natural hazards and disasters; energy, water, land remote sensing; environment, and natural resources. He served as co-chair of the U.S. Group on Earth Observations and was OSTP liaison to the U.S. Climate Change Science Program. He directed the Future of Land Imaging Interagency Working Group, and served as National Science Technology Council director for the Subcommittee on Disaster Reduction and the Subcommittee on Water

Availability and Quality. Dr. Whitney coordinated the federal interagency science and technology portfolio for the United States in UNESCO (United Nations Educational, Scientific, and Cultural Organization). He served as a member of the Joint U.S.-Canada Task Force investigating the massive electrical blackout of August 14, 2003 in the northeastern United States and southern Canada, and worked with the President's Council of Advisors on Science and Technology on national energy efficiency policy. Before OSTP, Dr. Whitney was chief scientist for the U.S. Geological Survey (USGS) Energy Resources Team, where he managed the energy research and assessment group, conducting basic research on the geology, geochemistry, and geophysics of fossil fuels, conducting national and global assessments of oil, natural gas, and coal resources, and assessing availability and economics of fossil fuels. He has authored or co-authored numerous scientific papers and abstracts. He received a National Research Council postdoctoral fellowship at the National Aeronautics and Space Administration's Jet Propulsion Laboratory and was awarded a senior postdoctoral fellowship at École Normale Supérieure in Paris. His international experience includes working with the governments of China, Russia, Pakistan, Algeria, Bangladesh, and Japan on energy and mineral resource issues. Dr. Whitney received his Ph.D. in geology from the University of Illinois.

Mary Lou Zoback
Risk Management Solutions, Inc.

Mary Lou Zoback (member, National Academy of Sciences) is recently retired as vice president of Earthquake Risk Applications with Risk Management Solutions in Newark, California. RMS is the world's leading catastrophe modeling firm. Her responsibilities at RMS include leading initiatives on the significance of risk quantification for expanding the societal role of earthquake insurance, disaster management, and risk reduction activities worldwide. She previously served as chief scientist of the U.S. Geological Survey's (USGS) Earthquake Hazards team in Menlo Park, California, and also as regional coordinator for the USGS Northern California Earthquake Hazards Program. From 2003 to 2006, she was chair of the steering committee for the 1906 Earthquake Centennial Alliance, a nonprofit promoting public outreach on seismic safety and coordinating more than 280 groups and organizations that put on events to commemorate the 1906 earthquake. She has served on numerous national committees and panels on topics ranging from defining the next generation of Earth observations from space, storage of high-level radioactive waste, facilitating interdisciplinary research, and science education. She is a member of the National Academy of Sciences, a past president of the Geological Society of America (GSA), a member of the board of directors of the Seismological Society of America, and currently serves on the National Research Council's Disasters Roundtable. She is the recipient of the 2007 GSA Day Medal, 2007 GSA Public Service Award, the

Leadership, Innovation, and Outstanding Accomplishments in Earthquake Risk Reduction Award from the Earthquake Engineering Research Institute (2006), and the American Geophysical Union (AGU) Macelwane Award for Young Scientists (1987). She joined the USGS in 1978 after receiving her B.S., M.S., and Ph.D. in geophysics from Stanford University.

Appendix B

Workshop Agenda

Tuesday, January 18th
Keynote Presentation

Grand A Room, Astor Crowne Plaza Hotel

17:30-18:30 **Craig Colten, Louisiana State University, Keynote presentation**
"Forgetting the Unforgettable: Social Memory and Resilience in New Orleans"

18:30-19:30 **Committee Dinner**

Wednesday, January 19th

Field Tour, New Orleans and Coastal Mississippi

Lobby, Astor Crowne Plaza Hotel

7:50-8:00 Bus Pickup

8:00-11:30 New Orleans, guided by Dr. Pam Jenkins, University of New Orleans

8:15-09:45 Visit Holy Cross neighborhood, Holy Cross Carbon Neutral Plan, Make It Right (Lower 9th), Bayou Bienvenue restoration, and Lower 9th Ward, with guidance from Doug Meffert, Tulane University.

10:00-11:15 Visit New Orleans East, Versailles community, Vietnamese community and Community Development Corporation, Inc.

11:20-12: 30 Drive to Waveland, Mississippi

12:30-15:00 Mississippi visits: Waveland, Gulfport, and Biloxi, guided by Tracie Sempier, Mississippi-Alabama Sea Grant Consortium; and Ronnie Schumann, University of South Carolina

12:30-13:10 Waveland, Mississippi. Visit with Mayor David Garcia and Fire Chief Mike Smith at Community Civic Center.

13:20-14:45 Windshield visits to localities in Waveland, Gulfport, Biloxi corridor.

15:00-17:00 Knight Nonprofit Center, 11975 Seaway Road Suite B250, Gulfport

Discussion about resilience topics:

Alice Graham, Executive Director, Mississippi Coast Interfaith Disaster Task Force

John Hosey, Disaster Behavioral Health Project Manager, Mississippi Coast Interfaith Disaster Task Force

John Kelly, Chief Administrative Officer for the City of Gulfport

Rupert Lacy, Director, Harrison County Emergency Management Agency

Tom Lansford, Academic Dean and Professor, Political Science, University of Southern Mississippi, Gulf Coast

Reilly Morse, Senior Attorney, Mississippi Center for Justice

Kimberly Nastasi, CEO, Mississippi Gulf Coast Chamber of Commerce

Tracie Sempier, Coastal Storms Outreach Coordinator, Mississippi-Alabama Sea Grant Consortium

Lori West, Gulf Region Director, IRD, US Gulf Coast Community Resource Centers

17:00-19:00 Astor Crowne Plaza Hotel, New Orleans

Thursday, January 20th
Workshop

Toulouse A & B, Astor Crowne Plaza Hotel

8:30-8:40 **Welcome and introductions by Susan Cutter, Committee Chair**

8:40-8:45 **Senator Mary Landrieu, opening remarks (via videotape)**

8:45-9:30 **Keynote presentation**
Allison Plyer, Greater New Orleans Community Data Center
"The New Orleans at Five: From Recovery to Transformation"

9:40–15:00 **Panel sessions (5)**
Facilitated by Ann Olsen, Meridian Institute; panels moderated by members of the committee

9:40-10:25 **Business-Insurance-Real Estate panel**
Julie Rochman, President and CEO, Institute for Business and Home Safety
Eric Nelson, Travelers Vice President, Personal Insurance
Ommeed Sathe, Director of Real Estate Strategy, New Orleans Redevelopment Authority

Moderated by Howard Kunreuther

10:25-10:40 **Break**

1040-1125 **Critical Infrastructure panel**
Marcia St. Martin, Executive Director, Sewerage and Water Board of New Orleans
Justin Augustine, CEO, New Orleans Regional Transit Authority and Vice President, Veolia Transportation
Greg Grillo, Entergy Corporation, Director, Transmission Project Management and Construction and Incident Commander, Entergy Corporation

Frank Wise, Verizon Wireless

Moderated by Gerry Galloway

1130-1215 **Governance panel**
Earthea Nance, University of New Orleans
Bill Stallworth, Executive Director/Councilman East Biloxi Coordination and Relief Center/Biloxi City Council
Stephen Murphy, Director of Planning, City of New Orleans Office of Homeland Security and Emergency Response
Charles Allen III, Advisor to the Mayor and Director New Orleans Office of Coastal and Environmental Affairs

Moderated by Ellis Stanley, Sr.

1215-1315 **Lunch**

1315-1400 **Social Capital panel**
Natalie Jayroe, CEO, Greater New Orleans and Acadiana Food Bank
Steven Bingler, President, Concordia
Mary Claire Landry, Director, Domestic Violence Programs (Family Justice Center; Crescent House; Sexual Assault Services; and Project SAVE) Catholic Charities Archdiocese of New Orleans
Pam Jenkins, University of New Orleans

Moderated by Susan Scrimshaw

1405-1450 **Healthy Populations and Responsive Institutions panel**
Joseph Donchess, Executive Director, Louisiana Nursing Home Association
Knox Andress, Designated Regional Coordinator, Louisiana Region 7 Hospital Preparedness; Louisiana State University Health Sciences Center-Shreveport, Louisiana Poison Center
Garcia Bodley, Program Director for the Louisiana Spirit Coastal Recovery Counseling Program
Paul Byers, Acting State Epidemiologist, Mississippi State Department of Health

Moderated by Monica Schoch-Spana

1450-1510 **Break**

1510-1630 **Open Discussion**
Committee, panelists, and audience open discussion on: business-insurance-real estate; critical infrastructure; governance; public health; and social capital

1630-1730 **Plenary session**

1900-2100 **Working Committee Dinner**
Conversations with guests: **John Barry** (author) and Commissioner **Mike Chaney** (Insurance Commissioner, Mississippi)

Appendix C

Biographies of Workshop Participants

Charles E. Allen III
Charles Allen is the director the Mayor's Office of Environmental Affairs of the City of New Orleans. He has also served as president of the Holy Cross Neighborhood Association (HCNA). Founded in 1981, the Holy Cross Neighborhood Association is a neighborhood organization in the Lower Ninth Ward of New Orleans, whose mission is to improve the living conditions and serve the needs of its residents, preserve cultural and architectural heritage, serve as a clearinghouse for information, and actively represent the interests of the neighborhood with city, state, and federal agencies; private businesses; community organizations; and individuals for the purpose of improving the community. As HCNA president, Mr. Allen helped to spearhead multiple restoration and recovery efforts in the Holy Cross–Lower Ninth Ward community. Mr. Allen has been an active REACH NOLA partner since its inception in April 2006, and co-leads the Sustainability Workshop project and sits on the Health and Resilience project council.

Knox Andress, R.N.
Knox Andress is a practicing emergency department nurse and the weapons of mass destruction (WMD) response coordinator at Christus Schumpert Health System, Shreveport, Louisiana. He leads hospital disaster planning and chairs his hospital's disaster safety team. Mr. Andress also serves on the Shreveport Metropolitan Medical Response System's (MMRS) Hospital Committee and is the Region 7 hospital coordinator of the Health Resources and Services Administration (HRSA)—Louisiana Bioterrorism Hospital Emergency Preparedness Program. He is the chair-elect of the Emergency Nurses Association's Emergency Preparedness Committee and instructs WMD medical management throughout

Louisiana with the Louisiana Homeland Defense Education Team. Mr. Knox is a Department of Justice (DOJ), Office of Domestic Preparedness, WMD instructor and serves as a consultant to DOJ and SAIC (Science Applications International Corporation).

Justin Augustine

Justin Augustine is the chief executive officer of the New Orleans Regional Transit Authority (RTA) as well as a vice president of Veolia Transportation. Mr. Augustine is a professional in management and finance with more than 28 years of experience in the fields of transportation management and finance and accounting. The Veolia Transportation team is responsible for all aspects of the public transportation system in New Orleans. The city of New Orleans and the RTA Board of Commissioners has worked with Veolia Transportation to be the first city in the United States to implement a "delegated management" modeled contract under which Veolia Transportation assumed the numerous responsibilities that are associated with running an urban public transit system. As a transit executive, he has managed numerous multimodal transit agencies including Capital Metro in Austin, Texas; the Africa Transportation Company in Johannesburg, South Africa; and Regional Transit Authority and Transit Management of Southeastern Louisiana, Inc., in New Orleans, Louisiana; and many transit agencies in California, including San Diego, Santa Clarita, San Francisco, Oakland, Napa Valley, Sonoma County, Los Angeles, Beverly Hills, San Jose, Redding, Chico, Victor Valley, Antelope Valley, and Yolo County. Mr. Augustine received his undergraduate degree from Xavier University, where he studied accounting.

John M. Barry

John Barry is a prize-winning and *New York Times* best-selling author whose books have won more than 20 awards. In 2005 the National Academies named *The Great Influenza*, a study of the 1918 pandemic, the year's outstanding book on science or medicine. In 2006 the National Academies also invited Mr. Barry to give its annual Abel Wolman Distinguished Lecture; he is the only nonscientist ever to give that lecture. In 1998, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* won the Francis Parkman Prize of the Society of American Historians for the year's best book of American history. After Hurricane Katrina, the Louisiana congressional delegation asked Mr. Barry to chair a bipartisan working group on flood control. In 2007 a Democratic governor appointed him to both the Southeast Louisiana Flood Control Authority East, which oversees levee districts in the metropolitan New Orleans area, and the Louisiana Coastal Protection and Restoration Authority, which develops and implements the hurricane protection plan for the state. In 2009 a Republican governor reappointed him to both positions. In addition to serving on advisory boards at Johns Hopkins and the Massachusetts Institute of Technology, he is on

the boards of the Society of American Historians and American Heritage Rivers, and the advisory board for the National Mississippi River Museum in Dubuque. Before becoming a writer, Mr. Barry coached football at the high school, small college, and major college levels. Currently distinguished scholar at the Center for Bioenvironmental Research of Tulane and Xavier Universities, he lives in New Orleans.

Steven Bingler

Steven Bingler received his architectural training at the University of Virginia, where he was free to indulge his curiosity of democratic principles. In 1983 he founded Concordia, a community-based planning and architecture firm, to pursue systemic and collaborative design practices. *Concord*—which means harmony among things and agreement between people—is the firm's one-word mission statement. Design projects include the Contemporary Arts Center in New Orleans, where a cooperative partnership with seven sculptors explored visual art and architectural design as a collaborative enterprise; and the Henry Ford Academy in Dearborn, Michigan, where Concordia worked with teams of teachers, students, and arts curators to integrate a learning environment for 400 inner-city high school students into the 80-acre Henry Ford Museum complex. In 2006, Concordia coordinated the development of the Unified New Orleans Plan, a comprehensive strategy for the redevelopment of the city of New Orleans after Hurricane Katrina. The process incorporated the work of 12 urban planning firms, 54 community planning district meetings and 3 citywide community congress events, with a combined participation of more than 9,000 New Orleans citizens. Concordia was also the principle education facilities planning consultant for the development of the New Orleans School Facilities Master Plan, which features a melding of school planning and urban design principles to form a nexus of walkable, equitable, and environmentally sustainable community programs, facilities, parks and public spaces. Concordia's research alliances have included the MIT Media Lab, Harvard University's Project Zero, the University of New Mexico, the National Aeronautics and Space Administration, the Thornburg Institute, the Appalachian Education Lab, and the West Ed Research Lab. In addition, Mr. Bingler has served as a special consultant to the Office of the Secretary of the U.S. Department of Education for policy related to the design of schools as centers of community. His papers have been published in a wide range of books and journals in the fields of urban planning, architectural design, education, public health, and smart growth.

Paul Byers, M.D.

Paul Byers received his B.S. in biology from Millsaps College. He earned his medical degree from the University of Mississippi, with training in internal medicine in 1992. Dr. Byers has been employed with the Mississippi State Department of Health since 1993 in the position of medical director for the Copiah County

and Hinds County Health Departments. He is currently the deputy state epidemiologist for the Office of Communicable Diseases, Division of Epidemiology.

Mike Chaney

Mike Chaney is Mississippi's commissioner of insurance. Before his election in 2007, Commissioner Chaney served 7 years in the Mississippi House of Representatives and 8 years in the Mississippi Senate. Since taking office in January 2008, Commissioner Chaney has opened a Mississippi Insurance Department office on the Gulf Coast. He has also spearheaded a wind mitigation program for the Mississippi Gulf Coast region to strengthen homes against hurricane-force winds and help homeowners realize discounts on their wind insurance premiums. In addition to the mitigation program, he has overseen the addition of 49 property and casualty companies in the state, with 30 being multiline and 19 single-line companies, and he has overseen the addition of 18 surplus lines companies. Commissioner Chaney has worked to streamline and modernize the licensing procedures used in the department; strengthen and stabilize the state's Windpool, the insurer of last resort for some homeowners; lengthen the amount of time the department has in responding to rate filings; worked to secure insurance for volunteer firefighters; and sought legislation to protect victims of domestic violence from discrimination by health insurance companies. He has also directed a market conduct study on a major insurer in the state and studied and reduced several major rate filings by companies. Commissioner Chaney has received many awards for his legislative work in education, economic development, and catastrophe recovery, and has served on many community development entities, including as president of the Vicksburg–Warren County Chamber of Commerce and president of the Vicksburg–Warren County Economic Development Committee. He is also a Rotarian and Paul Harris fellow. He is a past president of the Republican Elected Officials of Mississippi and serves on the state Republican Executive Committee. He is a 1966 graduate of Mississippi State University with a B.S. in business and finance and is a veteran of the U.S. Army, having served in Vietnam in 1968–1969.

Craig E. Colten

Craig Colten is the Carl O. Sauer Professor of Geography at Louisiana State University. A native of north Louisiana, his recent research has focused on New Orleans. His award-winning *An Unnatural Metropolis: Wresting New Orleans from Nature* (2005) appeared months before Hurricane Katrina and provided essential geographic insight on the circumstances that contributed to the calamity unleashed by the storm. A subsequent book, *Perilous Place, Powerful Storms* (2009), portrayed the protracted construction of a hurricane protection system in southeast Louisiana. Currently he is a research associate with the Community and Regional Resilience Institute at Oak Ridge National Laboratory and a member of the U.S. Department of Interior's Strategic Science Working Group, which

was established in response to the Deepwater Horizon oil release in the Gulf of Mexico. He also serves as the editor of the *Geographical Review*.

Joseph Donchess
Joseph Donchess is the executive director of the Louisiana Nursing Home Association. Before joining the association in 1986, Mr. Donchess worked as an attorney for the Louisiana Department of Health and Human Resources. Mr. Donchess is a member of several organizations, including the Louisiana State Bar Association, Louisiana Emergency Preparedness Association, Alzheimer's Association of Louisiana and Louisiana Patients' Compensation Fund Oversight Board. He served on the Louisiana Health Care Collaborative, a commission assigned to redesign health care in Louisiana after Hurricanes Katrina and Rita. He received his undergraduate degree from Chaminade University of Honolulu and his juris doctorate from Southern Law School.

Alice Graham
Alice Graham is the executive director of the Mississippi Coast Interfaith Disaster Task Force (MCIDTF). MCIDTF was formed in 1980 as a Long-term Recovery Committee to respond to the needs of Mississippi Gulf Coast citizens following Hurricane Frederick. The task force also provided services to the community after Elena in 1986, and Georges in 1998. MCIDTF is working with its partners to address the short- and long-term impacts of the Gulf oils spill disaster on coastal residences. As a member of South Mississippi Voluntary Organizations Active in Disaster (VOAD), it played a key role in the summit's organization and coordination. MCIDTF is working with local partners to determine necessary resources for assisting citizens affected by the oil spill disaster. Before taking this position, Dr. Graham was a professor of pastoral care and counseling at Hood Theological Seminary. She holds a Ph.D. from Northwestern University in pastoral psychology and counseling.

Greg Grillo
Mr. Grillo is the director of transmission project management and construction and incident commander for Entergy Corporation. Mr. Grillo previously served as Entergy Arkansas' director of distribution operations, a job he held for 5 years. During his career at Entergy, Mr. Grillo has held positions in engineering, distribution planning, system meter reading, revenue protection, and load research. He has worked both for electric and gas operations for three of the five utility companies. He also worked for Entergy's London Electricity company for 2 years. He is an alumnus of the University of New Orleans.

John M. Hosey
John Hosey received his M.Div. from Southeastern Baptist Theological Seminary, Wake Forest. He is currently serving as the disaster mental health project man-

ager and disaster response coordinator for the Mississippi Coast Interfaith Disaster Task Force in Biloxi, Mississippi. He serves as a board member for the South Mississippi Voluntary Organizations Active in Disaster (SMVOAD) and as the committee chair for the Emotional and Spiritual Care Committee for the MSVOAD. He has co-published several articles related to faith-based and collaborative partnership recovery efforts following hurricane Katrina. His work includes an effort with Dr. Jamie Aten (Wheaton College) and Dr. Sharon Topping (University of Southern Mississippi) to develop collaborative partnerships between faith-based organizations and mental health professionals to address disaster preparedness plans for congregations and addressing the unmet psychosocial needs following disasters like Hurricanes Katrina and Gustav and more recently the Deep Water Horizon oil spill. This effort has been funded by the American Red Cross, Foundation for the Mid-South, and the United Jewish Communities. More recently, the Mississippi Department of Mental Health awarded his organization a grant to manage a five-partner mental health collaborative to conduct a comprehensive assessment and provide a culturally appropriate intervention program to address the psychosocial impacts of the Gulf oil spill on residents of the Mississippi Gulf Coast region. Mr. Hosey is also currently serving as lead facilitator and chair for the Mississippi Coast Primary/Mental Health Collaborative and as the chair for the sixth annual Mississippi Coast Mental Health and Community Wellness Conference. As a part of its work in Katrina recovery, his organization was recognized in 2009 as a merit finalist for the 2008 Community Partnership Award.

Natalie Jayroe

Natalie Jayroe is the president and chief executive officer of Second Harvest Food Bank of New Orleans and Acadiana. Following hurricanes Katrina and Rita she was the Feeding America representative at the Joint Field Office in Baton Rouge. The mission of Second Harvest is to lead the fight against hunger in south Louisiana through food distribution, advocacy, education, and disaster response. Second Harvest currently distributes more than 19 million pounds of food annually through more than 240 faith-based and nonprofit agency members in 23 parishes of south Louisiana. Through the Lagniappe Backpack Program, 1,100 children at 14 schools receive backpacks of kid-friendly nutritious food every Friday of the school year. In 2010 Second Harvest piloted a summer feeding program. Senior Box, 9-A-Day the Head Start Way, and Supplemental Nutrition Assistance Program (SNAP) outreach are other programs that Second Harvest has added under Ms. Jayroe's leadership to help achieve its mission. Second Harvest continues to be a strong partner of local, state and federal agencies in disaster response, providing emergency food relief after hurricanes Gustav and Ike and currently working to support families affected by the Gulf oil spill. Second Harvest has also worked with five Louisiana universities to conduct a "farm-to-fork" food system analysis of post-Katrina and Rita south Louisiana. In

her 17-year career in food banking, Ms. Jayroe has since held several positions of leadership within the Feeding America network. She was a founding member of the National Council of America's Second Harvest, served on the 2004 Contract Task Force, and chaired the eastern region of Feeding America from 2000 to 2002. She served on many national state and local boards and committees while in Georgia, including the Governor's Workforce Investment Board of Georgia, the Board of Parent and Child, and as chair of the United Way Executive's Association. Currently, Ms. Jayroe is a founding member of the Louisiana Food Bank Association and the Food Policy Advisory Committee of New Orleans' City Council. She is a member of Louisiana's Sustainable Food Policy Council. She was named one of *City Business's* Women of the Year in 2007, and in 2008 she was honored with MAZON's Irving Cramer award, given to individual leaders and groups who emphasize passion, wisdom, and dedication in their mission to end hunger across America.

Pam Jenkins

Pam Jenkins is a professor at Louisiana State University. Dr. Jenkins teaches primarily in two areas, criminology and women's studies. She has taught classes on criminology, sociology of law, women and crime, and sociology of corrections. Her most recent course offerings include an applied sociology course and a women's studies service learning course. She is also a member of the faculty in the Women's Studies Program at the University of New Orleans (UNO). Her research is on a variety of topics that concern how communities sustain themselves, solve problems, and resolve conflicts. She is also a founding and associate member of UNO's Center for Hazard Assessment, Response and Technology. She has published on a variety of community issues, including several manuscripts outlining community responses to domestic violence, and more recently, several articles focusing on Louisiana coastal communities' response to coastal erosion. Post-Katrina, she has been documenting the response to Katrina as part of a national research team on Hurricane Katrina evacuees. She has published on first responders, faith-based communities, response to the storm, and the experiences of the elderly during and after Katrina.

John R. Kelly

John Kelly serves as a vital link between the Mayor's Office, City Council, department directors and other entities to facilitate outcomes consistent with the overall vision and mission of the city of Gulfport, Mississippi. The chief administrative officer (CAO) oversees the city's more than 20 departments and is responsible for oversight and management of city operations, ensuring efficiency, accountability and productivity in the city's commitment to deliver quality services through the daily operations of municipal government. Dr. Kelly is a 1970 graduate of Alcorn State University. He also earned a master's degree from Wayne State University in Detroit and a doctorate from the University of

Southern Mississippi in Hattiesburg. Before becoming Gulfport's CAO, he served as the city's municipal court administrator for a short period. In addition, he has also served as president of the Board of Gulfport Job Corps Center. From 2000 to 2004 he served as chairman of the Board of Trustees for Gulf Coast Medical Center. Dr. Kelly served 4 years as a national officer (regional vice president) of his fraternity Alpha Phi Alpha. He is currently servicing as sire archon of his local Boule' of Sigma Pi Phi. Last year he was named a trustee for Leadership Gulf Coast. He is a member of Morning Star Missionary Baptist Church, where he serves as chairman of the Board of Deacons and the church's Rebuilding Committee. The church, which was virtually destroyed by Hurricane Katrina, recently moved into its new $3 million facility.

Rupert Lacy

Rupert Lacy was appointed director of the Emergency Management/Homeland Security/E911 Agencies for Harrison County in August 2006. Before serving in this position, he was captain of Harrison County Sheriff's Department for 6 years.

Mary Claire Landry

Mary Claire Landry is the director for Domestic Violence Programs at the Catholic Charities Archdiocese of New Orleans. Catholic Charities Archdiocese of New Orleans is an umbrella agency of health and community services throughout the archdiocese. On July 13, 1938, the agency was formally incorporated under the name of Associated Catholic Charities of New Orleans, Inc. On August 8, 1996 the name of Associated Catholic Charities of New Orleans, Inc., was legally changed to Catholic Charities Archdiocese of New Orleans.

Tom Lansford

Tom Lansford is associate dean of the College of Arts and Letters and professor of political science at the University of Southern Mississippi. His research areas and public speaking topics include transatlantic relations, homeland security, American foreign and security policy, arms trade and disarmament, and environmental politics and coastal development. He is also the editor of multiple books including *Judging Bush*; *America in World History*; *Ethics and Global Politics*; and *U.S. Foreign Policy and Conflict in the Islamic World*. He received his B.A. from Virginia Wesleyan College and his M.A. and Ph.D. from Old Dominion University.

Douglas Meffert

Doug Meffert is the Eugenie Schwartz Professor of River and Coastal Studies and deputy director for policy at the Tulane/Xavier Center for Bioenvironmental Research (CBR), where he also serves as CBR's chief financial officer. He is also director of Tulane's RiverSphere, a new initiative fostering green jobs in renewable energy through testing and development of hydrokinetic energy systems in

the Mississippi River. Dr. Meffert has faculty appointments in Tulane's School of Public Health's Environmental Health Sciences Department and the Tulane Law School's Payson Center for International Development. He is also co-principal of Meffert + Etheridge Environmental Projects, LLC. Recent awards include a 2007 joint Loeb Fellowship at Harvard's Graduate School of Design and the Lincoln Institute of Land Policy in Cambridge, Massachusetts, where he currently serves as a faculty associate and, in 2009, an award of excellence from the American Society of Landscape Architects. Dr. Meffert has more than 15 years of research, policy development, and practice related to urban sustainability and coastal restoration and protection. He currently serves as the New Orleans coordinator for the United Nations Education Scientific and Cultural Organization's Urban Biosphere Program, which is dedicated to intellectual exchange and research to promote resilience and sustainability of urban ecosystems worldwide. Dr. Meffert received his undergraduate engineering and a master's in business degrees at Tulane University and doctorate of environmental science and engineering from the University of California, Los Angeles.

Reilly Morse

Reilly Morse is a senior attorney at Mississippi Center for Justice. Mr. Morse is a third-generation Gulfport lawyer with more than 20 years experience in civil and criminal law. He has specialized in land use, zoning, and environmental justice issues with pro bono and paying clients that include the low-income, minority, and substantially elderly communities of North Gulfport and Turkey Creek, the Mississippi Sierra Club, Concerned Citizens to Protect Isles and Point, and Citizens Association for Responsible Development. Mr. Morse is a former assistant municipal judge and assistant municipal prosecutor of the city of Gulfport. He is also a member of the Affordable Housing Committee of the Governor's Recovery Commission and the Harrison County Recovery Committee. A graduate of the University of Mississippi School of Law and Millsaps College, Mr. Morse held a judicial clerkship with Mississippi Supreme Court Justice Michael Sullivan (1984–1985); he is licensed to practice law in the state and federal courts of Mississippi.

Stephen Murphy

A native of south Georgia and graduate of the University of Georgia, Stephen Murphy moved to New Orleans only 10 weeks before Hurricane Katrina to continue graduate school studies in public health at Tulane School of Public Health and Tropical Medicine after earning an M.B.A. in health care management at Mercer University in Georgia. Katrina immediately forced Mr. Murphy to relocate to Baltimore, Maryland, where he matriculated with Johns Hopkins University and began his master's pursuit of infectious disease epidemiology. Mr. Murphy returned to Tulane to continue his studies in the field of environmental health sciences and disaster management, where he received his master's

of public health (MPH), and is currently focused on a Ph.D. Upon finishing the M.P.H., Mr. Murphy joined the New Orleans Office of Homeland Security and Emergency Preparedness, where he serves as the planning section chief (or director of planning). Mr. Murphy's previous roles have included serving as deputy planning section chief and medical and public health planning lead. His responsibilities include (among others) pandemic influenza planning for the city, mass prophylaxis/medical countermeasure planning for infectious disease outbreaks or bioterrorism, mass casualty and mass fatality planning, and graduate school intern coordinator.

Earthea Nance

Dr. Earthea Nance is an assistant professor of environmental planning and hazard mitigation at the University of New Orleans, and a fellow in the National Science Foundation's Next Generation of Hazards and Disaster Researchers Program. She recently served as the director of disaster mitigation planning and the director of infrastructure and environmental planning for the city of New Orleans in its recovery from Hurricane Katrina, and she previously held faculty positions at Virginia Tech and the Massachusetts Institute of Technology. Dr. Nance holds a B.S in civil engineering (1985) and an M.S. in environmental engineering (1991) from the University of California at Davis, and a Ph.D. from the department of civil and environmental engineering at Stanford University (2004). Dr. Nance's research addresses the intersection of environmental and urban development problems in vulnerable socioeconomic settings and postdisaster areas. She has studied the role of community participation in expanding basic urban services to chronically underserved neighborhoods. Her research has generated methods for critically evaluating infrastructure performance using multiple perspectives, and has produced strategies for sustainable urban development and environmental justice in areas of severe environmental hazard. Dr. Nance is currently researching the impacts of climate change on urban development and the effects of environmental trauma on urban social and ecological systems.

Kimberly J. Natasi

Kimberly Nastasi is the chief executive officer of the Mississippi Gulf Coast Chamber of Commerce. Born in Utah, Ms. Nastasi earned a speech communications degree from the University of Southern Mississippi (USM) in 1999, followed by a summer studying at the Universidad de Cemanahuac in Cuernavaca, Mexico. In 2000 she earned a master's degree in communications from USM and soon began teaching public speaking at Mississippi Gulf Coast Community College. Her first postcollege role was handling public relations for the Mississippi Sea Wolves professional hockey team in Biloxi. She then joined the Biloxi Chamber of Commerce, where she left as executive director after 5 years to take over the interim post at the Mississippi Gulf Coast Chamber of Commerce, which serves nearly 1,000 members. Ms. Nastasi graduated from the Leadership Gulf

Coast Class of 2003 and the Leadership Mississippi Class of 2004. Also in 2004, she traveled with three others from Louisiana to Brazil for 5 weeks, representing Mississippi and the Mississippi Rotary district club. Soon after, Lighthouse Business and Professional Women named her an Outstanding Career Woman, and the *Sun Herald* named her one of the area's Top 10 Under 40. She was also selected as one of the 50 Leading Business Women in 2007 by the *Mississippi Business Journal*.

Eric M. Nelson
Eric Nelson is Vice President of Risk Management for the Travelers companies. Travelers is one of the leading providers of property insurance in the United States; with the number 2 market share in commercial property and number 5 market share in homeowners. Mr. Nelson coordinates product, pricing, and underwriting strategy related to natural catastrophes. Since 2008, he has led the Travelers' efforts to develop a public policy solution to the crisis in coastal homeowners' marketplace. Mr. Nelson holds a finance degree from Bryant University.

Ann Olsen
Ann Olsen is a senior mediator at the Meridian Institute. She has extensive background supporting collaboration among diverse parties and identifying issues, opportunities, and solutions. Ms. Olsen currently facilitates the Gulfport, Mississippi, community partnership for the Community and Regional Resilience Initiative (CARRI) directed by the National Security Directorate (NSD) at Oak Ridge National Laboratory (www.resilientUS.org). She has also facilitated working sessions of the NSD Strategic Advisory Group. For CARRI, Ms. Olsen also contributes to the development of the larger CARRI program, provides day-to-day contract management leadership for Meridian's engagement, and has assisted in facilitating community workshop sessions for the CARRI Charleston, South Carolina, partner community. Ms. Olsen is a Ph.D. candidate and Bridgestone fellow in environmental management at Vanderbilt University. Her dissertation research examines cross-state diffusion patterns for the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Rating System s™. She earned her masters in management and M.A. in economics at Vanderbilt and her B.A. in economics and mathematics at Rice University.

Allison Plyer
Allison Plyer is co-deputy director of the Greater New Orleans Community Data Center. She works collaboratively with the Brookings Institution to analyze the state of the New Orleans recovery through the regular publication of the *New Orleans Index* and with the Urban Institute to analyze the state of the New Orleans housing market. Dr. Plyer is recognized as an expert in post-Katrina demographics and New Orleans recovery trends. Her other areas of expertise include market research and analysis. She spearheaded the city of New Orleans' challenge to the

Census Bureau's 2007 population estimate, resulting in a nearly 50,000-person adjustment to the bureau's estimate of the city's population. She frequently provides commentary on recovery issues to local and national media such as WDSU television, WWL radio, the New Orleans *Times-Picayune*, National Public Radio, the *Associated Press* and the *New York Times*. Dr. Plyer joined Knowledge Works with 12 years experience developing the management capacity of nonprofit and microenterprise organizations in New Orleans, the San Francisco Bay Area, and Guatemala. Additionally, she has almost a decade of experience in the for-profit sector as a marketing consultant to large and small companies including AT&T, Barnes and Noble, Lexus, and *Inc.* magazine. She received her doctorate in science from Tulane University's School of Public Health and Tropical Medicine with a dissertation entitled "An Analysis of Administrative Data for Measuring Population Displacement and Resettlement Following a Catastrophic U.S. Event." She has an M.B.A. in marketing and organizational behavior from the Kellogg Graduate School of Management at Northwestern University and a B.A. in religious studies and Spanish from Vanderbilt University.

Julie Rochman

Julie Rochman is president and chief executive officer at the Institute for Business and Home Safety (IBHS). She has more than 20 years of public affairs and advocacy experience representing major corporations, research and safety organizations, and issue-based coalitions. She is regularly consulted and quoted by national print, broadcast, and electronic media on a wide variety of topics. IBHS is an independent, nonprofit, applied research and communication organization supported by the property insurance industry. IBHS conducts field and laboratory research to identify and advance improved construction, maintenance and preparation practices. Before joining IBHS, Ms. Rochman was senior vice president of public affairs for the Glover Park Group, senior vice president of public affairs for the American Insurance Association (AIA), and vice president of communications for the Insurance Institute for Highway Safety (IIHS), where she successfully managed media relations for the IIHS and the Highway Loss Data Institute (HLDI). Upon leaving the IIHS, Ms. Rochman served on the IIHS and HLDI boards of directors for several years. Before joining IIHS, Ms. Rochman managed federal communications for the Alliance of American Insurers, worked for the Insurance Information Institute, for a public health organization dedicated to preventing drunk driving, at an advertising agency, and for a global insurance brokerage. A native of Omaha, Nebraska, Ms. Rochman earned a bachelor's degree in international relations from Tulane University and a master's degree in American government from the University of Virginia.

Marcia A. St. Martin

Marcia St. Martin is executive director of the Sewerage and Water Board (S&WB) of New Orleans. She serves as the board's first female and first African American

executive director. She has offered innovative approaches to logistical development, problem solving, human resource management, operating and capital budget administration and project planning. Ms. St. Martin previously served as deputy director of the S&WB for almost 12 years, director of the Department of Safety and Permits, and parking administrator for the city's Department of Streets. Ms. St. Martin serves on the board of Water for People—USA and Water for People—Canada, an international humanitarian organization that helps communities throughout the world that lack access to drinking water, sanitation, and hygiene education. She is a member of numerous water agencies and associations and is an active alumna of St. Mary's Academy in New Orleans.

Ommeed Sathe

Ommeed Sathe has served as director of real estate development for the New Orleans Redevelopment Authority (NORA) since June 2007. NORA is a quasi-public entity, whose mission includes the alleviation of blight, the redevelopment of residential and commercial properties (including nearly 5,000 properties acquired by the state of Louisiana following Hurricane Katrina), and the implementation of crucial public projects. At NORA, Mr. Sathe manages all of the agency's acquisition, redevelopment, and disposition programs and raises capital to support development ventures. In addition, he has led the agency's effort to examine distortions in the homeowner's insurance market. He commissioned groundbreaking research that demonstrates that current insurance rates are four to five times higher than actuarial levels would suggest. He is currently leading NORA's attempts to devise mechanisms to address this discrepancy—including catastrophe bonds, reciprocal insurance vehicles, regulatory reform, and government guarantees—and has been recognized by the International Risk Linked Securities industry for his work in this field. Before joining NORA, Mr. Sathe was a real estate associate at the law firm of Fried, Frank, Harris, Shriver and Jacobson LLP in New York. While at the law firm, he was involved in Columbia University's expansion and worked on the merger of two of the largest commercial property owners in the country. He received his law degree from Harvard Law School and a master's degree in city planning from the Massachusetts Institute of Technology. He received his undergraduate degree from Columbia University, where he studied neuroscience and urban planning.

Tracie Sempier

Tracie Sempier is the Coastal Storms Program outreach coordinator for the Mississippi-Alabama Sea Grant Consortium. She is working to design a coastal storms outreach and education program that will introduce people to storms tools, information, and partnerships. In this capacity she works with local communities, state and federal agencies, nonprofit organizations, port authorities, emergency and floodplain managers, residents, and other audiences to try to decrease the negative impacts of coastal storms on families, communities, the environment,

natural resources, and property. Dr. Sempier has more than 15 years of professional experience in education and outreach with various audiences in formal and informal learning environments. She completed her Ph.D. at Mississippi State University in curriculum and instruction, has a M.S. in science and mathematics education from Oregon State University, and holds a B.S. in marine science and biology from the University of Alabama.

William F. Stallworth

Bill Stallworth is the executive director of East Biloxi Coordination and Relief Center and a councilman on the Biloxi City Council. A former Biloxi High School teacher, Mr. Stallworth has served the city of Biloxi in various capacities since 1976, most recently as the councilman for Ward II, a position he also previously occupied for 12 years. Mr. Stallworth was also the city's residential and business relocation officer, the community development planner, community development specialist, the personnel officer and voter registrar, and vice president for economic development for the Biloxi Chamber of Commerce Board of Directors. In addition to his public service, he is a businessman, founding BFS Services, a construction and landscaping company, in 1985 and becoming a partner of Computer and Technology Support Services in 1992. Compelled to return to politics 12 years later, he was once again elected to the city council as the only African American member shortly before Katrina struck, and has since founded the East Biloxi Coordination, Relief, and Redevelopment Agency (later named the Hope Community Development Agency) and dedicated himself to the rebuilding of his community.

Lori R.West

Lori West is Gulf Coast region director for International Relief and Development (IRD), which runs U.S. Gulf Coast Community Resource Centers in Mississippi and Louisiana. IRD's initial emergency services in 2005 prompted the creation of IRD US and its Gulf Coast Community Resource Center (GCCRC) in Gulfport, Mississippi. GCCRC now provides a comprehensive set of services to low- and middle-income residents of the Gulf Coast. Ms. West is also vice chair of the South Mississippi Voluntary Organizations Active in Disaster (SMVOAD).

Appendix D

Field Trip Maps

Field Guide
New Orleans and the Mississippi Gulf Coast
January 19, 2011

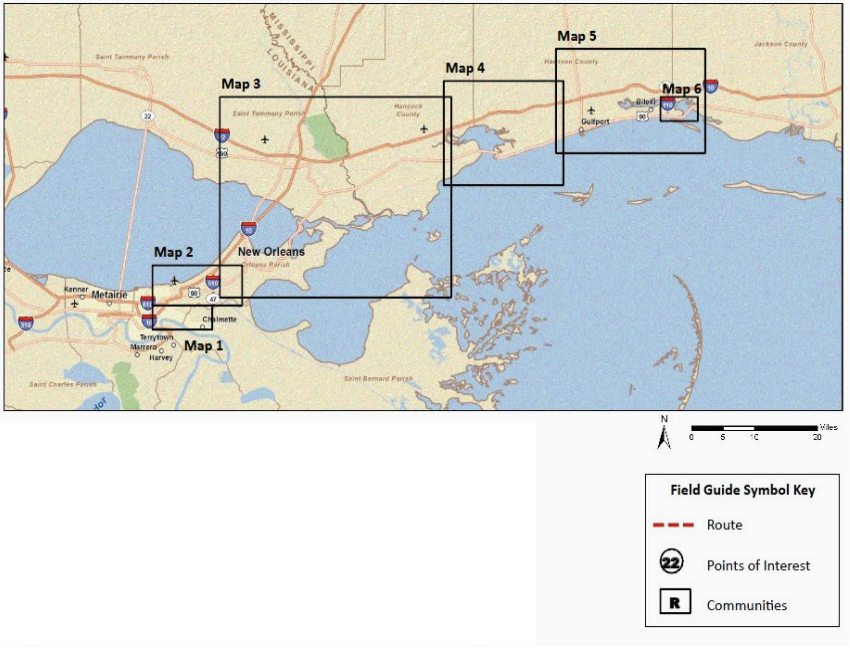

Figure: D-1 Overview of the field trip
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

Map 1: French Quarter to the Lower Ninth Ward
Map 2: Lakefront and New Orleans East
Map 3: Slidell and the North Shore
Map 4: Waveland to Long Beach
Map 5: Gulfport to Biloxi
Map 6: East Biloxi

Figure D-2 French Quarter to the Lower Ninth Ward
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

1. Iberville Housing Development
One of the last surviving pre-HOPE IV public housing developments in New Orleans.

A. French Quarter: Original city limits of New Orleans founded on the natural levee, 1718.

B. Tremé: Historical area that has been home to African American servants and working class. A tightly knit community thrives here with little gentrification.

C. Marigny: Historically Creole neighborhood settled about 1800 where gentrification is ongoing. This neighborhood now attracts a wide range of individuals altering its culture.

2. Industrial Canal
Completed in 1923 as part of the Gulf Intracoastal Waterway, the canal connects Lake Pontchartrain and the Mississippi River. Though greatly expanding New Orleans' wharf space, the channel severed the Lower Ninth Ward from the rest of the city.

D. Holy Cross: The narrow natural levee thwarted development here until the 1870s. Slaughterhouses, rendering plants, and other nuisance land uses were confined to this farthest downriver corner of the city.

3. CSED – Center for Sustainable Engagement and Development [STOP]
Doug Meffert, speaker

E. Lower Ninth Ward: Developed mostly between 1920 and 1970, this area sits on drained swampland. Originally the most ethnically diverse neighborhood in the city, it became the least diverse after the 1960s. Pre-Katrina residents were primarily poor and working-class African Americans with a high rate of homeownership.

4. Bayou Bienvenue Restoration [STOP]
Example of marsh restoration, a component of the neighborhood's sustainability goals and the state's coastal restoration plan.

5. Industrial Canal Floodwall Breaches
Two sections of floodwall (one-quarter mile in length) fronting the Lower Ninth Ward gave way during Katrina. An illegally moored barge may have been partially to blame. The neighborhood also suffered flooding from levee overtopping in neighboring St. Bernard Parish.

6. Make-It-Right Foundation
Funded by actor and philanthropist Brad Pitt, the foundation has enlisted architects nationwide in designing "green" homes to foster a return of residents to the Lower Ninth Ward.

7. Hurricane Katrina Memorial
The framed structure and empty chairs in the median of Claiborne Avenue stand as one of the few memorials to Katrina victims.

F. St. Bernard Parish: Community downriver of New Orleans developed mainly post-World War II. Most residents are working-class whites employed at local refineries or in commercial fishing. The area suffered both flooding and an oil spill from the Murphy Refinery during Hurricane Katrina.

G. Upper Ninth Ward: Like the Lower Ninth, this area is also built on drained swampland and sustained extensive flooding from another floodwall breach along the Industrial Canal.

8. Musicians' Village
Spearheaded by New Orleans musicians Harry Connick, Jr., Branford Marsalis, and New Orleans Area Habitat for Humanity, the village provides housing for displaced musicians and other disaster victims. While the village has heightened the recovery of the neighborhood, the current crisis caused by Chinese sheetrock in these homes has caused enormous stress on village residents.

Figure D-3 Lakefront and New Orleans East
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

9. London Avenue Pumping Station
One of three pumping stations at the head of a northbound outfall canal. Used for street drainage.

10. St. Bernard Housing Development
New mixed-income community that replaces the former St. Bernard Housing Development.

H. Gentilly: Predominately African American suburban neighborhood. Gentilly Boulevard (U.S. 90) winds along the Gentilly Ridge, 2 to 3 feet above sea level. This natural berm saved houses to the south from flooding during Hurricane Betsy in 1965.

I. Paris Oaks and Filmore: Two neighborhoods. Paris Oaks (southernmost) is predominately middle-class African American. Filmore (northernmost) is upper-middle-class white and largely elderly.

11. Project Home Again
A nonprofit company that allows families without the resources to rebuild their own home to trade their damaged home or empty lot for a new home.

12. London Avenue Canal Breach
Canal wall undermined by sand boils.

J. St. Anthony: Working class, primarily black neighborhood.

K. New Orleans East: New Orleans' suburban "city-within-a-city" developed during the oil boom of the 1970s and early 1980s. The area was developed to compete against suburbanizing Jefferson Parish to the west. The lowest elevation in New Orleans (12 feet below sea level) is located near Hayne Boulevard in New Orleans East.

L. Versailles/Village de L'Est: One of twelve communities planned for the eastern marshes of New Orleans in the 1970s and 1980s. It is home to a large Vietnamese community and has a large African American population.

13. "Urban Fishing Village"

Example of a community collectively agreeing to raise their homes.

14. Mary Queen of Vietnam Community Center [STOP]

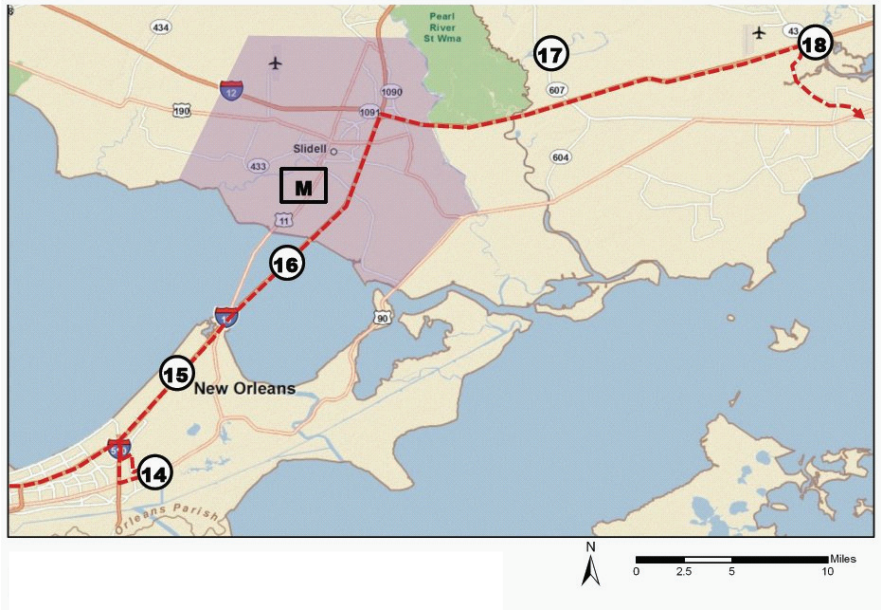

Figure D-4 Slidell and the North Shore
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

15. Lake Pontchartrain Hurricane Protection Levee
Levee raising is a part of 100-year flood protection for the metro area.

16. New Twin Span
Bridges for U.S.Hwy 11 and I-10 (left) and for U.S. Hwy 90 (far right) suffered damage from Katrina's storm surge. Both I-10 and Hwy 90 bridges were rebuilt 20 feet higher than the old spans. The old I-10 Twin Span Bridge can be seen to the left at the hump.

M. Slidell: A bedroom community of New Orleans developed mostly since the 1960s. Only waterfront homes sustained heavy damage from surge, though the entire community suffered wind damage (left). Many pre-Katrina New Orleans residents (and even several corporations) have relocated to the North Shore.

18. Katrina High Watermark
Commemorative marker showing height of floodwaters at Exit 13 on I-10.

N. Waveland, Mississippi: Gulf Coast resort town turned working-class suburb. Most development occurred in the 1960s with the opening of Stennis Space Center. Residents displaced by Stennis' construction also relocated here. Katrina's highest storm surge measured 40 feet along the coast here.

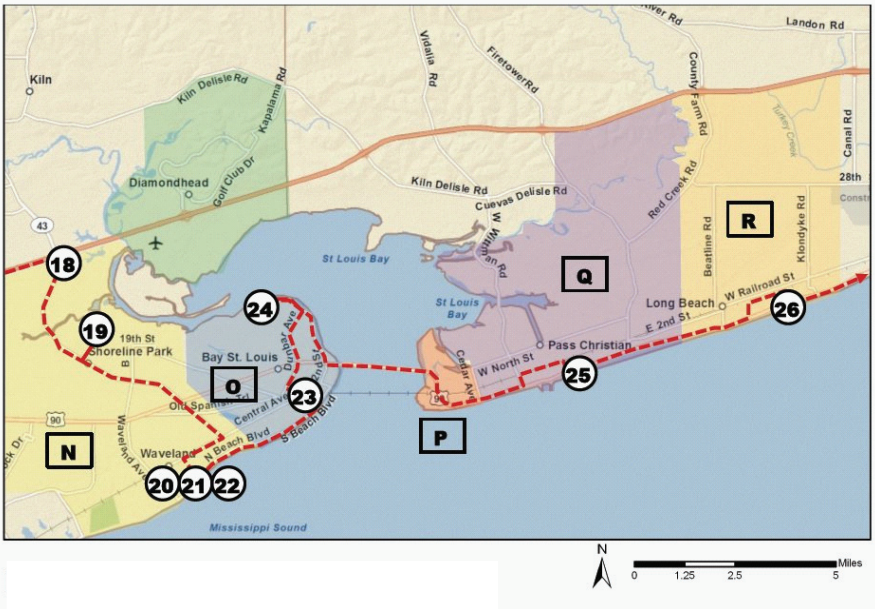

Figure D-5 Waveland to Long Beach
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

19. Waveland Back Bay
Recovery point. Storm surge from the back bay pummeled houses in this area. Note sea grass in the light pole from earlier photo and raised mobile home.

20. Waveland Community Civic Center [STOP]
David Garcia, Mayor
Mike Smith, Fire Chief

21. Katrina Cottages
Along with so-called FEMA trailers, these ubiquitous structures are used to house storm victims during rebuilding process.

22. Necaise Street
Recovery point, slow to return because of lack of water and sewer services.

O. Bay St. Louis, Mississippi: Historic resort town for residents of New Orleans and Mobile. The town also became a source of bricks and lumber for New Orleans in the 1800s.

23. Third Street
Recovery point near downtown Bay St. Louis.

24. Back Bay St. Louis

Elevated house on concrete pilings provides an extreme example of flood mitigation. Vegetation is reclaiming former subdivisions in this area.

P. Henderson Point, Mississippi: A small fishing community that has adopted among the toughest post-Katrina mitigation standards in Harrison County.

Q. Pass Christian, Mississippi: Shrimping town and historic resort village for New Orleans' wealthy Creoles. Initiatives to land new industries have met with resistance from residents.

25. Scenic Drive Bluff

This 15- to 20-foot bluff saved many historic homes in Pass Christian during both Camille and Katrina, though the storm tide washed through the first floor of these residences.

R. Long Beach, Mississippi: Like Waveland, Long Beach is a working and middle-class suburban community developed since the 1960s.

26. Pass Christian and Long Beach, south of the tracks

The CSX railroad line running parallel to the coastline about one-half mile inland served as a barrier to the storm surge from Katrina. Structures south of this 6-foot berm received flooding, while those to the north received only wind damage.

S. Gulfport: Gulfport is the second largest city in Mississippi and one of the fastest growing cities in the state. In recent years the city has expanded north of I-10. Originally established as a lumber port in 1902; today bananas, agricultural products, and chemicals make up the bulk of the port's tonnage. The Naval Construction Battalion "Seabee" Center in Gulfport is also a major area employer.

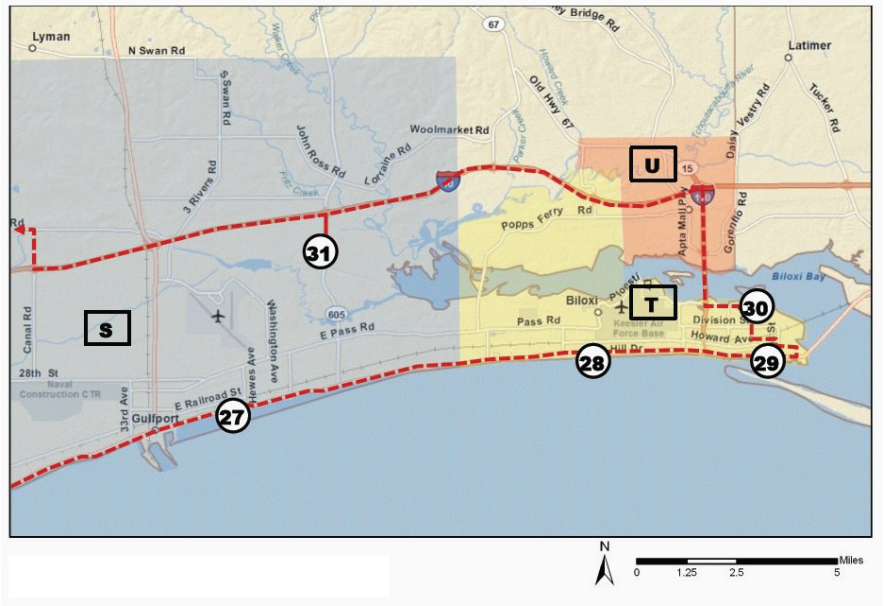

Figure D-6 Gulfport to Biloxi
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

27. Post-Katrina Slab Construction
Many homes rebuilt in eastern Gulfport along Beach Boulevard received approval before new base flood elevations were adopted. Many of these slab homes lack even wet flood-proofing.

28. Dune Reconstruction
Newly built fences, sea oats, and palm trees planted after Hurricane Katrina are aiding in dune accretion. Before the storm, the artificial beaches along the coast had lacked dunes.

29. Casino Row
Casino gaming became legal in 1990 for the Mississippi coast, provided casino structures were built over water. Post-Katrina laws allow gaming establishments to be located within 1,000 feet of the shoreline.

30. East Biloxi Vietnamese Enclave
Formerly, the most densely populated Asian enclave in the state. Asian residents made up 10–40 percent of the population, blacks 10–60 percent. Most were poor and working-class renters.

U. D'Iberville: Suburban community experiencing significant residential and commercial growth post-Katrina.

31. Knight Nonprofit Center [STOP]

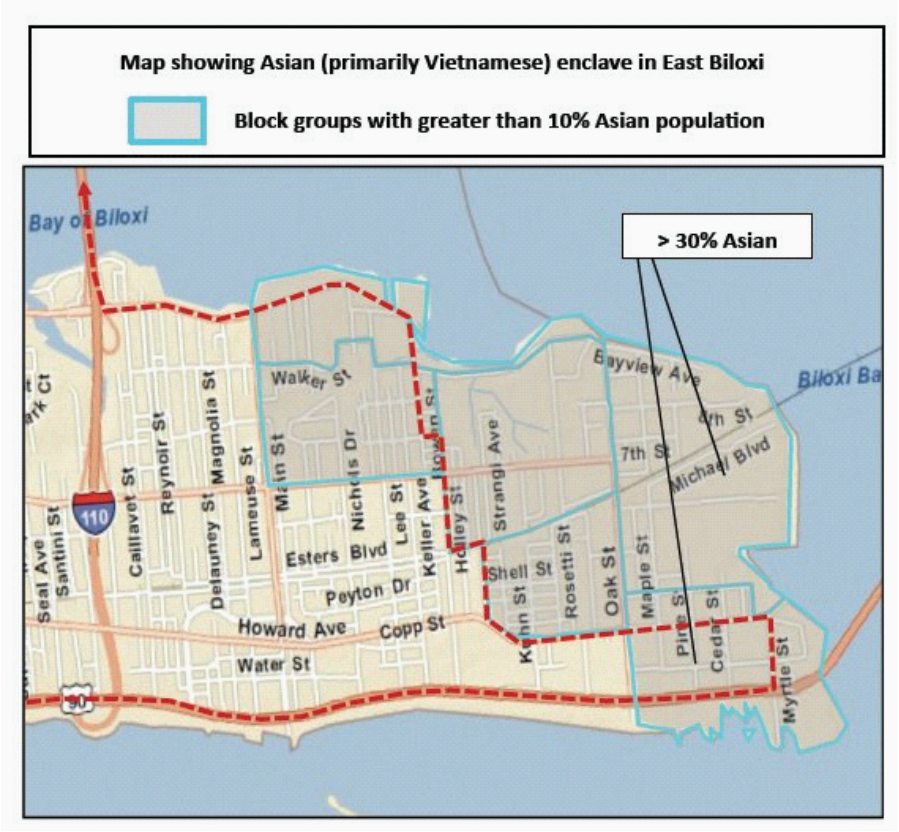

Figure: D-7 East Biloxi Detail
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

T. Biloxi: Historic capital of French Louisiana in the early 1700s, Biloxi's economic base has transitioned from lumber and canning to seafood, tourism, and gaming. Keesler Air Force Base, built during World War II, also employs a significant number of area residents. Italians, Sicilians, African Americans from the Delta region, and more recently Vietnamese have made Biloxi home. Biloxi relies heavily on gaming taxes for revenue generation.

Figure D-8 Diamondhead and return to New Orleans
Map created using ESRI ArcMap 9.3D Street Map Server
Maps by: Ronald Schumann III

Note:

32. Katrina Cottage Graveyard
Holding area for Katrina cottages.

32. West Harrison High School
An example of a post-Katrina capital improvements project that seeks to locate critical infrastructure away from the Gulf. The high school also acts as a hurricane shelter.

> **V. Diamondhead, Mississippi:** An upper-middle-class and affluent suburban community that emerged after the opening of Stennis Space Center. The community continues to expand even today.

34. Diamondhead Recovery Point
Recovery point, showing empty lots in place of former waterfront mansions. Another reminder of how Hurricane Katrina altered the lives of residents across the socioeconomic spectrum.

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