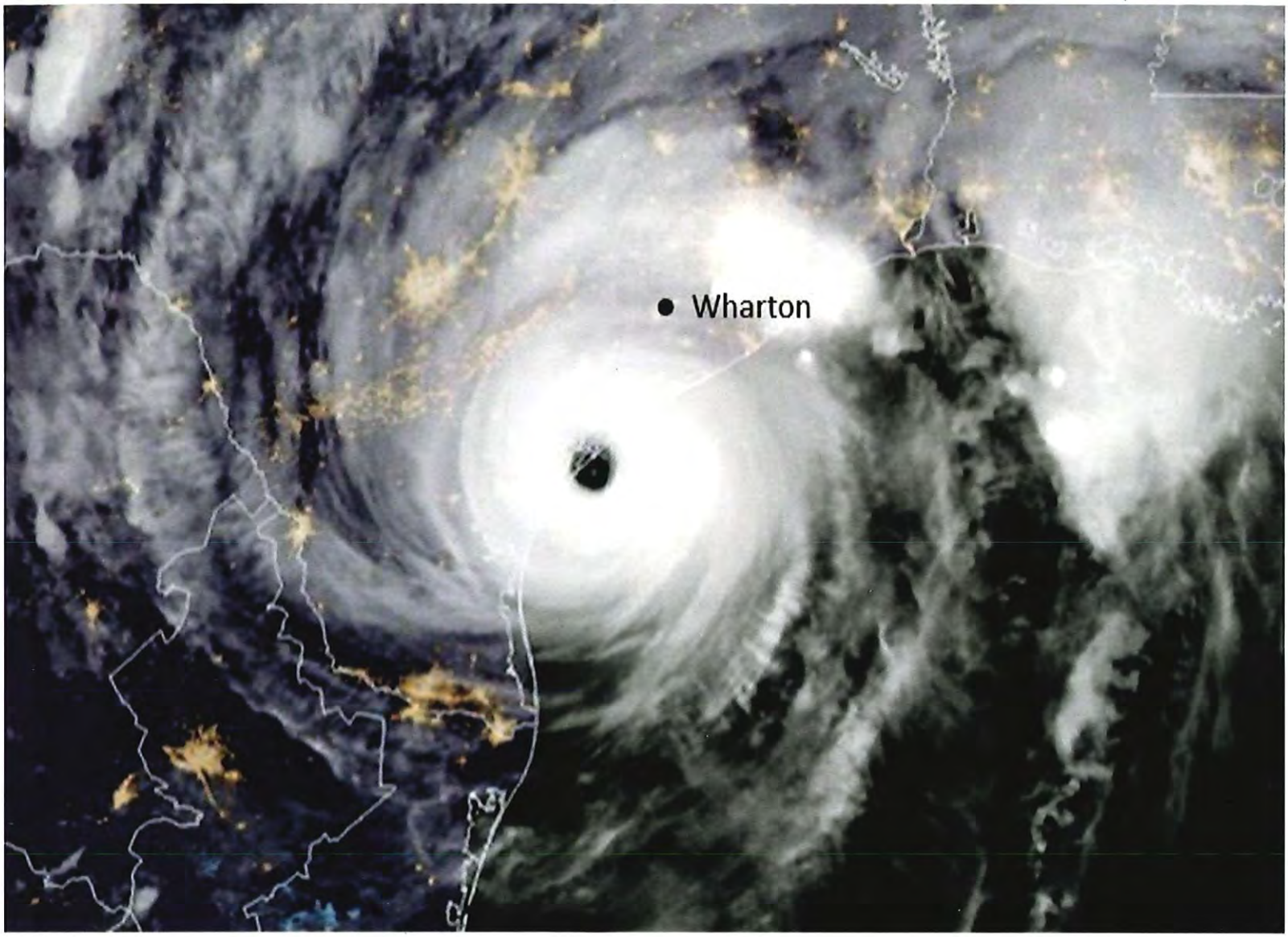

Building Resilience: Planning and Recovery Strategies for Small Towns after Hurricane Harvey Flooding - The City of Wharton, Texas

2019 Master of Public Service and Administration Candidates at The Bush School of Government and Public Service at Texas A&M University

Capstone Team: Carolina Albuja, Harrison Dawley, Hailey Duncan, Lindsay Escalante, Sydney Grimes, Kimberly Roach, and Garrison Rutledge

Faculty Advisors: Dr. Arnold Vedlitz and Dr. Bryce Hannibal

The Bush School
OF GOVERNMENT & PUBLIC SERVICE
TEXAS A&M UNIVERSITY

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Acknowledgments

This report was made possible thanks to the support and collaboration from various individuals and organizations. We would like to express our gratitude to Mr. Andreas Garza Jr., Gweneth Teves, the community of Wharton, specifically those who contributed to the interview process. Additional thanks to Dr. Vedlitz and Dr. Hannibal for their support and guidance throughout the entire project. [1]

[1] We would like to provide a special thanks to former Associate Vice Chancellor, John Barton, for bringing the needs of Wharton to light and allowing students to examine the recovery process further.

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List of Abbreviations and Acronyms

CDBG-DR: Community Development Block Grant - Disaster Recovery

EPA: Environmental Protection Agency

FEMA: Federal Emergency Management Agency

GLO: The Texas General Land Office

HMGP: Hazard Mitigation Grant Program

HUD: Housing Urban Development

ICC: International Code Council

KFF: Kaiser Family Foundation

NFIP: National Flood Insurance Program

NOAA: National Oceanic Atmosphere Agency

OHCD: Rhode Island Office of Housing and Community Development

RIDLTRG: Rhode Island Disaster long term recovery groups

RIEMA: Rhode Island Emergency Management Administration

SBA: Small Business Administration

SWMM: Storm Water Management Model

TDEM: Texas Department of Emergency Management

USACE: US Army Corps of Engineers

Executive Summary

As part of The Bush School of Government and Public Service capstone project, this report was conducted in an effort to provide recovery assistance to Texas communities in the aftermath of Hurricane Harvey. Specifically, this report focuses on the City of Wharton, Texas, a small community 60 miles southwest of Houston that experienced extensive damage and destruction from Hurricane Harvey. The following report is the product of several months of work conducted by a team of Master of Public Service and Administration graduate students using available literature, case studies, secondary data analysis, and stakeholder interviews to provide a detailed analysis of the storm and its aftermath experienced in Wharton, including recommendations to community leaders for current and future recovery actions, areas to increase resilience, and possible priorities for consideration to improve response and recovery for future natural disasters.

The report begins by providing a comprehensive overview of existing literature on recovery following hurricane related disasters and examines vulnerability, problems faced by communities in their response and mitigation efforts, and identified best practices to increase resilience and improve hazard mitigation. In working to understand the effects of natural disasters that have occurred in the United States previously, two case studies on the 1993 Great Midwest Floods and the 2010 Rhode Island flooding event were conducted. This report also includes a summary of information gained from 32 stakeholder interviews and their experiences during Harvey and the recovery process. These interviews provide important insight for understanding public perceptions of response, recovery, and problems experienced in Wharton during and in the aftermath of the storm. A secondary data analysis using survey data from the Kaiser Family Foundation Post-Harvey Survey and the Texas A&M Hurricane Harvey Household Survey provides accounts of individual's experiences in the aftermath of Hurricane Harvey and supports key themes and issues identified previously in the report.

Recommendations are also provided to the City of Wharton regarding actions community leaders can take for recovery, comprehensive planning, and communication and collaboration practices. Below are some key points which highlight relevant findings that will be discussed in more detail in the full report:

- The importance of effective communication and emergency management policies for successful disaster management and recovery.

- The importance of collaboration among community members and outside resources throughout the recovery process.
- The importance of conducting secondary data analysis to provide relevant information from citizen's experiences following the disaster to support the value of emergency planning and community engagement in the planning process.
- The importance of learning from prior flooding events to prepare for and mitigate risks associated with devastating events such as Harvey.
- The importance of having a process for updating existing emergency response and preparedness plans to ensure successful response and recovery.

The severe rainfall, flooding, and damaging winds associated with Hurricane Harvey have had devastating effects on communities in Texas. Specifically, small communities with limited personnel and resources are experiencing difficulties in fully recovering from the aftermath and damage the storm had on housing, businesses, public facilities, and recreational spaces. These effects, especially on small cities such as Wharton, serve as an important example to the Texas Legislature for the need to develop and update comprehensive disaster plans and resilience strategies, not only along the Gulf Coast, but across the State of Texas. This project will seek to identify strategies, actions, and best-practices to help local leaders and citizens in the City of Wharton in their long-term recovery efforts.

Introduction

Hurricanes have affected the Gulf Coast and Southeastern Coasts of the United States throughout much of the nation's history. From 1850 to 2017, the United States has experienced over 290 hurricanes, with 91 being classified as Major Hurricanes which includes storms that cause severe amounts of damage and loss of life. In recognizing states that have experienced Major Hurricanes, Texas and Florida have been identified as confronting the most with a total of 56 during the time period examined (National Oceanic and Atmospheric Administration, 2018). As a result of this history and experiencing the damaging effects of hurricane activity, recovery planning and actions to address existing vulnerabilities represent key elements of preparedness and community resilience.

On August 26, 2017, Hurricane Harvey made landfall in Texas as a Category 4 hurricane near the coastal city of Rockport. Harvey immediately wreaked havoc on the coast and, as it moved inland, the storm slowed significantly to five miles per hour (Blake & Zelinsky, 2018). This decrease in movement resulted in the storm hovering over many areas of southeast Texas pouring over 60 inches of rain in a nine-day period, with the average recorded rainfall being 48 inches (Harris County Office of Homeland Security and Emergency Management, 2018; Blake & Zelinsky, 2018). Homes were destroyed, infrastructure left in disrepair, livelihoods were lost, and 103 people were left dead in the wake of Hurricane Harvey. In examining the economic impacts of Harvey, damage totaled $125 billion, making it the single most expensive natural disaster in 2017 (Blake & Zelinsky, 2018). The effects of Harvey and other powerful events including Hurricane Irma experienced in the Atlantic categorized 2017 to be the most costly year monetarily for natural disasters in recorded history (Mooney, 2018).

While coastal towns like Galveston and Rockport dealt with high winds and storm surges, many inland towns and cities faced severe flooding from the heavy rainfall. The bayous and rivers many inland communities bordered spilled their banks and flooded surrounding homes and businesses. Communities became cut off from resources, making it difficult for supplies and assistance to be reached. The City of Wharton is settled directly on the Colorado River, with many homes and businesses situated within several hundred feet of its banks. The rainfall from Harvey caused the river to swell and crest at 54 feet with rising waters flooding the North and West side

of town. Over 2,000 homes and businesses were damaged or flooded in Wharton County during the storm (Blake & Zelinsky, 2018).

An outline of this report is as follows; 1) a brief description of Harvey's rainfall and the Colorado River Basin; 2) a comprehensive literature review that examines the effects of flooding, the importance of planning, and community actions for recovery found in academic articles, government documents, and department reports; 3) detailed case study analyses that examines two communities who experienced similar challenges with flooding events and identifies lessons learned and best practices that may be emulated in other communities; 4) a secondary data analysis analyzing the responses from public opinion surveys in Texas conducted by the Kaiser Family Foundation and Texas A&M Public Policy Research Institute; 5) an analysis of 32 interviews with key stakeholders to understand experiences of those affected by the storm and identify local challenges and successful practices for recovery an analysis of 32 interviews with key stakeholders to understand experiences of those affected by the storm and identify local challenges and successful practices for recovery; and 6) final recommendations for consideration to the City of Wharton to improve recovery outcomes and strengthen planning practices.

Technical Overview of the Region

1. Precipitation

Hurricane Harvey was one of the greatest magnitude rainfalls the United States has experienced. Eighteen locations across Texas reported 48 inches or more of rainfall, with 60.54 inches being the highest recorded amount (Blake & Zelinsky, 2018). This rainfall caused severe flooding within the Houston metro region and river-basin communities throughout Southeast Texas. The rainfall rate was so severe in some areas that standard rain gauges could not be emptied to measure proper rainfall. In an analysis completed by NOAA, it was found that Harvey rainfall flooded areas that previously had a 0.1% chance of flooding in any given year, meaning that areas experienced flooding they would only experience every 1,000 years (Blake & Zelinsky, 2018). According to the National Hurricane Center and NOAA, Harvey's rainfall event was unusual due to a weak stationary front that occupied the Southeast Texas area blanketing the region with bands of warm humid air from the Gulf of Mexico (Blake & Zelinsky, 2018). The stationary nature of the front and stagnant air ultimately contributed to the heavy rain and Harvey's 48-hour stall over Southeast Texas, thus resulting in the increasingly high amount of rainfall.

2. Colorado River Basin

The Colorado River Basin lies within the Natural Southeast Texas Coastal Plains Region. The river is fed by a variety of creeks and streams that slope throughout the county while shallow and deep ditches work to carry runoff water towards the Colorado River. In examining surface properties throughout the region, soil composition within Wharton County is primarily made up of loam, sand, clay, and alluvial soils (Wharton County Emergency Management & JSW, 2015).

The predominant clay and silt geology of Wharton County can create low-mud permeability, meaning that the region is prone to experiencing both flash flooding and major flooding after heavy rainfall. In working to address and reduce the effects of flooding in the region, prior construction of large reservoirs along the Colorado River can mitigate some flooding and potentially disastrous events (Wharton County Emergency Management & JSW, 2015).

Approximately 223,700 acres of Wharton County lies within the 100-year floodplain, and 260,080 acres lies within the 500-year floodplain. Specifically, for the City of Wharton, 2,888 acres lie within the 100-year floodplain and 4,131 acres lie within the 500-year floodplain. In total,

4.3% of Wharton's 100-year floodplain is made up of developed land. The combination of the heavy presence of hydrophobic soils (clay and silt) and development along the river increases the effects storm runoff has on a community. As a result, excess runoff increases the probability of flash flooding and greatly influences how the Colorado River floods within the county (Wharton County Emergency Management & JSW, 2015).

While risks associated with dam failure extend throughout the county, that of levee failure is limited to the City of Wharton and the southern portions of the county. Wharton County could potentially be affected by several high-hazard dams that are located outside of the county. If the failure of one of these high-hazard dams did occur, it could result in loss of life. Other high-hazard dams are located outside the county and their drainage systems enter Wharton County either by direct drainage through parts of the county or by inflow into the Colorado River or San Bernard River upstream from Colorado County (Wharton County Emergency Management & JSW, 2015).

Literature Review

1. Purpose

This literature review will provide an in-depth analysis of written studies examining and analyzing mitigation steps and policy measures taken before, during, and post-disaster, actions taken to improve recovery and resilience outcomes, and efforts to ensure all members of a community are included in future planning activities and decision making about such threats. We examine available literature that addresses the challenges and prospects for community recovery concerning natural disasters, specifically hurricane-related events. We will seek to understand the response and recovery process for communities that have been affected by severe flooding. This capstone project will also examine actions taken by communities that have experienced similar flooding disasters to determine best practices the City of Wharton, and other Texas cities, can use to better prepare for such disasters and recover from them in the future. In addition to evaluating best practices repeated in the literature, it is also important to understand the different effects disasters can have on communities across citizen socio-economic differences.

Understanding factors that contribute to specific groups experiencing higher vulnerability than others during the actual emergency and into the recovery process is a key area of analysis in working to understand how disasters affect communities.

2. Who is Vulnerable and Why

2.1 Social Vulnerability

Social vulnerability describes the socioeconomic features of a community including characteristics such as race/ethnicity, income, education, and housing capacity that can affect the ability of a population to withstand environmental threats and build resilience against the effects of potential hazards (Highfield, Peacock, & Van Zandt, 2014; Peacock et. al., 2015; Mitsova et. al., 2019). While efforts to improve disaster assessment and mitigation capabilities have incorporated the physical aspects of critical infrastructure as a potential source of vulnerability, Flanagan et. al. (2011) argue the role of social characteristics have been overlooked in describing community vulnerability and, thus, have not been addressed by practitioners (Flanagan et al., 2011; Highfield, Peacock, & Van Zandt, 2014). Social vulnerability can be explained as a function of "unequal exposure to risk coupled with unequal access to resources," as different levels of

capability within a community affect the severity of damage experienced and the overall timeline of disaster recovery efforts (Mitsova et al., 2019; Rumbach, Makarewicz, & Németh, 2015).

In recognizing the effects of social vulnerability on recovery and resilience, understanding which populations are vulnerable and factors that contribute to such experiences serve to increase overall awareness and improve future recovery operations and perceptions of government responsiveness. Across the literature examined on risk and vulnerability affecting recovery, research findings identify low-income populations as having fewer resources to recover following a natural disaster, and the severity of damage experienced in these communities is typically higher than areas with more resources (Masozera et al., 2006; Zhang & Peacock, 2009). In a study examining the effects of Hurricane Irma on central and south Florida communities' ability to recover, Mitsova et. al. (2019) found elderly individuals together with minority groups including Black/African Americans and Hispanic/Latino populations as experiencing a prolonged recovery when compared to the results and recovery outcomes of White populations.

In addition to demographic characteristics, social vulnerability includes financial factors such as income and purchasing power when considering decision-making in regards to flood insurance and other disaster preparedness behaviors affecting community resilience. In the aftermath of Hurricane Harvey, it was reported that only 17 percent of homeowners in locations that were hit hardest by the storm had purchased flood insurance (Mitsova et al., 2019; Long, 2017). Despite over 80 percent of homeowners significantly affected by Harvey not having purchased flood insurance, Kousky (2017) emphasizes such security is of value for low to moderate income residents who would otherwise be less capable of making large personal payments to go towards damage expenses. In recognizing the value of flood insurance, Mitsova et al. (2019) found that low-income residents are frequently without coverage and are most likely to experience vulnerability in terms of potential damage and lack of overall protection from losses sustained in the event of an incident or natural disaster.

2.2 Physical Vulnerability

Improving the physical capabilities of critical infrastructure and working to reduce the consequences of current damage is often a primary consideration when addressing immediate vulnerabilities and determining emergency response efforts. Physical characteristics of structures include the "roof, foundation, exterior materials, and building standards," as such external features

can work to describe the severity of a natural disaster and provide a general idea of observed effects and overall monetary damage experienced (Mitsova et al., 2019; Highfield, Peacock & Van Zandt, 2014 p. 290).

Factors that influence vulnerability include the quality of public housing structures, as units are often built in vulnerable areas within a community, and as a result, low-income populations living in such housing are more likely to experience the most significant damage and maintain the slowest ability to recover (Tran, 2013). In working to understand why low-income and minority populations experience the severity of damage at a higher impact, Peacock et al. (2015) underline the physical characteristics of such neighborhoods and how community perceptions of desirability have historically affected and shaped investment and improvement decisions. Features of homes typically occupied by low-income and minority residents include being "built to older, less-stringent building codes, used lower-quality designs and construction materials, and were less well maintained," also, for economic reasons, located in less desirable and more vulnerable areas, as such factors contribute to overall lower neighborhood resilience (Peacock et al., 2015, p. 357). In assessing the relationship between damage and appraisal value, Highfield, Peacock, & Van Zandt (2014) found homes experiencing less damage were associated with a higher overall value as neighborhoods which observed significant damage were those primarily comprised of Hispanic and African American populations (Peacock et al., 2015).

2.3 Locational Vulnerability

When analyzing the role of the physical environment in the aftermath of a natural disaster, researchers have argued that flooding in many areas was the result of wetland alteration and topography destruction and change (Brody et al., 2008). Additional findings contend that location in terms of living next to a body of water or in a flood plain dramatically increases the possibility of a home flooding and experiencing related damage (Brody, 2015). Rumbach, Makarewicz, and Neméth (2015) examine the role of location in the context of disaster recovery following the 2013 Colorado floods and contend that attributes of location including physical and local government factors affect overall risk exposure and hazard vulnerability.

Location affects the level of susceptibility a community can experience, as the position of a home or neighborhood effects mitigation and recovery efforts. Consistent with vulnerability, location can work to determine where a hazardous incident or potential damage could reasonably

occur based on projected risk and exposure (Rumbach, Makarewicz, and Neméth, 2015). In responding to a natural disaster, location can also direct which level of government has the appropriate capability to engage in planning and recovery operations. Decision-making in regards to planning and navigating rebuilding opportunities is primarily the decision of local government officials and can affect immediate emergency action and long-term future recovery operations (Rumbach, Makarewicz, & Neméth, 2015). Local government authority and development priorities affecting exposure to risk have periodically allowed the building of housing and additional community development activities in flood-prone areas, thus exacerbating community vulnerability by increasing the probability the region will experience flooding (Burby, 2006). This represents another reason to examine the role of locational vulnerability in prioritizing and communicating risk when considering economic and community development opportunities.

3. Problems Encountered by Local Communities

In analyzing issues experienced by communities, the disaster management cycle describes natural disaster and the management practices that follow as a continuum of interlinked activities encountered during mitigation, preparedness, response, and recovery (Carter, 2008; FEMA, 2013). The purpose of the disaster management cycle serves to identify goals and responsibilities of government decision-makers and response officials in avoiding or reducing potential losses from hazards, providing timely and appropriate assistance to disaster victims, and achieving rapid and effective recovery operations (Carter, 2008). However, the ongoing process by which governments, non-profit organizations, private stakeholders, and the public, in general, react before, during and following a natural disaster is confronted with challenges that arise throughout each stage of response and recovery (Global Development Research Center, n.d.).

3.1 Before

Citizen engagement, participation, and involvement across the community is essential for a successful planning process, for it is important to have citizen buy-in on mitigation efforts and expenditures. One of the primary obstacles communities experience before a natural disaster occurs is the lack of community input gathered during mitigation and recovery planning. Public and community engagement opportunities in the planning process have been found to be minimal for some groups and nonexistent for others (Brody, Godschalk, & Burby, 2003). For a community to adequately prepare and recover from natural disasters, public involvement and engagement

throughout each phase of the disaster management cycle is a critical component of responsiveness (Carter, 2008). Researchers have also found that a lack of public involvement in the planning process can negatively affect government preparedness, responsiveness, and representative functions. Participation rates among minority groups, the elderly, and disabled citizens are particularly low, which creates a significant challenge for the community and local officials in working to bring as many members of the community together to participate in productive planning discussions and mitigation activities (Priestley & Hemingway, 2007; Center for Community Health and Development, 2018).

In addition to citizen engagement during planning, hazard mitigation actions are another factor used to measure a community's ability to endure and recover from a weather-related disaster. Although residents can be aware of the benefits of hazard mitigation, action presents a challenging context for local government officials when community willingness-to-pay creates a barrier for actual implementation of the infrastructure improvements necessary to support mitigation (Bichard & Kazmierczak, 2010). Moreover, convincing community members to spend money to mitigate risks and address vulnerabilities is also a challenge that many local officials experience as managing risks associated with natural disasters are dependent not only on physical conditions and events but also on human actions, decisions, and cultural characteristics (Eiser et al., 2012).

Overall actions identified within the literature affecting local governments, businesses, and citizens in reducing the adverse effects of flooding and guiding the recovery process include protective zoning, land use planning, and the construction of flood protection infrastructures. In addition, constructing more and larger storm drains and developing building codes that require homes to have higher elevations, and deeper foundations can improve mitigation practices and increase community resilience (Kennedy et al., 2011). Such improvements, however, can be expensive and not always favored by local residents and taxpayers.

3.2 During

Even when a community has preparedness plans in place, actual crisis management during a natural disaster does not always align with identified policies and procedures (Quarantelli, 1988). Some of the key management problems communities experience refers to the communication and

coordination process (Quarantelli, 1988). Challenges, therefore, represent the importance of such factors consistent with providing an efficient and effective response during a natural disaster.

Difficulties observed in the communication process can be exacerbated when considering the uncertainty surrounding community perceptions of risk. In examining local jurisdictions and community perceptions of protection efforts and policy, areas can react differently to evacuation orders, as regions within different sub-sectors develop a varied response to government directives and emergency notifications (Dixon et al., 2017). Different community perceptions of risk affecting the willingness or hesitancy of residents to evacuate impose a challenge for local government and emergency officials when working to protect residents (Weller, Baer, & Prochaska, 2016). Research findings maintain general community knowledge about hurricanes and hurricane safety is unrelated to evacuation; however, the belief that one's own home is subject to flooding strongly correlates with whether the occupant decides to leave or not (Baker, 1991). When an evacuation order is issued, 30 to 40 percent of residents in official evacuation zones fail to evacuate (Weller et al., 2016). In the case of Hurricane Floyd in 1999, traffic congestion problems factored heavily into the decision-making process for residents to evacuate from coastal areas (Dow & Cutter, 2002). Mass evacuations from Florida created heavy traffic congestion along South Carolina evacuation routes ultimately deterring residents from evacuating (Dow & Cutter, 2002).

In addition to mass evacuations, shadow evacuations (evacuations from people not under mandatory evacuation) also contributed to traffic congestion experienced in the area. Not only were shadow evacuations a problem for local response operations in terms of experiencing increased levels of traffic, but the lack of communication across government and community actors to citizens also created coordination challenges. Rather than evacuating inland, residents along the Atlantic coast of the U. S. evacuated northward, congesting highways and leaving many people stranded on the road. This lack of coordination extended to a miscommunication among residents, and thus, intensified traffic congestion (Wolshon, Urbina, Wilmot, & Levitan, 2005). Additional examples to convey the challenges of evacuation and other protection-related policies include a study of Galveston, Texas. Findings from Weller, et al. (2016) examined local resident decision-making during Hurricane Ike. Of the people surveyed, the number one reason given by residents who decided to stay in their homes was the fear of being stuck in traffic while attempting to evacuate (Weller et al., 2016).

Communication problems have also been shown to occur due to a lack of clarity regarding roles and responsibilities among organizations working in disaster-related capacities. Conflict regarding such authority over decision-making and jurisdictional differences across organizations can affect and even reduce efforts made during emergency response (Quarantelli, 1988). Such effects were identified during Hurricane Katrina in New Orleans, where a lack of communication between government officials, agencies, and recovery organizations exacerbated the overall effects of the disaster (Olshanksy et al., 2008).

Consistent with communication, Burby (2006) presents the lack of coordination as the local government paradox; that is, while residents bear the burden of human suffering and financial loss following a natural disaster, local officials often do not have sufficient resources or established plans in place to address community vulnerability. In examining how governments across sectors respond to natural disasters, The Report of the Senate Committee on Homeland Security and Governmental Affairs (2006) issued findings in the aftermath of Hurricane Katrina. In responding to the natural disaster, government officials at all levels did not fully comprehend Hurricane Katrina's devastating potential to create immense damage. This lack of understanding by government officials led to an "undermining of confidence in our government's' ability to plan, prepare for, and respond to national catastrophes" (The Report of the Senate Committee on Homeland Security and Governmental Affairs, 2006, p. 2). Similar to the Homeland Security and Governmental Affairs Report, the Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina U.S. House of Representatives (2006) presented findings concluding the lack of response planning and flexibility across levels of government can contribute to such negative effects following a natural disaster.

4. Recovery Following Natural Disaster

During post-disaster recovery, decision-makers across levels of government concentrate efforts to rapidly reduce risk, engage in the protection and rebuilding of critical infrastructure and work to restore daily operations throughout affected communities (Ingram et al., 2006). In analyzing factors that affect community recovery, research finds the response process following a natural disaster is typically quick, but short-lived. While communities usually come together in the aftermath of an emergency or devastating event, such sentiments of unity often do not continue throughout the recovery process (Moore et al., 2004). As a result, such attitudes may affect the

ability of local governments to provide adequate recovery operations and complete mitigation efforts to increase community resilience.

Despite the pressure to urgently address complex situations and difficult decisions, such immediacy of actions can result in inadequate policies that can potentially increase long-term vulnerabilities of affected populations. In this context, it is important to identify suitable strategies to address recovery, ensuring an adequate balance between short and long-term community efforts (Ingram et al., 2006). Although the role of government is a central factor, the response process is the responsibility of multiple actors within a community. As a result, residents and families, private business stakeholders, non-profit organizations, and officials across levels of government all have a role in achieving successful response outcomes. Consistent with the response time period, local recovery efforts account for all stakeholders within a community, as each entity works to create and identify goals for improving mitigation performance and completing reconstruction priorities (Olshansky & Johnson, 2014). One of the primary goals of governments in navigating the recovery process is to have the capabilities to transition from short-term response and recovery to long-term planning and improvements while still engaging key stakeholders and community members (Ingram et al., 2006; Olshansky & Johnson, 2014).

4.1 Short-Term Assistance

The short-term recovery process provides the immediate extension of resources for the purpose of relieving disaster-affected communities, restoring critical infrastructure services, and securing essential community functions (Government Accountability Office, 2008). To provide an adequate source of relief, the role of short-term recovery policies and efforts serve to minimize the time between living in a disaster zone and returning a community to a sense of normalcy (Ingram et al., 2006). In addition, effective short-term recovery planning will serve to transition a community into the long-term recovery process and future disaster planning considerations. In working to achieve adequate response operations and move into long-term recovery, local officials and stakeholders often feel pressured by community members to identify the fastest possible route to normalcy. However, by doing so, valuable time and resources can be misallocated affecting the success of planning and mitigation efforts and creating potential consequences for resilience in the event of future disasters (Hamideh, 2015).

4.1.1 Community Networks & Involvement

Civic engagement and involvement represent an important role within the disaster planning, response, and recovery process, as these communities can recover faster than those who do not have the same level of networks and connections (Nakagawa & Shaw, 2004). Following a natural disaster, feelings of a "common experience" are often prevalent among community members and can even work to overshadow prior class divisions (Richardson et al., 2014). The effects of active community engagement has been well documented in the post-disaster literature. After a series of tornadoes struck rural southern Indiana in 2012, researchers examined the speed at which communities were able to recover. Evidence found that strong citizen engagement observed in the planning and recovery process aided in the rate at which families and homes recovered (Sadri et al., 2016).

While community engagement represents an important factor affecting community recovery, involvement in specific situations has the potential to overpower or impede the recovery and mitigation planning process. While it rarely occurs, an oversaturation of unorganized community engagement has been shown to negatively affect and obstruct the community recovery timeline. This situation happened in Galveston in 2008 when a large number of citizens tried to participate in recovery planning efforts for housing on the island (Hamideh, 2015). This example represents the importance of organized civic and community engagements in the local government planning process to include residents while working to conduct effective recovery actions.

The ability of local governments to organize recovery planning and facilitate involvement opportunities is often determined by the capabilities and resources available to a community (Patterson et al., 2009). Lack of organizational capacity for local governments to effectively engage in planning also represents a significant factor negatively affecting the ability to address short-term recovery from natural disasters (Webb, Tierney, & Dahlhamer, 2002; Burby, 2006). Capacity describes the ability of local government agencies and officials to achieve recovery goals and objectives and reflects the level of fiscal and human resources administrators have to perform related tasks and responsibilities (Krouse & Woods, 2014). Increased organizational capacity can allow for local governments and communities to be better able to coordinate response efforts using available resources and address the needs of community members severely affected by the disaster (Comfort, 1990). In working to maximize capacity, smaller governments who lack fiscal and

operational resources can implement low-cost response strategies that address community need while taking into account available funding and assistance opportunities. In addition, mutual aid agreements with neighboring cities, counties, and non-profit organizations to address response and recovery are used within the State of Texas (Texas Department of Emergency Management, 2019).

4.1.2 Infrastructure and Housing

Consistent with previously discussed factors in the recovery process, communities experience several challenges regarding the protection of critical infrastructure and repairing physical housing, government, education, and business structures. Short-term disaster recovery generally focuses on residents and businesses who can insure property and related assets (Peacock, Dash, & Zhang, 2007). As a result, this focus can intensify the mistrust individuals in poverty and other marginalized groups who do not have the financial ability to insure or participate in coverage programs tend to have towards government (Boix & Posner, 1998).

An additional problem communities experience within the recovery process is the question of simply repairing existing structures as opposed to investing in long-term capital improvements (Olshansky & Johnson, 2014). While immediate surface repairs of housing and infrastructure without long-term improvements is a cheaper alternative for governments and communities, such actions do not necessarily address underlying community vulnerabilities. In addition, while policies and programs that work to replace lost housing structures can provide immediate accommodations, such actions can often leave families vulnerable to experience damage during future natural disasters. Consistent with challenges that affect recovery investments, individuals often do not make necessary home repairs following appraisals from FEMA despite being awarded grants to fund specific projects.[2] As a result, in subsequent disasters, these residents are often not eligible for additional relief and recovery assistance (Knowles & Kunreuther, 2014). This cycle is referred to as the Natural Disaster Syndrome; where people do not take actions because their perceptions of risk are not aligned with true risk or experience budget constraints which prevent them from employing mitigation strategies.

In working to address community vulnerability and increase neighborhood resilience, research findings indicate communities that develop comprehensive redevelopment policies to

[2] Requirements to apply for FEMA grants include being a homeowner and having flood insurance for housing assistance.

improve current and future housing capacity aid long-term community recovery (Ingram et. al. 2006; Berke et. al., 2014) As in the case with Galveston, Texas after Hurricane Ike, housing recovery was a significant problem experienced within the community (Hamideh, 2015). In Galveston, the lack of comprehensive planning created problems specifically for low and moderate-income residents working to recover from the storm. Following a rushed recovery planning process, only minimal mitigation improvements were able to be achieved as a result of coordinating immediate rebuilding activities with insufficient community and financial resources (Hamideh, 2015). In the long-term, this prevented many homes in Galveston from recovering to pre-Hurricane Ike conditions and prolonged the recovery process a year longer than the average housing recovery timeline of two to three years (Hamideh, 2015).

To reduce community risk and address vulnerabilities, infrastructure improvements such as bridges, levees, and dams require sufficient resources, effective planning and mitigation strategies, and the continued investment and commitment of multiple agency actors (Olshansky & Johnson, 2014). Such infrastructure improvements, however, are time-consuming and if improperly planned can create long-term recovery issues for a community (Olshansky & Johnson, 2014; Hamideh, 2015). An example of this was experienced in the City of New Orleans, where ineffective government action for recovery planning and coordination had both immediate and long-term consequences for recovery outcomes post-Hurricane Katrina (Olshansky & Johnson, 2014). In addition, improper planning can also lead officials and stakeholders to identify goals and objectives that do not align with desired outcomes and misuse resources intended for recovery operations (Hamideh, 2015). As illustrated by the experiences of other communities, coordinating a rushed recovery process to achieve a state of normalcy often does not work in decreasing vulnerabilities and can increase potential risk (Olshansky & Johnson, 2014; Berke et al., 2014). To improve the mitigation planning process, local government action includes creating proposals that are substantive and cost-effective to promote and advance rebuilding efforts. In working to prevent and reduce the effects of natural disasters, and recover from them as quickly as possible, appropriate planning actions represent a core element of any viable recovery framework.

4.2 Long-Term Planning and Recovery

In planning for recovery, factors including plan quality, stakeholder involvement, optimal design, and funding allocations work to determine the effectiveness and success of community

efforts (Berke et al., 2014; Olshansky & Johnson, 2014; Eid & El-adaway, 2018). Consistent with other objectives affecting resilience, research findings indicate recovery plans can contribute to higher levels of community vulnerability if actions do not work to improve public infrastructure and address social, environmental, and economic concerns (Eid & El-adaway, 2018). Multi-agency coordination, community engagement, and strong policies are essential in achieving long-term disaster recovery, hence it is important to ensure resources and planning functions are directed towards completing long-term goals and objectives (Ingram et al., 2006). Research findings indicate long-term disaster recovery is not the exclusive task of a single community actor but rather a coordinated effort across planners, agencies, and stakeholders. In analyzing the effects of such coordination, similar recovery goals and mitigation practices reinforced by how many actors participate in the recovery process was shown to influence the speed of a community's ability to "bounce back" following a natural disaster (Ingram et al., 2006; Hamideh, 2015).

Economic recovery provides an essential security function for affected communities. As a result, it is critical for community actors, government officials, and planning professionals to understand the economic base and primary areas of employment in their jurisdiction when creating disaster preparedness plans and implementing recovery actions (Lindell & Prater, 2003). Planning is not a task that is limited exclusively to local governments officials. Business and development opportunities serve an essential role in supporting the local economy of a community (Runyan, 2006). In examining economic recovery post-disaster, one of the primary reasons found by researchers regarding the slow recovery of small businesses is the lack of sufficient planning. Factors significant to recovery efforts include the ability of local businesses to survive the disaster and return to normal business operations quickly (Runyan, 2006). The importance of planning activity extends to business recovery, as research findings indicate small businesses that engage in planning for the potential effects of a natural disaster tend to be more successful in the immediate response and recovery process than those which do not engage in planning (Runyan, 2006). Ensuring small businesses have plans in the event of an absence of cash flow, lack of government assistance and infrastructure damages or destruction is a key aspect of providing businesses can stay in the area following a disaster (Runyan, 2006). A study conducted by Webb, Tierney, and Dahlhamer (2002) in California examined long-term recovery of businesses following natural disasters and found that several factors affect the ability of businesses to remain open and profitable. The sector in which the business operates, the age of the business, and financial assets

are among the factors that affect resilience throughout the local business community (Webb, Tierney, & Dahlhamer, 2002).

In identifying specific communities affected by natural disasters, businesses within the City of New Orleans experienced difficulty in resuming operations following the devastation caused by Hurricane Katrina in 2005. A study on local business operations in hurricane-affected areas found businesses that had developed emergency plans recovered more effectively after Hurricane Katrina. Planning features including physically preparing the building (i.e. boarding windows), establishing emergency contact information for employees such as alternative email accounts and cell phone numbers, arranging long-distance operations, and purchasing adequate flood insurance policies were all found to be effective techniques businesses can use to prepare for and recover after a major event (Corey, Deitch, 2011).

Natural disasters not only affect property recovery but may also affect the mental well-being of communities, families, and individuals directly impacted (Green & Solomon, 1995) for extended periods after a disaster. In assessing the effects of disaster-related events on mental health, an estimated 50 percent of people in the direct path of a hurricane develop post-traumatic stress disorder as well as anxiety disorders (Shultz & Galea, 2017). Supplementary research estimates PTSD rates are much lower but still acknowledge this affect as a valid medical concern following natural disasters. Six months after Hurricane Andrew, an estimated 15 percent of White populations and 38 percent of Hispanic populations experienced PTSD (Perilla, Norris, & Lavizzo, 2002). The availability of mental health services is not always guaranteed, especially in small communities. Thus, working with nonprofit organizations to provide mental health resources as part of the long-term recovery process can work to increase the organizational capacity of local communities in providing important services which would not have been available otherwise (Berke & Campanella, 2006).

In examining the role of long-term planning in natural disaster recovery, understanding how local governments navigate best practice strategies and techniques will provide a context throughout our research, analysis, and final recommendations for the City of Wharton.

5. Best Practices

In analyzing strategies communities can take to protect residents from the effects of natural disaster, the literature maintains one plan or policy that would fit all instances of community

recovery are inefficient. Often, the most effective mitigation and recovery plans are designed to identify and tailor risk management procedures to the needs and vulnerabilities of each geographical region to allow for the achievement of safety goals and security measures for each community (Dixon et al., 2017). While communities can enact a variety of best practices during the recovery process, this literature review will focus on home buyout programs and building codes as such programs and standards have been identified as viable options toward mitigation planning.

5.1 Home Buyout Programs

Within the preparedness and recovery framework, there are many mitigation tools and policies defined within the literature to limit the potential negative effects of a natural disaster. One specific type of program which has gained increasing popularity in the United States is the home buyout. Although home buyouts are often associated with being an expensive policy option, such programs can also serve to save money and permanently remove citizens from dangerous environmental situations (Binder & Greer, 2016). Additionally, home buyouts represent a useful policy alternative by physically relocating families to higher ground and re-establishing floodplains toward their natural function of storm-water storage. Historically, home-buyout programs have not been used in the United States as a type of hazard mitigation or recovery practice in flood-prone or hazardous areas. The first time this type of program was implemented on a full-scale was after the 1993 Midwest floods (which will be discussed more as part of the case studies) which resulted in over $3 billion of damage (FEMA, 2003). This flooding event was the first time FEMA included buyout programs as a valid use of the Hazard Mitigation Grant Program (HMGP) funds. Such a decision represents an important recognition by the federal government of the potential effectiveness of a home buyout program. As a result, $200 million was allocated specifically for buying homes following this disaster and created a precedent for federal dollars to be used for this type of mitigation activity in the future.

In adopting a home buyout program, this type of policy option is used to encourage permanent relocation from an area deemed unsafe or hazardous (FEMA, 2008). In most cases, a cost-benefit analysis is conducted to help determine which homes are selected. However, Binder, et al. (2015) emphasizes the cultural and historical context of the community and the characteristics of the geographical area should also be considered throughout the home buyout process (Binder, Baker, & Barlie, 2015). A home buyout program requires intergovernmental cooperation across

federal, state, and local government officials in working to negotiate the purchase of homes and land from private owners. The role of planning and implementation of this program is the responsibility of the local level and is funded through two primary federal sources: FEMA and HUD (Tate, Strong, Kraus, & Xiong, 2015). Both programs require geographic locations to have been under a Presidentially Declared Disaster to qualify for funding. However, differences exist between the requirements for issuing funding assistance.

Home buyout programs are categorized under FEMA's Hazard Mitigation Grant Program (HMGP). While FEMA does not specify the implementation of the actual buyout, guidelines have been developed for participation in the program (FEMA, 2008):

- Homes must not be purchased directly, but the land on which they reside.
- Purchased land can be used as a trust or open space
- The buyout program must be voluntary
- Owners must be provided the fair market, the pre-disaster price for their property
- Property purchased must be maintained
- No duplicate benefits may be given for homeowners

Federal assistance for buyout programs is also available to state and local governments through The Department of Housing and Urban Development Community Development Block Grant Disaster Recovery (CDBG-DR) funding. It is also indicated that upon applying for such assistance that all of the above HMGP criteria be met to receive CDBG-DR funding. Contrary to HMGP funding, state and local entities can apply for this grant and use it along with HMGP projects. While such assistance is available, CDBG-DR funding is intended to be a "last funding source," and because of this, it can be used to match funding from different sources to complete a community project (HUD, 2012).

5.2 Zoning and Building Codes

To mitigate risk, such as those associated with increased levels of heavy rainfall, there are several actions local governments, businesses, and citizens can take to reduce the adverse effects of flooding and strengthen recovery. These actions range from protective zoning and land use planning to effective implementation of building codes. Some specific policies which mandate land use practices and building code standards have been incorporated as traditional hazard mitigation practices. Such policies specify where community development can occur and

processes for implementation, thus decreasing the likelihood of damage or loss of life in the event of a disaster (Aerts & Botzen, 2011). In examining community practices around the world, the International Code Council (ICC) standards exist to outline the types of buildings which can be built and the materials which can be used for construction. Despite the enactment of code councils, there is no internationally accepted standard for land use practices. Research has shown that enacting stricter policies on floodplain development could reduce the economic burden following a disaster (Albright & Crow, 2015; Aerts & Botzen, 2011). While achieving a high level of effectiveness once adopted, such policies require extensive coordination between local government actors and FEMA officials to ensure highly impactful results which can often be difficult to achieve (Aerts & Botzen, 2011).

In examining the effects of strict zoning laws and building codes including the prevention of building in environmentally sensitive areas that act as a flood buffer, research findings indicate such actions can be effective in reducing community vulnerability. The enactment and enforcement of zoning and building codes which go beyond ICC standards fall under the regulatory power of local jurisdictions (Beuchert, 1963). Therefore, it is essential to ensure communities have the organizational capacity to enforce building standards and development requirements (Godschalk, 2003). In regulating land-use development, such policy actions, however, are not always popular within the business and broader local community and can be challenging to implement.

Building codes and land use zoning are not only useful in guiding the construction of new projects, as such policies can also serve as an effective tool to improve the resilience of existing physical structures (Aerts & Botzen, 2011). It may be necessary to enact mitigation policies through building codes (Kunreuther, 2006). When addressing the vulnerability of buildings previously constructed in hazardous areas, it is often difficult to remove the structure entirely from experiencing potential damage. In working to increase resilience, the policy of building codes can be strengthened to incorporate not only new developments but also those which currently exist to achieve overall structural improvements.

6. The Importance of This Literature Review

In the aftermath of Hurricane Harvey, local communities like the City of Wharton have experienced challenges that are similar to problems faced by other communities. Throughout this

literature review, such challenges have been addressed along with actions, strategies, and policies communities can implement to improve recovery outcomes and strengthen local resilience. To effectively take action and support recovery operations, it is imperative community leaders and residents understand vulnerabilities within their area, use available resources effectively, and learn from the actions of other communities to determine recovery operations that could potentially be successful for future response efforts.

This literature review has provided an initial overview of research to provide local officials best practices in moving forward in the recovery process and to ensure the City of Wharton is more resilient for future events. As this report continues, case study analysis and stakeholder interviews will provide insight on mitigation planning and recovery measures to increase preparedness and overall resilience.

Case Study #1: The Great Midwest Flood, 1993

Introduction

As urbanization, changing climates, and the Earth's population continue to increase, natural disasters have become prevalent across the United States and around the world. In examining specific analyses of communities that have recently faced similar challenges and experiences, leaders and citizens can learn from different problems and opportunities and work to better prepare for, recover from, and mitigate the damage of future disasters. This case study will examine the natural disaster event of The Great Midwest Flood of 1993 (particularly the twin cities of Kansas City, Missouri and Kansas City, Kansas), in addition to identifying successful outcomes, problems the community encountered, and overall lessons learned to provide insight to the City of Wharton on how to increase preparedness and overall resilience for future hurricanes and potential flooding events.

Background of the Flood

The Great Midwest Flood of 1993 was a natural disaster event without precedent in modern US history. The late summer and winter of 1992 were wetter seasons than normal in the Midwest region, and this precipitation combined with cooler temperatures produced extremely wet soil conditions. Increasingly heavy rainfall throughout the spring, summer, and early fall months of 1993 set record-breaking rainfall amounts in all nine states affected by the floods. In early summer, the intense and near continuous rainfall coupled with wet soil conditions began to fill streams and channels throughout the region, creating record flows on many tributaries of the Missouri and Mississippi rivers (Galloway, 1995). The flooding eventually pushed the Mississippi River to a crest in St. Louis on July 12th, 1993 of 43 feet, equivalent to the previous record (Leavesley, 1997). In late July, heavy rainfall began in North Dakota, Nebraska, Kansas, and Missouri. These rains produced record flooding on the Missouri River, which crested in Kansas City, MO at 48.9 feet, setting a new record (Leavesley, 1997). The record flow of the Missouri River joined the already full Mississippi River at St. Louis and pushed the river to another record crest of 49.47 feet on August 1st, 1993 (Leavesley, 1997). This level remains the record to date.

The Great Midwest Flood created unique challenges for the region. The widespread flooding event covered a total of nine states and spanned 400,000 miles. Fifty deaths can be attributed to the flooding and over 1,000 levees were topped or failed. The flood was also

extremely long in duration, lasting 200 days in some locations (Leavesley, 1997). Additionally, the flood caused extensive financial costs to the nation. Fiscal damages ranged from $12 billion to $16 billion, with $6 billion committed to flood response and recovery operations (Galloway, 1995). As a result, over 100,000 homes experienced physical damage along with the unquantifiable emotional effects on the physical and mental health of the community (Galloway, 1995).

Recovery- The Importance of Funding

Specific to the Kansas City, Missouri region, recovery efforts have spanned 25 years. The progress Kansas City has made in regards to recovery after the 1993 flood is in large part due to the community's collaboration and overall efforts to lobby for federal funding to prevent the effects of another natural disaster (Fox, 2018). In 2018, Congress approved an additional $17.4 billion in funding for levees and flood control - including $453 million for the Kansas City Levees project along the Missouri River. The levees will run along the Kansas and Missouri rivers for over 60 miles and will work to protect $20 billion in infrastructure and 20,000 residents (Fox, 2018). Following the completion of this project, the levees will serve to be a reliable tool for preventing future flooding from the Kansas River Basin (Fox, 2018). Two new levee projects have already been constructed since the 1993 floods, bringing Kansas City's levee total to nine. With the two additional levees and the Kansas City, Kansas Levee project underway, city officials are hopeful they will never have to confront extensive rebuilding again (Nelson, 2018).

Money allocated to support the recovery of businesses and homes from the federal government was crucial to the successful recovery of the Kansas City area following the Great Midwest Flood. Neighborhood homes and private businesses in the Kansas City area were severely damaged by the flooding. The effect of such damage was highlighted by data from the Disaster Housing Assistance program, which found at least 100,000 residences had been flooded (US FEMA, 1994). Surveys distributed by local Red Cross workers immediately after the flood occurred identified more than 55,000 flooded residences with the estimate updated following FEMA's own reports to 70,545 residences (Galloway, 1995). By April of 1994, the federal government had received 16,224 registrations for individual assistance and 112,042 applications for the Disaster Housing Program. A total of 90,000 applications were approved for residents to receive funding from the federal government, affording such recipients a new home following the disaster (Galloway, 1995).

In addition to housing assistance, money from the federal government played a critical role in the recovery of businesses across the region. Much of the damages to businesses in Kansas City, Missouri occurred due to the failure of several levee systems (Galloway, 1995). Payments made to small businesses from the National Flood Insurance Program (NFIP) and Small Business Administration (SBA) indicate over 5,000 businesses were damaged by the floods (US FEMA, 1994). In working to promote small business recovery, SBA loans to businesses exceeded $334 million to address physical and economic damage experienced in the region (Kulik, 1994). Coupled with $94 million in loans from the NFIP given to address small business and other non-residential building needs, the total amount of federal funding spent in an effort to engage local businesses in recovery exceeds $431 million (FEMA, 2014). In working to understand the recovery process of the Midwest region following the 1993 flooding event, it is important to address best practice and overall challenges faced by these communities that affected response and emergency actions.

Best Practices & Challenges

Communication

Prior to the event, region officials were able to effectively notify citizens of the oncoming dangers, protect human life, and secure physical property. Over 1,000 flood warnings and statements-five times the normal amount, were issued to warn the public and the appropriate officials of the high river levels (NOAA, 2018). Although there were successful outcomes experienced in the region, several areas of communication proved to be challenging during the flooding. For example, information issued on the ongoing flood conditions and the recovery process was often incomplete or not timely. In addition, estimates reported on losses were generally inaccurate for a considerable period of time after the floods (Changnon, 2005). Furthermore, an unclear definition of the division of responsibilities for floodplain management among federal, state, and local government officials created communication and coordination problems.

The role of each level of government in floodplain management can work to describe the challenges experienced in the region. State governments have limited fiscal stake in floodplain management, resulting in a lack of incentives for involvement and participation in this process (Galloway, 1995). Federal agencies, therefore, generally are associated with the primary role of

floodplain management, but it became clear after the 1993 floods there were several examples of state non-compliance with federal floodplain management requirements. While state agencies believed federal agencies were complying with such requirements, a lack of communication between the two levels of governments and confusion from the 1977 Floodplain Management Executive Order led to a Department of Housing and Urban Development (HUD) funded low-income housing project and a federal state prison to be built within vulnerable floodplains (Galloway, 1995).

Acquisition/Buyout Programs

Following the 1993 flooding event, Kansas City, Missouri was able to obtain financial support from FEMA's Hazard Mitigation Grant Program (HMGP) and the HUD Community Development Block Grant (CDBG) Program. Subsequently, such funding has helped the Kansas City community take measures to effectively mitigate damage from future floods (FEMA, 2011). Kansas City received $1.3 million from the federal government to purchase homes from residents who wanted to move out of the floodplain and used the funding assistance to purchase 61 residential properties. In working to reduce the risks associated with living in or around a floodplain, residential structures were cleared and wildlife was returned to inhabit the area. Kansas City officials realized the important policy tool of land use regulation and used the 1993 floods as an opportunity to correct long-standing environmental problems and update inadequate policies. As a result of increased resilience, when Kansas City experienced flash flooding again in 1998, the community was not heavily affected. Overall, minimal damage occurred and high costs associated with response and recovery, including warning alerts, evacuation procedures, and rescue operations were avoided. In identifying potential outcomes, all 61 structures that had been removed from the floodplain after the Great Midwest Flood would have likely experienced flooding and received extensive damage in 1998 in the event such buildings had not been cleared (FEMA, 2011).

Development of Storm-Water Management Design Criteria

Since the devastation of the Midwest Flood, flood prediction research and development activities in the Kansas City area have aimed to identify optimal stormwater control requirements. In 2008, 53 years of precipitation data from the Kansas City region were applied to the Environmental Protection Agency's (EPA) Storm Water Management Model (SWMM) to conduct

water flow simulations in receiving stream channels (Pomeroy et al., 2008). Data from the region was used to examine future erosion potential as the result of urbanization of different streambed materials. Research findings indicated coarse streambed materials were less sensitive to changes in erosion. Thus, the application of appropriate storm-water control features includes prior analysis based on characteristics of erosion potential (Pomeroy, et al, 2008). Although extensive damage occurred in the aftermath of the 1993 floods, both scientists and engineers recognized the importance and value of conducting flood prediction exploration and experiments. Knowledge gained from such experiments ultimately serves to increase community resilience and benefit flood mitigation policy nationwide (Changnon, 2005).

Lessons Learned from the Great Midwest Flood

Inadequate Flood Control Systems and Floodplain Management

When the flooding occurred in 1993, Kansas City and the surrounding region had relied on levees and various flood control methods, with over 1,500 levees running the length of the Missouri and Mississippi River Basins (Changnon, 2001; Hickcox, 1994). In examining the performance of the levee systems in regulating regional water levels, 6 out of 48 (12.5 percent) of federal levees failed within Kansas City while all 818 private levees were breached or topped (Hickcox, 1994).

Two factors attributed to the failure of the levee systems in Kansas City, Kansas, including poor communications between officials in determining the placement of local levees versus federal levees. Unclear federal limitations and guidelines and non-existent local floodplain regulations created the conditions for the levees to become overwhelmed and breached by floodwaters (Galloway, 1995). In addition, a lack of local floodplain regulations also left many communities and businesses without levee systems to protect and prevent the overflow of water (Nelson, 2018). The second attributing factor includes how the construction of levees vastly alters and constrains the height and flow of a river. While a levee may relieve pressure at one point in a river, it can create further problems upstream and downstream (Hilcox, 1994). As the water seeks an exit, it will overspill smaller levees upstream and potentially devastate any communities lying within those floodplains while the water headed downstream flows faster and higher, breaching any weaker or compromised levees (Hilcox, 1994).

The 1993 floods also served as an example for the importance of stricter local policies to control levee and floodplain management within urban and rural areas of the Kansas City region. Communities which lacked appropriate policies and procedures on levee maintenance and placement experienced higher breaches than those levees that were coordinated with or built by the federal government. While levee systems are intended to be one of the most efficient and cheaper policy options to mitigate and prevent flood damage, clear policy objectives across levels of government are necessary to increase protection abilities as harm to a floodplain can have direct and lasting consequences affecting the physical and environmental safety of a region. In addition, communities that engage in the planning process to build local levees need to consider long-term solutions and address problems which could occur in the worst-case events (100 and even 500-year floodplains).

One of the most cited problems as a result of the 1993 Midwest Flood was the lack of public policy for managing development and flood control systems within the floodplains of the Missouri and Mississippi River Basins (Hickox, 1994; Changnon, 2001). As there was not one single federal or state agency with the responsibility to regulate the development/destruction of floodplains, they became mis-managed and improperly monitored. (Hickox, 1994). In addition, several state floodplain managers did not comply with the 1977 Floodplain Management Executive Order which mandates federal agencies to demonstrate there is no alternative to building in a floodplain and requires preventative actions to be taken to minimize risks (Galloway, 1995).

In the case of the Kansas City river tributary Turkey Creek, unchecked development on the Kansas City suburban watershed altered the route and flow of the creek. Specifically, the area was a focus for transportation development for a majority of the community's history. This resulted in significant flooding damages to the surrounding community whenever heavy rainfall occurred (Kabbes et al., 2013). At the time of the Kansas City Floods, around 90 percent of the watershed had been urbanized (Kabbes et al., 2013). The U.S. Army Corps of Engineers (USACE) and ecological experts determined that if additional urbanization were to take place in the watershed, extensive consequences (such as the 1993 floods) could create irreparable damage to the urban community and the ecology of the environment (Kabbes et al., 2013). Taking into account the area's flooding history, the USACE and community stakeholders determined the leading course of action would be to slowly begin to restore the environment of the Turkey Creek watershed by expanding floodplains and removing unnecessary developments (Kabbe et al., 2013). Highly

urbanized watersheds are one of the key issues confronting communities experiencing urban flooding events. If residents desire to live in or near floodplains surrounding streams and rivers, environmental principles and preservation actions are necessary in order to reduce the risk of urban flooding events in the future. In examining the communities selected for case study analysis, a lack of policy led to significant problems and exacerbated damages. Correspondingly, officials and leaders in the area responded with policies and approaches, such as the Turkey Creek project, to ensure such devastation would never be experienced again.

Policy Changes and Areas for Improvement

The 1993 Great Midwest Flood ultimately resulted in the identification of several necessary policy changes. Most notably, changes to the National Flood Insurance Program Act and Federal Crop Insurance Program in 1994 led to increased sales and better coverage as well as less reliance on relief payments (Changnon, 2005). Such changes have been successful in improving the nation's flood policy and increasing resilience. Since the Great Midwest Flood, however, some areas experienced a lack of action. Although considerable funding has been appropriated to restore damaged levees, such as the Kansas City Levees project, little has been done to alleviate the risks associated with current floodplain management practices. Furthermore, an improvement plan for the Upper Mississippi River Basin has not come to fruition since the Great Midwest Flood (Changnon, 2005). Conflicting goals, policy objectives, and differing views may continue to affect actions necessary to prevent another disaster of such magnitude and could have potentially negative consequences for future preparedness and resilience.

Relevance to the City of Wharton

The Kansas City area serves as an example of the importance of improving physical infrastructure and managing flood risk. Innovative approaches to flood risk management, including the development of the Turkey Creek and Kansas City Levee Projects, provide a framework for communities like the City of Wharton in working to increase state and local community resilience, understand the role of money during natural disasters, and strengthen ongoing recovery efforts. The Great Midwest Flood of 1993 affirmed it is imperative for federal and local policies and actions to improve flood-prevention infrastructure, to mitigate efforts, and increase local resilience.

Case Study #2: Rhode Island Flooding, 2010

Introduction

As we noted, in examining the aftermath of Hurricane Harvey, understanding the effects of previous disasters in other communities can help identify lessons learned across levels of stakeholders and determine which actions, best-practices, and experiences from other areas are applicable to the City of Wharton in their recovery and planning efforts. This case study will examine the March 2010 flooding event in Rhode Island, which was similar to Wharton in terms of impact, damages, and funding opportunities.

Background of Floods

In the Spring of 2010, Rhode Island experienced the worst flooding event in its history as the result of multiple precipitation events (NOAA, 2018). Factors attributing to the flooding include a heavy rainfall event which lasted from March 30th to 31st (Grumm, n.d.). In total, 19 to 25 inches of rain was measured in the New England area as a result of the rainfall leading five major watershed basins to flow above capacity (U.S. Department of Interior, & U.S. Geological Survey, 2011). In addition, flooding in the region reached the 100-year flood mark and high-water markers measured peak loads 88% above normal (U.S. Department of Interior, & U.S. Geological Survey, 2011).

All five Rhode Island counties were included in Disaster Declaration 1894, opening the entire state to federal assistance dollars to go towards recovery efforts (NOAA, 2018; FEMA, 2010; FEMA, 2010). It is estimated total home damage was $100 million with an additional $70 million worth of damage to businesses across Rhode Island. (OHCD, 2010) Two major Rhode Island critical infrastructure facilities (a water treatment plant and an electricity substation) were damaged by the flood, requiring every Rhode Island citizen to conserve water and electricity until the facilities could be repaired (CBS, 2010; NOAA,2013).

Recovery

Although there was not an existing recovery plan in place prior to the flooding event, there were action plans implemented at the state level and in those jurisdictions, which received additional funding from the U.S. Department of Housing and Urban Development (HUD). Almost all recovery preparation, planning, and implementation of funding priorities were the responsibility

of the RI Housing and Community Development Department. At the state level, officials named three focus areas for recovery which include "using FEMA Public Assistance Monies to rebuild infrastructure, coordination of private resources with non-profits, and development of municipal Hazard Mitigation Plans," (OHCD, 2010 pg. 5).

Approved FEMA dollars totaled $61 million for recovery assistance, with over half of the amount approved for individual household grants (OHCD, 2010). In addition to immediate funds provided by FEMA, Rhode Island was awarded nearly $9 million at the state level and two cities (Cranston and Warwick) were each awarded separate allocations of $1.2 and $2.7 million respectively to assist in their specific recovery efforts by HUD through its Community Development Block Grant - Disaster Recovery (CDBG-DR) fund. An estimated 3,000 businesses were awarded $43 million in loans by the Small Business Administration (SBA) (OHCD, 2010). Loans were used by business owners to address damages, make any necessary repairs, and regain economic stability after the flood.

Recovery planning and activities were largely contingent on the HUD CDBG-DR grants awarded to the state and did not include mitigation and/or recovery activities beyond what funding would allow. Planning for future events was divided into short-term and long-term goals. In the short-term, the state wanted to use CDBG-DR Funding for financial assistance to businesses which lost critical assets or operating revenue as a result of the flood; assistance to individuals with eligible unmet needs; repairs, rehabilitation and debris removal programs for affected private property; and assistance to municipalities for repairs to damaged infrastructure and the provision of public services necessary as a result of the flood. In the long term, the state anticipated using CDBG-DR funds to improve hazard mitigation strategies and conduct buyout programs for structures prone to flooding (OHCD, 2010).

To achieve the second recovery goal of coordinating resources with non-profits, the Rhode Island Disaster Long-Term Recovery Group (RIDLTRG) was established through the local United Way. In creating this group, 71 non-profits collaborated monetarily and through in-kind donations to establish the fund which was used to fulfill unmet needs.

In creating proposals consistent with HUD requirements, Cranston and Warwick, two town in Rhode Island which experienced heavy damage during the flood, implemented recovery action plans separately which were similar to the state's plan, however, within the context of a limited

scope (Department of Community Development for the City of Cranston, 2011). Both cities implemented plans that incorporated the short-term agenda of providing financial and technical assistance to affected parties. In the long term, the remaining funding was intended to be used for mitigation activities such as home buyout programs, flood risk analysis, and flood control barriers. Specifically, the assessment of critical infrastructure and home buyouts were two activities earmarked as part of long-term hazard mitigation efforts. In addition, each individual plan included mechanisms for monitoring funding usage.

Unanticipated Problems

Home Buyouts

As mentioned in the first case study, home buyouts are a tool often used by local government officials in the hazard mitigation process as a way to permanently remove citizens and structures from hazardous zones. While home buyouts represent an identified policy option to improve community resilience, the Rhode Island case serves as an example that recovery efforts are often not resistant to the pace of bureaucratic governance and can sometimes be difficult to qualify for. Following the flooding event, 38 homeowners had applied for FEMA voluntary buyout funding. By December of 2011, 37 applications had been denied presumably because of outdated flood maps used by FEMA in conducting the cost-benefit analysis to determine approval for acquisition. One Councilman argued the cost-benefit analysis used for buyout decisions was flawed while also acknowledging a paperwork change may have contributed to the large number of denials. The paperwork changes were caused by the second round of flooding from Hurricane Irene when 2010 applications were "stuck somewhere in Washington, D.C. in the midst of a freeze on FEMA funds," (Schieldrop, 2011). As of September 2015, following three rounds of applications, no additional buildings were found to be eligible for a buyout. Leftover funding was taken back by HUD. Despite this reallocation, 21 homes were acquired (Kasakove, 2017). Attempts to facilitate home buyouts, in this case, did not serve as an effective strategy primarily due to a cost-benefit analysis conducted by FEMA which placed strict limitations on homes which could be purchased and resulted in paperwork issues affecting potential awards.

Communication

Communication channels and protocols are critical elements to establish during emergency management planning in addition to daily operations. As part of disaster protocol, some Rhode

Island officials are instructed to communicate with each other through two sources including an 800 MHz radio and an online forum called Web-EOC. However, it should be noted not all agencies were included in these communication channels. For example, the municipal wastewater treatment facility officials were not provided sufficient communication information during the emergency. This incident is important in light of the facility, which flooded during the storm, creating municipal water issues for the entire state. Although it cannot be determined whether including the facility members in the circulation of communication could have alleviated this facility from flooding, it is important to consider who or what entities are included or excluded from communication and decision-making during a disaster.

In the "Rhode Island Emergency Management Advisory Council The 2010 Flood: Lessons Learned" panel, members of the state, local, and private levels all identified communication as an area which could be improved (Offices of RI Department of Transportation, 2010). This consensus is supported by the lack of reverse 911 calling in some smaller communities. Reverse 911 allows officials to use existing 911 systems to dial out to landlines to notify citizens of an emergency (Sammamish.wa.us, 2010). While large communities such as the City of Coventry were able to evacuate 2400 people using reverse 911, other townships such as West Warwick found communication with citizens to be difficult without the technology. Similarly, small communities found it difficult to communicate with their own staff because of a lack of centralized communication space. The Richmond Town Council member Judge Reddish III stated during the Panel his community is looking into installing a conference call number for better communication (RI Department of Transportation, 2010).

Successful Practices

Research

Prior to the event, the state of Rhode Island made significant efforts in researching the effects of climate change in the region (Georgetown Climate Center.,2018). Although these efforts did not directly relate to hazard mitigation or recovery, they demonstrate a willingness and acknowledgment of vulnerabilities affecting Rhode Island and the importance of increasing overall resilience. To complete the inquiry, the Rhode Island Commission on Climate Change was created with FEMA funding at the beginning of 2010. The 'Resilient Rhodie' action strategy was produced in 2017, which used research and science to identify statewide vulnerabilities and potential needs

in the face of climate change (Rhode Island Office of Governor, 2017). Since March 2010, Rhode Island has continued to address vulnerabilities through scientific research studies. Four studies focused on climate change implications, watershed and river modeling, and risk management have been conducted in the period since the flooding occurred (OHCD, 2010). A result of these initiatives includes the creation of a $300,000 flood wall along an adjacent river as an effort to mitigate future flooding in Cranston (Roberts, 2011).

In addition, research has contributed to the planning process at both the state and municipal level. Since 2010, comprehensive plans which include land use planning and mitigation actions, have been produced by 31 municipalities (Rhode Island Department of Administration, 2018). Although it is not clear if the flooding in 2010 prompted the attention to increase planning efforts, it is relevant to highlight the actions taken to identify, address, and respond to future hazards.

Personnel Training

Another activity which can be attributed to the successful response to this flooding event is the Rhode Island Emergency Management Administration's (RIEMA) participation in crisis training and alternative preparedness events. Training operations across several agencies, including National Guard, fire, and police departments participated in a Vigilant Guard training in addition to standard training activities. This training opportunity allowed teams to prepare for disaster response by participating in a real-world simulation. The value of situational training and awareness serves to increase the capacity of responders from all levels of government in gaining valuable emergency management and response experience (Army, 2017).

Community-Based Centers to For Recovery

In the interim between the response and recovery phase, five Disaster Recovery Centers were opened in an effort to streamline the recovery process. These centers were intended to create "one-stop-shops" for disaster assistance and stayed open until May 2010. Representatives from SBA, FEMA, mental health professionals, and caseworkers were there to help citizens navigate the recovery assistance process and support communication operations at all levels of government. The Disaster Recovery Centers are recognized for the successful allocation of individual FEMA assistance grants and SBA loans to business owners and for distributing critical recovery information to citizens in a timely manner.

Targeted Funding Allocations

The reality of the disaster recovery process indicates some categories of citizens are affected disproportionately than the rest of society in and following a natural disaster. In the case of Rhode Island, it was found low-income households were more likely to experience the effects of natural disasters at a higher rate (Roberts, 2011). In an interview conducted by Brown University students at the Center for Environmental Studies, Paul Salera the director of Westbay, a local non-profit, discussed this topic. From his experience of the 2010 floods, he conveyed "people coming in [to Westbay] for flood assistance was already in the [Westbay] system." (Roberts, 2011, p. 52). Meaning many of the people seeking assistance after the disaster were disadvantaged in some way, and using nonprofit services prior to the storm. Re-emphasizing the idea that vulnerable populations often require additional funding in comparison to the normal citizen. This statement demonstrates that community members who need the most help after a disaster, are often those who needed help pre-disaster. In this case, there is evidence that the lowest income communities (West Warwick and Cranston) were the ones to receive the most FEMA funding and illustrates the finding that low-income brackets will typically be the most affected by disaster (Roberts, 2011). In addition, 39 percent of statewide homeowners who received funding fell into the low to medium income bracket with an estimated 25,000 households who applied for individual assistance (OHCD, 2010). Ultimately, 14,744 were approved by FEMA (FEMA, 2010). While nearly 60 percent of those who applied for funding received such assistance, challenges were identified for individuals who received FEMA funding following this disaster. In this case, it appears that individuals who needed the most help were able to receive assistance and the necessary resources to address recovery challenges.

Key Takeaways: The Great Midwest and Rhode Island Case Studies

While the events experienced by these two communities during the Rhode Island and Midwestern flooding events were not exactly like the experiences of Wharton during Hurricane Harvey, actions, challenges, and best practices are relevant and can be applied to Wharton.

Both case studies demonstrate the importance of effective communication and emergency management policies in place when a disaster occurs. In the Great Midwest Flooding event of 1993, successful communication techniques served as a critical asset prior to the onset of the flooding. Kansas City region officials were able to effectively notify and warn citizens of potential

dangers by issuing five times the normal amount of flood warnings to the public. In Rhode Island, communication efforts were supported by technology and notification techniques including reverse 911 and the EOC system. Rhode Island government officials recognized the ability to stay in communication worked in helping to increase overall safety and emergency management functions during the storm, as the state did not have an emergency protocol to address river flooding.

In identifying communication as a key asset in the case of Rhode Island and The Great Midwest Flood, such practices extend to disasters across affected communities and represent a vital mitigation and preparedness strategy to improve response outcomes. As mentioned in the Rhode Island case study, there was not an existing plan in place to address river flooding. As a result, emergency management teams were forced to use hurricane preparedness plans which addressed flooding to respond to the emergency. Officials acknowledge this method of emergency management was not sustainable to address flooding events in the future. Since the flooding occurred, existing emergency plans at all levels of government have been updated to include river flooding and response areas unique to such events.

Updating existing emergency plans addresses another important lesson for communities affected by flooding which includes using scientific studies to create and validate emergency plans. By conducting scientific studies, communities can identify risks, understand potential hazards, and develop strategies to determine response actions in the event of a disaster. In addition, data gathered from studies can be leveraged to implement actions that work to increase mitigation and response capacity. An example of such activity includes the city of Cranston in Rhode Island a building a flood wall to reduce the effects of future flooding. Similarly, the flooding events in the Kansas City region prompted scientific research and policies to be implemented in order to better prepare for and mitigate future flooding events. For example, the Turkey Creek restoration project expanded floodplains and removed unnecessary developments to better protect against potential damages as a result of flooding.

The Rhode Island case study serves as a reminder that funding can often be challenging for individual citizens to obtain and the application process is often difficult to navigate. Examples of such challenges include attempted home acquisitions in which a majority of applicants were declined in their requests to have their home buyouts after experiencing consecutive floods. In

addition, the low number of approvals was attributed to the cost-benefit analysis used by FEMA as well as paperwork issues affecting the application process. However, sources generally did not express difficulty in obtaining funding for individual assistance or small business loans. Such outcomes may be attributed to the establishment of community-based recovery centers, which were placed throughout the hardest hit regions. By having direct access to representatives from these agencies, citizens may have experienced a decreased amount of difficulty in applying for recovery assistance. Conversely, federally funded home buyout programs were shown to be extremely successful following the Great Midwest Flood.

Both case studies serve to examine existing best practices and response actions in communities affected by natural disasters and identify areas which can be improved to increase resilience and strengthen the planning and execution of disaster management techniques and procedures. From this analysis, Wharton and similar communities can learn from these experiences and apply best practices to strengthen local government awareness and support response and recovery operations.

Post Harvey Public Opinion: A Secondary Data Analysis

The following section will provide further information in regards to the impact of Hurricane Harvey in different counties within the State of Texas. The analysis includes data collected from two surveys- Kaiser Family Foundation Post-Harvey Survey and the Texas A&M Hurricane Harvey Survey. For the scope of our capstone project, the following information provides a useful representation of individual experiences in the aftermath of Harvey, reflects key themes previously examined in the literature review, and will support final report recommendations to improve emergency planning and strengthen preparedness activities for future natural disasters.

Kaiser Family Foundation Post-Harvey Survey

In the aftermath of Hurricane Harvey, the Kaiser Family Foundation conducted a telephone survey of a random sample of people living in 24 counties along the Texas Gulf Coast. The counties were selected based on FEMA's property damage mapping analysis (See Figure 1). The region was further divided into four groups of counties (See Figure 2): 1) Harris County; 2) Counties surrounding Harris[3] (Liberty, Chambers, Galveston, Brazoria, Matagorda, Wharton, Colorado, Austin, Waller, Fort Bend, Montgomery, and Walker counties); 3) Golden Triangle (Jefferson, Hardin, and Orange counties); and 4) Coastal counties (Nueces, San Patricio, Refugio, Aransas, Calhoun, Victoria, Jackson, and Lavaca counties).

[3] The Kaiser Family Foundation Data refers to this group as "Outside Harris," which is how the analysis will be addressing this group.

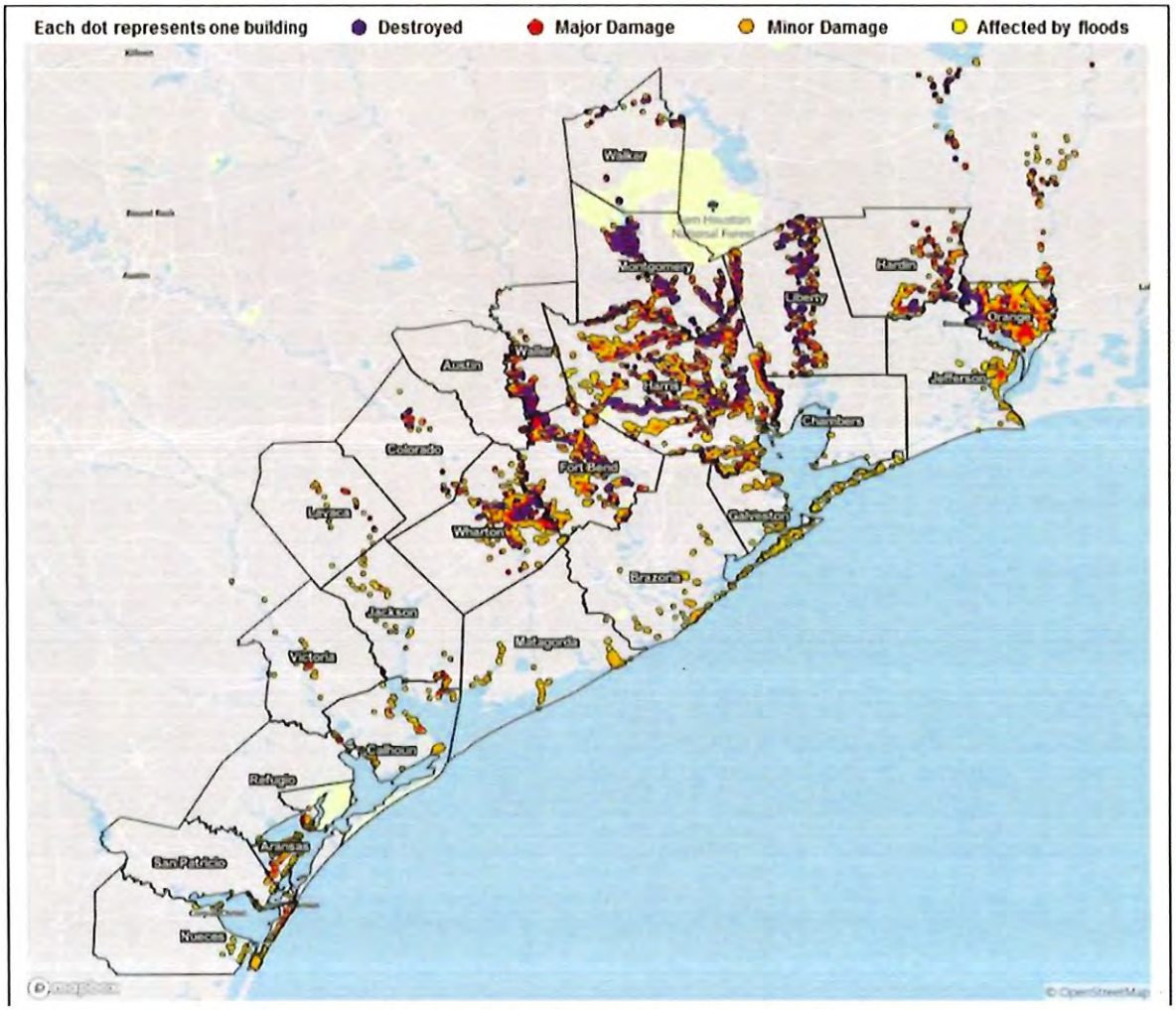

Figure 1: Counties included in survey sample based on FEMA damage assessments

Source: Federal Emergency Management Agency, https://gis.fema.gov/REST/services/FEMA/FEMA_DAMAGE_Assessments/MapServer

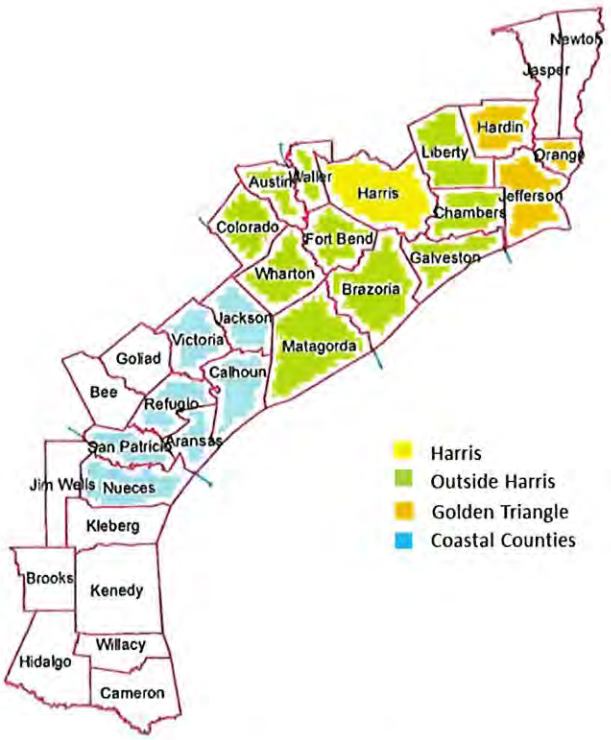

Figure 2: Counties divided by groups

Although the analysis was not conducted specifically for Wharton County, the information provides a general overview and context for describing significant impacts of Hurricane Harvey and the areas that could benefit from greater attention and consideration. The following four sections (A to D) are based on descriptive analysis of the Kaiser Family Foundation data and represents information concerning the region as a whole in addition to data for the groupings of counties mentioned previously. Section E, based on the Texas A&M University data, will summarize the main policies which citizens consider necessary to ensure adequate recovery.

1. Areas of Disruption

As previously discussed in the literature review, all aspects of a community can experience disruption following a natural disaster including areas of physical infrastructure, housing, and local businesses. In examining resources affecting recovery, different levels of financial capacity impacts how communities respond to natural disasters as supported by the data and referenced (see page 15) (Mitsova et al., 2019; Rumbach, Makarewicz, & Németh, 2015). Furthermore, delays in re-establishing housing often interrupt and suspend other dimensions of recovery operations (Peacock, 2007). Such factors represent extensive challenges for local officials to consider when

almost 66 percent[4] of respondents from counties surveyed reported being affected by Hurricane Harvey in terms of housing and vehicle damage, employment disruption, or income loss (KFF, 2017). It working to understand impacts of damage, is important to consider the following question:

Was your home or the place you were living damaged as a result of Hurricane Harvey, or not?

Considering all counties surveyed, 49 percent of respondents stated they experienced damages where they lived, whereas the other 51 percent of respondents did not report experiencing damages. When examining this information by groups of counties, out of all respondents who reported damage because of Hurricane Harvey, 36 percent belong to Harris County, while 15.3 percent are from groups outside Harris County. In both Golden Triangle and Coastal counties, 24 percent of respondents reported experiencing housing structure damage.

Table 1: Respondents by group of counties, whose living place was damaged

Group	Percentage
Harris	35.5%
Outside Harris	15.3%
Golden Triangle	24.4%
Coastal	24.8%
All counties	**49.1%**

A lasting impact individual who experience disasters often face is the financial burden of rebuilding. When combined with loss of income, such challenges could exacerbate and delay the recovery process. To understand the effects of unemployment and income loss as a result of a natural disaster, the following question was considered:

As a result of Hurricane Harvey, have you or another family member living in your household been laid off or lost a job, had overtime or regular hours cut back at work or experienced any loss of income?

[4] Data shown in the Kaiser Family Foundation Report" An Early Assessment of Hurricane Harvey's Impact on Vulnerable Texans in the Gulf Coast Region," pg. 5. Retrieved from: http://files.kff.org/attachment/Report-An-Early-Assessment-of-Hurricane-Harveys-Impact-on-Vulnerable-Texans-in-the-Gulf.

Considering the 24 counties surveyed, 13 percent of respondents were laid off or lost a job, while 29 percent had regular or overtime hours cut back at work, and 28 percent experienced other losses of income, such as lost income from a small business or unpaid missed days of work. In analyzing the data across county groups, Harris County reports the highest number of respondents that experienced a loss of income due to Hurricane Harvey, followed by respondents of counties from the Golden Triangle.

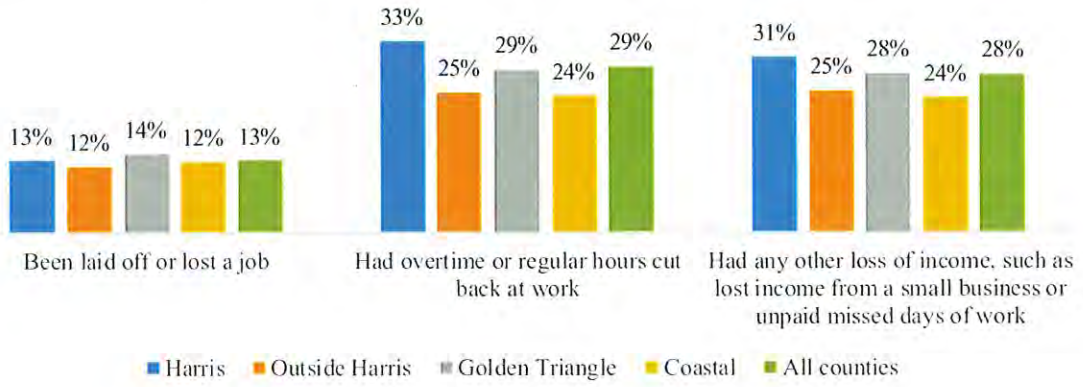

Figure 3: Percentages of people who underwent some employment loss as a result of Harvey

2. The Level of Disruption (Short-Term and Long-Term Damage)

Taking into account efforts to improve response and recovery after a natural disaster, actions are often specifically directed at rapidly reducing risk, engaging in the protection and reconstruction of critical infrastructure, and working to restore daily operations in affected communities (Ingram et al., 2006). Research findings indicate the response process after a natural disaster is usually swift, but short-lived, which can have direct consequences for long-term community recovery (Moore et al., 2004). As discussed on page 20, this short-lived response may also affect the ability of local governments to effectively address emergency response and recovery following a disaster. As a result, it is important to address short and long-term damages in order to effectively manage emergency response operations and support the rebuilding process. Questions concerning damages, major problems, and recovery status include:

If your home or the place you were living was damaged by Harvey, was that minor damage that could be repaired within a month, major damage requiring more than a month to repair, or was your home destroyed?

Results suggest 51 percent of respondents stated damage was minor, meaning that it could be repaired within a month. Roughly 40 percent reported their place of residence experienced major damage potentially requiring more than a month to complete repairs and 8 percent of respondents stated their home had been destroyed.

Table 2: Percentages of respondents by group of counties that experienced some level of damage in their living place

Damage	Harris	Outside Harris	Golden Triangle	Coastal	All counties
Minor damage	57%	44%	38%	61%	51%
Major damage	37%	47%	50%	33%	41%
Home was destroyed	6%	9%	12%	6%	8%

In examining the data by groups of counties, it is important to recognize although in absolute terms Harris County overall had the highest number of respondents report experiencing damage, in relative terms, counties from the Golden Triangle experienced greater widespread damage and housing destruction.

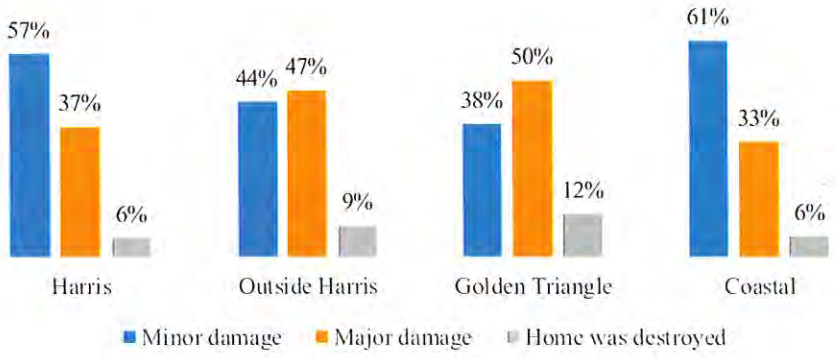

Figure 4: Percentages of respondents by groups of counties experiencing various levels of damage

As mentioned previously, delays in re-establishing housing could potentially interrupt other aspects of overall recovery. Correspondingly, the following questions were used to identify levels of disruption in focusing on recovery efforts:

Was the loss of income or property damage you experienced as a result of the hurricane a major problem, a minor problem, or not a problem for you and your family?

From the respondents affected by Hurricane Harvey, 50 percent stated that the loss of income or property damage was a major problem, while 36 percent reported this as a minor problem, and 13 percent stated it was not a problem at all. In analyzing the data by groups of

counties, although the tendency is the same, in counties belonging to the Golden Triangle, the proportion of respondents reporting major problems from damage is higher (61 percent). This result supports research findings identified in the literature review regarding the idea that damage is experienced differently throughout a community (Peacock et al., 2015). Furthermore, Peacock et al. (2015) emphasize low-income and minority populations are often at a greater disadvantage and experienced greater effects as a result of decreased ability to bounce back from a disaster.

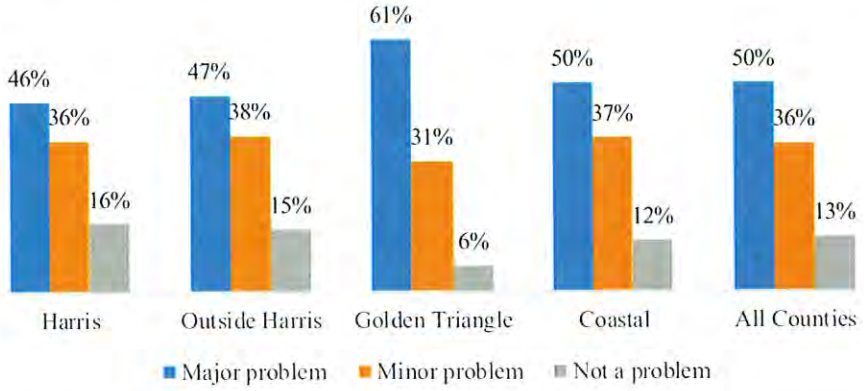

Figure 5: Percentages of respondents reporting loss or income or property damage by magnitude of the problem

After a natural disaster, it is critical for recovery efforts to focus on actions to ensure the daily life of residents can return to normal while increasing planning practices and preparedness measures to reduce risks for future natural disasters. Respondents affirmed the importance of such actions, as officials maintained local recovery efforts should work on returning the community to a state of normalcy as quickly as possible. The following question examines personal situations for recovery:

Which of the following best describes your personal situation in terms of recovering from Hurricane Harvey? Would you say that your day-to-day life is largely back to normal, almost back to normal, still somewhat disrupted, or still very disrupted?

At the time this survey was conducted, 62 percent of respondents said their day-to-day life was largely (36 percent) or almost (26 percent) back to normal, while 36 percent still experienced disruption at some level. Only 2 percent of respondents did not experience any disruption in their day-to-day life. In examining the data by groups of counties, the Golden Triangle reported the highest proportion of respondents whose day-to-day life was still disrupted. Harris County has a higher "back to normal" rate that could be attributed to higher funds which were distributed to that area compared to funds earmarked for smaller counties.

Table 3: Day-to-day life situation after Harvey

	Harris	Outside Harris	Golden Triangle	Coastal	All counties
Largely back to normal	41%	39%	21%	38%	36%
Almost back to normal	27%	24%	25%	25%	26%
Still somewhat disrupted	19%	20%	24%	23%	21%
Still very disrupted	10%	13%	29%	12%	15%
Life was not disrupted	2%	4%	0%	1%	2%

3. People's Actions During Harvey

One of the major challenges local governments and emergency officials experience when working to protect residents is confronting different community perceptions of risk affecting the willingness or hesitancy of residents to evacuate or take actions to respond to a natural disaster (Weller, Baer, & Prochaska, 2016). The following question highlights the importance of people's perceptions when responding to a natural disaster.

Did you evacuate or leave your home for any amount of time as a result of Hurricane Harvey, or not?

Considering all counties surveyed, 44 percent reported they did not take any action to evacuate during Hurricane Harvey. While the other 56 percent reported evacuating or leaving their home. However, focusing only on the people that were affected, 55 percent of respondents evacuated, while 45 percent of affected people did not. The data presents interesting findings in that Harris County (58 percent) and counties outside Harris (47 percent) have the highest percentages of affected respondents who did not evacuate (see Figure 6).

In Wharton, individuals on the Northside of town were impacted by perceptions of risk for how their part of the community could potentially flood, as will discussed on page 67 of the stakeholder interviews. Wharton's Northside had not flooded in over 100 years according to stakeholders; thus, residents had not experienced a flooding event of the magnitude of Hurricane Harvey and ultimately believed their homes would not be impacted by extensive flooding. This perception of flood risk is well documented, as discussed on page 19 of the literature review, as perceived flood safety strongly influences an occupant's decision to leave or not to leave.

In the stakeholder interviews local leaders in Wharton indicated challenges community groups experienced when evacuation was necessary. Time of evacuation in Wharton is difficult to

calculate as people either could not evacuate, evacuated and became permanently displaced, or were able to evacuate and later return to their homes. Stakeholders estimate 800-1,000 residents have moved to neighboring towns and cities following damages experienced and issues affecting overall recovery.

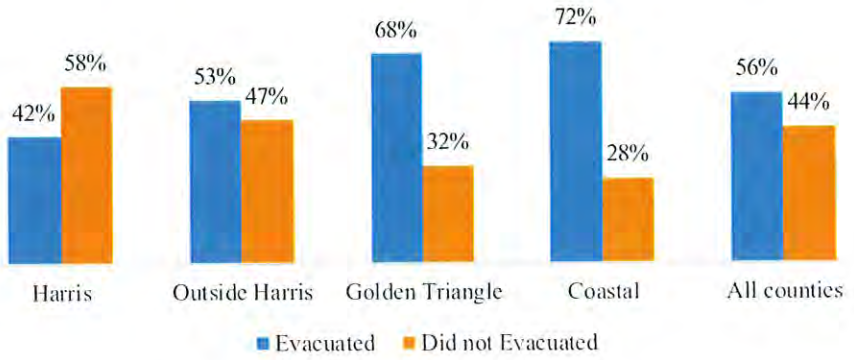

Figure 6: Percentages of respondents evacuated, by groups of counties

4. Perceptions of Recovery Actions

The capacity to provide post-disaster resources to residents who are most in need is important for community recovery and resilience. In these situations, researchers affirm the distribution or mobilization of support should follow the "rule of relative needs," which provides the most support is directed to those who need it the most (Norris, Stevens, & Pfefferbaum, 2008). Thus, identifying the most vulnerable or affected populations and determining community need could improve the recovery process and support short and long-term outcomes. In addition, research findings indicate the response following a disaster is typically quick, but short-lived (Moore et al., 2004). This tendency is also reinforced in the survey results, which indicates people are still struggling in multiple aspects of recovery.

The next two questions address resident perceptions in terms of how sufficient the assistance received has been and which areas were identified as necessary for more help.

Overall, do you feel like you are getting the help you need to recover from Hurricane Harvey, or not?

Of respondents affected by Hurricane Harvey, 45 percent reported receiving the help they needed, while 46 percent stated they were not receiving enough help. Only 7 percent of survey respondents said they didn't need help. Across groups of counties examined, the same behavior can be observed among respondents.

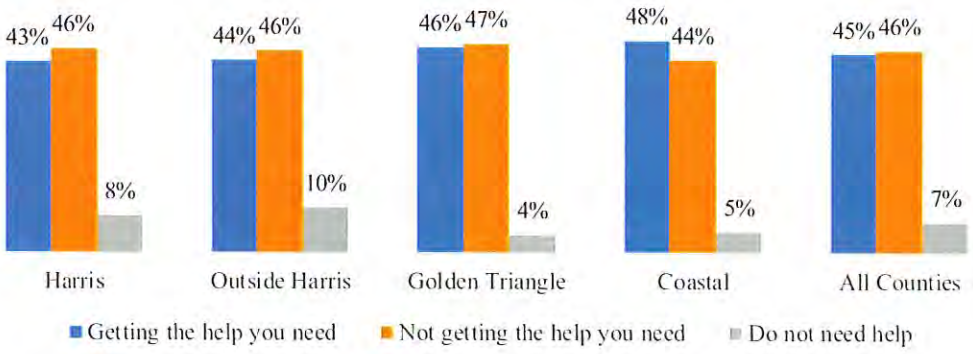

Figure 7: Percentage of respondents who were affected by Hurricane Harvey reporting if they are getting enough help to recover

In which area do you need more help to recover from Hurricane Harvey?

Overall, areas respondents reported needing more help to recover from Hurricane Harvey includes applying for disaster assistance, repairing damage to their homes, and assistance in finding affordable permanent housing.

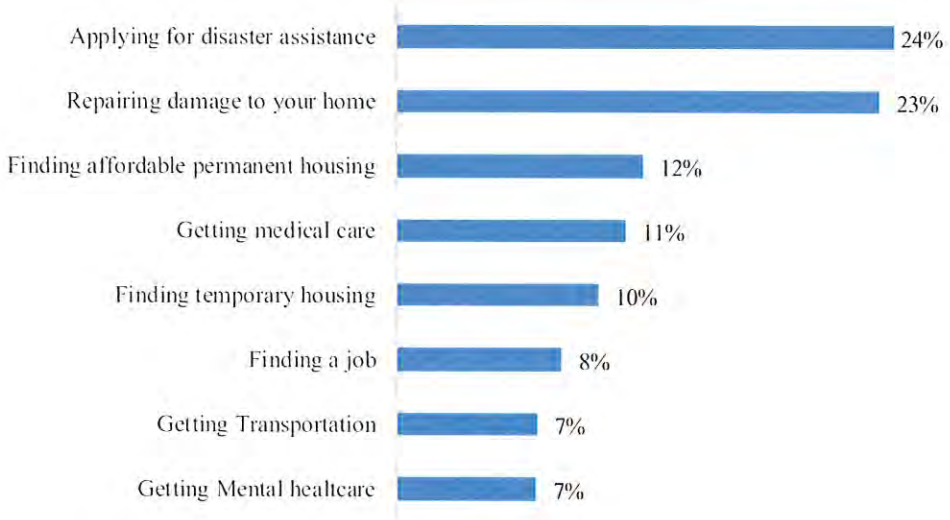

Figure 8: Areas where more help is needed by the respondent in order to recover from Hurricane Harvey

However, in examining the data by groups of counties, the answers differ to some extent. For all groups except for Harris County, the top three areas where further assistance is needed include applying for disaster assistance, repairing home damage and finding affordable permanent housing. For Harris County, receiving medical care was among the top three areas of need.

In recognizing factors affecting community resilience, lower-income populations experience significant challenges during the recovery process. In analyzing challenges identified during the stakeholder interviews, individuals expressed concern for how difficult the recovery process is for lower-income families. Concern extends to displaced residents who experience strain as a result of housing shortages and difficulties in finding affordable permanent housing after the storm. The literature reflects challenges experienced in Wharton, as researchers indicated affordable housing is generally in short supply (Tran, 2013).

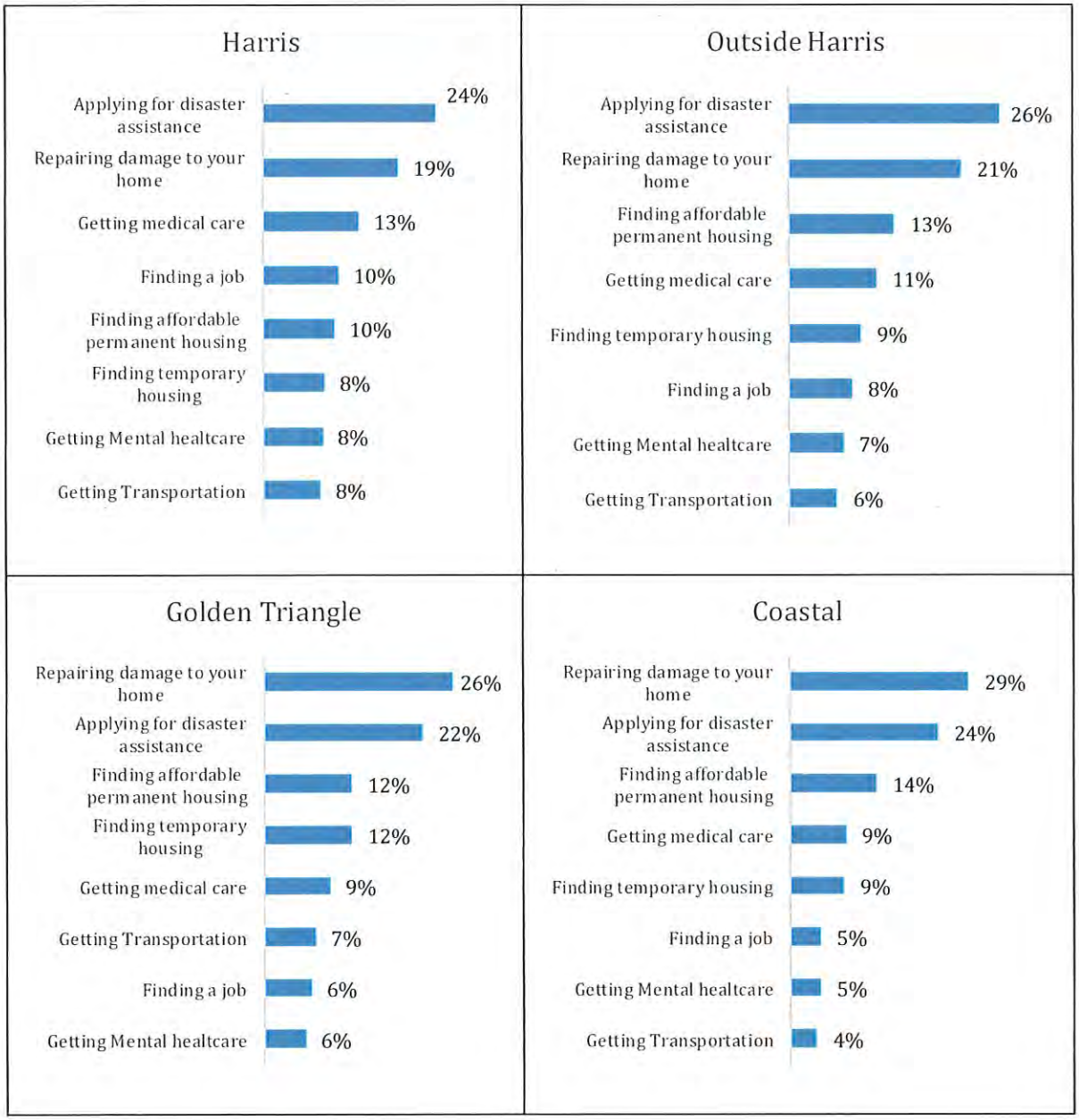

Figure 9: Areas where more help is needed by the respondent to recover from Hurricane Harvey

Considering findings that indicate citizens unanimously consider resources should be focused on reconstruction efforts, it is important to determine which specific areas of assistance citizens believe resources should be allocated. These results were similarly reflected in the stakeholder interviews, which will be further discussed in the next section. Stakeholders reported affected homeowners experienced difficulties in acquiring disaster assistance and housing. In addition, residents were confronted with challenges in trying to navigate the disaster assistance process. As a result, some applications for assistance were denied based on the absence of specific details or unmet requirements residents did not know were necessary or had at the time of application.

The data also reflects research findings within the literature regarding social vulnerabilities affecting a community. Researchers identify low-income populations as having fewer overall resources to effectively recover following a natural disaster and the extent of damage experienced in these communities is typically greater than those with more resources (Masozera et al., 2006; Zhang & Peacock, 2009). In addition, low-income individuals experience difficulties in finding temporary or permanent housing within their local areas. The following question addresses perceptions regarding the allocation of resources:

Thinking about the rebuilding and recovery efforts in your area, if more resources are necessary please tell in which areas more resources should be allocated.

Overall, respondents think more efforts were needed for getting financial help to people who need it, rebuilding destroyed homes, and providing access to affordable permanent and temporary housing, in that order of priority.

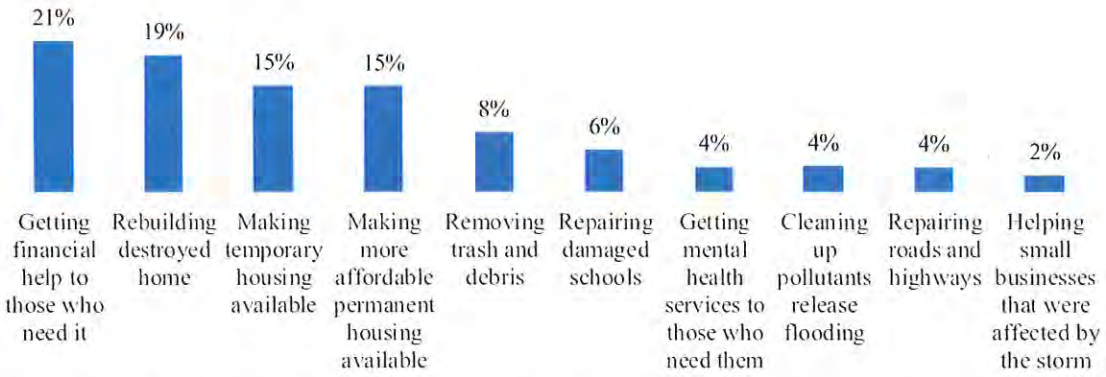

Figure 10: Ranking of areas where more resources are needed for the rebuilding efforts to recover from Hurricane Harvey

The same tendency was found when analyzing the data by groups of counties, except for the Coastal area which believes more resources are needed for making more affordable permanent housing available.

Table 4: Ranking of areas where more resources are needed for the rebuilding efforts to recover from Hurricane Harvey by county

	Harris	Outside Harris	Golden Triangle	Coastal	All Counties
Getting financial help to those who need it	22%	25%	20%	15%	21%
Rebuilding destroyed homes	20%	16%	22%	17%	19%
Making temporary housing available	14%	16%	15%	16%	15%
Making more affordable permanent housing available	13%	14%	16%	18%	15%
Removing trash and debris	8%	10%	8%	9%	8%
Repairing damaged schools	6%	6%	4%	7%	6%
Getting mental health services to those who need them	5%	3%	2%	2%	4%
Cleaning up pollutants release flooding	4%	3%	2%	5%	4%
Repairing roads and highways	4%	3%	3%	5%	4%
Helping small businesses that were affected by the storm	2%	2%	4%	2%	2%

The role of decision-makers across levels of government is key to provide adequate recovery operations and complete mitigation efforts to increase community resilience. The efforts made by different government actors should not be isolated and instead should be congruent to ensure effective response and recovery. The importance of involvement across levels of government is discussed in the stakeholder interviews, as individuals emphasized the value of effective communication and coordination. In this context it is necessary to consider questions to understand how people perceive the actions completed by different levels of government in responding to a natural disaster:

How would you rate the job these institutions are doing in responding to Hurricane Harvey?

The data collected finds that the majority of respondents from all counties believe all levels of government are doing a good job of responding to Hurricane Harvey. Nevertheless, it appears respondents agree a better job could be done by the President and US Congress. Additionally, citizens from all the counties surveyed agree that from all levels of government, local officials in

their respective communities have done the best job in terms of providing emergency response and recovery efforts.

Table 5: The level of satisfaction with the job done as a response to the hurricane by institution and group of counties

	Excellent	Very good	Good	Fair	Poor
US Congress					
Harris	8%	11%	31%	31%	18%
Outside Harris	6%	12%	31%	27%	24%
Golden Triangle	8%	7%	26%	28%	31%
Coastal	9%	11%	30%	27%	22%
Texas State Officials					
Harris	17%	20%	37%	18%	8%
Outside Harris	20%	25%	31%	17%	7%
Golden Triangle	17%	19%	29%	22%	13%
Coastal	19%	20%	37%	18%	6%
Government officials in your county					
Harris	18%	21%	36%	17%	7%
Outside Harris	16%	23%	35%	18%	8%
Golden Triangle	16%	18%	29%	22%	15%
Coastal	18%	22%	32%	20%	8%
Local officials in your city or town					
Harris	24%	21%	33%	16%	6%
Outside Harris	21%	24%	29%	17%	8%
Golden Triangle	21%	21%	25%	17%	16%
Coastal	22%	19%	33%	19%	8%
President Trump					
Harris	12%	9%	18%	22%	39%
Outside Harris	19%	15%	24%	12%	31%
Golden Triangle	18%	12%	23%	21%	27%
Coastal	19%	12%	20%	17%	33%

The KKF survey information is consistent with our literature review findings in terms of vulnerability, short-term and long-term recovery actions, and identification of where more resources and assistance are needed to ensure improved recovery and preparedness outcomes. The following section from the Texas A&M University data examines resident perceptions in terms of policy issues which need to be addressed and actions that could be implemented to help manage the effects of Hurricane Harvey. Further information on community perceptions in terms of factors which contributed to flooding, areas where the government needs to invest during the disaster

recovery period, and which level of government bears the greater responsibility to address the effects of natural disasters is available in Appendix B.

Texas A&M Hurricane Harvey Survey

The survey conducted by Texas A&M University in February 2018, complements the information obtained by the Kaiser Family Foundation survey in terms of citizen perceptions and ideas for actions needed to mitigate the effects of natural disasters. The survey had a total of 198 responses from the Houston area and provides valuable information which reflects the views of the majority of areas affected by Hurricane Harvey.

5. Citizens' Participation and Feedback for Policy-Makers

As previously mentioned, one of the primary obstacles communities experience, when a natural disaster occurs, is the lack of community input gathered during mitigation and recovery planning. Citizen participation and involvement across the community is essential for a successful planning process, not only in terms of committing resources to mitigation efforts but also committing financial resources to address needed expenditures (Brody, Godschalk, & Burby, 2003). Furthermore, as discussed on page 22, community involvement in the planning and recovery process can increase the rate at which families and homes are able to recover (Sadri et al., 2016). To address the role of community input in mitigation and prevention planning, the following questions were examined:

Have you participated in any community forums or planning discussions to address flooding in your neighborhood and/or community?

In terms of citizen engagement in the planning process, from the people interviewed, only 11 percent of respondents participated in planning discussions. This represents a significant challenge for both the community and local officials in working to bring as many members of the community together to participate in productive planning discussions and mitigation activities.

Figure 11: Percentage of people who participated in planning discussions

As shown in Figure 11, the majority of respondents are not participating in planning discussions. From the local government's perspective this could potentially lead to drawbacks in terms of understanding the community needs and expectations. Whereas, from the community's perspective, this could lead to a decrease in the understanding of the agency's responsibilities and capacity during the recovery process. Overall this could result in uninformed decision-making that may not consider residents' perspectives.

To address challenges concerning public participation in the planning process, institutional recognition represents the importance of different levels of government working to understand what they seek to obtain from public participation, identifying the internal capacity necessary to increase public participation, and recognizing the extent to which institutions can commit to citizen participation. Additionally, future studies should address if citizens are aware of planning efforts, processes, or the plans themselves.

While recovery from hurricane Harvey goes on, there is also the need to address future flood risks through improving or widening the bayous or installing new drainage systems. To what extent do you support or oppose attending these types of long-term needs while the recovery process from hurricane Harvey is still going on?

Approximately 80 percent of respondents support actions such as improving or widening the bayous or installing new drainage systems in order to address future flood risks. While constructing more and larger storm drains can work to improve mitigation outcomes and increase community resilience, these improvements are not always favored by local residents due to high associated costs and overall disruption to everyday life.

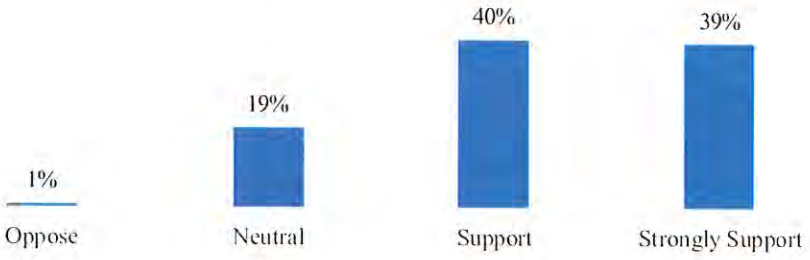

Figure 12: Percentages of respondents by level of support to improving or widening the bayous or installing new drainage systems

Some policy actions could be taken to reduce the dangers of fnture flooding in the Houston area. From the following list of possible policy actions, how much would you oppose or support each of the options?

In terms of policy actions to mitigate or reduce potential risks of future flooding, respondents believe actions should be mainly focused on improving stormwater systems, limiting new development in flood-prone areas, building additional reservoirs and retention ponds, and protecting wetlands and open spaces. It is also important to acknowledge that minimizing additional developments are among the policy actions most citizens oppose.

Table 6: Percentages of respondents according to support level of the following policy actions

	Strongly Oppose (0)	1	2	3	4	Strongly Support (5)	Don't Know
Limit new development in flood prone areas	7%	1%	2%	12%	15%	56%	6%
Elevate the buildings	6%	5%	7%	27%	16%	32%	7%
Strengthen infrastructure design standards	1%	1%	2%	20%	22%	47%	6%
Establish and implement flood hazard reduction programs	3%	1%	5%	16%	23%	38%	12%
Minimize additional development	10%	4%	15%	24%	11%	30%	6%
Build additional protective dams	2%	2%	4%	20%	25%	43%	3%
Build additional protective levees or embankments	1%	2%	4%	17%	24%	45%	6%
Build more reservoirs and retention ponds	2%	2%	2%	13%	23%	52%	3%
Protect wetlands and open spaces	1%	2%	5%	20%	15%	50%	6%
Improve storm water systems	0%	1%	0%	10%	27%	58%	2%
Temporarily prohibit development in the period immediately after a disaster event	7%	3%	6%	26%	13%	37%	7%
Charge impact fees for development in the flood prone areas	13%	5%	10%	16%	14%	29%	11%

Main Findings

Hurricane Harvey created severe damage in the State of Texas, exposing not only the importance of having plans in place when facing an emergency but also taking adequate and timely actions to build community resilience. Overall, from the information gathered by the Kaiser Family Foundation and Texas A&M University, we were able to identify that approximately 50 percent of respondents experienced damage at some level because of the Hurricane. Of these respondents, 70 percent experienced a loss of income predominantly due to job loss and cuts in regular hours at work. Such findings present evidence on the importance of ensuring businesses are able to return back to normal as soon as possible, as these areas of employment represent a source of income for residents. Furthermore, the data indicates one of the most impacted areas after Hurricane Harvey is housing. Approximately 50 percent of respondents declared experiencing major damage or complete destruction of their homes. However, out of those people, only half evacuated in response to the emergency. In this context, respondents believe extra help is needed for applying for disaster assistance, repairing home damage, and finding affordable permanent housing.

Considering citizen perceptions in terms of current government actions and assistance throughout the recovery period, it is important to recognize respondents overall are more satisfied with the performance of local officials rather than any other level of government. Moreover, citizens believe everybody should share responsibility for the prevention of long-term flooding risks. Across the 24 counties that participated in the survey, citizens indicated that during the recovery period the government needs to invest more in the provision of basic services, medical resources, and security functions. The data also finds citizens believe policy actions should include improvements of storm water systems, limiting new developments in flood-prone areas, construction of additional reservoirs and retention ponds, and protection of wetlands, among others. According to citizen perceptions, building in inappropriate areas, extensive land covered with concrete or solid materials impeding water from flowing, and ineffective intergovernmental collaboration are among the greatest factors that contribute to flooding.

Finally, it is necessary to recognize although this information does not cover the entire State of Texas and counties experienced the impacts of Hurricane Harvey at different levels, this analysis still provides relevant information to support the value of emergency planning and community engagement in the planning process.

Stakeholder Analysis

1. Purpose of Conducting Stakeholder Interviews

In order to understand locally-specific problems, efforts, and perceptions of individuals who experienced the effects of Hurricane Harvey, information was gathered from 32 stakeholder interviews sampled from leaders and organizations in and around the Wharton community. The interviews were conducted during March of 2019 and served to provide insight on local experiences during the response and recovery process, actions taken by community leaders, and opportunities moving forward for the community. Interviews work to reinforce key themes identified in the literature review, secondary data analysis, and provide a context for summary recommendations presented for consideration to the City of Wharton. Further information about the stakeholder discussion guide is available in Appendix A.

2. Planning

In a community prone to experiencing flooding such as Wharton, planning for natural disasters is an important step in ensuring the community can withstand future events. In the discussions with stakeholders throughout the community, planning was a major theme that was identified and discussed. Variance in responses examined helps to provide a complete picture of the current situation Wharton is facing in regard to planning for future events.

During Hurricane Harvey, the major issue that was identified by stakeholders was that the north side of Wharton flooded for the first time in recent memory of citizens who have lived in the city their entire lives. Although the north side had not flooded in recent history, there were plans in place that presented this area could potentially flood. One point conveyed was that although existing plans were in place, nothing has been done yet to mitigate these risks or increase resilience in the north side.

For many residents of the Wharton area, the west side of town is expected to flood no matter how little rain falls; therefore, the community and the city are ready to experience this flooding. Flood plans for this area of town are geared towards response and recovery, not mitigation and prevention. It appeared to be generally accepted by stakeholders that flooding on the west side and recovery from it was "down to a science." Throughout the interviews, the point was made that the city has experienced repeated flooding events, making it difficult to get ahead

of the recovery process as the focus has been primarily on getting residents back into their houses as quickly as possible. As a result of experiencing repeated flooding, officials are left fighting an uphill battle with less time and resources left to allocate towards needed future planning.

As the city is today, if another 'Harvey' hit, one stakeholder affirmed "the exact same thing would happen." This point reinforces the importance of stakeholders' emphasis for planning across jurisdictions, agencies, and levels of government that would include updated flood maps, completion of the levee that is being constructed, as well as the experience that was gained by going through a flooding event like Harvey. Despite the construction of the levee taking place, it is important for the city to continuously improve hazard mitigation planning, especially for vulnerable populations.

Planning across levels of government is an important part of the overall planning process. As stakeholders identified, this would allow the early response and activation of resources from all levels of government. This type of planning would also assure that no organization is relying only on memory, but uses detailed and updated written plans to reference as a resource for response and recovery. The importance of written plans was emphasized by stakeholders repeatedly. Overall, respondents seemed to agree that Hurricane Harvey exposed areas of need in prior planning at the intergovernmental level, and lessons learned have given the community, officials, and organizations guidance on important improvements that could be made in the future.

3. Budgeting

One of the most difficult parts of recovery is identifying and managing the budget to cover expenses while applying for and waiting for reimbursements from outside organizations and government entities. Immediately following Hurricane Harvey, the community had to begin recovery efforts. These efforts created expenditures that had to come out of reserves the city had on hand. With prior preparation, and existence of these funds, Wharton was able to begin recovery efforts by using these reserves to fund efforts such as debris removal. Debris removal is an example of a service that could not wait until funding was issued from other government entities. In order for citizens to move forward and begin to recover, they had to remove destroyed portions of their homes, furniture, and debris left by the flood. The majority of this debris was left along the streets and the city was then responsible for its removal. Reimbursements for some of these costs from other levels of government did not come through until over a year later.

The City of Wharton did an excellent job of covering the immediate costs of recovery while applying for reimbursement opportunities and grants that would cover the costs the city allocated during initial recovery operations. Along with the city being responsible for funding many recovery efforts, the city was dealing with local revenues being reduced following the flooding. For example, many people were displaced from their homes, therefore they were not using any utilities and the city was affected from this loss in revenue. According to the interviews conducted, the city should be commended on their budgeting practices and capabilities that allowed them to meet emergency requirements until outside funding could be allocated to the city.

4. Unity within the Wharton Community

Stakeholder interviews indicate that most community stakeholders have lived in the Wharton area for the majority of their lives. This is an important element to consider when examining all stages of the disaster cycle. Because of stakeholders' experience within the community, these individuals are likely to have a higher level of connections and are more likely to have shared experiences with other individuals in the community. However, some stakeholder interviews uncover a hesitancy to accept innovations due to longstanding customs and norms within the community. Moving forward, it may be necessary that the hesitancy to accept such innovations is recognized and overcome to be creative and ultimately better serve constituents.

Throughout the stakeholder interviews, the unity of the community during and immediately following Hurricane Harvey was a consistent theme. The community came together well during and in the wake of the storm. Personal sacrifices made on behalf of city staff and residents were noted repeatedly throughout the stakeholder interviews. Unity and sacrifice by local government agencies were discussed repeatedly in the interviews.

However, based on the interviews, continuing this sense of community following a natural disaster is essential as recovery can take many years, not just a few weeks. This theme of a short-lived response is also prevalent in the literature review findings. As discussed on page 20 of the literature review, research finds the response process following a natural disaster is typically quick, but short-lived. Such findings present important challenges for local communities in continuing unity into long term recovery.

5. Personnel & Training

One common theme identified during the stakeholder interviews is the lack of local expertise on behalf of FEMA representatives. For example, many interviewees report retirees and individuals with no prior emergency response experience being dispatched to the Wharton area following Hurricane Harvey. Emergency "substitutes" were pulled in from FEMA in the wake of the storm. These individuals were untrained and unfamiliar with the aid processes, according to interviewees. Furthermore, one issue discovered is the lack of consistency within the representatives sent to the area. In explanation, one FEMA representative would be in Wharton on a particular day only to be replaced by someone else entirely only a few days later.

Interviewees also stressed the importance of additional training not only for officials at the federal level, but also local officials and nonprofit actors. An increase in training and education will help in future disaster response and recovery, according to the stakeholders interviewed. A need for a volunteer coordinator was also discussed in multiple interviews, as many stakeholders noted there was not one single designated volunteer coordinator.

6. Stakeholder Perceptions of Damage/Response – A Look Toward the Future

Perceptions of the response and recovery of Hurricane Harvey in the Wharton area display both best practices as well as areas for improvement. A common theme during the stakeholder interviews is that the community as a whole will never completely recover and the damage to social structures is too substantial to ever completely repair. Feelings of abandonment on behalf of some stakeholders regarding actions or non-actions by officials of both the State of Texas and federal government are prevalent among stakeholders as well. Many respondents felt the damage experienced in the Wharton area was equal to that of Harris County, yet media attention and federal and state aid were focused primarily on Harris County.

7. Local Vulnerability

There was a general consensus among stakeholders that the West End of the town is the most vulnerable both because of its location and low socioeconomic status. Numerous actions have been taken to address the physical aspects of this vulnerability. However, a few responses mentioned that little has been done to address the social and emotional vulnerabilities of the community populations of both the North and West ends of town.

Regarding community vulnerability, the responses pointed towards frustration with federal and state agencies who did not understand locally-specific needs. The common theme with FEMA was that there was a disconnect between their knowledge of national policies and what would be useful for city recovery in this specific instance. Many expressed frustrations with FEMA's response teams due to the practice of acting without understanding the Wharton area at all. In terms of state and regional agencies, stakeholders had varying opinions on these institutions. The Texas General Land office was described as both a great and frustrating agency, depending on the interviewee. Stakeholders acknowledge the intentions of GLO in coming to provide assistance; however, the GLO was not always able to help in the recovery process because of a lack of understanding local community needs. For example, many stakeholders felt they spent more time educating government officials than was spent on recovery efforts. Many expressed frustrations in being delayed by officials who did not understand the needs of Wharton, and tried to impose unreasonable time limits on the recovery process.

8. Nonprofit Response

The nonprofit response to Hurricane Harvey received large amounts of positive praise from the stakeholders of Wharton, Texas. Team Rubicon and the Mennonite Disaster Relief Service received excellent praise for the immensity and scale of their responses. Both organizations played a large part in the cleaning and rebuilding of homes according to stakeholders. One stakeholder responded that the best nonprofit response came from those who asked, "what do you need?" and did not act on their own. Nonprofits served to bridge the gap for Wharton's needs when government agencies could not provide assistance yet.

In regard to coordinating response and recovery efforts with federal and state agencies, stakeholder expressed a desire for consistency. FEMA's coordination was described as confusing and complex and for some stakeholders, as there was not a consistent person to talk to as FEMA representatives constantly came in and left. Due to the confusing nature of policies and a lack of federal coordination, local stakeholders felt as if they had received less help than they really needed.

9. Collaboration and Communication

Overall communications during Hurricane Harvey received mixed grades from the stakeholders of Wharton. There were many positive reviews of communication with state

emergency response officials and the use of social media to communicate with the local residents. From the stakeholders interviewed, several areas of improvement have been identified.

Something that became apparent during the stakeholder interviews was the reliance on cell phone coverage for the city to communicate. During the storm, a cell phone tower failed during the day, resulting in numerous stakeholders and citizens losing service during this critical time. This reliance proved to be problematic for responders and city officials by interrupting communications and response efforts for that day. Some stakeholders believed the city should look into other methods of communication that do not rely entirely on cell phone coverage. Without coverage, internal city communications and communications with the public is at risk when cell service is lost.

While social media served as an important medium for city officials and nonprofit organizations, it also became a source of confusing information and misinformation. Some stakeholders reported a lack of coordination between the city and county Facebook pages, which led to misinformation being spread by residents or intentionally by individuals working to cause trouble.

Finally, several stakeholders noted that Wharton should reach out to similar or neighboring communities to determine what solutions work best in times when communications can be difficult for cities of Wharton's size. Through these collaborations, it was thought, Wharton can discover different methods that could improve communications during disaster response. These methods and techniques will be further examined in the recommendations section of this report.

Recommendations

Based on the literature review, case studies, secondary analysis of public opinion surveys, and stakeholder interviews produced through this project, the following are the recommendations the team presents for consideration to the City of Wharton.

Actions for Recovery

Our research findings indicate that while immediate response after a natural disaster is often short-lived, this phase is often characterized by unity of officials and community members coming together to address immediate dangers. The team has identified actions the City of Wharton can implement to improve the recovery process which includes addressing the needs of vulnerable populations, helping citizens apply for assistance, and diversifying funding sources.

Addressing the Needs of Vulnerable Populations

While the recovery process is a difficult path for all to go down, there is a section of the population which is more vulnerable during disasters and who experience increased negative effects and challenges during recovery. As discussed in the literature review, vulnerability is not limited to socio-economic status, but can also be exacerbated by physical or mental disability, geographic location, or linguistic barriers. In providing assistance to vulnerable populations, factors extend beyond monetary resources and should also include areas such as mental health, child care, and housing assistance. Because not every citizen will have the same recovery experience, it is important for the City of Wharton to acknowledge and assist those who experience the most vulnerability in their recovery process. Improving recovery outcomes within vulnerable populations can work to build resilience for future disasters and represents a substantial challenge for Wharton, and other vulnerable cities, to consider moving forward after a disaster event.

Other considerations for addressing the needs of vulnerable community members include ensuring funding is administered to those who need it. Most federal programs are designed to assist homeowners and those who can afford to set aside personal savings for themselves are advantaged. One investigation conducted by NPR discovered that, out of 40,000 home buyouts, white communities received a disproportionate amount of funding for buyout programs compared to communities of higher ethnic diversity (Hersher & Benincasa, 2019; Benincasa, 2019). Investigators believed the inequity may be related to the cost-benefit analysis used by FEMA

which incorporates taxpayer risk into the analysis. The inclusion of risk results in outcomes where properties that are higher in value are approved rather than those that are perceived as incurring higher risk. Implications of such findings for communities like Wharton includes working to make sure alternative sources of funding and assistance are available to such vulnerable populations. Additional resources include additional assistance in applying for funding to increase the likelihood of vulnerable populations completing applications successfully and attracting diverse funding options for recovery to those who may not qualify for significant federal aid.

Community-Based Recovery Centers

As examined in the Rhode Island case study of the March 2010 floods, aid can be given to citizens in a centralized approach through the creation of resource centers. The centers had representation from agencies directly involved with recovery funding, such as FEMA and the Small Business Bureau. Additionally, the centers included staff to provide resources for addressing social challenges associated with disaster recovery such as mental health. These centers could play a role in increasing transparency for citizens in the application process, which is often an area of frustration. Additionally, having face to face time with representatives from the agencies residents are applying to for assistance helps ensure citizens are filling out paperwork accurately, including necessary documents, and providing required information, which were identified as areas of concern from our stakeholder interviews and secondary analysis. Further, having help in applying for disaster assistance was the number one issue identified by respondents in the Kaiser Family Foundation survey. Community-based centers present an opportunity to improve recovery outcomes for citizens by creating opportunities for help in applying for assistance and providing a place to seek help with disaster-related concerns.

Diversifying Funding Opportunities

The largest amount of funding available for recovery assistance will be allocated from the federal government following a natural disaster through agencies including FEMA and HUD. While these sources have the largest dollar impact for recovery, the application process is often complicated and wait times can be long for both local governments and citizens. In recognizing such challenges, there is a large network of disaster assistance trusts, foundations, and non-profit organizations which can provide assistance following a disaster. These funding sources can often be deployed faster than federal dollars, which is important given the need for communities to return

back to functioning as soon as possible. Further, funding sources outside government are often more flexible in the areas they can be applied and could help Wharton address long-term challenges such as affordable housing, healthcare, and various systemic issues present in the community. Because of these factors, we recommend the City of Wharton consider creating a full or part-time "External Funding Facilitator" position to help arrange for and coordinate diverse recovery funding sources both within and beyond governments in order to effectively implement resilience and mitigation projects and increase overall preparedness. Given this, it is vital for the community and government to work towards strengthening long-term relationships with these organizations, so that in the face of disaster, those connections can be leveraged for diverse funding opportunities.

As the State has a rainy-day savings fund, local communities may also think about supporting actions to create their own such fund to fund emergency projects in the event of another natural disaster. While it may be challenging to set aside amounts from the operating budget, these types of funding sources work to ensure local governments can cover immediate costs until agencies or the state can provide reimbursements. Not only is it important for local governments to preserve financial resources in the event of an emergency, state governments can also provide assistance in this capacity. The State of Texas rainy day fund is a potential source to allocate bridge funding following a natural disaster. If cities experience having to pay for emergency expenses out of pocket and it takes a long time for reimbursements to be distributed, this loss of operating money reinforces the potential use of bridge funding as a policy option both local and state governments can use to issue local reimbursements from the state while local governments dedicate emergency funding to internal savings accounts. By allocating from the state rainy day fund, local governments can ensure emergency services and projects are funded from internal sources while the state government can increase the speed at which reimbursements are distributed. We, therefore, urge the city to work with their State Senators and Representatives to modify state rainy day fund policies to be more readily available and usable to local governments in the event of an emergency.

Comprehensive Planning

Although natural disasters cannot completely be anticipated or prevented, communities can work to reduce the severity of the effects of such events by creating and improving existing preparedness plans in the event of a disaster.

Scientific Planning

To increase the effectiveness of local government planning, we recommend the City of Wharton not only include all key actors in planning discussions but also consider scientific criteria and lessons learned from previous emergencies as critical inputs for designing and implementing evidence-based and flexible proposals to adapt to different emergency circumstances. As a result, increased communication and coordination between researchers, emergency planners, and local responders could lead to a balanced and complete application of resources to improve current disaster preparedness.

Engaging the Community

A complete preparedness plan requires an understanding of citizen risk perceptions and behavior, particularly in emergency situations. Therefore, citizen engagement serves as an imperative tool for local government preparedness planning. Critical actions for planning include making the community feel heard and taking ideas and feedback into account throughout the decision-making process. As a result, public participation could be enhanced through actions such as awareness and educational programs concerning emergency management among schools, business organizations, and church groups. Training sessions, flyers, radio commercials, and posters are some of the tools local city officials can use to educate the community on what to do during and after experiencing a natural disaster.

Educational programs should also consider and plan for the possibility of experiencing personnel shortages to address immediate recovery needs and engage in emergency operations during a natural disaster. To address a potential shortage of external volunteers, citizens could potentially step in as home volunteers, similar to Volunteer Fire Departments, to facilitate help if properly trained. In considering the potential for identifying "bridge personnel" to act as volunteers in the event of a such a shortage, it is important for the City of Wharton to provide appropriate training and knowledge for volunteers to have the tools to be successful and effectively help the community during an emergency. Furthermore, we recommend the City of Wharton consider a

cross-training program for existing personnel. This strategy would increase operational readiness for current employees and help to address potential volunteer shortages.

Finally, training exercises are a necessary component of comprehensive preparedness planning and act as a tool to test and validate strategies. Conducting exercise evaluations could identify gaps in planning while recognizing actions that worked well in responding to an event. Discussion-based exercises are commonly employed to familiarize the community with current plans and emergency procedures. Seminars, workshops, tabletop exercises, and games represent possible discussion-based exercises the City of Wharton could engage in to increase preparedness and local readiness. Training activities and exercises can be developed to maximize benefits throughout a community by including governmental, non-governmental, volunteer and faith-based organizations to participate and learn from different scenarios and risk-based situations.

Improving Planning Interactions Across Institutions

Effective planning requires entities from all levels of government to provide input, knowledge, and experience into comprehensive preparedness policies and procedures. Effective coordination can be achieved through communication across institutions to understand roles and responsibilities, reduce risk affecting community resilience, and minimize the possibility of overlapping actions and efforts. In recognizing the importance of effective communication, we recommend the City of Wharton consider building on existing policies to increase local communication efforts throughout each stage of the planning process. For example, creating a means whereby different agencies and stakeholders can be involved in the planning process. This may come about through city meetings, forums, technological, or individual points of contact.

Written Plans

By making existing plans available to appropriate stakeholders and the public, written plans work to increase transparency and provide an opportunity for review, introspection, and actions necessary to ensure successful response and recovery. Having a process for updating written plans can increase preparedness and provides an element for monitoring actions and determining responsibility. In addition, official written plans serve as a tool for decision-makers in learning and sharing information on a wider platform to create networks of collective action, accepted standards, and consistent guidelines across stakeholders. Ensuring local departments and agencies create and update existing written emergency response and preparedness plans can serve as a

valuable readiness strategy and is something the City of Wharton should continue to do in working to improve recovery outcomes and increase response capacity.

Communication and Collaboration

Communication during and in the immediate aftermath of a natural disaster represents a significant responsibility for government officials and emergency personnel in working to ensure residents are informed and receive updates of issues affecting daily operations and intensity of dangerous situations. Consistent with communication efforts, collaborating with neighboring jurisdictions to identify best-practices and challenges affecting successful response and recovery can be an effective strategy local government can use to increase resilience and identify areas of improvement.

Consolidating Social Media Outlets

Across stakeholders interviewed, perceptions regarding the success of communications were mixed, as some believed such efforts were successful while others believed efforts could be improved. Specific challenges affecting communication for Wharton include an observation that a lack of centralized communication created challenges for navigating social media sites and online information. Difficulties affecting communication can affect overall risk awareness and prevent successful coordination between officials and the public in delivering close to real-time information and responding to updates in an effective and time sensitive manner. In working to ensure residents have a consistent source for receiving information, consolidating social media sites such as Facebook and other informational web pages to one "City of Wharton" outlet to provide official government information and re-post important notifications can be a useful communication strategy and is something city officials might consider as a potential tool for future emergency notification efforts and normal day-to-day updates. In recognizing community vulnerability, the City of Wharton will need to determine if communications through tools such as social media sites are an effective strategy for providing information, as not everyone in a community will have access to the internet and online resources.

Collaboration with Affected Communities

Based on interviews with stakeholders, participants recognized the importance of taking action within their organizations to increase preparedness and overall resilience. Actions include reaching out to other departments and agencies in neighboring cities to gather information on what

worked and collaborate on how to improve future practices and emergency response actions. In working to determine best-practices and identify new strategies for improving response and recovery performance, the City of Wharton should continue and further consider expanding its collaborative efforts by creating official meeting opportunities with similar agencies and departments in affected cities and counties to provide suggestions and gather recommendations for addressing challenges and identifying successful practices. Through institutionalizing these collaborations and neighboring community engagement opportunities, both Wharton and similar cities affected by natural disasters can learn from the experiences and actions of other areas and determine if successful practices can be applied to local agencies and departments.

Conclusion

The frequency of natural disasters is on the rise world-wide, as settlement patterns and population growth have led to greater vulnerability to devastating events. This report has served to examine the effects of natural disasters on both the physical landscape and human community of Wharton. The City of Wharton has experienced many flooding events throughout its history. Repeated flooding has affected businesses, homeowners, and agriculture. As a result of the unprecedented flooding event associated with Hurricane Harvey, the City of Wharton has taken action to implement new communication methods and home buyout programs to support long-term recovery objectives.

This report serves as a tool the City of Wharton and other communities can use to increase the effectiveness of response and recovery and improve planning and preparedness. First, a detailed literature review examines issues concerning vulnerability, problems encountered by local communities, recovery following natural disasters, assistance programs, community engagement, infrastructure and housing, best practices and challenges, and lessons learned. Second, two case study analyses from the Midwest and Rhode Island floods provide examples of communities that have experienced similar flooding situations like Wharton during and after Hurricane Harvey. In addition, 32 stakeholder interviews were conducted for the team to gain a better understanding of locally-specific problems, perceptions, and effects Hurricane Harvey had on the Wharton community. A summary of key findings identified in the stakeholder interviews is included to help the City of Wharton better understand community perceptions concerning observations, needs, and suggestions moving forward in the aftermath of Hurricane Harvey. Finally, secondary analysis was conducted using data from the Kaiser Family Foundation Post-Harvey Survey and the Texas A&M Hurricane Harvey Household Survey. This broad survey of Texans affected by Harvey provides a useful representation of individual experiences in the aftermath of a natural disaster and works to identify key needs and problems from other, fellow citizens. This report concludes with team recommendations for consideration by officials regarding actions for recovery, comprehensive planning, and communication and collaboration.

The City of Wharton has done an excellent job in working to recover from Hurricane Harvey and in efforts to mitigate the effects of future storms. They may still face future weather-related events. We hope this report will help them in the planning and policy process they will use to be ready for future events.

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Appendix A

Stakeholder Discussion Guide

1. **General Information**
    a. What is your current position within the organization? How long have you been in the position?
    b. How long have you been living in the Wharton area?
    c. Did you or your organization have a role during the storm? Were you or your organization involved in some recovery efforts?
2. **Operation of Your Organization**
    a. Did your organization have any preparedness plans in place before Harvey made landfall? Recovery plans?
    b. What did your organization do well during Harvey?
    c. What major problems were encountered during the emergency and recovery process?
3. **Coordination**
    a. How were communications before, during, and after Harvey? With state and federal government agencies? With the public?
4. **Impacts of Harvey**
    a. How much damage did the City of Wharton experience as a result of Hurricane Harvey?
    b. Do you think Wharton had more or less damage than other communities?
    c. What was the physical impact of Harvey on your organization? How did the storm affect daily operations?
    d. Which communities were more affected than others? In your opinion, are there communities that are still susceptible to flooding in the future?
5. **Recovery**
    a. What is your organization's role in the recovery (rebuilding, cleanup, etc.) process? Is your work continuing as a response to Harvey?

    b. Did your organization have adequate financial resources to respond to Harvey? Were the funds you had acquired internally or from outside sources?

6. **Lessons Learned**
    a. What actions has your organization taken to increase preparedness and resilience?
    b. What actions need to be taken to increase the resilience of the community to withstand future disasters?
    c. Overall, considering what other organizations and agencies did, what you think really worked well? What didn't work well?
7. **Evaluation**
    a. Did your organization apply for recovery assistance from government agencies at the state and/or federal level? What aid did your organization receive? Were any applications rejected, if so why?
    b. Did your organization receive recovery assistance from any non-profit organizations?
    c. What is your evaluation of government agencies and nonprofits' response to Harvey?
    d. Did your interaction with government agencies help you in the recovery process (funds, directions, other examples of assistance)? Do you believe your organization was supported in the recovery process?
    e. Which level of government do you believe was most helpful, why? Which level of government do you believe was least helpful, why?
    f. Which levels of government do you believe should be responsible for various recovery actions?
    g. What policy changes do you recommend for resilience?
8. **Personal Experiences**
    a. How were you personally affected as a result of Harvey?
9. **Concluding Questions**
    a. Is there anything else I should have asked you?
    b. Is there anyone else I should talk to?
    c. Are there any written materials or reports you could give me that could support our research

Appendix B

Kaiser Family Foundation and Texas A&M Survey Questions

How strongly do you agree that each of the following factors contributed to flooding?

According to citizens that participated in the survey, the main factors which contributed to flooding include building in flood-prone areas, having too much land covered in concrete impeding the flow of water, ineffective intergovernmental collaboration in flood planning, insufficient capacity of stormwater systems, and insufficient capacity of levees or embankments. Such perceptions reflect resident knowledge in understanding factors that can potentially increase risk and vulnerability affecting the community in the event of a natural disaster.

Table 7: Percentage of respondents that agree these factors contributed to flooding

	Strongly Disagree (0)	1	2	3	4	Strongly Agree (5)	Don't Know
Building in areas prone to flooding	6%	2%	3%	15%	14%	50%	9%
Insufficient protection of wetlands and open space	4%	2%	8%	15%	20%	33%	17%
Too much land covered in concrete or solid materials through which water cannot flow	4%	1%	6%	15%	17%	49%	7%
Ill-designed dams	9%	4%	7%	18%	12%	29%	21%
Inability of dams to hold back water	8%	6%	9%	14%	16%	31%	15%
Dam located in wrong areas	13%	9%	7%	16%	10%	20%	24%
Inadequate levee or embankment designs	5%	4%	7%	19%	17%	26%	20%
Insufficient capacity of levees or embankments	5%	4%	7%	14%	18%	35%	14%
Levee or embankment located in wrong areas	11%	7%	10%	14%	14%	22%	18%
Ill designed storm water system	8%	3%	10%	15%	17%	33%	11%
Insufficient capacity of storm water system	4%	3%	6%	16%	19%	35%	14%
Storm water infrastructure located in wrong areas	9%	7%	7%	23%	12%	22%	17%
Ill designed retention ponds	10%	5%	11%	17%	14%	27%	17%
Insufficient retention pond capacity	8%	5%	11%	16%	17%	27%	14%

Retention pond located in wrong areas	11%	9%	12%	24%	9%	18%	16%
Ineffective intergovernmental collaboration in flood planning	4%	4%	6%	16%	16%	37%	15%
Public's lack of information about flood	6%	6%	10%	24%	18%	30%	5%
Neglect of potential flooding issues by public agencies	2%	7%	10%	19%	21%	33%	8%
Funding shortage to build flood protection infrastructures	3%	4%	6%	21%	18%	30%	16%

How would you prioritize the following sectors the government needs to invest in during the disaster recovery period?

In examining investment areas, citizens agree that during the disaster recovery period the government should prioritize investments in medical resources, water, sewer, sanitation and security. These sectors reflect the short-term needs citizens have identified as high-priority.

Table 8: Percentage of respondents that believe in governmental investment in these sectors

	High Priority	Medium Priority	Low Priority	Not a Priority at All
a. Neighborhood shops/supermarkets	31.6%	34.5%	19.6%	13.4%
b. Water	79.9%	13.4%	3.4%	1.0%
c. Sewer	79.4%	13.9%	3.4%	1.0%
d. Sanitation/hygiene	77.5%	15.3%	3.8%	1.4%
e. Electricity	70.3%	23.9%	2.9%	1.4%
f. Roads/transportation	60.8%	32.1%	3.4%	1.9%
g. Medical resources	85.7%	9.6%	3.4%	0.0%
h. Schools	48.3%	33.5%	12.0%	3.8%
i. Security/Policing	69.4%	24.9%	2.9%	1.4%
j. Solid waste (e.g. debris) management	56.0%	34.5%	6.7%	1.4%
k. Communications (including the Internet)	57.4%	31.6%	7.2%	1.9%

Which level of government has the *greatest responsibility* for the prevention of long-term flooding risks?

The majority of respondents agree that when it comes to prevention of long-term flooding risks, all levels of government plus citizens share responsibility in addressing and taking effective actions to prevent long-term flooding risks. Such perceptions of government generally reflect

stakeholders in Wharton, as many individuals emphasized the collective responsibility and importance of all levels in working together to provide successful response and recovery actions.

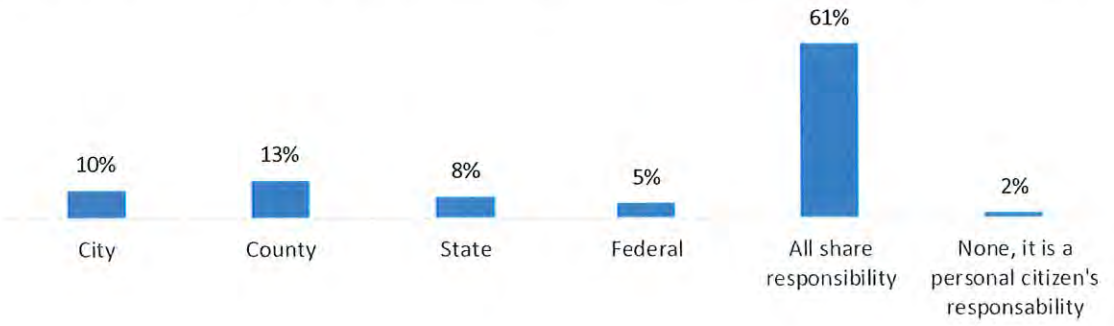

Figure 13: Percentages of respondents that attribute greatest responsibility according to level of government