

**Recovery challenges of public housing residents after disasters: Lumberton, North Carolina after Hurricane Matthew**

by

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this thesis. The Graduate College will ensure this thesis is globally accessible and will not permit alterations after a degree is conferred.

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**DEDICATION**

To Maman, Baba, and Amir

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**NOMENCLATURE**

ACS	American Community Survey
AMI	Area Median Income
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant- Disaster Recovery
CDL	Community Disaster Loan
CoE	Center of Excellence for Risk-Based Community Resilience Planning
DHAP	Disaster Housing Assistance Program
DHS	Department of Homeland and Security
DOT	Department of Transportation
DSS	Department of Social Services
DVP	Disaster Voucher Program
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
HA	Housing Agencies
HACL	Housing Authority of City of Lumberton
HMGP	Hazard Mitigation Grant Program
HMGP	Hazard Mitigation Grant Program
HOME	Federal HOME Investment Partnership Program
HUD	Department of Housing and Urban Development
IAA	Internal Review Board Authorization Agreement
IHP	Individual and Household Assistance Program
IHP	Individual and Households Program

IRB	Internal Review Board
MHR	Minimal Home Repair Program
NIST	National Institute of Standards and Technology
PA	Public Assistance
PBV	Project-Based Section 8 Voucher
PPS	Probability Proportion to Size
RAD	Rental Assistance Demonstration
SBA	Small Business Administration
TPV	Tenant Protection Voucher
UNISDR	United Nation International Strategy for Disaster Risk Reduction's

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## ABSTRACT

Social vulnerability acknowledges that social structures shape disaster vulnerabilities and recovery outcomes. Public housing residents are one of the most socially vulnerable people that experience significant losses in disasters. Many factors, such as lower income and limited access to information, cause a delay in the housing recovery of public housing tenants. To explore these challenges, I examined the disaster impacts and recovery of public housing units in Lumberton, North Carolina, following the floods induced by Hurricane Matthew in 2016. This research is a part of an interdisciplinary recovery-based field study conducted by the Center of Excellence for Community Resilience Planning funded by the National Institute of Standards and Technology.

Hurricane Matthew made landfall in North Carolina on October 8, 2016, as a Category 1 storm. Several communities, including Lumberton, were devastated by heavy rainfall and the river flooding that occurred after Hurricane Matthew. Lumberton is a socioeconomically diverse community with 729 public housing units, many of which got damaged after the floods. Extensive damages have led to the displacement of many public housing families.

Using descriptive statistics, mapping, and qualitative analysis, I investigated the recovery progress and challenges of public housing residents. Data on race, income, and housing tenure of the residents at Block Group level were collected from the 2015 ACS-5-year estimation to map the social vulnerability and overlaid with the location of the public housings and the spatial distribution of residential damages. Also, household survey data on disaster impacts, recovery resources, decisions, and dislocations were

collected using longitudinal field study surveys conducted in December 2016 shortly after the flooding, and January 2018 one year after the disaster. Furthermore, In-depth interviews with local officials in Lumberton were utilized to examine recovery challenges and progress.

Findings show that housing tenure, race, and poverty make up the most significant portion of public housing residents' vulnerabilities. These vulnerabilities resulted in widespread damages to public housing developments and lengthy displacement of the public housing developments. State's priorities in recovery, absence of strong voice advocating for recovery of affordable housing, funding resources, and allocations influence the pace of the recovery of public housing residents.

## CHAPTER 1. INTRODUCTION

### 1.1 Problem Statement

Disaster losses are increasing around the world. Disaster management attempts to reduce the potential losses caused by hazards, help the survivors of the disaster, and offer a quick and effective recovery. The disaster management cycle has four stages including mitigation, preparedness, response, and recovery. Recovery is the least investigated stage of these four phases of the disaster cycle (Haas, Kates, & Bowden, 1977; Rubin, Saperstein, & Barbee, 1985; Berke, Kartez, & Wenger, 1993; Olshansky, 2005; Zhang & Peacock, 2009). Post-disaster recovery is the process of restoring, rebuilding, and reshaping the physical, social, economic, and natural environment (Smith & Wenger, 2007). This process includes rebuilding homes, businesses, and community assets such as parks, public buildings, and community icons, as well as repairing infrastructure (Olshansky, Hopkins, & Johnson, 2012; Smith & Wenger, 2007). Housing is a key element of disaster recovery, but housing recovery is not an equal process for everyone in a community. Few studies have addressed the inequalities in post-disaster housing (Zhang & Peacock, 2009; Green & Olshansky, 2012; Green, Bates, & Smyth, 2007; Hamideh, Peacock, & Van Zandt, 2018).

Scholars have begun to use the concept of social vulnerability to discuss the fact that social structures and procedures can cause vulnerabilities. Social vulnerability in regards to natural disasters has been defined as “the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (Blaikie, Cannon, Davis, Wisner, 1994)”. Factors including race or ethnicity, income and poverty, gender, age, housing tenure and even religion are considered dimensions of social vulnerability (Van Zandt, Peacock, Henry, Grover, Highfield, & Brody,

2012; Cutter, Boruff, & Shirley, 2003). These factors affect household capability at all stages of a disaster such as preparedness, warning, evacuation, casualties and recovery (Highfield, Peacock, & Van Zandt, 2014; Flanagan, Gregory, Hallisey, Heitgerd, & Lewis, 2011; Van Zandt et al., 2012; Morrow, 1999). The social construction of vulnerabilities plays a significant role in housing recovery. Specifically, class and racial or ethnic differences have been seen to impact the complex social process of housing recovery.

The literature suggests that socially vulnerable populations may have difficulties in achieving or being qualified for housing financial assistance in the aftermath of disasters to start the recovery process. They lack the education or language skill necessary for applying for financial aid and they have limited savings and insurance (Van Zandt et al., 2012). Therefore, disadvantaged communities such as neighborhoods with low-income and minority residents recover more slowly than other neighborhoods.

Public housing complexes are one of the socially vulnerable communities in cities where residents cannot afford temporary and permanent housing in the aftermath of disasters. Public housing is one of the programs of the Department of Housing and Urban Development (HUD) in the U.S. that provides affordable housing for low-income people and households, i.e., households with incomes at 30% or less of the Area Median Income (AMI). Historically, the public housing program in the U.S. has resulted in segregation as well as the concentration of poverty and minorities in distressed neighborhoods, creating socially vulnerable spots in cities (Schill, 1993; Carter, Schill, & Wachter, 1998). The literature suggests that low-income and minority households experience more damages (Peacock, Van Zandt, Zhang, & Highfield, 2014; Morrow, 1999) and go through different recovery

trajectories (Hamideh and Rongerude, 2018; Highfield, Peacock, & Van Zandt, 2014; Fothergill & Peek, 2014; Van Zand et al., 2012; Morrow, 1999).

Public housing developments are known for their social vulnerabilities and this results in the trajectories of public housing recovery and single-family housing recovery being unequal. Unlike single-family housing, public housing recovery has not been prioritized in previous studies. Unequal trajectories of housing recovery, and difficulties of various cohorts within a community in affording their housing in the aftermath of disasters, call for studies that investigate the housing recovery processes for different types of residential units. This knowledge would help drive more actions and policies to address inequalities within communities in similar possible disasters. I have therefore examined the recovery process of public housing residents within a community that was affected by a natural disaster. Using a case study approach, I investigated the challenges of the housing recovery of public housing residents in the aftermath of a natural disaster resulting from their specific vulnerabilities.

More specifically, this study investigates the flood impacts and the challenges of the recovery of public housing units in Lumberton, North Carolina, after the floods caused by Hurricane Matthew in 2016. This knowledge would help communities to plan, prepare for, and recover from disasters. This study is part of a larger, longitudinal and interdisciplinary recovery-based field study in Lumberton, North Carolina, conducted by the Center of Excellence (CoE) for Risk-Based Community Resilience Planning with collaborators from the National Institute of Standards and Technology (NIST).

## **1.2 Background**

Hurricane Matthew made landfall in a few countries including the Dominican Republic, Haiti, Cuba, Bahamas, and the United States between September 28 to October 9,

2016 (Stewart, 2017). It was classified as Category 3 hurricane when it hit the east coast of the United States on October 7 (Van de Lindt et al., 2018). The storm hit Florida, Georgia, some parts of South Carolina, and North Carolina. Hurricane Matthew made landfall in North Carolina on October 8, 2016, as a Category 1 storm (Van de Lindt et al., 2018). Some areas in North Carolina received more than 15 inches of rainfall in two days. Several communities were devastated by the heavy rainfall and river flooding that began after Hurricane Matthew. Approximately 100,000 homes, businesses, and government buildings were damaged in North Carolina due to Hurricane Matthew with an estimated \$1.5 billion worth of damages (Van de Lindt et al., 2018).

Lumberton, the county seat of Robeson County, is located in the southeast part of North Carolina. The town was named Lumberton because Lumber River bisects the city. The Indian name of Lumbee was initially used for the river that came from an Indian word that means “black water” (Van de Lindt et al., 2018). It is believed that Native Americans may have lived in the region since 20,000 B.C. and the river and its swamps were the homes of several displaced Native Americans of the coastal region as Europeans advanced westward (City of Lumberton, n.d.). Today, Lumberton has a population of 21,707. The town was one of the communities in North Carolina devastated due to the floods induced by Hurricane Matthew. The Lumber River crested at 21.5 feet above the datum and flooded on October 8. Flooding was exacerbated by ground already saturated from the heavy September rains.

The floods destroyed over half of the total residential units in Lumberton including damages to 267 out of 729 public housing units and displacing 267 families living in these units (HA CL, 2017). The Housing Authority of Lumberton (HA CL) estimated the flood damages to the public housing developments to be a total of \$8 million, with approximately

\$5 million in remaining unmet needs. Unmet needs were defined as necessary expenses and serious needs that are unmet through insurance or other means (State of North Carolina, 2017). The households living in damaged public housing units lost their apartments and were displaced for more than seven months after the flood. More than half of these families did not return to Lumberton.

Lumberton was chosen as a case study because of its specific characteristics. Lumberton is a diverse city from a socio-demographic stand point with a third of households who live at or below the poverty level. Lumberton has a large proportion of minorities with a high percentage of African American and Native American. Around 52.3% of the housing units in Lumberton are occupied by renters<sup>1</sup>. There are 24 low-income housing apartment complexes which contain 2,228 affordable apartments for rent in Lumberton. About 1,528 of these rental apartments are income-based housing. Among them, there are 210 Project-Based Section 8 subsidized apartments (PBV) in the town.<sup>2</sup> PBV is a governmental funded program that provide rental units with the cost of 30% of the low-income household's gross income in a privately owned or managed rental unit. This voucher stays with the building and cannot be applied to the renters after moving out of that rental unit<sup>3</sup>. Before Hurricane Matthew, Lumberton also had 729 public housing units in twelve developments and less than 596 section 8 vouchers<sup>4</sup> (HACL, 2017). Section 8 vouchers are another governmental program which assists very low-income, elderly, and disabled families to afford renting a unit in the private market. The local officials informed that the HACL is the largest housing authority in

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<sup>1</sup> <https://affordablehousingonline.com/housing-search/North-Carolina/Lumberton>

<sup>2</sup> <https://affordablehousingonline.com/housing-search/North-Carolina/Lumberton>

<sup>3</sup> [www.housinglink.org/SubsidizedHousing/ProjectBased](http://www.housinglink.org/SubsidizedHousing/ProjectBased)

<sup>4</sup> [https://www.hud.gov/topics/housing\\_choice\\_voucher\\_program\\_section\\_8](https://www.hud.gov/topics/housing_choice_voucher_program_section_8)

Robeson County. However, the city had a shortage of affordable housing which is shown by the fact that 53.3% of renters spent 30% or more of their income on their rent (HACL, 2017).

### **1.3 Purpose of the Study**

This research seeks to improve the current state of knowledge about the recovery challenges of public housing units through examining the recovery of public housing units in Lumberton following the floods caused by Hurricane Matthew in 2016. Previous researchers have focused on the role of social vulnerability factors in the housing recovery and some researchers have examined the different recovery trajectories of different housing types. However, few studies have worked on recovery with regards to the interconnected impacts of social vulnerability factors and housing types, such as public housing residents. Few pieces of research have focused on recovery of public housing unit in general, and how this recovery is shaped by social vulnerabilities and access to resources. This thesis aims to address these gaps in the research/literature, specifically in regards to three points of interest. The main question is: What are the obstacles for recovery of public housing units? The sub-questions are as follows: Question 1: What are the specific vulnerabilities of public housing residents in the face of disasters as socially vulnerable people? Question 2: How do the vulnerabilities of public housing residents shape the recovery outcome of the individual households in the aftermath of disasters? Question 3: How do funding sources, plans, and policies affect the recovery outcomes of public housing units?

I used a mixed method approach for my analyses. I used descriptive statistics and mapping methods, as well as qualitative analysis to find the answers to my research questions. The investigation is undertaken in three steps. First, I mapped social vulnerability in Lumberton Block Groups and the specific vulnerabilities of public housing residents using the social vulnerability index weighted map. I then investigated the impact of social

vulnerability factors on the outcome of the public housing recovery, and I found the gaps in funding, decision making, and policies for the restoration of the units of public housing.

#### **1.4. Structure of Thesis**

This thesis is organized as follows. First, I review the literature on community and housing recovery and research on the recovery policies and funding, and factors that determine disparities in housing recovery including social vulnerability. Then I provide a brief history of public housing in relation to disaster impacts and the challenges of the recovery of these units. This review concludes with a discussion of the gaps in the literature about the recovery challenges of the public housing units. Next, the data collected for this study and the methodology of data analysis is presented. In this chapter, I discuss the data collection process, including interviews, field notes, and surveys as well as the data analysis steps for each of the research questions. Then, in the following chapter, I explain the case study and the results of the analyses. Finally, in the last chapter, I summarize the study findings and discuss the research implications and limitations.

## CHAPTER 2. LITERATURE REVIEW

### 2.1 Introduction

Disaster losses in the United States continue to increase. Weather-related hazards including hurricanes represent 86% of the total losses in the past 45 years in the United States (Cutter, Johnson, Finch, & Berry, 2007). More than 69% of all the hazard damages followed by flooding and severe weather are caused by hurricanes and tropical storms. “Disaster” has various meanings in different contexts and disciplines. In this thesis, disaster refers to the United Nation International Strategy for Disaster Risk Reduction’s (UNISDR) definition. UNISDR (2017) defines disaster as “a serious disruption of the routine of a community or a society causing widespread human, material, economic, or environmental losses which exceed the capability of the affected community or society in managing their resources.” Disasters as unusual events, overwhelms the response capacity of a community and causes various damages and losses in all aspects.

Disaster management attempts to reduce or eliminate the potential losses caused by hazards, provide prompt and proper assistance to the survivors of the disaster, and offer a fast-effective recovery (Pathirage, Seneviratne, Amaratunga, & Haigh, 2012). Disaster management encompasses four phases in its cycle, including mitigation, preparedness, response, and recovery. Mitigation aims to decrease the impact of hazards utilizing structural and non-structural measures. Preparedness refers to the activities taken before disasters to guarantee an effective response to hazards. Response deals with the provision of assistance and life preservation for the affected people and takes place immediately after a disaster and has a short-term duration. Recovery refers to all decisions and activities that are implemented in the aftermath of a disaster to restore and improve the living condition of the affected

community with a goal of mitigating future possible disaster risks (Tun, Gehbauer, Senitz, & Mueller, 2007). In this thesis, I will focus on the recovery phase of the disaster cycle.

In the recovery, a community attempts to return to a normal or improved level of operation by allocating resources, rebuilding, and providing lifeline repairs (Fothergill & Peek, 2004; Bolin 1995; Olshansky, Hopkins, & Johnson, 2012). The Federal Emergency Management Agency (FEMA, 2000) defines recovery as “the non-emergency measures following disasters that aim to bring back all formal and informal systems to a normal state.” All the activities including reconstruction, restoration, rehabilitation, and post-disaster redevelopment are a part of the recovery process. This stage involves seeking accommodation, rebuilding homes, public agencies and utilities repairing infrastructure, and households surviving lean times as well as coping with new strains (Olshansky et al., 2012; Smith & Wenger 2007). Recovery is an opportunity for the development of disaster affected regions, as will be seen. It is a multidimensional, complex process that involves many stakeholders. Therefore, it is important to understand that this process is unequal.

The post-disaster context provides unique urban development opportunities. Local jurisdiction have access to external recovery aids to facilitate economic, social, and physical developments by strengthening local organizational capacity. This provides the local authorities with the chance of defining goals, controlling resources, and directing redevelopment initiatives with long term economic and social benefits. Urban planners often view a disaster as an opportunity for making physical, economic, and social improvements (Berke, Kartez, & Wenger, 1993; Olshansky, 2005). The improvements in physical development patterns can reduce vulnerabilities and mitigate future hazard risks. Rebuilding a community with lower vulnerability to disasters in comparison to pre-disaster conditions

can occur with appropriate construction, restoration, and land use standards (Topping & Schwab, 2014).

Post-disaster recovery is a long-term and interdependent process that involves multiple organizations with different capabilities and requires interactions between these organizations in response to a range of technical, social, and economic issues that produce effects of varying intensity on different groups in the population (Olshansky et al., 2012; Comfort, Birkland, Cigler, & Nance, 2010; Rubin et al., 1985). Some scholars believe that community recovery may or may not correlate with physical reconstruction (Olshansky & Johnson, 2014). Bolin (1995) finds that community recovery is a multidimensional process that involves economic, psychosocial and physical restoration. In the aftermath of the disaster, the community needs to keep the businesses and rebuild the houses to shelter the families. Socioeconomic factors play a significant role in the pace of recovery, which means people who are better integrated into economic and social networks recover faster (Olshansky, 2005; Bolin, 1995). However, people with few resources get less attention from the organizations providing aid resources and recover slower.

Recovery does not have a specific endpoint or agreed upon measure of success. It concerns the rehabilitation of people's lives more than the reconstruction of buildings and infrastructures (Olshansky, 2005). It is a process of interaction and decision making among various groups and institutions including families, businesses, organizations, and society. Some scholars subsume that recovery eventually blends with normal processes of community, while some others argue that recovery never returns a community to pre-existing conditions (Olshansky, 2005; Olshansky & Johnson, 2014). Rather, it requires accepting a new normal rather than a return to pre-disaster conditions (Johnson, 2014). Recovery always

encompasses changes. While cities aim to rebuild themselves as much as they can to return to where they were before the disaster, they cannot avoid the transformations of urban environment following disasters. However, significant changes are difficult to achieve since there are political and administrative limitations, but in general, cities see a level of physical improvement in the aftermath of disasters.

Although many actors are involved in the recovery process, the federal government has a significant role. One of the crucial functions of federal government in recovery is to facilitate, support, inform and influence the many other recovery actors. However, the bureaucratic system is limited by the time compression of the recovery process, which has resulted in an increasingly critical role of nongovernmental organizations (NGO) in recovery. Nonetheless, the higher level of governments can provide technical and financial resources to meet the needs of the recovery actors that NGOs struggle to match (Olshansky & Johnson, 2014). Therefore, local leadership, local economy, resources, and recovery policies are involved in the recovery process.

## **2.2 Recovery Policies**

There are various management approaches for the management and decision-making processes in post-disaster contexts. Recovery management has three categories including centralized, partly decentralized, and decentralized. In the centralized approach, the national government controls recovery management and policy creation. In the partly decentralized method, organizations at different levels of government manage policy making with close coordination with the national government. The decentralized approach includes policy-making and management of various organizations at multiple levels of government in which the national government provide some support and coordination (Sylves, 2015).

In the United States, recovery management and policy-making take a decentralized approach. The structure of disaster response and recovery policies in the U.S. respects the dominance of states to direct activities. This policy leads to the federal government acting as a supporter of state and local governments due to the reasoning that states know the unique requirements of their geography and citizens. Therefore, while the policies are top-down and applied to the whole nation, federal agencies do not dictate the actions of state and local officials in emergencies (Johnson & Olshansky, 2017).

The disaster management decision-making system within the U.S. has local governments, special districts, and Native American tribal governments responsible for the emergency phase and recovery process in the aftermath of disasters, with regional, state, and national agencies supporting them as requested. This system is bottom-up but there is cooperation between all levels of government as well as many private organizations. This cooperation means that states assist local governments, and the federal government aids both as needed.

The Disaster Relief Act of 1974 was the primary law that first defined the system and the role of the federal government in disaster response and recovery. This Act was amended in 1988 and titled the Stafford Act. This amendment defined the Federal Emergency Management Agency (FEMA) as the lead agency in organizing the role of federal government in the preparation, prevention, mitigation, response, and recovery stages of natural or manmade disasters (Comerio 1998; Topping & Schwab, 2014; Johnson & Olshansky, 2017). FEMA oversees four disaster laws: The National Flood Insurance Act, Robert T. Stafford Disaster Relief and Emergency Assistance Act, the Disaster Mitigation Act, and the Post-Katrina Emergency Management Reform Act. These laws address disaster

management and their contents are organized under four categories: mitigation, preparedness, response, and recovery. FEMA also coordinates recovery-related programs under the Stafford Act including Individual Assistance, Public Assistance, and the Hazard Mitigation Grant Program (HMGP). In addition to FEMA, there are some other federal agencies with important roles and resources in recovery, such as the U.S. Department of Housing and Urban Development (HUD), the Small Business Administration (SBA), the Economic Development Administration, and the U.S. Department of Transportation (DOT) (Olshansky & Johnson, 2014; Johnson & Olshansky, 2017), and army corps of engineers.

The Stafford Disaster Relief and Emergency Assistance Act is the nation's primary disaster law which directly addresses disaster management. This law is primarily implemented by FEMA and the U.S. Department of Homeland and Security (DHS). Under the Stafford Act, the governor of a disaster-stricken state can generate federal involvement in the disaster management process by requesting the president to declare an emergency or major disaster (Topping & Schwab, 2014). According to FEMA (2016), this request can be applied when the governor finds the severity and magnitude of the disaster beyond the capabilities of the state, and so federal assistance is required to complement the states' resources, execution of the states' emergency plan. The state and federal government follow cost-sharing requirements during this process. After this request, the president has to determine that the state's capabilities are not sufficient for addressing the disaster and that the state needs federal assistance for disaster response and recovery.

### **2.3 Housing Recovery**

Housing is an important segment of physical, financial, and social infrastructure in the U.S. The structures used for the housing represent the highest portion of all buildings in the U.S. in local scale, county, and the state levels (Comerio, 1997; Sutley & Hamideh,

2017). Housing recovery is a significant component of post-disaster recovery (Bolin & Stanford, 1997). Housing units face the most significant damages in natural disasters (Comerio, 2014). Moreover, a house is an essential component of the economy and the primary source of investment for the majority of Americans. Re-establishing housing plays a crucial role in the ability of individuals to return to their normal activities, domestic functions, and routines (Peacock et al., 2017). Housing recovery is a major part of a community recovery. Community recovery depends on housing recovery.

In the U.S., housing recovery is driven by the market and the government does not have an active role in this stage of recovery. Housing recovery is managed by the market which differs from the public facilities and infrastructure because housing is privately owned (Comerio, 1998; Zhang & Peacock, 2009; Comerio, 2014). This means that while the federal and state governments guide the financing elements in the recovery process, the basic tenet of government remains to follow a hands-off intervention strategy (Comerio 1998; Peacock, Dash, Zhang, & Van Zandt, 2017).

Before the 1970s, the U.S. disaster assistance policies did not include any funding for housing recovery. After the 1970s, some disaster assistance programs were created to help homeowners recover (Comerio, 1998; Comerio, 2014). After the declaration of a disaster, federal agencies play roles in housing recovery through FEMA, SBA, and HUD (Bolin 1995; Zhang & Peacock, 2009, Comerio, 2014). The Minimal Home Repair Program (MHR) of FEMA provides owners with partial insurance with grants to cover the minor repairs and rebuilding costs to build safe and habitable shelters. SBA provides Disaster Loan Program to assist the rebuilding costs of the insured and uninsured properties. The amount of the loan, interest rate, and terms are decided based on the value of the property as well as the

borrower's credit. Recently, HUD plays a more significant role than the FEMA grant or the SBA loan in housing recovery through its CDBG and HOME investment partnership programs. Local officials in federally declared disaster regions can apply for the grants provided by HUD, or if they already have a pending request, they can expedite said request (Zhang & Peacock, 2009; Peacock et al., 2017). Although the CDBG funds are a great assistance to disaster-stricken communities, the political requirements can act as deterrents since HUD requires action plans supported by community involvement in order to receive any funds (Olshansky & Johnson, 2014).

The U.S. market-based approach has resulted in a neglect of housing recovery in local communities' recovery policies (Bolin, 1985; Zhang, 2006). In the market-based recovery, the owners of the houses are responsible for restoring and reconstructing the units either themselves or by contracting others to do the rebuilding. National recovery policies assume that insurance, private funds, or both will be applied for the housing recovery (Comerio, 1998; Zhang & Peacock, 2009; Comerio, 2014). Similarly, renters and their families have to recover on their own and this often results in them having to move to other homes.

The market-based approach is a conservative method that aims to restore the pre-disaster conditions of a community (Bolin, 1985). Housing markets in the U.S. are known by their sequential filtering in which the lower-income households live in physically deteriorated and unsafe neighborhoods, while higher-income households live in high-quality homes in safer areas (Foley, 1980). This means that on the one hand, focusing on the distribution of housing in the U.S., it becomes apparent that inequality exists in the pre-disaster housing stock that results in higher levels of damages and higher demands of financial resources for repairing and rebuilding these units after the disaster. On the other

hand, the market-based recovery may accentuate the pre-disaster inequalities (Bolin, 1985; Bolin & Stanford, 1991; Kamel & Loukaitou-Sideris, 2003; Zhang, 2006). Studies show that marginalized communities are confronted with higher hurdles to access resources, to express collective needs, and to engage in decision-making (Kamel & Loukaitou-Sideris, 2003). Therefore, these social groups have a longer displacement period and a slower recovery pace in comparison to the other groups in a community.

#### **2.4 Recovery Funding Resources**

Local governments deal with various emergencies on a regular basis. If they need additional assistance and resources, they have to request from the neighboring communities for emergency aid based on their pre-existing mutual aid agreements. If resources from the neighboring communities prove inadequate, the localities can appeal the state emergency management agency with a request for a declaration by the governor to demand aid from other state agencies. If the emergency resources from the state are insufficient, the state then demands for a federal disaster declaration by the president (Topping & Schwab, 2014). After the emergency declaration from the president, the U.S. Congress has various funding options that complement the Stafford Act allocations in assisting states and local governments to finance recovery efforts.

Federal agencies provide a community with various funding options in the aftermath of disasters. This study focuses on public housing recovery. Therefore, in this section, various funding resources which can be allocated for the housing recovery within a community are discussed. These resources are provided by federal agencies including FEMA, HUD, SBA, and insurance in the aftermath of disasters.

#### **2.4.1 Federal Emergency Management Agency (FEMA)**

FEMA has four federal programs in terms of assisting recovery efforts including the Public Assistance Program (PA), the Hazard Mitigation Grant Program (HMGP), the Community Disaster Loan Program (CDL), and the Individual and Household Assistance Program (IHP). During the managing of applications and the distribution of resources process, state emergency management agencies have a significant intermediary role in collaboration and on behalf of FEMA.

Public Assistance (PA) is the primary federal assistance for the local government. This fund provides the state, local government agencies, private nonprofit organizations, and federally recognized tribal organizations support for activities including debris removal, emergency protective measures, and repair, replacement, or restoration of damaged facilities and infrastructures (FEMA, 2005). Funds of these activities are granted and are proved to be eligible for reimbursement only after a large documentation of the damage, proposed scope of works, and cost estimations has been completed. The federal share of assistance is at least 75% of the eligible cost, and the state and local governments can have up to 25% of the cost (FEMA, 2005; Johnson, 2014).

Hazard Mitigation Grant Program (HMGP) funding is provided under section 404 of the Stafford Act, and contributes to the hazard mitigation plans of state and tribal organizations. This funding is allocated based on a cost-share basis similar to PA program. However, it is not available until much later in the recovery process (FEMA, 2005; Johnson, 2014).

The Community Disaster Loan (CDL) is provided by FEMA to assist local governments in offering essential services when the local government or any eligible jurisdiction has suffered an extensive tax or any other revenue loss. The congress passed this

program in 2005 for the first time, authorizing FEMA to provide CDL loans. The jurisdiction in question has to reveal a need for financial support to perform its governmental functions. This loan is not to exceed 25% of the local government's annual budget and has a maximum of \$5 million (FEMA, 2005).

The Individual and Households Program (IHP) provides eligible renters and displaced homeowners with grants to find shelter within the boundaries of the state quickly after the disaster. This assistance can also be used for other needs that are not met through other assistance forms and insurance such as personal property, transportation, etc., and for any hardship or injury caused by the disaster. This funding is on a cost-share basis in which there is 100% federal assistance for housing, and 75% federal and 25% state or local governments for the other needs (FEMA, 2005). It is short-term assistance and usually is not substantial enough to cover the financial recovery needs of a household (Johnson, 2014). FEMA noticed in 2017 that the maximum allowable IHP fund is \$34,000 for any major disaster declared on or after October 1, 2016 (FEMA, 2017).

### **2.3.2 U.S. Department of Housing and Urban Development**

Community Development Block Grant (CDBG) in general is a flexible program that was established in 1974 by HUD. This program aims to provide resources to communities to address community development needs. The CDBG program provides local government and states annual grants to ensure decent affordable housing for the most vulnerable population in the communities and to create jobs by expanding and retaining businesses. HUD determines the amount of grant based on several factors of the community need, including extent of poverty, population, housing overcrowding, and population growth lag related to other metropolitan areas. At least 70% of this grant must be used over a 1-, 2-, or 3-year period for activities that benefit low and moderate-income persons. Each of the activities must meet one

of the government's objectives including "(1) benefit low- and moderate-income persons, (2) prevention or elimination of slums or blight, or (3) address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available."<sup>5</sup>

In the disaster context and after an emergency or a major disaster declaration, HUD offers the Federal Housing Assistance Program which provides housing vouchers to the victims of the disaster and funds the rebuilding of public housing units as well as mortgage assistance. HUD can also expedite annual awards such as CDBG programs and the Federal HOME Investment Partnership Program (HOME) for the disaster-affected area. These funds are applied to HUD by Congress and are not a part of Stafford Act. This authorization means that HUD can waive many regulatory requirements (Johnson, 2014).

One of the additional disaster recovery funds of Congress is the HUD Community Development Block Grant-Disaster Recovery (CDBG-DR) program. Congress can use the CDBG-DR fund rapidly if it meets particularly urgent community development needs that pose a serious and immediate threat to the public. Moreover, regarding the flexibility of CDBG-DR funds, they can be used in various ways such as restoration of essential services, mitigation of future possible disasters, and long-term recovery of businesses, houses, and infrastructures (Johnson and Olshansky, 2017).

Local governments and states as the grant recipients must develop and submit an action plan for the disaster recovery before receiving funds. The action plan should define the needs, strategies, and the uses of the disaster recovery funds for the projects. In addition, the grant recipients have to report the recovery progress quarterly.

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<sup>5</sup> [https://www.hud.gov/program\\_offices/comm\\_planning/communitydevelopment/programs](https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs)

The CDBG-DR is the major source of federal recovery assistance. The largest amount of CDBG-DR assistance in the history of this program was \$19.7 billion for the post-Katrina recovery and reconstruction. However, the CDBG recovery program was implemented in a class and racial discriminatory manner that was against the fair housing purposes for low and moderate-income households. Therefore, CDBG funding approved in 2005 limited the amount of grants that a state can use for administrative expenses to 5%; required each state to develop recovery plans that have to be approved by HUD; seek waivers for the normal requirements except for the ones related to fair housing, nondiscrimination, labor standards, and environmental review; and prevent the use of funds for activities that can be otherwise provided and reimbursed by FEMA or by the U.S. Army Corps of Engineers (Gotham, 2014; Johnson, 2014).

#### **2.4.3 U.S. Small Business Administration**

SBA provides an assistance program in the form of loans for all sizes of businesses, homeowners, and renters for the restoration of their damages. The loan covers the losses that are not compensated by insurance. They are activated immediately after the disaster declaration. Individuals and homeowners can apply for it through FEMA while business owners can apply directly to the SBA (Johnson, 2014).

Homeowners can apply for the loan to repair or to replace their properties up to \$200,000. The loans are used for upgrading homes only if it is required based on the building codes. If a homeowner makes improvements to reduce the future risk of disasters, he may be eligible for up to 20% of property's value increase in loan amount. Renters and homeowners may also apply for up to \$40,000 to replace or repair personal property (SBA, n.d.b).

#### **2.4.4 Insurance**

Insurance is the primary financial source for the recovery in the U.S. It occurs both in the form of government and private sources. The National Flood Insurance (NFIP) is another large federally funded disaster recovery program. However, it is funded by the flood-prone properties' owners and businesses rather than by congress. NFIP provides the property owners with insurance settlements for their flood losses as well as providing funds for buyouts of flood-prone properties (Rubin, Saperstein, & Barbee, 1985; FEMA, 2014; Johnson & Olshansky, 2017).

The communities that are in the flood prone areas and do not become involved in the NFIP within one year of notification that they are in flood zones are not eligible for getting any federal assistance for the recovery and reconstruction purposes. Additionally, anyone who received any flood disaster assistance for any repair, restoration, or replacement of any property and failed to have flood insurance will not be eligible for any federal disaster assistance for any damages due to recurring floods (Johnson, 2014).

Private insurance is one of the most critical sources of recovery that goes directly to policyholders in the disaster-affected regions. Policies cover structures, contents, and the costs of additional residential or business interruptions. Some states and local governments may choose to be self-insured instead of having disaster-related private insurance. Therefore, they have to rely on the federal programs such as FEMA's PA to restore public properties. However, the public property which is located in FEMA designated special flood hazard area will receive PA for the restoration in the aftermath of a flood only if it is insured (Johnson, 2014).

According to the process, as mentioned earlier regarding funding and different financial sources in the aftermath of a disaster, it can be concluded that money is a driving

force in the recovery process. A large amount of money can speed up rebuilding. However, in previous disasters, it seems that there was never enough money and rarely was the money available within the time that was needed (Olshansky, 2005). It appears that setting priorities for communities given the limited funds has been a big challenge in most disasters due to the fact that the process does not follow a rational system. Financial resources in the forms of loans are required immediately but they are not ready immediately, creating problems for many years after the disaster. Additionally, the delivery of resources is a crucial factor for recovery and is affected by the national political context. It has been observed that if local representatives within communities have good connections with the federal party power, they can influence both the quantity and speed of financial assistance, thereby improving disaster recovery results (Olshansky, 2005).

## **2.5 Disparities in Housing Recovery**

Housing recovery plays a crucial role in the community recovery. Housing recovery can be unequal, where some neighborhoods recover fast whereas others lag behind. This section focuses on the various factors that cause residential recovery disparities including housing tenure and social vulnerability. While housing tenure is a factor of social vulnerability, it is considered as a separate section in this chapter because of the focus of this thesis on public housing.

### **2.5.1 Housing Tenure**

Housing tenure defines the relationship between the household and the housing unit. Housing tenure has a real impact on the ability of the household to anticipate, prepare for, respond to, and recover from a disaster (Lee & Van Zandt, 2018; Hamideh & Rongerude, 2018). Renters have less control on limited sources to maintain, improve, and repair their

homes in comparison to the owners (Lee & Van Zandt, 2018; Van Zandt et al., 2012).

Housing tenure factor results in diverse disparities in different parts of the recovery process.

In the U.S., the focus of federal policy has been on the emergency phase. Restoration and reconstruction of the houses have to be done by the property owners, regardless of if they have to do it by themselves or contract others to do the work for them. Therefore, the financial burden of recovery is on the private sources including insurance, loans and personal savings. Consequently, recovery requirements of low-income homeowners and renters in most cases cannot be fulfilled sufficiently.

Rental units have specific recovery issues and problems. The policies assume that renters can find another alternative rental, while multifamily housing losses may leave many renters homeless in the aftermath of disasters. The owners of such rental units often decide not to invest on housing replacement because there is less profit in the low-income market (Fussell & Harris, 2014; Comerio, 2014). The fact that tenants have no control over their homes may cause limitations when considering hazard mitigation options. Homeowners are often more prepared for the disasters than the renters because they stay longer in the unit and they have more incentives to invest in their units. Landlords of multiunit houses invest less for mitigation measures due to the complicated costs that may increase the rents in the long-term. Like mitigation, in the aftermath of a disaster, the pace of the recovery of rental units are different from the privately-owned units (Peacock et al., 2007; Lee & Van Zandt, 2018). Compared with owned properties, rental units recover slow.

Rental disaster financial assistance sources are typically slow because of the political and rental market forces (Fussell & Harris, 2014; Fothergill & Peek, 2004). For example, in the aftermath of Hurricane Katrina, FEMA assistance for small rental apartments was issued

two years after the hurricane through the Road Home Program. Therefore, in New Orleans, the economic and social pressures resulted in the increase of rents (Fussell & Harris, 2014). While the landlords of low-income units are reluctant to restore the units due to limited profits, other owners of rental units may take the opportunity of the disaster and rebuild their properties for a higher rent market. Either way, the landlords are responsible for the recovery of the building and providing safe occupancy. The lack of prompt financial assistance caused a longer reconstruction because of the delays of landlords in rebuilding due to the limited financial assets, especially when they owned multiple rental units (Zhang, 2006; Fussell & Harris, 2014).

### **2.5.2 Social Vulnerability**

Housing recovery is a complex socially constructed process. Household characteristics of affected communities such as damages level, financial resources, housing requirements and preferences, knowledge and availability of shelter options, household demographics, and social factors affect housing recovery (Bolin & Stanford, 1991). Natural disasters magnify the existing pre-disaster inequalities (Bolin, 1985; Bolin and Stanford, 1991; Kamel and Loukaitou-Sideris, 2003; Zhang, 2006). Pre-disaster social patterns in the housing market have impacts on post-disaster housing recovery. Therefore, disasters are not “equal opportunity” occasions, they affect various cohorts of people in different ways. Multiple disciplines, including disaster management, use the concept of “vulnerability.” In disaster management literature, the vulnerability concept incorporates the conditions and characteristics that make people vulnerable.

Vulnerability discusses the weakness or possibility of losses due to destructive impacts of a disaster caused by hazards (Van Zandt et al., 2012). Vulnerabilities can be in different shapes such as exposure to the natural or built environment risks. However, a

concept that has begun to be discussed is that social structures and procedures are likewise causing vulnerability. For instance, Morrow (1999) declares that disaster vulnerability rises out of daily social and economic conditions. This approach highlights the prominent role of social systems in community vulnerability towards hazards (Bergstrand, Mayer, Brumback, & Zhang, 2015). Cutter (1996, 530) defines social vulnerability as “the susceptibility of social groups or society at large to potential losses (structural and nonstructural) from hazard events and disasters.” Blaikie et al. (1994, 11) describe social vulnerability as “the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.” Social vulnerability focuses on features and diversity of people according to their social and cultural background.

Socioeconomic factors play a crucial role in all aspects of social phenomena such as disasters (Fothergill & Peek, 2014). Therefore, factors like race or ethnicity, income and poverty, gender as well as factors like age, housing tenure and even religion are included as dimensions of social vulnerability (Van Zandt et al., 2012; Cutter, Boruff, & Shirley, 2003; Tate, 2012). Social vulnerability factors often result in intensified vulnerability, since socially vulnerable people tend to cluster in poor-quality neighborhoods (Morrow, 1999). This clustering causes low-income and minority households to experience more damages (Peacock et al., 2014; Morrow, 1999). Furthermore, it should be noted that social vulnerability factors affect the household in all stages of a disaster including preparedness, warning, evacuation, casualties, and recovery. This means that social vulnerability not only increases the risk of damages but also contributes to different post-disaster outcomes

(Highfield, Peacock, & Van Zandt, 2014; Fothergill & Peek, 2014; Flanagan et al., 2011; Van Zandt et al., 2012; Morrow, 1999).

Low-income and minority households may have difficulties in achieving housing financial assistance to start the recovery process since they have difficulties in applying for aid as well as possessing limited savings and insurance. On the other hand, the members of racial and ethnic minorities in most cases are less likely to qualify and receive aids such as loans and grants (Fothergill, Maestas, & Darlington, 1999). Many of these communities may not be covered by powerful insurance companies or their insurance payments may be reported as insufficient by the companies. Low-income households may also have limited access to transportation due to the extensive disruption of public transportation in the aftermath of disasters. This lack of mobility may slow their recovery efforts (Zhang, 2006).

Racial or ethnic groups often are underrepresented during the recovery planning process due to their lack of representation in decision-making groups and lack of economic power (Van Zandt et al., 2012; Hamideh & Rongerude, 2018). With less economic power and political representation, these marginalized cohorts are often excluded from the decision making and planning process. Due to receiving limited aid, according to Zhang and Peacock (2010), neighborhoods with low-income and minority residents recover more slowly in comparison to other neighborhoods. Consequently, these different trajectories in housing recovery draw attention towards planning in order to reduce unequal reconstruction processes.

One of the community cohorts that faces various challenges in the aftermath of disasters due to their vulnerabilities are the residents of public housing units. They are often low-income, minorities, elderly and in some cases persons with disabilities who live in

multifamily, governmental, or voucher based rental units. They are neither homeowners nor renters. These characteristics make the housing recovery of these residents complicated in comparison to the other cohorts of a community.

## **2.6 Public Housing and Disaster**

In the disaster context, HUD works with the local partners to shelter the displaced public housing residents. HUD provides regulatory relief through waivers or suspensions of standard requirements to accelerate the recovery process. When disaster strikes, FEMA and HUD work together on a joint housing assistance program (HUD, n.d.). These assistance programs are mostly for the temporary sheltering of public housing displaced residents and are different in various disasters. For example, in the aftermath of Hurricanes Katrina, Rita, and Ike, HUD provided a Disaster Housing Assistance Program (DHAP) through local housing authorities for temporary long-term housing of the public housing households. DHAP provides displaced households with temporary rental assistance, a reasonable amount that covers the cost difference between what the household can afford, and their rent. After several months, these households are needed to pay a greater amount of their rent to be encouraged and to be prepared for the full responsibility of their housing costs at the end of the program (NLIHC, 2017). The Disaster Voucher Program (DVP) also provided for the public housing residents to be sheltered and Tenant Protection Voucher (TPV) were distributed to the former residents of public housing developments which were planned to be demolished or redeveloped in the aftermath of Katrina (Henrici, Helmuth, & Fernandes, 2010).

There is no predefined policy for the permanent recovery of public housing units, and their recovery is often a function of political agendas. Local housing authorities not only have little economic motivation in restoring damaged units but are also sometimes

confronted with political resistance against the replacing of lost units (Hamideh & Rongerude, 2018). Thus, local housing authorities use the opportunity provided by the disaster to demolish public housing units using emergency financial resources. They may demolish the developments which are in a hazard-prone area to reduce the risk of future disasters and relocate them to a safe area or have other development plans such as providing mixed-income neighborhoods. For example, in Bessemer, Alabama during the aftermath of Tropical Storm Lee in 2011, the Bessemer housing authority decided to relocate those complexes to a safer place to reduce future risks (Debro, 2011). However, in this process, detailed information about the demolition date or the exact process was not provided to residents, and the planning process was not cleared in ways that would allow the residents to be involved in the recovery process.

### **2.7 Public Housing Residents' Challenges in a Disaster Context**

The concentration of poverty in distressed public housing developments can generate a myriad of problems. This concentration makes residents of public housing one of the most socially vulnerable populations in American cities that may face significant damages in disasters. These damages are due to the vulnerable location of developments and the distressed units of public housing complexes.

The residents of these units are renters. Like other, market-based renters they have no control over the restoration of their buildings. However, public housing residents face unique challenges in that the housing authorities are responsible for the repairs which are dependent on governmental funding resources. This specific housing tenure causes a long-term displacement for the residents of these units in the aftermath of disasters. Public housing residents often cannot afford temporary or permanent shelters after disasters due to lower income and limited access to information (Finch, Emrich, & Cutter, 2010). They also

experience a more extended displacement period due to the difficulties of accessing assistance through the bureaucratic system of compensation (Fothergill & Peek, 2004).

Prolonged displacement limits the involvement of public housing residents in the decision-making regarding the recovery process. Dynamic social marginalization decreases the role of socially vulnerable people in the recovery decision-making process and static vulnerabilities limit their access to the recovery resources. The limited participation is due to physical displacement of the public housing residents as well as the social stigmatization of public housing (Hamideh & Rongerude, 2018). Racial and class-based stigmas also play a significant role in creating social obstacles against the recovery of public housing units.

Hamideh and Rongerude (2018) argue that there is no predefined program for the permanent recovery of the public housing units and that their fate depends on the various political agendas present in the aftermath of disasters. For example, Graham (2012) focused on the case study of addressing the replacement of a public housing development with mixed-income complexes in the aftermath of Katrina in New Orleans. She revealed the way that desirable results of HOPE VI interrelated with the local organizational and historical circumstance. This interrelation confused the goals of housing and community developers regarding the provision of equity and social justice in Lafitte (Graham, 2012). Local governments do not have economic incentives for the reconstruction of these units and have significant political barriers in replacing the lost affordable units. While multi-family houses are business projects and private resources are the main reconstruction resources, investments flow where the risks are lower. Therefore, the communities that are less desirable for investment are left with no rehabilitation resources for multi-family housing (Kamel &

Loukaitou-Sideris, 2004). These limitations result in various challenges for the residents of public housing and slow their housing recovery in the aftermath of the disasters.

## **2.8 Conclusion**

In this chapter, I reviewed pieces of literature which have focused on disaster recovery in three main areas including recovery policies, social vulnerability, and the challenges of the housing recovery. This review highlighted that disaster recovery is not an equal opportunity for the whole community. While some people recover fast due to their stronger financial and social situation, others lag. This review concluded that post-disaster recovery is a complex social phenomenon that housing recovery plays a crucial role in. Reestablishing permanent housing in the aftermath of disaster has a significant role in the ability of individuals to recover their normal activities and daily routines. Therefore, a delay in housing recovery may result in delaying the recovery of the entire community. The bureaucratic process of recovery and the flow of financial resources limits the housing recovery in disadvantaged communities that have a smaller voice in the decision-making process. Besides, market-based policies provide limited financial resources and cause various difficulties for the citizens who are not the owners of their housing units.

A review of the works of the literature in post-disaster housing recovery showed that a group of researchers have focused on the role of social vulnerability factors in the housing recovery and some researchers also examined the differences of the recovery of different types of housing. The policies and resources that are established for the community recovery in general, as well as housing recovery as a part of the community, were explored in this chapter. Moreover, I reviewed the history of public housing units in addition to the policies that were designed for these units in the context of natural disasters. My review concluded

with the identification of two types of gaps in terms of the public housing recovery in the aftermath of disasters.

Firstly, I found that there is a gap in the literature in terms of focusing on housing recovery with regards to the interconnected impacts of social vulnerability factors and the housing types that have no control on the reconstruction of their houses. Specifically, there are few studies that have explored the recovery of public housing units and the impact of their specific social vulnerabilities in the face of disasters and on the recovery outcomes of communities as a whole. Secondly, I found that even though there are predefined policies and resources for housing recovery, there is a gap in the policies regarding the recovery of public housing units that make their circumstance vulnerable to different political plans. Also, the bureaucratic process of recovery and the financial resources of the recovery are not clear for this type of residential units.

Consequently, this thesis focuses on the challenges of the recovery of public housing residents through the lens of their interdependent vulnerabilities and how the existing recovery process and financial policies influence their recovery outcomes. In the next chapter, I will investigate the applied methodology of this thesis to draw out the challenges of the recovery of public housing units in the aftermath of a disaster using a case study.

### **CHAPTER 3. METHODOLOGY**

This thesis attempts to examine the recovery challenges of public housing residents. The approach used to achieve this goal is a case study which enables an investigation of a contemporary phenomenon in depth to explore causation. After reviewing the disaster recovery literature on trajectories of recovery, inequalities in the recovery resources, and plans for the recovery of public housing, three gaps and subsequently three research questions were identified. First, what are the specific vulnerabilities of public housing residents in the face of disasters? Second, how do the vulnerabilities of public housing residents shape the outcome of the recovery of these units in the aftermath of disasters? Third, how do recovery funding sources, plans, and policies influence the recovery of public housing unit? All these three questions direct this study to investigate the main question which is what are the obstacles for recovery of public housing units? In order to answer these questions, I applied descriptive statistics and mapping method to analyze various quantitative and qualitative data that is elaborated on in this chapter.

This study is part of a larger longitudinal and interdisciplinary recovery-based field study of Lumberton, North Carolina, conducted by the NIST-funded Center of Excellence (CoE) on Risk-Based Community Resilience Planning with collaborators from the National Institute of Standards and Technology (NIST). The CoE is headquartered at Colorado State University (CSU) in Fort Collins, Colorado and includes collaborations with engineers, economists, and sociologists from 12 universities across the United States including Iowa State University. Collectively, this team of researchers is working to understand what makes a community resilient – or able to bounce back – in the face of a disaster.

The CoE field study in Lumberton focuses on several aspects of community resilience following the flooding that occurred due to Hurricane Matthew. All the universities involved in the field study effort have signed an Internal Review Board (IRB) Authorization Agreement (IAA), that designates the CSU and NIST as the lead institutions for the field study protocol review and approval (Van de Lindt et al., 2018) (See Appendix A).

### **3.1 Case Study**

A case study research is formed by identifying, describing, and analyzing a specific example. This research approach is instrumental when a research question is proposed, and perplexity exists, where there is a need for general understanding and a feeling that we can gain insights into the research question by investigating a specific case (Creswell & Poth, 2018). Case study research attempts to examine a specific phenomenon in depth to explore causation (Yin, 2014). In this thesis, in order to investigate the challenges of recovery for public housing residents in the aftermath of a disaster, I chose a community in the process of recovering following a hurricane as a case study. I aim to have an in-depth and detailed exploration of public housing developments' recovery in Lumberton in the aftermath of Hurricane Matthew to understand the disparities in the recovery of these residential units in comparison to the privately-owned units.

In my research, I use both qualitative and mapping procedures to find the answers to my research questions. The analyses cover three distinct categories including an examination of vulnerabilities of the city and the public housing developments, correlation between these vulnerabilities and the outcome of recovery, and the impact of policies, financial sources, and plans on their recovery. These analyses are conducted using various data sources including the American Community Survey (ACS)-5-year estimations at block group level, survey data collected in two longitudinal studies of residential units' recovery, interviews, field notes,

media content about Hurricane Matthew, and governmental document reviews including HACL's strategic plan and a CDBG-DR action plan.

### **3.2 Social Vulnerability Analysis**

To investigate the specific vulnerabilities of public housing in the wake of disasters, I used quantitative analysis. Thus, using the 2015 American Community Survey (ACS) 5-year estimation data at the block group level, I created a social vulnerability map (See Figure 4.6 in next chapter). I used 2015 ACS data to conduct an analysis of the social vulnerability of the city before the occurrence of the floods which resulted from Hurricane Matthew. The primary objective was to find the spots of social vulnerability in the city to investigate the relationship between vulnerability, damages, and recovery outcomes. I chose ACS data as secondary source data that would provide acceptable resolution to identify the homogenous clusters of the socially vulnerable populations. Similarly, block-group level data was used because it offers an opportunity to measure a range of information about the social vulnerability in a sufficiently small spatial scale that represents more or less homogenous neighborhoods. In my research, I utilized Van Zandt et al. (2012) methodology in mapping social vulnerability in which I have a social vulnerability index weighted by block groups.

To create the social vulnerability map, 17 indicators were used to identify the socially vulnerable populations. The indicators offered a variety of factors. Factors related to household structure (such as single-parent household with children), age (children below 5, individuals above 65, and individuals above 65 living in poverty), transportation dependence (have no car or rely on public transportation), housing characteristics (vacancies, mobile homes, group quarters), minority, poverty, educational and employment status, and language skills (Van Zandt et al., 2012). To simplify the comparability among block-groups and in every case, each of these indicators was converted to a proportion between 0 to 1 by a related

base. The block group's proportion that is closer to 1 has a higher concentration of the vulnerable groups that display the particular characteristic of vulnerability in that block group.

*Table 3.1 Social Vulnerability Indicators*

<b>Base Social Vulnerability Indicators (Percentages)</b>
Single parent households with children/ Total Households
Population 5 or below/Total Population
Population 65 or above/Total Population
Population 65 or above & below poverty/ Pop. 65 or above
Workers using public transportation/ Civilian pop. 16+ and employed
Occupied housing units without a vehicle/ Occupied housing unit
Vacant Housing units/Total housing units
Persons in renter occupied housing units/ Total occupied housing units
Non-white population/Total population
Population in group quarters/Total population
Housing units built 20 years ago/Total housing Units
Mobile Homes/Total housing units
Persons in poverty/Total population
Occupied housing units without a telephone/Total occupied house unit
Population above 25 with less than high school/Total pop above 25
Population 16+ in labor force and unemployed/Pop in Labor force 16+
Population above 5 that speak English not well or not at all/Pop >5

*(Source: Van Zandt et al., 2012)*

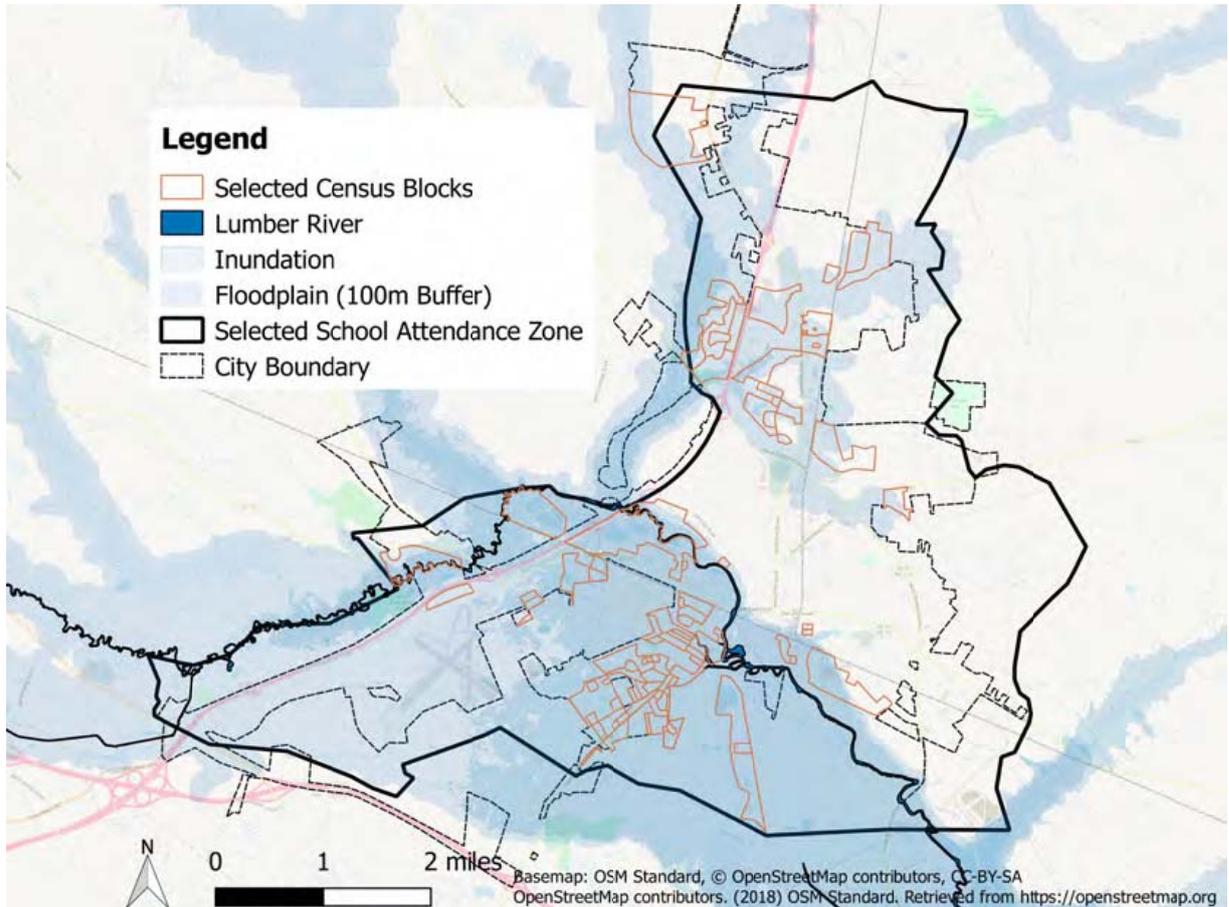
Consequently, by adding across all these 17 indicators, I created a combined social vulnerability score that indicates distribution of social vulnerability within and across the various block-groups in a community. In order to correct these indicators to be reliable for all block groups with different population densities, the social vulnerability scores were weighted by the population density of each block-group. With this correction, it can be assured that there is no bias in each block-group with high social vulnerability scores and low populations in the block-group.

Finally, these scores were shown on the map of the city using Geographic Information System (GIS) software. All the scores were shown as a detailed Choropleth map in Arc-GIS including, low (0-25 percentile), medium (25-75 percentile), and high (75-100 percentile) social vulnerability for block-groups. This social vulnerability map was overlaid with the location map of the public housing developments to find the relation between the location of these complexes and the socially vulnerable neighborhoods in the city, as well as investigating the specific factors that cause a social vulnerability in these developments. This map was also used in composition with the survey results to examine the effect of social vulnerability of the block-groups on the outcome of the recovery of residential units and the public housing units.

### **3.3 Social Vulnerability Impacts on the Recovery Outcomes**

To explore the impacts of social vulnerabilities on the recovery outcome and the recovery of public housing in the aftermath of disasters I used both mapping and descriptive statistics. For this study, I applied the results of two households' surveys that were implemented by CoE through two waves of a longitudinal study in December 2016, shortly after Hurricane Matthew and in January 2018, 14 months after the Hurricane.

The sampling goal of the household surveys was to provide a representative sample of housing units and the households occupying the units in the school attendance zone for Lumberton Junior High which represents the study area.



*Figure 3.1 Target sampling area with sample blocks (Van de Lindt et al., 2018)*

Figure 3.1 shows the school boundary that includes Lumberton and adjacent areas to the city. This boundary includes areas that were inundated by the floods and the regions that were not impacted directly. The samples had variability and representativeness of Lumberton regarding damage (flood heights and structural damage), socio-demographic characteristics of the population (race/ethnicity, income, and tenure), and housing types (single family detached and attached, and various forms of multi-family structures) based on the 2010 decennial census, updated where possible by the 5-year ASC estimates (2011-2015) (Van de Lindt et al., 2018).

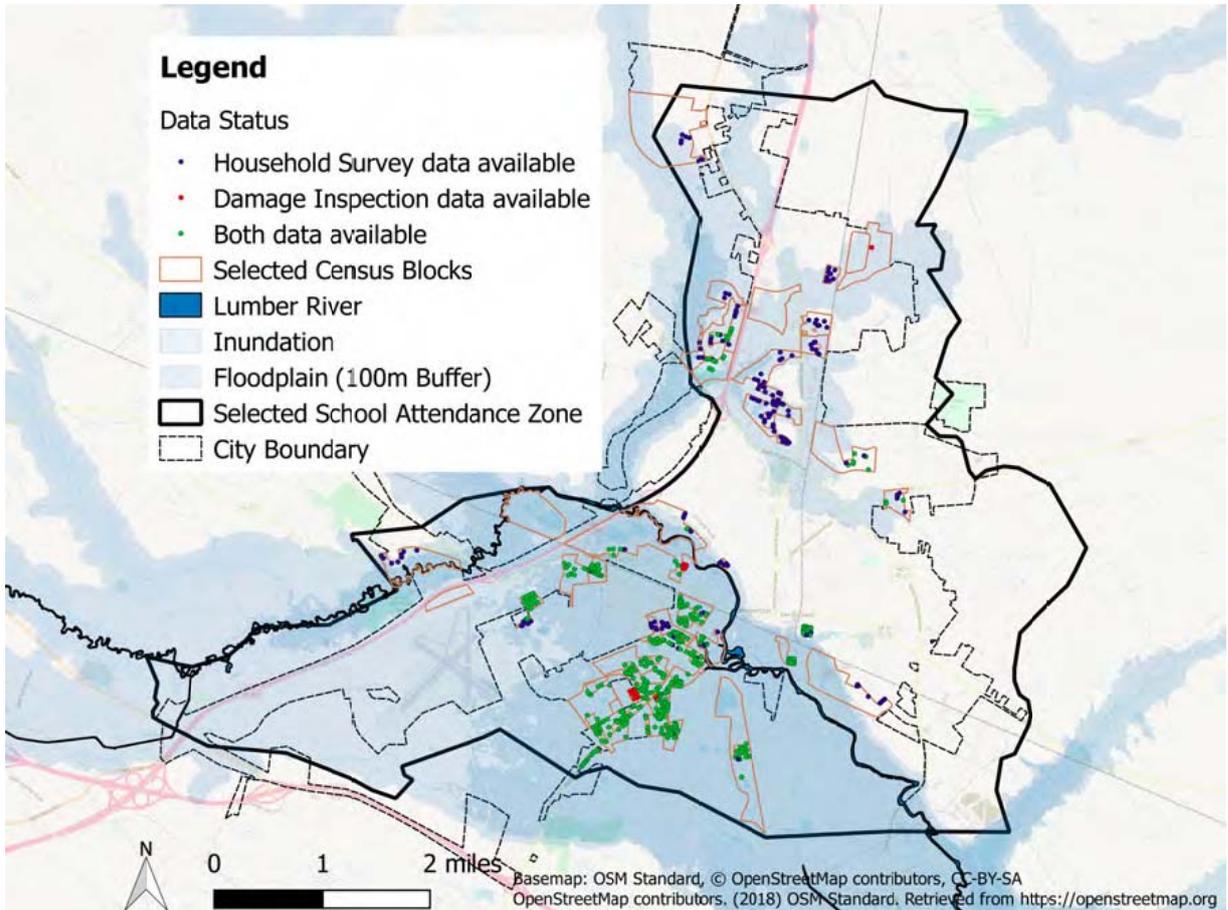
The sampling strategy was a two-stage non-proportional stratified cluster; one including the penultimate sampling units using census blocks, and the other containing primary sampling units utilizing housing units and the households residing in the units. This strategy had the advantage of face-to-face surveys in a spatially separated region. Sampling was developed using boundary files for block and census data on the population data, households, race and ethnicity, and housing types gathered from U.S. census website. Using a probability proportion to size (PPS) random sampling procedure to select the penultimate sample units (blocks), blocks in high probability flooding areas selected 3 to 1 over low probability flooding regions. The housing units were then chosen randomly with a fixed rate of 8 units per block. This sampling strategy assured a representative sample of the area (Van de Lindt et al., 2018).

Implementing this sampling strategy included the following steps. First, all census blocks that are within the school zone and within the 100-year as well as 500-year floodplains which were identified and supplemented by additional information regarding likely inundation areas within the school attendance zones. This resulted in 1,153 blocks with 9,714 housing units identified as falling completely or intersecting with the Lumberton Junior High school boundary area. Of these, 323 blocks were dropped from the sample because they had too few housing units ( $< 5$ ). Therefore, 830 blocks with 5 or more occupied housing units were sampled. Out of these blocks, 168 fell either entirely or partially into the high- or low-probability flooding areas within the school district. The remaining 662 blocks were outside of the focus areas. Thus, 168 blocks were within our sample frame which included 79 with low probability and 89 with high probability of experiencing flooding. A random sample of 80 blocks based on a PPS (proportion of the sampling area's housing units

(HUs)), and oversampling blocks in high probability flooding areas were sampled. In the end, the sample included 56 census blocks in the high probability and 24 in regions with low probability flooding. These census blocks contained 3,617 housing units, 3,320 (91.8 %) of which were occupied with 297 (8.2 %) being vacant.

Following the selection of the census blocks, the US Census data on housing units of the blocks were merged with Google mapping data, Google Street View, and tax portfolio parcel data to detect the numbers and locations of structures and identify housing units within structures that are in the block. Among these 80 blocks of the initial sample, a fixed number of eight HUs were randomly selected with an additional random selection of two HUs as replacements. These replacements were essential if initially selected HUs were not actual residential HUs or if households could not be located or surveyed (e.g., hard refusals, no adult, no access).

After the field assessments were completed by the team, two census blocks were decided to be dropped from the high flooding probability areas: one block that was recognized as unsafe for teams to enter, and one block that had no housing units in contrary to the census data. Additionally, a number of blocks in the low probability flooding areas, mostly in the northern section, were well away from the inundation areas and had no risk of flooding. These blocks were therefore given low priority in terms of data collection since the overall sample provided excellent coverage of the impacted and unimpacted units. Finally, 75 of 80 census blocks, including 54 of 56 in the high probability of flooding damage regions and 21 of 24 blocks in the low probability areas, were visited.



*Figure 3.2 Sampled housing units and final data status indicated in selected census blocks (Van de Lindt, 2018)*

Figure 3.2 shows the study area and the blocks where the household units' data were collected. In the final analysis, 568 valid primary housing units (Average of 7.6 HUs per block) were visited (Van de Lindt et al., 2018).

In this thesis, I utilized damage assessments, as well as the household surveys data for the analyses. The damage assessments were provided by the CoE team considering the physical condition of the building and other engineering parameters and ranging from 0 to 4. These damage assessments were shown in a unique value map in ArcGIS to be overlaid with the social vulnerability map. I employed the damage assessment map of household surveys

for the 568 random samples of residential units in 2016 to overlay this data with the social vulnerabilities map to investigate the damage distribution in the ArcGIS platform.

*Table 3.2 Damage description for residential units*

<b>Damage</b>	<b>Description</b>
<b>State Level</b>	
0	No damage: water may enter crawlspace or touch foundation (crawlspace or slab on grade) but water has no contact to electrical or plumbing, etc. in crawlspace, and no or limited contact with floor joists. No sewer backup into living area.
1	Minor water enters house; damage to carpets, pads, baseboards, flooring. Approximately 25.4 mm (1 in), but no drywall damage. Touches joists. Could have some mold on subfloor above crawlspace. Could have minor sewer backup and/or minor mold issues.
2	Drywall damage up to approximately 0.3 m (2 ft) and electrical damage, heater and furnace and other major equipment on floor damaged. Lower bathroom and kitchen cabinets damaged. Doors or windows need replacement. Could have major sewer backup and /or major mold issues.
3	Substantial drywall damage, electrical panel destroyed, bathroom/kitchen cabinets and appliances damaged; lighting fixtures on walls destroyed; ceiling lighting may be ok. Studs reusable; some may be damaged. Could have major sewer backup and/or major mold issues.
4	Significant structural damage present; all drywall, appliances, cabinets etc. destroyed. Could be floated off foundation. Building must be demolished or potentially replaced.

*(Source: Van de Lindt et al., 2018)*

In addition, I conducted an analysis of the relationship between social vulnerabilities and the sites of public housing units as well as the impact of the disaster on these units using ArcGIS software. Then, using the household surveys of the 568 samples from January 2018, I compared the recovery outcome of the public housing units with the rest of residential units one year after the disaster to draw out the disparities in recovery outcomes. I mapped the data that was collected in the 2018 household survey by the CoE team to show the housing units occupancy status in ArcGIS which was then overlaid with the social vulnerability map. Therefore, the impact of social vulnerability factors on the pace and quality of the recovery

of public housing units were investigated in comparison with other housing units in Lumberton.

### **3.4 Qualitative Analysis**

My approach to investigate the impacts of funding, policy-making, and planning on the recovery of public housing was through qualitative analysis. I analyzed interviews I conducted with various stakeholders as well as media and various official documents' content. I reviewed the media content from October 8 of 2016 to December 2019 and found 25 relative articles. I organized the articles to gather information about the damage losses, financial aid allocations and distributions to the HACL, recovery policies and plans of the state and the city for the recovery of public housing units, and residents' displacement and return to their public housing units. In addition to the media content, I reviewed the HACL strategic plans and the CDBG-DR action plans to identify the projects and funding allocations for the recovery of public housing developments. These media and official document reviews helped me to collect data as well as find the names of the critical stakeholders, governmental agencies, non-profits, advocates, and charities that were involved in the recovery of public housing developments.

This media review provided me with a purposive list of the public housing recovery key actors that I needed to interview in order to obtain detailed information on how local officials and stakeholders addressed the recovery of public housing units and what they defined as the challenges for the recovery of these units. These participants were contacted through emails and phone calls based on their involvement in the recovery efforts and their job titles. My qualitative interviews were conducted in December 2018 with 14 community leaders and key stakeholders including local officials and non-profits in Lumberton (See Appendix B). These interviews were done as a part of the CoE study and were funded by the

NIST Center of Excellence. Each of the interviewees was informed about the goal of the project at the beginning of the interview and was asked to sign a consent form (See Appendix C).

The interviews were conducted using a semi-structured interview guide (See Appendix D) that asked questions about the affordable housing needs, damage and displacement assessments, recovery plans and their progress, funding resources, and the recovery obstacles for public housing developments. The questions were open-ended to give the interviewees the opportunity to share their information without any restriction. The interviews were all conducted face-to-face, except for one that was conducted via phone, and lasted between 45 minutes to 100 minutes. Thirteen interviews were audio recorded, with one not recorded due to the interviewee declining the request to be recorded, and complimented with the field notes. These interviews provided significant real numbers of the damages, displaced families, funding allocation and disbursed money, as well as an excellent insight into the obstacles of public housing recovery.

All the interviews with local authorities and officials were transcribed and uploaded into Atlas.ti for the qualitative analysis. This coding helped me to reduce the massive amount of data to focus on more in-depth and nuanced insights. I coded the data in order to move toward a specific understanding of social vulnerabilities of public housing residents, their recovery outcome, and the differences of their recovery in comparison with the other residential units. I developed a coding system such as what Saldana (2016) describes as categories and subcategories to push my codes to a conceptual one. I categorized the codes into four significant groups based on my research questions including social vulnerability, disaster impact, recovery outcome, and recovery disparities. Each of these code groups

included some detailed codes that all together produced the insight into the relations and patterns in the data to have a coherent story of the challenges. The final list of codes consists of four major categories, and 36 subcategories in order to best describe the data (See Appendix E). This coding system provided an overview of the data and an insight of the gaps in funding, policy-making, and planning for the recovery of the public housing units and how these gaps had impacts on the recovery outcomes of public housing units.

Additionally, I conducted interviews with seven public housing residents whom their units were damaged by the floods in the aftermath of Hurricane Matthew to explore their specific vulnerabilities. These interviews were conducted in April 2019. Each of the interviewees was informed about the goal of the project at the beginning of the interview and was asked to sign a consent form (See Appendix F). The interviews were conducted using a semi-structured interview guide (See Appendix G) that asked questions about the displacement and recovery experience of public housing residents. The interviews were conducted face-to-face and lasted between 15 minutes to 45 minutes. The interviews were all audio recorded, but were not coded. These interviews provided significant real challenges of displaced families, as well as an excellent insight into the vulnerabilities of public housing residents.

### **3.5 Limitations**

This study did not face significant challenges or limitations. However, there was no access to the detailed information about the sociodemographic characteristics of the public housing tenants. Therefore, the weighted social vulnerability index could not be considered for public housing developments separately. In addition, there was no possibility to have interviews with the public housing residents whom their units got significant damages and were sent to other housing authorities to be rehoused. This was due to the fact that the

housing authority does not keep documentation of them. However, I had discussions with seven public housing tenants who were rehoused in the public housing developments within Lumberton whom were not significantly flooded by Hurricane Matthew.

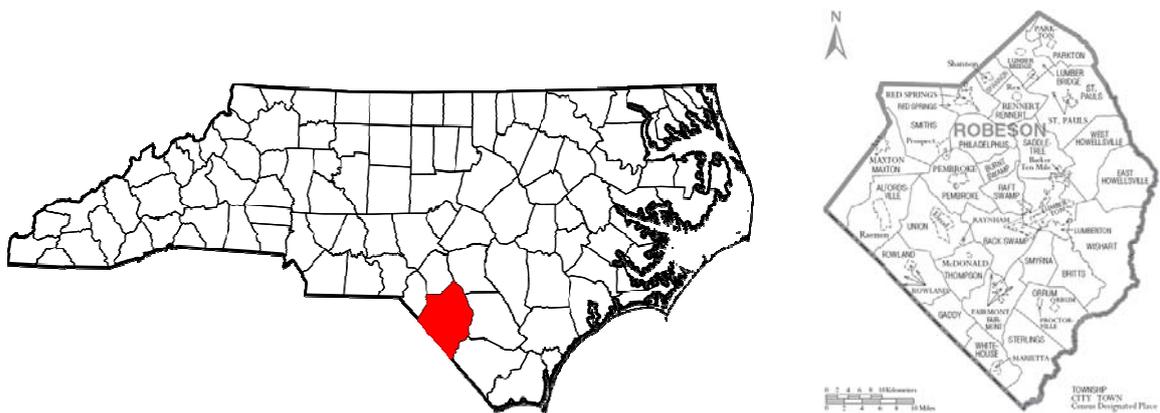
In the next chapter, I will elaborate on the results of the analysis to outline the challenges of the recovery of public housing units in Lumberton in the aftermath of Hurricane Matthew. In the first section, I will provide a background of the case study. I will then, show the vulnerability maps and how vulnerabilities impact on damages and the recovery outcomes. The analysis of the interviews is also provided. Finally, I will discuss the findings of this study.

## CHAPTER 4. FINDINGS AND DISCUSSIONS

In this chapter the findings of this study are elaborated and discussed. In the first section, I provide a description of the case study and discuss public housing in Lumberton, the impacts of Hurricane Matthew, as well as resources and policies for recovery of the public housing units. In the following section, I explore the findings related to each of the research questions. Social vulnerability is mapped, and the specific vulnerabilities are presented to explore the relationship between social vulnerability and the damages, as well as public housing recovery pace. The impacts of funding and policies on the recovery of public housing are also examined. In the last section of this chapter, I provide an updated discussion of findings in the Lumberton case study.

### 4.1 Case Study Overview

The city of Lumberton is the county seat of Robeson County and is located in the coastal plain region of southeastern North Carolina.

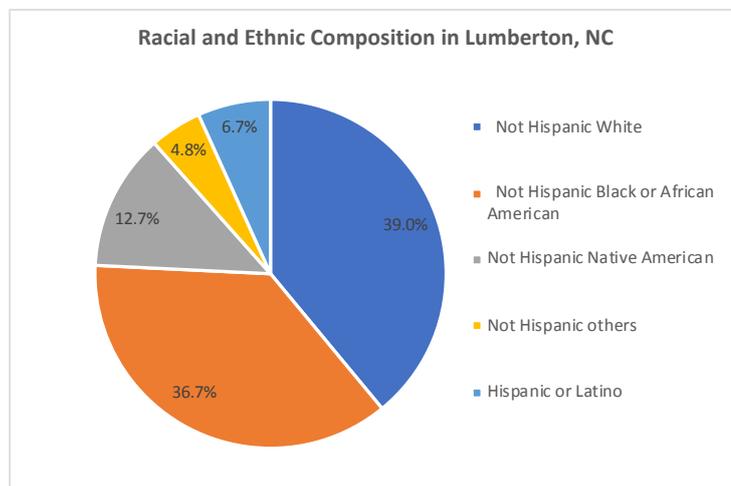


*Figure 4.1 Robeson County in North Carolina highlighted in red (left) and cities including Lumberton in Robeson County (right).*

Lumberton was founded in 1859. The town was named Lumberton because the Lumber River bisects the city. It is believed that the Native American name of Lumbee was

initially used for the river which comes from an indigenous word that means “black water” (Van de Lindt et al., 2018). The river is a National Wild and Scenic River according to the North Carolina General Assembly and is a part of the North Carolina Natural and Scenic River System. It is believed that Native Americans may have lived in the region since 20,000 B.C. and the river and its swamps were the homes of several displaced Native American tribes of the coastal region as Europeans advanced westward. Lumber River is classified as a natural, scenic, and recreational site. Recreational activities include canoeing, boating, hunting, fishing, and picnicking, and the areas is also home to several archaeological sites (City of Lumberton, n.d.).

According to the United States Census Bureau, Lumberton spans 15.8 square miles and has a population of 21,707. Lumberton is a diverse community with 39% non-Hispanic White, 36.7% non-Hispanic Black, and 12.7% Native American population, according to 2015 5-year ACS estimates.



*Figure 4.2 Racial and ethnic composition in Lumberton, NC based on 2010 Census data.*

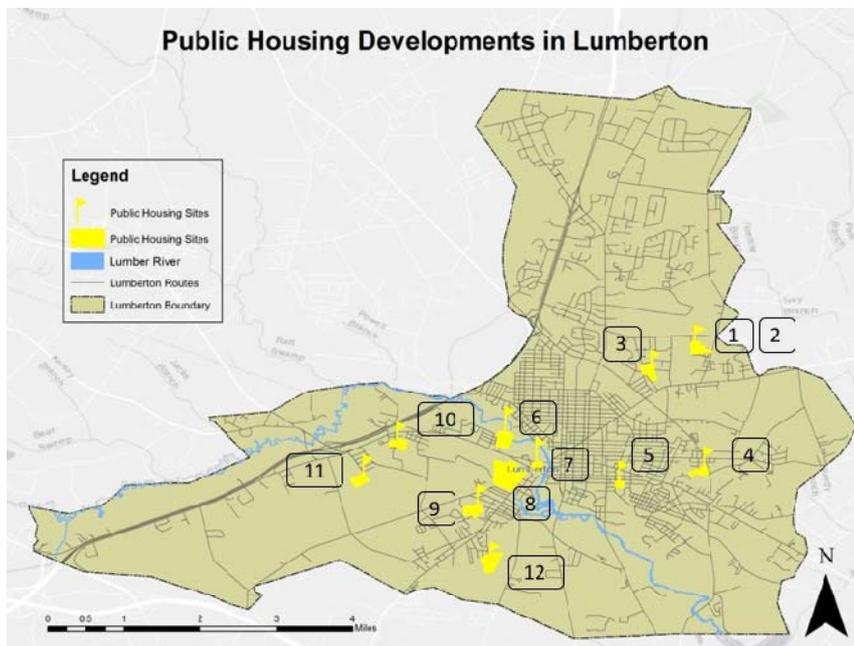
The city of Lumberton is considered as a “minority-majority community” (Van de Lindt et al., 2018) that may follow the general pattern of minority status in the U.S. in which

racial or ethnic standing are disproportionately correlated with poverty and unemployment. According to 2015 5-year ACS estimates, in Lumberton, 34.8% of the population lives at or below poverty levels, and the median household income is \$31,245 which is 62% of the median household income of the North Carolina State (which is currently \$50,584). According to the 2017 Housing Authority of City of Lumberton (HACL) annual plan, 53.3% of renters spend 30% or more of their income on rent, which means people were rent burdened prior to Hurricane Matthew.

#### **4.1.1 Public Housing in Lumberton**

HACL is located in Lumberton in Robeson County. It was established in 1949 to provide safe, clean, and affordable housing to low-income citizens with assistance to improve the quality of their lives. HACL is managed as a governmental unit, and is commissioned under N.C.G.S., the North Carolina General Statutes, statute 157 (Housing Authority of the City of Lumberton, n.d.). Under this statute, the mayor of Lumberton assigns a Board of Commissioners for HACL per state law. Currently, the seven-member board of commissioners serve five-year terms. At least one of the seven members must be a resident of the public housing units owned and managed by HACL. The board of commissioners are responsible for setting policy and to choosing the Executive Director. The board also has a day-to-day responsibility to guarantee that HACL works in compliance with HUD rules, regulations, and relevant state and local laws (Housing Authority of the City of Lumberton, n.d.). HACL is funded primarily through the U.S. Department of Housing and Urban Development (HUD). The office was previously located in Hilton Heights, which is one of the developments in King street. However, after being flooded during Hurricane Matthew, the office moved temporarily to a city government property located near the City Hall.

Before Hurricane Matthew, Lumberton had 729 public housing units in twelve developments that were all leased (HACL, 2017). The interim director of the Lumberton Housing Authority in 2016, Lemark Harris, believed that HACL was the largest housing authority in Robeson County (Shiles, 2017). Local officials who were interviewed for this study stated that Lumberton had 1,200 households on the waiting list for the section 8 housing vouchers. HACL had less than 596 activated vouchers before the floods, of which 450 were used by families for their housing. Figure 4.3 shows the location of the twelve developments in the city's school zone boundary. The information about each of the twelve complexes and their units are shown in tables 4.1 and 4.2 respectively. Table 4.1 shows that all the developments had been built more than 30 years ago. Two of the complexes were built more than 60 years ago which included 123 of the city's public housing units. Among these 12 complexes, two developments including Hilton Heights and Myers Park, which housed 72 units, are located in the 100-year floodplain area (HACL, 2017).



*Figure 4.3 Public housing development in the school zone of Lumberton prepared by the author.*

In Figure 4.3, each number represents one development. This is further detailed in Table 4.1. The table provides the information of each of the developments in terms of names, numbers of units, addresses and the year in which the complex had been built. Table 4.2 shows details about the units in terms of the number of bedrooms per units.

*Table 4.1 Public housing complexes in Lumberton.*

<b>NO</b>	<b>HACL properties in Lumberton</b>	<b>Total Units</b>	<b>Year Built</b>	<b>Address</b>
1	THE MEADOWS	40	1984	Meadow View Rd.
2	THE MEADOWS Ext.	24	1989	Meadow View Rd.
3	DAVIS HEIGHTS	60	1974	Turner Place
4	EASTWOOD TERRACE	50	1968	Eastwood Terrace
5	ROZIER HOMES	30	1950's	S Seneca St.
6	HILTON HEIGHTS	42	1979	King St.
7	MOHR PLAZA	100	1975	North Martin Luther King Dr.
8	TURNER TERRACE	100	1973	Spruce St.
9	LUMBEE HOMES	93	1950's	Lee Circle
10	MYERS PARK	30	1974	Arnold St.
11	TUDOR COURT	60	1974	West Dr.
12	WEAVER COURT	100	1968	Parmelee Ave.
	<b>Total Units</b>	<b>729</b>		

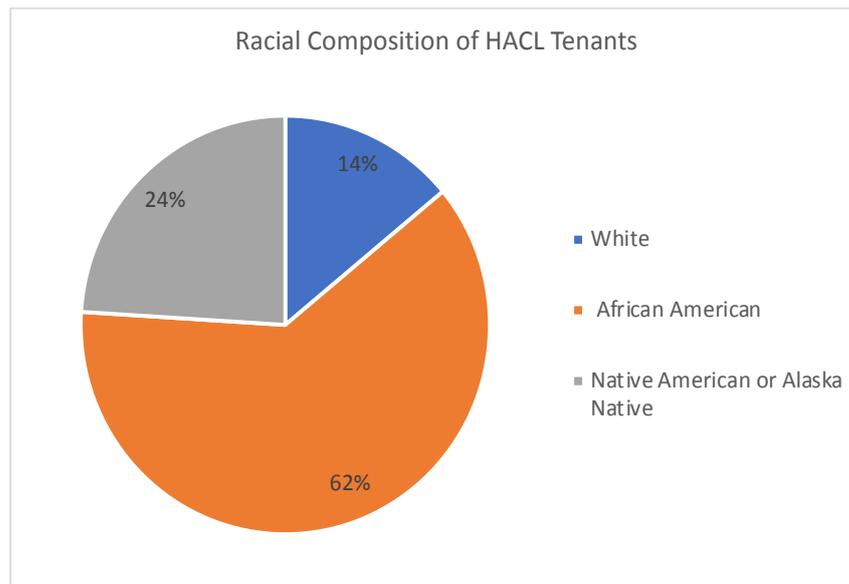
*(Source: HACL Archive)*

*Table 4.2 HACL units' details*

<b>HACL Units</b>	<b>Units</b>	<b>% of Total Units</b>
0 Bedroom	23	3.1
1 Bedroom	154	21.1
2 Bedrooms	234	32.1
3 Bedrooms	218	29.9
4 Bedrooms	85	11.7
5 Bedrooms	15	2.1
Handicapped	36	4.9
Sight and Hearing	15	2.1
<b>Total Units</b>	<b>729</b>	

*(Source: HACL Archive)*

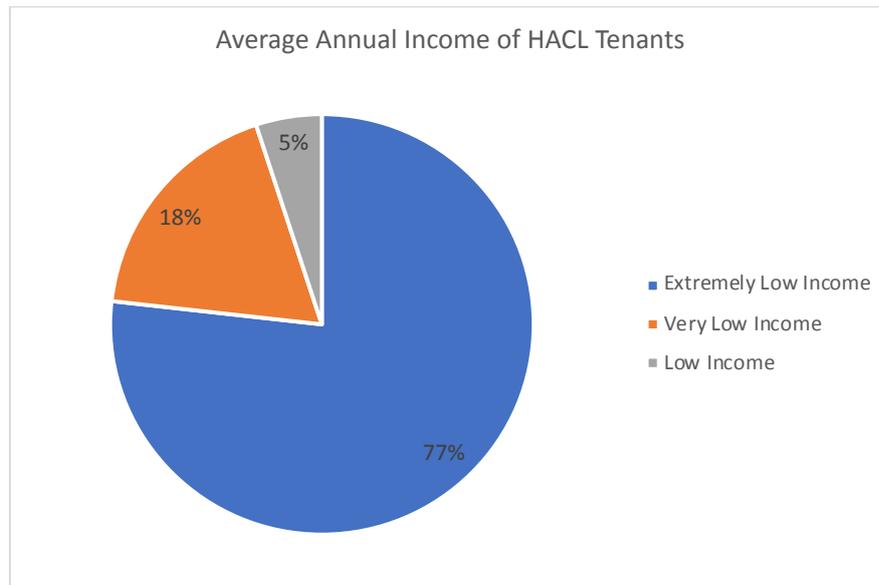
According to the 2017 HUD's public housing resident characteristics report<sup>6</sup> which was published after the Hurricane Matthew, HACL currently has 504 households in which 1244 tenants live. This means the average household size of the residents is 2.5 per unit. Half of the residents are below the age of 18, and 7% are above 61 years old. HACL tenants' race and poverty composition are shown in the following figures 4.4 and 4.5. In 2017, all of the tenants except one were non-Hispanic, based on the ethnicity of the household head. The majority of the residents are either African-American or Native American and are extremely low-income.



*Figure 4.4 Racial composition of public housing units in Lumberton, NC based on 2017 HUD report.*

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<sup>6</sup> Retrieved from <https://pic.hud.gov/pic/RCRPublic/rcrmain.asp>



*Figure 4.5 Average annual income of public housing residents in Lumberton, NC based on HUD report.*

#### **4.1.2 Impacts of Hurricane Matthew**

Lumberton was one of the devastated communities in North Carolina due to the flooding in the aftermath of Hurricane Matthew. The Lumber River water level rose on October 8th because of the heavy rain caused by Hurricane Matthew. Water and electricity services were disrupted in Lumberton immediately after the flood (Van de Lindt et al., 2018). Electrical power was completely restored by December 9th and water services was not fully resumed until October 15<sup>th</sup>, 2017.

In Lumberton, many of the residential units were damaged due to the floods induced by the Hurricane. The 2017 CDBG action plan for the State of North Carolina stated that 876 houses in Lumberton had sustained major to severe damages (State of North Carolina, 2017). These significant damages resulted in the displacement of a large number of individuals in the state. In the media, it was reported that 1400 individuals from Robeson County were sheltered at the height of the emergency phase (Futch, 2017). Reports showed that 355

families remained displaced even four months after the floods had receded. These displaced families were sheltered in hotels across the Robeson and Cumberland counties (Futch, 2017).

Around 35% of the public housing stock was affected by the floods (Dorsey, 2017). According to HACL information, 267 households of the 355 displaced families in Lumberton were residents of public housing units, which included 725 individuals (HACL, 2017). Some of these families were sheltered in the hotels and motels in Lumberton, Laurinburg, Fayetteville, Rowland, Charlotte, Spring Lake, and Durham, and some of them were sheltered by their relatives. Many of these families remained displaced for about six months after the Hurricane. HACL administrative office explained in their interviews that they only had shelter information documentation on 82 families including 246 individuals in the aftermath of the Hurricane. The rest may have found other housing options in other housing authorities around the county or other housing options for which HACL did not follow their activities anymore. HACL ceased tracking those residents who found a permanent house in other housing authorities.

HACL had estimates of the damages totaling \$8 million, with approximately \$5 million in remaining unmet needs by November, 2017 <sup>7</sup> (State of North Carolina, 2017). According to the 2017 HACL report, 145 units out of the 267 damaged units were covered by insurance, while the rest of the units did not have any flood insurance coverage. Among those insured units, 112 units suffered significant damages and 33 suffered minor damages. Considering that HACL had 729 housing units available before Hurricane and 276 of those were damaged by the floods, HACL retained 462 available housing units for lease after the

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<sup>7</sup> Unmet needs are defined as necessary expenses and serious needs that are unmet through insurance or other means (State of North Carolina, 2017)

hurricane, which still made this authority the largest housing authority in Robeson County (Shiles, 2017).

#### **4.1.3 Resources and Policies for the Recovery**

In an interview published in local media, HACL Executive Director, Adrian Lowery stated that FEMA was providing 75% of funds for HACL recovery projects through public assistance aid. The rest of the funds were to be allocated by the state government to restore the public housing units (Hunter, 2017). In August 2017, HACL director declared that FEMA had allocated \$13 million of funds to HACL for the recovery programs. FEMA approved funding for the 16 public assistance projects HACL had requested aid for in order to facilitate the recovery work. HACL Executive Director stated that the members of HACL Board of Commissioners and FEMA representatives had a meeting in which HACL was declared eligible for \$13 million in recovery assistance. The director also announced that this money would be reimbursed to the housing authority. Reimbursement meant that HACL was responsible to spend money on debris removal, hazard mitigation, and recovery projects, and would receive the allocated fund after completing FEMA's audit at the end of each of the projects (Shiles, 2017b).

In addition to FEMA funds, insurance also covered \$3 million of the reconstruction projects (Reeves, 2017). Moreover, the State of North Carolina in the CDBG-DR action plan allocated \$5 million to HACL for the unmet needs of the public housing development in Lumberton. In this situation, unmet needs were defined as necessary expenses and serious needs that are unmet through insurance or other means (The State of North Carolina, 2017).

In terms of recovery plans, HACL planned for the aftermath of Hurricane Matthew to relocate two developments, Myers Park and Hilton Heights which housed 72 apartments, outside of the 100-year floodplain. Therefore, for more than two years after the floods,

HACL scheduled Myers Park and Hilton Heights as “off-line”<sup>8</sup> and made the 72 units vacant. Offline units are excluded units from the leasing list with HUD approval because of their vacancy due to natural disaster or casualty loss, market conditions, etc. In addition, HACL planned to develop three of the complexes, Mohr Plaza, Turner Terrace, and Weaver Court, with a deconcentration policy for development. Deconcentration is a policy that was ruled by HUD in 1999 to assure fair housing and eliminating poverty concentration in public housing developments. In this policy, HUD required public housing agencies to decide an overall average income for the households of their developments; describe each building as higher income or lower income based on the average income in the building; and admit lower income households to higher income units and higher income families to lower income buildings. Public housing developments which house only elderly persons or persons with disabilities, or both, are exempted from this policy (HUD, 2001). Therefore, Mohr Plaza was excluded from this plan due to the condition of its residents whom were disabled and elderly. In the HACL 5-year plan, Lumbee homes was also planned to be modernized and renovated to have physical and management improvements (HACL, 2017).

The mentioned allocations and plans may seem perfect for the recovery of the public housing units in terms of having plans and funds, however, two years after the hurricane, 182 out of 267 damaged public housing units are still abandoned or not repaired. This delay in the recovery was investigated by interviews that were conducted with the administrators of housing authority of the city of Lumberton and other local officials. Findings from the interviews will be further discussed in the third research question’s section.

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<sup>8</sup> [https://www.hud.gov/program\\_offices/public\\_indian\\_housing/systems/pic/faq/dev](https://www.hud.gov/program_offices/public_indian_housing/systems/pic/faq/dev)

## **4.2 Findings: Response to Research Questions**

In the following sections, the analysis and findings related to the research sub-questions are explored. These findings help this research to outline the obstacles of public housing recovery. First, I examine the specific vulnerabilities of public housing residents in the face of disasters. Second, I explore the relationship between the vulnerabilities of public housing residents and the damages as well as recovery of these units in the aftermath of disasters. Third, I examine the impacts of funding sources, plans, and policies on the recovery of public housing units.

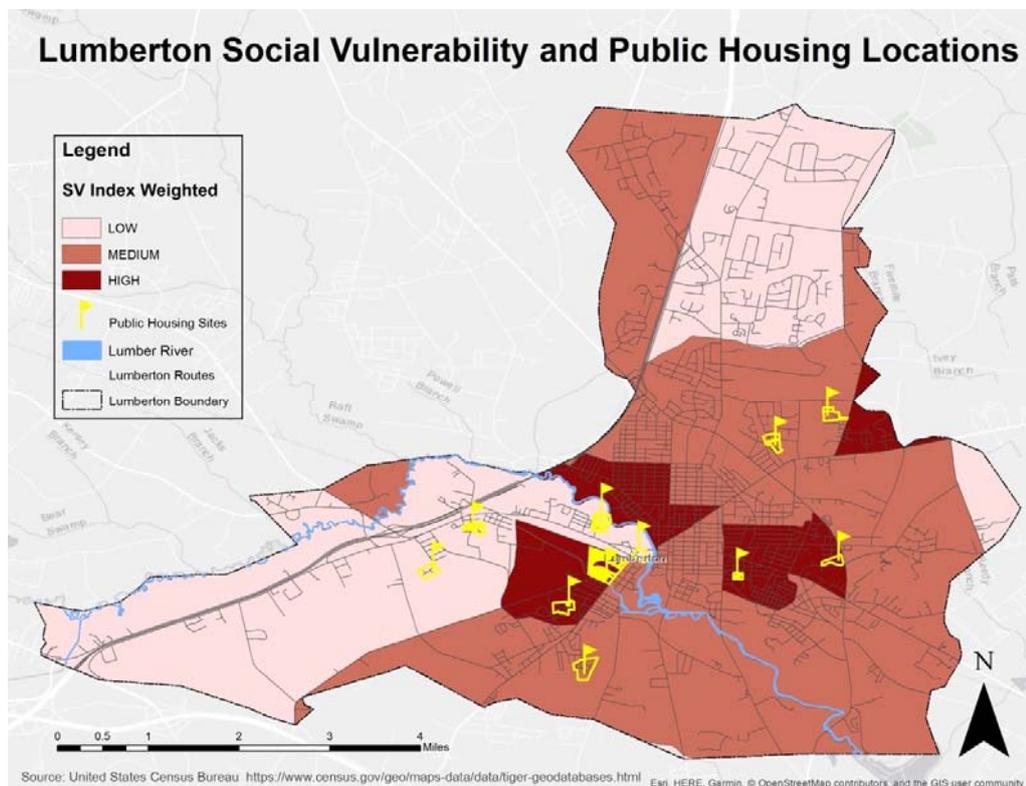
### **4.2.1 First Research Sub-Question: Social Vulnerability and Public Housing**

The purpose of the first research question was to investigate the specific social vulnerabilities of the public housing residents. Using Van Zandt and co. (2012) methodology, a social vulnerability map was produced. Lumberton is a poor community, not only in Robeson County and North Carolina, but also in comparison to the nation at large. According to the 2015, 5-year ACS estimation, 52.3% of the residents of Lumberton are renters which is a relatively large percentage of renters. The majority of the houses in this city are located in the old structures since only 10% of the units have been built since the year 2000.

The population is densely located in the central part of Lumberton. However, minority renters with school children are concentrated in the southern parts of the city (Van de Lindt et al., 2018). Not surprisingly, the city is a socially vulnerable community, where the majority of the block groups have a weighted social vulnerability index with medium to high scores (See Figure 4.6). The analysis shows housing tenure, race, poverty, and age of the housing units make up the largest portion of the social vulnerability scores in the block groups of Lumberton.

The high percentage of old structures increase the probability of high percentages of damages in the face of disasters. The combination of high poverty with a high percentage of minority populations indicates the possibility of being impacted by disasters disproportionately in terms of damages and displacement as well as having difficulties in overcoming these impacts in post-disaster contexts. Also, a higher proportion of rental housing does create the potential for generating larger displaced populations whom have serious challenges finding temporary and permanent housing.

Figure 4.6 displays the weighted social vulnerability composite measures overlaid with the public housing complexes map to identify the relationship between the social vulnerability of the city and these complexes. The map displays that the majority of public housing units are concentrated in the socially vulnerable block groups in the city.



*Figure 4.6 Social vulnerability in block group level with the public housing developments location prepared by the author.*

Based on the social vulnerability map and the developments' location, 273 units of the public housing developments are located in the neighborhoods with high social vulnerability and 224 units in the block groups with the medium weighted index scores, as indicated by dark red on the map. Therefore, around 68% of the public housing units are in neighborhoods with medium and high social vulnerability.

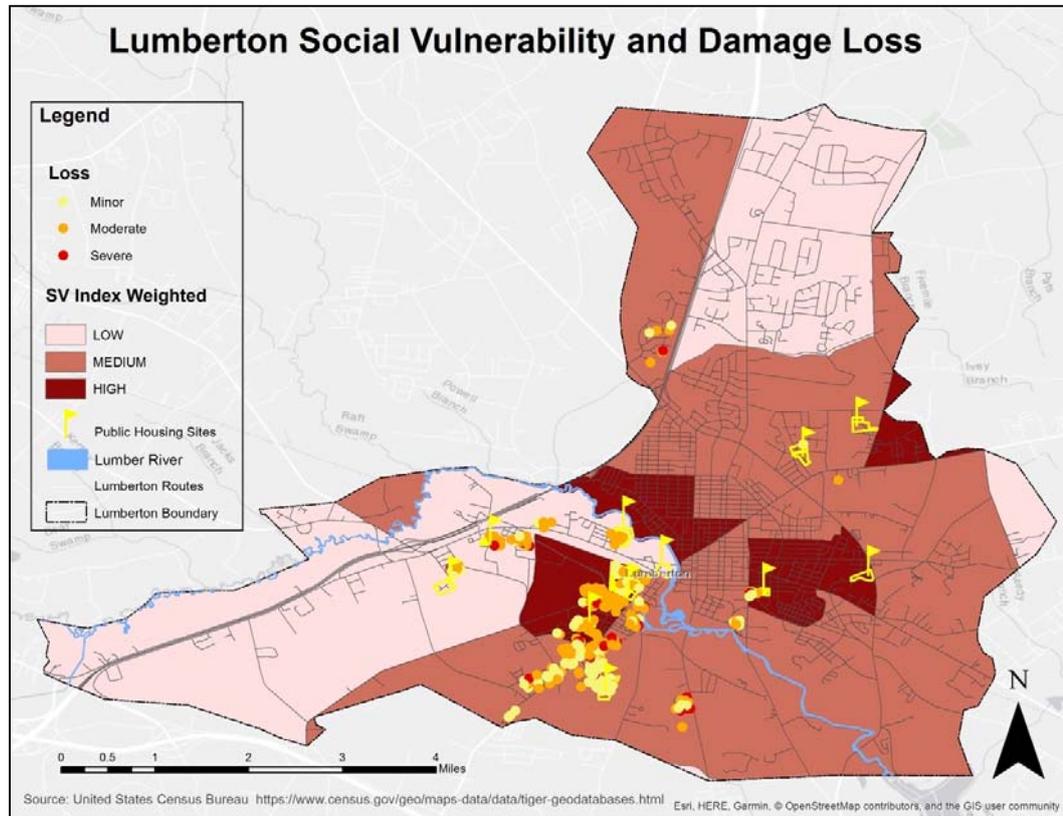
Surprisingly, four of the developments including Hilton Heights, Myers Park, Mohr Plaza, and Tudor Court, with a total of 232 units, are located in block groups with low social vulnerability. However, these complexes are located in the poorest region of the city based on the field observation and interviews. Closer inspection of the results shows that the raw score of social vulnerability in this block group is high. Nonetheless, the population density is low in this region because of the broad area of this block group.

This combination of findings shows that the high proportion of rental units, minorities, and poverty in the block groups of public housing developments have the potential of increasing difficulties for the residents in terms of overcoming disaster impacts. These findings show that these block groups have the possibility of creating a large displaced population who have difficulties with finding temporary housing and full recovery. It was mentioned before that half of the residents of public housing development are children. This means that the block groups with public housing developments have challenges with the evacuation and providing day care services to the impacted families in post-disaster context. Moreover, dislocation of the public housing residents and their children may have negative effects on school and community recovery in disaster contexts.

#### **4.2.2 Second Research Sub-Question: Impacts of Vulnerability on the Damages and Recovery**

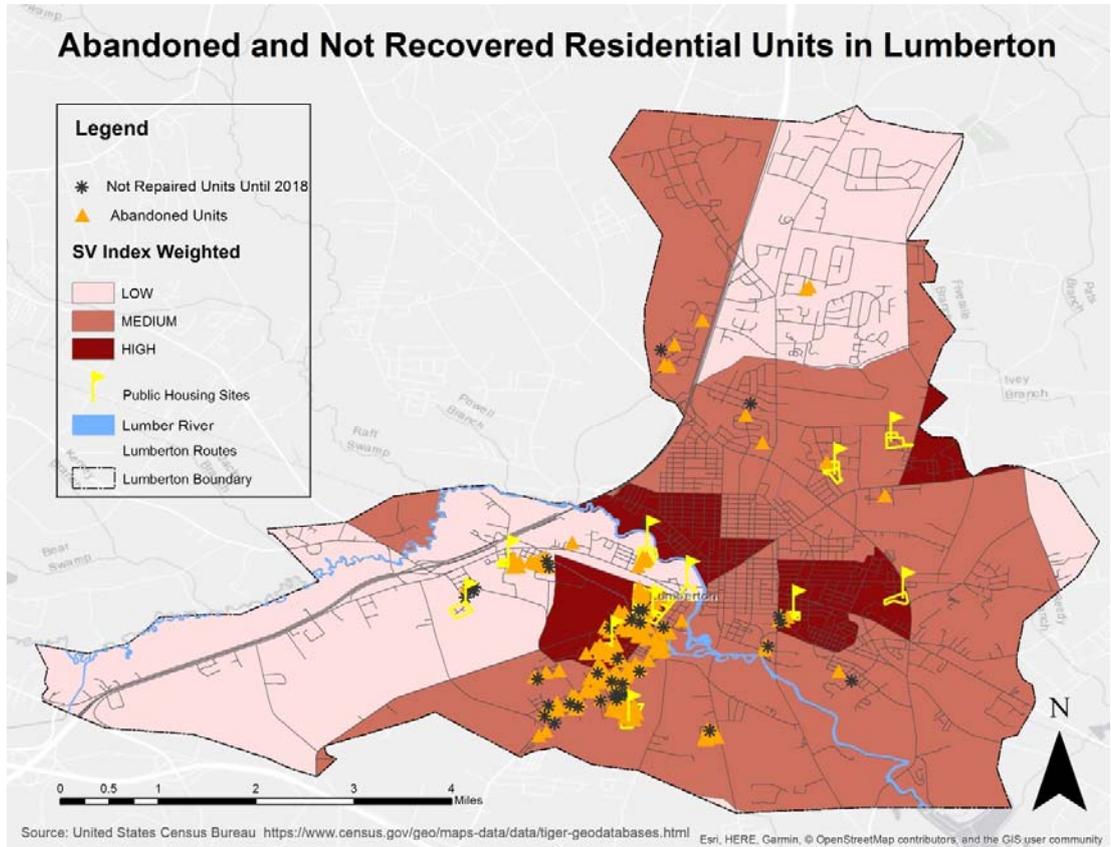
The second research question aims to investigate the impacts of public housing residents' social vulnerabilities on their housing damages as well as their overall recovery outcomes. In order to explore the second research question, this study used the data of two CoE field study waves in Lumberton in 2016, right after Hurricane Matthew, and in 2018, about fourteen months after the hurricane. These sets of data include damage assessments of the sampled structure losses in the aftermath of the floods and the household recovery surveys in 2018, in which the status of the sampled units in terms of recovery, repair, or abandonment are provided.

The map of damage losses and social vulnerability are overlaid to investigate the relationship between social vulnerability and the damage loss of the residential units and the public housing developments. Figure 4.7 displays the distribution of damaged homes on the map in which different colors show the levels of damage. Based on the map, most of the damaged homes, around 84%, are concentrated in block groups with medium or high social vulnerability. According to the sampled residential units, around 68% of privately owned and 36% of public housing units suffered moderate to severe losses.



*Figure 4.7 Damage assessment of the residential units with the social vulnerability map prepared by the author.*

Similar to the above damage assessment map, the recovery map is overlaid with the social vulnerability map. This map was prepared based on the status of the residential sample in January of 2018 shown in Figure 4.8. Based on the map, 85% of abandoned units are located in block groups with medium or high social vulnerability. Additionally, a third of the damaged units are still not repaired fourteen months after Hurricane Matthew, and 81% of these unrepaired units are located in block groups with medium or high vulnerability. Based on the sampled units, fourteen months after the floods, two-thirds of the public housing units remained abandoned, whereas a third of damaged privately-owned units were still vacant. This abandonment percentage is based on the sampled units' status.



*Figure 4.8 Recovery outcome with the social vulnerability map prepared by the author.*

The high percentage of abandoned and unrepaired units have negative impacts on the low-income housing stock in the city. Also, the lengthy and protracted housing recovery results in longer dislocations that have negative impacts on the displaced families and can even result in the failure of local businesses. This may affect the social and economic aspects of community recovery and cause additional delays in community rebounding in post-disaster contexts.

In addition to the abandoned sampled units, there are also some evacuated apartments in these 12 developments based on HACL documents and the field observations. There are 72 public housing units which have been considered as off-line during the past two years

after the floods. While these units are not located in the socially vulnerable neighborhoods, they are in the 100-year floodplain areas. These units were abandoned after Hurricane Matthew to be relocated to a safe site in terms of floodplain areas in order to mitigate future flood risks. However, two years after abandonment, these units have not yet been relocated. This means that 72 individual households were displaced for an uncertain length of time. This dislocation has negative impacts on the displaced families whom lost their local networks and resources.

Based on the interviews with HACL administrators in December 2018, two years after Hurricane Matthew, only 85 of the 267 damaged units are restored and less than 50% of the displaced residents have returned to Lumberton. From those 267 damaged units, 182 apartments have still not recovered. Fourteen of these were damaged again two years after Hurricane Matthew by the floods induced by Hurricane Florence in September 2018.

#### **4.2.3 Third Research Sub-Question: Impacts of Funding Resources and Policies on the Public Housing Recovery**

The purpose of the third question is to explore the impacts of policies, plans, and funding sources on the recovery outcomes of public housing residents. Several financial resources and plans were considered for the recovery of public housing complexes in the aftermath of Hurricane Matthew. These funding resources were announced in the media and the plans for the recovery and the development of public housing complexes were announced in official documents such as HACL annual plans. This study analyzes these financial resources and plans to investigate their impact on public housing recovery outcomes. Part of this investigation involved interviews which were conducted with local officials and stakeholders in Lumberton to explore the recovery outcomes and magnify the challenges facing HACL in the recovery of these units. The interviews were transcribed and coded with

ATLAS.ti. Hence, the codes memos have been written based on the research questions. The codes memos shaped the findings of the third question and also added context, transparency, and reliability to the discussions of the first and second research questions.

In interviews with local officials and recovery stakeholders, the first set of questions were about the interviewees' assessment of affordable housing in Lumberton. The overall response to this question was negative. The interviewees were concerned about the shortage of affordable housing stocks in the city. They mentioned the city's poverty and specifically the racial composition in their conversations. One of the interviewees believed that while many of their citizens are dependent on governmental assisted housing there is not a sufficient number of units for housing them. The Program Manager of the Department of Social Services mentioned that:

*“We are a very poor county, so lots of families depend on government housing, subsidized housing. There's always been a wait list, as long as I can remember.”*

The long waitlist of governmental assisted housing and the great number of public housing units in the city show the needs for affordable housing in the city. One of the other interviewees stated that:

*“Public housing is the same to me as affordable housing. It was not sufficient for the area. So, it was already a problem with affordable housing. [...] So as far as public housing affordable housing, for Robeson County, for the city of Lumberton, there was not a sufficient amount of affordable housing. The public housing units, for a particular area especially due to the fact that we are one of the poorest or poverty-stricken counties not only in North Carolina, but in the United States of America. And where that plays in Lumberton and Robeson County is a unique place, where first of all there's the diversity of the culture.*

*Native American, Caucasian, African-American at one time it was almost 33%, 33%, 33%. So, it's almost, it's all a little project in itself based on a diversity our community ...."*

The interviewees provided this study with some information about the damages to the public housing units in the aftermath of Hurricane Matthew. They mentioned that most of the public housing units which were damaged in the floods were located in the southern and western parts of the city, the poor regions of Lumberton. They believed that those units were also inside or close to the 100-year floodplain areas. These considerable damages resulted in the displacement of the public housing families for a long time after Hurricane Matthew. For example, Barbara Brown, one of the displaced public housing residents informed media about her experience. She is one of the HACL commissioners and was displaced for four months in the aftermath of Hurricane Matthew. She stated in the media and in this study's interview that:

*"I feel better about it, but I will never ever go back to the new units [restored units] because of that, because of the water, the flood that I saw! Right now, when I go to that area, I get a little teary-eyed, but where I am now, they have me across town"* (Reeves, 2017).

The displaced families were sheltered in motels and hotels in Lumberton and neighboring cities. In literature, it has been found that it is hard for the socially vulnerable population to find a temporary housing due to the fact that they have limited access to the resources. It was believed that they cannot apply for the financial aids because of their limited education. In this study, it was found that the Department of Social Services (DSS) helped this community with their application, while they did not use the received money for their temporary shelter due to their poverty or lack of knowledge in using their assisted

money for its defined purpose. This caused some challenges for the city to help them find temporary housing.

For example, Kathy Talor is one of the displaced public housing residents. She lived in a motel for four months after Hurricane Matthew flooded her apartment. She stated in media that finding a new home isn't easy for her and she was displaced until the interview date, because:

*"One, they're full. Two, they're too far. Where FEMA sends me, they're too far, and they're expensive (Fodera, 2017)."*

The Program Director of the Department of Social Services mentioned the chronic poverty of the socially vulnerable population and the limited shelter financial assistance. She stated that:

*"They have money, they work, but they don't have money to start over. They have money to continue paying their rent, like they were currently doing, and their light bills. They don't have money to pay first month's rent, deposit and all that."*

One of the managers of North Carolina Baptists mentioned the limited ability of this cohort in spending their money in an appropriate way. He stated that:

*"They just spend for today. [They usually say] My rent's due next week. It's going to be four hundred dollars. I've got three hundred and fifty now, but there's a sale on a flat screen TV. Let's go get that TV. I [interviewee] see that all the time. Everything is day to day."*

HACL also faced many challenges in rehousing those displaced families due to the fact that the recovery plans for these units were open to the policies of HUD. HUD's current policy is aiming to change the public housing units to Rental Assistance Demonstration

(RAD). Congress authorized RAD as a voluntary HUD's program in 2012 to examine a new method of meeting the growing capital improvement needs of the old public housing units and preserve the HUD's programs of Rental Supplement, Rental Assistance Payment, and Moderate Rehabilitation. This program allows public housing agencies to reduce the public and private debts and reinvest in the public housing stocks without depending on additional money from Congress. This is critical for HUD because of the \$25.6 billion backlog of public housing capital improvements. The RAD policy aims to move physical units to a Section 8 platform with a long-term contract which should be renewed by law. In this program, housing authorities are provided with the opportunity to replace the public housing units with the voucher programs. Nevertheless, in Lumberton, HACL could not offer many of these families with the section 8 vouchers due to the fact that these families cannot afford even the subsidized rent with vouchers. As the Executive Director of HACL said:

*“So, what's unique about us in the city of Lumberton is [that] not only have we been here with Matthew. Then we were hit with Florence and on top of that we've got HUD making a big push to get rid of housing units. [...] Well, we don't want to convert to RAD not necessarily [because of] existing units. And here's my question. That person that I've got [who has] lived over ten years in Turner Terrace right now that can only afford to pay 50 dollars a month rent. Am I going to find a fifty-dollar vouchers? [No]. What happens to them?! In Louisville, Kentucky, in New York in those areas, Resources abound. Robeson County resources don't abound!”*

Therefore, HACL attempted to rehouse these families by finding them other public housing units in other housing authorities with available housing choice voucher units around the county or the state. Then, HACL attempted to rehab the units, demolishing the units

which were flooded twice, first by Hurricane Matthew in 2016 and then by Hurricane Florence in 2018, and relocating two developments to maintain the public housing stock in the city. Moreover, the Executive Director of HACL mentioned that in order to modernize the 93 units of Lumbee Homes, HACL may take RAD into consideration if they were to be provided with enough funding.

HACL has another challenge in the public housing recovery process in terms of reimbursing the financial assistance provided by FEMA. For example, HACL announced in December 2018 that FEMA only reimbursed \$3.5 million of the \$13 million promised money. Based on FEMA policies of funding reimbursement, the recovery of the public housing units has to be aligned with mitigation purposes. The housing authority has to improve the condition of the units in terms of mitigating future risks. In this regard, the interviewees discussed the necessity of mitigation plans such as elevation. However, in some developments it is not economical to elevate the units and it might be better to relocate them to an area outside the floodplains. The Planning Director and Flood Plain Administrator of the city stated that:

*“I think there are seven [twelve] public housing developments in Lumberton that are owned by the housing authority. Of those seven, two of them didn't come back after Matthew. One was a two-story development called Hilton Heights, and the other was single level duplexes that is Meyers Park. [...] We looked at Hilton Heights, we looked at the elevations, the ground elevations versus the required elevations for building units and there is about a four-foot discrepancy. So, if you were to try to redevelop Hilton Heights for example it would not be economical to try and elevate those existing two-story buildings. As old as they are and the bottom floor is on a slab, it would be very difficult and cost prohibitive to try and*

*raise that. If you were to demolish them and start from ground up, you would need to bring in about four feet of fill dirt to elevate the ground and that is cost prohibitive. So, it's probably best for that to wind up being green space of some type. The downside of that is that they lost however many units were in Hilton Heights. Meyers Park on the flip side is a single level. When we checked elevations there you would only have to elevate the ground about eighteen inches to be able to build which is a foot and a half, not much. So, we've got some ideas of how to deal with that."*

As mentioned, in addition to the mentioned mitigation solutions, the city decided to relocate two of the developments to an area outside the floodplain. This decision was met with many challenges in the past two years. The housing authority has had some limitation in terms of finding a site which meets the criteria of the city. For example, if HACL decides to move these units to another part of town where it is not in the floodplain, they have to consider the limitation of having too many public housing units within a quarter mile radius. HACL suggested three possible sites to the North Carolina Department of Emergency Management to have them conduct environmental studies and evaluation on these sites and in order for the sites to be considered for the CDBG-DR funds. However, there is still no decision made on these possible sites more than two years after Hurricane Matthew, delaying the recovery process. HACL's Executive Director said:

*"We have an ongoing contract as far as engineering and quality control at Raleigh. When we did the application, we had to have someone (an engineer CEO) to estimate the cost. That's the first thing we have to do for the application of the CDBG-DR money. They help us to do the project cost estimate and put the name of the CEO engineer on it and ask them to sign up on it. They signed it on August [2018]. They helped us with the cost, with the*

*design, with the site. [...] We sent the application to North Carolina Department of Emergency Management. The State did their own resilience recovery redevelopment plan. We just attached on to it.”*

Limited resources for the housing authority of the city of Lumberton resulted in a delay in the recovery of public housing units in addition to the bureaucratic process of relocation. The Executive Director of HACL believes that the funding allocated for recovery of the units by FEMA reimbursement is not sufficient and is calculated based on unreal assumptions by FEMA. He said:

*“We're going to receive [Money] for Hilton Heights. \$800,000 the state portion of it. from FEMA we're going to get \$2.4 million. That's what we work for! we signed a contract with FEMA saying we're going to rebuild these outside the flood zone and we can't get a penny anymore from what FEMA [promised,] \$2,430,766.*

*We're estimating that the cost to rebuild the 42 units is going to be 8 million dollars. Our insurance that we collected was \$1 million. 1 M plus 2 million is 3 million, 3 million minus \$8M is \$5M. that's what we estimated [we have less] for Hilton Heights! Now, did we estimate high? Yes [Sarcastic]! \$125 per square foot. But if you want to build something new right now on here in Lumberton would be \$ 150-265 per square foot.”*

One of the issues mentioned in literature in terms of reducing the marginalization of socially vulnerable population is to involve their representatives in the recovery planning process. This can help to improve the vulnerabilities and plan for the resilience of that community. It can be inferred from the quote that HACL or the county did not have any inclusive participation in the state recovery planning process. The state planned for the resilience recovery and the HACL plan has been attached to it. A similar finding was also

reported by Hamideh and Rongerude (2018). It is found that public housing advocates have little voice in recovery planning and decision-making, and they have little influence in the local recovery debates.

Housing authorities relied on the governmental funding for their recovery programs. This reliance can be seen as an important determinant of recovery outcomes since it was mentioned by the interviewees. It is found that the CDBG-DR fund had not yet been received by HACL in December 2018. The Executive Director of HACL stated that while HUD claimed that the promised CDBG-DR money was sent to the State of North Carolina, HACL has not received the funds yet, two years after the Hurricane. Therefore, the interviewees were asked about the CDBG-DR and other recovery funds and the priorities for spending the allocated money. In the conversations, the local officials mentioned the flexibility and discretion of local jurisdictions in spending CDBG in North Carolina. This means that the state has spent more of the CDBG on infrastructure instead of affordable housing for low-moderate income. They believed the policy of the state of North Carolina in the aftermath of Hurricane Matthew is similar to their policy in normal condition. The state directs the flow of money to the infrastructure rehabilitation and improvement instead of housing recovery of low-moderate income residents. They believed that this might be a good mitigation strategy to improve infrastructure. However, in the poor communities such as Lumberton it may cause many challenges in terms of providing affordable housing for the low-income people. The interviews highlighted the low voice of Lumberton in the state decision-makings. As the Executive Director of HACL said:

*“When all the money was taken from housing and put in the infrastructure who did it impact [hurt]? it impacted low-income and disabled individuals. One of the officials*

*somewhere in the state of North Carolina made this decision. [...] Robeson County was getting \$400,000 every three years to provide housing. All that money goes to the infrastructure now! So, there's no money going in the housing. Guess where the infrastructure money goes to? Did they go to the poor areas? No, they don't! The probable place go in North Carolina is Charlotte, Raleigh, Wilmington, Asheville. If you look at the way money spent is, it goes to the more populated area. The rural areas are getting less and less of the pie because they have the least amount of voice. who's standing up when CDBG housing money that helps low-income individuals, senior citizens, when I was saying it's taken out and put in infrastructure, who stand up and scream it from the mountain tops? Nobody.”*

In addition to the priority changes of the CDBG-DR money, the interviewees highlighted the time-consuming process of providing financial sources for the housing projects. The bureaucratic process results in a delay in the recovery of public housing units. The City Manager stated that:

*“If you were applying for housing under CDBG, then that application has to go to the county, to the state, to HUD in Washington and they review it and approve it. [...] By the time you send it [application] to the state and to FEMA or to CDBG, it's just a time-consuming process.”*

### **4.3 Discussion**

Findings show that the majority of public housing developments in Lumberton are located in neighborhoods with medium to high social vulnerability. Regarding the weighted social vulnerability index scores, housing tenure, race, and poverty are the principal vulnerabilities of the residents of public housing units. This study finds that the concentration of poverty in distressed units of public housing developments which locate in socially vulnerable neighborhoods make this cohort of the community vulnerable in the face of

extreme shocks. The poverty of the residents and limited maintenance efforts of housing authorities force these community to be in risk of great damages. The high number of damaged units in the public housing developments show the impacts of vulnerabilities on the amounts of damage caused by disasters. This cohort disproportionately faced damages and displacement. The shortage of public housing stocks results in the lengthy displacement of these households.

As mentioned in the literature review, social vulnerability can affect the ability of a community in terms of disaster response, temporary shelter, and reconstruction (Highfield, Peacock, & Van Zandt, 2014; Flanagan et al., 2013; Van Zand et al., 2012). Similarly, this study finds public housing residents often cannot afford temporary shelters after disasters due to many factors such as lower income, lower bank credit, and limited access to information that causes a delay in their rehousing. This inability to adequately respond to disasters may result in the long-term displacement of this community in the aftermath of disasters. Furthermore, prior studies mentioned that static vulnerability such as their poverty may limit their ability to find shelter or new housing units in the aftermath of disasters (Hamideh, & Rongerude, 2018).

This study's findings about public housing residents are consistent with these prior studies on socially vulnerable population. Findings show that a large number of public housing units are located in the floodplains which received significant damages. These damages resulted in the displacement of a large population. These displacements and damages were highlighted in the interviews in terms of the impacts of Hurricane Matthew. In the interviews, it is also highlighted that the households of public housing units were displaced for a long time, from 6 months to more than 2 years after the hurricane due to

constraints resulting from their poverty and their misspending of assisted money. They could not afford to find permanent housing because of the limited resources and their poverty. Moreover, these cohorts of the community have some challenges during their displacement. For example, as a whole, this cohort has not used FEMA assistance funding based on the purpose of the assistance in the aftermath of the floods. Most of the families spent those assistance funds for purposes other than housing. For example, some of them spent that money to replace their damaged properties including TV or car, etc. This aspect of the challenges they face was rarely mentioned in the previous literature. The literature instead focused on how the limited education of socially vulnerable populations may put them in difficult and unfavorable positions for applying to various funding assistance options (Van Zandt et al., 2012).

Furthermore, the high numbers of abandoned and unrepaired public housing units show that the vulnerabilities including housing tenure and poverty have impacts on the pace of the recovery. This study finds that the residents of public housing cannot restore their own units due to their housing tenure. The local Housing Authority is responsible for the recovery of these units using governmental funding sources. This dependence results in the fate of public housing recovery being open to the discussions and influences of different political plans. The lack of representation forces the Housing Authority to pursue any plan, regardless of the impacts on the displaced residents. In the State of North Carolina, there was not a strong voice in advocating for the recovery of affordable housing. The state's plans for spending CDBG money was therefore not prioritized towards the recovery of affordable housing for low-moderate income households. Additionally, the poverty, minority status, and the social class of the concerned parties limit the voice of public housing residents. They may

face barriers in participating in decision makings or planning for their housing recovery. In Lumberton, it was seen that insufficient financial resources, the slow flow of funding, and the priority of the state in funding allocations to the improvement of infrastructure instead of affordable housing for medium, low-income population reduced the pace of public housing units' recovery.

The slow pace of recovery has resulted in a shrinkage of public housing stocks for the low-income tenants in Lumberton. Based on field observations and interviews with some of the present public housing residents in Lumberton, many of those displaced residents whom never returned to HACL developments were housed in other housing authorities around Robeson County and in the state of North Carolina. It was found that HACL has often helped them to find a unit in other housing authorities. Some of those tenants were also offered housing options other than public housing units such as vouchers or were assisted in paying the down payments for buying a house.

The administrative staff of HACL believed that it was not good for the city to just lose its residents. The city needs to keep its residents due to their role as social capital and economic actors. However, with the limited funding sources and the slow pace of recovery of these affordable units, the shrinkage in low-income housing stock was inevitable. This resulted in the loss of population from those searching for affordable housing. They went to neighboring communities to fulfill their needs. This loss of population may have a long-term effect on the city's social capital.

In the next chapter, I will provide a summary of this study's findings. These findings outline the obstacles for the recovery of public housing units. Lastly, this thesis will conclude with recommendations for affordable housing recovery planning and for future studies.

## CHAPTER 5. CONCLUSION

Disasters are not equal opportunity events; they affect people in a community in different ways. Pre-disaster socioeconomic disparities are magnified in the aftermath of acute shocks. Underprivileged communities therefore have more difficulty in rebounding from disasters. One of the marginalized populations that often face many difficulties in the aftermath of disasters are the residents of public housing. This study investigated the recovery outcomes and challenges of the public housing residents in Lumberton, NC, in the aftermath of the floods induced by Hurricane Matthew in 2016.

Lumberton was targeted for this study due to the specific conditions present within this community. Lumberton has a special combination of racial composition and high poverty within the state of North Carolina. The city has considerable percentages of minorities and population who live at or below poverty level. Therefore, I used a combination of mapping, descriptive statistics, and qualitative analysis to explore 1) specific social vulnerabilities of public residents, 2) the impact of these vulnerabilities on recovery outcomes, and 3) the impact of funding resources, policies, and plans on the recovery of public housing units. These investigations helped this study to outline the obstacles for the recovery of public housing units.

This study found that poverty, and housing tenure comprise the vulnerabilities of public housing residents. Segregation in housing market direct the public housing program to build the developments in socially vulnerable neighborhoods. Concentration of poverty in distressed complexes located in floodplains resulted in a large number of damaged public housing units. The 1937 housing Act did not consider any federal provision for the maintenance and renovation of the public housing units when the public housing program

was introduced. The construction of the units is financed by the federal government, while rents should cover the operating and maintenance expenses. However, the residents of these units cannot afford a high amount of rent that can cover the maintenance costs. This financial limitation affected the quality and the design of the public housing units. Public housing authorities estimated that they need at least \$70 billion currently unmet capital around the U.S. for basic repairs and upkeep (Vock, 2019). This growing proportion of public housing exhibits physical distress. This distress may have resulted in a combination of physical corrosion and social problems in both normal conditions and in disaster contexts. This huge backlog of required maintenances and restorations is a major reason for the loss of about 10,000 public housing units across the country every year and loss of many public housing units during every disaster.

The disaster damages along with loss of public housing units caused displacement of a large number of families for a long period of time. These displaced families could not afford their temporary or permanent shelters due to their poverty level due to the depletion of their savings and their lower bank credit. These difficulties prevent them to afford the secured deposits or other requirements for their temporary and permanent housing. They also have limited access to information about using their limited federal financial assistance. Public housing residents are not provided with various temporary housing alternatives similar to other middle-class households due to their poverty. Moreover, these residents are marginalized within their community. Their lack of information and familiarity with institutional norms and practices has led to their misinformation about federal financial assistance post-disaster such as FEMA assistance. This study shed new light on that public housing residents did not use the financial assistance for providing their temporary shelter

due to their depleted savings. They used those assisted funds for the replacement of their lost properties instead of housing. Therefore, it would be helpful to assist these communities with special programs including Disaster Housing Assisted Program (DHAP) regarding the provision of housing instead of providing financial assistance in the aftermath of disasters for their temporary shelters. It would also be helpful to assist these communities with special instructions regarding the provided financial assistance in the aftermath of disasters if they are provided any.

Furthermore, this community cohort is known as a transient population in which the displaced households are pushed to be rehoused in other housing authorities if there are any available units. However, currently, the national trend of public housing is losing 10,000 units each year. This means that it will be harder to find excess units to rehouse public housing residents displaced by disasters. This study magnifies this growing interrelated issue in public housing nationally which should be considered in long-term policies about this program.

The market-based recovery policies do not provide transparent plans for the recovery of public housing units which have a special tenure. The market-driven approach of housing recoveries has led to minimum intervention of the government in the recovery process. This means that the recovery process for those who are not being served by the market including public housing residents will be faced with various challenges. The recovery process is not an equal event for the whole community but rather one in which some will be winners and others losers of the market-driven system.

On the other hand, a housing authority itself is dependent on the governmental funding and political agendas, when planning for the recovery and rehabilitation of the units

of their possession. The limited power of the housing authority in state policy-making and the fact that public housing carries a certain stigma can force the housing authority to pursue plans that do not necessarily prioritize the needs of displaced tenants.

Housing authorities' decisions and efforts for recovery and mitigation of future losses are limited by the policies of the state in terms of restriction of assisted funds. For example, in Lumberton, the assisted funds were directed to the infrastructure improvements. While the housing authority planned various mitigation and recovery programs, the outcome of recovery was not acceptable, and none of the plans created by the housing authority were executed. This finding will be of interest to look through pre-disaster policies of the states and CDBG investments which have impacts on post-disaster plans. Less share of CDBG investments on affordable housing for medium, low-income households in comparison with infrastructure improvements causes a continuous issue in the aftermath of disasters. Priorities other than providing medium-low income households with affordable housing, limited funds, as well as the bureaucratic hurdles in allocating the flow of funds has resulted in the delay of the public housing recovery. This delay seen in this case study and the national trend of public housing decrease, which has been mentioned may contribute to the shrinkage of the low-income housing stocks in the U.S. in the long-term.

The main question of this study aims to outline the obstacles for the recovery of public housing units. It is highlighted in this study that the public housing units lag behind the other residential units in terms of recovery. The static vulnerabilities of the public housing residents affect the recovery outcomes of this community by limiting the access of public housing residents to the recovery resources. Their vulnerabilities, including poverty, housing tenure, and dependence on the governmental assistance, makes the public housing

residents a passive population in recovery decision-making. The public housing authorities do not have a strong voice in the states' decision-making process to advocate for housing for medium-low income households. Also, the housing tenure of these units cannot be classified as either rental nor owned properties. Therefore, their housing recovery fate is open to the decisions of their housing authority which is a function of state's policies.

### **5.1 Recommendations**

Recovery challenges of public housing units observed in this case study provide several lessons for recovery practice:

- Planners have to plan in advance and focus on reducing the spatially concentrated vulnerabilities by mapping them and prioritizing mitigation, recovery resources, and preparedness activities in neighborhoods and for populations with greatest vulnerability in pre-disaster resilience plans.
- The recovery policy should emphasize the long-term recovery based on risk mitigation planning. Reducing social vulnerabilities, improving public housing maintenance, and reducing exposure may help the socially vulnerable population resistant damages from natural hazards.
- Federal assistance programs should work on instructions for the receivers of the assistance funds to assist them learn about the goals of those funds and help them use the grants based on its purpose. FEMA, local agencies, and social workers may collaborate together to improve the system of financial assistance to improve the efficiency of these funds for the socially vulnerable population.

- Recovery of affordable housing has to become a priority. Federal recovery policy should require the states to plan inclusively for the recovery of medium-low-income housing such as public housing developments.
- HUD should focus on the planning for the recovery, improvement, and risk mitigation of the public housing units considering the housing authority capacities in the communities with limited resources.
- HUD policy in terms of RAD program should be considered in the aftermath of disasters based on the capacities of housing authorities. HUD should apply a comprehensive policy in terms of immediate rehousing and replacements of damaged units in post-disaster context.
- Engage public housing representatives, in decisions about distribution of recovery resources, to enable everyone, not only to rebuild their lives, but also to seize the window of opportunity to rebuild back better.

## **5.2 Future Research Directions**

Further research should focus on the following questions about the public housing units to further improve the knowledge of disaster recovery planning:

- What policies can be implemented to reduce social vulnerability concentrations in the city and public housing developments? Exploring case studies which focus on the deconcentration of poverty and minority in public housing developments and the impact of the deconcentration in facing acute shocks.

- What are the common elements of the successful recovery of socially vulnerable populations which succeed in recovery and enhance resilience?
- What are the elements of the inclusive planning process in which the socially vulnerable populations are empowered and are provided with the opportunity to build back better?
- In-depth case studies should explore the gaps of policies in terms of public housing recovery. What are the common elements of public housing recovery that should be considered in Federal policies?

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**APPENDIX A. IRB APPROVAL**



Research Integrity & Compliance Review Office  
Office of the Vice President for Research  
321 General Services Building - Campus Delivery 2011 eprotocol  
TEL: (970) 491-1553  
FAX: (970) 491-2293

**NOTICE OF APPROVAL FOR HUMAN RESEARCH**

**DATE:** November 29, 2018  
**TO:** van de Lindt, John, 1372 Civil Engineering  
Ellingwood, Bruce, 1372 Civil Engineering, Tobin, Jennifer, Ioripeek, Ioripeek, Shackelford, Charles, 1372 Civil Engineering  
**FROM:** Swiss, Evelyn, CSU IRB 2  
**PROTOCOL TITLE:** Center for Risk-Based Community Resilience Planning: A NIST-Funded Center of Excellence  
**FUNDING SOURCE:** Funding - Grants/Contracts  
**PROTOCOL NUMBER:** 15-6003H  
**APPROVAL PERIOD:** Approval Date: November 25, 2018 Expiration Date: September 14, 2019

The CSU Institutional Review Board (IRB) for the protection of human subjects has reviewed the protocol entitled: Center for Risk-Based Community Resilience Planning: A NIST-Funded Center of Excellence. The project has been approved for the procedures and subjects described in the protocol. This protocol must be reviewed for renewal on a yearly basis for as long as the research remains active. Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

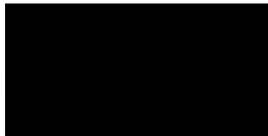
Important Reminder: If you will consent your participants with a signed consent document, it is your responsibility to use the consent form that has been finalized and uploaded into the consent section of eProtocol by the IRB coordinators. Failure to use the finalized consent form available to you in eProtocol is a reportable protocol violation.

If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice.

This approval is issued under Colorado State University's Federal Wide Assurance 00000647 with the Office for Human Research Protections (OHRP). If you have any questions regarding your obligations under CSU's Assurance, please do not hesitate to contact us.

Please direct any questions about the IRB's actions on this project to:

IRB Office - (970) 491-1553; [RICRO\\_IRB@mail.Colostate.edu](mailto:RICRO_IRB@mail.Colostate.edu)  
Evelyn Swiss, Senior IRB Coordinator - (970) 491-1381; [Evelyn.Swiss@Colostate.edu](mailto:Evelyn.Swiss@Colostate.edu)  
Tammy Felton-Noyle, IRB Biomedical Coordinator - (970) 491-1655; [Tammy.Felton-Noyle@Colostate.edu](mailto:Tammy.Felton-Noyle@Colostate.edu)



Swiss, Evelyn

Amendment approved to conduct a follow-up study in Lumberton, NC, to explore the recovery decisions and resources for the restoration of the public housing units. These data will contribute to the IN-CORE community resilience modeling



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environment. Approval includes use of consent document for this phase of the study. No change in risk.

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<b>Approval Period:</b>	November 25, 2018 through September 14, 2019
<b>Review Type:</b>	EXPEDITED
<b>IRB Number:</b>	00000202
<b>Funding:</b>	National Institute of Standards and Technology

**APPENDIX B. INTERVIEWEES - COMMUNITY LEADERS AND KEY  
STAKEHOLDERS**

<b>Category</b>	<b>Interviewee</b>	<b>Affiliation</b>
Housing Authority	Adrian E. Lowery	Executive Director-HACL
	Barbie Jo Hunt	Interim Director of Facilities Maintenance-HACL
	Sheila Oxendine	Interim Director of Housing Services-HACL
	Lemark Harris	Pembroke Housing Authority Interim Director
City Official	Wayne Horne	City Manager - Lumberton
	Brandon Love	The Planning Director and Floodplain Administrator - Lumberton
Emergency Service	Stephanie Chavis	Director at the Emergency Services for Robeson County
	Mattie L. Caulder	Assistant Director at the Emergency Services for Robeson County
Non-Profit	Paul Langston	Consultant at NCBM/ Baptists on Mission Church - Lumberton
	Chip McGuirt	Manager at NCBM/ Baptists on Mission Church - Lumberton
	Rev. Rick Foreman	Pastor at West Lumberton Baptist Church - Lumberton
Social Service	Eric Chavis	Robeson County Sheriff
	Dawn Gavasci	Program Manager at Robeson County Department of Social Services
	Connie Oxendine	Service Program administrator at Robeson County Department of Social Services

**APPENDIX C. COMMUNITY LEADERS AND KEY STAKEHOLDERS  
INTERVIEW CONSENT SCRIPT**

**Consent to Participate in a Research Study  
Colorado State University**

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**Title of study:**

Center of Excellence for Risk-Based Community Resilience Planning

**Principal Investigators:**

This project is led by Dr. John van de Lindt and Dr. Bruce Ellingwood, both Professors from the Civil and Environmental Engineering Department at Colorado State University. Dr. van de Lindt can be reached at 970-491-6697 or via email at [jwv@engr.colostate.edu](mailto:jwv@engr.colostate.edu) and Dr. Ellingwood can be reached at 970-491-5354 or via email at [bruce.ellingwood@colostate.edu](mailto:bruce.ellingwood@colostate.edu).

**Who is doing the study?**

This five-year project is funded by the National Institute of Standards and Technology (NIST). Our research team is made up of professors, postdoctoral fellows, and graduate students across 14 universities. Two or more of our field research team members will be interviewing you for this project.

**What is the purpose of this research and why am I being invited to take part in this study?**

You have been chosen to be part of this research study because of your experience with the 2016 flooding that occurred in Lumberton, N.C. following Hurricane Matthew. We would like to speak with you about the choices that you made before, during, and after the flood so we can learn more about how people responded to and are beginning to recover from the event. Up to 200 people from your community may be invited to be interviewed for this study; however, the team will begin interviews, initially, with a smaller group of community leaders and key informants.

**What will I be asked to do and how long will it take?**

You will be asked to answer questions about what happened before, during, and after the flood. We are interested in your experiences with preparedness, evacuation, damage, loss, and rebuilding. The interview will be held in a mutually agreeable, private location. With your permission, each interview will be audiotaped and will take about 30 minutes of your time. We would also like to speak to you in the future to learn more about your experiences as they unfold. Also with your permission, the research team may take photos or videotape of you or your home.

**What will it cost me to participate?**

There is no cost to you for being part of this study and you will not be paid for your time.

**What are the possible risks, discomforts, and benefits?**

It is not possible to identify all potential risks during a research project, but our team has taken reasonable safeguards to minimize any known and potential risks. The potential risks associated with this study are difficult emotions such as anger and sadness. There is no known benefit in participating. We hope, however, this will provide a space for reflection and an opportunity to make a difference for others by sharing your knowledge and experiences.

**Do I have to take part in the study?**

Your participation in this project is completely voluntary. You may withdraw your consent and stop participating at any time. You have the right to refuse to answer any question(s) for any reason. You also have the right to refuse to be photographed or audio/video recorded.

**Who will see the information that I give?**

We will keep private all research records that identify you, to the extent allowed by law. Anything that you share during our interview will be kept confidential. In addition, your privacy will be maintained in all written and published documents resulting from this study. However, if any abuse or illegal activity is discussed, we will have to report that information to the authorities. Any reports created from this study will use fake names in place of real names of people and organizations.

Other identifying features may be altered as well to protect your confidentiality. Audio files will be stored in a secure location. They will be marked with an interview number separate from your name. At the end of the study, all audio files will be erased and all other written materials will be permanently stored in a secure location. This data will be kept for future use. We may be asked to share the research files for audit purposes with the CSU Institutional Review Board and the NIST Human Subjects Protection Office.

If you have questions about this study, you should ask the researcher before you sign this consent form. If you have questions regarding your rights as a participant, any concerns regarding this project, or any dissatisfaction with any aspect of this study, you may contact the Colorado State University Institutional Review Board at: [RICRO\\_IRB@mail.colostate.edu](mailto:RICRO_IRB@mail.colostate.edu); or 970-491-1381.

A signed copy of this three-page consent form and Photo/Video-release form will be provided to you at the time of the interview.

Participant's Initials \_\_\_\_\_ Date \_\_\_\_\_

I agree to be audio recorded for this study (please initial):

Yes

No

If you are willing, we may want to conduct 1-2 more interviews with you over the next two years so that we can follow changes in recovery. We have asked for your address below so that we may contact you again. I am willing to be contacted again to participate in similar studies related to disaster recovery (please initial):

Yes

No

*I have read this paper about the study or it was read to me. I know the possible risks and benefits. I know that being in this study is voluntary. I choose to be in this study. I know that I can withdraw at any time. I know that it is my choice to be audio taped. I know that any contact information I provide is optional and will only be used to follow up on the community recovery process following Hurricane Matthew. I have received, on the date signed, a copy of this document containing two pages.*

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Phone: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Email: \_\_\_\_\_

\_\_\_\_\_  
Signature of Research Staff

\_\_\_\_\_  
Date

Please direct follow-up questions to:

*Dr. Sara Hamideh, Department of Community and Regional Planning, Room 399, Iowa State University, Ames, IA, 50010, 515-294-5470*

*Dr. Van de Lindt, Department of Civil Engineering Room A201, Colorado State University, Fort Collins, CO 80523-1301, 970-491-6697*

**APPENDIX D. COMMUNITY LEADERS AND KEY STAKEHOLDERS  
INTERVIEW GUIDE**

**Lumberton field study Wave 3b  
Public Housing Recovery Decisions and Resources: Perspectives of Local Government  
and Other Stakeholders**

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**Housing Authority of City of Lumberton:**

1. Assessment of affordable housing needs in Lumberton before Hurricane Matthew?
2. Number and type of households on HACL waitlist for different types of public housing (PH), change since the 2016 floods?
3. Discussions and plans before the floods (Matthew and Florence) for replacing PH with HOPE-IV?
4. Impacts of the Matthew and Florence floods on PH units: damage levels, demolished, etc.
5. Process for evacuation, assessing damages, eviction, repair, and demolition of PH after Matthew and Florence?
6. How many of PH units were officially confirmed as demolished/damaged? Where?
7. Where were PH residents sent after Matthew and Florence (with their vouchers both temporary and shelters)? How many vouchers allocated after Matthew and Florence?
8. Number and status of displaced families after Matthew and Florence? Assessment of displacement issues caused by each storm? Differences between displacement issues after each storm?
9. How many of PH residents did return to their units and how many wants to return after Matthew?
10. Plans and timelines for helping PH residents to return? Assessment of the progress?
11. Number of units that will be demolished for various reason; Number of new units that will replace the demolished units; Number of units to be repaired within a certain number of years
12. What resources available for repairing PH? Assessment of the adequacy and accessibility of funds?
13. According to HACL 5-year plan for the fiscal year 2017-2021, three complexes (Weaver Court, Myers Park with 30 units and Hilton heights with 42 units) may have to be relocated. What is the relocation plans and options?
14. According to HACL 5-year plan for the fiscal year 2017-2021, two complexes will be subjected to de concentration policy (Turner terrace on Spruce Street and Weaver Court on Parmele Dr.). What are the plans for providing housing to current residents after the development of these two complexes?
15. Progress in repairs to PH units after Matthew and Florence?
16. Challenges in completing the repairs after Matthew: funding, regulations, eligibility, etc.

17. Opportunities for building affordable housing back better after Hurricanes Matthew and Florence?

**Other local governmental agencies, nonprofits, advocates, charities involved in housing:**

1. What are the priorities for spending the CDBG-DR funds? How are/have the local agencies deciding on the projects?
2. How are the local agencies getting people involved in discussions about spending recovery funds?
3. Who is/was locally involved in planning to use the CDBG-DR and other recovery funding after Hurricane Matthew?
4. What are the assumptions and expectations about funding allocation and return of households?
5. Assessment of share of housing needs are met by different recovery funds? Unmet housing needs?
6. Number of families that were helped (financial, material, time, etc.) by different organizations for housing?
7. Housing status of the families that received helped
8. Assessment of affordable housing recovery progress
9. Obstacles to affordable housing recovery
10. Which groups falling behind in housing recovery and why

**APPENDIX E. LIST OF INTERVIEW CODES**

<b>Code</b>	<b>Grounded</b>	<b>Code Groups</b>
SV_PH_Age	8	Social_Vulnerability
SV_PH_Disability	12	Social_Vulnerability
SV_PH_Female_Kids	1	Social_Vulnerability
SV_PH_Insufficient_Voucher/AffordableHousing	31	Social_Vulnerability
SV_PH_Low_Education	7	Social_Vulnerability
SV_PH_Low-income	35	Social_Vulnerability
SV_PH_Minority	3	Social_Vulnerability
SV_PH_No_Phone	2	Social_Vulnerability
SV_PH_OldUnits	2	Social_Vulnerability
SV_PH_Transient_Population	32	Social_Vulnerability
SV_PH_UnitsInFloodPlain	43	Social_Vulnerability
Impact_PH_Displacement	76	Disaster_Impact
Impact_PH_Displacement_new locations	31	Disaster_Impact
Impact_PH_Financial_Loss	11	Disaster_Impact
Impact_PH_instability	14	Disaster_Impact
Impact_PH_Psychological	1	Disaster_Impact
Impact_PH_School	0	Disaster_Impact
Impact_PH_socialSupport loss	2	Disaster_Impact
Impact_PH_Unit_Damage	37	Disaster_Impact
Impact_PH_Work/job/payloss	2	Disaster_Impact
Recovery__PH_CDBG-DR rules and priorities	17	Recovery_Disparities
Recovery__PH_CDBG-history in the NC State	11	Recovery_Disparities
Recovery__PH_Future flood risk	29	Recovery_Disparities
Recovery__PH_HA_before Matthew	12	Recovery_Disparities
Recovery__PH_Slow_Pace	17	Recovery_Disparities
Recovery_PH_Limited_Knowledge_FinancialAid_Application	8	Recovery_Disparities
Recovery_PH_No_Policies	9	Recovery_Disparities
Recovery_PH_No_Power	27	Recovery_Disparities
Recovery_PH_No_RecoveryIncentives	15	Recovery_Disparities
Recovery_PH_No_Solid_Plans	23	Recovery_Disparities
Recovery_PH_NotEnough_Funding	30	Recovery_Disparities
Recovery_PH_NotFulfilled_Plans	7	Recovery_Disparities
Recovery_PH_Slow_FundingFlow	17	Recovery_Disparities
Recovery_PH_Alternatives_OtherHA	29	Recovery_Outcome
Recovery_PH_NotCompleted	13	Recovery_Outcome
Recovery__PH_Relocation_Issues	20	Recovery_Outcome

**APPENDIX F. PUBLIC HOUSING RESIDENTS INTERVIEW CONSENT SCRIPT**

**Two-Year Post-Hurricane Matthew Field Study in Lumberton, North Carolina  
Recovery Challenges of Public Housing Residents  
Consent Script  
OMB CONTROL NO. 0693-0078 Expiration date: 07/31/2019**

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Hello, my name is *Sayma Khajehei* and I am a graduate student from *Iowa State University in the Department of Community and Regional Planning*. I am conducting a research study in Lumberton on community recovery following the flooding that occurred due to Hurricane Matthew in early October 2016. I would like to speak with you about how this event has continued to affect your household. In particular, I am interested in learning about the process of recovering from the flooding.

I would like to ask you some questions about your household's experience after the flood. You should be older than 18 years of age to participate in this study. This interview will be recorded with a digital voice recorder. I will only record the interview with your permission. Participation will take approximately 30-45 minutes, depending on the experience of your household with Hurricane Matthew. Your participation is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participation at any time without penalty. Your name will not be audio-recorded, so it will not be connected with the information that you provide. Information about you will only be used by the research team for the project described in this document.

I will be collecting information about the damage to your home, the process of making repairs, and how the flood disrupted your household's living arrangements and daily life. I will not collect any unique identifiable individual or household information during this interview. Also, when I report and share my findings, I will combine the data from all participants into summary to guarantee that no individual or household can be identified by any chance. There are NO KNOWN RISKS to you for participating in this interview.

You will receive a \$20 gift card in appreciation of your participation, regardless of how much of the focus group or interview you complete. I hope to gain more knowledge on how you and others were affected by Hurricane Matthew and the flooding so that I can learn from your experiences to help public housing communities better prepare for similar events in the future.

If you have questions about the study, you can contact my Thesis supervisor, *Sara Hamideh*, at the contact information listed below. This study has been approved by the Iowa State University IRB. For questions concerning participant rights, please contact the Iowa State University's Office for Responsible Research at 515-294-1516.  
Thank you again for your time and participation in our study.

Sincerely,  
Sayma Khajehei, Graduate Student Researcher, cell: 515- 708-4763, khajehei@iastate.edu

Sara Hamideh, Thesis advisor, cell: 979-436-7849, shamideh@iastate.edu

**Consent and Authorization Provisions**

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study. The regulations require that a copy of the informed consent document shall be given to the person signing the form.

Participant's Name (printed) \_\_\_\_\_

Participant's Signature \_\_\_\_\_

**APPENDIX G. PUBLIC HOUSING RESIDENTS INTERVIEW GUIDE****Lumberton Field Study  
Recovery Challenges of Public Housing Residents**

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1. Did your unit get flooded after Hurricane Matthew, 2016? How extensive was the damage?
2. Where did you stay after evacuation? How long have you been there? Did you feel safe there? were your daily needs met?
3. Is your unit recovered completely now? How long have you waited for the unit to be recovered? Where did you stay during this period? how would you describe your living conditions while away?
4. Did you have any alternative to choose for staying temporarily? How did you learn about where to go to stay during the recovery process?
5. Did you have any alternative to move to another public housing development in another site?
6. Who did rebuild your unit? Have you been informed about the reconstruction process?
7. Did you get any assistance other than shelter and housing in the aftermath of the flood? What kind of assistance did you get?
8. Was it easy for you to get information about assistance and the application process, and recovery process after the flood?
9. What challenges did you have in the aftermath of the flood in terms of housing, financial assistance, food, information, etc.?
10. What were your main expectations from the housing authority in the aftermath of the flood?