

Living in "Flash Flood Alley": Describing Citizen
Awareness and Satisfaction Regarding Flood
Hazard Mitigation Programs in Austin, Texas.

By

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Applied Research Project

Submitted to the Department of Political Science

Texas State University-San Marcos



In Partial Fulfillment for the Requirements for the Degree of

Masters of Public Administration

Spring, 2013

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Abstract

This paper describes citizen awareness of and satisfaction with flood hazard mitigation strategies implemented by the municipal government of Austin, Texas. Nearly four thousand self-administered questionnaires were mailed to two samples of randomly-selected addresses, one representing Austin residents as a whole and one representing Austin residents in the floodplain. The questionnaire focuses on four categories of flood mitigation strategies that affect the general public: (1) floodplain maps (and associated regulations), (2) stormwater control structures, (3) awareness campaigns, and (4) flood warning systems. The results suggest that Austin residents are generally unconcerned about flooding and unaware of many of the City's flood hazard mitigation strategies. The results also indicate that Austin residents are relatively satisfied with the City's efforts, although most have no strong opinion.

About the Author

James Helfrich graduated from the University of Texas at Austin with a Bachelor of Arts in Government. He is a recipient of the 2012-2013 George Weinberger Scholarship and a member of the Pi Alpha Alpha honor society for academic achievement in a public affairs/administration program. The Watershed Engineering Division hired James to conduct social survey research, and the data he collected for the Division served as the basis of this capstone project for a Master of Public Administration degree from Texas State University at San Marcos. Contact the author at james.helfrich@gmail.com.

Acknowledgements

A major research project is never the work of a single person. The contributions of many people, direct and indirect, made this paper possible. I would like to express my sincere gratitude to the following individuals:

Thomas Longoria, my faculty advisor, for his patience in reading multiple drafts and in helping me to structure my thinking and writing.

Mapi Vigil, **Beatriz Perez**, and **Stephanie Lott** for providing me with an opportunity to work for the Watershed Engineering Division and for their continual support throughout my employment there.

The managing engineers in the Watershed Engineering Division, particularly **Kevin Shunk**, **Jorge Morales**, and **Johnnie Price**, for sharing their expertise in flood hazard mitigation and for providing me with opportunities to observe the Division's work firsthand.

William Burdick, for sharing some of his immense knowledge of Geographic Information Systems and his key role in obtaining the samples and conducting the analysis.

All of the other employees of the Department of Watershed Protection who made my job possible in innumerable small but crucial ways, including: **Myrtle Bashara**, **Lynne Lightsey**, and **Katie Pfeil**.

Ken Tran for his keen editorial skills, lucid prose style, thoughtful questions, and abiding friendship.

Rachel Jacobson for the love, the understanding, and the invaluable proofreading service she provided throughout my long, and sometimes hectic, career as a graduate student.

My parents, **Brenda and Terry Helfrich**, who have encouraged, challenged, and nurtured me throughout my life and who deserve ultimate credit for all of my accomplishments, large and small.

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Chapter 1

Introduction

Flood Hazards

Floods are one of the primary natural hazards faced by human beings (Chen et al. 2012, p. 682; Lara et al. 2010, p. 2081). Flooding causes more death and destruction than any other natural hazard, and losses are increasing due to rapid urbanization and global climate change (Brody et al. 2009, pp. 912-13; Danso-Amoako et al. 2012; Lehner et al. 2006; Van Herk 2011). Eighty-eight percent of counties in the United States experienced flooding in the second half of the 20th century, and more than 12 percent of the US population lives in areas of periodic inundation (Blanchard-Boehm et al. 2001; Burby 2011). In addition to threatening human life and property, floods can trigger massive disruption to "cultural setting, social structure, and regional economy, destroying critical relationships in times of crisis" (Douglas et al. 2001, p. 182). Even without fatalities, a flood can result in displacement, stress-related mental health problems, and localized shortages of labor and goods. (p. 186). Floods also cause environmental damage by disbursing urban contaminants, such as heavy metals and pathogenic bacteria, into rivers and soils (Dennis et al. 2003, p. 1657; Hathaway et al. 2007, p. 1276).

Floods fall into one of three categories, according to the water source: coastal, riverine, or localized (areal). Coastal flooding results from storm surges, storm waves, or tsunamis (Bates et al. 2005, p. 4). Riverine flooding results when heavy rainfall causes rivers and creeks to rise above their banks (Correia et al. 1998, p. 215). Localized

flooding occurs at a remove from an existing body of water, when runoff accumulates in streets and low-lying areas, as stormwater overwhelms the urban drainage system (Chen 2009; Correia et al. 1998, p. 215).

Flooding necessarily involves discussion of floodplains. A floodplain is the area of land adjacent to a body of water that would become submerged if the water level rises to flood stage. The oft-misunderstood “100-year floodplain” refers to the area of land around a body of water that would be submerged in a 100-year storm, i.e., a storm large enough that it has only a one-percent chance of occurring in any given year. A 25-year floodplain is smaller than a 100-year floodplain, because it represents the area of land that would become submerged in a flood that has a four percent chance of occurring in a given year. Put another way, a 25-year floodplain results from a smaller storm than does a 100-year floodplain and includes less area around a body of water.

Flooding in Urban Areas

Urbanization entails an increased concentration of people and property in areas of exposure (Montz and Gruntfest 2002, p. 16). Additionally, the installation of impermeable groundcover such as asphalt roadways and concrete sidewalks exacerbates flood hazard in urban areas. Impermeable groundcover seals off soil and vegetation that would otherwise absorb excess stormwater, increasing the total volume of runoff (Morelli et al. 2012; Olivera and DeFee 2007; Prudhomme et al. 2002). Impermeable groundcover also dramatically alters the hydrology of an area in two ways. First, it shortens the “lag time” between precipitation and stormwater discharge to

natural stream channels,” causing rainwater to flow into stream and river channels more rapidly than would occur in natural conditions (Hancock 2010, p. 1145). Second, impermeable groundcover “raises peak flows during storms while lowering base flows” between storms; these dramatic swings in the water level contribute to the erosion of stream channels (p. 1146).

Urban flooding has many of the characteristics of so-called “wicked problems,” which public institutions often confront. It results from a highly complex, interdependent system, it recurs and evolves over time, it is multijurisdictional, and it has prominent intractable elements (Jentoft and Chuenpagdee 2009, Rittel and Webber 1973, Thurmond 2010). As a result, the solutions to this problem, collectively referred to as “urban flood hazard mitigation,” tend to be interdisciplinary in nature, involving pure sciences like geology, applied sciences like civil engineering, and social sciences like psychology (Correia et al. 1998, p. 209). The policy environment is evolving according to the “punctuated equilibrium framework,” wherein “long periods of policy and institutional stability are interrupted by short episodes of radical change” (Cashman 2009, p. 79). A major flood often acts as a signal event, which calls public attention to flooding as a collective problem and compels institutional responses to more effectively address it.

History of Flooding and Flood Hazard Mitigation in Austin, Texas

In Austin, Texas, the Memorial Day Flood of 1981 acted as just such a signal event. On May 24th of that year, eleven inches of rain fell on the Austin area in three

hours, and the creeks in the area swelled, carrying away trees, vehicles, and buildings. Thirteen people lost their lives, and total property damage amounted to \$88 million in 2012 dollars (Williams 2011; Bureau of Labor Statistics). The Memorial Day Storm was the most catastrophic flood event to occur over the past 50 years in the Austin area, but it was hardly unique. Just six years prior, in November of 1974, another thirteen people perished during a flood, during which "every road in the county had people stranded on the rooftops," according to a Travis County Sheriff's Office spokesperson (City of Austin, Watershed Protection Department, Public Information Office). A few months afterward, in May of 1975, another flood left four people drowned and millions of dollars in property damage (Slade and Patton 2003).

A decade after the Memorial Day Floods, in 1991, the so-called Christmas Floods caused the water in local creeks to rise to record levels and destroyed 200 homes in Travis and Bastrop counties (Slade and Patton 2003). In 1998, twin hurricanes off the Pacific coast of Mexico fueled storm systems that caused major flooding in the Onion Creek area of southeast Austin, inundating at least 200 homes (Segal 2012). In the evening of November 15, 2001, a large thunderstorm cell stalled near the Hays-Travis County line, spawning tornadoes that touched down at various locations along the I-35 corridor and produced enough rainwater to flood 968 homes, costing \$11.3 million in property damage (Slade and Patton 2003). As of this writing, the most recent major flood in the Austin area occurred in 2010, when storms associated with Tropical Storm Hermine in the Gulf of Mexico —dropped more than a foot of rain in some areas of Central Texas," prompting numerous water rescues, some road closures, and a few evacuations on the northern edge of Austin (Harrell 2010; Spencer 2010).

Twelve inches of rain fell directly into Lake Austin and combined with runoff from Bull Creek, forcing the Lower Colorado River Authority (LCRA) to open floodgates above Lady Bird Lake, which runs through the heart of the city (Lower Colorado River Authority 2010). Lady Bird Lake topped its banks, causing minor damage to low-lying areas along Cesar Chavez Street and near Austin High School (Spencer 2010). Several deaths occurred, including one woman whose car was swept from RM 2222 a, a major east-west arterial street in Central Austin, by the torrential flood waters of normally-placid Bull Creek (Winters 2012). Insured financial losses in Texas measured in hundreds of millions of dollars, with total losses presumably much higher (Harrell 2010).

In the 1970s, the City of Austin began implementing more comprehensive countermeasures to increase the community's resilience to flooding. At the time of the Memorial Day Flood, the City of Austin had only recently begun to address urban flooding through the land development code. In 1974, the City passed the Waterway Development Ordinance, which —required a development permit and site plan, limited development in the 25-year floodplain, required erosion and sedimentation controls, and emphasized protection of the natural and traditional character of creeks” (Guerrero 2012). A few months after the flood, the City of Austin joined the National Flood Insurance Program (NFIP) and created the Watershed Engineering Department to implement the associated regulations.

The next year, the City introduced a drainage fee to support engineering and field operations programs, and within a decade it established a drainage utility to ensure that the funds raised through the drainage fee would be used only for stormwater management and watershed protection programs (Guerrero 2012). Between 1981 and

2011, the City ~~spent~~ \$200 million to buy and raze 450 flood-prone homes along creeks, build flood walls and retention ponds, expand creeks like Shoal Creek for more water-carrying capacity and improve storm drains in older neighborhoods” (Austin American-Statesman 2011). The city also coordinated with the US Geological Survey to implement a flood early-warning system that monitors 120 stream flow and rain gauges throughout the city (Austin American-Statesman 2011).

The Watershed Protection Department formed in 1996 from a merger of the flood and erosion programs of the Public Works Department and the water quality protection programs of the Environmental and Conservation Services Department. It still retains this basic allotment of responsibility within its organizational structure. Its two primary programmatic divisions are the Watershed Engineering Division and Environmental Resource Management Division, with the former focusing on water quantity and the latter focusing on water quality.

Even with a dedicated institution and a permanent funding source, Austin will never completely eliminate the risks posed by flooding, because the city lies in a vulnerable region, colloquially known as ~~the~~ “Flash Flood Alley” (City of Austin, Watershed Protection Department, National Weather Service). This vulnerability arises from several factors: (1) Central Texas draws major storms from both the Atlantic and Pacific Oceans as well as the North American landmass; (2) the Edwards Escarpment causes storm systems to stall in the area; (3) the seasonal weather pattern has long periods of drought with intermittent heavy rain; and (4) the ~~underlying~~ geology of the watershed...encourages rapid runoff of rainwater” (Slade and Patton 2003). In short, the climatic and physical features of the area around Austin ensure that large floods will

continually threaten its residents. A timeline presenting major floods in Austin and the steps that the City has taken to address the problem appears below in Figure 1.1.

Figure 1.1 Flood History in Austin and Regulatory History Relevant to WED

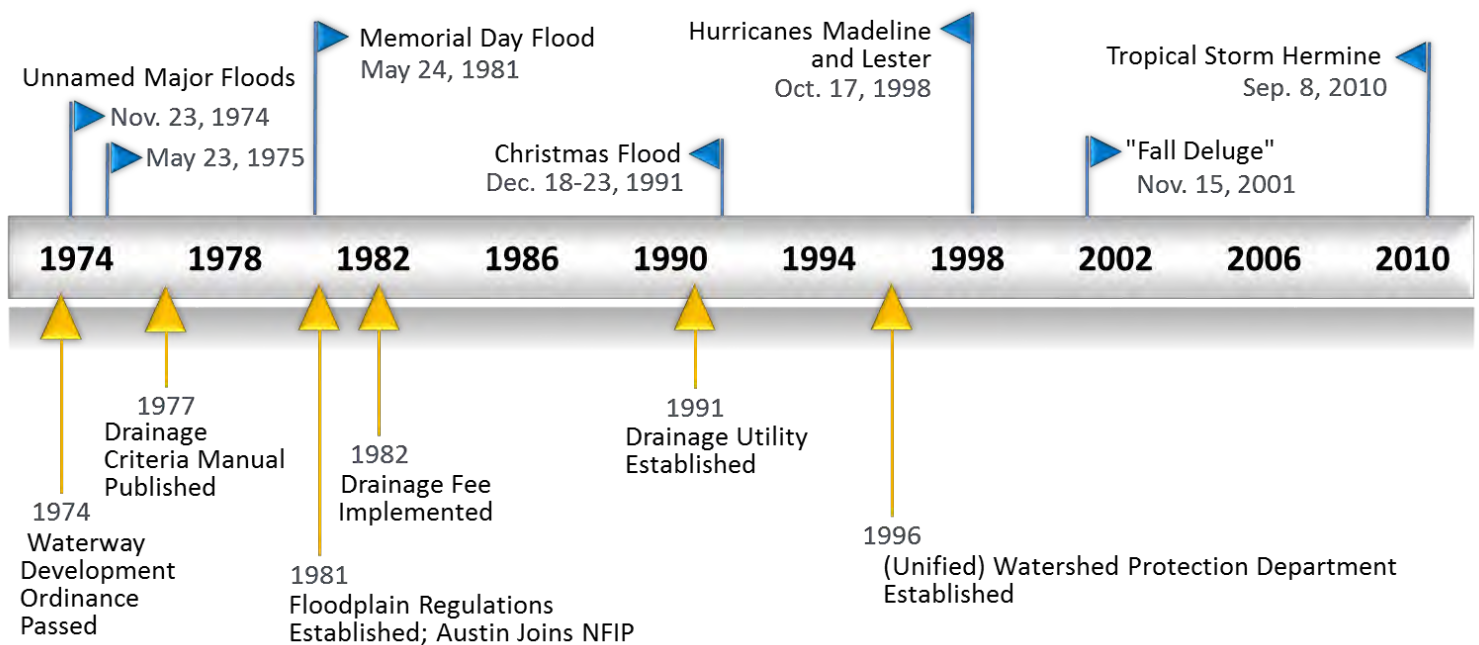


Figure 1.2 Photographs from the Memorial Day Flood in Austin, Texas (May, 1981)



Clockwise from upper left:

1. Thundercloud forming over Austin, Texas, May 24, 1981. (Photo by John E. Fine)
2. Body being pulled from Shoal Creek. (Austin History Center, Austin Public Library. PICA 29466)
3. Cars washed into Shoal Creek. (Austin History Center, Austin Public Library. PICA 15139)
4. Man inspects his flooded home. (Austin History Center, Austin Public Library. PICA 29472)

The Watershed Engineering Division and Flood Hazard Mitigation

The Watershed Engineering Division (hereafter, the Division) is the entity charged with flood hazard mitigation for the City of Austin and comprises three major sections: Creek Flood Hazard Mitigation, Floodplain Management, and Localized Flood Hazard Mitigation. The Division as a whole manages a large inventory of structures, including over 10,000 buildings in the floodplain (or in areas of localized flooding) and more than 400 low-water crossings across the city (Vigil 2012). The Creek Flood Section is responsible for the “planning, design, and construction” of capital improvement projects to mitigate the risks posed by creek flooding, such as culvert and low water crossing upgrades, floodwalls, buyouts [of homes in the floodplain], detention ponds, and channel modifications” (Cook 2012).

The Floodplain Section coordinates with the Federal Emergency Management Administration (FEMA) to produce flood insurance rate maps and floodplain studies. It is responsible for disseminating floodplain information to citizens and developers, and for enforcing floodplain regulations through the review of residential building permits and commercial site plans (Shunk 2012). The Floodplain Section also maintains the Flood Early Warning System (FEWS), which monitors weather conditions to predict imminent flood hazards, and coordinates with the Field Operations Division and with the Office of Emergency Management to barricade roadways and initiate evacuations when necessary (Shunk 2012).

Public Engagement

Public engagement can increase the effectiveness of flood hazard mitigation strategies, such as those undertaken by the Watershed Engineering Division in Austin, Texas. Every potential flood hazard mitigation strategy, from storm sewer upgrades to zoning regulations, benefits from increased governmental engagement with the general public (Correia et al. 1998). Engagement can increase the public's willingness to cooperate with flood hazard mitigation strategies by raising awareness of different flood management techniques, increasing the sense of responsibility to help connected communities at risk of flooding, and raising awareness of the beneficial impacts flood control projects (Howgate and Kenyon 2009). Additionally, communication between experts and the general public enhances "residents' awareness of both self- and mutual-help efforts in community flood risk mitigation" (Yamada 2010, p. 126). This is important, because resilience to natural hazards depends on a multitude of small-scale decisions by individuals as well as large-scale decisions made by institutions (Paton 2003, p. 210).

Public engagement strategies fall into one of three types, depending on the "flow of information" (Rowe and Frewer 2005, p. 254). Public communication occurs when officials provide information to citizens, public consultation occurs when officials solicit information from citizens, and public participation occurs when officials and citizens engage in dialogue or negotiation (p. 254). Direct participation by the citizenry in government is obviously the most intensive of these types of engagement. However, citizens do not participate directly in flood hazard mitigation, and there seems not to be an obvious way for them to do so. Laypeople have little inclination to engage in

technical problem solving, and planners have found it —particularly difficult to generate high levels of public participation in making plans to reduce the dangers of natural hazards,” despite the high costs these hazards can impose (Godschalk et al. 2003, p. 734). Therefore, the most relevant questions about public engagement in hazard mitigation necessarily focus on public communication, i.e. how well public officials communicate hazards to the public, and on consultation, i.e. how well public officials solicit information and opinions about hazards from the public.

Many of the difficulties presented by public engagement in public administration illustrate the tension between the —“technocratic orientation” and the —“democratic orientation” towards governance (Fiorino 1990). The field of risk-management, which includes urban flood hazard mitigation, seems to favor the technocratic orientation on its face. —“The sheer complexity of the issues” demands action by —“administrative officials in concert with scientific experts, acting under instructions from elected representatives, and consulting as necessary with interest groups representing aggregated ‘public’ interests,” under the assumption that —“this ...will make more rational decisions” (Fiorino 1990, p. 227).

Those with a democratic orientation tend to respond with the following arguments: (1) —“lay judgments about risk” occasionally prove more accurate than the judgments of experts, (2) public participation in risk decisions tends to legitimize these decisions in the eyes of the citizenry, and (3) an exclusive focus on technocratic solutions is fundamentally —“incompatible with democratic ideals” (p. 227-228). Ultimately, hybrid solutions must emerge that incorporate the knowledge and

professionalism of experts with the experience, needs, and desires of laypeople (Dewey 1927, p. 125).

Over the past three decades, theories of public administration have moved toward more public engagement, including both increased responsiveness, i.e. viewing citizens as clients or customers of a governmental agency, and increased collaboration, i.e. viewing citizens as partners in problem-solving (Vigoda 2002, p. 527). The City of Austin has manifestly embraced both aspects of this trend. Recent examples of the City's efforts at public engagement include the much-lauded collaborative process used to develop Austin's long-range comprehensive plan, the redevelopment of its website to improve public access to information, the establishment of community outreach offices in the code compliance office and the electric utility, and the establishment of an online discussion forum for citizens to offer "feedback and ideas" to improve city management (City of Austin Budget Office 2012, pp. A-5 and A-6; SpeakUpAustin!). One can see the results of the City's commitment to responsiveness in the high levels of satisfaction Austin residents express with the City's customer service performance. In the most recent citywide survey, the percentage of Austinites who indicated that they were satisfied or very satisfied with the "overall quality of customer service" was 27 points higher than the average for other cities of comparable size (ETC Institute 2012, p. 16).

Citizen Awareness and Satisfaction

One can describe the engagement of the general public in the area of flood hazard mitigation along two lines: (1) awareness of flood hazards and hazard mitigation strategies and (2) satisfaction with the implementation of those strategies. Public

awareness represents the effectiveness of public communication undertaken by flood management authorities. People may not be aware of flooding as a problem, nor of the things being done to mitigate the problem, unless someone tells them. Major flood events happen at intervals that stretch over many decades or even generations. Awareness is a necessary precondition for a layperson to more fully engage in risk management by gathering more information, forming opinions, and participating in dialogue.

Public satisfaction measures an agency's responsiveness to the needs of citizens. The benefits of measuring satisfaction follow the basic logic of the —democratic orientation” stated above. First, citizen dissatisfaction may suggest improvements to programs. Second, soliciting feedback can legitimize the activities of the flood management authority in terms of perceived accountability. Third, asking about satisfaction represents a form of basic respect for citizens, who are both the funders and intended beneficiaries of these programs.

Research Purpose and Overview

The purpose of this research project is to describe citizen awareness of and satisfaction with urban flood hazard mitigation programs undertaken by the municipal government of Austin, Texas. The literature review chapter presents strategies for mitigating urban flooding hazards and categorizes these strategies in a conceptual framework. The methodology chapter formulates a list of questions from the conceptual framework and discusses the survey procedures used to gather responses to those

questions. The results chapter presents the main findings, and the final chapter provides recommendations and possible avenues for further inquiry.

Chapter 2

Literature Review

Introduction

Experts in flood hazard mitigation use a variety of strategies to minimize the risks posed by flooding. The following review of scholarly literature organizes these strategies into a conceptual framework comprising several categories. It then examines the ways in which average residents may encounter these strategies and interact with the Watershed Engineering Division. Describing the awareness and satisfaction of Austin residents provides insights into how to target these strategies more effectively.

Broadly considered, flood hazard mitigation strategies fall into two categories: structural solutions and non-structural solutions. Structural solutions, such as detention ponds, dams, and storm sewers, attempt to physically control stormwater flows using the built environment. Nonstructural solutions attempt to adapt to or cope with the effects of flooding rather than prevent it outright through physical controls. Nonstructural solutions fall into three broad categories, all of which entail more direct involvement of average residents than do structural solutions: land-use planning, insurance, and communication, which includes both flood awareness and flood warning. Maps and models support the implementation of both structural solutions and nonstructural solutions but are closely related to nonstructural solutions such as land use regulations and flood insurance. Thus, this study considers four main categories of flood control strategies: (1) Floodplain maps, including the insurance and land-use requirements they

entail (2) Structural Solutions, (3) Awareness of flooding and flood control programs, and (4) Flood warning. The conceptual framework is presented below, in **Table 2.1**.

Table 2.1 Conceptual Framework

<i>Descriptive Categories</i>	<i>Supporting Literature</i>
Floodplain Maps Method of Access Communication of Changes Land Use Planning Insurance	Amaguchi 2012 Blanchard-Boehm et al. 2001 Brody et al. 2009 Burby 2011 Chivers et al. 2002 Correia et al. 1998 Douglas and Korom 2001 Federal Emergency Management Agency 2013 Merwade et al. 2008 Norris and Moon 2005 Olivera and DeFee 2007 Popovska et al. 2010 Prior 2010 Qi and Altinakar 2011 Van Herk 2011 Vandenberghe 2010 Winter and May 2001 Winterscheid 2007
Structural Solutions Visibility Effectiveness	Baker and Crompton 2000 Cembrano et al. 2004 Correia et al. 1998 Danso-Amoako et al. 2012 Hincapié -Ramos et al. 2010 Howgate and Kenyon 2008 Kelman and Rauken 2011 Moura et al. Star 1999 Sun et al. 2011 Werritty 2005
Awareness Experience of Flooding Reporting Public Campaigns	Arriss 2003 Birmingham et al. 2008 De Marchi and Scolobig Gattig 2007 Hacque et al. 2002 Lara et al. 2010 McDonald 2002 National Weather Service 2013 Parker et al. 2009 Rashid 2011 Scolobig 2012 Shannon and Lowe 2002 Tekeli-Yeşil et al. 2011 Wagner 2007
Flood Warning	Carsell 2004 Cools et al. 2012 Del Carmen Llasat and Siccardi 2010 Parker et al. 2009

Flood Maps

Modern flood control systems for urban areas rely on detailed representations of the natural and built environment in order to identify hazards and prioritize projects. In the past few decades, three developments have converged to increase the value of modeling to urban flood hazard mitigation: (1) the increased availability of detailed data about the urban environment, (2) the development of GIS software to store and visualize these data, and (3) advances in computing hardware that make it possible to store ever-larger quantities of data and feed them into complex equations at ever-faster speeds (Amaguchi 2012, p. 214). These flood models rely on highly-detailed maps of urban areas that include a variety of different kinds of data, such as land-use zones, topography, building footprints, and property lines (Amaguchi 2012).

The complexity of the models, which often employ probabilistic procedures to account for the variability of conditions in the real world (e.g., Popovska et al. 2010; Merwade et al. 2008), renders them relatively opaque to a lay audience. Public input is more useful in long-term strategic planning, rather than in short-term implementation. However, underlying uncertainty about real-world conditions makes evaluations of long-term changes to riverine systems extremely difficult (Olivera and DeFee 2007; Qi and Altinakar 2011).

Floodplain maps are fundamental to a flood risk management strategy, because they provide tools to educate stakeholders about flooding in terms of probabilities, extent and depth, probable economic damage, and probable social impact (Vandenberghe 2010). Local officials use maps and models to gauge flood risk, but residents must also have easy access to this information in order to make informed

decisions about where to live and what risks to assume. Also, the boundaries of the floodplain may change due to changes in the landscape, more detailed models, or both. Alterations to the floodplain map can change who must insure themselves against flood risk and what building restrictions apply.

Method of Access

The transmission of information from government to citizens is important at the local level, because local institutions are closest to the people and “deliver the greatest number of services directly” to them (Norris and Moon 2005, p. 65). Examining the use of electronic information dissemination is especially important at the local level because of its “potential reach, cost, and impact” (p. 65). Therefore, it is important to ask citizens about the ways they would like to access floodplain information, especially including various types of electronic communication technologies.

Communication of Changes

In order for a local jurisdiction to qualify for reduced flood insurance rates under the Community Rating System of the National Flood Insurance program, it must conduct public outreach campaigns, including mailers and public meetings, to inform residents about changes to floodplain maps (Federal Emergency Management Agency 2013). However, some floodplain managers have suggested that people are generally unaware of whether they reside in the floodplain. Thus, it is important to ask if residents know

whether they are in the floodplain, if they have been affected by changes to floodplain maps, and how satisfied they are with the way they learned about the changes.

Land use planning

Land use planning is a proactive strategy for flood hazard mitigation that attempts to limit the exposure of structures by limiting what private property owners may do in the floodplain. Such an approach relies on the expertise of professional planners, who strive to "establish facts, create images, and set ambitions" (Van Herk 2011, p. 546). Land use regulations often involve controlling the location and characteristics of urban development. For instance, such methods may include restricting new building in areas subject to high levels of flood hazard (Correia et al. 1998, p. 211) as well as requiring certain elements of site-design to minimize the runoff resulting from new roofs and parking lots. The use of geographic information is "critical" for nonstructural solutions in order to delineate high risk zones for target flood-proofing initiatives (Douglas and Korom 2001). The value of "creating images" and the use of geographically-referenced data to target programs indicate the interrelationship between floodplain maps and land-use regulations, namely that the location of the floodplain boundaries determines who is subject to regulation.

Significant obstacles confront effective implementation of land use planning. Despite the existence of a "consistent policy framework," coordinated land use planning to reduce flood hazards often receives limited "institutional support" (Winterscheid 2007). Furthermore, floodplain regulations are "controversial and difficult to enforce,"

because —~~any~~ many people want the freedom to build ...without government controls” (Federal Emergency Management Agency 2013). Frequently, residents may not be aware they need a local permit to begin construction (Federal Emergency Management Agency 2013).

Not only is it —~~axiomatic~~ axiomatic” that awareness of regulation is a ~~prerequisite~~ prerequisite to compliance,” but studies have empirically demonstrated that individuals who report low levels of awareness of rules will have limited compliance, while those who report higher levels of awareness of rules will have higher compliance (Winter and May 2001 680). This is true even when —~~taking~~ taking other factors into account,” such as the perceived likelihood of detection, a perceived ethical duty to comply, and the perceived capacity to comply (pp. 689-90). A lack of awareness on part of the affected population could arise because the regulations are new or not sufficiently publicized (p. 680).

Even if a person knows that an activity is regulated, he or she may still not understand the specific requirements of the regulation (Winter and May 2001, p. 680). The enforcement of development restrictions by local authorities illustrates this problem acutely. The ~~broad~~ broad definition of ‘development’ combined with —~~to~~ to complex contingencies and qualifications by which minor developments are ‘permitted’ ...can often create uncertainty in the minds of property owners as to whether planning permission is required” (Prior 2010, p. 64). Thus, it is important to ask residents if they are aware, not of building restrictions in general, but of regulations that limit construction in the floodplain, including the building or remodeling of a house.

Insurance

Flood insurance programs are a more reactive mitigation strategy than land use planning. FEMA's National Flood Insurance Program (NFIP) plays a substantial role in flood hazard mitigation within the United States. The NFIP mandates flood insurance for most residents in the 100-year floodplain and provides a subsidy for obtaining such insurance. Thus, the NFIP functions both as an attempt to create an efficient market and as a social program. The first function arises from the mandate, because a compulsory national flood insurance program (ideally) improves the economic efficiency of floodplain occupancy by increasing the costs of living in the floodplain (Chivers et al. 2002). The second function arises from the subsidy, because it makes flood insurance more affordable for vulnerable populations (but has the unintended consequence of perpetuating hazards by making it more affordable to live in the floodplain). The administration of a flood insurance program is fraught with problems and has garnered criticism from across the political spectrum, but no one disputes that it plays a substantial role in the current practice of flood management.

Two aspects of the NFIP have bearing on this research project: (1) the Community Rating System (CRS) that provides financial incentives to local jurisdictions that undertake mitigation strategies above and beyond the minimum qualifications for obtaining national flood insurance (Brody et al. 2009, p. 915), and (2) the significant reform in 1994 that transferred the locus of regulation from floodplain residents to mortgage-lenders (Blanchard-Boehm et al. 2001). The first aspect is covered above in the section about communication of changes to floodplain maps. The second aspect,

the 1994 overhaul, was meant to increase the proportion of properties in the floodplain covered by flood insurance, but a lack of compliance on the part of the lenders has inhibited this. Low market penetration remains the most significant problem facing the NFIP, and, currently, only about 25 percent of floodplain residents actually have flood insurance, despite the mandate and the subsidy (Burby 2011). This is possible because public institutions do not investigate noncompliance. Compliance is voluntarily enforced by private banks who require their clients with federally-guaranteed home mortgages to purchase flood insurance if the home falls within the boundaries of the 100-year floodplain. Because of this widespread lack of insurance coverage, it is important to ask residents, especially those who live in the floodplain, whether they have flood insurance.

Structural Solutions

Structural solutions are fundamental to urban flood hazard mitigation one of the primary concerns of the Watershed Engineering Division in the City of Austin. The design of flood-control infrastructure strives for optimality in terms of combining minimal construction costs with maximal reduction of flood risk (Sun et al. 2011, p. 249).

Prioritizing upgrades and adapting to new technical standards have improved rapidly over the past several years because of sophisticated computer risk models (e.g., a risk assessment methodology for pond dams using an artificial neural network model) and better-catalogued inventories of existing structures (Danso-Amoako et al. 2012).

Technological advances, such as the automation and remote-control of some structural elements, also offer the promise of more adaptability for flood-control devices (Cembrano et al. 2004)

Structural solutions also face many difficulties. First, professionals in the field of flood hazard mitigation have traditionally relied on structural solutions as the default response to flood problems, due to “population pressures,” the assumption that “human activity [is] more important than ecosystems or [the] natural flow of rivers,” and the pressure of “powerful interest groups at the local level [that] often benefit from fast, and largely unplanned, urban growth” (Werritty 2005, p. 16; Kelman and Rauken 2011, p.144; Correia et al. 1998, p. 215). Second, design standards have often relied on under-predictions of rainfall intensity and post-development runoff flows (Hancock et al. 2010). Third, the performance of these structures is often difficult to gauge, due to conflicting criteria (Moura et al. 2011). Fourth, structural solutions often have high capital costs to construct and renovate (Werritty 2005; Howgate and Kenyon 2008). Fifth, many structures also have environmental costs, primarily because they do not allow pollutants present in the urban environment to settle or filter out of runoff before directing this runoff into natural areas where it contaminates soils and rivers (Correia et al. 1998, p. 212). Finally, structural solutions to flooding, such as straightening a streambed, may efficiently channel stormwater away from homes, but degrade the stream’s environmental or aesthetic quality and thus undermine the “public acceptance or consensus” necessary to undertake such projects (p. 212).

Structural solutions are an imperfect but necessary component of any mitigation plan. Some method of directing and regulating the excess runoff generated by urban development need to exist in order to protect human life and property. Regardless of whether structural solutions are strictly necessary in an abstract sense, the concrete

reality consists of actual buildings, sewers, and dams—things that are costly to retrofit, remove, or replace.

Visibility

Several difficulties exist with regard to public awareness of structural solutions. The first difficulty is that infrastructure tends to be “invisible,” because it is embedded and transparent (Star 1999, p. 381). Infrastructure is embedded in the sense that it is “subsumed into and inside of other structures, social arrangements, and technology,” and it is transparent in the sense that “it does not need to be reinvented for each task,” but comes ready-made to unobtrusively support those tasks (p. 381). The invisibility of infrastructure results in a general “lack of understanding” of its “nature and characteristics” outside of the professionals who build and maintain it (Hincapié-Ramos et al. 2010, p. 203). Flood control structures conform to this general characterization of infrastructure because they are “embedded” underground or in marginal locations such as at the outer edges of parking lots and are transparent in the sense that an untrained eye cannot easily identify their purpose, as in a floodplain easement. If a person sees a raging river flowing down an artificially widened and stabilized stream channel, her immediate thought is not about what sort of planning and labor it took to build the channel, in the same way that she does not marvel at the wonders of modern plumbing every time she brushes her teeth.

This “invisibility” would seem to necessitate asking residents if they are aware of recent construction, which would presumably stand out from the surrounding

environment to a larger degree than infrastructure that remains embedded. However, the construction and reconstruction of flood control infrastructure often occurs simultaneously with other maintenance or beautification projects, and municipal governments contract much of this work to private construction firms. Thus, a resident may live near a recent flood-control project but be unaware of its purpose or that it is financed by the City. For this reason, it is extremely important to ask if residents have noticed a flood-protection or drainage project conducted by the City in their immediate vicinity before asking how satisfied they are with these projects.

Effectiveness

Even if residents are aware of a City flood control project as such, they probably do not have the expertise necessary to judge its success or failure. An additional problem arises because, even if residents could accurately judge the success of a project, they would not necessarily feel satisfied with the outcome. Their responses would likely skew negative because “infrastructure attributes” have a taken-for-granted or “hygiene” quality that is “expected but unexciting” (Baker and Crompton 2000, p. 799). This means that infrastructure, such as storm sewers, is subject to expectation thresholds, insofar as infrastructure exceeding some minimal expectation will not lead to increased satisfaction, but infrastructure failing to meet this minimum expectation will cause pronounced dissatisfaction (p. 799). However, it is still important to describe this satisfaction, even if only a minority are dissatisfied and the rest are neutral. Dissatisfaction, if analyzed geographically, could point to problem areas that the City needs to analyze.

Awareness

Increasing flood awareness involves communicating the uncertainty involved in prediction and the preparatory actions that individuals can take in the event of a major flood. In the short term, this contributes to individual flood preparedness, and in the long term, it contributes to increased economic and political feasibility of future mitigation projects (Tekeli-Yeşil et al. 2011; Hacque et al. 2002).

People tend to underestimate flood risk for several reasons. Systemic cognitive bias causes people to "consistently underestimate the chances of adverse consequences in relation to their own situation" (Parker et al. 2009, p. 108). The —It'll never happen to me" distortion is even more pronounced with regard to environmental risks because these are "highly uncertain, strongly delayed, occurring at distant places, and, thus, mostly borne by others" (Gattig 2007, p. 22). Additionally, many of the mitigation strategies mentioned above may unintentionally increase vulnerability by inspiring unwarranted confidence in such countermeasures. Examples of such phenomena include the "safety paradox" and the "efficiency paradox," wherein the increased protection provided by structural devices and by dedicated institutions, respectively, translates into a lack of awareness and agency on the part of the general public (De Marchi and Scolobig 2012). Many social surveys have shown that there is "widespread" agreement with the notion that "the costs of flood protections must be borne by public institutions," and "most residents do not, therefore, take steps to protect their dwellings either before or after a flood" (Parker et al. 2009, p. 107).

Despite the impediments to accurate risk assessment, most "people tend to discount the costs of future environmental problems less than they do for health or financial problems." Additionally, the key physical processes for flash floods are relatively easy for the general public to understand, compared to landslides and other types of natural hazards (Wagner 2007). This suggests that appeals to the public's long-term preferences may be successful (Gattig 2007, p. 36)

Experience

Studies of vulnerability to flood hazards have shown that flood warnings are less effective for those with lower socioeconomic status, lower levels of education, lower levels of flood experience, and a shorter length of time in a particular residence (Birmingham et al. 2008). These are all background factors that shape general flood awareness, rather than factors that directly affect the communication of flood warning. Thus, it is important when conducting a survey of flood awareness to ask residents how concerned they are about flooding, their income level, the length of time in their current home, and whether they have experienced flooding in the past.

Much research has also been conducted on the subject of what increases flood awareness and preparedness. Content analysis of local newspapers reveals a discourse "rich in context, providing explanations of the causes and impacts of flooding," compared to the discourse of the national media (Rashid 2011). This corroborates social-survey research showing that increased "involvement with the affairs of the local community" has a significant effect on flood awareness and

preparedness (Lara et al. 2010, p. 2081). Other contributing factors include "living in the most risky areas, having a low level of trust in local authorities, increased knowledge about the local environment, and ...strong local support networks" (Scolobig 2012, p. 517). Other factors that increase flood awareness and preparedness include: the existence of multiple sources of information, the overall fear of disasters, and previous experience with specific hazards (Wagner 2007, p. 678). Thus when assessing awareness, it's important to ask how long a respondent has lived in an area and how long they have lived in their current homes. To avoid asking detailed questions about social networks, trust in authorities, and other aspects of social capital, the length of time in the general area could serve as a proxy measure for engagement in community affairs.

Reporting

Little scholarly research exists on reporting non-emergency problems to local governments, although there are many studies about self-reporting in other contexts, such as crime and workplace injuries. This research shows that even for incidents that are quite serious, e.g. a robbery or a slipped disk, underreporting is quite common (McDonald 2002; Shannon and Lowe 2002). Admittedly, both crime and workplace injuries involve the possible fear of retaliation, which would play a marginal role, at most, in reporting of flood or drainage problems. However, fear of retaliation may not be the sole driver of under-reportage. For instance, workers often do not report health issues to their supervisors because of an assumption that it is the normal consequence of work or aging, a lack of recognition, improper diagnosis or causal attribution, [a] lack

of knowledge of reporting requirements, administrative barriers, and [a] lack of reporting mechanisms” (Arriss 2003).

The analogy with flood reporting is obvious. People may assume that flooding or drainage problems are “normal,” that they are the result of one-time blockages of sewer inlets and not a chronic issue, or that there is no means for reporting the problem. To overcome some of these barriers, it is necessary to ask residents if they are aware of the way to report flooding problems, their preferred methods for reporting flooding in the future, and their perception of the importance of reporting flooding.

Public Campaigns

Motor vehicle deaths account for more than half of all flood fatalities in the United States (Parker et al. 2009, p. 107). The National Weather Service (NWS) operates the most prominent public campaign on this topic, known as, “Turn around Don’t Drown”® (National Weather Service). The phrase is a registered trademark of the National Oceanic and Atmospheric Administration, and according to its policy on fair use, the National Weather Service (NWS) expects educators, public safety officials, meteorologists, and weather reporters on local media to utilize the phrase in their communication with the general public (National Weather Service). On its website, NWS includes a variety of multimedia resources for disseminating the phrase. One way of gauging the effect of public awareness campaigns is to simply ask people if they have encountered this simple, seemingly well-known phrase. This might also an indication of whether more active attempts must be made to popularize the phrase in

particular, or to determine if awareness of the phrase is correlated with concern about flooding.

Warning

Another crucial avenue of communication between expert and the public is an early-warning system (EWS) that predicts imminent flooding and initiates emergency management measures. These systems provide a direct, tangible benefit, namely, the reduction of losses through increased mitigation time (Carsell 2004). The available evidence indicates that increasing flood warning lead-time correlates with lower fatality rates (Parker et al. 2009, p. 109). Although —essential to coping with flash floods, ...physical science and engineering advancements ...will only make a difference if the recognition and understanding of warnings, warning response, and risk communication are increased” (Montz and Gruntfest 2002, p. 19). In other words, the human element is as important as the technical elements when it comes to a warning system.

To implement effectively, an EWS requires both high-quality data and a high level of institutional capacity (Cools et al. 2012), and it must maintain an extremely high level of accuracy to maintain public credibility (Del Carmen Llasat and Siccardi 2010). One common problem facing early warning systems is that, even in relatively affluent and electronically-connected societies, flood warnings may reach less than half of the people who are eventually affected by floods (Parker et al. 2009, p. 105). In order to create effective warning systems, officials must —start with monitoring and forecasting, and move through decision-making and message dissemination, to preparedness and mitigation” (Montz and Gruntfest 2002, p. 18). Without a broad-scope message

dissemination strategy capable of reaching masses of people, a warning system cannot operate effectively. Providing information on a variety of media is important, including dial-in systems, local radio, and informal social networks (Parker et al. 2009, p. 106). Thus, it is necessary to ask respondents about the media through which they have encountered flood warnings in the past as well as about the media through which they would like to receive flood warnings in the future.

Conclusion

Urban flooding is a complex problem that demands an ensemble of solutions to address adequately. This overview has shown that nearly every approach to flood hazard mitigation has shortcomings of one type or another and that some of these shortcomings relate directly to the public that finds itself threatened by flooding. By measuring the ways in which the public interacts with flood control programs, one can identify some of these shortcomings and the means of addressing them.

Chapter 3

Methodology

Description of Survey Research

The following chapter describes the methods used to answer the research question, —Are Austin residents aware of flood hazard mitigation strategies undertaken by their municipal government, and how satisfied are they with these strategies?” The methods used to answer this research question adhere to the standards of survey research as conducted by social scientists, wherein a standardized questionnaire is administered to a sample of respondents representing the population of interest (Babbie 2010, p. 254). The questionnaire, or survey instrument, contains —questions and other items designed to solicit information appropriate for analysis” (256). The questionnaire typically contains mostly closed-ended questions to "provide uniformity of responses" and allow for easy processing (p. 256). It may also include open-ended questions, in case the questionnaire has neglected any important issues (p. 256). The questionnaire used in this study employs one open-ended question, and several questions that provide the option of open-ended responses.

Advantages and Disadvantages of Survey Research

Survey research has many strengths, including its applicability to large populations, its analytical flexibility, and its uniformity (Babbie 2010, p. 287). Descriptive research questions, i.e. those which entail analyzing a large number of variables

simultaneously, demand a large number of cases. Surveys make such large samples feasible, and self-administered questionnaires are particularly well-suited to this task because of the minimal labor needed to solicit responses. Surveys also provide analytical flexibility because the researcher can ask several different questions on a given topic, and then modify the operational definitions of concepts (e.g., "awareness" or "satisfaction") after collecting data. By focusing on some questions and/or discarding other questions, the researcher can develop "operational definitions from actual observations," rather than commit to an operational definition before gathering data, as in experimental research designs (p. 287). Finally, because the researcher asks uniform questions of all subjects and "impute[s] the same intent" to similar responses, he or she can compare all respondents to one another and make generalizations (p. 287).

Although a survey provides the most feasible method for answering a descriptive research question about a large population, the method suffers from some inherent weaknesses. The results of survey research can be somewhat "superficial," because the standardization of the questions for all respondents requires the researcher to design questions that will be "at least minimally appropriate to all respondents," and this may overlook what is most relevant or important to many respondents (Babbie 2010, p. 287). As in many other quantitative research techniques, survey research sacrifices depth for breadth. Surveys also demonstrate procedural inflexibility, because the survey instrument must remain unaltered throughout a study, precluding adaptations to changing conditions, misunderstandings of survey questions, or problems in sampling procedure. Finally, survey research can produce "artificial" results in the sense that they cannot measure events directly, but can only "detect self-reports of recalled past action

or of prospective or hypothetical actions” (p. 288). For instance, the researcher cannot directly measure the actual floods that have occurred on a particular property but can only ask about respondents' recollections of flood events.

Nonresponse bias poses an additional threat to validity. (Berman 2007, p. 89). This occurs when the characteristics of the non-respondents differ in some significant aspect from those of respondents, —~~thus~~ affecting the generalizability from the sample to the population” (Berman 2007, p. 89). Low response rates are a particular concern for —~~surveys~~ based on enclosures in mass mailings” (p. 89). A researcher can control for nonresponse bias in two ways: (1) by increasing participation rates with reminders and incentives and (2) by statistically weighting survey responses to match the demographics of the population (p. 89)

Survey Procedure

Population and Sampling

The research question considered here immediately suggests two populations of interest: the residents of Austin as a whole and those Austin residents living in the floodplain. From the outset of the project, it was known that these populations were quite large. The US Census identified 322,979 households in Austin as of 2011, and according to the head of the Floodplain Modeling Group within the Division, there were approximately 15,000 residential homes located in the floodplain. Because the research purpose entails "attitudes and orientations" of a "population too large to observe directly," surveys were chosen as the most appropriate research method (Babbie 2010,

p. 254). A mail-in survey was chosen as the most appropriate means of distribution, because the researcher did not have access to email addresses nor the large number of professionally-trained survey administrators needed to conduct telephone interviews.

Survey research begins with three important steps: defining the unit of analysis, defining the sampling frame, and defining the sample-selection method. In this case, the unit of analysis is necessarily the household, because surveys are sent to physical addresses, rather than to individual people. However, some questions are relevant only to individuals, such as those concerning a person's race/ethnicity or a person's previous flood experiences. Other questions are more relevant to the physical property, such as the location of flooding. Thus, the individual person or the property could be considered the unit of analysis for certain questions.

The sampling frame is the master list from which the sample is drawn, and it strives to match the population of interest as closely as possible (Babbie 2010, p. 208). For the population of general Austin residents, the sampling frame is a list of all the occupied households within the city limits. To obtain this, a register of all occupied housing units maintained by the City's Geographic Information System (GIS) was narrowed to all of those addresses existing within city limits and then again to those addresses existing in residential land-use zones (including the central business district and other mixed-use zones). The resulting sampling frame contains 380,691 unique addresses.

The sampling frame for the second population is a list of all residential households that have some portion of their property falling within the 100-year

floodplain. As stated above, the 100-year floodplain is defined as the area that would experience flooding from a storm of sufficient size that it has only a one-percent chance of occurring in a given year. The most recent update of this map was obtained from the Floodplain Modeling Group within the Watershed Engineering Division. (For a rough outline of this map, please refer to Figure 4.2 on page 65.) This map of the floodplain was then overlaid with land parcel boundaries taken from the Travis County Tax Assessor's records, and those parcels that overlapped at all with the floodplain were retained in the sampling frame. Then, this list of parcels was cross-referenced with the list of addresses (including unit numbers) obtained from the City's master list, as above. The resulting sampling frame contains 73,709 unique addresses.

A simple random sample was taken from each of these sampling frames, using a random selection algorithm available for ArcGIS software. Because a simple random sample ensures that each element in the sampling frame has an equal chance of being selected, one can assume that the resulting sample is representative of the population as a whole, at a given level of confidence (Babbie 2010 198, p. 211). The size of the necessary samples was determined, based on a 95% confidence level and a ± 5 confidence interval. This was done because obtaining higher confidence levels would require extraordinarily large sample sizes, which would entail exorbitant costs for printing and mailing. A response rate of 20% was assumed, as a middle ground between the 60% achieved by ETC in its 2012 survey of Austin residents using a trained staff of telephone interviewers and the low response rates of under 5%, which can occur when only mail-in methods are used. This yielded a total of 3,830

questionnaires mailed, with 1,910 going to floodplain residents and 1,920 going to general residents

Questionnaire Construction and Distribution

This survey uses the format of a self-administered mail-in questionnaire. A bulk-mail permit and a business reply mail permit were both available through the Environmental Resource Management Division within the Department of Watershed Protection. Although self-adhered postage may carry a "personal touch," the substantial cost-savings obtained through the use of these permits made them attractive options (Babbie 2010, p. 271). Additionally the local postmaster in charge of permits gave his assurance that bulk mail was nearly as accurate as first class, if 2-5 days slower.

The questionnaire received pretesting from flood management professionals and several friends and family members, and their suggestions resulted in slight alterations to the question wording. Each residence in the sample received a copy of the questionnaire in English and Spanish and a cover letter on City of Austin letterhead explaining the purpose of the research, encouraging participation, and assuring the anonymity of responses. To increase response rate, and thus lower the possibility of nonresponse bias, a follow-up postcard was sent two weeks after the initial mailing (Babbie 2010, p. 272). This offered a reminder about the survey and contact information for obtaining an additional copy of the questionnaire. Sending additional copies of the questionnaire with the follow-up was considered because this increases response rate even more, but previous research has shown that reminder postcards are a far more

cost-effective option (Babbie 2010, p. 272; Becker et al. 2000). A copy of the cover letter appears in Appendix B, and a copy of the reminder postcard appears in Appendix C.

Human Subjects Protection

On January 25th, 2013, the Institutional Review Board at Texas State University declared this Applied Research Project exempt from review. According to criteria presented in the Belmont Report (the document that provides the basis for the human subject protection regulations), this study presents very low risks. The cover letter attached to the questionnaire provides comprehensive, comprehensible information about the purpose of the research project and assures the voluntariness and anonymity of all responses. The method of a mail-in survey renders coerced participation nearly impossible, because a person who does not consent to the answering the questions could merely discard the questionnaire rather than take the positive step required to mail it back. Respondents' involvement in the study is limited to the few minutes it takes to complete the questionnaire, and none of the questions contained therein addresses a particularly private or sensitive subject-matter. Finally, the sample of respondents was taken randomly across a large urban space, presenting a very low probability of disproportionate burdens on disadvantaged groups.

Operationalization of the Conceptual Framework

Table 3.1, presented below, operationalizes the conceptual framework.

Operationalization is the process by which a social researcher specifies the operational definition of social concepts, i.e., “the exact operations involved in measuring a variable” (Babbie 2010, 46). A conceptual framework provides a systematic procedure for operationalizing several variables in a coherent way, by developing the survey questions that link to descriptive categories derived from the scholarly literature (Shields and Tajalli 2005). Each category and subcategory appears next to the relevant question(s). The table will also provide a rubric for discussing the results and conclusions in subsequent chapters. To see a complete copy of the questionnaire, please refer to Appendix A

Table 3.1 Operationalization of Conceptual Framework

<i>Descriptive Categories</i>	<i>Questions</i>
<u>Maps</u>	
Method of Access	14. If you wanted access to the City’s floodplain maps and information, what would be your preferred method? <input type="checkbox"/> View digital maps and information online <input type="checkbox"/> View maps and information on paper in the public library <input type="checkbox"/> Call and ask for the desired information <input type="checkbox"/> Other (please list)
Communication of Changes	12. Is your current home located in the floodplain?

	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know 15. Have you ever been affected by changes to floodplain maps? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know 16. If you have been affected by changes to floodplain maps, how satisfied were you with the way the City communicated with you about the changes? <input type="checkbox"/> Very satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Neutral <input type="checkbox"/> Dissatisfied <input type="checkbox"/> Very dissatisfied <input type="checkbox"/> Not applicable
Land Use Planning	17. Are you aware that there are restrictions on development in the floodplain which can affect the building and remodeling of a house? <input type="checkbox"/> Yes <input type="checkbox"/> No
Insurance	12. Is your current home located in the floodplain? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know 13. Have you ever considered purchasing flood insurance? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Already have flood insurance
<u>Structural Solutions</u>	
Visibility	10. Are you aware of any City of Austin projects near your home related to flood protection? <input type="checkbox"/> Yes <input type="checkbox"/> No
Effectiveness	11. If you are aware of any flood protection-related projects near your home, do you think that the projects have

	<p>reduced flooding for you or your neighbors?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know <input type="checkbox"/> Not applicable</p>
<u>Awareness</u>	
<p>Experience</p> <p>General</p>	<p>3. Approximately how long have you lived in Austin? _____ Years</p> <p>4. Approximately how long have you lived in your current home? _____ Years</p> <p>28. Do you own or rent your current residence? <input type="checkbox"/> Own <input type="checkbox"/> Rent</p> <p>2. How concerned are you about flooding? <input type="checkbox"/> Very concerned <input type="checkbox"/> Concerned <input type="checkbox"/> Slightly concerned <input type="checkbox"/> Not at all concerned <input type="checkbox"/> Don't know</p>
(ii) Specific	<p>5. Since living in your current home, have you experienced flooding in any of the following locations? Please check all that apply, and indicate the number of times you have experienced flooding in each location to the best of your recollection.</p> <p> <input type="checkbox"/> House <input type="checkbox"/> Garage <input type="checkbox"/> Crawl space (under house or deck) <input type="checkbox"/> Yard <input type="checkbox"/> Street in front of house <input type="checkbox"/> Other (please list): <input type="checkbox"/> I have not experienced flooding. </p>

	<p>6. Have you ever been prevented from traveling to or from your home due to flooded roadways?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
Reporting	<p>7. Are you aware that you can report flooding or a drainage problem to the City by dialing 3-1-1?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>9. How important do you think it is to report flooding to the City?</p> <p><input type="checkbox"/> Very important <input type="checkbox"/> Important <input type="checkbox"/> Somewhat important <input type="checkbox"/> Not at all important <input type="checkbox"/> Don't know</p> <p>8. What is your preferred method for reporting flooding and drainage problems to the City?</p> <p><input type="checkbox"/> Dialing 3-1-1 <input type="checkbox"/> Sending text message <input type="checkbox"/> Sending e-mail <input type="checkbox"/> Filling in form on website</p>
Public Campaigns	<p>18. Have you ever heard or seen the phrase, —Turn Around Don't Drown!"® on the radio, on television or elsewhere?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>
<u>Warning</u>	
General Warnings	<p>19. Where have you seen or heard warnings about flooding? (Please check all that apply.)</p> <p><input type="checkbox"/> Radio <input type="checkbox"/> Television <input type="checkbox"/> Internet <input type="checkbox"/> Newspaper</p>

	<input type="checkbox"/> Flashing lights or barricades on roads <input type="checkbox"/> Other (please list): <input type="checkbox"/> I have not encountered flood warnings. 20. What is your preferred method for receiving flood warnings? <input type="checkbox"/> Radio <input type="checkbox"/> Television <input type="checkbox"/> Website <input type="checkbox"/> E-mail <input type="checkbox"/> Text message <input type="checkbox"/> Smartphone app
Road Closures	21. What is your preferred method for receiving information about road closures due to flooding? <input type="checkbox"/> Radio <input type="checkbox"/> Television <input type="checkbox"/> Website <input type="checkbox"/> E-mail <input type="checkbox"/> Text message <input type="checkbox"/> Smartphone app
<u>Satisfaction</u>	
Overall	22. In general, how satisfied are you with the City's efforts to reduce the risks of flooding? <input type="checkbox"/> Very satisfied <input type="checkbox"/> Satisfied <input type="checkbox"/> Neutral <input type="checkbox"/> Dissatisfied <input type="checkbox"/> Very dissatisfied <input type="checkbox"/> Don't know 23. In the space below, please include any comments or concerns you have about flooding in the City of Austin or the City's efforts to address flood-related issues:

Floodplain Mapping

The first descriptive category is Floodplain Mapping, and it contains the following subcategories: Method of Access, Communication of Changes, Land Use, and Insurance. The question for Method of Access is important because maps are fundamental to risk communication. The question associated with this subcategory is: —If you wanted access to the City's floodplain maps and information, what would be your preferred method?" The possible answer choices include: "View digital maps and information online, view maps and information on paper in the public library, call and ask for the desired information," or "other (please list)."

Asking about the communication of changes to floodplain maps is important, because the City must follow specific procedures in order to earn points in FEMA's Community Rating System, which allows residents to purchase flood insurance at reduced rates. Although much of the Division's work centers on creating and maintaining these maps, the only way that an ordinary resident would notice this work is when changes to the map directly affect them. Presumably, apart from the experience of catastrophic flooding, one of the few incidents likely to cause high levels of dissatisfaction with the Division's work is when a person's property is reclassified into the floodplain, forcing the person to absorb increased insurance costs and abide by additional building restrictions. To address this issue, respondents are asked, first, "Have you ever been affected by changes to floodplain maps? (Yes, no, or I don't know)" and then, "If you *have* been affected by changes to floodplain maps, how satisfied were you with the way the City has communicated with you about the

changes?" The answer choices to the second question take the form on a five-point semantic differential scale (i.e., —~~Very~~ Satisfied" to —~~Very~~ Dissatisfied").

Land use is important because, based on anecdotal evidence from FEMA and Division staff, residents are often surprised by the restrictions that exist in the floodplain and proceed with building or remodeling without first confirming that such actions are permitted by City code. The question appears on the survey instrument as: "Are you aware that there are restrictions on development in the floodplain which can affect the building and remodeling of a house (Yes or No)?"

Insurance is important because it is the primary way that society distributes flood risk, and the direct financial costs it imposes presumably have a high salience for respondents. Additionally, the City does not know exactly how many residents of the floodplain possess insurance. Asking about this issue presents some difficulty because residents may feel uncomfortable answering honestly, given the legal requirement to purchase flood insurance. The question asks, "Have you ever considered purchasing flood insurance?" with the answer choices of "Yes," "No," and "Already have flood insurance." The intention is that a person in the floodplain who should have flood insurance but does not would not be asked directly whether they have purchased it, but only if the person has *considered* doing so.

Structural Solutions

The second descriptive category is Structural Solutions, which contains two subcategories: Visibility and Effectiveness. Because the Division is concerned specifically with the design and performance of infrastructure, oversees the construction

and maintenance of this infrastructure, and primarily employs engineers to do so, this category is extremely important for ascertaining respondents' awareness and satisfaction with the activities of Watershed Engineering Division.

However, as mentioned in the previous chapter, this topic presents difficulties because infrastructure often has a “~~ak~~ken for granted” or background quality that makes it difficult for respondents to notice, much less evaluate. As a result of these difficulties, only two questions were asked in connection with this descriptive category. Regarding visibility, respondents are asked, “Are you aware of any City of Austin projects near your home related to flood protection? (Yes or No).” Regarding effectiveness, respondents are asked, “If you *are* aware of any flood protection-related projects near your home, do you think that the projects have reduced flooding for you or your neighbors? (Yes, No, Don't know, or Not applicable)”

Awareness

The third descriptive category is Awareness. It contains the following subcategories: Experience, Reporting, and Public Campaigns. Each subcategory is addressed below.

Experience

General Experience refers to life experiences that have accumulated over the long-term, and only one question explicitly mentions flooding. Based on previous research, it seems reasonable to suggest that someone who has lived in or around

Austin for a long time, and especially a person who has lived in the floodplain for a long time, will be more aware of flooding as a serious problem than someone who has not. Therefore, the questions associated with this category ask, "Approximately how long have you lived in Austin?" and "Approximately how long have you lived in your current home?" Because it seems reasonable that a homeowner is more likely to educate themselves about particular natural hazards when they will bear the costs of damage caused by exposure to that hazard, respondents are asked, "Do you own or rent your current residence?" Finally, respondents are asked, near the beginning of the questionnaire (before they have spent several minutes thinking only about flooding), "How concerned are you about flooding?" The answer choices provided are: "Very Concerned, Concerned, Slightly concerned, Not at all concerned," and "Don't know."

The Specific Experience sub-subcategory refers to recollections of personal experiences of flooding in particular. The primary question for this sub category is somewhat lengthy, but attempts to gather detailed information on flood experience across the city. It asks: "Since living in your current home, have you experienced flooding in any of the following locations? Please check all that apply, and indicate the number of times you have experienced flooding in each location, to the best of your recollection." The answer choices include: ☐ House, ☐ Garage, ☐ Crawl space (under house or deck), ☐ Yard, ☐ Street in front of house, ☐ Other (please list)," and ☐ +have not experienced flooding." Next to each location a blank space is provided for indicating the number of times a particular part of the house has been flooded. It is essentially the same question used by the Division to survey residents near upcoming flood control projects. Also included in Specific Awareness is a question about flooded roadways, which

account for most deaths during floods. The question asks, "Have you ever been prevented from traveling to or from your home because of flooded roadways? (Yes, No)."

Reporting

Another sub-category related to Awareness is Reporting. The survey instrument measures this with three questions. First, it asks, —Are you aware that you can report flooding or a drainage problem to the City by dialing 3-1-1? —Second, it asks, —What is your preferred method for reporting flooding and drainage problems to the City?" The answer choices provided include: dialing 3-1-1, sending a text message, sending an email, and filling in a form on the website. Finally, it asks, —How important do you think it is to report flooding to the City? (Very Important to Not At All Important)."

Public Awareness Campaigns

The final subcategory examines the effectiveness of the public awareness campaign about flooding that is coordinated at the federal level. The survey asks residents, "Have you ever heard or seen the phrase, 'Turn Around Don't Drown!'® on the radio, on television, or elsewhere?" The purpose of this, as stated in the previous chapter, is to gauge local familiarity with this phrase.

Warning

The fourth major descriptive category addresses the Flood Early Warning System operated by the Division. Although the system is multifaceted, it only affects the general public directly via warnings issued over mass media. These broadcast warnings are important, because they are the final link in the chain of flood response. The first question in this subcategory asks, "Where have you seen or heard warnings about flooding? (Please check all that apply)." The answer choices include: "Radio, Television, Internet, Newspaper, Flashing lights or barricades on roads, Other (please list)," and "I have not encountered flood warnings." The next question asks, "What is your preferred method for receiving flood warnings?" The answer choices provided include, "Radio, Television, Website, Email, Text message," and "Smartphone app." Respondents are also asked, "What is your preferred method for receiving information about road closures due to flooding?" The answer choices are identical to those of the previous question. This was asked as a separate questionnaire item to avoid the problem of a —double-barreled" question, which can confuse respondents and mislead researchers (Babbie 2010, p. 257). Flashing lights were not included because these represent the last line of defense in a flood warning system and not a preferred method for receiving warnings, and it was assumed that most people would rather know about specific floods and road closures before they are en route. This is not meant to suggest that such measures are unimportant.

Satisfaction

Although not a descriptive category that arises scholarly literature on flood hazard mitigation, general satisfaction deserves special mention in the context of the methodology. The survey measures this in two ways. First, it asks about overall satisfaction with the following question: "In general, how satisfied are you with the City's efforts to reduce the risks of flooding? (Very satisfied to Very dissatisfied)." It then asks an open-ended question about flooding: "In the space below, please include any comments or concerns you have about flooding in the City of Austin or in the city's efforts to address flood-related issues."

Coding

Dichotomous variables were coded in the form (0 = No, 1 = Yes). For example, responses to the question —~~Have~~ "Have you ever experienced flooding?" were coded as (EXPFLD = 0, 1). In the case of nominal variables with more than two categories, each answer choice was coded as a separate dichotomous variable. For example, with responses to the question, ~~What~~ "What is your preferred method for receiving flood warnings: Radio, Television, Website, Email, Text message, or Smartphone app?" each answer choice was considered as a separate yes/no question (e.g., Radio: Yes/No, Television: Yes/No, etc.). Responses were thus coded separately as (WRNRAD = 0, 1), (WRNTV = 0, 1), (WRNWEB = 1, 0), etc.

Such an approach allows for the possibility that a respondent might select more than one answer. If each answer were treated as a different category of the same

question (e.g. [FLDWRN = 1, 2, 3, 4, 5, 6] where 1=Radio, 2=Television, 3=Website, etc.), then the researcher would need to place a respondent who selected both radio and television into an arbitrary category, or would need to devise categories for every possible combination of answer choices.

Continuous variables were coded straightforwardly with the number provided. For example, answers to the question —“How long have you lived in Austin?” the number of years was entered, and if a respondent provided months, this was simply converted to decimal form as a partial year. A complete codebook can be found in Appendix B.

Analysis

The descriptive nature of the research purpose suggests the use of simple descriptive statistics, such as frequency histograms, contingency tables, and measures of central tendency and dispersion. These summary calculations will communicate the range of attitudes among Austin residents with regard to flooding and flood control, which can suggest program improvements and directions for further research.

Additionally, a basic Chi-square test will be used to compare floodplain residents to the general population for the questions dealing with flood experience and concern about flooding. Researchers use the Chi-square test to determine whether there is a significant association between the two categorical variables. These numbers appear in the following chapter.

Conclusion

A self-administered questionnaire was chosen as the most appropriate method for answering a research question about the attitudes of a large population. The responses of a random sample of Austin residents with some portion of their lot on the floodplain was compared to the responses of a random sample of Austin residents at-large. The questions posed to these samples of residents derive from the major strategies adopted in urban stormwater management, as presented in the literature review. The next chapter will analyze the responses to these questions.

Chapter 4

Results

Overview

This chapter presents the results of the survey of Austin residents about their attitudes regarding flooding and flood control. The collection of data occurred from February 15, 2013 through March 22, 2013, and thus the results presented here represent a snapshot of public attitudes and orientations over this short period. This chapter presents simple descriptive statistics for each of the close-ended questions. In addition, the chapter will summarize the open-ended responses by placing them into categories and also use them to contextualize the quantitative findings.

Of the 1,920 surveys randomly distributed to Austin residents at-large, 238 were returned, yielding a response rate of 12.4 percent. Of the 1,910 surveys randomly distributed to residents with some portion of their property in the floodplain, 136 were returned, yielding a response rate of 7.1 percent. This discrepancy presents a finding in itself and prompts the question: Why did the floodplain residents have such a lower response rate? If one treats both groups as a single sample (a sample that over-represents people living near the floodplain), the response rate naturally was between the response rates of the two samples treated separately, at 9.8 percent. This represents a pure average of all cases from both samples. A 9.8 percent response rate produces a 5.1 confidence interval at a 95 percent level of confidence for a dichotomous variable. For example, because 30.4 percent of the sample answered “~~Yes~~” to the question —~~Have~~ you ever experienced flooding,” the researcher can be 95 percent

certain that the percentage of the population that would answer “Yes” to this question is between 25.3 percent and 35.5 percent (i.e., 30.4 percent plus-or-minus 5.1 percent). A summary of the public’s response to the survey appears in Table 4.1, below.

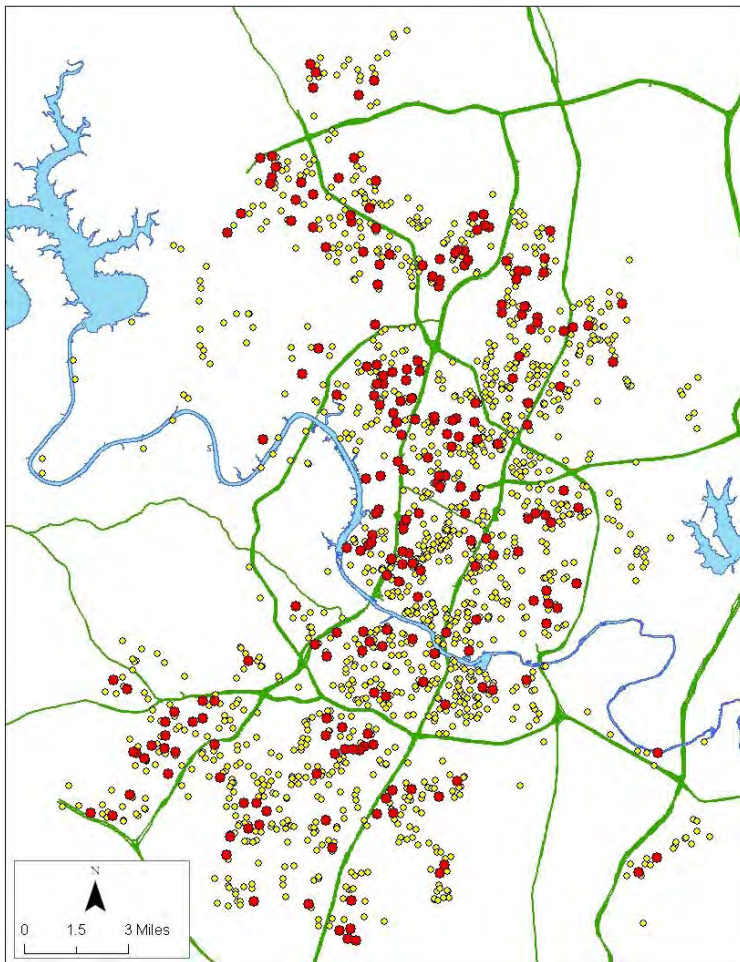
Table 4.1 Summary of Response to Survey

	Residents At-large	Floodplain Residents	All Surveys
Sampling Frame	380,691	73,709	380,691
Total Surveys Sent	1,920	1,910	3,830
Total Responses Received	238	136	375
Response Rate	12.4%	7.1%	9.8%
Confidence Level	95%	95%	95%
Confidence interval	± 6.4	± 8.4	± 5.1

The geographic distribution of survey responses appears in Figure 4.1 below. Although nearly identical numbers of surveys were distributed to Austin residents at-large as to Austin residents near the floodplain, one would expect to see roughly equal numbers of data points on the maps. However, because floodplain residents are concentrated in the narrow ribbons of floodplain boundaries, the “dots” representing surveys mailed in the floodplain overlap and obscure one another. Figure 4.2 shows the responses from floodplain residents overlaid on a map of the floodplain boundaries. From a visual inspection of the maps of responses, one can see that surveys were returned from across the urban area and that there are no patterns to indicate large-scale response bias based on the sectors of the city.

Figure 4.1 Response of General Austin Residents and Floodplain Residents

Responses from General Austin Residents



Responses from Floodplain Residents

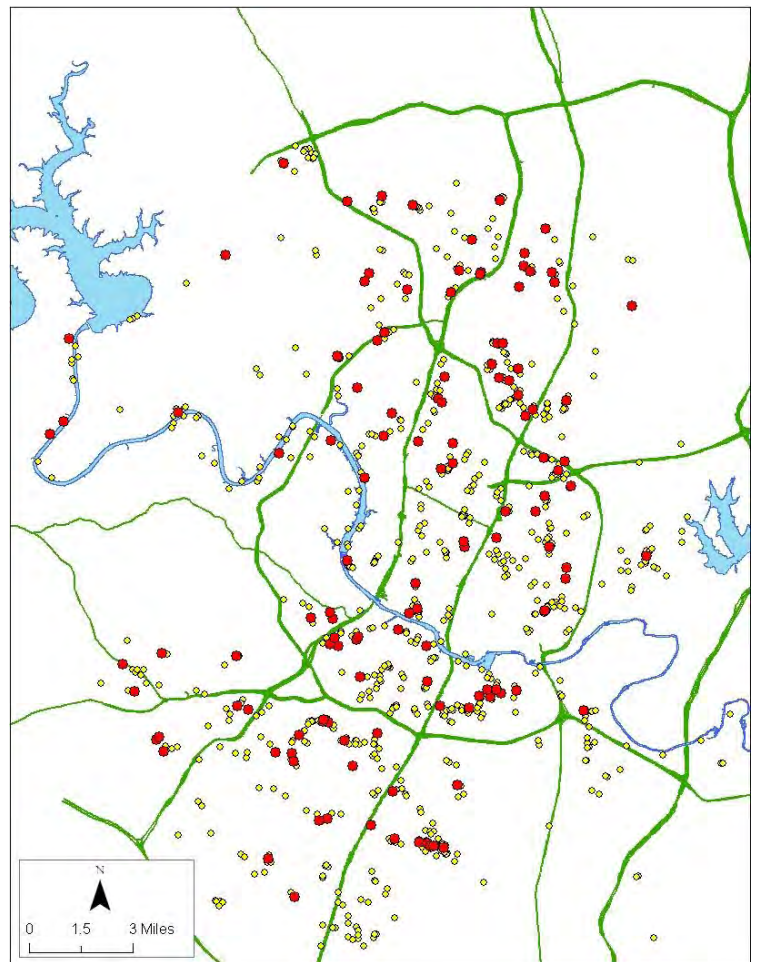
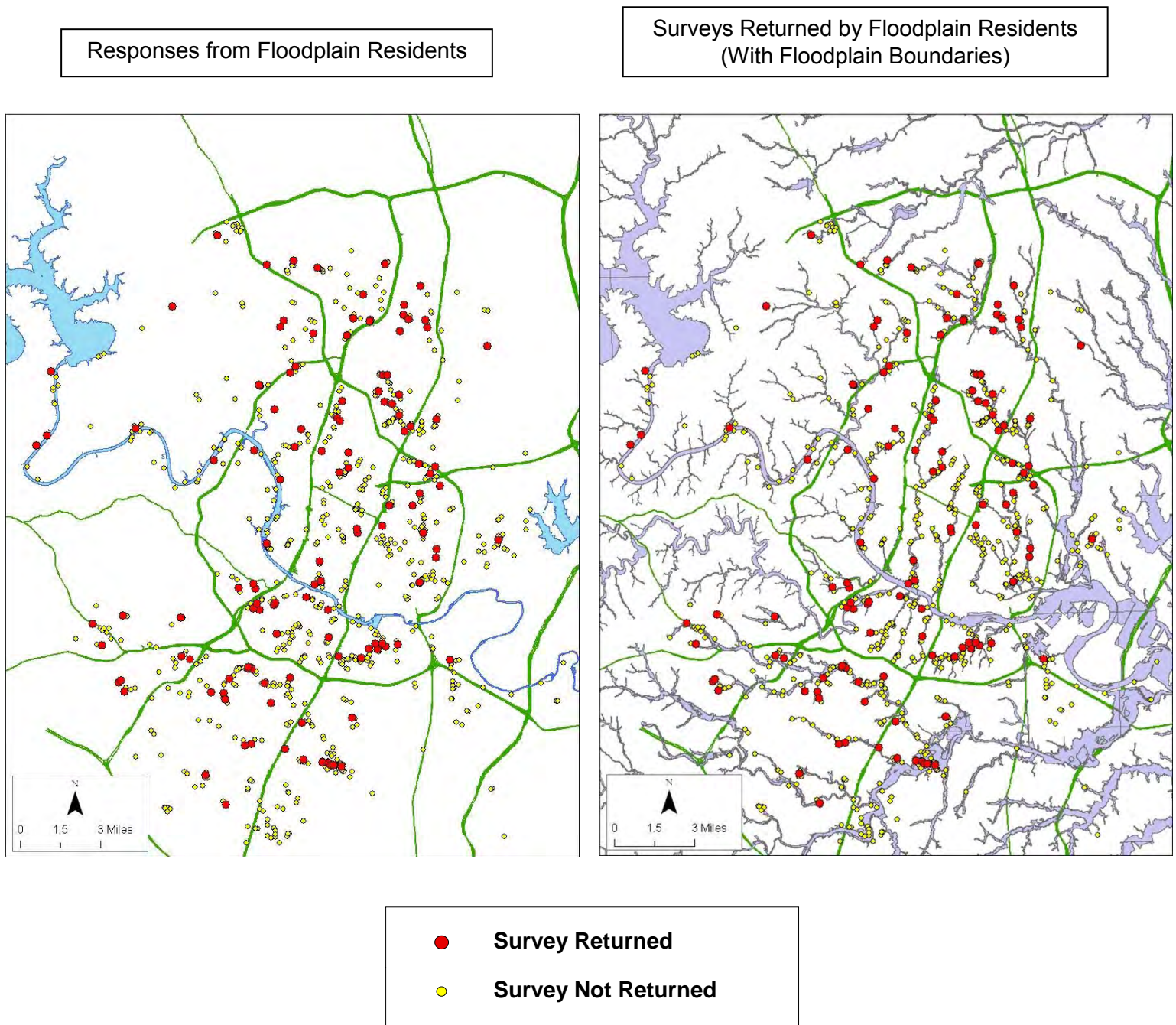


Figure 4.2 Responses of Floodplain Residents and Floodplain Boundaries



Presentation of Results

The following paragraphs present the results of the survey. The discussion proceeds from the Table 3.1, presented in the previous chapter. To view the results in tabular form, please refer to Appendix E.

Maps

The vast majority of all respondents (69 percent) prefer to access floodplain maps on the Internet, although a significant portion (21 percent) prefer talking to a City employee on the telephone, and some (eight percent) would like to access them at the public library. Of those whose house is located in the floodplain, fully a quarter (26.5 percent) do not know whether their house is in the floodplain, and nearly 15 percent actively believe that their home is *not* in the floodplain (false negative). Of those respondents whose house was not in the floodplain, nearly 40 percent did not know whether their house was in the floodplain, and six percent actively believed they *were* in the floodplain (false positive). As anticipated, not many people (eight percent of total respondents) reported being affected by changes to floodplain maps. Of those that had been affected, though, fully one-third (34 percent) are very dissatisfied with the way in which the City communicated with them about the changes. This is perhaps due to the fact that many respondents were negatively affected by such changes, and this influenced satisfaction with the communication about those changes. However, such speculation should not detract from the fact that this represents an area where there is significant room for improvement. Additionally, nearly one-half (48 percent) of all

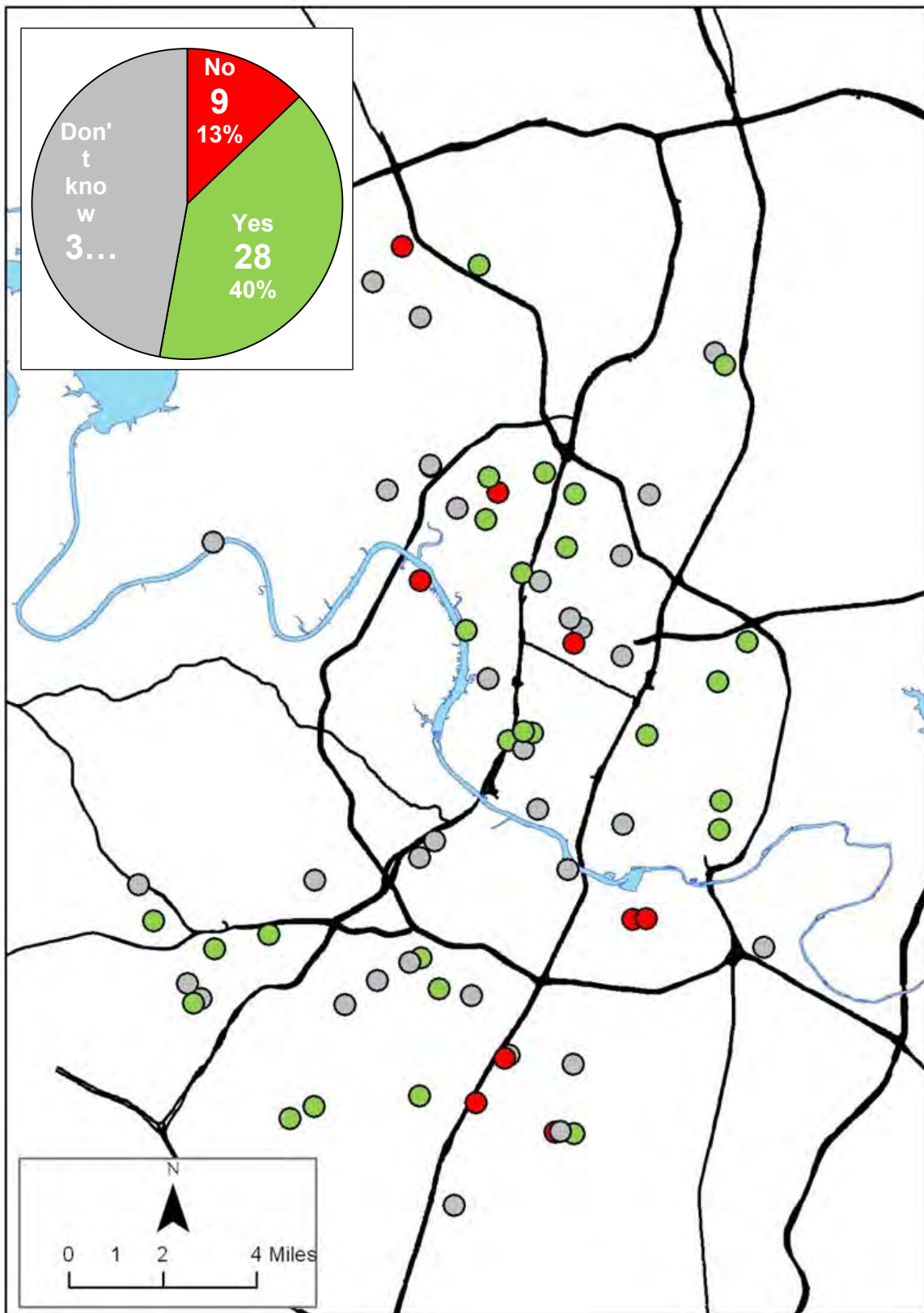
respondents are unaware of building restrictions in the floodplain. This suggests that these regulations are not widely publicized and confirms anecdotal evidence from Division staff as well as the assertions made in FEMA documents.

One of the more surprising findings was that only one-fifth (19 percent) of respondents with some portion of their property in the floodplain have purchased flood insurance. Of those respondents whose actual house was located in the floodplain, the ratio is not much better. Only 38.2 percent have insurance. This confirms the findings presented in scholarly literature, that —market penetration” of federally-mandated insurance across the country is quite low.

Structural Solutions

As expected, only a small percentage (17.6) of respondents reported any awareness of flood control projects near their homes. This is likely due to the embeddedness and transparency of infrastructure, as noted in the literature review. Of those that are aware of flood control projects, nearly half (47.1 percent) are unsure of whether the projects had been effective in reducing flooding for them or their neighbors. Of those that did have some opinion, three times as many believe the projects have been effective in reducing flooding (28 respondents) as believe they have been ineffective (nine respondents). Despite the few data points available, it is worth noting that those who are dissatisfied with the projects seem to be concentrated in the Northwest and Southeast parts of the city. See Figure 4.3, below.

Figure 4.3 Perceived Effectiveness of Flood Control Projects



Awareness

Flood Experience

The length of time a person has spent in Austin served as an imperfect approximation of community ties and general awareness of flooding as an issue in the region. Perhaps because the age structure of the sample skews older compared to the residents of Austin as a whole, the length of time respondents have spent in Austin is quite high. The median length of time is twenty-three years. The length of time a person has spent in his or her current home was likewise intended to measure flood experience, but takes into account the particular vulnerabilities of a respondent's current residence. The median length of time lived in the current home is considerably lower at only eight years, suggesting that many respondents have relocated within the city limits at least once.

The level of concern about flooding varies significantly. More than a quarter of respondents (29 percent) say that they are not at all concerned with flooding, while nearly two-fifths (39 percent) said that they are only slightly concerned. Only 20 percent say they are concerned, and only 9 percent say they are very concerned.

Out of all respondents, thirty percent have experienced flooding at some time in the past. Out of all respondents, 23 percent have experienced flooding in their current homes. Out of respondents with some portion of their property in the floodplain, 34 percent have experienced flooding in their current homes. A chi-square test of independence shows that having some proportion of one's property in the floodplain has

a significant influence on whether or not one has experienced flooding while living in one's current home.

Across all respondents, most reported flooding in the yard or street. Additionally, flooding in yards and streets recurred with more frequency than flooding in the house itself. The average person who has experienced flooding in her house reports that it has happened about three times, while the average person who has experienced flooding in her yard reports that it has happened six times.

Only eleven percent of general Austin residents have been prevented from traveling to or from their homes due to flooded roadways, while nearly twice that many (20.3 percent) of floodplain residents have encountered this problem. A Chi-square test confirms that living near a floodplain significantly increases the likelihood that a person will encounter flooded roadways that inhibit travel.

Reporting

Nearly half of respondents (44 percent) do not know that they can report flooding and drainage problems to the City using the 3-1-1 service, despite the fact that nearly all (84 percent) of the respondents feel that it is important or very important to report flooding. Respondents also overwhelmingly prefer the 3-1-1 service as a method to report flooding.

Public Campaigns

The vast majority (84 percent) of respondents were familiar with the slogan, —Turn Around Don't Drown.”® Many respondents made mention of the campaign in their open-ended responses, saying it was an effective way to —get the word out.” Living in the floodplain had no significant effect on a person's familiarity with the phrase.

Warning

Only a small fraction of people (3 percent) report having never encountered flood warnings in the past. Of those that have encountered warnings, most indicated multiple sources of warning. The vast majority of respondents (85.3 percent) have encountered flood warnings on television. Slightly fewer (65.1 percent) have encountered flood warnings on the radio. Nearly half (49.9 percent) have encountered flood warnings at flashing lights and barricades. Far fewer have encountered flood warnings on the Internet (20.0 percent) or in the newspaper (26.9 percent). Only about 3.5 percent of people have encountered flood warning via some other medium; most of these mentioned the flashing billboards on highways used for public service announcements.

Respondents heavily favored television as their preferred medium for receiving flood warnings in the future. Radio was the runner-up, but had significantly fewer votes (43 percent for radio versus 70 percent for television). The next most-commonly preferred method is text message (22 percent). After that, the numbers taper off a bit for website (16 percent), email (13 percent), and smartphone app (11 percent). The reader may have noticed that these numbers do not add up to 100 percent. This is because

many respondents selected multiple media, despite no instruction to do so.

Respondents' preferences for receiving road closure information followed almost exactly the same pattern as their preferences for receiving flood warnings.

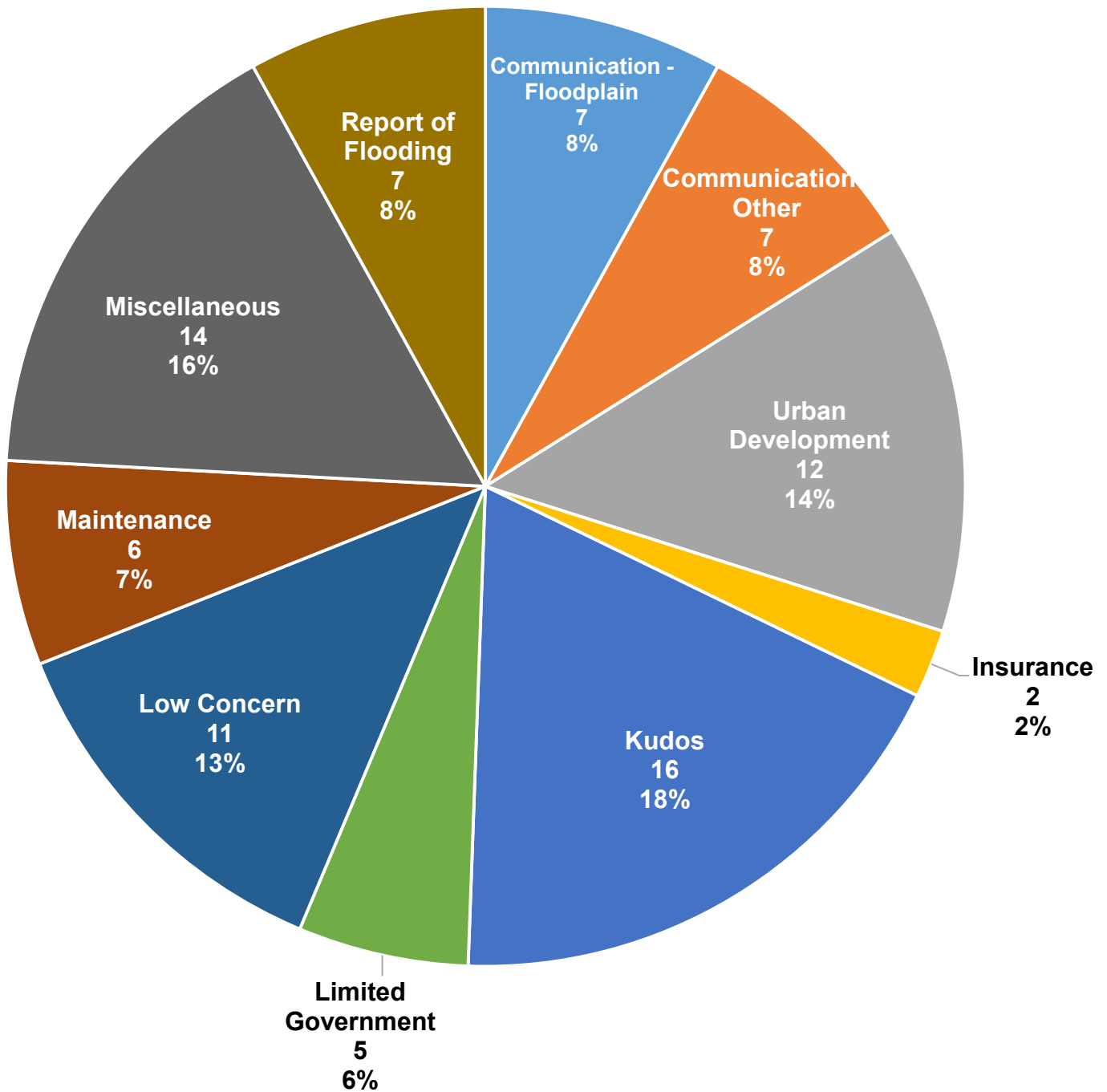
Satisfaction

As expected, few respondents have strong feelings of satisfaction or dissatisfaction regarding efforts to control flooding in Austin. More than half of respondents have no opinion, with one quarter (26.1 percent) selecting —~~Don't~~ "Don't know" and another quarter (27.5 percent) selecting —~~Neutral~~ "Neutral" to the question, —~~In~~ "In general how satisfied are you with the City's efforts to reduce the risks of flooding?" Only a small number of people (3.2 percent) are dissatisfied or very dissatisfied. A plurality of respondents (42.9 percent) are satisfied or very satisfied. There are nearly ten times as many people who are very satisfied as are very dissatisfied (10.1 percent versus 1.1 percent).

The responses to the open-ended questions run the gamut but do allow for some generalizations. As expected from theories about the —~~it~~ "pitchfork effect," the open-ended responses skewed largely negative. Many responses expressed concern with uncontrolled urban growth and its impact on flooding. Some of the positive responses, labeled as —~~kl~~ "kl," also mentioned urban growth, but expressed gratitude for the development controls already in place. If the comment was positive, no matter the subject matter, it was placed in the —~~kl~~ "kl" category. Many people expressed low concern of some type or another, often mentioning that Austin was experiencing

prolonged drought conditions. Many others wanted to know how they could find out more information about the location of the floodplain and the kinds of building restrictions that applied. Many complained about the cost of insurance or that they found out that they were in the floodplain only when they refinanced their home mortgage. A pie chart summarizing the results to the open-ended question appears in Figure 4.3 below, and a complete list of all open-ended responses appears in Appendix F.

Figure 4.4 Summary of Responses to Open-ended Question



Chapter 5

Conclusions and Recommendations

Summary of Research

This paper has attempted to describe citizen awareness of and satisfaction with flood hazard mitigation programs enacted by the municipal government of Austin, Texas. Specifically, it has examined the ways the general public encounters floodplain mapping, flood-control structures, awareness campaigns, and early warning systems. The paper began with a history of flood events in Austin and the institutional mechanisms that have evolved in response to these events. It then grouped major flood-control strategies into functional categories and devised a survey instrument based upon these categories. Using the literature review, survey results, and comments from the respondents, the final chapter will illustrate some conclusions and potential policy implications that one can draw from these data.

Floodplain Maps

Floodplain maps affect the general public in myriad ways. They provide general information about flood risk, and they determine who must pay flood insurance and where urban development can occur. The survey results indicate the following: (1) most Austin residents prefer to access maps over the Internet, (2) many residents are unaware of whether they are in the floodplain, (3) many of those affected by changes to floodplain maps are unsatisfied with the City's communication in this regard, (4) nearly half of residents are unaware of building restrictions in the floodplain, and (5) most floodplain residents have not purchased flood insurance.

Method of Access

The survey results provide ample justification for the Division's recent decision to publish floodplain maps on the Internet. The majority of people prefer to access floodplain maps online, as one would expect from increasing rates of internet access and increasing expectations of information on-demand. The fact that so many people do not know whether their home is located in a floodplain underscores the value of making a concerted effort to disseminate this information as widely as possible.

The survey results also indicate that the Division should continue to dedicate resources to fielding citizens' queries about floodplain information over the telephone, considering that many people prefer this method and that it provides the opportunity to quickly answer citizens' questions. For instance, in an open-ended response, one person indicated that he looked up the floodplain map, but was unable to discern whether his house was inside the floodplain boundary or not. The option of calling on the telephone provides such a person with the means to easily interpret the floodplain information. Continuing to provide this information in print form at the library may not be a priority, given that less than one-in-ten people prefer that option. However, if providing paper maps to libraries is relatively easy and inexpensive, then it may make more sense to continue the practice, in order to maximize public awareness of flood risk.

Communication of Changes

The communication of changes to floodplain maps is the areas where citizens expressed the most dissatisfaction with the work of the Division. Although the number of people with a negative assessment is small in absolute terms, it represents an opportunity to improve the "customer service" orientation of the organization. Upon

viewing the results, administrators may wish to contact those who expressed dissatisfaction in order to record their thoughts about how to improve the process. However, because the cover letter sent with the survey assured respondents that the City would not identify them as individuals, targeting those who expressed dissatisfaction seems ethically dubious, despite the non-punitive intentions. Initiating a new study with a new sample would provide a much better approach. Because the issue of communicating changes with adverse effects on citizens is a potentially complicated topic with multiple dimensions, a researcher or administrator should use more exploratory methods to target those affected by changes to floodplain maps in the past five or ten years, such as conducting focus groups or a small-scale survey with multiple open-ended questions.

Land Use

The fact that nearly half of people were unaware of the building restrictions applicable in the floodplain suggests that the Division might do more to publicize these regulations. It is possible that the average person is unaware of such restrictions until he or she begins building or renovating a house, at which time the general contractor, financier, or some other entity raises the issue. From one perspective, such a situation is perfectly satisfactory, as long as the City can ultimately enforce regulations limiting urban development in the floodplain. However, it is possible for homeowners to begin their own construction or renovation. In this case, either an inspection will interrupt the project at significant personal cost, or a successfully completed project will increase the homeowner's exposure to flooding.

It seems reasonable to suggest that increased awareness of building restrictions among the general public would have many beneficial, though indirect, effects. More general awareness could increase compliance in the construction industry, especially among those who have relatively small operations, as well as among those who decide to do the work themselves and finance it themselves. It would also increase the political will to enforce existing regulations for major development projects that seek variances or other special accommodations from City Council. Designing programs to further publicize building restrictions in the floodplain is beyond the scope of this research purpose. However, the Division, or the Public Information Office, could develop new material like press releases and public service announcements, or they could append short messages to existing communications.

Insurance

This survey confirms that the majority of people in flood-prone areas do not have flood insurance. Only 38 percent of those respondents whose houses were in the floodplain have already purchased such coverage. This is better than the nationwide rate of 25 percent, as noted in the literature review. However, this number should be much higher if the NFIP is to succeed in its goal of creating an efficient market and protecting as many vulnerable properties as possible. A substantial proportion of residents (26 percent of those their house in the floodplain and 13 percent of the city at large) has considered purchasing flood insurance. This suggests that the City could pursue policies to increase the number of insured houses, perhaps through public education campaigns targeted at residents in the 100-year floodplain.

Structural solutions

Very few respondents were aware of upgrades to flood-control infrastructure, despite the widespread work done in recent years as a result of a 2006 bond package, which dedicated 145 million dollars to drainage improvements (City of Austin Capital Planning Office). More surprising is the large number of respondents who, though they were aware of flood control projects, did not know whether the projects had been effective. This result highlights an inherent limitation of this research project, namely, the difficulty of communicating with laypeople about engineering problems. However, it may be possible to raise awareness of the existence and effectiveness of these engineering projects through targeted public engagement campaigns. Using flyers, neighborhood association newsletters, local meetings, or other communication strategies to increase awareness of the projects and their effects may increase the likelihood of passing future bond packages to continue such infrastructure upgrades, some of which are badly needed. One open-ended response asked if there was some kind of log of City flood control projects, which may suggest a possible means to increase public knowledge and perhaps political support for additional bond-funded improvements.

Awareness

Public awareness of the dangers of flooding is fairly high. Despite rapid population growth in the Austin area, most Austin residents surveyed have lived in the

area for many years and a sizeable minority of residents have had personal experience with flooding. Many people also express concern about flooding, understand the importance of reporting flooding, and know the most significant precaution one should take to avoid drowning during a flood. Each sub-category is addressed below.

Experience

Nearly a quarter of all survey respondents report flooding in their current home, and the majority of these have seen floodwaters in the yard and street. On average, flooding recurred more frequently in the yard and street than in other locations. The obvious relevance of this question is that flooding in the house is far more dangerous in terms of economic damages and health risks than flooding that occurs elsewhere. The results of these questions do not give cause for alarm about house flooding as a widespread problem, because only ten out of 375 total respondents reported any flooding in their houses.

Reporting

The findings about flood reporting are somewhat ambiguous. However, it seems clear that people are generally unaware that they can report flooding and drainage problems via the City's 3-1-1 non-emergency hotline. It seems likely that respondents indicated that it was very important to report flooding because they knew it was the "right" answer in terms of demonstrating pro-social behavior as well as being the answer that the asker was looking for. In much the same way, more people believe in the

importance of voting in elections than actually cast ballots. This finding could also indicate that this is an area that could especially benefit from an awareness-raising campaign. People are already receptive to the message (i.e., they believe that reporting is important), and they also have the means (i.e., most people prefer to report flooding in the way already provided). It follows that people have the willingness and the way; they merely need to know that the option is available to them. A simple flyer with some basic information about flood reporting could make a difference especially if targeted at neighborhoods that the Division's flood models predict will experience drainage issues.

The pilot for such a hypothetical campaign could function as a useful quasi-experiment, because the Division already compiles and maps which addresses report flooding via the 3-1-1 service. An administrator could do something like the following: (1) identify several neighborhoods that do not report much flooding relative to the predictions of the Division's flood models, (2) send an informative flyer about flood reporting to a randomly-selected portion of these neighborhoods, and (3) observe whether flood reporting increases in those neighborhoods that received the flyer relative to those that did not. This would entail a minor difficulty, because precipitation can be extremely localized, falling on some neighborhoods and not others during a single storm. However, with random assignment to treatment and control groups and a sufficiently long enough time period with several rainstorms, these localized effects would average out.

If flood reporting increased for those that received the flyer, it would confirm the finding of this survey that citizens do not know how to report flooding. If this finding is indeed correct, it lends itself to two different interpretations. First, it might indicate that

self-reported flood incidents are less reliable than the flood models, and the Division should therefore rely on mathematical models rather than the “flood complaint layer” for purposes of project prioritization or other decision making. Alternatively, the finding that people do not know how to report flooding may also suggest further benefits from intensified campaigns to raise awareness about flood reporting—on the grounds that some places may flood where the mathematical models do not predict, but this flooding goes unnoticed by the Division because local residents do not know how to report it. Such contrasting conclusions mirror the “technocratic” and “democratic” orientations mentioned in the introduction.

Public Campaigns

One cannot justifiably attribute widespread awareness of the public campaign, “Turn Around Don’t Drown,”® to the policies and programs of the Watershed Engineering Division. However, the finding gives cause for optimism, because the collective actions of many different institutions and individuals have led to a high degree of recognition in the community. One of the respondents’ comments indicates how seriously some people take the notion of driving on flooded roadways: “get very angry when people drive around barricades, then die or need to be rescued-- emergency personnel should not take undue risks to save people who make poor choices.” Others were less callous, saying things like, “The Turn Around Don’t Drown® campaign along with good news (TV) media coverage has seemed beneficial in increasing public awareness.”

The survey results also indicate that there is a relationship between the length of time lived in Austin and awareness of the slogan. People who have not heard of the slogan have lived in Austin eleven fewer years. Superficially, this suggests that living in the area has some correlation with increased knowledge of the phrase. It may indicate that the Division has been successful in raising local awareness through programs such as those it conducts during Flood Awareness Week. It may also indicate that the local news media, including staff meteorologists and news anchors, are aware of Austin's vulnerability, and place extra emphasis on the slogan compared to people in other places. However, it may only indicate the presence of a confounding variable, since a person who has lived in Austin longer has lived longer in general and has had more time to encounter the slogan.

Warning

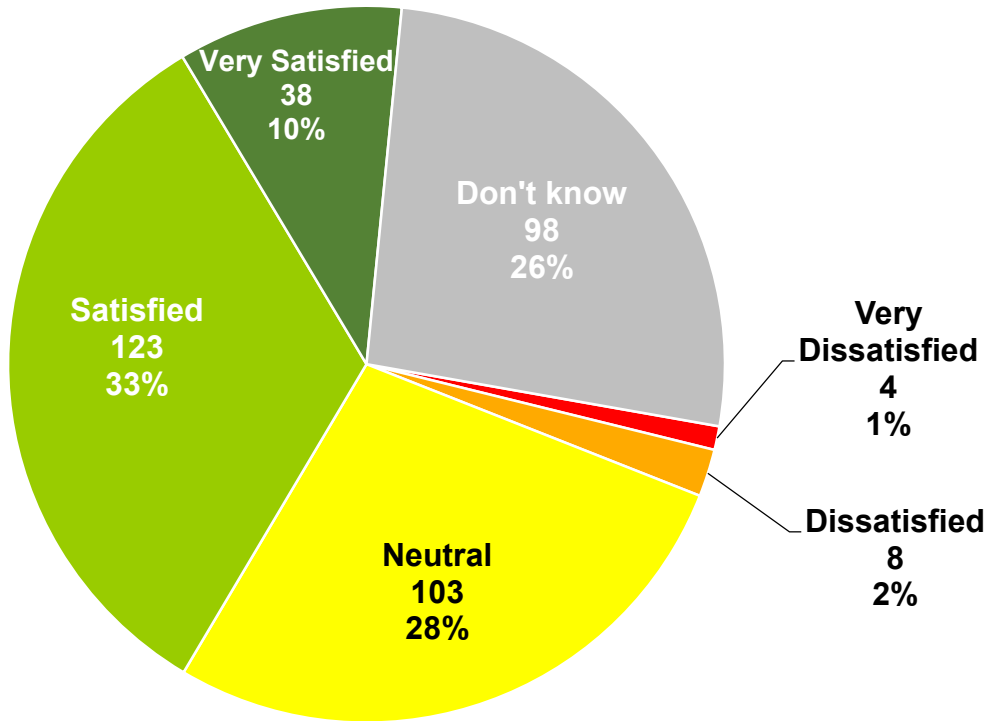
Most Austin residents surveyed reported receiving flood warnings via traditional broadcast media, and most preferred to continue receiving flood warnings in this way. The data show that only a small minority have never before encountered flood warnings but provide no insight into what proportion of those who suffered flood damage had received any prior flood warning about that flood in particular. The fact that a substantial proportion of people would prefer flood warnings via text message suggests that the Division may want to explore programs to accomplish this. It may be possible to collect cell phone numbers on a voluntary basis in areas that are especially vulnerable to flooding or road closures.

Satisfaction

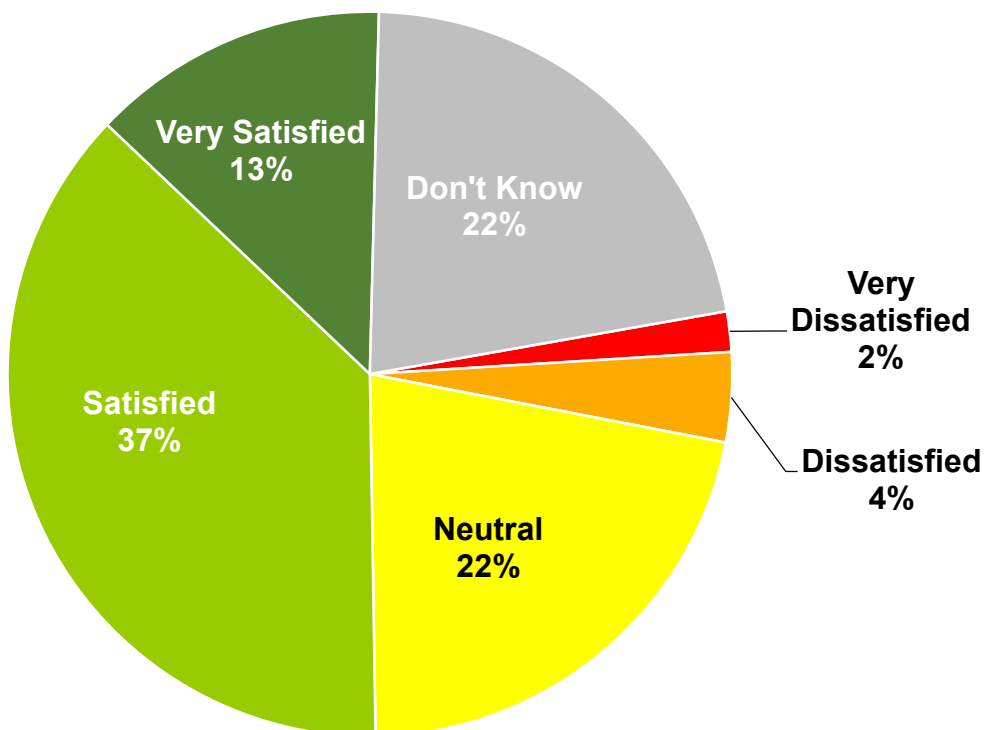
Overall satisfaction strongly resembles the results obtained through the most recent Austin Community Survey. For the past three years, the City of Austin has contracted with ETC Institute, a specialized market research firm with a 10,000 square foot state-of-the-art call center, to conduct research on citizen satisfaction with municipal services (ETC Institute Website). The consistency between the answers to this survey question and the one asked by the ETC Institute in 2012 can be seen in Figure 5.1 below. This consistency suggests a few conclusions. First, it indicates that both questions, despite slightly different wording are measuring the same concept. Second, it suggests that the entity administering the survey does not have a substantial bearing on the responses. Third, the results of this mail-only method of distribution are relatively robust in that they replicate the results of a survey incorporating several methods that thereby achieves a much higher response rate.

Figure 5.1 Comparison of Overall Satisfaction Results

In general, how satisfied are you with the City's efforts to reduce the risks of flooding?
(Responses to WED Survey Question)



Please rate your satisfaction with flood control efforts. (Responses 2012 Austin Community Survey, ETC Institute)



Closing remarks

Some of the results presented above support the conventional wisdom that most people do not pay attention to natural hazards nor to local government. This confirms much of the cynicism about public awareness and citizen engagement. Most people work long hours and spend their remaining free time engaged in individual pursuits, whether cooking or watching television (Putnam 2000). This does not leave much room for educating oneself about issues of community concern such as urban flooding. This lack of awareness also undercuts optimism arising from the fact that people are relatively satisfied with flood hazard management programs. If the general public has little concern about flooding and little knowledge about mitigation strategies, what does its level of satisfaction really matter?

It matters for a few reasons. First, as noted in the literature review, laypeople may have more insight than experts in terms of specific hazards. For instance, a person might notice some debris under a bridge near her house that the no City employee would notice until it impedes water flow in the creek and exacerbates flooding. Conducting a social survey has the ancillary benefit of reminding people to recognize and report flood related problems. Several citizens, after receiving the questionnaire in the mail, contacted the Watershed Engineering Division to report clogged drains, the need for flood control projects, and the erosion of nearby creek banks.

Second, measuring satisfaction and awareness establishes a baseline. One can view these low levels of awareness as an opportunity rather than an inevitability.

Governments of all types are often expected to solve problems but must settle for amelioration, for a slow process of marginal improvement to bad situations. In order to make even piecemeal progress, public officials must first understand the extent of the problem. They must assess where they are before deciding where to go and how to get there. This paper does not intend to make specific policy prescriptions. However, the findings do suggest a lack of awareness about some basic issues, such as the location of the floodplain and the existence of building restrictions, and this would clearly suggest more intensive publicity campaigns and awareness-raising events. Although the Division already conducts significant outreach and educational programs, it may be possible to engage differently, or more frequently, with neighborhood associations, local environmental organizations, and other community groups, with some basic facts drawn from the questions used in this study.

A researcher or administrator could refine or redefine this research project in several ways to improve the quality of information gathered or to answer related research questions. Some suggestions appear below:

- Ask more questions about the City's communication of changes to floodplain maps, using more targeted sampling procedures and/or more qualitative methods.
- Attempt a quasi-experiment with an information campaign about reporting flood and drainage problems.
- Attempt a quasi-experiment by comparing the perceptions of residents around a major flood control project, before, during, and after construction.

- Interview other stakeholders, such as construction contractors who execute major flood control projects, or engineers from the private sector who work with the City's Drainage Criteria Manual. Such an approach would allow specific questions addressing the content of the regulations or how the business community regards an issue of public concern like flood exposure vis-à-vis their own economic interest in increased development.
- Present questions that ask respondents to rank flood control strategies (such as limiting growth or requiring stormwater diversion structures) or competing values (such as drainage capacity, aesthetic appearance, environmental quality, and cost).

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Appendix A: Survey Instrument



Below is a series of questions about the City's efforts to reduce the risks posed by flooding. Please answer to the best of your ability by checking the boxes or writing in the blank space where appropriate.

1. While living in Austin, have you ever experienced flooding due to rainfall?
☐ Yes ☐ No
2. How concerned are you about flooding?
☐ Very concerned ☐ Concerned ☐ Slightly concerned ☐ Not at all concerned
☐ Don't know
3. Approximately how long have you lived in Austin?
_____ Years
4. Approximately how long have you lived in your current home?
_____ Years
5. Since living in your current home, have you experienced flooding in any of the following locations? Please check all that apply, and indicate the number of times you have experienced flooding in each location to the best of your recollection.

<input type="checkbox"/> House.....	Number of times: _____
<input type="checkbox"/> Garage.....	Number of times: _____
<input type="checkbox"/> Crawl space (under house or deck).....	Number of times: _____
<input type="checkbox"/> Yard.....	Number of times: _____
<input type="checkbox"/> Street in front of house.....	Number of times: _____
<input type="checkbox"/> Other (please list):_____	Number of times: _____
<input type="checkbox"/> I have not experienced flooding.	
6. Have you ever been prevented from traveling to or from your home due to flooded roadways?
☐ Yes ☐ No

7. Are you aware that you can report flooding or a drainage problem to the City by dialing 3-1-1?
- ☐ Yes ☐ No
8. What is your preferred method for reporting flooding and drainage problems to the City?
- ☐ Dialing 3-1-1 ☐ Sending text message ☐ Sending e-mail ☐ Filling in form on website
9. How important do you think it is to report flooding to the City?
- ☐ Very important ☐ Important ☐ Somewhat important ☐ Not at all important
☐ Don't know
10. Are you aware of any City of Austin projects near your home related to flood protection?
- ☐ Yes ☐ No
11. If you *are* aware of any flood protection-related projects near your home, do you think that the projects have reduced flooding for you or your neighbors?
- ☐ Yes ☐ No ☐ Don't know ☐ Not applicable
12. Is your current home located in the floodplain?
- ☐ Yes ☐ No ☐ Don't know
13. Have you ever considered purchasing flood insurance?
- ☐ Yes ☐ No ☐ Already have flood insurance
14. If you wanted access to the City's floodplain maps and information, what would be your preferred method?
- ☐ View digital maps and information online
☐ View maps and information on paper in the public library
☐ Call and ask for the desired information
☐ Other (please list): _____
15. Have you ever been affected by changes to floodplain maps?
- ☐ Yes ☐ No ☐ Don't know
16. If you *have* been affected by changes to floodplain maps, how satisfied were you with the way the City communicated with you about the changes?

☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐ Not applicable

17. Are you aware that there are restrictions on development in the floodplain which can affect the building and remodeling of a house (Yes or No)?

☐ Yes ☐ No

18. Have you ever heard or seen the phrase, "Turn Around – Don't Drown!"® on the radio, on television or elsewhere?

☐ Yes ☐ No

19. Where have you seen or heard warnings about flooding? (Please check all that apply.)

- ☐ Radio
- ☐ Television
- ☐ Internet
- ☐ Newspaper
- ☐ Flashing lights or barricades on roads
- ☐ Other (please list): _____
- ☐ I have not encountered flood warnings.

20. What is your preferred method for receiving flood warnings?

☐ Radio ☐ Television ☐ Website ☐ E-mail ☐ Text message ☐ Smartphone app

21. What is your preferred method for receiving information about road closures due to flooding?

☐ Radio ☐ Television ☐ Website ☐ E-mail ☐ Text message ☐ Smartphone app

22. In general, how satisfied are you with the City's efforts to reduce the risks of flooding?

☐ Very satisfied ☐ Satisfied ☐ Neutral ☐ Dissatisfied ☐ Very dissatisfied ☐ Don't know

23. In the space below, please include any comments or concerns you have about flooding in the City of Austin or the City's efforts to address flood-related issues:

The following demographic questions are to aid in analysis only. The information provided will not be used to identify you as an individual.

24. Please indicate your age:

- ☐ 18-24 years
- ☐ 25-34 years
- ☐ 35-44 years
- ☐ 45-54 years
- ☐ 55-64 years
- ☐ 65+ years

25. Please indicate your sex:

- ☐ Male
- ☐ Female

26. Please indicate the race/ethnicity with which you most closely identify:

- ☐ Asian or Pacific Islander
- ☐ Black or African American (Non-Hispanic)
- ☐ Hispanic or Latino
- ☐ Native American
- ☐ White (Non-Hispanic)
- ☐ Other (please specify): _____

27. Please indicate your level of household income:

- ☐ Less than \$20,000
- ☐ \$20,000-\$59,999
- ☐ \$60,000-\$99,999
- ☐ More than \$100,000

28. Do you own or rent your current residence?

- ☐ Own
- ☐ Rent

This concludes the survey. Thank you for your participation!

Please fold the completed questionnaire and insert it into the return envelope provided.

If you have any questions about this survey, please contact James Helfrich at (512) 974-2641 or james.helfrich@austintexas.gov.

Printed on post-consumer recycled paper

Appendix B: Cover Letter



City of Austin

Founded by Congress, Republic of Texas, 1839
Watershed Protection Department
P.O. Box 1088, Austin, Texas 78767

February 1, 2013

Dear City of Austin Resident:

You have been randomly chosen to take part in a survey measuring your satisfaction with the City's efforts to reduce risks from flooding. The Watershed Protection Department would like to understand how you perceive our efforts to protect lives and property. By completing this survey, you can help to measure our progress, identify areas that need our attention, and ultimately help protect our community from flooding.

Your participation is voluntary. If you choose to participate, please complete the enclosed questionnaire in either English or Spanish (only one survey per household) and return it in the enclosed self-addressed, postage-paid envelope by **February 19, 2013**. We estimate that completing the questionnaire will take fewer than 15 minutes. The information from the questionnaire will only be reported as group data, and your name will not be identified with any response. If you have any questions about the survey, you may contact James Helfrich at

(512) 974-2641 or james.helfrich@austintexas.gov. Thank you very much for your time and attention.

Sincerely,

Appendix C: Reminder Postcard

SURVEY REMINDER

Dear Austin Resident,

About two weeks ago, the City of Austin mailed you an Austin Flood Protection Survey. If you have already completed and returned the survey, please accept our thanks. If you have not yet completed the survey, please consider doing so in the next couple of days.

Your response to the survey is important because it represents the views of many Austin residents like yourself, and we want to hear those views to help keep our community safe from flooding.

If you did not receive a survey, or if you need another copy, please contact James Helfrich at **512-974-2641** or **james.helfrich@austintexas.gov** and we will send you one immediately. Thanks again.

Kind regards,

Appendix D: Codebook



CODEBOOK

29. **EXPFLOOD:** While living in Austin, have you ever experienced flooding due to rainfall?

[1] Yes [0] No

30. **CONFLD:** How concerned are you about flooding?

[4] Very concerned [3] Concerned [2] Slightly concerned [1] Not at all concerned [7] Don't know

31. **YRSAUS:** Approximately how long have you lived in Austin?

_____ Years

32. **YRSNHM:** Approximately how long have you lived in your current home?

_____ Years

33. **Since living in your current home, have you experienced flooding in any of the following locations?**

Please check all that apply, and indicate the number of times you have experienced flooding in each location to the best of your recollection.

FLDHOS [0, 1]: House.....

HOSX: _____

FLDGAR [0, 1]: Garage.....

GARX: _____

FLDCRA [0, 1]: Crawl space

CRAX: _____

FLDYD [0, 1]: Yard.....

YDX: _____

FLDST [0, 1]: Street in front of house.....

STX: _____

FLDOTH [0, 1] : Other (please list):_____

OTHX: _____

FLDNA [0, 1]: I have not experienced flooding.

34. **FLDCAR:** Have you ever been prevented from traveling to or from your home due to flooded roadways?

[1] Yes [0] No

35. **RPTAWA:** Are you aware that you can report flooding or a drainage problem to the City by dialing 311?

[1] Yes [0] No

36. What is your preferred method for reporting flooding and drainage problems to the City?

RPT311 [0,1] Dialing 3-1-1 RPTTXT[0,1] Sending text message RPTEML[0,1] Sending e-mail
RPTWEB[0,1] Filling in form on website

37. RPTIMPT: How important do you think it is to report flooding to the City?

[4] Very important [3] Important [2] Somewhat important [1] Not at all important [7] Don't know

38. PRJAWA: Are you aware of any City of Austin projects near your home related to flood protection?

[1] Yes [0] No

39. PRJEFF: If you *are* aware of any flood protection-related projects near your home, do you think that the projects have reduced flooding for you or your neighbors?

[1] Yes [0] No [7] Don't know [8] Not applicable

40. FLDPLN: Is your current home located in the floodplain?

[1] Yes [0] No [7] Don't know

41. FLDINS: Have you ever considered purchasing flood insurance?

[1] Yes [0] No [2] Already have flood insurance

42. If you wanted access to the City's floodplain maps and information, what would be your preferred method?

MAPNET [0,1] View digital maps and information online

MAPLIB [0,1] View maps and information on paper in the public library

MAPCAL [0,1] Call and ask for the desired information

MAPOTH [0,1] Other (please list): _____

43. MAPCHG: Have you ever been affected by changes to floodplain maps?

[1] Yes [0] No [7] Don't know

44. CHGSAT: If you *have* been affected by changes to floodplain maps, how satisfied were you with the way the City communicated with you about the changes?

[5] Very satisfied [4] Satisfied [3] Neutral [2] Dissatisfied [1] Very dissatisfied [8] Not applicable

45. BLDRES: Are you aware that there are restrictions on development in the floodplain and that these restrictions apply both to the building and remodeling of a house?

[1] Yes [0] No

46. TADD: Have you ever heard or seen the phrase, “Turn Around—Don’t Drown!”® on the radio, on television or elsewhere?

[1] Yes [0] No

47. Where have you seen or heard warnings about flooding? (Please check all that apply.)

PSTFM: [0, 1] Radio

PSTTV: [0, 1] Television

PSTNET: [0, 1] Internet

PSTNWS: [0, 1] Newspaper

PSTLIT: [0, 1] Flashing lights or barricades on roads

PSTOTH: [0, 1] Other (please list): _____

PSTNA: [0, 1] I have not encountered flood warnings.

48. What is your preferred method for receiving flood warnings?

WRNFM: [0, 1] Radio **WRNTV:** [0,1] Television **WRNWEB:** [0, 1] Website **WRNEML:** E-mail

WRNTEXT: [0, 1] Text message **WRNAPP:** [0, 1] Smartphone app

49. What is your preferred method for receiving information about road closures due to flooding?

RDFM: [0, 1] Radio **RDTV:** [0, 1] Television **RDWEB:** [0, 1] Website **RDEML:** [0, 1] E-mail

RDTXT: Text message **RDAPP:** [0, 1] Smartphone app

50. GNLSAT: In general, how satisfied are you with the City’s efforts to reduce the risks of flooding?

[5]Very satisfied [4] Satisfied [3] Neutral [2] Dissatisfied [1] Very dissatisfied [7] Don’t know

51. In the space below, please include any comments or concerns you have about flooding in the City of Austin or the City’s efforts to address flood-related issues:

52. AGE: Please indicate your age:

[1] 18-24 years

[2] 25-34 years

[3] 35-44 years

[4] 45-54 years

[5] 55-64 years

[6] 65+ years

53. SEX: Please indicate your sex:

[1] Male

[0]Female

54. RACE: Please indicate the race/ethnicity with which you most closely identify:

ASIAN [0, 1] Asian or Pacific Islander

BLACK [0, 1] Black or African American (Non-Hispanic)

WHITE [0, 1] Hispanic or Latino

NATIVE [0, 1] Native American

WHITE [0, 1] White (Non-Hispanic)

OTHER [0, 1] Other (please specify): _____

55. INCOME: Please indicate your level of household income:

[1] Less than \$20,000

[2] \$20,000-\$59,999

[3] \$60,000-\$99,999

[4] More than \$100,000

56. OWNRNT: Do you own or rent your current residence?

[1] Own

[0] Rent

Appendix E: Results

Descriptive Categories		Questions							
<u>Maps</u>									
Method of Access		How do you want to access maps?							
	<u>Internet</u>	<u>Library</u>	<u>Telephone</u>	<u>Other</u>	<u>Missing</u>				
<u>Frequency</u>	258	30	80	4	9				
<u>Percent</u>	68.8	8.0	21.3	1.1	2.4				
Communication of Changes		Is your home in the floodplain?							
	<u>No</u>	<u>No %</u>	<u>Yes</u>	<u>Yes%</u>	<u>Don't know</u>	<u>Don't know %</u>	<u>Total</u>		
<u>Structure Not in Floodplain</u>	187	55.5	20	5.9	130	38.6	337		
<u>Structure in Floodplain</u>	5	14.7	20	58.8	9	26.5	34		
<u>Total</u>	192	51.8	40	10.8	139	37.5	371		
		Have you been affected by map change?							
	<u>Yes</u>	<u>No</u>	<u>Don't know</u>	<u>Missing</u>	<u>Total</u>				
<u>Frequency</u>	30	160	180	5	375				
<u>Percent</u>	8.0	42.7	48.0	1.3	100.0				
		How satisfied are you with communication of changes?							
	<u>Very dissatisfied</u>	<u>Dissatisfied</u>	<u>Neutral</u>	<u>Satisfied</u>	<u>Very satisfied</u>	<u>Don't know</u>	<u>Not applicable</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	11	5	6	7	1	2	340	3	375
<u>Percent</u>	2.9	1.3	1.6	1.9	0.3	0.5	90.7	0.8	100.0
<u>Valid Percent</u>	34.4	15.6	18.8	21.9	3.1	6.3	-	-	100.0
Land Use		Are you aware of floodplain building restrictions?							
	<u>No</u>	<u>Yes</u>	<u>Total</u>	<u>Missing</u>	<u>Total</u>				

<u>Frequency</u>	178		190		368	7	375
<u>Percent</u>	47.5		50.7		98.1	1.9	100
Insurance			Have you ever considered purchasing flood insurance?				
	<u>No</u>	<u>No %</u>	<u>Yes</u>	<u>Yes %</u>	<u>Already have it</u>	<u>Already have %</u>	<u>Total</u>
<u>General Austin</u>	183	78.2	32	13.7	19	8.1	234
<u>Floodplain</u>	83	61.5	25	18.5	27	20.0	135
<u>Total</u>	266	72.1	57	15.4	46	12.5	369
<u>Structure in Floodplain</u>	12	35.3	9	26.5	13	38.2	34
<u>Structure Not in Floodplain</u>	255	75.9	48	14.3	33	9.8	336
<u>Total</u>	267	72.2	57	15.4	46	12.4	370
<u>Structural Solutions</u>							
Visibility			Are you aware of any flood control projects nearby?				
	<u>No</u>		<u>Yes</u>		<u>Total</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	302		66		368	7	375
<u>Percent</u>	80.5		17.6		98.1	1.9	100.0

Appendix E: Results

Effectiveness			Are the projects effective for you or your neighbors?			
	<u>No</u>	<u>Yes</u>	<u>Don't know</u>	<u>Not applicable</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	9	28	33	300	5	375
<u>Percent</u>	2.4	7.5	8.8	80.0	1.3	100.0
<u>Valid Percent</u>	12.9	40.0	47.1	-	-	100.0
<u>Awareness</u>						

Experience General Experience			How long have you resided in Austin?				
<u>Years in Austin</u>	<u>N</u> 374	<u>Minimum</u> 0.2	<u>Maximum</u> 87	<u>Mean</u> 25.1	<u>Median</u> 23	<u>Std. Deviation</u> 18.7	
			How long have you resided in current home?				
<u>Years in Current Home</u>	<u>N</u> 374	<u>Minimum</u> 0	<u>Maximum</u> 61	<u>Mean</u> 13.4	<u>Median</u> 8	<u>Std. Deviation</u> 13.3	
			Do you own the home?				
	<u>Rent</u>	<u>Own</u>	<u>Missing</u>	<u>Total</u>			
<u>Frequency</u>	105	250	20	375			
<u>Percent</u>	28.0	66.7	5.3	100.0			
			How concerned are you about flooding?				
	<u>Not at all concerned</u>	<u>Slightly concerned</u>	<u>Concerned</u>	<u>Very concerned</u>	<u>Don't know</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	108	147	73	32	9	6	375
<u>Percent</u>	28.8	39.2	19.5	8.5	2.4	1.6	100.0
Specific Experience			Have you ever experienced flooding?				
	<u>Yes</u>	<u>Yes %</u>	<u>No</u>	<u>No %</u>	<u>Missing</u>	<u>Missing %</u>	<u>Total</u>
<u>Floodplain</u>	50	36.8	82	60.3	4	2.9	136
<u>General Austin</u>	63	26.5	169	71.0	6	2.5	238
<u>Total</u>	114*	30.4	251	66.9	10	2.7	375
<u>Chi-square Test for Ind.</u>	<u>Value</u> = 4.52	<u>df</u> = 1	<u>Asymp. Sig. (2-sided)</u> = .034				
			Flood experience while in current home?				

	<u>Yes</u>	<u>Yes %</u>	<u>No</u>	<u>No %</u>	<u>Missing</u>	<u>Missing %</u>	<u>Total</u>
<u>Floodplain</u>	46	33.8	88	64.7	2	1.5	136
<u>General Austin</u>	55	23.1	182	76.5	1	0.4	238
<u>Total</u>	101	27.0	271*	72.2	3	0.8	374
<u>Chi-square Test for Ind.</u>	<u>Value</u> = 5.34		<u>df</u> = 1	<u>Asymp. Sig. (2-sided)</u> = .021			
			Location of floods experienced while in current home?				
<u>Location of flooding</u>	<u>Number of respondents</u>		<u>Percent of those experiencing flooding</u>	<u>Mean # of times per respondent</u>	<u>Median # of times per respondent</u>		
House	10		9.9	3.2	2		
Garage	18		17.8	3.7	2		
Crawlspace	6		5.9	2.5	1		
Yard	53		52.5	6.0	2		
Street	37		36.6	6.8	2		
Other Locations	13		12.9	4.9	4		
			Have you experienced flooded roadways near home?				
	<u>Yes</u>	<u>Yes %</u>	<u>No</u>	<u>No %</u>	<u>Missing</u>	<u>Missing %</u>	<u>Total</u>
<u>Floodplain</u>	28	20.3	108	78.3	2	1.4	138
<u>General Austin</u>	26	11.0	210	89.0	0	0.0	236
<u>Total</u>	54	14.4	319	85.1	2	0.5	375
<u>Chi-square Test for Ind.</u>	<u>Value</u> = 6.37		<u>df</u> = 1	<u>Asymp. Sig. (2-sided)</u> = .012			
Reporting			Do you know how to report flooding?				
		<u>No</u>	<u>Yes</u>	<u>Missing</u>	<u>Total</u>		
<u>Frequency</u>		166	207	2	375		
<u>Percent</u>		44.3	55.2	0.5	100.0		
			What is the importance of reporting flooding?				

	<u>Not at all important</u>	<u>Somewhat important</u>	<u>Important</u>	<u>Very important</u>	<u>Don't know</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	5	38	96	219	10	7	375
<u>Percent</u>	1.3	10.1	25.6	58.4	2.7	1.9	100.0
				What are your preferred methods for reporting flooding?			
		<u>3-1-1</u>	<u>Text Message</u>	<u>Email</u>	<u>Webpage</u>	<u>Missing</u>	
<u>Frequency</u>		289	21	25	29	22	
<u>Percent</u>		77.1	5.6	6.7	7.7	5.9	
Public Campaigns				Are you aware of "Turn around don't drown"?			
		<u>No</u>	<u>Yes</u>	<u>Total</u>	<u>Missing</u>	<u>Total</u>	
<u>Frequency</u>		55	317	372	3	375	
<u>Percent</u>		14.7	84.5	99.2	0.8	100.0	
<u>Warning</u>							
General Warnings				Where have you heard flood warnings in the past?			
	<u>Radio</u>	<u>TV</u>	<u>Internet</u>	<u>Newspaper</u>	<u>Light, Barricades</u>	<u>Other</u>	<u>N/A</u>
<u>Frequency</u>	244	320	75	101	187	13	25
<u>Percent</u>	65.1	85.3	20.0	26.9	49.9	3.5	6.7
				What is your preferred medium for warnings?			
	<u>Radio</u>	<u>TV</u>	<u>Website</u>	<u>Email</u>	<u>Text</u>	<u>App</u>	<u>Missing</u>
<u>Frequency</u>	161	263	61	47	83	42	1
<u>Percent</u>	42.9	70.1	16.3	12.5	22.1	11.2	0.3
Road Closures				What is your preferred medium for road closures?			

	<u>Radio</u>	<u>TV</u>	<u>Website</u>	<u>Email</u>	<u>Text</u>	<u>App</u>		
<u>Frequency</u>	157	246	61	42	71	43		
<u>Percent</u>	41.9	65.6	16.3	11.2	18.9	11.5		
<u>Satisfaction</u>								
Overall			What is you general satisfaction with programs?					
	<u>Very dissatisfied</u>	<u>Dissatisfied</u>	<u>Neutral</u>	<u>Satisfied</u>	<u>Very satisfied</u>	<u>Don't know</u>	<u>Missing</u>	<u>Total</u>
<u>Frequency</u>	4	8	103	123	38	98	1	375
<u>Percent</u>	1.1	2.1	27.5	32.8	10.1	26.1	0.3	100.0
			Open-ended					
<u>Category</u>			<u>Number of responses</u>					
Communication - Floodplain			7					
Communication - Other			5					
Insurance			2					
Kudos			16					
Limited Government			5					
Low Concern			11					
Maintenance			6					
Misc.			14					
Specific Reports of Flooding			7					
Urban Development			12					

Appendix F: Responses to Open-Ended Questions

Category	Paraphrase	Verbatim Comments
Communication - Floodplain	Need to communicate floodplain changes to residents.	Does the city notify residents in floodplains that changes have been made?
Communication - Floodplain	difficult to interpret floodplain map	I owned a condo in SE Austin which I sold a year ago. I had a hard time reading the floodplain map and figuring out whether or not my condo was located in a floodplain.
Communication - Floodplain	Concern about crime spikes in buyout zones.	I currently live in a floodplain and I am in one of the 5 stage for home purchases. There is very little communication between the City and the residents. People are being given very short notice to accept bids, find a house, and then move to that house. Also, at the rate they are buying up the houses, it's leaving many dark areas and crime rate spiked with houses and cars being broken into. My house was one. I'm in stage 5, and I don't know where the City is with the stages of buying houses at this time. The house across is gone and is an empty lot with brush that's just sitting there that attracts all sorts of things.
Communication - Floodplain	Not sure if in floodplain	I would like to know if my house is considered to be in the floodplain area, because I plan on building a new house on my property. [No contact info given. ~JH]
Communication - Floodplain	Wants to find more info about building restrictions in floodplain.	It would be nice to know where information pertaining to number 17 can be obtained. [Question number 17 is about building restrictions in the floodplain ~JH]
Communication - Floodplain	City is overzealous in some ways, overly lax in others. Need signs to indicate floodplain.	Since we are in a drought, I am concerned that the City is overly proactive about some floodplain measures taken. Evacuating residents of Rio Lado housing, for example. In other ways too lax. Too few signs along roads indicate floodplain.
Communication - Floodplain	Re-zoned into floodplain, found out during mortgage refinanced	We were not informed that our property had been rezoned to flood zone. We found out this information during a mortgage refinance. We were originally in a flood zone when we purchased this home in '89, but were taken out of the flood zone at some point. We were not told when this happened. Now, we find out that we are now backing in flood zone. We have not moved. Our house has not moved during all these changes and our property and house have not experienced flooding.
Communication - Other	Prefers flood warning info through email and text message	Email and text updates please.

Communication - Other	Need to warn people using a variety of media.	I think public announcements across multiple platforms are crucial to flood awareness.
Communication - Other	Better communication of flood hazards.	For those of us who are not at a location prone to flooding, you might communicate things that would affect the whole system of water drainage. Would there be times when toilets would not flush properly, etc.?
Communication - Other	Better communication of flood hazards.	I would like to know actual flood risk of my house
Communication - Other	Need better communication of precautions for individuals	(Spanish) A que lugar nos alojariamos en caso de inundaciones. [Where would we stay in case of flooding? ...I think this is a question?? ~JH]
Communication - Other	Communicate projects.	Is there a method to inform the general population on the ongoing and completed projects on a monthly or quarterly basis?
Communication - Other	Need to communicate better with deaf residents (?)	It's not suitable or safe for deaf residents due to lack of communication. Sewage must be clear for flood-related. [This is verbatim... unclear ~JH]
Development	flooding along Waller Creek improved after '81 flood	We live on Waller Creek. After Memorial Day Flood (1981), upstream actions made a significant improvement to severity of flooding. More recent upstream development (e.g., the Triangle) has caused flooding to worsen (how bad is unknown since no major rains in the last several years). Although I was affected by changes to the floodplain map, I never heard from the City that I recall.
Development	Litter causes flooding. Overdevelopment without greenspace. Need impact fees for builders.	When my home flooded due to City lack of drainage and trash cans, I was shocked and very disappointed. The City allowed over development in areas and not enough "green" recharge areas to support urban runoff. Drainage ponds are NOT the answer. Impact fees for builders or remodels and open green space are.
Development	Need to regulate builders and educate citizens.	The city is growing, so I hope the City enforces any regulations on builders or other groups or factors that may affect flooding in the city of Austin. It is also important to keep educating Austin's citizens about flooding related issues. Thank you.
Development	Development upstream has hurt Bull Creek, and Frank has a dream on how to make it a better amenity.	Bull Creek has no type of flood protection and is getting worse with all of the new development upstream. I have developed a plan that would help with flooding and provide a swimming area, parks, and greenbelt areas for citizens of Austin. Attached is my Bull Creek Watershed Revitalization Plan. Please contact me for a water dam blueprint. I'd be happy to help.

Development	Understands causes of flooding; need to limit floodplain development.	Austin has a lot of thin soil, concrete, and limestone. I expect flooding. A lot of money is spent trying to mitigate the effect of heavy rain. I know the government sees increasing tax revenue from floodplain development, but having spent time in NOLA, I question whether it is the smart thing to do long-term.
Development	Concerned that proper development controls are not in place; appreciates engagement with a variety of stakeholders	I have read in the paper of development projects (residential and commercial) which have negatively impacted adjacent or downstream/hill neighbors. I am somewhat concerned about the effectiveness of the plan review process to identify/anticipate/prevent these impacts (or is it a lack of effective ordinances, I don't know?). Thanks for asking, and for your efforts to work with so many different stakeholders on flooding issues.
Development	Lack of development controls in Davenport	Lack of controls in Davenport Ranch.
Development	Long diatribe. Need development controls.	See attached sheet. "As soon as I arrived in Austin and witnessed the first rainfall, I knew there was a drainage problem. However, we need to ask ourselves if it is due to the continued building of roads, homes, and businesses, or due to the drainage system." [Long story short, she thinks it's both. She doesn't identify a specific problem or leave any contact info. Not filed as a complaint. ~JH]
Development	Control development in floodplain.	You need to quit letting developers build in the floodplain. Make it a park or greenbelt.
Development	City ignores citizen concerns about flooding caused by new development	Several years ago, my neighborhood had great concerns about a new development that was in a creek watershed. The City did NOT listen or heed any of our concerns, even when presented with PROOF of flooding on roadways. City staff had approved the project and Planning Commission said there was nothing to be done. So, I am quite concerned about the City IGNORING citizen concerns.
Development	New houses take up entire lot and will cause flooding in future.	The buildings going up are taking all the yard. We have had two houses in one block demolished so they can build from front to back and side to side-- this may cause flooding problems in the future.
Development	Concerned that proper development controls are not in place.	We are allowing so much development at such a rapid rate; the unfettered growth and the City's desire to continue to attract even more leaves me wondering if we are taking appropriate precautions to prevent flooding and environmental hazards.
Insurance	Insurance unaffordable for the elderly	I'm retired. I live in a floodplain area. I'm 67 years old. It's getting harder and harder for me to pay my flood insurance, which this

		year is \$550. It goes up every year! My neighbor next door to me only paid \$300 all their lives. It never went up. Why is that? Why doesn't the City take measures to correct and improve this floodplain area? Maybe I wouldn't have to pay insurance. The houses across from me don't have to pay flood insurance. *Why is that?* I also think as a senior citizen, we should get a break, and not be charged so much. PS: It's very hard on me because I live on a fixed income. My house needs repairs which I can't afford.
Insurance	Floodplain map not accurate	We are supposedly in a floodplain and therefore are required to have flood insurance per our mortgage. We have seen torrential rains and the deepest we've seen the water in the streets get is maybe 3/4" deep as it runs down the side of the street, but this is supposed to be a floodplain. I don't agree.
Kudos	Keep on keepin on.	Solamente que sigan como asta ahora. [Just continue as before. ~JH]
Kudos	Likes TADD.	The "Turn around, don't drown" campaign along with good news (TV) media coverage has seemed beneficial in increasing public awareness.
Kudos	Kudos	You guys rock!
Kudos	Low-water crossing is well-labeled. TADD helps.	I reside next to low water crossing subject to flood, but there is an alternate route to take. Labeled well. Turn around--Don't drown is a good campaign that gets the word out.
Kudos	Good job, but insurance shouldn't be mandatory	From my experience, the City seems to be doing a good job. I'd rather flood insurance wasn't mandatory, but I know that's FEMA and not the City.
Kudos	Recognizes flooding as a problem, but trusts City to manage it.	(Spanish) A pesar del poco tiempo que llevo viviendo en austin he escuchado por la televisión en varias ocasiones de inundaciones en algunos lugares y por eso estoy muy preocupado pero a la vez se que rápidamente las autoridades actúan con al objetivo de salvar vidas y objetos. [Despite the short time I've been living in Austin, on several occasions I've heard on television about floods in some places, and therefore I am very concerned, but, at the same time, I know the authorities act with the goal of saving lives and property.]
Kudos	Flood control project on Wells Branch has taken house out of floodplain. Very satisfied.	The flood control project on Wells Branch Creek at Parmer Lane seems to have worked as planned. My house on Willow Bend is now out of danger and out of the floodplain! Thank you thank you!!!! We no longer see high spikes in that creek eroding away property and making us afraid.

Kudos	Pleased with City's efforts	(Spanish) La ciudad está trabajando bastante bien para prevenir las inundaciones. Ayudando de esa forma a evitar algunas tragedias. Estoy satisfecho con el esfuerzo y trabajo que están haciendo. [The city is working well enough to prevent flooding, thereby helping to prevent some tragedies. I'm pleased with the effort and work they are doing.]
Kudos	No flooding problems, but trusts the City.	(Spanish) No tengo inquietudes por que nunca etenido problemas de inbudasion. Para: mi en una ciuda muy bonita. [Rough Translation: I do not have concerns because I have never had flooding problems. Because (?) My city is very nice.
Kudos	Progress on flooding is slow.	There is progress; however, it's a slow process.
Kudos	Appreciates development controls	I live at William Cannon and Westgate; there are a lot of greenbelt/woods areas that have waterways. This makes me appreciate the planning and preparations and codes Austin has over the years to properly direct development. I own a commercial condo space built in the last few years; a big detention area was required. Though expensive, I think it is an appropriate requirement.
Kudos	Appreciates work of local authorities regarding floods.	I have not experienced any kind of flooding ever since I came here. The impression I have is that the authorities are very responsible. I would like to commend you on the effort you put into trying to solve this problem. May the almighty God help you. Thanks.
Kudos	City does the best it can	I think the City is doing the best job they can.
Kudos	Artificial creek bed alleviates flooding, but cul-de-sac has drainage problems	In the area where I live, the City seems to stay on top of flooding issues. I am located where two creeks come together-- one man-made, one natural-- which works great to avoid flooding. On the corner where we turn into the cul-de-sac is usually flooded with standing water.
Kudos	Big improvement since '81.	We lived here during the Memorial Day floods of '81. There has been terrific improvement in flood control and awareness-raising with public service announcements.
Kudos	Likes TADD.	I always try to avoid low water areas and always love your advertisements.
Limited Government	Don't rescue fools	I get very angry when people drive around barricades, then die or need to be rescued. Emergency personnel should not take undue risks to save people who make poor choices.
Limited Government	Waste of money to send to apt	Why send this to apartment residents? Waste of taxpayer monies!

Limited Government	Gov should do as little as possible	Keep regulation to a minimum; keep fees and taxes to a minimum; do not create a big bureaucracy.
Limited Government	Should not subsidize flood insurance.	People living in floodplain should not be insured at everyone else's expense. Their gamble -- their loss.
Limited Government	Regulatory capture	As with all government regulations, they are actually controlled by powerful (i.e., moneyed) interests. Regulations of this sort should be made by experts in the field and not by politicians. Developers goad officials to change the floodplain boundaries.
Low Concern	Low concern	Since I live in the Highland location, I'm not very concerned about flooding
Low Concern	low concern	We plan to remain in our home for many years and have no concerns about flooding.
Low Concern	Low concern - drought	Since I've lived here, there has been so little rain; I know nothing about where it floods.
Low Concern	Aware of hazards.	I rarely get impacted by flooding close to home. I am aware of the danger areas Around Austin
Low Concern	Traffic	Only flooding that disrupts freeway traffic concerns me.
Low Concern	No flooding problems, because lives on 3rd floor.	Nunca me he visto afectada por las inundaciones. Quizas sea porque no tengo carro y vivo en el tercer piso. :) [I have never been affected by the floods. Maybe it's because I have no car and live on the third floor.]
Low Concern	Traffic	I am more concerned about Austin's traffic.
Low Concern	Drought	Have not been here during times of flooding. Not enough rain in past year and a half to affect us.
Low Concern	Not exposed.	I don't have any comments right now because have not been in situations where flooding occurs.
Low Concern	City ignores citizens. Tangential.	In 28 years, never even had a scare. Water moves quickly from the hills and down through he many ravines and waterways, created by both the city and subdivision (Bull Creek). So we often think "What's the point to respond?" Sorry I failed to take care of this earlier, *but* we've long gotten the impression our City Council doesn't care-- even when they spend our money and have bond elections. Where we and our votes are totally ignored for a second time! Ex: we voted YES to finally widen Spicewood Springs (between 360 and Mesa Drive) and what did the Council do??? Didn't widen but used Federal and stimulus money and narrowed the already narrow stretch by putting in A BIKE LANE forcing autos to cross under double stripes and into oncoming traffic!! IGNORED OUR VOTE! Which is exactly what they're doing after

		our last vote regarding lower income housing in East Austin. Voters said NO, so they're raiding the General Revenue Fund and totally ignoring the citizen's VOTE!!
Low Concern	Green spaces	More concerned about lack of green spaces.
Maintenance	Treen in Eanes Creek clog waterway	Our backyard borders on a greenbelt on Eanes Creek. Power lines are along the creek and when they trim the trees, lots of them die due to a combination of stress and drought. Then, they fall across the creek, slowing the current and sometimes it results in flooding in our backyard. I have cut up two large oaks that fell across the creek to prevent flooding. Are the waterways ever checked to see if there are trees blocking the water flow? Should we report fallen trees to the City if they block waterways? I've never seen any information on this in the newsletter that comes every month with our utility statement.
Maintenance	Debris from homeless camps, espily under bridges	A challenge I know, but more money, manpower needs to be directed at keeping debris from homeless camps out of the watershed and cleaned from bridges.
Maintenance	Debris in Walnut Creek.	Clean the brush and trees and tree limbs out of Walnut Creek, clear the bank for better water flow.
Maintenance	Debris in Ratan Creek	We live along Ratan Creek and are concerned about the amount of fallen trees and branches in the creek area. If we experience heavy rainfalls we might see flooding in areas where we have not in the past, because all the debris in the creek area will pile up and prevent water to flow down the creek.
Maintenance	Drains clog. City is not proactive enough.	Drains aren't cleared often enough. All planning has sucked because the City fixes items after it's already an issue.
Maintenance	Bridge on Webberville Rd has debris.	1616 Webberville Road. The Bridge has too much debris in it. Need to keep eye on bridge under the bridge so when the water comes it doesn't clog up.
Misc.	Bad flood in '78 or '79. Tangential.	Gobi flood was bad in 1978 or 1979. Water to door of van. Our duplex neighbors helped my husband push the van to Mojave cause water was high and I had to get off, but they let me stay in. I think I walked thru the high water. Residents from McKinney Falls Homes would like work done to streets on William Cannon going East to Nocales road to their homes. Also Del Valley needs grocery stores, Walmart, food chains, etc., maybe recreation centers like in Northeast Austin and West and South . Libraries, etc. Amusement parks like sea world. ...Um, right.
Misc.	Need to ensure CIP fairness.	Make sure dollars spent for flood mitigation are directed based on greatest need and not greatest amount of campaign

		contributions or ZIP code
Misc.	Joke	What?! It floods here? I'm moving. Just kidding.
Misc.	Buyouts lead to declining property value	My neighborhood has been greatly affected by the City of Austin's decision to buy out my neighborhood in Onion Creek. Due to the City's failure to complete this project my neighborhood has become a neighborhood of low rent, section 8, drug dealers, and prostitution. The value of my property has greatly decreased! Whoever makes these decisions have turned their backs on this problem and put tax payers' money elsewhere.
Misc.	Helicopters and fires. Tangential.	The City of Austin needs more helicopters which will help extinguish fires, which will improve natural flood control.
Misc.	Moved because of flooding	I moved to current home because of flooding at prior home. [Has lived in current home for 36 years. ~JH]
Misc.	Poor health	Thank you. I'm not well. Forgive me. My home was nearly destroyed in the Memorial Day Flood. We also lost two cars. [Survey not completed. Comment left on returned cover letter. ~JH]
Misc.	Flooding from water main	Water main broke on my street, which resulted in street flooding and water turned off for 2 hours. Otherwise, I've had no effects from flooding.
Misc.	Removed from floodplain	Removed from floodplain several years ago.
Misc.	Eliminate ash juniper.	I think the City should do more to eradicate juniper on City-owned lands such as greenbelts, preserves, etc. This type of tree robs the aquifer of water, causes soil erosion, and is a fire hazard. Runoff from areas choked with juniper makes flash flooding worse.
Misc.	Nativist	As I live in an English-speaking country, I feel that surveys should be in English only.
Misc.	Aware of hazards.	I think the southern edge of the condominium where I live is in the 100 year floodplain. My home is at the opposite end of the property.
Misc.	Constructive criticism of survey.	Questions 1 and 2 are unclear-- are you asking about experiencing flooding anywhere in Austin or in our home? Are we concerned about flooding in Austin or that our house could be flooded?
Misc.	Communicate need to avoid driving in floods	My concern is for people who drive through flooded areas. I think it needs to be stressed more that people should not try to drive in

		flood conditions.
Report of Flooding	N. Lamar Blvd, near campus, floods in heavy rains.	We live on a hill west of Shoal Creek (very elevated) near 24th Street. The only flooding we deal with is at that low part of Lamar between 9th and 12th that floods, so we avoid it.
Report of Flooding	House floods	Although there is some standing or flowing water in the street and yard on occasion, the water that gets in my garage seems to percolate up. Floating on a clay bubble? Never saw this before.
Report of Flooding	Street flooding on McNeil and Lakewood Dr.	I have not seen anything done that is effective for reducing flooding in our neighborhood or streets leading to it, on Merriltown-McNeil since we've lived here. I also see it flood many times on Lakewood Drive at Bull creek. [Respondent has lived in current home for 11 years. ~JH]
Report of Flooding	Mopac floods	When I was working in downtown Austin, Mopac Northbound would flood between 15th Street and 24th Street, which would stall traffic. But, fortunately I drive a four-wheel drive truck.
Report of Flooding	House floods in heavy rains.	[Flooding occurs] right by my front door when we have had heavy rain in the past. A few times, I worried it would come in front door. I think the City replaced drainage pipes in Bouldin Creek--took one year! I did receive notice that CoA would be working on area at the end of Cardinal St and Lueke Ln.
Report of Flooding	Flooding in Onion Creek	We live in Onion Creek golf Subdivision. Anything to control flooding in the creek would be welcome. In 30 years, only one house has actually experienced water in the house, at the low end of the creek.

Report of Flooding	Disgruntled citizen. Wants city to pay for drainage improvements on her property.	<p>I live on a greenbelt that has risen to extreme levels with heavy rains. The greenbelt in back of my house on Deer Lane. [City employee A] took pictures in my yard that are not a true representation of the problem. The water rises very high in the back of my house but it slowly goes down throughout the day after a heavy rain. [City employee B] told me that my deed showing the map of my land is not correct. I have lived her for 29 years and own my house. I am concerned that the promises made to me are trying to be evaded. Affected residents should have been made aware of the City's anticipated action. [City employee A] left a message on my answering machine suggesting that I only talk to him in regards to the concerns that I have regarding my property line. I should not be in a flood plane was not identified as floodplain on the initial deed. Flooding on Deer Lane has been a problem in the past. However, I have lived in my home for 29 years. When this house was purchased, I was assured as well as my neighbors that we would eventually receive all of the land that was indicated as on my property in our deeds. We were told that eventually the City would straighten out the boundaries, correct our fence lines, and give us our property. I have met with the City engineers [City employee A] and [City employee B]. I am very concerned for my property that I have paid taxes on for the past 29 years. I also spoke with the UT research group as well as [Illegible]. I asked if we have a homeowner's association. I introduced him to my neighbor George which lies on the other side of the flood drainage ditch. Did not talk to him in my presence. I offered to introduce him to the [Illegible] who lives across the street from me.</p>
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