

**Regulatory Floodplain Revisions, the National Flood Insurance Program,  
and Future Implications:  
A Case Study of Ada County, Idaho**

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**by**

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## AUTHORIZATION TO SUBMIT THESIS

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## **ABSTRACT**

This study employed a sequential explanatory strategy mixed methods approach in order to explore the potential effects of a 100-year floodplain revision in Ada County, Idaho. Results indicate that vulnerable populations are more likely to be affected negatively by floodplain revisions, especially those in Garden City, Idaho. This study finds that vulnerable populations not only include those with lower socio-economic statuses, but also populations that are in the middle class. These populations may become strained and as a result, displacement, voluntary migration, neighborhood instability, and gentrification may occur. There is also a disparity amongst professionals within the public sector versus the private sector who perceive that impacts may only be short-term, rather than long-term. This study then concludes with a discussion of possible adjustments that can be made at the micro- and meso- level enabling individuals and communities to adapt, which in turn may potentially increase community resiliency.

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# 1. REVIEW OF LITERATURE AND RESEARCH QUESTIONS

## 1.1. Introduction

Floods have accounted for nearly one third of all natural disasters between 1900 and 2006 (Birkholtz et al, 2014). Losses to floods affect both life and property and changes in climate are expected to increase the frequency and magnitude of major flood events in the coming decades (Lo, 2013). This has led to two main concerns, one of which is how to contain the damage floods cause. The other is how to provide economically feasible relief to victims that will help them recover from the disaster (Kunreuther and Roth, 1998). In the United States, a combination of mitigation/actions/projects and the National Flood Insurance Program (NFIP) are two human approaches addressing these concerns at the community level.

The National Flood Insurance Program was created in 1968 to provide assistance to private insurance companies. Additionally, this federally-regulated program was intended to provide residents located within flood-prone areas the ability to engage in preventative measures that will substantially reduce damage costs after a flood disaster. Flood insurance becomes available if a community agrees to adopt and enforce floodplain management ordinances for new development within the Special Flood Hazard Area (SFHA) or the 100-year regulatory floodplain (Kunreuther and Roth, 1998). The 100-year regulatory floodplain is delineated on a Flood Insurance Rate Map (FIRM), which designates both the special hazard areas and risk premium zones for the community (FEMA, 2011). Mandatory flood insurance purchases are required for those buildings with federally backed loans, such as a Federal Housing Administration (FHA)

loan, and are located within the 100-year regulatory floodplain. In order to determine these flood areas within a community, the Federal Emergency Management Agency (FEMA) performs a Flood Insurance Study (FIS) for the participating community.

A Flood Insurance Study (FIS) is a compilation of flood risk data for specific flood hazard areas within a community (FEMA, 2011). A FIS concerns itself with the physical aspects of a region and how this affects the physical flooding potential. Data is gathered based on historical data (e.g., river flow, storm tide, rainfall data), meteorological data, topographic data, hydrologic data, hydraulic data, open-space conditions, flood-control works, and development (FEMA, 2011). These data enable engineers to delineate specific flood zones through water depth, which then allow for damage and insurance premium rates assessments.

In addition to Flood Insurance Studies, various amendments to the National Insurance Act (NFIA) have contributed to the revisions of 100-year regulatory floodplain boundaries within communities. The National Reform Act of 2004 is an amendment to the NFIA that provides emphasis towards mitigation efforts and the addition of geospatial data in the creation of FIRMs. The addition of geospatial data has led to more accurate flood risk zone delineations for a community's 100-year floodplain boundary. A combination of FISs and recent amendments to the NFIA has led to revisions of 100-year regulatory floodplains nationwide. This research concerns itself with one such map revision for the Lower Boise Watershed in the state of Idaho.

The Lower Boise Watershed encompasses the main stem of the Boise River and its tributaries from the Lucky Peak Dam to the confluence of the Snake River near Parma, Idaho (FEMA, 2011). Its NFIP participants are the counties of Ada, Canyon,

Elmore, Boise, Gem, and Payette, and various incorporated cities within these counties. Due to outdated FIRMs and limited riverine flood analyses, a FIS was conducted in 2011 for the entire watershed. This FIS consisted of new flood source studies and enhanced data collection, which provided the factual basis for the revised 100-year regulatory floodplain boundary delineation. Factors that determined this new delineation included an update of a number of flooding sources within the watershed, an identification of two repetitive losses in Garden City, and a re-delineation of areas in Ada County where scattered Letters of Map Amendments (LOMAs) were present. A LOMA is a letter that officially revises an effective FEMA NFIP map (FEMA, 2011). This is given once a review of scientific or technical data is completed as requested by the owner or lessee of property whom believes that their property has been wrongfully included within the 100-year regulatory floodplain. Moreover, Light Detection and Ranging (LiDAR) data was collected for the entire reach of the Boise River and lower portions of its main tributaries (FEMA, 2011), which geospatially enhanced the delineation of the 100-year regulatory floodplain boundaries. Lastly, through a combination of local floodplain administrators, the U.S. Army Corp of Engineers, the National Levee Database, FEMA's Regional Flood Hazard Layers, and the Mid-Term Levee Inventory, it was determined that all current levees within the Watershed were not compliant with 44 CFR 65.10 (FEMA, 2011). As a result, these levees were not incorporated into the hydrological analysis for the FIS.

To date, research has shown that 100-year regulatory floodplains may have a great impact on local communities (e.g., decreased property values, decreased community tax base, population displacement). This research aims to look into these

effects for Ada County, Idaho. The main goal of this research is to determine which parts of Ada County have the largest changes in the delineation of the 100-year regulatory floodplain boundaries and how these changes will affect Ada County as perceived by the community. Moreover, this research aims to take these results and suggest future adjustments at the micro- and meso- level in order to cope with these revisions, which in turn can help increase community resiliency.

Chapter One of this thesis provides an overview of the literature and concepts related to this research. Included are concepts pertaining to natural hazards and theory; floods and the approaches humans have taken to cope with the effects; vulnerability; sustainability; mitigation and mitigation planning; and the National Flood Insurance Program (NFIP). Concepts related to the NFIP that are discerned in greater detail include its history, processes, and current requirements, risk perception and the purchase of flood insurance, and the effects of flood insurance on participating NFIP communities. Chapter One then concludes with the goals and questions of this research.

Chapter Two describes the study area for this research. The state of Idaho and Ada County's geologic and natural resources are described, as well as the county's population and demographic, economic, real estate and development trends, land use, and flooding characteristics. Chapter Three describes the quantitative data collection process, stating each data type and source used throughout this research. Chapter Four describes the methodology of the floodplain revision analysis, the economic exposure analysis, the Hazus-MH level II flood analysis, and the qualitative interview process undertaken for this study.

Chapter Five provides the results for the quantitative and qualitative portions of this thesis. The areas of major floodplain revisions; business, economic sector and residential exposure; and interview responses are discerned within this chapter. Chapter Six provides for a discussion of the major findings of this thesis. Chapter Seven concludes this thesis by answering the research questions, providing the study limitations, presenting future research needs, and stating this research's societal relevance.

## **1.2. Literature Review**

### *Natural Hazards and Theory*

This research focuses on proactive approaches to planning for natural hazards. It is pertinent to distinguish the differences between a natural disaster and a natural hazard. A natural hazard is defined as “an interaction of people and nature governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system” (White, 1945). This differs from a natural disaster, which refers to society as already having experienced losses and damages from a specific and spatially contained geophysical event (Tierney, Lindell, and Perry, 2001).

Historically, humans have occupied some of the most hazard-prone landscapes. Reasons for this include searching for fertile land, commercially advantageous locations, and attractive locations with scenic views (Tierney, Lindell, and Perry, 2001). This development pattern makes society vulnerable to geophysical events and leads to losses in life and property. The socio-economic status of society can further exacerbate this vulnerability (Bryant, 2005). This can be found through elements of Marxist geographies, which can be used as justification for human occupancy within hazard

zones. This is strongly related to the human use system that is used within the abovementioned definition of natural hazards.

Marxist geography in relation to natural hazards refers to the distribution of marginal populations within hazard prone landscapes. Society is already vulnerable due to historical development patterns, yet poor or oppressed populations become even more vulnerable due to socio-economic conditions and a lack of adaptive capacity, or ability to cope. Marxist geography in relation to natural disasters has been summarized by Bryant (2005) into the following concepts:

- The poor classes suffer the most
- Disaster relief maintains the status quo and works against the poor
- Measures to prevent losses to natural hazards reinforce the conditions of underdevelopment

Furthermore, in contemporary times, this vulnerability has increased, as have the damages that have been incurred due to natural disasters (O'Keefe, Westgate, and Wisner, 1976). As a response to these conditions, humans have approached floods in various ways that have evolved throughout history.

### *Floods*

Floods, predominantly inland floods, have been the focus of the twentieth century. This is due to the extensive damage this geophysical event can cause. Floods are considered to be the most devastating natural hazard to both life and property (White, 1945; Watson and Adams, 2011). Moreover, changes in climate are expected to increase the frequency and magnitude of major flood events in the coming decades (Lo,

2013). Flooding may occur at any time during the year and in any place. Inland floods are a result of stormwater runoff that exceeds the capacity of the built infrastructure and/or streams and river systems (Watson and Adams, 2011). With the addition of natural hazards theory and its social implications related to flood insurance, the definition of flooding used for this research is as follows (FEMA, 2011):

“A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from overflow of inland or tidal waters, from unusual and rapid accumulation or runoff of surface waters from any source, or from mudflow”

#### *Human Adjustments to Floods*

Human approaches to flooding have evolved throughout the last century, and have occurred in various forms due to their societal and physical damages. There are six main human approaches. Each has occurred as a response to the frequency and magnitude of floods and their damages (Brinkmann et al., 1975). Humans have also approached floods in ways to continue using the beneficial aspects of these hazardous areas, while also trying to reduce vulnerability. Those six approaches are:

- Control and protection works
- Forecast and warning systems
- Flood-proofing and their contents
- Land use management
- Flood Insurance
- Relief and rehabilitation services



Each approach comes from either a physicalist origin or a Marxist origin. A physicalist approach aims to control the environment, whereas a Marxist approach aims to reduce vulnerability. Previous literature suggests using a combination of both types of human approaches in order to be most successful. Moreover, without vulnerability, natural hazards lose their danger and the potential for environmental resources to become benign or exploited increases (Castree and Braun, 2013).

### *Vulnerability*

Vulnerability and its definitions have been unclear throughout natural hazard literature and can include various elements. Understanding vulnerability and its local context is crucial in order to understand which human adjustments need to be made for local communities (Weichselgartner, 2001). For this research, vulnerability is defined as the potential for loss and is a function of exposure, sensitivity, and adaptive capacity (Frazier, Thompson, and Dezzani, 2013). Exposure is the proximity of a community to a hazard, sensitivity is the degree to which a community is affected by a hazard, and adaptive capacity is the ability of the community to adapt and cope with hazard impacts (Frazier, Thompson, and Dezzani, 2013). The end goal in reducing vulnerability is to create a resilient community.

### *Resiliency*

Resiliency can be achieved through sustainable development (Burby, 1998). In order for communities to engage in resilient-based actions, it is necessary to understand what a resilient community looks like. Resiliency's ultimate goal is to construct communities that are able to survive and recover rapidly from the effects of

geophysical events, such as floods (Tobin, 1999). The characteristics of a resilient community must include the following (Tobin, 1999):

- Lowered levels of risk to all members through reduced exposure to the geophysical event
- Reduced levels of vulnerability for all members of society
- Planning for sustainability and resilience must be on-going
- High level of support from responsible agencies and political leaders.
- Incorporation of partnerships and cooperation at different governmental levels
- Strengthened networks for independent and interdependent segments of society.
- Planning at the appropriate scale.

Resilient communities can be achieved through hazard mitigation planning and also, through flood insurance policies. For this research, flood insurance will be considered a separate human adjustment from that of hazard mitigation planning. Though, they are highly related. In order to understand hazard mitigation planning in relation to flood insurance, a brief overview of mitigation and its history is necessary.

#### *Mitigation and Mitigation Planning*

Natural hazards and disasters can cause damage to both life and property. In order to reduce or eliminate these damages, action can be taken in the form of mitigation. Mitigation is defined as “sustained action taken to reduce or eliminate long-term risk to life and property from hazards (FEMA, 2013).” Actions for mitigation can be either structural or non-structural; the latter said to be the most effective. Though, a

combination of both is desirable. This is consistent with the combination of human adjustments to flooding posed by White (1945). Non-structural mitigation can help reduce manufactured risk that communities often create, whereas structural mitigation often increases development in hazardous areas, known as the “levee effect.” Damages can then become two-fold if the structural mitigation efforts fail. The goal is to reduce these effects and strive towards becoming sustainable and resilient. Mitigation is considered one of four phases of emergency management. The other three phases are preparedness, response, and recovery. There is no clear distinction of when mitigation begins and ends (Jackman and Burivides, 2013) and as a result of this ambiguity, literature has oriented the concept of mitigation into the term hazard mitigation planning.

Hazard mitigation planning includes “pre-disaster measures aimed at minimizing or preventing losses and long-term risk to people and property from natural hazard events and their impacts with an overall goal of reducing a community’s vulnerability and creating more hazard resilient communities” (Frazier, Walker, Kumari, and Thompson, 2013; FEMA, 2012). Mitigation planning is a “bottom up” approach that is highly participatory and literature suggests that it is most effective with the addition of land use management. Mitigation planning combines both technical analysis and community participation. Though, the latter has been waning according to the literature. Due to the complex and technical nature of hazards planning, participation is often low in communities, which presents a need to encourage participation by incorporating public participation programs (Godshalk, Brody, and

Burby, 2003). The results of the hazard mitigation planning process are then presented within a Hazard Mitigation Plan.

Hazard Mitigation Plans (HMPs) consist of two major goals. The first is to provide actions that could be taken in order to mitigate hazards, risks, and vulnerabilities. Second, states and counties must create a strategy to implement those determined actions (Jackman and Beruvides, 2000). HMP's are considered to be one of two types of hazard mitigation plans: a Hazard Mitigation Plan (HMP) or a hazard component within a comprehensive plan (Godshalk, Brody, and Burby, 2003). The goal is to implement the former into the latter in order for effective policy formation, adoption, and implementation. Moreover, integrating an HMP into a comprehensive plan can link hazard policy with other community components, such as land use, the economy, and parks and recreation, while increasing resilience simultaneously. The risk assessment component is the factual basis for HMPs and is used as justification and support of chosen mitigation strategies (Burby, 1998).

Risk assessments are thus defined as a "quantitative estimate of the damage, injuries and costs that are likely to be experienced within a specific geographic area over a specific period of time" (Burby, 1998). A risk assessment is considered to be the most detailed and technical hazard assessment (Burby, 1998). This particular hazard assessment provides the sound and causal theory that is needed in order for effective hazard policy formation, adoption, and implementation of HMPs at a local level (Prater and Lindell, 2000). Hazus-MH, created by FEMA, is a model used to produce the data within risk assessments. The model also provides crucial data for flood insurance policy rates and zones of high flood-risk requiring the purchase of flood policies.

### *Hazus-MH*

The Hazus-MH flood model was created as a response to previous hydrologic and flood models that had not incorporated structural and vulnerability elements within a cost estimation framework. Other flood models have included the HEC-1 and HEC-2 developed by the Army Corp of Engineers and Flood Insurance Rate Maps (FIRMs) developed by FEMA, which are now guided by results of Hazus-MH (Burby, 1998). However, these previous models have not incorporated measurements for flood protection failure or debris in floodwaters. Hazus-MH incorporates these elements and provides quantification of human, property, financial, and social impacts of natural hazards. This deterministic model can also include mitigation measures that are in place (Scawthorn et al., 2006).

Hazus-MH was developed in two separate phases in 1997 and is constantly being reviewed, updated, and tested. The first phase of development included a review of the existing loss estimation studies, models and data. The second included the identification of user needs (Scawthorn et al., 2006). This process suggested gaps within previous flood model development. One of the limiting factors found was a lack of staff capacity and the ability to train staff on flood models. Hazus-MH sought to reduce this concern by making the software and user manuals readily available to local communities. The goal of the Hazus-MH flood model is to help decision makers with informed decisions, which corresponds into effective policy formulation, adoption, and implementation. This is the factual basis for hazard mitigation plans and FIRMs. There are two main components within this model: a flood analysis and a flood estimation analysis (Scawthorn et al., 2006). Flood analyses can provide for a better understanding

of hazard specifics by calculating floodplains and flood depths, whereas flood estimation analyses can provide for a better understanding of hazard effects through building structure and societal damage calculations. Hazus-MH consists of three levels of analysis: Level I, Level II, and Level III.

A Level I Hazus-MH analysis provides for a basic estimate of flood losses based on national databases and expert-based analysis parameters that are already included within the software (FEMA, 2014). This is considered the “default” scenario and is based on various assumptions that may provide less accurate results. For example, essential facilities and general building stock (GBS) provided within the Hazus-MH database may not include the actual building infrastructure residing in the study area. In order to provide for more accurate results, a Level II analysis is recommended.

A Level II Hazus-MH analysis provides for more accurate flood loss estimates by the addition of detailed information on local hazard conditions and/or by replacing the national default inventories with more accurate local inventories of buildings (FEMA, 2014). For example, using the Flood Information Tool (FIT) within Hazus-MH allows for a Level II analysis. This tool calculates flood depths and elevations based on local ground elevations, flood elevations, and floodplain boundary information (FEMA, 2014). The end result is a depth grid that can be used to calculate future flood losses. A Level II analysis provides more accurate flood loss estimates, however it requires a user with more Hazus-MH experience. Additionally this level of analysis demands data from various professionals including geologists and hydrologists, which may exceed local capabilities.

The most state-of-the-art loss estimate analysis is produced at Level III. This last Hazus-MH analysis includes all of the hazard and inventory improvements from a Level 2 analysis and provides additional expert adjustments of analysis parameters (FEMA, 2014). This last level of analysis requires the most expertise in Hazus-MH's architecture and file structure. Moreover, collaboration with earth scientists, structural engineers, land use planners and emergency planners is crucial to gain the most accurate information on a community's flood vulnerability. A Level III HAZUS analysis is rarely within a community's capabilities and requires additional external technical assistance.

Using Hazus-MH as a flood risk assessment tool heavily relates to the use of other human adjustments to floods suggested by White (1945), including The National Flood Insurance Program managed by the Federal Emergency Management Agency. Hazus-MH analysis results can assist and generate policy rates for flood insurance, as well as delineate high-risk areas that mandate the purchase of a flood policy.

#### *The Evolution of the National Flood Insurance Program*

Costs resulting from flood losses have risen substantially within the past century due to increased development in hazardous areas and increased flood frequencies and magnitudes. The National Flood Insurance program (NFIP) is based on the idea that those in flood hazard-prone areas need to bear a substantial cost of making their communities safer and should be responsible for most of the losses if a flood disaster were to occur (Kunreuther and Roth, 1998). Additionally, research suggests that participating in self-protective behavior by those living in flood-prone urban areas can reduce monetary flood damage by 80%, and reduce the need for public risk management (Grothmann and Reusswig, 2006). The NFIP originally developed as

assistance to private insurance companies. Aggregated flood losses and the ambiguity of flood risk prohibited any profit that private insurers could make, causing an exit from the insurance market. Currently, the collaboration between private insurance companies and FEMA occurs through the Write Your Own (WYO) Program. This program is an arrangement where private insurers sell and service federally underwritten flood insurance policies under their name, but do so in compliance with the WYO Financial Control Plan (Kunreuther and Roth, 1998).

The National Flood Insurance Act of 1968 (NFIA) is the legislation that created the NFIP, which made flood insurance available to those communities that agreed to adopt and enforce floodplain management ordinances (Kunreuther and Roth, 1998). With the evolution of the NFIA over the years, various amendments have been enacted changing various aspects of the NFIP. The first amendment that occurred to the NFIA was the Flood Disaster Protection Act of 1973, which made community participation in the NFIP a condition for certain types of federal assistance. Moreover, the purchase of flood insurance became a condition for federal mortgage loans in high-risk flood areas (Kunreuther and Roth, 1998). A second amendment was the National Flood Insurance Reform Act of 1994, which strengthened the previous revisions, as well as included an added Flood Mitigation Assistance Grant Program.

A third amendment of the NFIA is the National Flood Insurance Reform Act of 2004 (FIRA04). FIRA04 provides emphasis towards mitigation efforts and the addition of geospatial data in the creation of FIRMs. This was paralleled by the addition of the Community Rating System (CRS) (Kunreuther and Roth, 1998). The CRS program enables individuals to receive subsidized insurance rates if their community has



already implemented flood-mitigating actions. Some of these actions can include public information activities, preservation of open space, or the acquisition of repetitive-loss properties. The fourth and fifth amendment explicated within this thesis will be discussed parallel to each other, as the latter was enacted in order to slow down the former.

The Biggert-Waters Flood Insurance Reform Act of 2012 (FIRA12) was an amendment that promised to eliminate all flood insurance subsidies and to impose full actuarial insurance rates (Nance, 2015). This Act was passed in order to offset the increasing risk of flooding, which is associated with an increase cost of damage from flood disasters. Parameters included within this Act include a phase-out of subsidized insurance rates for business, residences, repetitive loss properties, and grandfather properties. Also included within the FIRA12 is the stipulation that all new purchases, sales, and policy lapses must reflect full actuarial premiums immediately. Lastly, outdated maps are no longer allowed, which requires FEMA to update flood maps nationwide. As a response to the FIRA12 the Grimm-Waters Homeowner Affordability Act of 2014 (FIRA14) was enacted.

FIRA14 was enacted with a sole purpose of slowing down the effects of FIRA12. This was done with a repeal of two of FIRA12's 50 sections, the addition of subsidies, as well as the creation of surcharges rather than increased insurance premium rates. Each amendment to the NFIA has led to revisions and additions to the NFIP and its processes. One of these effected is the Flood Insurance Study process.

*Flood Insurance Studies*

Communities incur various changes over time. Water flow and drainage patterns are altered due to land use, community development, and other natural forces, such as erosion wildfire, or a changing climate (FEMA, 2015). Moreover, dam and levee infrastructure weaken over time, creating a larger risk to flood damages. As a result of these changes and NFIA mandates, A Flood Insurance Study (FIS) is conducted. An FIS is a compilation of flood risk data for specific flood hazard areas within a community (FEMA, 2011) and concerns itself with the physical aspects of a region and how this affects the physical flooding potential. Data is gathered based on historical data (e.g., river flow, storm tide, rainfall data), meteorological data, topographic data, hydrologic data, hydraulic data, open-space conditions, flood-control works, and development (FEMA, 2011). These data enable engineers to delineate the specific flood zones through water depth.

In order to make the results of an FIS spatially explicit, Flood Insurance Rate Maps and Flood Hazard Boundary Maps are created. This provides a greater connection to humans and society, or *spatial logic*. This *spatial logic* allows a local community to determine where it is necessary to mitigate flood damages and purchase flood policies.

#### *Flood Insurance Rate Maps and Flood Hazard Boundary Maps*

FEMA aims to map the flood hazard areas within the United States. These areas are either identified through a Flood Insurance Rate Map (FIRM) or a Flood Hazard Boundary Map (FEMA, 2011). Of the areas that are mapped, there are some with greater flood risk than others. These high-risk areas are then mapped as Special Flood Hazard Areas (SFHA). SFHA's are designated as 100-year regulatory floodplains, which means there is a 1 percent chance of a flood occurring per year. Other areas that are

mapped include the 500-year floodplains, which have a 0.2 percent chance of occurrence per year. However, flood insurance purchase is only mandatory for those residences and businesses located within the SFHA. In order for communities to determine which areas require flood insurance, FEMA has created the FIRM. This particular map delineates both the special hazard areas and the risk premium zones (FEMA, 2011). Zone AE designates the 100-year regulatory floodplain and Zone X designates the 500-year floodplain. Although flood insurance is mandatory in many communities, the flood insurance penetration is low in the 500-year floodplain, where flood insurance purchase is only recommended. This is based on individual risk perception and other contributing factors.

### *Risk Perception*

Choices in human adjustments to floods vary according to multiple factors. One of these factors includes risk perception. Risk perception regarding natural hazards is defined as an expectation of a future occurrence and of personal vulnerability related to a specific hazard (Kates, 1971). This concept also varies according to classes of individuals. Technical experts have different risk perceptions than those of resource managers, or the general public (Burton and Kates, 1964; Slovic, 1987). This variation often causes conflict over policy decisions at the local level. Though, two-way communication has the potential to reduce or resolve these conflicts (Slovic, 1987).

The elements relating to various risk perceptions are said to be a combination of the way in which characteristics are perceived, the nature of personal encounters with a hazard, and elements of personality (Kates, 1971). Natural hazard characteristics are perceived based on magnitude, duration, frequency, and the temporal spacing of the

event. Variation in perception due to personal encounters include how recent a hazard event occurs, its frequency, and intensity. Lastly, research suggests that internal-external locus of control due to personality is another factor affecting risk perception. Internal locus of control indicates that an individual will most likely adopt behavioral patterns that facilitate control of their environment. External locus of control indicates behavior of the opposite, due to a mindset that an individual feels powerless (Baumann and Simms, 1978). Each of these elements were said to be independent of socio-economic conditions. However, with the rise of Marxist geographies and the concept of vulnerability, contemporary research has indicated the opposite (Birkholz et al., 2014).

#### *Risk Perception and Flood Insurance Purchase in the 500-year floodplain*

Research suggests that those individuals with lower-income, who are non-white, are women, are elderly, or have had previous disaster experience fear natural hazards the greatest (Kunreuther and Roth, 1998). Though, in regards to flood insurance, this fear rarely translates into purchase within the 500-year floodplain or Zone X.

Individuals and businesses are willing to tolerate risk from activities seen as beneficial, translating into lack of preventative action (Slovic, 1987). A positively correlated factor said to effect the purchase of flood insurance most is the seriousness and likelihood of flooding occurring to an individual and business (Baumann and Simms, 1978). Two-way communication is another factor affecting risk and flood insurance purchases. Technical experts provide risk assessments to local communities that can quantify estimates of social and physical damages through the use of technologies such as Hazus-MH. However, these estimates are not brought to the residences and businesses said to incur these damages and therefore creates a disparity in risk perception levels. Future

research is needed to explore the effects of potential two-way communication regarding damage quantification and the purchase of flood insurance.

According to theory, if an individual has a high-risk perception, this should correlate into flood insurance purchase. Though, this does not always occur. Individuals and businesses located in the 500-year floodplain and are protected by flood control works, such as dams or levees are also less likely to feel the need to purchase flood insurance. This false sense of security lowers risk perception (Grothmann and Reusswig, 2006). Higher levels of income, formal education, and awareness of the NFIP are some of these factors that have shown increased purchases in flood insurance (Baumann and Simms, 1978; Webb, Tierney, Dahlhamer, 2000; Petrolia, Landry, and Coble, 2013). On the business side of flood insurance purchasing, businesses that are larger, are located within a strong economic sector, or are located within finance, real estate, and insurance sectors are more likely to purchase flood insurance (Webb, Tierney, Dahlhamer, 2000). Cultural differences and social norms have also been found to be related to the purchase of flood insurance (Kunreuther and Roth, 1998; Lo, 2013). According to this literature, more empirical research is needed to determine contradictions between theory and empirical evidence in regards to flood insurance purchasing in the 500-year floodplain.

#### *Flood Insurance in the 100-year Regulatory Floodplain and the Effects on Local Communities*

The NFIP, with its mandatory flood purchase requirements within the 100-year floodplain or Zone AE, effects communities and their residents living in and around these flood-prone landscapes. Research has shown that property values are likely to be

discounted for residential properties located within the 100-year regulatory floodplains and require the purchase of flood insurance. However, properties that are located within a flood risk area, but are not required to purchase flood insurance (e.g., 500-year floodplain) do not show a discount in property values (Shultz and Fridgen, 2001; Chivers and Flores, 2002; Posey and Rogers, 2010). A study done by Posey and Rogers (2010) using the Hedonic Valuation Method indicates that being located within the 100-year riverine floodplain reduces the value of a property by about 8.6 percent, including both direct and indirect effects. This value reduction is further exacerbated if a community has experienced a recent flood event (Bin and Polasky, 2004; Bin, Kruse, and Landry, 2008; Posey and Rogers, 2010). To date, literature has explicated the effects of flood insurance purchase requirements through quantitative studies and have focused primarily on residential properties, rather than commercial properties. These studies have also focused largely on coastal floodplains, with few studies dedicated to riverine floodplains. Moreover, there is little to no research using qualitative methods and exploring the effects of flood insurance beyond those related to property values.

#### *100-year Regulatory floodplain Revisions and the Effects on Local Communities*

Various amendments to the National Insurance Act (NFIA) and resulting FISs have contributed to revisions of 100-year regulatory floodplain boundaries within communities. Legal requirements for residents in updated flood zones have been well-documented. According to FEMA, the legal requirements for flood insurance purchase after a FIRM revision states that moving from a low-risk or moderate-risk zone to a high-risk zone requires the mandatory purchase of flood insurance and moving from a high-risk zone to a low-risk or moderate-risk zone makes the purchase of flood optional

and recommended. However, the effects of floodplain revisions on communities go beyond legal stipulations.

In a study done by Nance (2015) potential effects of map revisions are explored as a result of recent amendments to the NFIA and a national flood risk paradigm shift. Results from their research suggest that the FIRA12 and FIRA14 will greatly impact low-income households and minorities. Furthermore, their research explicates the reoccurring notion that flood insurance may possibly reduce property values. This is said to present the possibility of population displacement, increased mitigation activities, migration, and a shift of rental versus owned properties (Nance, 2015). However, that research was purely quantitative and does not present a specific case study where a floodplain revision is actually occurring. To date there is no known literature exploring the effects of a 100-year floodplain revision occurrence. Moreover, there has been little to no research discussing the possible adjustments a community can make in order to cope with these revisions. The research goals and questions in the following section aim to explore the abovementioned concepts and gaps within the literature.

### **1.3. Research Questions**

#### *Research Goals and Questions*

Communities most at-risk to major flood events are recommended to participate in the National Flood Insurance Program (NFIP) put forth by the Federal Emergency Management Agency (FEMA). In order to receive the ability to purchase flood insurance, the community must enact and enforce floodplain regulations. The goal of

this program is to ensure that residents living within the floodplain bear a substantial cost of making their communities safer. Furthermore, purchasing flood insurance is considered to be a self-protective behavior, which can reduce monetary flood damage by 80%. Flood insurance purchase is mandatory within the 100-year floodplain and these stipulations have a great impact on the local community.

The goal of this research is to determine how a modification in the 100-year regulatory floodplain affects a community as a whole, its residents, and its various economic sectors, and what future adjustments may arise from these revisions. This research will develop a framework that uses joined InfoUSA and Implan economic data in order to determine specific businesses and their economic sectors most impacted by a 100-year floodplain modification. This research will also employ a flood model analysis that shows residential economic losses from a 100-year flood event on. The quantitative methods of this research will be supplemented by local stakeholder interviews to explore the perceived impacts from the floodplain modifications. The research questions provided below will aim to achieve these goals:

1. What revisions were made to the 100-year regulatory floodplain within Ada County?
2. Which economic industries, businesses, and residences are exposed to the new revised 100-year floodplain?
3. What are the impacts of this revision on the community?
4. What potential adjustments can be made at the micro- and meso- level in order to adapt to and/or mitigate the negative impacts of these floodplain revisions and help increase community resiliency?



In order to address the abovementioned research questions, a case study of Ada County, Idaho will be employed.

## 2. STUDY AREA: ADA COUNTY, IDAHO

### 2.1. Introduction

Ada County is a participant in the NFIP and within its borders are six other participating communities: Boise City, Garden City, Eagle City, Kuna City, Meridian City, and Star City. This research focuses on Boise city, Garden City, Eagle due to their close proximity to the Boise Foothills and Lower Boise River and differing socio-economic statuses. The term community used in this study is the definition provided by FEMA for specific NFIP purposes. The definition states that a community is “any state, area, or political subdivision, any Indian tribe, authorized tribal organization, or Alaska native village; or authorized native organization that has the authority to adopt and enforce floodplain management ordinances for the area under its jurisdictions” (FEMA, 2011). The study area for this research was selected based on voluntary participation in the NFIP and due to recent updates in their FIRMs, also known as the 100-year regulatory floodplain. Moreover, this study area was also chosen based on joint research being performed on the Lower Boise Watershed Risk Report Project put forth by FEMA and the University of Idaho. The goal of this research is to explore the effects of a revised regulatory floodplain on a community as a whole; therefore it is pertinent to understand its various characteristics, including both current and future projections. Exploring these characteristics help provide local context and *genres de vie* for this research. *Genres de vie*, or ways of life, describes unified and identifiable patterns of living. This includes all idea, behaviors, and things that may be associated with culture (Cresswell, 2013; Johnston and Sidaway, 2004). The first section within this chapter

will explore the environment of Ada County, including its geology and natural resources, followed by its population and demographics in the second section. The third section will consist of exploring the economy of Ada County followed by the county's future land use projections in the fourth section. The fifth section will consist of the current real estate market and development trends. The sixth section of this chapter will consist of all characteristics related to natural hazards, more specifically flooding.

## **2.2. Study Area**

### **2.2.1. Geography, Geology, and Natural Resources**

#### *Ada County*

Ada County is located in the southwest portion of the State of Idaho and consists of 678,245 acres of land. It is bordered by five other counties, including Canyon, Boise, Elmore, Gem and Owyhee Counties. Ada County is located in what is called the Treasure Valley, which includes various geographical landscapes and natural resources. These include: mountains, prairies, buttes, canyons, and rivers (Ada County, 2007). The Treasure Valley has an elevation range from 2,400 feet at Halverson Lake to 4,463 feet at Aldape Summit. With Ada County there are three geologic sub-regions according to the Ada County Comprehensive Plan (2007). Those include:

- The Boise Front, a mountainous terrain region in the northeastern section of the county including Bogus Basin, which is characterized by steep slopes and high elevations

- The Boise Foothills, a region incorporating Boise, Eagle, and Garden City, which is characterized by relatively moderate slope grades and that incur water flow from Bogus Basin down into the Boise River
- The Lower Boise River Basin, a set a flat lowlands that covers the majority of the Treasure Valley

Ada County is considered to be part of the Lower Boise Watershed, which encompasses the main stem of the Boise River and its tributaries from the Lucky Peak Dam to the confluence with the Snake River near Parma (FEMA, 2011). The Lower Boise Watershed encompasses approximately 1,338 square miles and is a portion of the larger Boise River basin, which encompasses approximately 4,100 square miles and begins in the Sawtooth Mountains and ends in the high western desert of Idaho (FEMA, 2011). The main waterway that lies within the Lower Boise Watershed is the Boise River, which stretches from The Snake River to Lucky Peak dam at approximately 63 miles and Ada County encompasses the upper portion of the Boise River. These water resources, especially those of the Boise River, are a vital part to Ada County's quality of life, identity, and economy, as they provide ample recreational opportunities, wildlife habitat, irrigation water, and drinking water for its citizens and visitors. Figure 2.1 and Figure 2.2 shows the geographical extent of the study area for this research.

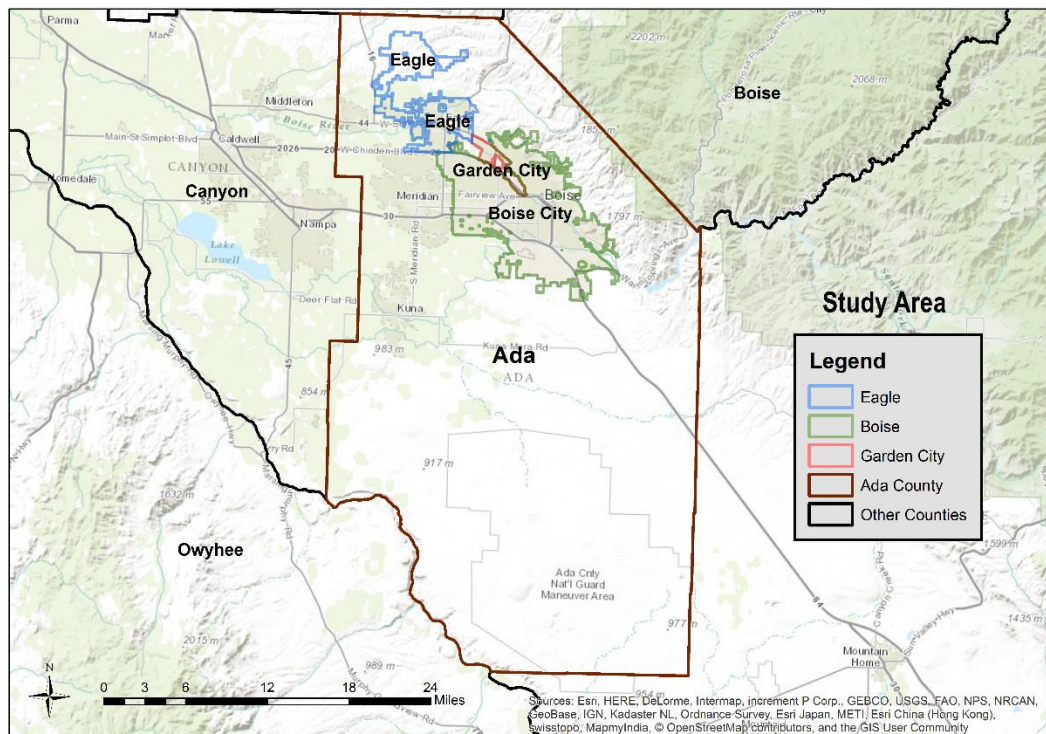


Figure 2.1 Geographical Extent of Ada County, Idaho Data Source: Esri, 2015

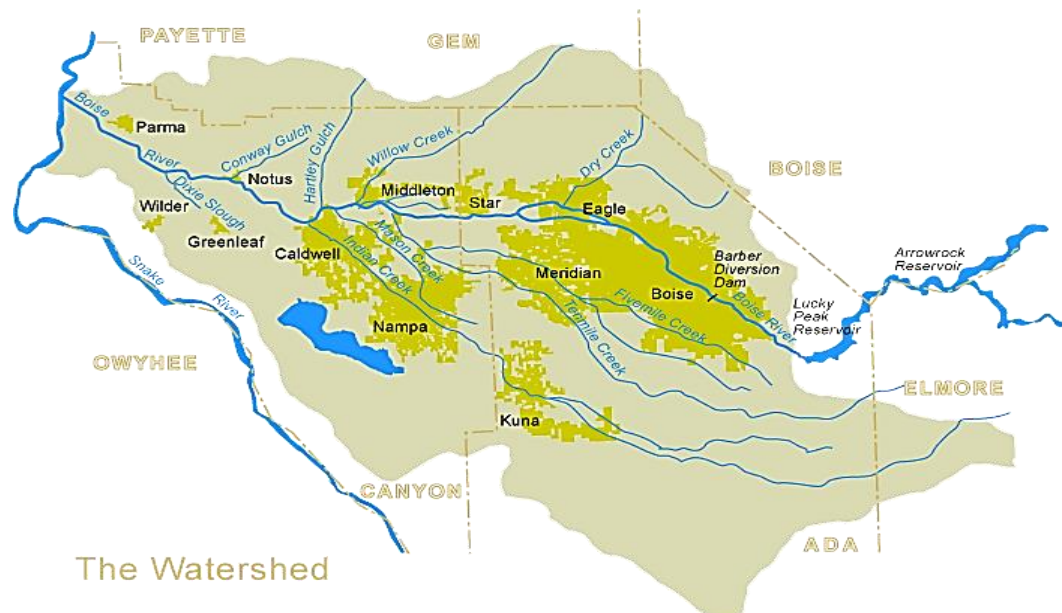


Figure 2.2 Lower Boise Watershed Data Source: Lower Boise Watershed Council, 2015

## 2.2.2. Population and Demographics

### *Ada County*

#### *Population*

According to Ada County's Comprehensive Plan (2007), its population has grown a substantial amount in recent years. Between the years 1990 and 2000, the population increased by approximately 50% with a growth rate of 3.9%, which at that time accounted for nearly one-third of the statewide total. Ada County is the most urban county in all of Idaho State, with Boise City as its largest city. Although Boise City accounts for the highest population in the county, other surrounding cities are growing at a more rapid pace. Eagle City and Garden City, along with Meridian City, Kuna City, and Star City accounted for over half of the county's population growth at 53% between 2000 and 2006, whereas Boise City's population since then has slowed considerably (Ada County, 2007). Table 2.1 shows the population estimates in Ada County, Boise City, Eagle City, and Garden City from 2010 to 2014.

**Table 2.1 Population Characteristics**

Geography	1-Apr-10		Population Estimate (as of July 1)				
	Census	Estimates Base	2010	2011	2012	2013	2014
Ada County, Idaho	392,365	392,365	393,412	401,100	408,891	416,556	426,236
Boise City, Idaho	205,671	206,105	206,333	209,280	212,244	214,234	216,282
Eagle City, Idaho	19,908	19,921	19,950	20,432	21,009	21,651	22,502
Garden City, Idaho	10,972	10,977	10,980	11,112	11,234	11,304	11,420

Source: U.S. Census Bureau 2014

According to population projections for Ada County, the estimated population is approximately 517,000 people by the year 2025 and over 560,000 people by 2030, with

an annual growth rate of nearly 2% (Ada County, 2007). Table 2.2 summarizes the projected populations for years 2000 through 2030 for Ada County.

**Table 2.2 Projected Populations**

<b>Year</b>	<b>Projected Population</b>	<b>Five Year Increase</b>	<b>Percent Increase</b>	<b>Average Annual Growth Rate</b>
<b>2000</b>	<b>300,904</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>2005</b>	<b>347,825</b>	<b>46,921</b>	<b>16%</b>	<b>2.94%</b>
<b>2010</b>	<b>384,547</b>	<b>36,722</b>	<b>11%</b>	<b>2.03%</b>
<b>2015</b>	<b>426,174</b>	<b>41,627</b>	<b>11%</b>	<b>2.08%</b>
<b>2020</b>	<b>469,011</b>	<b>42,837</b>	<b>10%</b>	<b>1.93%</b>
<b>2025</b>	<b>516,773</b>	<b>47,762</b>	<b>10%</b>	<b>1.96%</b>
<b>2030</b>	<b>561,150</b>	<b>44,377</b>	<b>9%</b>	<b>1.66%</b>

Source: Ada County Comprehensive Plan, 2007

### *Demographics*

There were approximately 113, 408 households in Ada County in the year 2000 with an average size of 2.59 individual household size (Ada County, 2007). Table 2.3 shows the age distribution for these households, as well their racial make-up in Table 2.4. These characteristics are crucial towards understanding and identifying local vulnerable populations. Society is already vulnerable due to historical development patterns, yet poor or oppressed populations become even more vulnerable due to socio-economic conditions and a lack of adaptive capacity, or ability to cope.

**Table 2.3 Age Distribution**

<b>Age Group</b>	<b>Ada County</b>	<b>Boise</b>	<b>Eagle</b>	<b>Garden City</b>	<b>Kuna</b>	<b>Meridian</b>	<b>Star</b>
<b>Under 5</b>	23,042	13,116	925	795	667	3,973	227
<b>5 to 19</b>	67,661	39,882	2,923	2,100	1,468	8,493	406
<b>20 to 29</b>	46,080	31,534	911	1,586	1,041	4,940	328
<b>30 to 39</b>	49,132	29,358	1,808	1,567	1,009	7,076	333
<b>40 to 49</b>	47,417	28,924	2,040	1,638	583	4,649	225
<b>50 to 59</b>	31,318	19,074	1,271	1,191	307	2,716	127
<b>60 to 69</b>	16,251	9,858	626	782	146	1,501	76
<b>70 to 79</b>	12,427	8,431	396	626	101	1,041	42
<b>80 and above</b>	7,576	5,670	185	339	60	530	31

Source: Ada County Comprehensive Plan, 2007

**Table 2.4 Racial/Ethnic Projections**

<b>Race Ethnicity</b>	<b>2000 Population</b>	<b>Percent of Total</b>
<b>White</b>	279,427	93%
<b>African American</b>	1,942	1%
<b>American Indian/Alaskan Native</b>	2,085	1%
<b>Asian</b>	5,223	2%
<b>Native Hawaiian/Pacific Islander</b>	448	0%
<b>Another Race</b>	5,025	2%
<b>Two or More Races</b>	6,754	2%
<b>Total</b>	300,904	100%
<b>Hispanic (All Races)</b>	13,467	4%

Source: Ada County Comprehensive Plan, 2007

Another pertinent factor contributing to vulnerable populations is income. Within Ada County, median incomes are higher than the statewide average, especially in the cities of Eagle and Meridian. Eagle City consists has a median income of \$65,313, whereas Meridian City has a median income of \$53,276. On the other end of the range, Garden City has the lowest median income at \$38,520 (Ada County, 2007). Table 2.5 shows the median household incomes within Ada County and incorporated



communities, which also shows poverty rate disparities between Hispanic residents compared to all residents in the county. This poverty rate is more than double for the Hispanic populations in the county (Ada County, 2007).

**Table 2.5 Income and Poverty Statistics**

<b>Jurisdiction</b>	<b>Median Household Income</b>	<b>Poverty Rate - All Residents</b>	<b>Poverty Rate - Hispanic Residents</b>
<b>Ada County</b>	\$46,140	8%	17%
<b>Boise</b>	\$42,432	8%	16%
<b>Eagle</b>	\$65,313	4%	6%
<b>Garden City</b>	\$38,520	13%	30%
<b>Kuna</b>	\$40,617	14%	28%
<b>Meridian</b>	\$53,276	6%	11%
<b>Star</b>	\$42,337	9%	25%
<b>State of Idaho</b>	\$37,572	12%	24%

Source: Ada County Comprehensive Plan, 2007

### **2.2.3. Economy**

#### *Ada County*

A crucial aspect of this research is an analysis identifying the economic sectors within Ada County and determining which percentage of those sectors are located within the former and updated floodplains. Therefore, this section will only present Ada County's future economic development goals, rather than current conditions, in order for opportunity to connect the results of this research to the County's goals in the discussion section of this thesis.

In the latest update of the Ada County Comprehensive Plan, two main issues were identified for the community: a strong economy and an agricultural sector. As the

area continues to attract business and jobs, maintaining a robust economy is crucial for Ada County as it contributes to the quality of life of its residents. Moreover, due to growth in urban development, land for large scale agricultural operations is becoming scarce. Therefore, it is pertinent to maintain small-scale operations in order to provide for local products and opportunities (Ada County, 2007). Ada County has developed various policy actions in order to address these issues while striving towards an overall goal to “increase the economic diversity, employment base and tax base of the County to improve employment opportunities for its residents” (Ada County, 2007). Those policies are as follows:

- Facilitate the expansion and diversification of existing and new businesses and industries that:
  - Are environmentally sustainable.
  - Will maintain and/or improve the County’s fiscal stability.
  - Increase the County’s tax base and employment.
- Designate sufficient land to meet the County’s current and projected future commercial and industrial needs. Locate and zone such land consistent with land use policies.
- Encourage consolidation of small parcels of industrial and commercial property to facilitate their use or reuse for efficient, infill projects.
- Encourage existing, new and expanding industries and businesses to hire from the local labor force and to provide job training programs.

- Encourage the location of industries and businesses in areas that are served by existing or planned public facilities, including water, sewer and transportation, and that have access to public transit.
- Encourage the development of mixed use centers which can incorporate smaller commercial uses and provide employment within walking or short commute distances from residential areas.
- Coordinate County economic development efforts with those of chambers of commerce, other business groups and agencies.

#### **2.2.4. Land Use**

##### *Ada County*

The major land use categories within Ada County include:

- Residential
- Commercial, Office, and Retail
- Industrial
- Public/Quasi-Public facilities
- Parks, Recreation, and Open Space
- Agriculture
- Mineral
- Common Areas
- Other (including Rangeland, Forest Land, Birds of Prey National Conservation Area, National Guard Firing Range, and other Multi-Use Public Lands)

Table 2.6 shows these land uses in a total land-use inventory for Ada County.

**Table 2.6 Comparative Land Use Inventory**

<b>Land Use Category</b>	<b>Acres</b>	<b>Percent</b>
<b>Residential</b>	<b>36,870.96</b>	<b>6.2%</b>
<b>Commercial, Office and Retail</b>	<b>1,139.46</b>	<b>0.2%</b>
<b>Industrial</b>	<b>989.29</b>	<b>0.2%</b>
<b>Agriculture</b>	<b>242,024.29</b>	<b>40.9%</b>
<b>Mineral</b>	<b>80.79</b>	<b>0.01%</b>
<b>Public/Quasi Public</b>	<b>42,265.92</b>	<b>7.1%</b>
<b>Common Areas</b>	<b>1,067.28</b>	<b>0.2%</b>
<b>Recreation</b>	<b>1,228.36</b>	<b>0.2%</b>
<b>Other</b>	<b>265,621.84</b>	<b>44.9%</b>
<b>TOTALS</b>	<b>591,288.18</b>	<b>100.0%</b>

Source: Ada County Comprehensive Plan, 2007

Land within Ada County is owned by various entities. There is a mix of public ownership, as well as private. Approximately 48% of land in the county is owned privately by individuals and companies, most of which is located within the Area of City Impact or within incorporated cities. Approximately 1.5% of Ada County is owned by its incorporated cities and is most often used for public facilities. Ada County itself owns about 0.6% of the land, using the 3,903 acres for park and recreation facilities. Local service providers own less than 1% of the total land and mostly consist of water, sewer, irrigation, fire, school, and other special districts. State and federal governments both have a large presence in land ownership in the county. The State Government owns approximately 7.1% of land, with most of it going towards wildlife habitat and resource protection. The Federal Government owns approximately 43.2% of land within Ada

County and is mostly used for grazing, recreational, and other public uses (Ada County, 2007).

Land use within Ada County and within the 100-year floodplain has the largest amount of land dedicated to agricultural uses. However, the 100-year floodplain is primarily located within the urban areas of the county; therefore a large amount of land is dedicated to residential and commercial uses (18.47%) whereas only making up 0.2% of overall Ada County land. Table 2.7 shows the land use inventory within the 100-year floodplain.

**Table 2.7 Comparative Land Use Inventory (Floodplains)**

Land Use	100-Year Floodplain		500-Year Floodplain	
	Area (acres)	% of total	Area (acres)	% of total
<b>Agriculture</b>	3543.34	14.84%	4327.81	14.16%
<b>Agriculture Prime Farmland</b>	3542.34	14.83%	3787.70	12.40%
<b>Commercial Retail and Office</b>	790.87	3.31%	1756.29	5.75%
<b>Industrial</b>	113.13	0.47%	115.12	0.38%
<b>Open Space</b>	2507.99	10.50%	2855.93	9.35%
<b>Other</b>	2989.16	12.52%	3558.92	11.65%
<b>Public Government</b>	6470.65	27.09%	6971.64	22.82%
<b>Residential</b>	3620.40	15.16%	6395.18	20.93%
<b>Residential TOD Density</b>	269.48	1.13%	504.98	1.65%
<b>Schools</b>	36.62	0.15%	290.98	0.92%
<b>Total</b>	23884.07	100%	30564.55	100%

Source: Ada County All Hazard Mitigation Plan, 2011

## 2.2.5. Real Estate and Development Trends

### *Ada County*

Various aspects of this research pertain to the real estate market and new construction within the 100-year regulatory floodplain. Therefore, it is pertinent to discern the current trends of each within Ada County.

Currently, the housing market within the Ada County is strong. This market is especially strong for houses priced above \$300,000, which has year over year continued to increase in closed sales. The inventory for these higher priced homes continues to grow as well, which then has year over year increased the median sales price in Ada County. For homes that are below this \$300,000 price point, the housing market is not as strong. The inventory for homes below \$250,000 has decreased significantly year over year, which has proceeded to lead to a decrease in closed sales for these homes. This reduction of housing inventory is especially affecting first time home buyers and move-up buyers, which is creating a standstill for homes priced below \$250,000 (Vanstrom, 2015). First time home buyers are showing signs of delayed housing searches, causing move-up buyers to stay in their homes longer than they had planned. Table 2.8 shows a summary of the housing market in Ada County for each price point.

According to Build Idaho (2015), the number of building permits has increased 22.5% since 2014 within Ada County, with the number increasing from 1885 to 2377. As a result of this increase in development, residential housing prices have also increased. Figure 2.3 shows the building permit review for the last 4 years. Figure 2.4 shows this building activity in relation to the overall real estate market.

Table 2.8 Ada County Real Estate Market

Price Points	Inventory			Closed Sales		
	Sep-15	YOY % Chg	Share	Sep-15	YOY % Chg	Share
\$119,999 or less	24	-42.9%	1.0%	20	-35.5%	2.4%
\$120,000 - \$159,999	148	-54.5%	6.1%	114	-19.7%	13.8%
\$160,000 - \$199,999	420	-27.2%	17.4%	184	11.5%	22.3%
\$200,000 - \$249,000	412	-20.2%	17.1%	151	18.9%	18.3%
\$250,000 - \$299,999	409	650.0%	17.0%	123	44.7%	14.9%
\$300,000 - \$399,999	484	-4.5%	20.1%	136	86.3%	16.5%
\$400,000 - \$499,999	215	1.9%	8.9%	57	50.0%	6.9%
\$500,000 - \$699,999	172	3.0%	7.1%	30	87.5%	3.6%
\$700,000 - \$999,999	81	-3.6%	3.4%	9	-	1.1%
\$1,000,000 or more	45	2.3%	1.9%	-	-	-

Source: Vanstrom, 2015

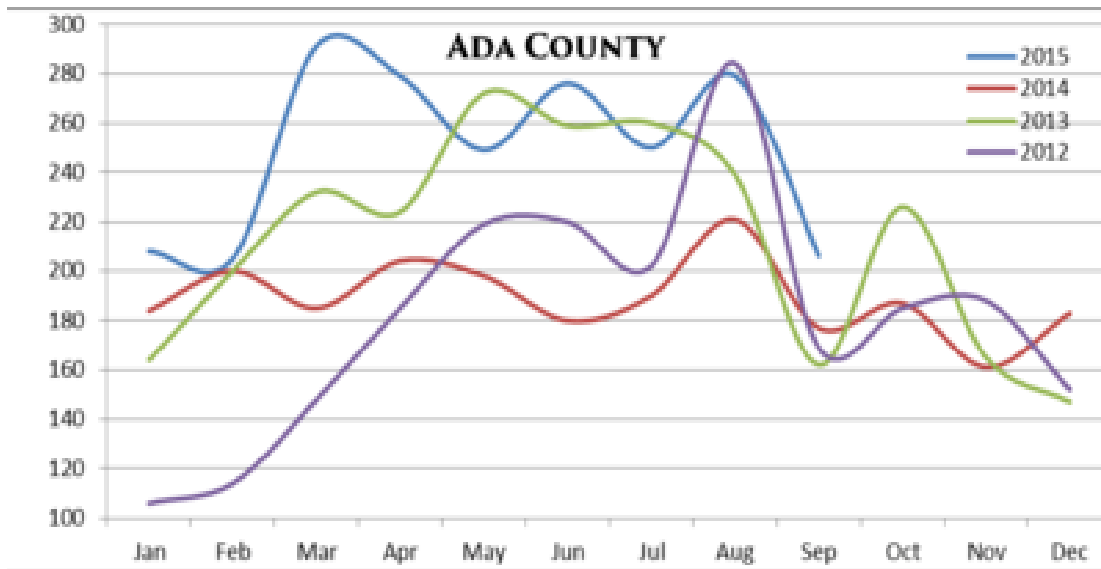
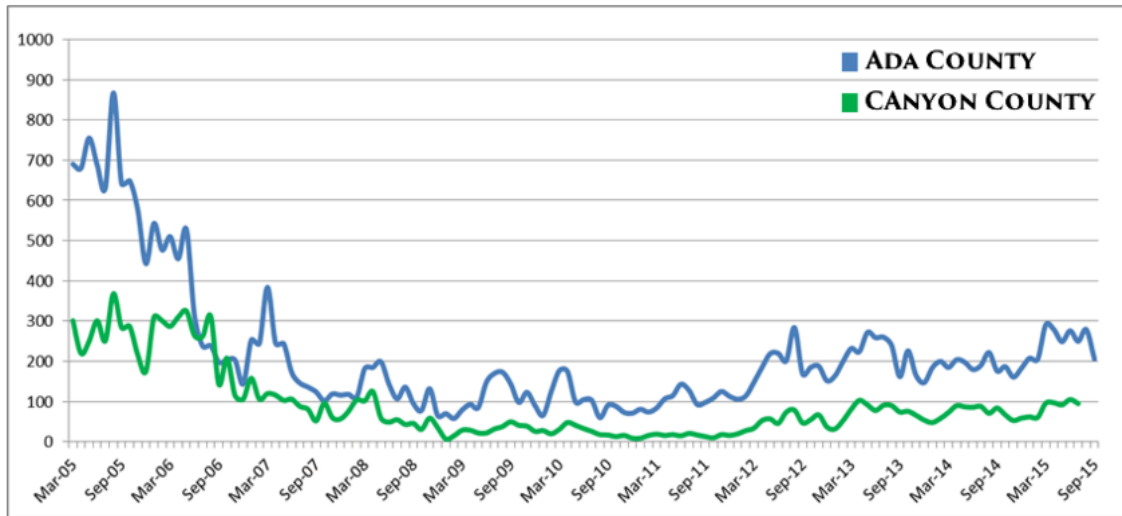


Figure 2.3 Building Permit Review

Source: Build Idaho, 2015



**Figure 2.4 Building Activity and Real Estate Market**

Source: Build Idaho, 2015

## 2.2.6. Hazard Profile: Floods

### *Ada County*

#### *Flood Events and Sources*

Floods are defined by Ada County as “the inundation of normally dry land resulting from the rising and overflowing of a body of water” (Ada County, 2011). Related to this definition of flooding is the notion of a floodplain. A floodplain is the area that lies adjacent to a body of water, such as river, which gets inundated by flood waters. This research particularly concerns itself with the 100-year floodplain, which is the regulatory floodplain that determines the Flood Insurance Rate Maps (FIRMs) according to FEMA. A 100-year floodplain is an area flooded by an event that has a 1 percent chance of occurring in a given year, although it may occur more than once in a shorter period of time.



Within Ada County there are several sources of flooding that contribute to the delineation and extent of this floodplain, including: the Boise River, Snake River, tributaries, canals, and urban flooding. Flooding can also occur due to dam and levee failure; however exploring this source of flooding goes beyond the scope of this research.

### *Flood History*

Various flood events have occurred within Ada County between the years 1955 and 2008, and are most prevalent along the Boise River and the Boise Foothills streams, with the largest recorded flood event ever recorded occurred on June 14, 1896 with a peak flow estimated around 35,500 cfs (Ada County, 2011). Figures 2.5 show all flood events occurring between 1955 and 2008 within the county (Ada County, 2011).

Date	Declaration #	Type of event
5/20/2008	N/A	<b>Flooding-Boise River</b> <i>High flows on the Boise Rivers forced Boise Parks &amp; Recreation to close three sections of the Greenbelt. The walking-only pedestrian area is under water from the Cottonwoods Apartments past River Run in southeast Boise. Two other areas are also closed down: Broadway Avenue tunnel on the north side of the river and Loggers Creek footbridge from Leadville Avenue east to the Park Center Bridge.</i>
5/6/2006	N/A	<b>Flooding-Kuna-Mora canal</b> <i>A breach in the Kuna-Mora Canal flooded parts of a south Kuna subdivision and came close to compromising a sewage pump about 2.5 miles away. Thirty to forty homeowners reported flooding. The canal broke about one quarter south of King Road. It started as a six foot breach and quickly became a 40 foot breach.</i>
5/25/2006	N/A	<b>Flooding-Boise River</b> <i>High water levels along the Boise River created a breach in the riverbank near Eagle Island. About 8- 10 homes along Artesian and Trout Roads were affected. The State of Idaho repaired the breach. For the affected residents Ada County provided sandbags, portable toilets, sump pumps and diesel for tractors.</i>
5/11/2006	N/A	<b>Flooding –Boise River</b> <i>High flows on the Boise River eroded a bridge near Garden City and nearly caused it to collapse into the river.</i>
4/5/2006	N/A	<b>Flooding-Tributaries</b> <i>Flooding along Five mile Creek and Lake Patricia flooded two homes and threatened several others as well as a small, private dam, southeast of Boise. Ada County inmate crews assisted in sandbagging.</i>
7/7/2004	N/A	<b>Urban Flooding</b> <i>The Idaho State Capital building was inundated by a flash flood. The flood occurred in the basement, displacing about 20 workers. Repairs are estimated to be between \$70,000 and \$100,000.</i>
3/7/1999	N/A	<b>Flooding-Boise River</b> <i>High water levels released from Lucky Peak Reservoir caused flooding in low lying areas. Segments of the Greenbelt were closed and areas in southeast Boise near Logger's Creek and Cottonwood Apartments were flooded. Also a 200' section of riverbank near Eagle's Starwood subdivision collapsed.</i>
May/June 1998	N/A	<b>Flooding-Boise/Snake</b> <i>Two weeks of rain fell on a melting snowpack caused flooding along the Snake, Weiser, Payette and Boise Rivers for the second year in a row. A levee break near Eagle Island caused flooding of nearby homes.</i>
9/11/1997	N/A	<b>Flash Flooding</b> <i>Flash flooding from thunderstorms caused damage in the Boise Foothills. Cloudburst dropped 0.40" of rain in 9 minutes on the Foothills area burned by the 1996 Eighth Street Fire, flooding homes, Highlands Elementary School, and streets in the Crane Creek and Hulls Gulch areas. Floodwaters were contained in several holding ponds. 15 people were evacuated and sheltered at Les Bois Junior High.</i>
March/July 1997	DR 1177	<b>Riverine Flooding</b> <i>Rapid melt of a record snowmelt led to flooded rivers throughout southern Idaho. The Snake River Basin received significant snowfall during the winter of 1996-97, and in higher elevations the snow pack exceeded 250 percent of normal, causing above normal runoff during the spring melt.</i>
1/1/1997	DR1154	<b>Riverine Flooding</b> <i>Warm temperatures combined with a rainfall 4-6 times normal caused snowmelt triggering floods, mudslides and avalanches in the Weiser, Payette and Salmon River drainages, damaging communities and infrastructure throughout Idaho. Increased flows in the Boise River to make room in reservoirs flooded homes and businesses along Eagle Island. A dike near South Eagle Road broke, flooding a road and surrounding fields. Parts of the Greenbelt along the Boise River were closed.</i>

**Figure 2.5 History of Flood Events**

Source: Ada County All Hazard Mitigation Plan, 2011

Date	Declaration #	Type of event
May 1993	N/A	Flooding-Boise River <i>Boise River floodwaters soaked 10 Eagle homes, 1 woman drowned.</i>
February 1986	N/A	Flooding-Tributaries <i>Melting snow flooded North Boise from creeks in the Foothills. Streets in downtown Boise were closed to form a temporary diversion canal to channel water from Cottonwood Creek to the Boise River. The canal carried an est. 800,000 gallons of water an hour</i>
June 1983	N/A	Flooding-Boise River <i>Snowmelt caused by high temperatures led to the raising of the Boise River to a peak runoff of 24,294 cfs. Flooding damaged the Greenbelt and river banks along Barber Park, Parkcenter, Garden City and Eagle Island. Homes along the river were flooded, and residents of Eagle Island used boats to travel. Cottonwood trees fell into the river, causing damming and further flooding. Municipal Park lost a chunk of land 300' long and 55' deep.</i>
February 1982	N/A	Flooding-Tributaries <i>Mudslides closed Hwy 55 three times in one month; erosion from floodwaters caused damage to numerous streets in the Foothills.</i>
1/5/1979	N/A	Flooding-Tributaries <i>In Boise, rain and melting snow caused flooding in North and West Boise from Foothills creeks. Over a dozen homes in the Highlands near Crane Creek were hardest hit, flooding basements, yards and streets despite sandbagging efforts. Flooding was also seen along Polecat Gulch, Stewart Gulch and Cottonwood Creek north of Boise, and Three mile, Five mile, Eight mile and Ten mile Creeks south of the airport, flooding homes, businesses and farmlands. Eckert Road bridge was closed.</i>
5/26/1973	N/A	Flooding-Canal <i>A 30' wide break in the Ridenbaugh Canal flooded the Triangle Dairy and 15 houses in SE Boise with muddy, waist-deep water. The affected area was between Broadway/Linden/Leadville</i>
1/17/1971	N/A	Urban Flooding <i>Heavy rain and snow over four days caused flooding in southwest Idaho. Basements, yards and low-lying roads were flooded. In Orchard, 3 of 30 homes were evacuated by rowboat. Floodwaters covered approximately 160 acres in the town.</i>
1/22/1969	N/A	Flooding-tributaries <i>Crane Creek, Cottonwood Creek, and other drainages in the Foothills flooded, with the Cottonwood Creek flow being measured at 30 percent above normal. The Boise River reached 3,643 cfs, three times normal. Flooding was mostly confined to roads and yards in North Boise.</i>
5/22/1965	N/A	Flooding-Boise River <i>300 acres of farmland and several houses near Eagle Island were flooded by the Boise River when a levee broke.</i>
1/29/1965	N/A	Flooding-Tributaries <i>Flooding from Cottonwood and Dry Creeks, Crane, Stuart and Hulls Gulch. Damage mostly was for repair to bridges and cleanup.</i>
12/21/1964	N/A	Riverine Flooding <i>Warm weather combined with heavy rains and melting snow caused flooding along the Payette, Big Wood, Little Wood, Portneuf, Clearwater and Boise River drainages. Hwy 21 and 15, US 95N and 30E were closed. Over 100 homes were damaged, numerous bridges were washed out, and thousands of acres of farmlands were flooded. Two deaths were attributed to the flood. A state of emergency was declared. Boise was isolated as surrounding roads and highways were closed, train and bus service cut off.</i>

**Figure 2.5 History of Flood Events (continued)**

Source: Ada County All Hazard Mitigation Plan, 2011

TABLE 13-2. ADA COUNTY FLOOD EVENTS		
Date	Declaration #	Type of event
2/1/1963	N/A	<b>Flooding</b> <i>In Ada County, Meridian streets and homes were flooded, farmland along Hwy 20-26 flooded. Canals in the area were running 3' above normal. Several highways were closed, bridges were washed away, and homes had basements and yards.</i>
9/22/1959	N/A	<b>Flash Flooding</b> <i>East Boise suffered two more floods caused when heavy storms caused flooding along Cottonwood Creek and other Foothill drainages. This flood brought more water and less mud than the August 20 flood. The force of the water broke dikes across from the Armory on Reserve Street. Hwy 21 was closed because of debris flows. The area affected was mainly in the North End, from Fourth to Eighth Streets and Thatcher to Resseguie; also from Reserve Street to MK Plaza to Eighth Street. After these floods, several local and federal agencies cooperated in the "Boise Front Watershed Restoration Project" involving contour trenching, furrowing, seeding with trees and grasses and building protective fences, at a cost of approx. \$165,000.</i>
8/20/1959	N/A	<b>Cloudburst Floods</b> <i>Called "The Cloudburst Floods" or "The Big Mud Bath of 1959," this event was caused by severe thunderstorms in the NE Boise Foothills. Estimated to be a 50- to 100-year rainfall event, 0.30" of rain fell in 5 minutes at Deer Point. Peak flow on Cottonwood Creek est. at 3,000 cfs, floodwaters was carried by other Foothills creeks draining Shaw Mountain and Aldape Summit. Also a factor in the flooding and mudslides were the earlier Lucky Peak fires, which had denuded the Foothills of vegetation. Debris flows over 10" deep filled basements and yards in north and east Boise. Floodwaters were diverted along Broadway Avenue to the Boise River. Approximately 500 houses were damaged by mud up to 10" deep; over 160 acres were covered by silt and debris flows. Hardest hit areas were Reserve Street, East Jefferson, East State, Krall and East Bannock, and Avenues D and E and Warm Springs Avenue. The agriculture area between Lucky Peak Dam and East Boise suffered extensive property, crop and livestock losses. The Boise police clubhouse on Mountain Cove road was destroyed, and the Idaho National Guard headquarters on Reserve Street was inundated, breaking out the windows, filling the basement with several feet of water, and destroying equipment and records.</i>
1/12/1958	N/A	<b>Flash Flooding</b> <i>A rainstorm that dumped over 2" of rain in Boise in a 12 hour period caused extensive flooding and heavy crop damage. Homes, roads and storm basins were flooded, several families were evacuated. The Boise Bench was hit hardest, with one family on Atlantic Street evacuated when their house was flooded with over a foot of water.</i>
2/25/1957	N/A	<b>Flooding-tributaries</b> <i>Parts of Eagle flooded by Dry Creek.</i>
8/1/1955	n/a	<b>Flooding-Canals</b> <i>200' section of the New York Canal broke 7 miles SE of Boise and flooded 200-300 acres of farmland with water, mud and rock. A dozen homes near the break were flooded with 3' of water and families were evacuated.</i>

**Figure 2.5 History of Flood Events (continued)**

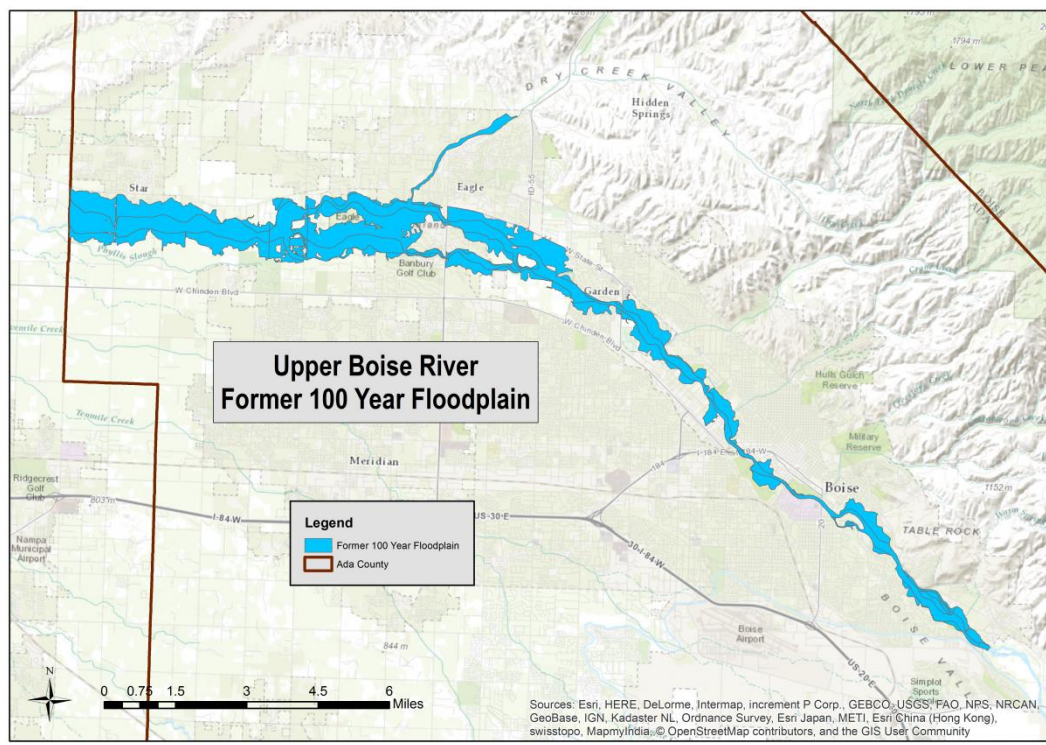
Source: Ada County All Hazard Mitigation Plan, 2011

### *National Flood Insurance Program and the Community Rating System*

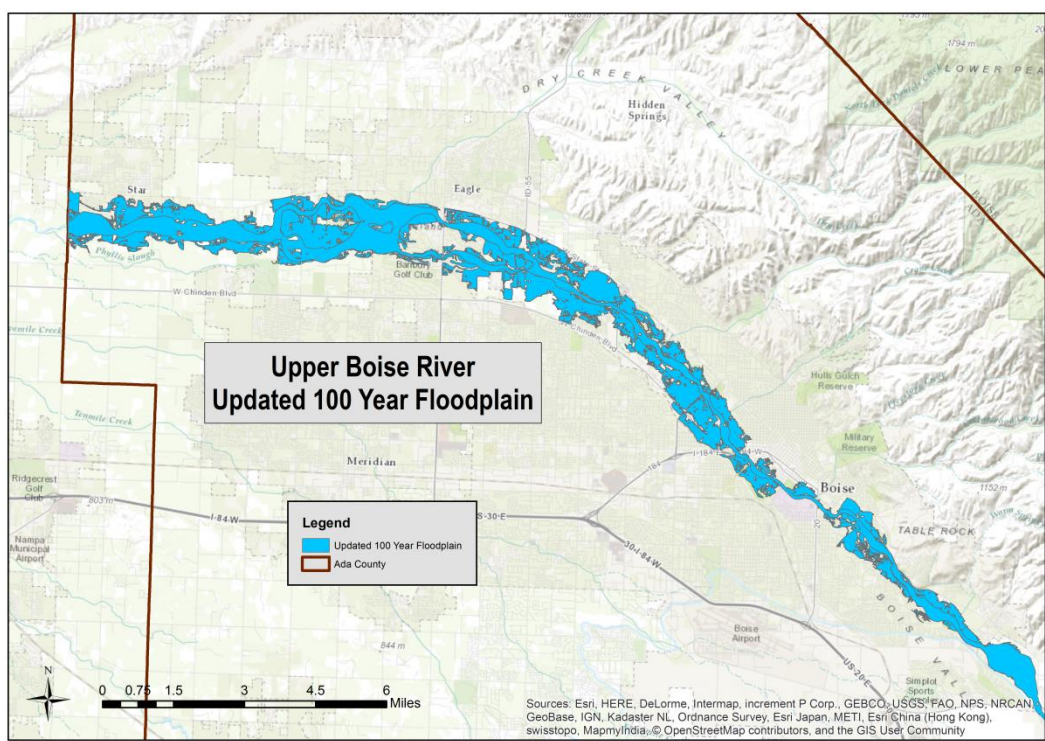
Ada County started participating in the National Flood Insurance Program (NFIP) on December 18<sup>th</sup>, 1984 (Ada County, 2011). This participation has provided opportunity for homeowners, renters, and business owners to purchase federally backed flood insurance as long as the community complies with regulations for development within 100-year and 500-year floodplains designated by the federal government.

This research focuses on the 100-year floodplain in Ada County, which not only requires compliance with the minimum NFIP development regulations, but also mandates that any federally regulated, supervised, or insured financial institutions and Federal Agency lenders must require flood insurance for buildings within this hazard zone. The geographical extent of the 100-year floodplain is mapped on a FIRM. These FIRMs can be updated and revised due to various factors and are evaluated through a FIS. The most recent FIS occurred in 2011 for Ada County, which significantly altered the 100-year floodplain. Figure 2.6 shows the former (currently in effect) 100-year floodplain, and figure 2.7 shows the revised 100-year floodplain (subject to review). Figure 2.8 through Figure 2.11 show the revised 100-year flood event water depths.



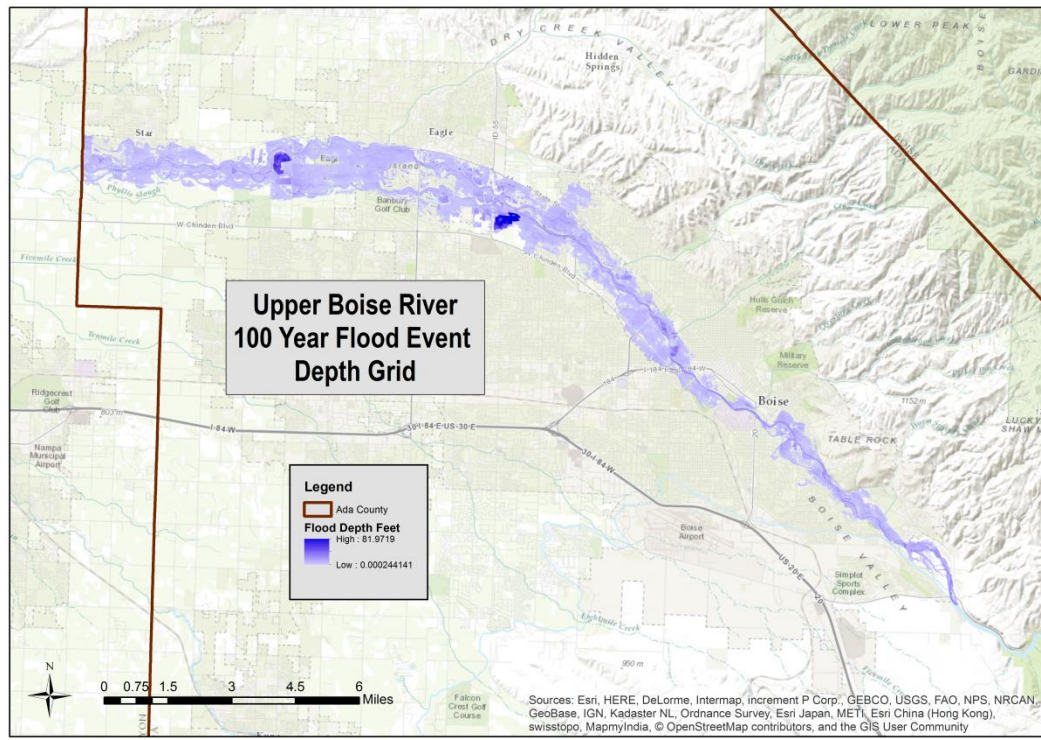


**Figure 2.6 Geographical Extent of Former 100 Year Floodplain**  
Data Source: FEMA, 2015

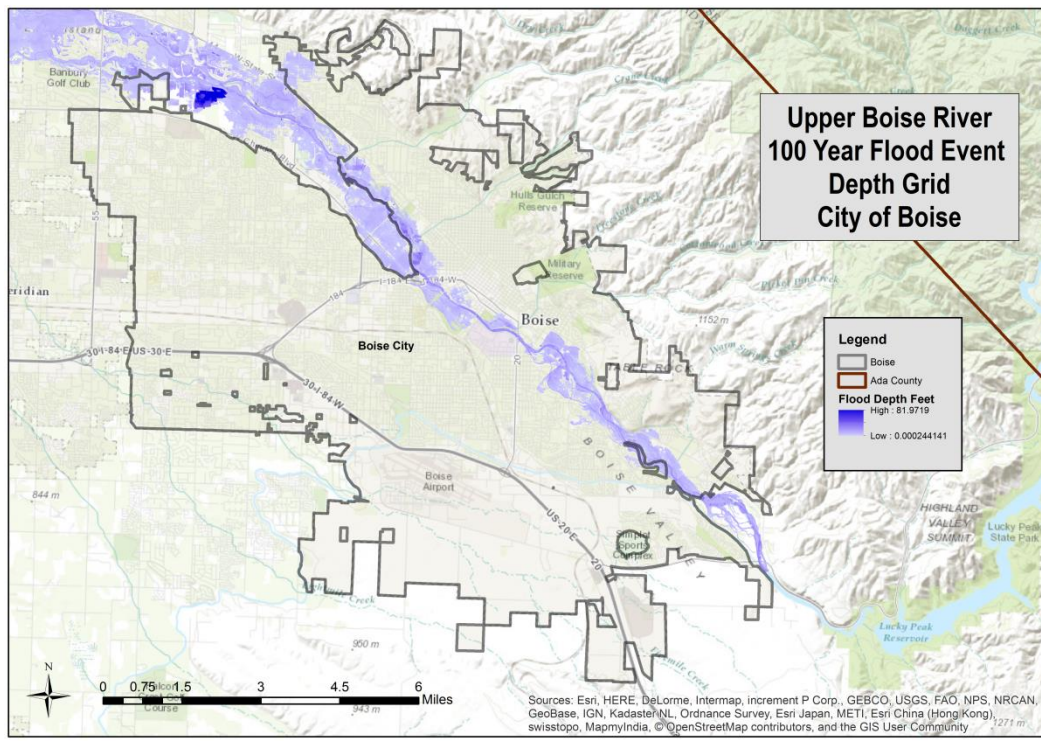


**Figure 2.7 Geographical Extent of Updated 100 Year Floodplain**  
Data Source: FEMA, 2015



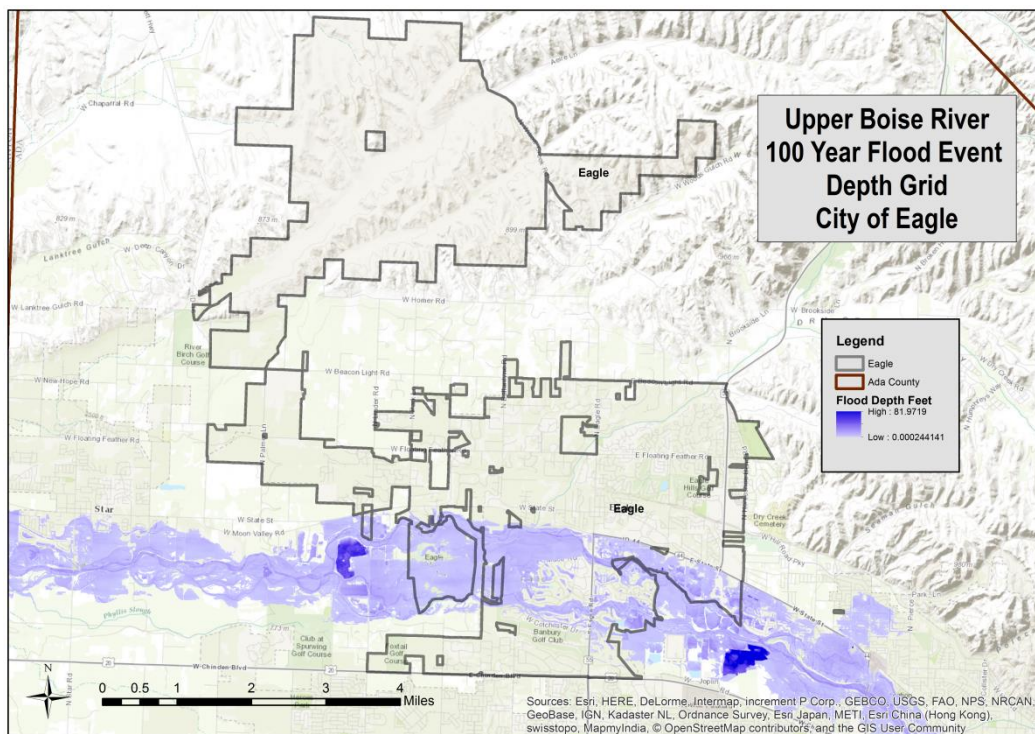


**Figure 2.8 100-Year Flood Event Depth Grid Ada County, Idaho**  
Data Source: FEMA, 2015

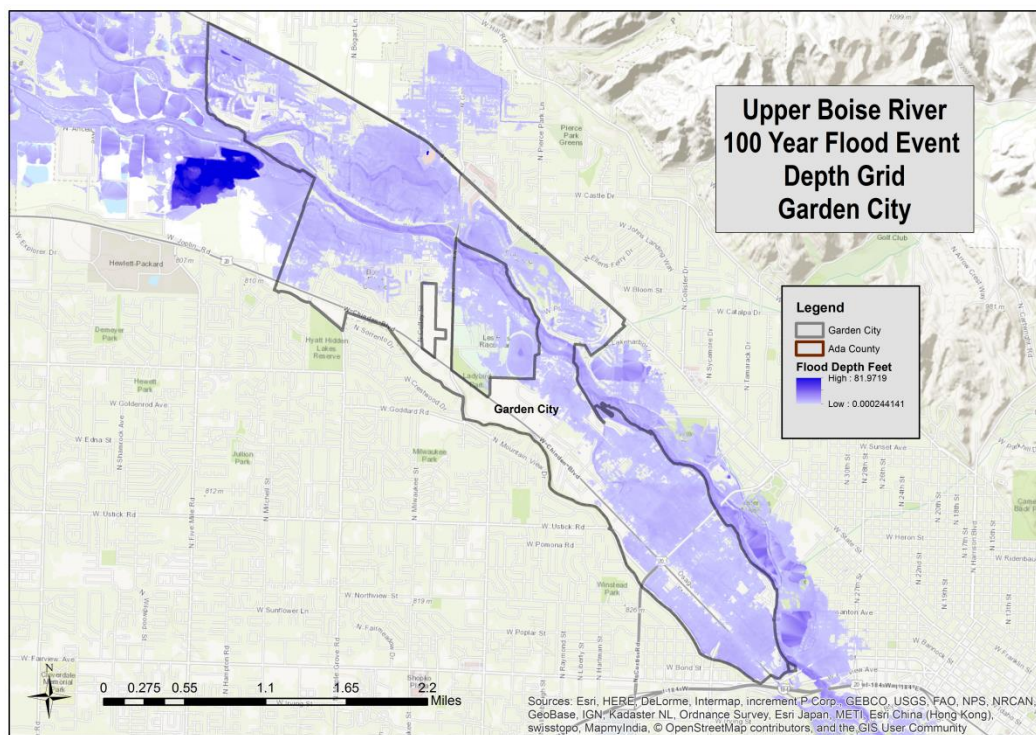


**Figure 2.9 100-Year Flood Event Depth Grid Boise City, Idaho**  
Data Source: FEMA, 2015





**Figure 2.10 100-Year Flood Event Depth Grid City of Eagle, Idaho**  
 Data Source: FEMA, 2015



**Figure 2.11 100-Year Flood Event Depth Grid City of Garden City, Idaho**  
 Data Source: FEMA, 2015



Ada County, Boise City, Eagle City, and Garden City are currently all in good standing in the NFIP program. Each community is also participating in the Community Rating System Program (CRS) in order to qualify for discounted insurance rates. This voluntary program provides these discounted insurance rates in return for floodplain management regulations and efforts that exceed the NFIP minimum. Discounts are provided based on a class ranking from Class 1 to Class 9, with each increase in class standing providing a 5% increase in insurance rate discounts, starting with 5% at Class 9 and 45% at Class 1. Table 2.9 and Table 2.10 show the current NFIP and CRS status for the study area in this thesis.

**Table 2.9 NFIP Community Status**

<b>Jurisdiction</b>	<b>Date of Entry Initial FIRM Effective Date</b>	<b># of Flood Insurance Policies as of 3/31/2011</b>	<b>Insurance in Force</b>	<b>Total Annual Premium</b>	<b>Claims, 11/1978 to 3/31/2011</b>	<b>Value of Claims Paid, 11/1978 to 3/31/2011</b>
Boise	4/17/1984	808	\$219,153,400	\$513,560	40	\$85,605
Eagle	3/4/1980	316	\$105,262,000	\$172,358	2	\$19,227
Garden City	5/15/1980	505	\$133,868,700	\$306,225	9	\$25,661
Kuna	10/2/2003	3	\$767,000	\$2,485	0	\$0
Meridian	9/27/1991	125	\$27,241,300	\$83,349	1	\$23,747
Star	12/18/1984	40	\$8,539,500	\$33,082	0	\$0
Unincorporated	12/18/1984	293	\$73,360,300	\$160,756	16	\$39,917
<b>Total</b>	-	<b>2090</b>	<b>\$568,192,200</b>	<b>\$1,111,059</b>	<b>68</b>	<b>\$194,157</b>

Source: Ada County All Hazard Mitigation Plan, 2011

Table 2.10 CRS Community Status

Community	NFIP Community #	CRS Entry Date	Current CRS Classification	% Premium Discount, SFHA/non-SFHA	Total Premium Savings
Ada County	160001	10/1/1994	7	15/5	\$19,478
Boise	160002	10/1/1991	6	20/10	\$81,310
Eagle	160003	4/1/2000	6	20/10	\$22,749
Garden City	160004	10/1/1998	9	5/5	\$12,590
<b>Total</b>	-	-	-	-	<b>\$136,127</b>

Source: Ada County All Hazard Mitigation Plan, 2011

### 2.3. Summary

This chapter has described the study area for this thesis. Ada County and three of its incorporated cities: Boise City, Eagle City, and Garden City were selected for this research. The geography, population and demographics, economy, land use, real estate and development trends, and flood profiles for each community were described providing local context and *genres de vie*. The following chapter describes the quantitative data and sources used for this research.

## 3. QUANTITATIVE DATA COLLECTION

### 3.1. Introduction

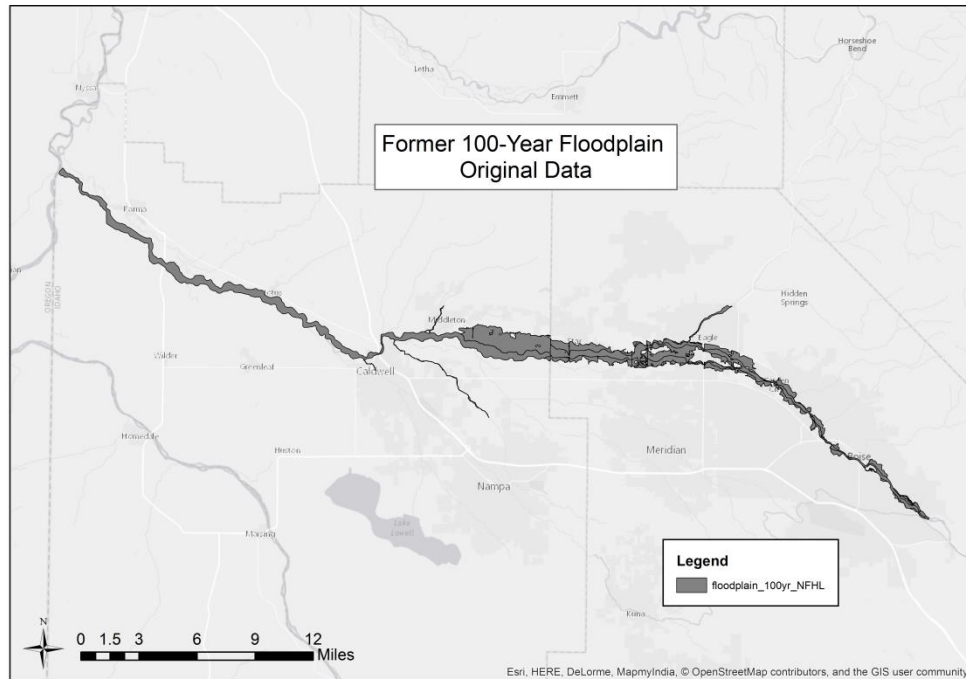
This research employs a mixed methods approach, using both quantitative and qualitative data. The quantitative portion of this thesis required that data be collected before the quantitative analyses in order to determine which type of analysis could be done. Data that were collected were chosen based on collaboration with my thesis committee. In this chapter, I will list and describe each data type and its source that was used for this research. The first section will describe the 100-year floodplain data, followed by the InfoUSA data in the second section. The third section of this chapter will describe the IMPLAN data, followed by the User Defined Facility data in the fourth section and last section.

### 3.2. Data Collection

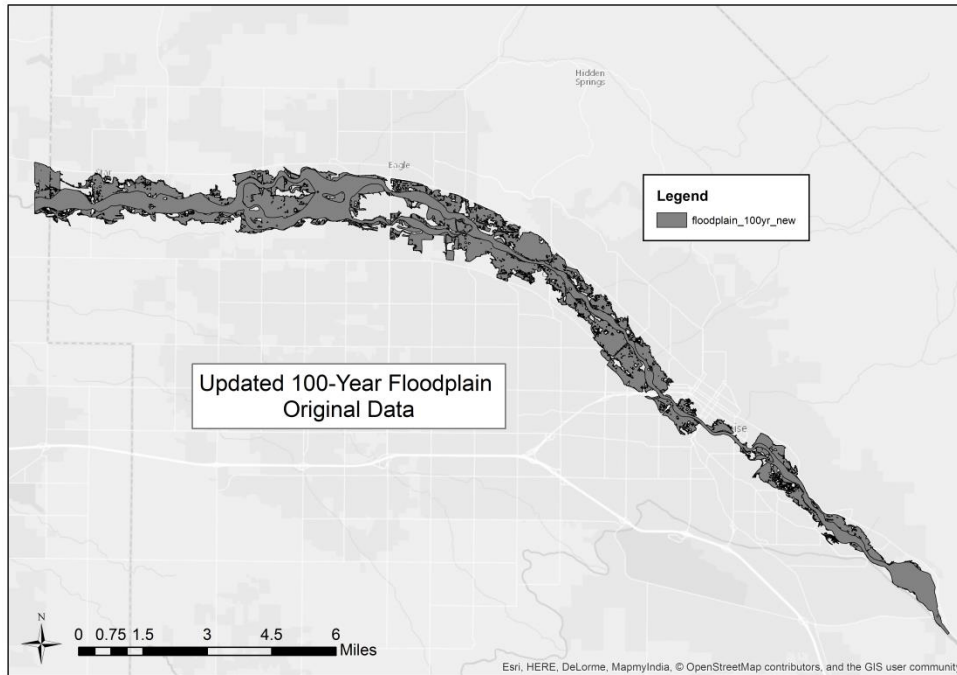
#### *100-year Floodplain and Depth Grid*

The former (1993) and revised (2011) 100-year floodplains used for this research were represented by two separate GIS shapefiles and the revised 100-year flood event depth grids were represented by a raster dataset. The shapefiles show the geographical extent and boundaries of the two floodplains, whereas the raster dataset shows flood water depths in feet for the revised 100-year flood event. The floodplain shapefiles were developed by the Federal Emergency Management Agency (FEMA) using the Hazus-MH flood model. The floodplain boundaries were produced using 100-year depth grids as input into Hazus-MH, which were developed by the Army Corp of Engineers using the Hec-Ras flood model. The data for this research was obtained

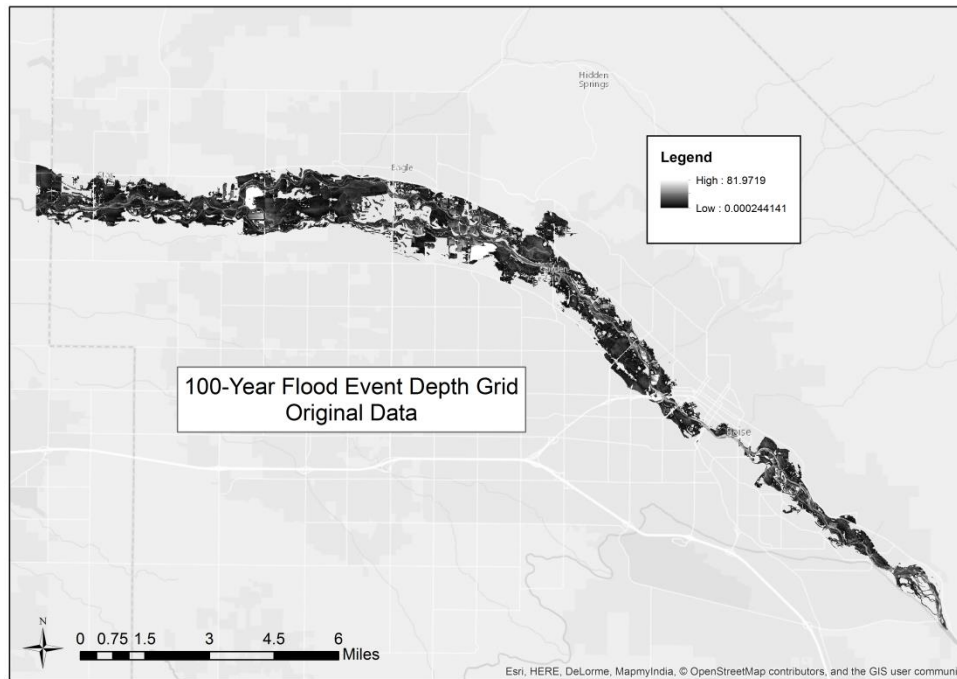
through two sources: FEMA and Garden City, Idaho as a secondary source. Figure 3.1 and Figure 3.2 show the two 100-year floodplain shapefiles in their original format. Figure 3.3 shows the 100-year flood event depth raster dataset in its original format.



**Figure 3.1 Original Format: Former 100-Year Floodplain Shapefile**  
Original Data Source: FEMA, 2015



**Figure 3.2 Original Format: Updated 100-Year Floodplain Shapefile**  
Original Data Source: FEMA, 2015



**Figure 3.3 Original Format: Updated 100-Year Flood Event Depths Raster**  
Original Data Source: FEMA, 2015

### *InfoUSA*

The InfoUSA dataset gathered for this research provides a spatially geocoded business inventory of Ada County for the year 2013, which is represented by a point layer GIS shapefile. The data for this research was obtained through InfoUSA. InfoUSA is a business unit of Infogroup that aims to deliver high quality business and consumer contact databases. Table 3.1 summarizes the business characteristics that are enumerated in the attribute table. Figure 3.4 provides a geovisualization of the 2013 InfoUSA data for Ada County in its original format.

**Table 3.1 InfoUSA Field and Attribute Description**

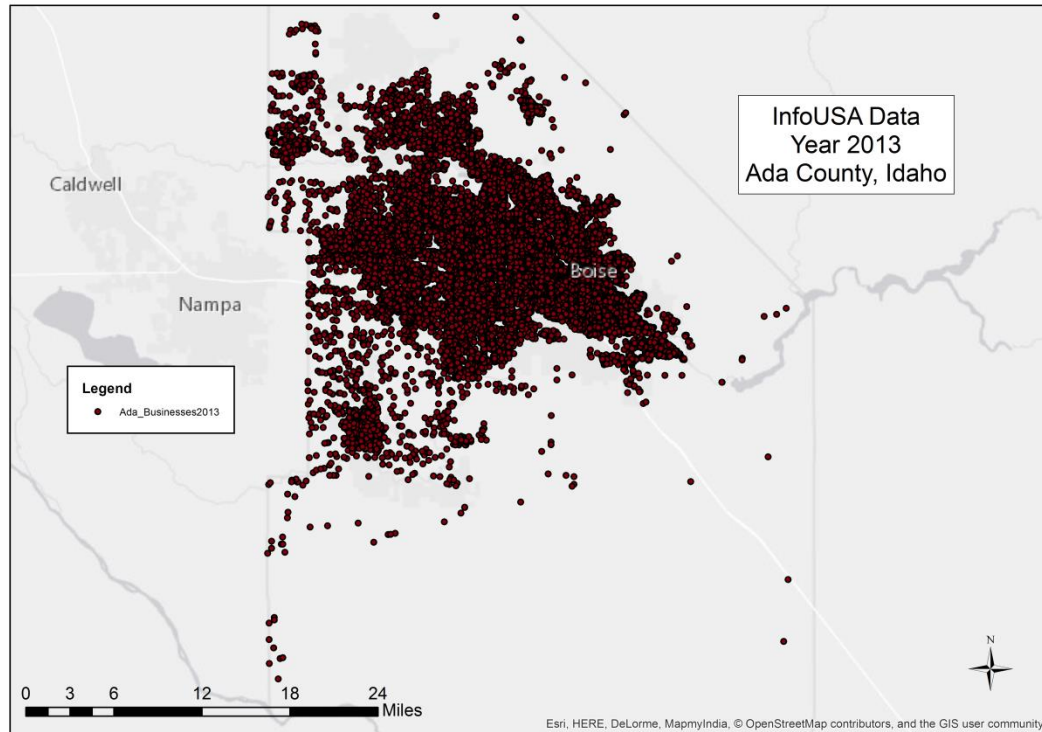
<b>Field Name</b>	<b>Attribute Description</b>
<b>DUNSNUM</b>	<b>Unique 9-digit identification number for each physical location of a business that is required before bidding on government proposals</b>
<b>CONAME</b>	<b>Name of each business</b>
<b>ADDR</b>	<b>Physical address for each business</b>
<b>PHONE</b>	<b>Contact phone number for each business</b>

Data Source: InfoUSA, 2013

**Table 3.1 InfoUSA Field and Attribute Description (continued)**

<b>NAICIS</b>	<b>North American Industry Classification System used for business establishments in the U.S. business economy for the purpose of collecting, analyzing, and publishing statistical data. This is represented by a 6-digit code, but which can also be summarized down to a 2-digit code. The first 2 digits represent the largest business sector. The third digit represents the sub-sector, the fourth digit represents the industry group, the fifth digit represents the NAICS industries, and the sixth digit represents the national industries.</b>
<b>SIC</b>	<b>Standard Industrial Classification System used by government agencies to classify industry areas. This is represented by a 4-digit code. The first 2 digits represent the major group and the third digit represents the industry group. The SIC codes are slowly being replaced by the NAICIS codes.</b>
<b>SALES_VOL</b>	<b>Total sales volume produced at each business</b>
<b>NUMBER_EMP</b>	<b>Number of employees maintained at each business</b>
<b>SQFT</b>	<b>Square footage of each business</b>

Data Source: InfoUSA 2013



**Figure 3.4 Original Format: InfoUSA Data, Ada County, 2013**

Data Source: InfoUSA, 2013

### *IMPLAN*

IMPLAN data provides a complete, comprehensive, and detailed view into any U.S. economy of interest (IMPLAN, 2015), which can be viewed at various scales, including at the national, state, county, or zip-code level. For this research, IMPLAN data were collected for Ada County for the year 2013. This IMPAN data are not spatially represented, but are represented as tables within an excel file. Characteristics that are provided within this table represent the industry detail of Ada County. Those characteristics include:

- Total Industry Outputs
- Employment



- Employee Compensation
- Proprietor Income
- Other Property Income
- Taxes on Production and Imports

IMPLAN data, unlike InfoUSA data, does not provide specific business attributes. Therefore, outputs are categorized and aggregated into industries based on the NAICS 3-digit codes. The data for this research was obtained through a researcher at the University of Idaho who had already run the input-output IMPLAN model, and therefore had Ada County's industry detail readily available.

#### *User Defined Facilities*

The User Defined Facility (UDF) data used for this research provides a spatial and descriptive inventory of commercial and residential properties located in Ada and Canyon Counties that are crucial to performing a level 2 Hazus-MH flood analysis. This data is represented as a table within a Microsoft Access personal geodatabase, which is the format required for import into the Hazus-MH interface. UDF inventories are commonly created using community parcel level data, building footprints, and structural engineering studies. The data for this research was obtained through FEMA and the agency's RiskMAP program. Various commercial and residential property characteristics are enumerated in this database. Table 3.2 summarizes these characteristics.

Table 3.2 UDF Field and Attribute Description

Field Name	Attribute Description
ADDRESS	Address of facility (street, city, zipcode, state)
COUNTY	County facility is located in (Ada or Canyon)
PHONE	Contact information (phone number)
OCCUPANCY	Facility Classification (7 general occupancies: COM, RES, IND, EDU, REL, GOV, and AGRI)
BLDGTYPE	Structure type (9 construction types: Wood, Steel, Concrete, Precast, Masonry, RMasonry, URMasonry, Mobile, Manufhousing)
COST	Replacement cost (thousands of dollars)
YEAR BUILT	Construction year (4-digit format)
AREA	Area (square feet)
NUMSTORIES	Number of stories
DESIGN LEVEL	PRE- or POST-firm facility classification based on year facility was constructed. (0 = unknown, 1 = Prior 1950, 2 = 1950-1970, 3 = Post 1970)
FOUNDATION TYPE	Type of built foundation (1 = Pile, 2 = Pier, 3 = Solid Wall, 4 = Basement/Yard, 5 = Crawl Space, 6 = Fill, 7 = Slab on grade)
FIRSTFLOORHT	Height of first floor (feet)
CONTENT COST	Cost of facility contents (thousands of dollars)
LATITUDE	Latitudinal coordinates (decimal degrees, WGS_1984)
LONGITUDE	Longitudinal coordinates (decimal degrees, WGS_19984)

Data Source: FEMA, 2015

### **3.3. Summary**

This chapter has described all data and data sources for the quantitative analysis portion of this research. An explanation of each dataset, the year the data represents, the geographical area it represents, and its source is discerned for the 100-year floodplain data, InfoUSA data, IMPLAN data, and UDF data used. The following chapter describes the methodology for this thesis.

## 4. METHODS

### 4.1. Introduction

In order to answer the research questions for this thesis, a sequential explanatory strategy mixed methods approach was employed. This approach was chosen with the purpose of using the qualitative results of this research to assist in explaining and interpreting the findings of the quantitative analysis (Cresswell, 2003). The quantitative portion of this research consisted of a spatial analysis conducted in Microsoft Excel, Geographic Information System (GIS) and Hazus-MH in order to determine the major revisions of the revised 100-year floodplain, as well as which economic sectors, businesses and residences are located within the revised 100-year floodplain. The qualitative portion of this research consisted of semi-structured interviews assessing the perceived impacts of the 100-year floodplain revisions, which were also guided by the quantitative analysis results.

The quantitative analysis aims to answer the first two research questions of this thesis and the qualitative analysis aims to answer the third research question of this thesis. The fourth research question of this thesis will be answered within the interpretation phase, using both the results of the quantitative and qualitative analyses. The first section of this chapter will explain the methodology of the floodplain revision analysis followed by the economic sector exposure analysis in the second section. The third section of this chapter will explain the Hazus-MH level II flood analysis methodology. The fourth and last section of this chapter will explain the interview process.

## 4.2. Methodology

### 4.2.1. Quantitative Analyses

#### *Floodplain Revision Analysis*

In order to answer the first research question within this thesis, a floodplain analysis was conducted using GIS methods to determine where the major floodplain additions and deletions occurred and which communities may be affected more than others. The data used for this spatial analysis consisted of the former and revised 100-year floodplain in shapefile format. More detail on the collection and source of this data can be found in the third chapter of this thesis.

Each floodplain extended beyond the boundaries of Ada County, therefore the data needed to be clipped to these boundaries before the analysis could be performed. This was done using the Clip function in ArcGIS, which extracts input features that overlay the clip features (ESRI, 2015). This was performed for each floodplain shapefile using an Ada County boundary shapefile that was obtained from the Hazards Research Group at the University of Idaho. Once the analysis was completed, the output consisted of the former 100-year floodplain and revised 100-year floodplain that were fit to our study area. The new feature classes were saved within a file geodatabase named 'AdaCnty\_Floodplains.' The floodplain analysis could then be performed.

In order to determine the modifications made from the former 100-year floodplain to the revised 100-year floodplain, an Erase function was used in ArcGIS. This tool creates a feature class by overlaying the input features with the polygons of the erase features and the portions saved to the output feature class are only those of the input features

that fall outside of the erase features (ESRI, 2015). The first Erase function performed was used to determine the portions of the 100-year floodplain that were deleted. Therefore, the former 100-year floodplain shapefile was used as the input feature and the revised 100-year floodplain shapefile was used as the erase feature. The second Erase function performed was used to determine the portions of the 100-year floodplain that were added. Therefore, the revised 100-year floodplain shapefile was used at the input feature and the former 100-year floodplain shapefile was used at the erase feature. Each output feature was saved as a feature class within the “AdaCnty\_Floodplains” geodatabase. The next step in the quantitative portion of this research consisted of performing an economic sector exposure analysis.

#### *Economic Sector Exposure Analysis*

In order to answer the second research question, an economic exposure analysis was conducted using Microsoft Excel and GIS methods to determine which businesses and their industries are located within the revised floodplain that may have to undertake new flood insurance requirements. The data used for this spatial analysis consisted of the Ada County 2013 InfoUSA point layer shapefile, the Ada County IMPLAN data in excel format, the former and revised 100-year floodplains, and the 100-year floodplain additions and deletions in shapefile format. More detail on the collection and source of this data can be found in the third chapter of this thesis.

The first part of this analysis consisted of spatializing the IMPLAN data. This was done by joining the InfoUSA data with the IMPLAN data based on their NAICS codes. However, the InfoUSA data had a 5-digit NAICS code, whereas the IMPLAN data only

had 3-digit and 2-digit NAICS code. Two new string type fields were then added to the attribute table of the InfoUSA data named 'NAICS3T' and 'NAICS2T.' A '3-digit left function' was then performed on the InfoUSA 5-digit NAICS code and the output was added to the 'NAICS3T' field. There was no '2-digit left function' performed as there were only 3 industries in the IMPLAN data that had 2- digit codes, which were then manually added to the 'NAICS2T' field.

The next step of spatializing the IMPLAN data consisted of importing the table from Microsoft Excel in ArcMap. A 'spatial join' based on the 3-digit NAISC codes was performed. Once the InfoUSA and IMPLAN data were joined, 6 new double type fields and 1 string type field were added to the InfoUSA attribute table that corresponded with the output tables in the IMPLAN data. Those fields included the following:

- Total Industry Outputs = 'Output'
- Employment = 'Employ'
- Employee Compensation = 'EmployComp'
- Proprietor Income = 'PropriInc'
- Other Property Income = 'OtherProIn'
- Taxes on Production and Imports = 'TaxPrdIm'
- Description = 'Industry'

Using the Field Calculator, each value from the IMPLAN data was added into the corresponding field. All spatial joins were then removed and the economic exposure analysis was performed in the next steps.

A 'spatial join by location' was then performed (intersect) using the InfoUSA data and the former and revised floodplain shapefiles. Once this was complete, a 'summary by count' was completed for the number of InfoUSA points within each industry for the former and revised floodplain shapefiles. A 'summary by average' was performed on all other fields, such as employment, industry output, etc. Once these summaries were completed, calculations were then performed in Microsoft Excel.

The next step in this economic exposure analysis consisted of calculating the percent of InfoUSA points (businesses) that were in the former floodplain and in the revised floodplain for each industry. This was done using the following equations:

$$\text{Percentage in Former Floodplain} = \frac{\text{Points in Former Floodplain}}{\text{Total Points in Ada County}}$$

And

$$\text{Percentage in Revised Floodplain} = \frac{\text{Points in Revised Floodplain}}{\text{Total Points in Ada County}}$$

The percent change of InfoUSA points (businesses) from the former floodplain to the revised floodplain for each industry was then calculated. This calculation only focused on the change from former to new, as this study is only looking at the impacts of the floodplain revisions. The following equation was used:

$$\text{Percentage Change in Revised floodplain} =$$

$$\frac{\text{Percentage in Revised Floodplain} - \text{Percentage in Former Floodplain}}{\text{Percentage in Former Floodplain}} * 100$$



The next step within this economic exposure analysis consisted of analyzing the points (businesses) that are within the 100-year floodplain additions and deletions and determine those points that had no change at all. This was done using ArcMap. The InfoUSA points that were in the former floodplain that intersected the floodplain deletions were calculated using a 'select by location intersect' function. The InfoUSA points that were NOT in the former floodplain that intersected the floodplain additions was also calculated using the same method. In order to calculate the InfoUSA points with no change, the following equation was used:

$$\text{InfoUSA Points (Businesses) with No Change} =$$

$$\text{Points in Former and Revised Floodplains} - \text{Points in Additions and Deletions}$$

The final step in this economic exposure analysis was to analyze the change of InfoUSA points (businesses) within Boise City, Eagle City, and Garden City. The InfoUSA points that were in the former floodplain that intersected Boise City's boundaries were calculated using the 'select by location intersect' function. The InfoUSA points that are in the revised floodplain that intersected Boise City's boundaries were also calculated using the 'select by location intersect' function. This method was employed for both Garden City and Eagle City as well. The percent change was then calculated for each city using the following equation:

$$\text{Percent Change of InfoUSA Points (businesses) in City} =$$

$$\frac{\text{Points in Revised Floodplain} - \text{Points in Former Floodplain}}{\text{Percentage in Former Floodplain}}$$

This last calculation completed the last step for the economic exposure analysis. The final step in the quantitative portion of this method consisted of a Hazus-MH flood analysis.

### *Hazus-MH Level II Flood Analysis*

In order to answer the second research question within this thesis, a level II flood loss estimation analysis was run using Hazus-MH for a 100-year flood event to determine monetary damage to residential and commercial structures, which may determine where the higher insurance premium rates occur. The data used for this spatial analysis consisted of the User Defined Facilities (UDF) and 100-year flood depth grid in raster format provided by the Federal Emergency Management Agency (FEMA). More detail on the collection and source of this data can be found in the third chapter of this thesis.

The first step of this flood analysis was to open the Hazus-MH 2.2 application, which then opened the Region Wizard. The study region created for this case study was named 'Lower Boise Watershed.' Six counties were included within the study region: Ada, Boise, Canyon, Gem, Elmore, and Payette. Although this study focused on only Ada County, the other counties were included as they are all part of the Lower Boise Watershed. This Hazus-MH flood analysis was based on the entire watershed to include all necessary hydrological features, but only residences within Ada County were analyzed further. The study region was then opened within the Hazus-MH program. Once the study region was opened in the Hazus-MH interface, the 100-year depth grids were added. The depth grids for the Upper Boise River, as this is the part of the river

that is located within Ada County, were imported from a separate file on an external drive. A return period of 100 years was set for the depth grid. After these parameters were set, the depth grid was successfully imported into the study region.

Once the depth grids were imported, the riverine flood hazard type was selected. The next step taken was to import the User-Defined Facilities (UDF). This was imported from a separate geodatabase (udf\_flood) on an external drive. Field types were then matched within a field mapping window. After all available field types were matched, the UDF were imported into the 'Lower Boise Watershed' study region.

All required data was now prepared and ready for the flood scenario and analysis.

However, before the flood scenario and analysis were employed, the 100-year floodplain was delineated. After that was completed, a scenario named '100 Year Flood' was created with a 100-year return period. The next step was to run the analysis on the User-Defined Facilities (UDF). Once the flood analysis was finished, the UDF were exported as a feature class into the 'AdaCnty\_Floodplains' geodatabase. This feature class was opened in ArcMap and a 'select by attribute' function was performed on all residential and commercial facilities. All residential and commercial facilities were then exported as a feature class into the same geodatabase. This last step then completed the quantitative methods portion of this thesis.

#### **4.2.1. Qualitative Analyses**

##### *Interview Process*

In order to answer the third research question within this thesis, a series of semi-structured interviews were employed, which may help to gain a better

understanding of local conditions and supplement the quantitative analyses. In order to determine which participants would be best for these interviews, results from the quantitative portion were used, as well as suggestions posed within the hazards literature. My thesis committee was also valuable in providing suggestions for potential interview participants.

Initially, it was determined that the interviews would be focused on local businesses in order to corroborate the quantitative results. Therefore, InfoUSA data was analyzed and searched. Businesses that were located within the revised floodplain and were not originally in the former floodplain were added to the list of potential interviewees. Furthermore, businesses in the economic sectors with the largest percent changes from the quantitative portion of this thesis were added to the list. Once the list of potential interviewees was completed, IRB approval was attained, and a number of phone calls were placed to the physical location of each business. Despite a plethora of phone calls to these businesses and a last minute effort to various Chamber of Commerce offices, there was not a single person willing to participate. The most common reason why this occurred was the business owner thought that this would not affect them anyway and therefore, declined. This then shifted the focus for whom to recruit for participation in these interviews.

Interview recruitment then focused on other sectors in the community, based on suggestions from the hazards literature and my thesis committee. The shift focused to those that are already somehow involved within the National Flood Insurance Program and could provide valuable insights on how the floodplain revisions could affect the

community. A new list of potential interviewees was then created. An email was sent out initially to each individual, but if there was no response after a few days, a follow up phone call was employed. Interviews were then scheduled for those that were willing to participate.

The questions that were created for these interviews were compiled using the results from the quantitative portion of this thesis, concepts from the literature, and suggestions from my thesis committee. Questions for each interview followed a similar format, yet were adapted for each participant as necessary. Each interview guide is provided in Appendix A at the end of this thesis.

Interviews were conducted at various locations in Ada County from October 21<sup>st</sup> through October 28<sup>th</sup>. Prior to each interview, a consent form was signed allowing for the recording of each interview. A copy of the consent form is provided in Appendix A. Interviews lasted from 15 minutes to 2 hours and a total of 8 interviews were conducted, however input from three additional individuals that were identified through a chain referral process are also included. Table 4.1 provides a list of individuals that were interviewed, including their title and date of interview.

**Table 4.1 Interview Descriptions**

<b>Participant Title</b>	<b>Date of Interview</b>
Director of Development Services, Garden City	October 21st, 2015
Founder of Build Idaho	October 21st, 2015
Real Estate Agent, Remax	October 22nd, 2015
Insurance Agent, Farmers Insurance	October 22nd, 2015
Engineer and Floodplain Specialist, Ada County	October 23rd, 2015
Insurance Agent, Farm Bureau Insurance	October 26th, 2015
Assessor, Ada County	October 27th, 2015
Appraisal Division Supervisor, Ada County	October 27th, 2015
Deputy Assessor, Ada County	October 27th, 2015
Boise City Planning Director, Boise City	October 28th, 2015
Civil Engineer, Boise City	October 28th, 2015

### **4.3. Summary**

This chapter has described each method for the quantitative and qualitative analysis portion of this research, including the floodplain revision analysis, economic exposure analysis, flood loss estimation analysis, and the interview process. The following chapter describes the results from each quantitative analysis, as well as the main findings from the semi-structured interviews.

## 5. RESULTS

### 5.1. Introduction

This chapter presents the results of each quantitative and qualitative method explained in Chapter Four of this thesis. The first section describes the floodplain revision analysis results and is followed by the economic exposure analysis results. The third section then presents the results of the Hazus-MH level II flood analysis followed by the interview results in the fourth and last section of this chapter.

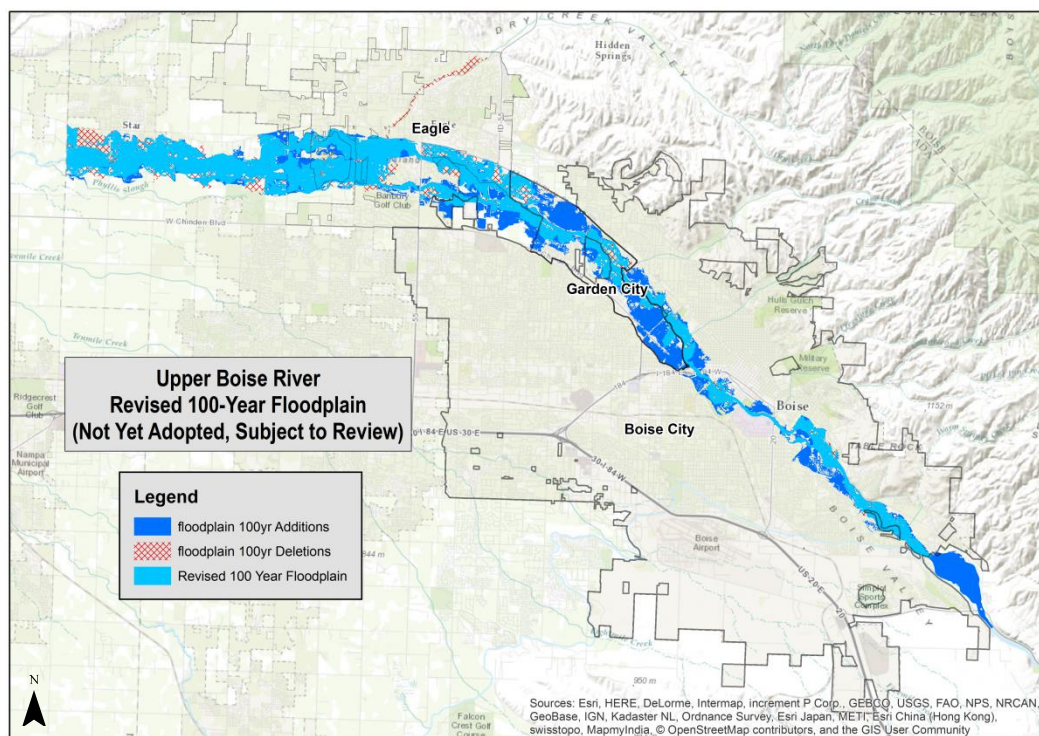
### 5.1. Results

#### 5.2.1. Quantitative Analyses

##### *Floodplain Revision Analysis*

Figure 5.1 shows the results of the floodplain revision analysis, showing areas that were added and deleted from the former 100-year regulatory floodplain. The majority of additions to the floodplain occurred within the northwestern and southeastern portions of Garden City, as well as in unincorporated Ada County southeast of Boise City. Large areas also added to the floodplain are located in unincorporated Ada County west of Garden City. The majority of floodplain deletions occurred within the eastern portions of Ada County near the City of Star, while other deletions occurred in various portions of Eagle City and Garden City. Figures 5.2 through 5.4 show the additions and deletions for Boise City, Garden City, and Eagle City. Income is a crucial aspect to this study and Figures 5.5 through 5.8 show the income ratio for the 100-year regulatory floodplain additions for Ada County, Boise City, Garden City, and Eagle City aggregated by census block. A ratio of 1.0 or below indicates

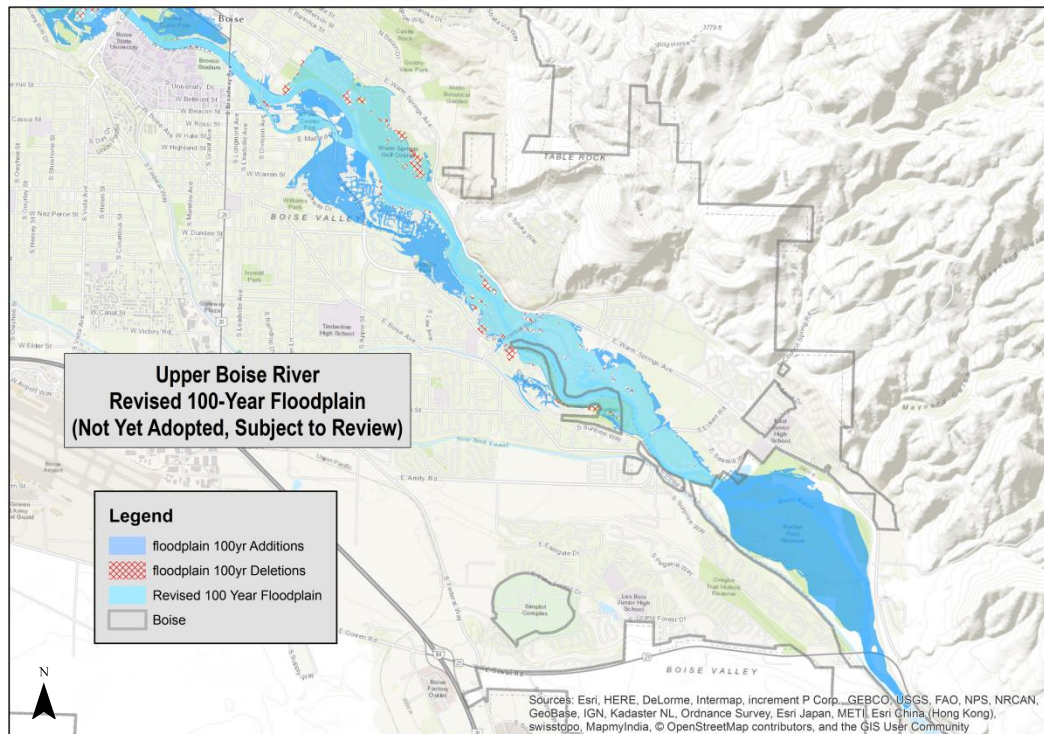
that the census block has an income level that is below the national poverty level, whereas a ratio of 1.0 or greater indicates the census block has an income level above the national poverty level (Census, 2010). Overall, the areas added to the 100-year regulatory floodplain showed a wide range of income levels. However, there is a great disparity of income levels between each participating NFIP city analyzed within this thesis. The majority of floodplain additions within Boise City and Eagle City showed an income ratio of 1.07 and above, whereas the majority of floodplain additions within Garden City showed an income ratio of 1.07 and below, despite small portions having income ratios of 1.4 and above.



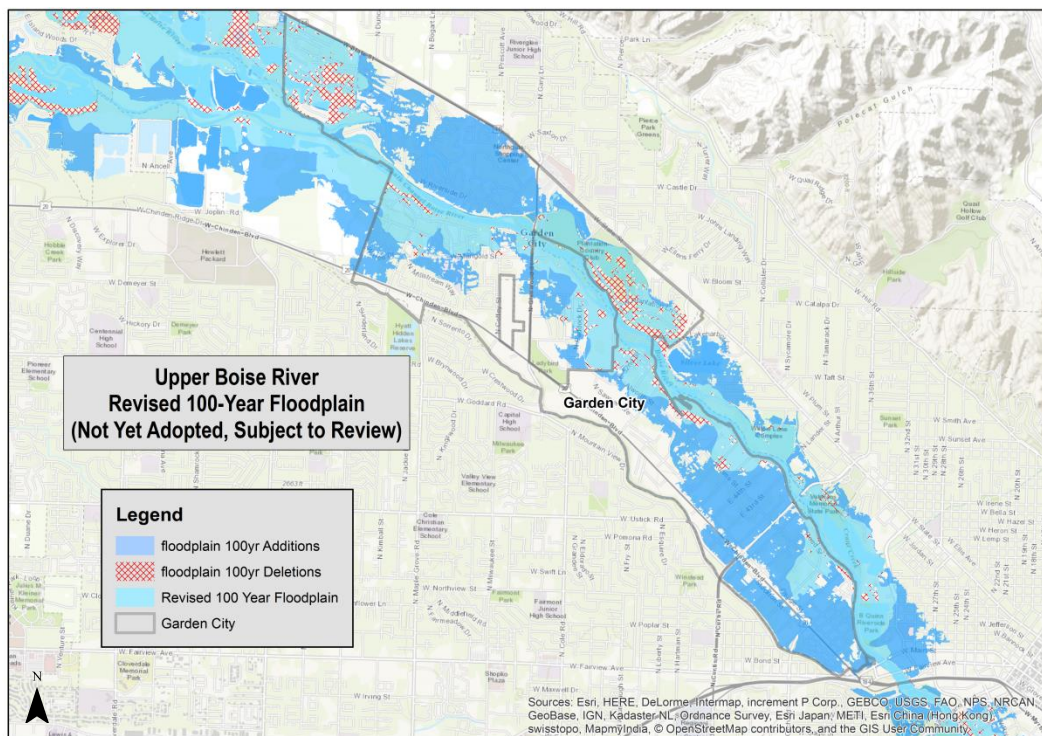
**Figure 5.1 Floodplain Revisions (Ada County)**

Data Source: FEMA, 2015



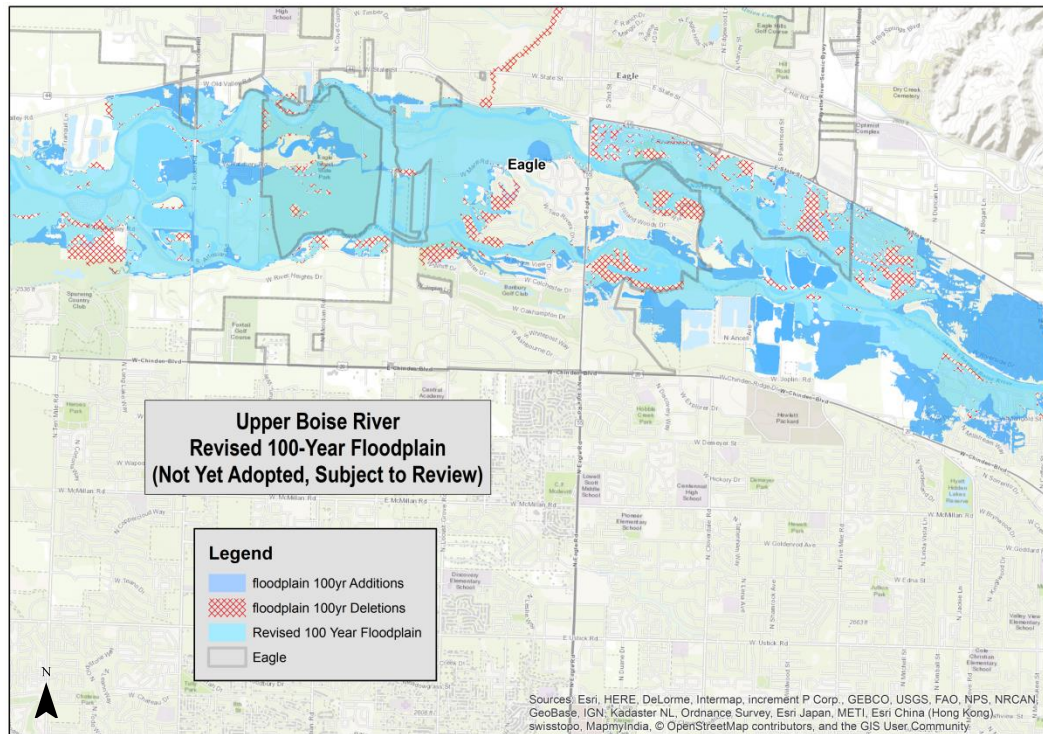


**Figure 5.2 Floodplain Revisions (Boise City)**  
Data Source: FEMA, 2015



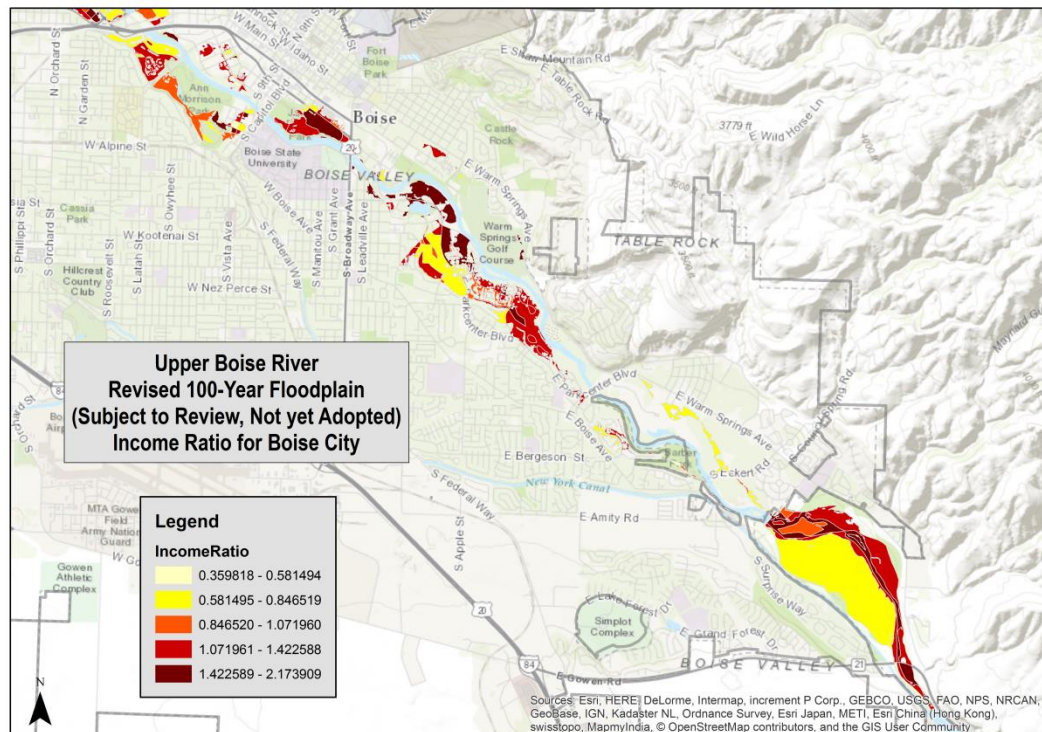
**Figure 5.3 Floodplain Revisions (Garden City)**  
Data Source: FEMA, 2015





**Figure 5.4 Floodplain Revisions (Eagle City)**

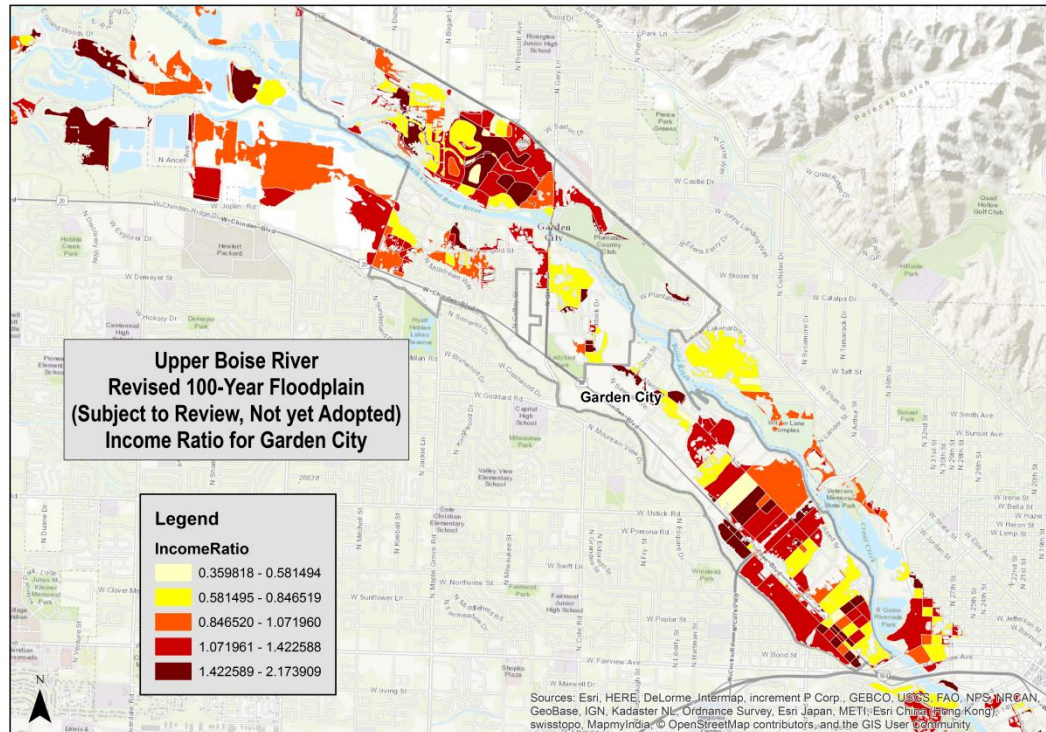
Data Source: FEMA, 2015



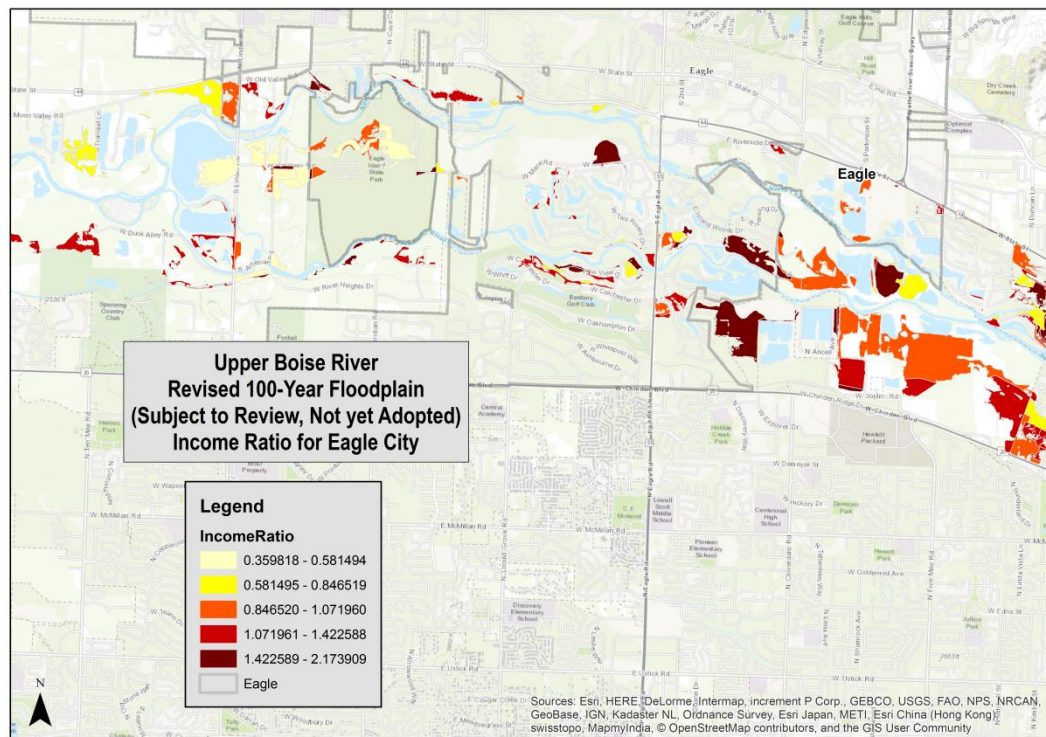
**Figure 5.6 Floodplain Additions Income Ratio (Boise City)**

Data Source: U.S. Census, 2010





**Figure 5.7 Floodplain Additions Income Ratio (Garden City)**  
 Data Source: U.S. Census, 2010



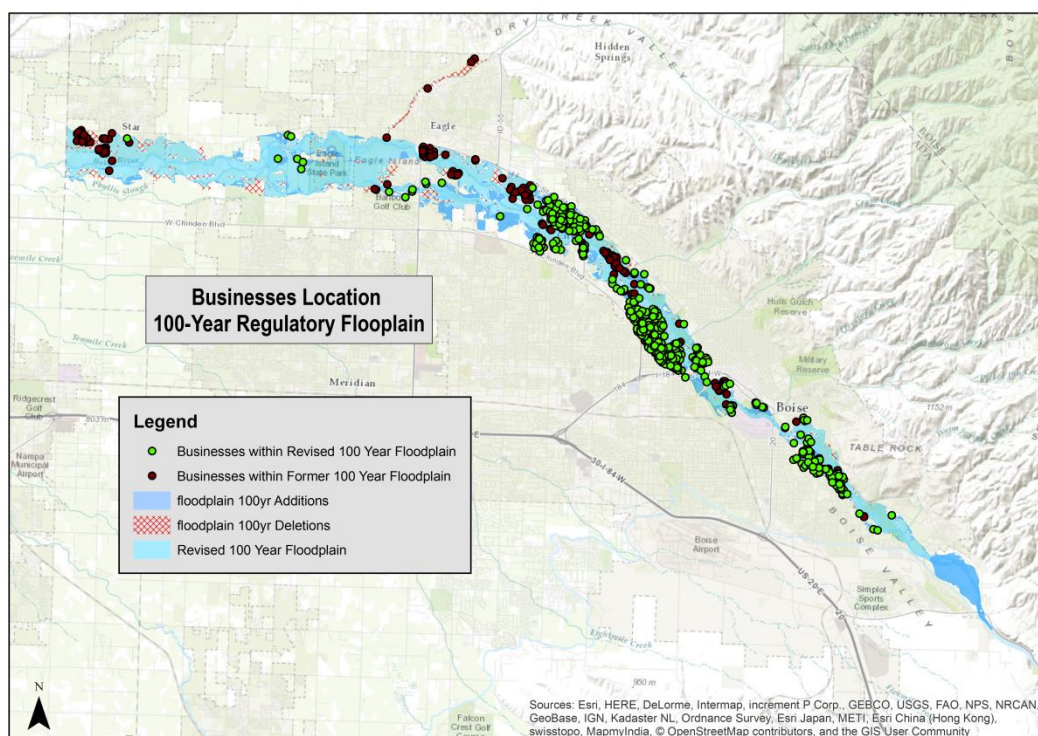
**Figure 5.8 Floodplain Additions Income Ratio (Eagle City)**  
 Data Source: U.S. Census, 2010

### *Economic Sector Exposure Analysis*

A total of 941 businesses were examined for this study, and Table 5.1 summarizes the business and economic industry exposure changes from the former 100-year regulatory floodplain to the revised 100-year regulatory floodplain. Figure 5.9 visually shows this change in business and industry exposure. A majority of these businesses and their designated economic industries within Ada County showed a positive percent change of exposure from the former 100-year regulatory floodplain to the revised 100-year regulatory floodplain. A positive percent change indicates that there was an increase in businesses and economic industries in the revised floodplain, compared to the former, whereas a negative percent change indicates that there was a decrease. There were 15 industries exposed to the floodplain, which had zero exposure beforehand. These included Agricultural and Forestry Services, Beverage and Tobacco, Textile Products, Leather and Allied, Wood Products, Printing and Related, Plastics and Rubber Products, Machinery Manufacturing, Computer and Other Electronics, Electrical Equipment and Appliances, General Merchandise Stores, Broadcasting, Funds- Trusts and Other Financial, and Museums and Similar. The industries that showed the largest increase in exposure, (i.e., located within the 100-year regulatory floodplain) that already had prior exposure, included Repair and Maintenance, Motor Vehicles and Parts Dealers, and Rental and Leasing Services, with each showing 600 percent or more increase in exposure. This may be due to the prevalence and growth of large industrial sectors in the majority of floodplain additions.

Industries with a negative percent change of exposure included Data Processing, Hosting and Related and Information Services with a 50 percent decrease. One business

classified under Oil and Gas Extraction showed a 100 percent decrease of exposure from the former floodplain to the revised floodplain. Eleven industries, with a total of 133 businesses, showed a zero percent change of exposure. These industries included Hospitals, Nursing and Residential Care, Insurance Carriers and Related, Telecommunications, Motion Picture and Sound Recording, Couriers and Messengers, Chemical Manufacturing, Clothing and Accessories, Textile Mills, Utilities, and Fishing, Hunting and Trapping.



**Figure 5.9 Business and Industry Exposure 100-Year Floodplain**

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.1 Business and Industry Exposure 100-Year Floodplain

Industry	Counts		Percent Exposed		Percent Difference
	Old Floodplain	New Floodplain	Old Floodplain	New Floodplain	
Not Identified by IMPLAN	5	8	2.27%	3.64%	60%
111 Crop Farming	6	9	2.93%	4.39%	50%
112 Livestock	2	8	1.74%	6.96%	300%
114 Fishing- Hunting & Trapping	2	2	16.67%	16.67%	0%
115 Ag & Forestry Svcs	0	2	0.00%	1.79%	-
211 Oil & gas extraction	1	0	50.00%	0.00%	-100%
221 Utilities	4	4	6.25%	6.25%	0%
230 Construction	43	119	1.68%	4.64%	177%
311 Food products	2	3	2.74%	4.11%	50%
312 Beverage & Tobacco	0	2	0.00%	25.00%	-
313 Textile Mills	1	1	11.11%	11.11%	0%
314 Textile Products	0	2	0.00%	10.53%	-
315 Clothing and accessories	1	1	8.33%	8.33%	0%
316 Leather & Allied	0	1	0.00%	4.55%	-
321 Wood Products	0	2	0.00%	2.94%	-
323 Printing & Related	0	6	0.00%	7.69%	-
325 Chemical Manufacturing	1	1	2.50%	2.50%	0%
326 Plastics & rubber prod	0	2	0.00%	14.29%	-

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.1 Business and Industry Exposure 100-Year Floodplain (continued)

327 Nonmetal mineral prod	2	4	4.65%	9.30%	100%
332 Fabricated metal prod	4	9	4.65%	10.47%	125%
333 Machinery Mfg	0	3	0.00%	4.92%	-
334 Computer & oth electron	0	3	0.00%	3.45%	-
335 Electircal eqpt & appliances	0	1	0.00%	4.35%	-
336 Transportation eqpmt	1	2	3.13%	6.25%	100%
339 Miscellaneous mfg	2	11	1.32%	7.24%	450%
42 Wholesale Trade	15	61	1.22%	4.97%	307%
441 Motor veh & parts dealers	3	22	1.16%	8.49%	633%
442 Furniture & home furnishings	3	7	1.64%	3.83%	133%
443 Electronics & appliances stores	4	7	2.50%	4.38%	75%
444 Bldg materials & garden dealers	3	7	1.46%	3.41%	133%
445 food & beverage stores	4	11	1.67%	4.58%	175%
446 Health & personal care stores	6	10	3.35%	5.59%	67%
447 Gasoline stations	0	1	0.00%	1.10%	-
448 Clothing & accessories stores	2	9	0.66%	2.98%	350%
451 Sports- hobby- book & music stores	5	16	1.95%	6.23%	220%
452 General merch stores	0	2	0.00%	3.57%	-
453 Misc retailers	5	18	0.95%	3.43%	260%
454 Non-store retailers	4	6	2.61%	3.92%	50%

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.1 Business and Industry Exposure 100-Year Floodplain (continued)

484 Truck transportation	2	6	0.92%	2.76%	200%
485 Transit & ground passengers	2	5	3.39%	8.47%	150%
492 Couriers & messengers	1	1	4.35%	4.35%	0%
493 Warehousing & storage	1	4	1.56%	6.25%	300%
511 Publishing industries	6	9	4.17%	6.25%	50%
512 Motion picture & sound recording	2	2	2.11%	2.11%	0%
515 Broadcasting	0	1	0.00%	3.85%	-
517 Telecommunications	1	1	0.52%	0.52%	0%
518 Data processing, hosting and related	2	1	4.65%	2.33%	-50%
519 Information services	2	1	6.90%	3.45%	-50%
522 Credit intermediation & related	9	12	2.78%	3.70%	33%
523 Securities & other financial	20	22	4.63%	5.09%	10%
524 Insurance carriers & related	16	16	3.71%	3.71%	0%
525 Funds- trusts & other finan	0	1	0.00%	2.56%	-
531 Real estate	37	56	3.48%	5.26%	51%
532 Rental & leasing svcs	1	7	0.62%	4.32%	600%
541 Professional-scientific & tech svcs	90	135	2.55%	3.82%	50%
551 Management of companies	2	5	2.86%	7.14%	150%
561 Admin support svcs	87	151	2.12%	3.67%	74%

Data Source: InfoUSA, 2013 and IMPLAN, 2013

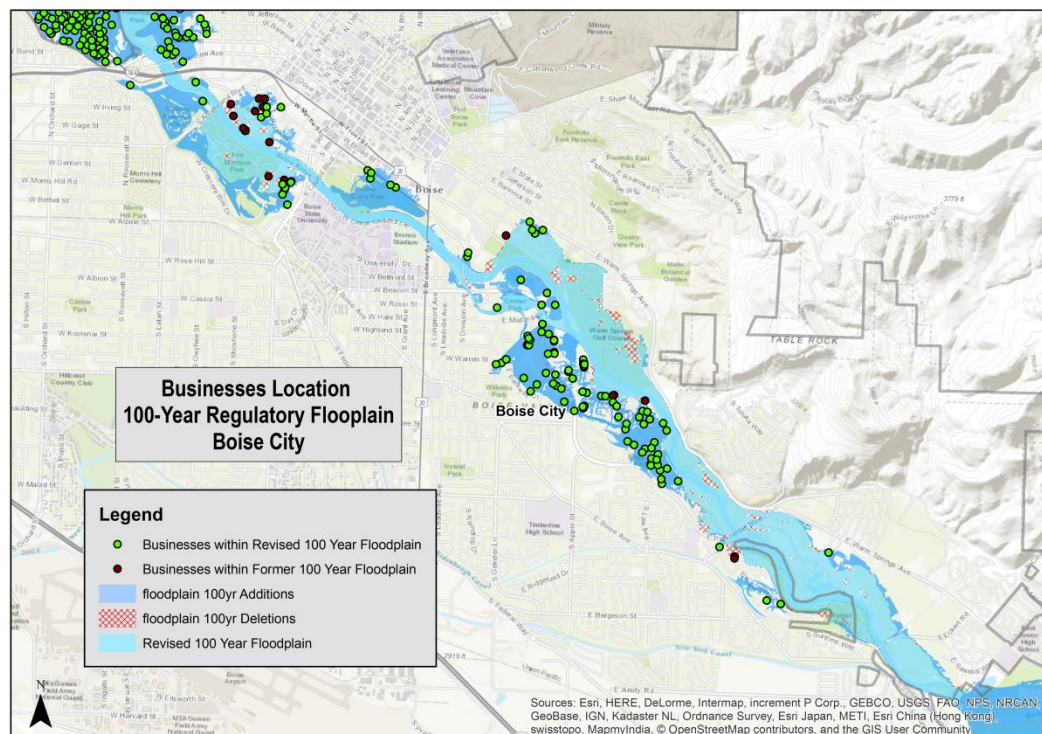


Table 5.1 Business and Industry Exposure 100-Year Floodplain (continued)

562 Waste mgmt & remediation svcs	1	3	2.27%	6.82%	200%
611 Educational svcs	6	15	1.26%	3.14%	150%
621 Ambulatory health care	28	45	2.01%	3.23%	61%
622 Hospitals	2	2	8.00%	8.00%	0%
623 Nursing & residential care	3	3	3.23%	3.23%	0%
624 Social assistance	9	12	1.68%	2.23%	33%
711 Performing arts & spectator sports	3	6	1.63%	3.26%	100%
712 Museums & similar	0	2	0.00%	10.53%	-
713 Amusement-gambling & recreation	8	9	3.40%	3.83%	13%
721 Accommodations	5	10	4.20%	8.40%	100%
722 Food svcs & drinking places	11	20	1.27%	2.32%	82%
811 Repair & maintenance	7	76	0.96%	10.44%	986%
812 Personal & laundry svcs	9	20	1.13%	2.52%	122%
813 Religious-grantmaking- & similar orgs	17	20	2.07%	2.44%	18%
92 Government admin and enterprise	8	12	2.14%	3.21%	50%

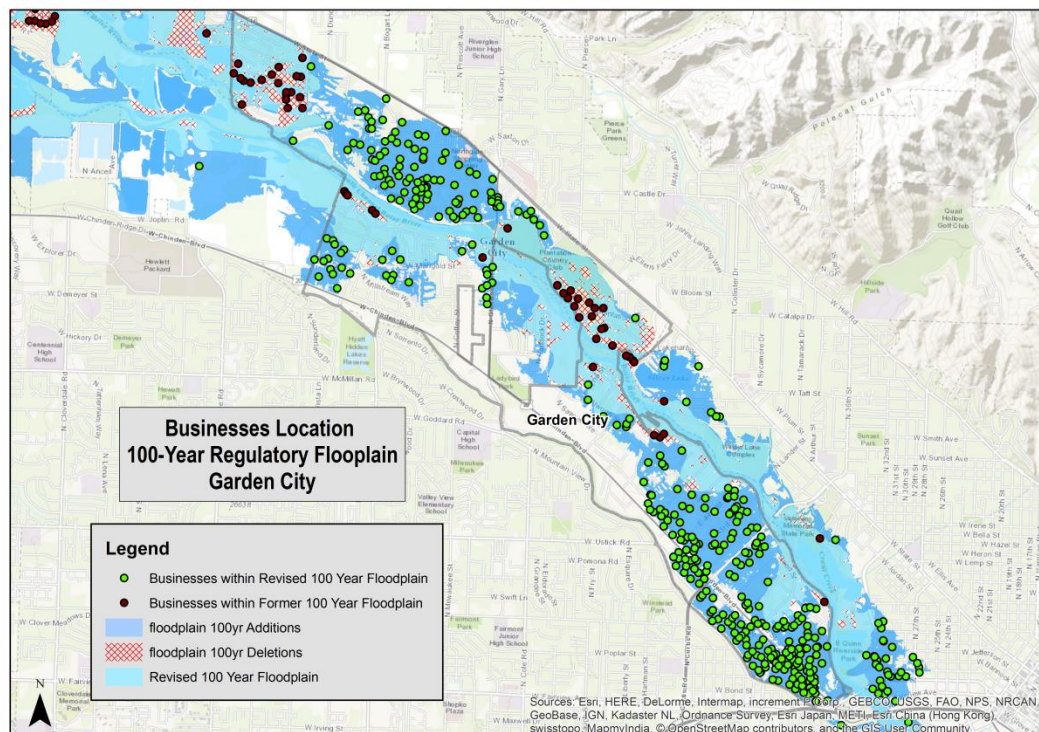
Data Source: InfoUSA, 2013 and IMPLAN, 2013

Businesses located within Boise City and Garden City showed a positive percent change of exposure. The City of Boise originally had 145 businesses exposed within the floodplain; however this number increased by 109.7 percent to 304 total businesses within the revised floodplain. Garden City saw a 235.23 percent increase in exposed businesses originally, from 193 businesses to 647 total businesses. Alternatively, Eagle City showed a negative percent change, with 122 businesses exposed decreasing by 38.5 percent to 75 total businesses. Figures 5.10 through 5.12 visually show the change in business exposure from the former 100-year regulatory floodplain to the revised 100-year regulatory floodplain for Boise City, Garden City, and Eagle City.



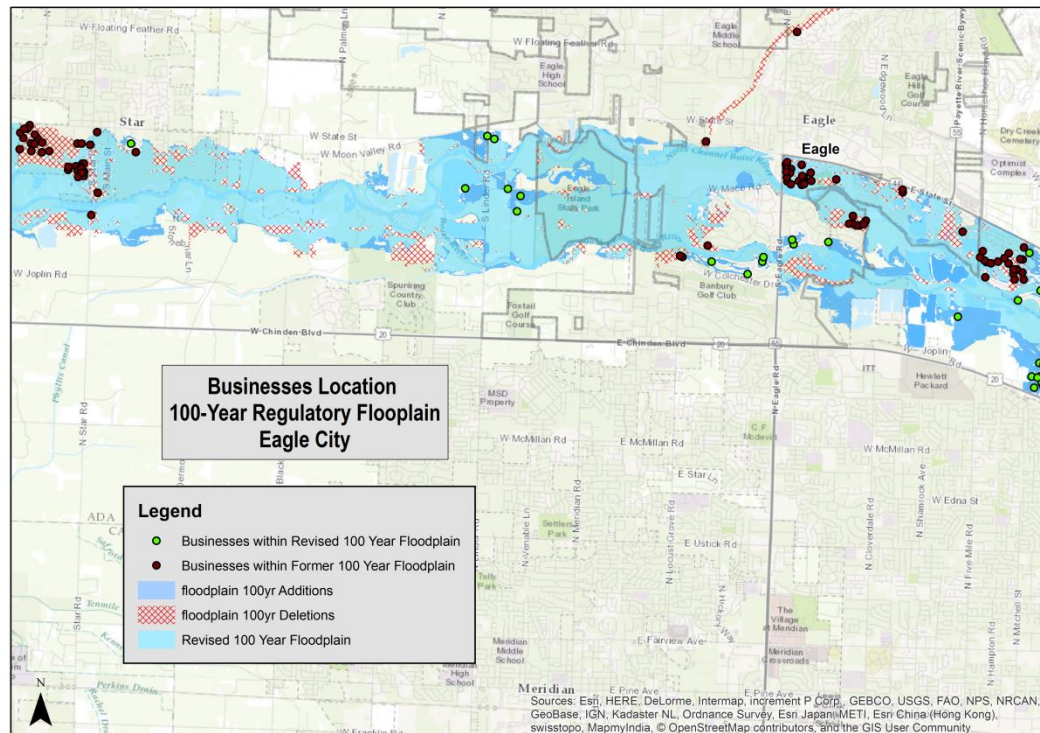
**Figure 5.10 Business and Industry Exposure 100-Year Floodplain (Boise City)**

Data Source: InfoUSA, 2013 and IMPLAN, 2013



**Figure 5.11 Business and Industry Exposure 100-Year Floodplain (Garden City)**

Data Source: InfoUSA, 2013 and IMPLAN, 2013



**Figure 5.12 Business and Industry Exposure 100-Year Floodplain (Eagle City)**

Data Source: InfoUSA, 2013 and IMPLAN, 2013

In order to portray the abovementioned exposure results in a larger economic context for the county as a whole, these changes were compared to the overall county economic industry totals. Table 5.2 summarizes these changes in exposure for each industry. Moreover, these results were further aggregated into four domains based on a study done by Frazier, Wood, and Yarnal (2010). These categories include: Environment, Emergency Management, Business and Manufacturing, and Government. Results were aggregated into these four domains as each is affected differently by flood events. For example, a business within the emergency management and infrastructure domain damaged by a flood event could greatly inhibit community response and recovery, whereas a business within the environmental domain may act as an asset that may either mitigate flood damages or improve community response and recovery, therefore enhancing community resiliency. Finally, each domain may have different ways of preparing for flood events.

According to the results, each of the four domains showed a positive percent change of 100-year regulatory floodplain exposure which are summarized in Table 5.3. Businesses and economic industries within the Government domain showed an increase of 50 percent, those within the Business and Manufacturing domain showed an increase of 108 percent, while businesses and economic industries within the Emergency Management and Infrastructure domain showed an increase of 94 percent, and those within the Environment domain showed an increase of 91 percent.

Table 5.2 Ada County Aggregated Business and Industry Exposure

Industry	Counts		Percent of Total Industry		Percent Difference
	Former Floodplain	Revised Floodplain	Former Floodplain	Revised Floodplain	
Not Identified by IMPLAN	5	8	0.0000%	0.0310%	60%
111 Crop Farming	6	9	0.0232%	0.0348%	50%
112 Livestock	2	8	0.0077%	0.0310%	300%
114 Fishing- Hunting & Trapping	2	2	0.0077%	0.0077%	0%
115 Ag & Forestry Svcs	0	2	0.0000%	0.0077%	-
211 Oil & gas extraction	1	0	0.0039%	0.0000%	-100%
221 Utilities	4	4	0.0155%	0.0155%	0%
230 Construction	43	119	0.1664%	0.4604%	177%
311 Food products	2	3	0.0077%	0.0116%	50%
312 Beverage & Tobacco	0	2	0.0000%	0.0077%	-
313 Textile Mills	1	1	0.0039%	0.0039%	0%
314 Textile Products	0	2	0.0000%	0.0077%	-
315 Clothing and accessories	1	1	0.0039%	0.0039%	0%
316 Leather & Allied	0	1	0.0000%	0.0039%	-
321 Wood Products	0	2	0.0000%	0.0077%	-
323 Printing & Related	0	6	0.0000%	0.0232%	-
325 Chemical Manufacturing	1	1	0.0039%	0.0039%	0%
326 Plastics & rubber prod	0	2	0.0000%	0.0077%	-

Data Source: InfoUSA, 2013 and IMPLAN, 2013



Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)

327 Nonmetal mineral prod	2	4	0.0077%	0.0155%	100%
332 Fabricated metal prod	4	9	0.0155%	0.0348%	125%
333 Machinery Mfg	0	3	0.0000%	0.0116%	-
334 Computer & oth electron	0	3	0.0000%	0.0116%	-
335 Electircal eqpt & appliances	0	1	0.0000%	0.0039%	-
336 Transportation eqpmt	1	2	0.0039%	0.0077%	100%
339 Miscellaneous mfg	2	11	0.0077%	0.0426%	450%
42 Wholesale Trade	15	61	0.0580%	0.2360%	307%
441 Motor veh & parts dealers	3	22	0.0116%	0.0851%	633%
442 Furniture & home furnishings	3	7	0.0116%	0.0271%	133%
443 Electronics & appliances stores	4	7	0.0155%	0.0271%	75%
444 Bldg materials & garden dealers	3	7	0.0116%	0.0271%	133%
445 food & beverage stores	4	11	0.0155%	0.0426%	175%
446 Health & personal care stores	6	10	0.0232%	0.0387%	67%
447 Gasoline stations	0	1	0.0000%	0.0039%	-
448 Clothing & accessories stores	2	9	0.0077%	0.0348%	350%
451 Sports- hobby- book & music stores	5	16	0.0193%	0.0619%	220%
452 General merch stores	0	2	0.0000%	0.0077%	-
453 Misc retailers	5	18	0.0193%	0.0696%	260%
454 Non-store retailers	4	6	0.0155%	0.0232%	50%

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)

484 Truck transportation	2	6	0.0077%	0.0232%	200%
485 Transit & ground passengers	2	5	0.0077%	0.0193%	150%
492 Couriers & messengers	1	1	0.0039%	0.0039%	0%
493 Warehousing & storage	1	4	0.0039%	0.0155%	300%
511 Publishing industries	6	9	0.0232%	0.0348%	50%
512 Motion picture & sound recording	2	2	0.0077%	0.0077%	0%
515 Broadcasting	0	1	0.0000%	0.0039%	-
517 Telecommunications	1	1	0.0039%	0.0039%	0%
518 Data processing, hosting and related	2	1	0.0077%	0.0039%	-50%
519 Information services	2	1	0.0077%	0.0039%	-50%
522 Credit intermediation & related	9	12	0.0348%	0.0464%	33%
523 Securities & other financial	20	22	0.0774%	0.0851%	10%
524 Insurance carriers & related	16	16	0.0619%	0.0619%	0%
525 Funds- trusts & other finan	0	1	0.0000%	0.0039%	-
531 Real estate	37	56	0.1432%	0.2167%	51%
532 Rental & leasing svcs	1	7	0.0039%	0.0271%	600%
541 Professional-scientific & tech svcs	90	135	0.3482%	0.5223%	50%
551 Management of companies	2	5	0.0077%	0.0193%	150%
561 Admin support svcs	87	151	0.3366%	0.5843%	74%
562 Waste mgmt & remediation svcs	1	3	0.0039%	0.0116%	200%

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)

<b>611 Educational svcs</b>	<b>6</b>	<b>15</b>	<b>0.0232%</b>	<b>0.0580%</b>	<b>150%</b>
<b>621 Ambulatory health care</b>	<b>28</b>	<b>45</b>	<b>0.1083%</b>	<b>0.1741%</b>	<b>61%</b>
<b>622 Hospitals</b>	<b>2</b>	<b>2</b>	<b>0.0077%</b>	<b>0.0077%</b>	<b>0%</b>
<b>623 Nursing &amp; residential care</b>	<b>3</b>	<b>3</b>	<b>0.0116%</b>	<b>0.0116%</b>	<b>0%</b>
<b>624 Social assistance</b>	<b>9</b>	<b>12</b>	<b>0.0348%</b>	<b>0.0464%</b>	<b>33%</b>
<b>711 Performing arts &amp; spectator sports</b>	<b>3</b>	<b>6</b>	<b>0.0116%</b>	<b>0.0232%</b>	<b>100%</b>
<b>712 Museums &amp; similar</b>	<b>0</b>	<b>2</b>	<b>0.0000%</b>	<b>0.0077%</b>	<b>-</b>
<b>713 Amusement-gambling &amp; recreation</b>	<b>8</b>	<b>9</b>	<b>0.0310%</b>	<b>0.0348%</b>	<b>13%</b>
<b>721 Accommodations</b>	<b>5</b>	<b>10</b>	<b>0.0193%</b>	<b>0.0387%</b>	<b>100%</b>
<b>722 Food svcs &amp; drinking places</b>	<b>11</b>	<b>20</b>	<b>0.0426%</b>	<b>0.0774%</b>	<b>82%</b>
<b>811 Repair &amp; maintenance</b>	<b>7</b>	<b>76</b>	<b>0.0271%</b>	<b>0.2941%</b>	<b>986%</b>
<b>812 Personal &amp; laundry svcs</b>	<b>9</b>	<b>20</b>	<b>0.0348%</b>	<b>0.0774%</b>	<b>122%</b>
<b>813 Religious-grantmaking- &amp; similar orgs</b>	<b>17</b>	<b>20</b>	<b>0.0658%</b>	<b>0.0774%</b>	<b>18%</b>
<b>92 Government admin and enterprise</b>	<b>8</b>	<b>12</b>	<b>0.0310%</b>	<b>0.0464%</b>	<b>50%</b>

Data Source: InfoUSA, 2013 and IMPLAN, 2013



Table 5.2 Ada County Aggregated Business and Industry Exposure

ENVIRONMENT	Count		Percent of Industry		Percent Difference
	Old Floodplain	New Floodplain	Old Floodplain	New Floodplain	
111 Crop Farming	6	9	0.0426%	0.0813%	91%
112 Livestock	2	8			
114 Fishing- Hunting & Trapping	2	2			
115 Ag & Forestry Svcs	1	2			
211 Oil & gas extraction	1	0			
TOTALS	11	21			
EMER MANGMT and INFRASTRUCTURE	Count		Percent of Industry		Percent Difference
	Old Floodplain	New Floodplain	Old Floodplain	New Floodplain	
221 Utilities	4	4	0.4759%	0.9247%	94%
230 Construction	43	119			
484 Truck transportation	2	6			
485 Transit & ground passengers	2	5			
492 Couriers & messengers	1	1			
515 Broadcasting	0	1			
517 Telecommunications	1	1			
518 Data processing, hosting and related	2	1			
519 Information services	2	1			
562 Waste mgmt & remediation svcs	1	3			
611 Educational svcs	6	15			
621 Ambulatory health care	28	45			
622 Hospitals	2	2			
623 Nursing & residential care	3	3			
624 Social assistance	9	12			
813 Religious- grantmaking- & similar orgs	17	20			
TOTALS	123	239			

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)

BUSINESS and MANUF	Count		Percent of Industry		Percent Difference
	Old Floodplain	New Floodplain	Old Floodplain	New Floodplain	
311 Food products	2	3	1.4780%	3.0722%	108%
312 Beverage & Tobacco	0	2			
313 Textile Mills	1	1			
314 Textile Products	0	2			
315 Clothing and accessories	1	1			
316 Leather & Allied	0	1			
321 Wood Products	0	2			
323 Printing & Related	0	6			
325 Chemical Manufacturing	1	1			
326 Plastics & rubber prod	0	2			
327 Nonmetal mineral prod	2	4			
332 Fabricated metal prod	4	9			
333 Machinery Mfg	0	3			
334 Computer & oth electron	0	3			
335 Electircal eqpt & appliances	0	1			
336 Transportation eqpmt	1	2			
339 Miscellaneous mfg	2	11			
42 Wholesale Trade	15	61			
441 Motor veh & parts dealers	3	22			
442 Furniture & home furnishings	3	7			
443 Electronics & appliances stores	4	7			

Data Source: InfoUSA, 2013 and IMPLAN, 2013

Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)

<b>444 Bldg materials &amp; garden dealers</b>	<b>3</b>	<b>7</b>			
445 food & beverage stores	4	11			
<b>446 Health &amp; personal care stores</b>	<b>6</b>	<b>10</b>			
447 Gasoline stations	0	1			
<b>448 Clothing &amp; accessories stores</b>	<b>2</b>	<b>9</b>			
451 Sports- hobby- book & music stores	5	16			
<b>452 General merch stores</b>	<b>0</b>	<b>2</b>			
453 Misc retailers	5	18			
<b>454 Non-store retailers</b>	<b>4</b>	<b>6</b>			
493 Warehousing & storage	1	4			
<b>511 Publishing industries</b>	<b>6</b>	<b>9</b>			
512 Motion picture & sound recording	2	2			
<b>522 Credit inmediation &amp; related</b>	<b>9</b>	<b>12</b>			
523 Securities & other financial	20	22			
<b>524 Insurance carriers &amp; related</b>	<b>16</b>	<b>16</b>			
525 Funds- trusts & other finan	0	1			
<b>531 Real estate</b>	<b>37</b>	<b>56</b>			
532 Rental & leasing svcs	1	7			
<b>541 Professional- scientific &amp; tech svcs</b>	<b>90</b>	<b>135</b>			
551 Management of companies	2	5			

Data Source: InfoUSA, 2013 and IMPLAN, 2013

**Table 5.2 Ada County Aggregated Business and Industry Exposure (continued)**

<b>561 Admin support svcs</b>	<b>87</b>	<b>151</b>			
711 Performing arts & spectator sports	3	6			
<b>712 Museums &amp; similar</b>	<b>0</b>	<b>2</b>			
713 Amusement- gambling & recreation	8	9			
<b>721 Accommodations</b>	<b>5</b>	<b>10</b>			
722 Food svcs & drinking places	11	20			
<b>811 Repair &amp; maintenance</b>	<b>7</b>	<b>76</b>			
812 Personal & laundry svcs	9	20			
<b>TOTALS</b>	<b>#REF!</b>	<b>#REF!</b>			
GOV	Count		Percent of Industry		Percent Difference
	Old Floodplain	New Floodplain	Old Floodplain	New Floodplain	
92 Government admin and enterprise	8	12	0.0310%	0.0464%	50%
<b>TOTALS</b>	<b>8</b>	<b>12</b>			

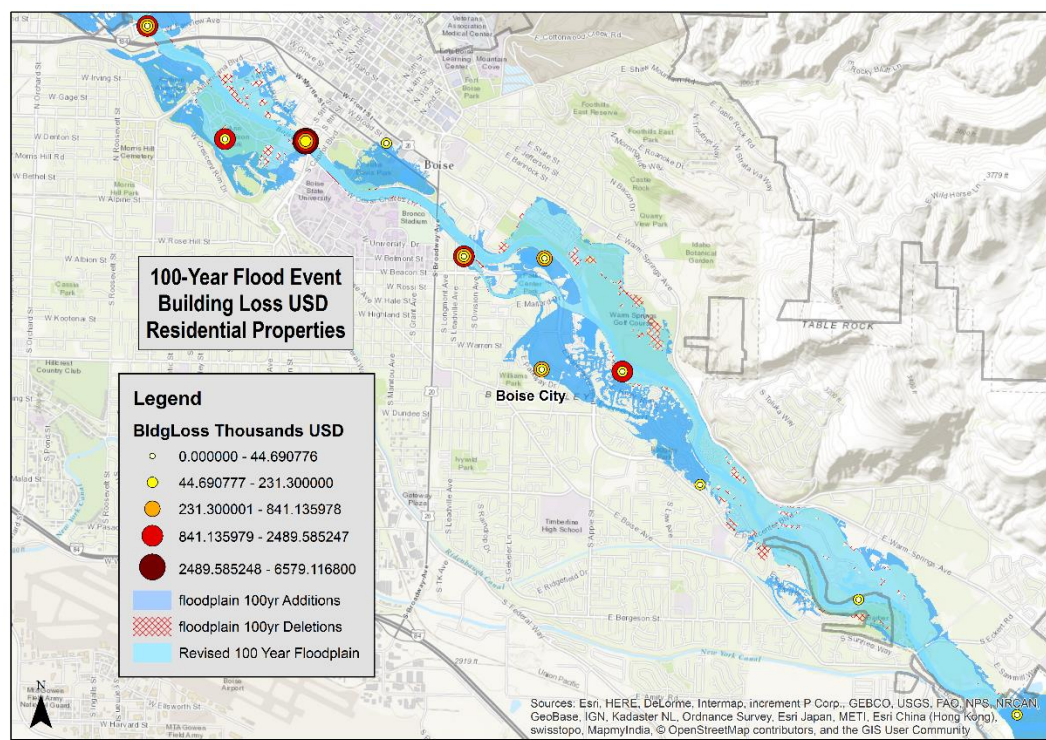
Data Source: InfoUSA, 2013 and IMPLAN, 2013

*Hazus-MH Level II Flood Analysis*

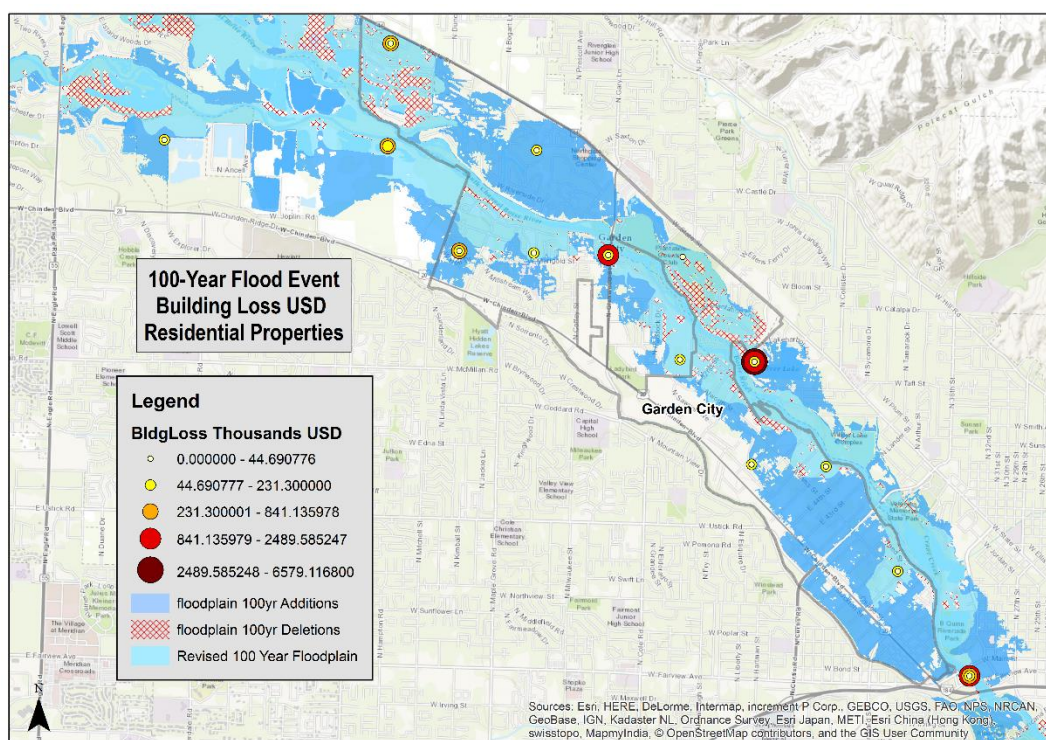
Multiple businesses and residential structures were examined using the Hazus-MH flood model, and Figure 5.13 through Figure 5.16 show the range of monetary losses for all residential structures within Ada County, Boise City, Garden City, and Eagle City. Of the 5,737 residential structures analyzed, 4,261 showed building losses in U.S. dollars (USD) to a 100-year flood event. Moreover, of these 4,261 buildings that showed monetary losses 2,026 were located within the 100-year floodplain that were not beforehand. Damage is presented using USD as flood insurance claims are made based on monetary losses. Content losses are not examined within this analysis, for this exceeds the scope of this thesis. The average monetary loss for these properties was approximately \$27,000, with the largest monetary loss at approximately \$6,579,000.



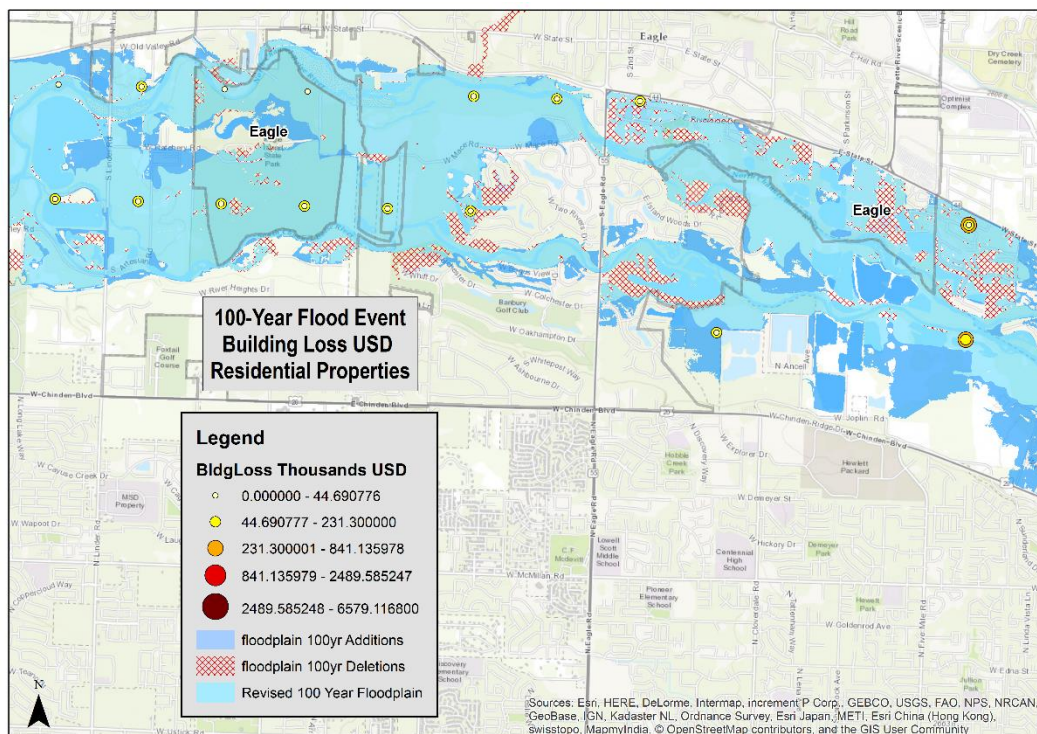




**Figure 5.14 Residential Structure Flood Losses USD (Boise City)**  
Data Source: FEMA, 2015



**Figure 5.15 Residential Structure Flood Losses USD (Garden City)**  
Data Source: FEMA, 2015

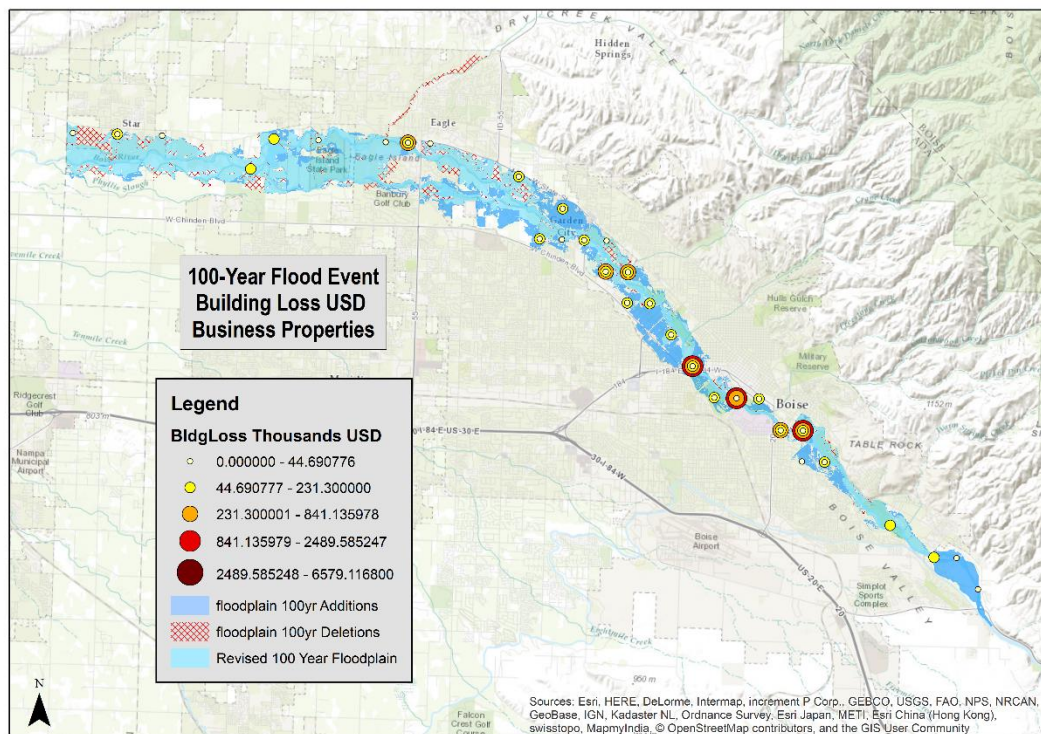


**Figure 5.16 Residential Structure Flood Losses USD (Eagle City)**

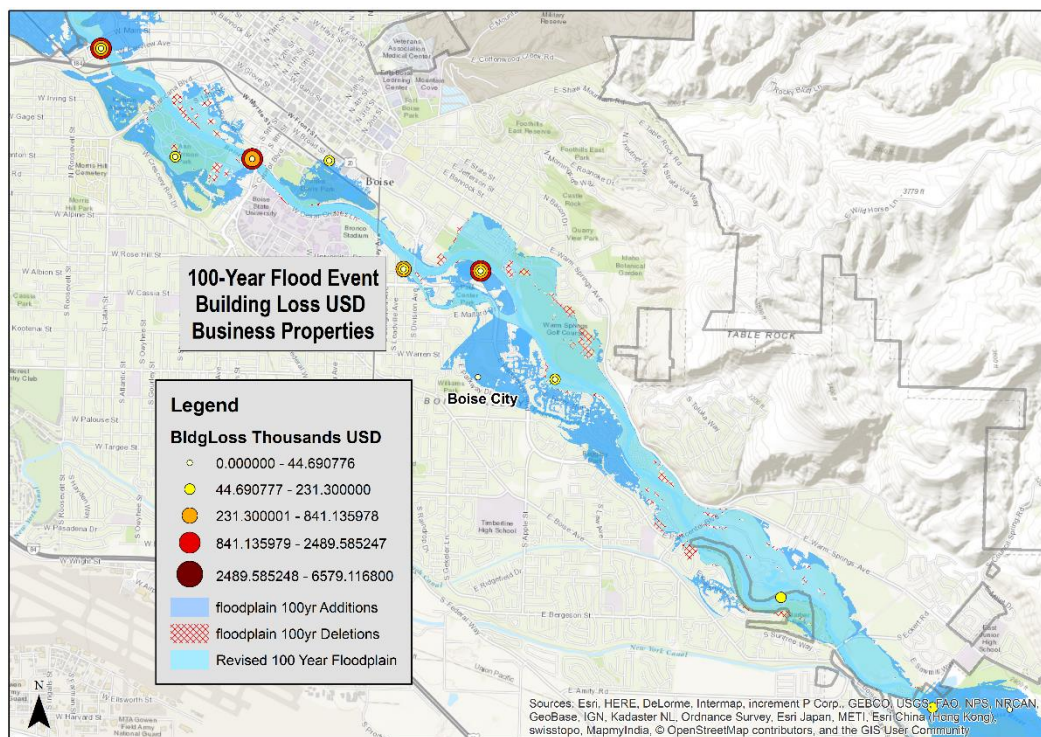
Data Source: FEMA, 2015

Figure 5.17 through Figure 5.20 visually show the range of monetary losses for all business structures within Ada County, Boise City, Garden City, and Eagle City. Of the 760 business structures analyzed, 449 showed monetary building losses, with the average loss at approximately \$58,500, and the largest monetary loss at approximately \$1,900,000. This property was located to the east of Garden City in northwestern Boise City. This portion of Ada County, including central Boise incurred the largest monetary losses to a 100-year flood event. Business structures within unincorporated portions of central Ada County also incurred large monetary losses. The smallest monetary loss to a business structure was approximately \$5.73 and this structure was located within central unincorporated Ada County near central Garden City.



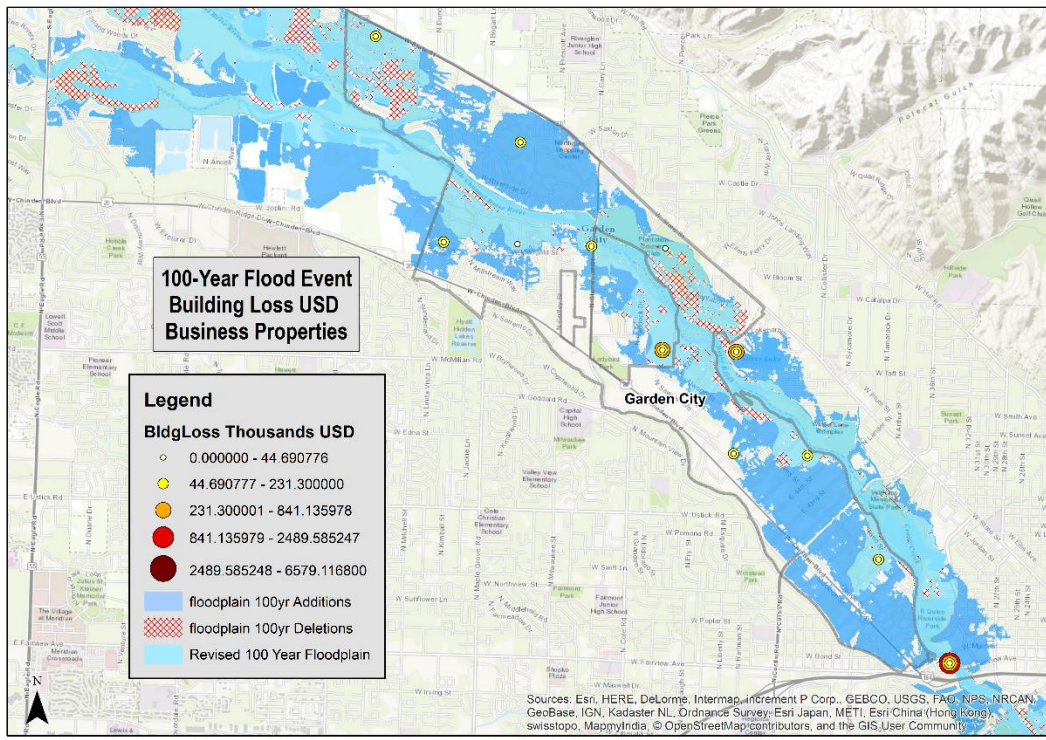


**Figure 5.17 Business Structure Flood Losses USD**  
Data Source: FEMA, 2015

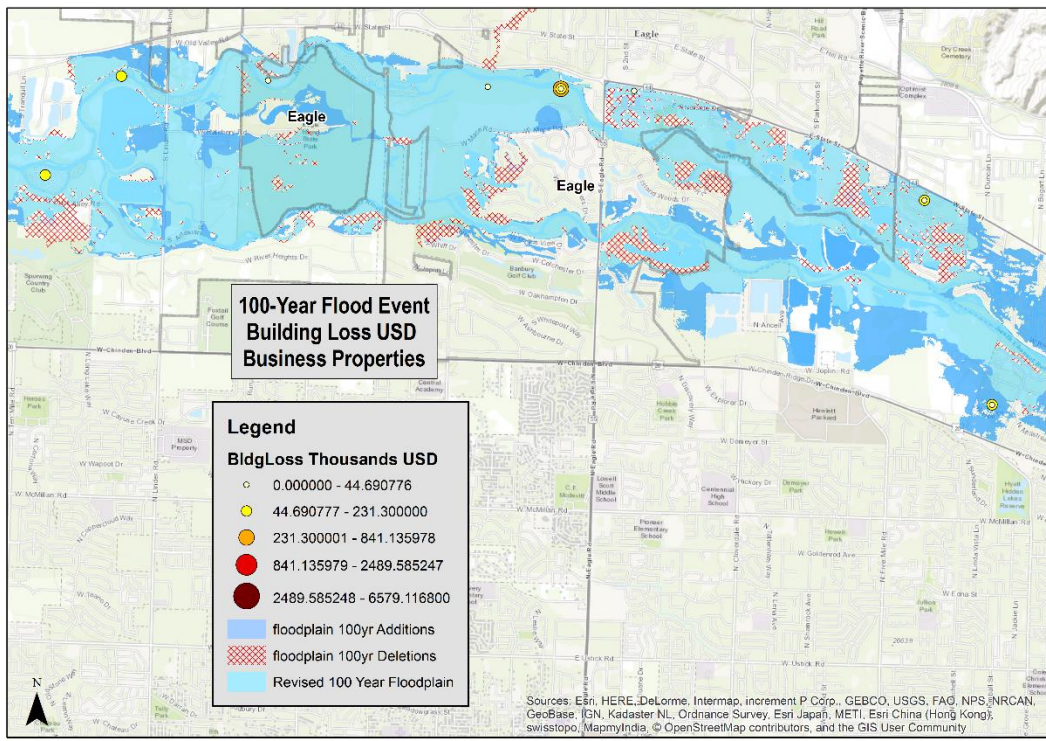


**Figure 5.18 Business Structure Flood Losses USD (Boise City)**  
Data Source: FEMA, 2015





**Figure 5.19 Business Structure Flood Losses USD (Garden City)**  
 Data Source: FEMA, 2015



**Figure 5.20 Business Structure Flood Losses USD (Eagle)**  
 Data Source: FEMA, 2015

### 5.2.1. Qualitative Analyses

#### *Interview Process*

Various interview questions were asked during the interview process, during which reoccurring themes then emerged. Interviews were analyzed for content and meaning using coding approaches to organize participant comments for their overt response about flooding and flood mitigation. A second coding further examined the data, identifying and applying sub codes to emergent themes and helped select exemplar quotes to illustrate the core nature of each theme. Exemplar quotes were independently selected by each of us to illustrate the key study findings. These quotes always represented the “mid point” of the range of responses, with a conscious effort to avoid the extremes. A second consideration was to select quotes that could also help establish the context for the theme, thus adding to the authenticity of the findings. A final coding scheme organized the data into analytically relevant categories (Table 5.3) to aid effective integration with the quantitative data. More detailed interview results can be found in Appendix A.

Table 5.3 Interview Themes and Exemplars

Emergent Themes	Exemplars		
Flood history	"Actual damage is not existent in the recent past. Yards perhaps could be flooded, but not structures"	"5 years ago, Dry Creek flooded. Behind Brookwood subdivision in Eagle. Flooding along Boise River, but not any that has damaged any structures to the best of my knowledge"	"Last big flood occurred 5 to 10 years ago. The bank was full. 6000 cfs. Flooding in the Greenbelt occurred. Properties in Eagle were most affected, but damage was limited. Lots of sandbagging"
Future flood risk	"As long as people want to build close to the river, there will be flooding"	"The question is not if the flooding will occur, but when it will occur. Had a previous experience where worked in an area and 100 year flood occurred 2 years in a row"	"Yes, will present a risk in the future. Aging infrastructure, low bridges, clogging hazards"
Effects on development	"Affect development, but not in a way you can put in dollars. If you are a developer and now know that these lands are in the floodplain, you may not develop a starter home development"	"All about risk for developer. Costs, time, etc. If the property is now going to cost more per month, you may have to talk to buyers that are more affluent"	"Infill is already happening in Garden City, new apartment complex (low-income) by these manufactured homes. Could see this occurring more so"
Effects on Real Estate	"There will be an initial problem. Will have to revalue the homes and prices will go down. Market will react, but then level out"	"Maybe at least 10 years for the market to adjust. Live in the home at least 7-10 years and gain appreciation, so not enough time for the market within that time. So will take longer than that for the market to adjust"	"Entire city is affected if all properties devalue. Lower tax base. No money for libraries, fire station, emergency services, and other services, etc"
Vulnerable populations	"Biggest hardships on those middle class"	"If mortgage increases to level where they cannot sustain, they will have to sell or vacate or pass on rent"	"May or may not affect depending on if they own the home and have no mortgage"
Potential effects on Garden City	"These changes will not affect the whole valley, just the most at-risk populations. The demographics are going to change. Especially in Garden City"	"People could come in and buy out Garden City properties"	"Concerned it will create slums and exacerbate homelessness"

Data Source: Interview Participants

Table 5.3 Interview Themes and Exemplars (continued)

Effects on Real Estate	"There will be an initial problem. Will have to revalue the homes and prices will go down. Market will react, but then level out"	"Maybe at least 10 years for the market to adjust. Live in the home at least 7-10 years and gain appreciation, so not enough time for the market within that time. So will take longer than that for the market to adjust"	"Entire city is affected if all properties devalue. Lower tax base. No money for libraries, fire station, emergency services, and other services, etc"
Vulnerable populations	"Biggest hardships on those middle class"	"If mortgage increases to level where they cannot sustain, they will have to sell or vacate or pass on rent"	"May or may not affect depending on if they own the home and have no mortgage"
Potential effects on Garden City	"These changes will not affect the whole valley, just the most at-risk populations. The demographics are going to change. Especially in Garden City"	"People could come in and buy out Garden City properties"	"Concerned it will create slums and exacerbate homelessness"
Adaptive capacity	"They (Eagle) put in ponds and grade the area, so they are not within the floodplain"	"Development in Eagle built up and had the money to do so"	"People will come in and buy with cash so they do not have to pay mortgages"
Map and model accuracy	"These maps are based on models and a model is only as good based on what you put into it. Based on LIDAR data that was from 2007. Lidar also cannot penetrate if the water is cloudy"	"Models also cannot model the specifics of the city, specific buildings, streets, etc. The model used for the floodplains (HEC-RAS) is 1 dimensional"	"Concerned with accuracy and they want it to present the actual risk in order to protect the people"

Data Source: Interview Participants

Table 5.3 Interview Themes and Exemplars (continued)

<p><b>Potential adjustments</b></p>	<p>"Most of Garden City is built out, with no mitigation funds. Property acquisition and green space could be an entire year's city budget. Trying to figure out what economic tool could use. Levees might be the only option (not a fan). River as a natural state is one of the biggest amenities. Maybe clever ways to make them nicer"</p>	<p>"Special flood district is a possible choice"</p>	<p>"Grading can help apply for LOMR and elevating structure can help apply for LOMA"</p>
<p><b>Pitfalls of NFIP</b></p>	<p>"Hidden costs of obtaining elevation certificates. Surveyor to provide one. Around \$750 dollar range"</p>	<p>"FEMA must declare the area a disaster area and just because flooding occurs, does not mean this is part of that area and ergo covered under the insurance policy"</p>	<p>"FEMA is going to stop subsidizing insurance and slowly increase rates"</p>
<p><b>Community Awareness and Education</b></p>	<p>"A lot of misinformation about the NFIP and the 100-year floodplain. People think that it is a flood event with a 1 percent chance of occurring"</p>	<p>"People being proactive in buying will depend on marketing. Public education will be important"</p>	<p>"Hardship occurs more so at the last minute, when those buying do not know they need flood insurance until they close and they have to pay out of pocket"</p>
<p><b>Other</b></p>	<p>"The unfortunate part is that people have been building on maps produced by the federal government, but now they are coming back and saying just kidding. Serious impacts on these people"</p>	<p>"The more people that have to purchase, the more level the rates will become. That is the problem now. There is a small group and therefore the rates are higher. Unique to itself, not a big market, but the more that you add to that market, the steadier the rates will be"</p>	<p>"Not going to lose out on tax base if the value goes down, the tax levies will adjust and then shift. Equates to a shuffle in the taxes. Those may end up paying more for those properties that cannot"</p>

Data Source: Interview Participants

### **5.3. Summary**

This chapter explicated the results for each quantitative and qualitative analysis performed for this study. The results from the floodplain revision analysis showed areas that were added and deleted to the 100-year regulatory floodplain. Results from the economic exposure analysis showed changes in businesses and economic industries flood exposure within Ada County. The Hazus-MH level II analysis results showed monetary flood losses to residential and business structures from a 100-year flood event. Lastly, results from the interview process were presented using a summarization of major themes and exemplary quotes. The next chapter integrates all of the aforementioned results and discusses the main findings of this research.

## **6. DISCUSSION**

### **6.1. Introduction**

In this chapter, the results from each quantitative and qualitative analyses are integrated and analyzed into major findings. There are 4 specific findings in which this chapter will discuss in further detail. These findings included: public versus private sector perspectives; vulnerable populations; business versus residential properties; and community risk perception. Moreover, study limitations and future research opportunities are addressed within this chapter.

### **6.2. Specific Findings**

#### **6.2.1. Public versus Private Sector Perspectives**

Participants interviewed for this research held positions in various professional sectors. These positions ranged from real estate agents, to insurance agents, planners, and property assessors. Results were analyzed and based on specific findings, these professionals were separated into two categories: public sector and private sector. Perspectives from the public and private sectors indicated a disparity pertaining to the NFIP, the 100-year floodplain revisions, and their potential impacts on the community.

Based on interview results, professionals within the public sector seemed to be concerned about the short and long-term impacts of the 100-year floodplain revisions on the community, rather than on an individual level. Alternatively, professionals within the private sector seemed to be concerned about the short-term impacts on the community and gave perspectives that concentrate on the impacts at the individual level. According to planners in Garden City, there is a worry that the new floodplain

additions within the city will initially cause a panic, “We are going to have a mess on their hands. Several thousand will come down to a staff of a couple of people. I do not know if we will have time to do other things. They will ask questions about data that they did not produce, questions that we cannot fully answer.” This belief demonstrated that the city may not have the local capacity in order to deal with major revisions to the 100-year floodplain. In the long term, there is a concern that these floodplain revisions will cause residents to abandon their homes, exacerbate homelessness, and possibly cause neighborhood blight. Moreover, professionals in the public sector are very much concerned with the impacts of the revisions on the real estate market and property values. Every public sector professional interviewed for this research stated that these floodplain revisions will lower property values, which in turn will decrease their tax base, and ability to support libraries, emergency services, etc. This will be especially prevalent for older homes within the new floodplain. There is also a concern that with decreased property values, properties will also be more difficult to sell due to the additional flood insurance premium cost that the homeowner will have to incur each month.

On the other hand, professionals in the private sector believed that the 100-year regulatory floodplain revisions will affect the community in the short term but not the long term. There is consensus that there may be an initial hit to the real estate market in which properties may be difficult to sell for a short period of time. Moreover, if there is a decrease in property values, the market will even out shortly thereafter. According to a founder of Build Idaho, “There will be an initial problem and homes will have to be revalued and prices will go down. The market will react, but then level out. It will take



maybe at least 10 years for the market to adjust. You have to live in a home at least 7-10 years to gain appreciation, so that is not enough time for the market to adjust within that time, so it will take longer than that.” This belief showed that there is a concern for the real estate market, but that this concern does not go beyond approximately 10 years. Moreover, there was also a consensus from professionals in the private sector that migration from California to Ada County will continue regardless and individuals with higher level incomes will continue to buy residential properties. Furthermore, if Garden City properties are in fact abandoned or cannot sell as a result of these floodplain revisions, the at-risk populations will be forced out of this centrally located area, and these individuals with high incomes will come in and buy out these properties.

Perspectives from the public and private sectors regarding the 100-year regulatory floodplain revisions and their impacts on development also showed a disparity. According to professionals within the public sector, impacts from the revisions, although they are not yet adopted, are already becoming prevalent. Public officials are making developers in the area aware of the possible changes and they are seeing community development going in three different directions. First, developers not invested in the community will continue build to the current regulations despite the possibility of future changes in development standards, which will transfer the future cost of increased flood insurance premiums to the buyers. Second, developers that may be vested in the community are making plans to build to possible future development standards despite the notion that this is not required. Lastly, public officials are seeing developers wait out the floodplain revision process. Also, concerns regarding floodplain

revisions are not only limited to new development. According to a planner from Boise City, “This (floodplain revisions) doesn’t only affect new development, but remodels and improvements as well.”

Alternatively, professionals within the private sector provided a different outlook regarding the developmental aspect. According to individuals within the real estate and development sectors, impacts from the 100-year regulatory floodplain revisions are not as concerning. Development will continue to occur regardless, concurrent with the recovery and growth of the construction sectors. Where and when development occurs is a calculation of various factors including cost and time. These changes will become another factor within a developer’s risk calculation. For example, a developer may decide a starter-home development is now no longer the best option, as the developable lands are now in the floodplain. Alternatively, a developer may decide to spend the money and raise the development and continue to build on lands within the floodplain. However, as a result of the extra costs, developers may shift their buying audience to those whom are more affluent.

Public versus private perspectives also varied regarding the accuracy of flood risk. Professionals within the public sector are very much concerned with risk being reflected accurately for the community as a whole. They are concerned with the accuracy of the 100-year regulatory floodplain delineation and the data and processes behind it. Every public official interviewed, except those in the land appraisal department, stated that the data going into the model does not accurately reflect what is on the ground and therefore is presenting major uncertainties. Some of the LIDAR data that was used in the creation of these revised floodplain maps is from 2007 and

since then, construction and development has recovered and grown significantly over the past few years, which has led to new development. The addition of new development may alter the direction and flow of waters in a flood event, which may correlate into a different flood risk for the community. According to planners from Boise City “We are concerned with accuracy and we want to present the actual risk in order to protect the people. We don’t want to pay for something if we do not have to.” This showed that professionals within the public sector show concerns for accurate flood risk at the meso-level.

Professionals within the private sector are concerned with risk being reflected accurately at the individual level through flood insurance rates. According to professionals within the insurance sector, insurance policies covered under the NFIP are not necessarily reflecting full actuarial rates, therefore not accurately reflecting flood risk, due to its \$250,000 maximum structural coverage. For example, there could be a home valued at 2 million dollars that is located within the 100-year regulatory floodplain, but due to NFIP stipulations, only \$250,000 can be covered by the program. The notion that FEMA mandates the purchase of flood insurance within flood-prone areas, but may not provide enough coverage for a structure if a flood event were to occur, shows a misinformation of what the flood risk may actually be for an individual. Moreover, due to the financial state of the NFIP and its recent amendments, insurance rates are increasing across the nation which further enhances the shared-risk paradigm. This increase in flood insurance rates may not accurately reflect the community flood-risk as rates are increasing due to an increase flood-risk in coastal

communities. The next finding within this chapter discusses the vulnerable populations that will be most affected by the revisions in the 100-year regulatory floodplain.

### **6.2.2. Vulnerable Populations**

Results of the floodplain revision analysis, economic exposure analysis, and Hazus-MH level II flood analysis show a large increase of residential and business exposure in the revised 100-year regulatory floodplain for Garden City, which will immediately result in an increase in populations required to purchase flood insurance that did not have to beforehand. This concept was then integrated and analyzed with Ada County real estate and income characteristics in order to determine the vulnerable populations most affected by the revisions in the 100-year regulatory floodplain.

Generally, these vulnerable populations are those strained by incurring an additional cost of a flood insurance premium in their monthly mortgage payments or rental payments that did not exist previously. Moreover, these populations are even more vulnerable as they may not be able to withstand an additional monthly cost based on their income level and budget. With this in mind, populations less affected are those that have a high income level or do not have mortgage payments or. Individuals without mortgages are not required to purchase flood insurance and the higher income level populations have a greater ability to adapt by either purchasing the flood insurance policy outright regardless of the cost, retrofitting their homes, or grading their properties.

There is also a consensus amongst the interview participants, both public and private sector professionals, that the citizens of Garden City will be most impacted by the floodplain revisions. According to the Ada County floodplain specialist, “Not

everyone will be financially impacted, but those living in Garden City will be as they did not have to pay for insurance before, but do now.” Garden City will be most impacted due to various factors such as large additions to the 100-year regulatory floodplain within the city, the current state of the real estate market, a prevalence of middle class populations, a large low income rental market, and a low local capacity to adapt at both the individual and community level.

Results of the floodplain revision analysis, economic exposure analysis, and Hazus-MH level II flood analysis show a large increase of residential and business exposure in the revised 100-year regulatory floodplain for Garden City, which will immediately result in an increase in populations required to purchase flood insurance that did not have to beforehand. This concept was then integrated and analyzed with Ada County real estate and income characteristics in order to determine the vulnerable populations most affected by the revisions in the 100-year regulatory floodplain.

Moreover, the current state of the real estate market within Garden City and Ada County as a whole further corroborates the notion that Garden City contains the most vulnerable populations. As previously mentioned in Chapter Two of this thesis, the real estate market is weak for properties below \$300,000 (Vanstrom, 2015) due to a lack of inventory and a low number of closed sales. According to a brief search of homes for sale on Zillow (2015), homes for sale within the floodplain additions in Garden City typically fall in the mid \$200,000 price range. As a result, individuals that may have to sell due to the financial hardship, may not be able to or will encounter severe difficulties, prolonging the additional flood insurance cost.

Income ratios within Garden City also make its populations more vulnerable. As stated previously, the middle class populations are vulnerable to the revisions in the 100-year regulatory floodplain as most often incur monthly mortgage payments on a stricter budget. According to the floodplain revision analysis results, the income ratios within Garden City are just above the national poverty level of approximately \$25,000 (HealthCare.gov, 2015), which places these populations within the middle class category according to the most standard definition middle class income falling in the range of \$25,000-\$100,000. Upper middle class is not included within this definition and is considered to be above \$100,000. Therefore, taking the income levels above the poverty level, but below the upper middle class income level, gives the standard definition of middle class used for this research.

According to various professionals interviewed for this research, there is a consensus that the areas of Garden City being added to the 100-year regulatory floodplain currently have a large prevalence of low-income rental properties. Moreover, this number of rental properties is said to increase due to new low-income rental property development in the area. Individuals often renting within these areas do so because of the inability to afford a home and incur a large monthly mortgage. However, even though renters do not incur large mortgage payments they are often on a stricter budget and may not be able to absorb any extra costs within their rental payments. There is potential rents to increase given the new floodplain additions, as rental property owners can pass the additional cost of flood insurance on to their renters. According to an insurance agent interviewed for this research “There are a lot of apartment complexes in the area [Garden City] and that will have an effect on them

[renters] as the person who owns the building will not have to worry about that [flood insurance cost].” This additional flood insurance cost, in collaboration with a renter’s budget, makes low-income renters a vulnerable population.

Garden City as a whole is also vulnerable to the revisions in the 100-year regulatory floodplain due to its low adaptive capacity. As stated previously in Chapter Two, Garden City has the lowest median income in all of Ada County, which translates into a smaller tax base and decreases the ability to adapt to hardships such as this increase of the floodplain. Building levees could mitigate the effects of a 100-year flood event and translate into a decrease in future 100-year regulatory floodplain delineations, ultimately resulting in a decrease in the number of renters/owners required to purchase flood insurance. However, building levees are expensive and the city lacks funds to sustain large capital improvement projects. According to the planners for Garden City “Most of Garden City is built out, with no mitigation funds. Property acquisition and green space could be an entire year’s city budget. We are trying to figure out what economic tool could use. Levees might be the only option, although not a fan of this idea.” To overcome this, individual-level adjustments can be made, such as purchasing the flood insurance policy outright regardless of the cost, retrofitting their homes, or grading their properties. However, vulnerable populations in Garden City have a decreased ability to do so as they lack the resources that an individual may have in the neighboring Cities of Boise and Eagle. The next finding in this chapter describes the disparities between residential and business properties pertaining to the NFIP, the 100-year floodplain revisions, and their potential impacts on each.

### 6.2.3. Residential versus Commercial Properties

Results from the floodplain revision analysis, economic exposure analysis, Hazus-MH level II analysis, and interview process showed disparities between residential and business properties. A visual analysis and comparison of the 100-year regulatory floodplain additions to the Boise City, Garden City, and Eagle City land-use maps showed that the additions are occurring mostly within residential zones. This will result in a larger floodplain exposure for residential properties resulting in a greater amount of residential flood insurance policies. Results from the Hazus-MH level II analysis corroborate this finding, as there are a total of 4,261 residential structures showing monetary building losses to a 100-year flood event and only 449 businesses showing monetary building losses to a 100-year flood event. However, despite large increases in floodplain exposure to residential properties, these revisions will still impact businesses.

This disparity in floodplain exposure for residential and business properties is further corroborated by this study's interview responses. Public officials perceive that revisions to the 100-year regulatory floodplain will more likely affect residential properties and strain home owners as there was no mention of impacts on businesses during their interviews. Interviews in the private sector did include responses related to business properties, yet these responses indicated that flood insurance for business properties are generally not part of their experience with the NFIP in their profession. For example, the two insurance agents interviewed indicated that they typically do not sell insurance to business properties. According to one insurance agent "Most commercial businesses will look outside the typical lenders for money and often times,



they (lenders) will not require it (flood insurance).” According to another insurance agent “I have not sold flood insurance to many businesses. They are not more expensive than residential. I do not know what a commercial loan looks like. Good question.” This quote coupled with responses from public officials show that there is a lack of knowledge regarding commercial flood insurance and the potential impacts of the floodplain revisions will have on local businesses. The last finding in this chapter describes the level of community risk perception determined by this study.

#### **6.2.4. Community Risk Perception**

Each professional interviewed provided a response displaying that they are concerned with some level of flood risk within the community. Professionals within the public sector perceive future flood risk based on their past flooding experience and increased knowledge of a potential 100-year flood event in the future. According to the Ada County floodplain specialist “The question is not if the flooding will occur, but when it will occur. I had a previous experience where I worked in an area and 100-year flood occurred 2 years in a row.” Professionals within the private sector perceive future flood risk based on their past experiences with minor flooding in the community. According to a real estate agent professional “I experienced flooding 5 years ago, where Dry Creek flooded behind the Brookwood subdivision in Eagle. There has also been flooding along Boise River, but not any that has damaged any structures to the best of my knowledge. This could present a risk with the same type of flooding as above under the right circumstances.”

Alternatively, results from the interview process showed that there are various factors affecting the level of risk perception for the community as a whole, including

both business and residential property owners. Interviews were initially focused on local business owners and their perceived impacts from the 100-year regulatory floodplain revisions; however, business recruitment was unsuccessful as local businesses perceived that this study did not pertain to them, showing a low level of risk perception. Responses from interviews also provided evidence for a low level of risk perception for residential property owners, even though no specific interview questions pertained to risk perception. According to various public officials, there is a misnomer of what the community believes to be a 100-year flood event. According to the planners of Garden City, "There is a lot of misinformation about the NFIP and the 100-year floodplain. People think that it is a flood event with a 1 percent chance of occurring. Also, people think if you are in the NFIP, your risk is greater than if you are not in the NFIP."

Private sector professionals also perceived community risk perception as being crucial to the potential new NFIP flood insurance requirements. There is a maximum of \$250,000 for flood insurance coverage on residential properties and this cap may distort an individual's risk perception that may not accurately reflect their actual flood risk. There is also a concern from the private sector that individual risk perception is altered based on FEMA's definition of flooding "A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is your property) from overflow of inland or tidal waters, from unusual and rapid accumulation or runoff of surface waters from any source, or from mudflow" (FEMA, 2011). According to a real estate agent, this definition greatly misinforms homeowners that are mandated to purchase flood insurance. "There

is a false sense of security for that policy to the consumer. They do not fully understand that FEMA has to okay the area, and their coverage will not cover just any type of flooding. I have seen people that want the policy even though that it is not required. However, they do not know that claims have never been paid around here.” Moreover, there is a consensus from professionals within the public and private sector that education will be necessary in order to address these community risk perception levels, as well as inform them about the new flood insurance requirements resulting from the 100-year floodplain revisions.

## **6.5. Summary**

This chapter has explicated the main findings of this thesis, which included public versus private sector perspectives; vulnerable populations; business versus residential properties; and community risk perception regarding the NFIP, 100-year regulatory floodplain revisions, and their impacts on the community. The next chapter will provide this thesis with an overview of the societal problem and goals for this research, followed by a summary of each chapter. Moreover, the research questions for this study will be answered and connected to the literature review within Chapter One. Study limitations and future research opportunities will then be explicated, followed by a conclusion stating the societal relevance of this research.

## 7. THESIS SUMMARY AND CONCLUSIONS

### 7.1. Overview

Losses from natural disasters affect both life and property. These losses have continued to increase in the past 50 years as a result of developmental patterns and an increase in frequency and magnitude due to climate change. Moreover, data is becoming more readily available as damages are being reported more frequently for disasters of all scales (Guha-Sapir and Santos, 2013). Floods are of particular importance, as they account for nearly one third of all natural disasters occurring between 1900 and 2006 (Birkholtz et al, 2014). As a result of this increased damage paralleled by an increase in recovery assistance, the federal government responded by enacting the National Flood Insurance Act (NFIA) of 1968.

The NFIA initiated the National Flood Insurance Program (NFIP), in which this research focuses on. The NFIP provides flood insurance for those living in flood-prone areas. Flood insurance becomes available if a community agrees to adopt and enforce floodplain management ordinances for new development within the Special Flood Hazard Area (SFHA) or the 100-year regulatory floodplain (Kunreuther and Roth, 1998). Moreover, mandatory flood insurance purchases are required for buildings with federally backed loans and are located within the 100-year regulatory floodplain. Flood insurance premium rates are delineated by zones on a Flood Insurance Rate Map (FIRM). Despite these flood insurance requirements, the NFIP initially reflected a flood risk paradigm which focused on providing affordable protection that reduced taxpayer costs and minimized the economic hardships of floods (Nance, 2015). This included

providing subsidized insurance rates for properties qualifying under the “grandfather rules,” which meant that with any update to a community’s FIRM, structures that were compliant with the former FIRM could still maintain the same insurance rate as before even if their flood zone changed. Also, if a flood zone altered as a result of map updates, the NFIP would allow for a two year delay so that a homeowner would have the ability to adjust to the new requirements. However, due to recent amendments to the NFIP, this flood risk paradigm has shifted to reflect full-actuarial rates and risk-based mapping based on state-of-the-art science (Nance, 2015). This risk mapping process includes community Flood Insurance Studies, which is a compilation of flood risk data for specific flood hazard areas within a community that enable engineers to delineate the specific flood zones through water depth (FEMA, 2011). As a result of recent amendments and FISs, maps are being revised nationwide. Revisions to the 100-year regulatory floodplain effect local communities in various ways. The goal of this research was to determine how a modification in the Boise River 100-year regulatory floodplain would affect the Ada County, Idaho and its residents and what future adjustments could arise from these revisions in order to increase community resiliency.

Chapter One of this thesis provided an overview of the literature and concepts related to this research. Gaps in the literature were also discerned. Included were concepts pertaining to natural hazards and theory; floods and the adjustments humans have made to cope with its effects; vulnerability; sustainability; mitigation and mitigation planning; and the National Flood Insurance Program (NFIP) and its effects on local communities. Chapter One concluded with the goals and questions of this research needed in order to advance the current NFIP research.

Chapter Two described the study area for this research. The state of Idaho and Ada County's geologic and natural resources were described, as well as the county's population and demographic, economic, real estate and development trends, land use, and flooding characteristics. Chapter Three described the quantitative data collection process, stating each data type and source used throughout this research. Chapter Four described the methodology of the floodplain revision analysis, the economic exposure analysis, the Hazus-MH level II flood analysis, and the interview process undertaken for this study.

Chapter Five then provided the results and findings for each analysis completed for this research. The areas of major floodplain revisions; business, economic sector and residential exposure; and interview responses were discerned within this chapter. Chapter Six presented the four major findings of this thesis including: public versus private sector perspectives; vulnerable populations; business versus residential properties; and community risk perception.

This final chapter answers the 4 research questions in this study. Research questions are addressed using current literature and the 4 major findings discussed in the previous chapter. Study limitations and future research opportunities are also provided, followed by a conclusion stating the societal relevance of this research, using the methods, results, and major findings.

## **7.2. Research Questions**

### *1. What revisions were made to the 100-year regulatory floodplain within Ada County?*

As this particular research is a case study, there is no prior academic research examining the revisions of the 100-year regulatory floodplain for the Boise River.

Changes made to this floodplain occur through either additions or deletions to the former floodplain. As previously stated, the majority of additions to the 100-year regulatory floodplain occur within residential land-use zones in the northwestern and southeastern portions of Garden City, as well as in unincorporated Ada County southeast of Boise City. Additions to the floodplain also occur in unincorporated Ada County west of Garden City. The majority of floodplain deletions occur within the eastern portions of Ada County near the City of Star and within small portions of Eagle City and Garden City. As a result of these revisions, various economic industries, businesses, and residences within the community are now exposed to a flood risk and mandatory flood insurance purchase requirements that were not present beforehand.

*2. Which economic industries, businesses, and residences are exposed to the new revised 100-year floodplain?*

Humans occupy the floodplain within Ada County due to various factors. Reasons include the close proximity to city centers and because of historical development patterns. These patterns are often a result of the desire to live in areas that are commercially advantageous and have scenic views (Tierney, Lindell, and Perry, 2001). As result of this desire to be located near flood-prone landscapes, commercial and residential properties must bear a substantial cost of making their communities safer and are responsible for most of the losses if a flood disaster were to occur (Kunreuther and Roth, 1998). Due to large revisions, a majority of them being additions, to the 100-year regulatory floodplain in Ada County, new businesses and residential property owners are now bearing this responsibility that did not previously have to and therefore must adjust to the new flood insurance requirements.

Businesses and their economic industries that are incurring this responsibility to purchase flood insurance that did not have to beforehand are majorly located within Garden City and include: Agricultural and Forestry Services; Beverage and Tobacco; Textile Products; Leather and Allied; Wood Products; Printing and Related; Plastics and Rubber Products; Machinery Manufacturing; Computer and Other Electronics; Electrical Equipment and Appliances; General Merchandise Stores; Broadcasting, Funds- Trusts and Other Financial; and Museums and Similar.

Residential property exposure increased two-fold as a result of the revised 100-year regulatory floodplain, which is consistent with the notion previously stated that additions to the 100-year floodplain occur majorly within residential land-use zones.

*What are the impacts of this revision on the community?*

The revised 100-year floodplain will impact residents within Ada County, as well as its incorporated communities. Business and residential property owners may be affected differently by mandatory flood insurance purchases depending on the price of the premiums. A property owner may be strained more by a higher flood insurance rate and vice versus. Flood insurance rates are based on various flood and structure characteristics. These characteristics include: the flood zone, location, building age, building occupancy, building design, whether or not a building is Pre- or Post- FIRM, and Base Flood Elevation (BFE) (FEMA, 2011). A Pre-FIRM structure is a building that is built before the community entered the NFIP, whereas a Post-FIRM structure is a building built after the community entered the NFIP. Other factors contributing to flood insurance premiums include: the amount of coverage included and the deductible chosen by the individual. Monetary losses said to incur from a 100-year flood event to



businesses and residential structures can help predict possible flood insurance rates. Business and residential property owners that may have to pay increased insurance rates are those located in areas east of Garden City, in northwestern Boise City, central Boise City, and unincorporated areas of central Ada County.

The revised 100-year floodplain will impact local businesses in Ada County yet which, and to what extent these impacts are, are largely unknown within the literature. Findings from this research further corroborate this notion. However, businesses that are larger, are located within a strong economic sector, or are located within finance, real estate, and insurance sectors are more likely to be prepared for flood events (Webb, Tierney, Dahlhamer, 2000). Individual businesses and economic sectors also highly depend on neighborhoods and communities, especially within mixed-use residential neighborhoods, where a majority of the floodplain additions are occurring. Therefore, the ability to adapt and cope to impacts from the 100-year regulatory floodplain revisions and the additional flood insurance purchase requirements may vary based on the health and characteristics of each individual business and their economic sectors, as well as how surrounding residential neighborhoods are affected by the same changes.

Alternatively, residential neighborhoods in Ada County will be greatly impacted by the revised 100-year floodplains. This is due to a large representation of residential property exposure and vulnerable populations within the floodplain additions. Furthermore, previous literature has found that residential properties located within the 100-year regulatory floodplain are reduced in value and this discount is even larger for properties that recently experienced a flood event (Bin and Polasky, 2004; Bin,

Kruse, and Landry, 2008; Posey and Rogers, 2010). Professionals within Ada County and its incorporated communities largely perceive that these same effects will occur after the adoption of the new 100-year regulatory floodplain. Paralleling the potential effects of the floodplain revisions on residential property values, are the potential effects the floodplain revisions may have on vulnerable populations.

Populations within flood-prone areas are already vulnerable due to historical development patterns however the poor or oppressed populations become even more vulnerable due to socio-economic conditions and a lack of adaptive capacity, or ability to cope (Bryant, 2005). This concept is known as Marxist geography and is summarized by the following concepts:

- The poor classes suffer the most
- Disaster relief maintains the status quo and works against the poor
- Measures to prevent losses to natural hazards reinforce the conditions of underdevelopment

The theory of Marxist Geography is consistent with the findings of this study. However, the poor is not the only class considered to be vulnerable for this study. As previously stated in the discussion section of this thesis, the vulnerable populations are those that will have to incur an additional cost of a flood insurance premium in their monthly mortgage payments or rental payments that did not exist previously, and are not able to withstand this additional monthly cost based on their income level and budget. This population includes the lower class, as well as the middle class

populations. Moreover, the vulnerable populations are majorly located within Garden City.

These vulnerable populations will feel the impacts of the revised 100-year regulatory floodplain in various ways. With an increased monthly mortgage payment, homeowners may be forced to sell. However, as their home is now located within the floodplain and has the attachment of a flood insurance requirement, the house may be difficult to sell. If a homeowner is unable to sell and is forced to incur the additional monthly cost on a budget that cannot absorb this cost, the probability of foreclosure increases. Foreclosures can then also have an effect on neighborhood property values. As the number of foreclosures in a neighborhood increases, the likelihood of neighborhood destabilization occurs and property values are likely to decrease (Rogers and Winter, 2009). This notion would further corroborate the decrease in property values said to incur as a result of location in a floodplain.

Population displacement for these vulnerable populations will likely occur, whether this occurs by having to sell immediately or foreclose on their home (Nance, 2015). This type of displacement will be more common for those the middle class populations. Displacement may also occur within the lower class populations, for they may be forced out by way of increased rental payments. Homelessness or neighborhood blight may then occur as a result of this displacement. Alternatively, populations may voluntary migrate from these areas, which might leave a swath of lower cost properties behind (Nance, 2015).

As a result of this displacement and/or voluntary migration, opportunity arises for gentrification to occur. More affluent populations would have the opportunity to move

in and redevelop these properties in the floodplain, as they are often considered to be desirable locations due to their scenic views and proximity to city centers. Over time, the demographics in Garden City and other floodplain additions that represent vulnerable populations may change.

*What potential adjustments can be made at the micro- and meso- level in order to adapt to and/or mitigate the negative impacts of these floodplain revisions and help increase community resiliency?*

Agency is defined as the capacity of human actors to project alternative future possibilities, and then to actualize those possibilities within the context of current contingencies, the current contingency being the NFIP (McLaughlin and Dietz, 2007). In order to offset the potential effects from the revised 100-year regulatory floodplain on an individual (micro-) and community scale (meso-), but within the limitations of agency and structure, various adjustments can be made accordingly. No current research provides for what those adjustments may be, therefore this questions aims to advance the literature in this respect.

On a micro- and residential property scale, adjustments that can be made as a result of the revised 100-year floodplain include: purchasing the flood insurance outright or retrofitting, by structure elevation or property gradation, in order to apply for a LOMR or LOMA. However, in order to do so there are actions that may need to be taken. First, a homeowner may have to look into their personal budgets and reallocate funds in order to cover the cost of an additional monthly payment or retrofit. Moreover, individuals may have to refinance in order to lower their monthly mortgage and decrease interest rates. Lastly, there is opportunity for if an individual has debt

elsewhere, they can file for bankruptcy and reaffirmation. This allows a homeowner to keep their home and avoid foreclosure by eliminating their debt and allowing for additional funds to pay for the flood insurance within their mortgage. Although there are adjustments at the micro- scale, these adjustments apply to homeowners and options for rental population are limited to the reallocation of their personal budget for additional funds to cover the increase in rental payments.

On a macro-scale, adjustments that can be made as a result of the revised 100-year floodplain can be approached by two methods. First, adjustments can be made to reduce the floodplain extent and second, adjustments can be made in order to deal with the revised floodplain as is, once it is adopted.

The first method can be approached through physical flood mitigation by way of levees. Levees protect neighborhoods by holding flood waters during a flood event, which therefore decreases the potential of flood damage. If a levee is accredited by FEMA, they are included on the 100-year floodplain maps and as a result decrease the geographical areas that are required to purchase flood insurance. However, levees are very expensive and communities included within this research do not have dedicated mitigation funds, therefore building levees exceeds their current capabilities. However, funds from external sources may be a potential option for these communities if they choose to build levees. There is a potential to create a flood district, or new tax levy, which would collect additional taxes for mitigation purposes. Moreover, communities may be able to apply for mitigation assistance through FEMA by applying for the PDM Grant, which provides funds for hazard mitigation planning and projects on an annual basis (FEMA, 2015).

The second method can be approached through community assistance actions, increased participation in the CRS program, and by appealing the 100-year regulatory floodplain maps. Community assistance can be done through educational programs focusing on flood-risk, the new floodplain requirements, and options for how an individual may cope with these requirements both businesses and residential properties. Education regarding these same topics may also be included in the curriculum of homeowner assistance programs through the U.S. Department of Housing and Urban Development (HUD) for the state of Idaho and other more local programs.

Community assistance can also be done through financial assistance, which may include creating tax incentives or credits for structure retrofits. Communities may also apply for mitigation assistance through FEMA by applying for the FMA grant, which provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis (FEMA, 2015). These funds can then go towards assisting homeowners and business owners with retrofitting.

The CRS is a program that enables individuals to receive subsidized insurance rates if their community has already implemented flood-mitigating actions. Some of these actions can include public information activities, preservation of open space, or the acquisition of repetitive-loss properties (FEMA, 2011). Ada County, Boise City, Garden City, and Eagle City are already participants in the CRS program yet increased participation in the CRS program and its flood-mitigating activities may be able to provide a lessened financial hardship on its residents while at the same time increasing flood awareness and reducing the potential for future flood damage. Lastly, if the

participating NFIP communities perceive the revised 100-year regulatory floodplains to be inaccurate, local officials may appeal the maps.

If the abovementioned adjustments can be made on both the micro- and macro-scale, negative impacts from the revised 100-year floodplain can potentially be offset, in turn increasing community resiliency.

### **7.3. Study Limitations**

As with any piece of research, there are inherent limitations that must be addressed. First, the revised 100-year regulatory floodplain used for this study are only drafts and may not necessarily be adopted. Appeals and public comments followed by additional studies could alter the final map that goes into effect. However, regardless of the final floodplain delineation, the potential implications and adjustments found in this study apply for communities nationwide that are also experiencing changes in their 100-year regulatory floodplains.

Interviews were conducted in order to determine community impacts resulting from the 100-year regulatory floodplain revisions. Findings from the interview responses are based on individual perceptions, and are, only potential impacts and may not necessarily occur. However, in order to supplement these uncertainties individuals were interviewed that presently have investments in the community and have prior knowledge and/or experience with the NFIP. Furthermore, interviews conducted for professionals in the public sector was representative of each participating NFIP community for this research except for the City of Eagle, where interview recruitment was unsuccessful. Due to the close proximity and collaboration between the communities in Ada County, public officials from, Boise City, and Garden City were able

to give their perspectives on the potential impacts that may occur as a result of the revised 100-year regulatory floodplain on the City of Eagle.

This research employed a loss-estimation flood model, which has inherent assumptions that may not always represent reality. For example, results presented visually show damages based on a general community scale, not an individual structure scale. In order to supplement model results and uncertainties, attribute tables were analyzed and interviews performed. This is consistent with each uncertainty that may be prevalent within each quantitative method used within this research.

Finally, limitations exist for the integration and comparison of the Hazus-MH level II flood analysis results and the economic exposure analysis results due to the different data sources. Data from the Hazus-MH level II analysis come from FEMA and the Ada County assessor's office, whereas data from the economic exposure analysis come from InfoUSA. Both data sources are sourced within the past 5 years and may not accurately reflect residential and business property counts and conditions in 2015. This holds for the IMPLAN data, which was provided for the year 2013. However, in order to maintain consistency within each particular method used for this research, data sources within each analysis are used for the same year. For example, the InfoUSA and IMPLAN data used for the economic exposure analysis are from the same year (2013), despite being outdated.

#### **7.4. Future Research**

Currently, there is little to no literature on what the impacts from floodplain revisions may be and there is ample opportunity for future research. A longitudinal study on the actual impacts from the revision of the 100-year regulatory will be needed



once the final maps are adopted, the findings of which will either reject or confirm the findings from this research. This study should analyze the effects on property values by using the Hedonic Valuation Method and change in List Price Reductions for homes that were not originally located within the floodplain, but are after the floodplain revisions. Moreover, demographic changes will need to be analyzed in order to determine if there were in fact displaced populations, a presence of migration, or signs of gentrification.

This research concentrates on the 100-year regulatory floodplain revisions for Ada County, however floodplain revisions are also occurring within Canyon County. Canyon County is located to the west of Ada County and is also located within the Lower Boise Watershed. A case study of similar nature to this one is necessary in order to gain a greater bioregional understanding. Finally, this could also create potential for multi-sector collaboration in future comprehensive planning and mitigation planning.

Additionally, there is little to no research regarding the spatialization of IMPLAN economic data. Although this research only focused on the types of industries provided within the data and did not use any of the other attributes, such as industry sales, employment compensation, etc., future studies that need to view these attributes spatially, now have the ability to do so using the method used for this research.

## **7.5. Conclusions**

Potential impacts of 100-year regulatory floodplain revisions and potential adjustments that can be made to mitigate/adapt to these impacts have been explored for the communities of Ada County, Garden City, Eagle City, and Boise City. This particular research has advanced the current state of literature which, as to date, there has been no known case study exploration of a floodplain revision within a community

and its associated impacts on business owners, residential owners, renters, property values, future development and growth, and potential hazard mitigation and adaptation actions. These results can help local communities nationwide plan long-term for future floodplain revisions by adopting policies within their HMPs and comprehensive plans that target vulnerable populations, as well as adjustments provided within this thesis. Adopting policies of this nature can help communities develop sustainably, which in turn may help increase resiliency. Finally, findings from this research may help to inform FEMA, as well as other state and local agencies, about the potential impacts these floodplain revisions may have on local communities. This may increase awareness and two-way communication between larger governmental agencies and local communities, which in turn has the ability to increase the amount of external assistance that FEMA and other state agencies may provide, which may reduce the negative impacts of floodplain revisions.

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## APPENDIX A

### INTERVIEW GUIDE

#### Public Officials

1. Has your specific community experienced flooding in the past? If so, when did this occur? What were the economic impacts?
2. Do you think that your community will be impacted by future flood events? If so, how?

SHOW MAP, All questions after this are related to changes.

3. Did you previously know about these revisions in the floodplain?
4. The average flood insurance policy costs approximately \$700 per year. Do you feel this will strain local businesses and residential property owners? If so, how or how not?
  - a. FOLLOW UP: Do you feel these changes will impact monthly mortgage payments? If so, how or how not?
5. Do you feel these changes will affect occupancy rates? If so, how or how not?
  - a. FOLLOW UP: Do you feel this will devalue properties within the floodplain?
  - b. FOLLOW UP: Do you think these changes will affect the ability to sell properties in flood-prone areas? If so, how or how not?
  - c. FOLLOW UP: Do you think the transfer of existing properties or new property development will become more difficult? If so, how or how not?
6. Do you feel these changes will affect development within the floodplain? If so, how or how not?
  - a. FOLLOW UP: Do you think these changes will affect building standards? If so, how or how not?
  - b. FOLLOW UP: Do you think these changes will shift development? If so, how or how not?
7. Do you feel that these changes will affect the growth or decline of the economic sectors in the community? If so, how or how not?
8. Is there anything you would like to add? Is there something I am missing and/or should consider?
9. Do you have any recommendations of other potential interviewees that may be impacted by this modification in the 100-year floodplain?
10. Can I contact you if I have additional questions in the future?

## INTERVIEW GUIDE

### Real Estate Agents

1. Has your specific community experienced flooding in the past? If so, when did this occur? What were the economic impacts?
2. Do you think that your community will be impacted by future flood events? If so, how?
3. Do you know if your community is involved in the National Flood Insurance Program? If so, what is your involvement?

SHOW MAP, All questions after this are related to changes.

4. Did you previously know about these modifications in the floodplain?
5. The average flood insurance policy costs approximately \$700 per year. Do you feel this will strain local businesses and residential property owners? If so, how or how not?
  - a. FOLLOW UP: Do you feel these changes will impact monthly mortgage payments? If so, how or how not?
6. Do you feel these changes will affect occupancy rates? If so, how or how not?
  - a. FOLLOW UP: Do you feel this will devalue properties within the floodplain?
  - b. FOLLOW UP: Do you think these changes will affect the ability to sell properties in flood-prone areas? If so, how or how not?
  - c. FOLLOW UP: Do you think the transfer of existing properties or new property development will become more difficult? If so, how or how not?
7. Do you feel these changes will affect development within the floodplain? If so, how or how not?
  - a. FOLLOW UP: Do you think these changes will affect building standards? If so, how or how not?
  - b. FOLLOW UP: Do you think these changes will shift development? If so, how or how not?
8. Do you think this modification in the in floodplain and corresponding policies could affect your current economic sector as a whole? If so, how?
9. Is there anything you would like to add? Is there something I am missing and/or should consider?
10. Do you have any recommendations of other potential interviewees that may be impacted by this modification in the 100-year floodplain?
11. Can I contact you if I have additional questions in the future?

## INTERVIEW GUIDE

### Insurance Agents

1. Has your specific community experienced flooding in the past? If so, when did this occur? What were the economic impacts?
2. Do you think that your community will be impacted by future flood events? If so, how?

SHOW MAP, All questions after this are related to changes.

3. Did you previously know about these modifications in the floodplain?
4. Do you think will this affect the price of premiums for flood prone properties in the community? If so, how or how not?
5. The average flood insurance policy costs approximately \$700 per year. Do you feel this will strain local businesses and residential property owners? If so, how or how not?
  - a. FOLLOW UP: Do you feel these changes will impact monthly mortgage payments? If so, how or how not?
  - b. FOLLOW UP: Do you think the maximum coverage of \$250,000 is enough for residential properties? If so why or why not?
  - c. FOLLOW UP: Do you think the maximum coverage of \$500,000 is enough for non-residential properties? If so, why or why not?
6. Do you think the insurance sector will grow in the community, as a result of these changes? If so, how or how not?
7. Based on all your answers to these prior questions and experience, do you feel businesses and residents in the community will likely purchase flood insurance?
8. Is there anything you would like to add? Is there something I am missing and/or should consider?
9. Do you have any recommendations of other potential interviewees that may be impacted by this modification in the 100-year floodplain?
10. Can I contact you if I have additional questions in the future?

## INTERVIEW GUIDE

### Construction

1. Has your specific community experienced flooding in the past? If so, when did this occur? What were the economic impacts?
2. Do you think that your community will be impacted by future flood events? If so, how?
3. Do you know if your community is involved in the National Flood Insurance Program? If so, what is your involvement?

SHOW MAP, All questions after this are related to changes.

4. Did you previously know about these modifications in the floodplain?
5. Do you feel these changes will affect occupancy rates? If so, how or how not?
  - a. FOLLOW UP: Do you feel this will devalue properties within the floodplain?
  - b. FOLLOW UP: Do you think these changes will affect the ability to sell properties in flood-prone areas? If so, how or how not?
  - c. FOLLOW UP: Do you think the transfer of existing properties or new property development will become more difficult? If so, how or how not?
6. Do you feel these changes will affect development within the floodplain? If so, how or how not?
  - a. FOLLOW UP: Do you think these changes will affect building standards? If so, how or how not?
  - b. FOLLOW UP: Do you think these changes will shift development? If so, how or how not?
7. Do you think this modification in the in floodplain and corresponding policies could affect your current economic sector as a whole? If so, how?
8. Is there anything you would like to add? Is there something I am missing and/or should consider?
9. Do you have any recommendations of other potential interviewees that may be impacted by this modification in the 100-year floodplain?
10. Can I contact you if I have additional questions in the future?

## INTERVIEW GUIDE

### Assessor

1. Has your specific community experienced flooding in the past? If so, when did this occur? What were the economic impacts?
2. Do you think that your community will be impacted by future flood events? If so, how?

SHOW MAP, All questions after this are related to changes.

3. Did you previously know about these revisions in the floodplain?
4. Do you think this will impact properties, both business and residential in the floodplain? If so, how or how not?
  - a. FOLLOW UP: Do you feel this will affect property taxes? If so, how or how not?
  - b. FOLLOW UP: Do you feel this will devalue properties within the floodplain? If so, how or how not?
  - c. FOLLOW UP: Do you think these changes will affect the ability to sell properties in flood-prone areas? If so, how or how not?
  - d. FOLLOW UP: Do you feel these changes will affect occupancy rates? If so, how or how not?
  - e. FOLLOW UP: Do you think the transfer of existing properties or new property development will become more difficult? If so, how or how not?
5. Is there anything you would like to add? Is there something I am missing and/or should consider?
6. Do you have any recommendations of other potential interviewees that may be impacted by this modification in the 100-year floodplain?
7. Can I contact you if I have additional questions in the future?

## INFORMED CONSENT FORM

University of Idaho

Title of Project: Community Impacts of Changing Regulatory Floodplains: An Ada County, Idaho Case Study

Principal Investigator: Karen Humes  
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1. Purpose of the Research Study: Communities most at-risk to major flood events are recommended to participate in the National Flood Insurance Program (NFIP) put forth by the Federal Emergency Management Agency (FEMA). In order to receive the ability to purchase flood insurance, the community must enact and enforce floodplain regulations. The goal of this program is to ensure that residents living within the floodplain bear a substantial cost of making their communities safer. Furthermore, purchasing flood insurance is considered to be a self-protective behavior, which can reduce monetary flood damage by 80%. Flood insurance is mandatory within the 100-year floodplain and recommended within the 500-year floodplain. These stipulations have a great impact on the local community. Also, flood insurance purchasing actions are greatly affected by an individual's risk perception and the purchase or lack thereof may affect the level of resilience at an individual, industry, and community scale. The goal of this research is to determine how a change in the 100-year regulatory floodplain affects various economic industries in a community, more specifically at a county level. Qualitative data will be collected through local stakeholder interviews in order to explore perceived impacts and behaviors of this change, which will be able to guide future decision making for various industry sectors and in turn increase overall community resiliency.
  
2. Duration: Participants will be involved in individual interviews of no more than two hours total in length. With your permission, you may be contacted for additional follow-up research activities, like follow-up interviews or questionnaires, based on the results of the interviews. You are NOT required to participate in follow-up research activities, and this document does NOT give your consent to participate in these activities. You may withdraw your permission for us to contact you about future follow-up research activities at any time by notifying one of the investigators above.
  - I **would** like to be contacted about future follow-up research activities.
  - I **would not** like to be contacted about future follow-up research activities.

3. Accurate assessments of your comments made during the interviews are critical to the exactness of this research. With your permission, you will be audio recorded. These recordings will be stored in a locked file cabinet in 116 McClure Hall, University of Idaho, Moscow, ID 83844, which is accessible only to research personnel. The recordings will be physically destroyed no more than one year after project completion. Please indicate your choices below:
- I **agree** to be audio recorded
- I **do not agree** to be audio recorded
4. Discomforts and Risks: The risks to participating in this research project are no more than that experienced in everyday life. You will have the opportunity to stop the interview process at any time and refrain from answering questions that you feel is beyond your job description, your expertise, or simply do not want to answer. You will be in control of the process and will give feedback as you see fit. Again, at any time during the process, you can stop the session should you experience discomfort or just do not want to answer any more questions.
- 5. Benefits: This research may provide new insights into providing a framework for how changes in regulatory floodplains might affect local communities and its various industries. It may also provide insight to these industries, local and franchise business owners, policy makers, planners, emergency management officials, and other local stakeholders, in order to plan for future flood events and increase overall community resilience.**
6. Statement of Confidentiality: No names from this research will be released without prior written permission. In the event of a publication or presentation resulting from the research, however, participant occupations and or office or position will be listed, and it is possible that identities could be ascertained based on the release of this information. However, with your permission, the ability to cite information from professionals in the field such as yourself will add enormous value and credibility to this research. The audio will be kept in a locked cabinet in 116 McClure Hall, University of Idaho, Moscow, ID 83844. The tapes will be retained until no longer than one year after the project completion. Only University of Idaho Geography research personnel will have access to recordings of the sessions. The following may review and copy records related to this research: The Office of Human Research Protections in the U.S. Department of Health and Human Services, the Social Science Institutional Review Board and the PSU Office for Research Protections.
- I **agree** to be quoted and/or cited and prefer to be quoted and/or cited in the following manner: \_\_\_\_\_
- I **do not agree** to be quoted or cited
7. Right to Ask Questions: Please contact Karen Humes at 203 McClure Hall University of Idaho Moscow, ID 83844; (208) 885-6506; khumes@uidaho.edu, if you have questions,

complaints or concerns about the research. You can also contact her if you feel this study has harmed you. If you have questions about your rights as a research participant, contact University of Idaho's Office of Research Assurances at (208) 885-6162.

8. Compensation: No compensation will be offered.
9. Voluntary Participation: You do not have to participate in this research. You can end your participation at any time by telling the person in charge. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to consent to participate in this research study. If you consent to participate in this research study and to the terms above, please sign your name and indicate the date below.

You will be given a copy of this consent form to keep for your records.

I have read and understand the information provided, and **AM** willing to participate in this study.

\_\_\_\_\_  
Participant Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Investigator Signature

\_\_\_\_\_  
Date



## Interview Transcripts

(Development Services):

- A lot of misinformation about the NFIP and the 100-year floodplain. People think that it is a flood event with a 1 percent chance of occurring.
- Also, people think if you are in the NFIP, your risk is greater than if you are not in the NFIP.
- High cfs, but majority of this is without the dams (flood history) last date 1971. Shows historic flows without the dams.
- If there is a repetitive loss, you have to address those. 1 repetitive loss. Storm drainage, not Boise River. 1 home.
- Haven't had repetitive loss in the last 10 years
- Actual damage is not existent in the recent past. Yards perhaps could be flooded, but not structures.
- Community could be impacted by future flooding. 3 dams. Probability is much lower than it used to be with the dams. Could be a major catastrophe that breaks that dam. Robust system to keep these maintained. Things are in place to reduce probability.
- Previously knew about revisions.
- A lot worse than \$700 annual premium.
- Models are going to be inaccurate, somebody's best guess on what would occur. FEMA adopted base flood elevations. Community was previously regulated to this and so they built based on these regulations. FEMA came back saying maps are inaccurate and saying now you are in the 100-year floodplain. People trusted these regulations, built there, and now BFEs have changed. Homes and businesses are going to end up paying more than \$700 dollars annually. Census Tract 11, at risk population. Median income: \$23,000.
- Concerned it will create slums and exacerbate homelessness.
- If mortgage increases to level where they cannot sustain, they will have to sell or vacate or pass on rent.
- Homelessness is critical already in Garden City.
- 2 cities in Garden City:
  - At risk population: see map
  - High value properties: see map
- People will come in and buy with cash so they do not have to pay mortgages.
- Curious to see how it will play out with the high value properties, as this will devalue their properties.
- Entire city is affected if all properties devalue. Lower tax base. No money for libraries, fire station, emergency services, and other services, etc.

- No mitigation funds. Garden City is small community. 4.2 miles land. 11-12 thousand people. Blighted property already. Tax base has to support 100-200 cars already passing through the area. A lot of policing.
- Already a constrained budget to manage the city.
- Engineer looked at installing levees. Estimated around 1 million per levee for one mile. There is 5 miles to protect (Don't quote exact). Both sides of river.
- No money for mitigation. Ways to do that. Create a new taxing district. Flood control district.
- A lot in the CRS program. Building codes are holding them back from higher rating. Would not be "a drop in the bucket for overall cost."
- Ability to sell will go way down.
- Already affecting development. Not required to regulate to these maps yet, but already letting people know.
- Expensive for new development. New development will be easier than existing. City is mostly built out. Massive structures will be hard to retrofit and raise to BFE.
- Possibility to retrofit. This is where you have to look at what is going on with land use side. Thousands of mobile homes that are not taken into consideration when outside 100-year floodplain (anchoring, etc.). Now they are in the floodplain and are now nonconformities. Would be difficult to retrofit, but not impossible.
- However, people are more worried about getting food on the table, then this is not financially feasible to retrofit.
- Perhaps there is grant money. Not easy to come by.
- Development shifts. Back to the at-risk population. Force them out of a centrally located place. If the only new feasible development is new development that is expensive to build, more likely new population will likely end up there that can afford the new regulations.
- Number of affordable housing projects occurring, also working towards new maps. Being creative about building garages that can get wet. Living space elevated over garages.
- The unfortunate part is that people have been building on maps produced by the federal government, but now they are coming back and saying just kidding. Serious impacts on these people.
- Level of understanding the public has is surprising. They think that there is really only a 1 percent chance of this occurring. When in reality they could have a 24 percent chance of flooding over a 30-year mortgage.
- Even the more savvy people talk about the dams and that they will not let the community flood.
- A couple of events where the river is high, but no damaged structures.

- Going to have a mess on their hands. Several thousands will come down to a staff of a couple of people. Do not know if we will have time to do other things. They will ask questions about data that they did not produce. Questions that we cannot fully answer. Hired engineers to see things in the modeling.
- Going to have to have outreach (meetings, etc.) But do not think people will walk away with a better understanding.
- May dictate where people choose to buy, with requirement of flood insurance.
- Grandfather rights for insurance rates. This is all over the place in the community. However, if someone pays off their house, now no longer have to have the mortgage. Common occurrence. Grandfather rights will not apply. Huge public outreach to not let grandfather rights lapse. Even though the outcome is an expense that may not be worth it. It will however be cheaper with the grandfather rights.
- NFIP is to protect the lender, not the property owner.
- If Garden City were to flood to this level, it will be a national disaster and the insurance does not matter anymore.
- Telling people your choice, this is what we have. If you are a developer that is not vested in the community, you might choose to only go to current standards and not consider the possibility of these new regulations because this is cheaper.
- If it is your own home or business, you might make a different choice. Even now people are building to these maps. Also, seeing the opposite and people feel they do not need to build to these maps.
- Also seeing people stand still. Expensive. Playing the money game. Can they wait this out and build to the new standards.
- Seeing a recovery of construction right now. Hasn't stopped construction in Garden City, but seeing some people wait.
- Very much nervous about this. Government adopted model is changing and creating serious affects. Hope that the grandfather abilities remain for the community.
- In an ideal world, you would not build in floodplain, but already a lot of property rights that exist in that floodplain.
- Most of Garden City is built out, with no mitigation funds. Property acquisition and green space could be an entire year's city budget. Trying to figure out what economic tool could use. Levees might be the only option (not a fan). River as a natural state is one of the biggest amenities. Maybe clever ways to make them nicer.
- Environmental impacts of levees, habitat, and speed of water could increase (best guess). Addressing the flooding concerns could cause other environmental impacts. Community would have to deal with constantly battling other federal regulations as well.
- Think that they will end up with levees. Figure out how to fund. Special flood district is a possible choice.

- Look into every funding source. Grants are expensive on the community, hard to get. A ton of work and money going into the preparation. Won't not look. Must balance. What are the things that you need to pay for in the near future?
- Garden City is being hammered. Looking at it from FEMA's perspective, having these new models is a good thing, to know where the risks are.
- Some areas where water is leaking is creating the large expansion. Sand bags could fix this, but it is not counted in the model as it is physical labor.
- Levees are not included within the maps. Garden City is therefore in seclusion giving the ability to fix and maintain these levees, so they can be hydraulically significant. They are showing on the maps they are not there.
- Conservative maps. This is just a guess. Other things could happen and change the flood waters. Tree in the water, etc.

(Real Estate Agent/Development):

- Seen the river come up, never seen flooding. The Shores Subdivision. River came up to the steps.
- If we have double the annual snowfall, flooding could be a problem. Leaving the preparedness to the politicians though.
- No experience with the NFIP. Have never worked with a home in the floodplains or been involved in a sale, but this is could be changing with the new revisions.
- Seen the maps and knew about these modifications.
- If you were not in the floodplain and now you are. This is a huge burden. But if going in knowing that you are in the floodplain and you want to be on the river that is your choice.
- People that want to live on riverfront property are going to pay the price or they have a number (price) that they can spend, stick to that. Therefore, might have to get a smaller home or not live on the river.
- Absorption rate will probably lower for the developer if people are no longer living on the river.
- People could just get a smaller house.
- If I want to live on the river, I am going to pay the price. But if I have only x, I am going to go where x is.
- For Boise: \$1,000 price increase, 513 people can no longer afford the property.
- Over the course of time, this will all even out. Initial reaction to the market.
- Buying a house is all about the seller's and buyer's motivation. If you need to sell immediately, you might sell for lower. If you like the house, you will pay the price.
- Compare and shop, start to have perceived values of homes.
- There will be an initial problem. Will have to revalue the homes and prices will go down. Market will react, but then level out.

- Maybe at least 10 years for the market to adjust. Live in the home at least 7-10 years and gain appreciation, so not enough time for the market within that time. So will take longer than that for the market to adjust.
- Affect development, but not in a way you can put in dollars. If you are a developer and now know that these lands are in the floodplain, you may not develop a starter home development.
- All about risk for developer. Costs, time, etc. If the property is now going to cost more per month, you may have to talk to buyers that are more affluent.
- Or spend money and raise the development.
- Subdivision in Eagle with no amenities, but as opposed to Legacy Subdivision with amenities that is a different type of purchase. He is gambling a lot of money that people are going to like his project.
- People have been living on and enjoying the river for years.
- 13-15 years living in Boise and never seen homes being that devastated. He would gamble to live on the river. Always a balance.
- Example: Not a demand for LEED homes in Boise because home buyers do not want this. Developers cater to what the market place wants in the community.
- RiverWalk, River District, all right on the river. Developers can look and see how these are affected and see how they are doing.
- The risk has not gotten greater, just a larger impact area. World has not changed.
- Currently, 20% increase in permits from last year. 40% of audience on his website is from California. Boise market, construction in particular, are not that local.
- Local real estate markets still does fairly well.
- As long as the economy is good in California, people are going to sell their homes and move to Boise. Period.
- If HP closes, would still have people moving here.
- People move here because they have been coming here for years. Really enjoy it. Visiting siblings, grandchildren, etc. Normally retired, semi-retired or can telecommunicate to work.
- World is going to continue. Will be some adjustments and corrections, people will find properties to develop because they need to. Need to keep up with the demand.
- Development trend is West of Boise. Eagle is doing very well, really nice subdivision. NE Boise also offers a great lifestyle. People also ask about Meridian and Star for the open space. Get away from traffic and people.
- Look at tables on Build Idaho.
  - Shows permit change for years 2011-2015
  - Average sale prices: 2006-2015
  - Month by month building activity
  - Permit Review years 2012-2015, month by month

- Market correct itself 2012
- The Big Picture 2005 to 2015

(Real Estate Agent):

- 5 years ago, Dry Creek flooded. Behind Brookwood subdivision in Eagle. Flooding along Boise River, but not any that has damaged any structures to the best of my knowledge
- Presents a risk with the same and type of flooding as above under the right circumstances.
- Different parts of town require different types of flood insurance. Talk about this with clients all of the time. Difference between areas that require it and places where flood insurance is available, but not required.
- Perception from the public that if it is required, it will flood.
- To the best of his knowledge, there has been no flooding that has occurred that is covered by the flood insurance, therefore promoting benefits that are not available.
- Has not seen in map format, the revisions made.
- Dealt with neighborhoods that have come in and out of different flood zones based on elevation certificates that they get.
- Combination of insurance premium and the elevation certification pose large costs. The biggest problem is the perceived loss by the public. This is what consumers feel is going to happen because the flood insurance is required.
- Does not know if it will affect occupancy rates, but it will affect the sellability of these properties, or their overall value.
- Hidden costs of obtaining elevation certificates. Surveyor to provide one. Around \$750 dollar range.
- Has a chilling effect on housing values, relative to people's perception.
- A lot of homes that are 3 or 4 times that amount (\$150,000). Also, part of the lot has been in the floodplain (AE zone) but the house is not. Must get information on where those two are separated.
- No concerns about maximum coverage. However, the effectiveness of the coverage has been brought up. FEMA must declare the area a disaster area and just because flooding occurs, does not mean this is part of that area and ergo covered under the insurance policy. Cannot utilize the policy.
- Never found anybody that has been covered by FEMA's standards. Seems that a catastrophic event has to occur for FEMA to pay claims.
- Already has affected development. If you are developing, you can choose to develop outside of the floodplain.
- That is what they do in Eagle. They put in ponds and grade the area, so they are not within the floodplain.

- Neighborhood specific (in terms of economic sector being affected). There is always a choice. River communities are attractive. Those most impacted will be in Garden City and Boise areas where the housing prices are much less to begin with.
- A lot more significant impact of an increased mortgage for those that are living in a \$200,000 house compared to a \$700,000 house.
- False sense of security for that policy to the consumer. Do not fully understand that FEMA has to okay the area, and not just any flooding has occurred.
- Seen people that want the policy even though it is not required, but they do not know that one has never been paid around here.
- FEMA does a good job of marketing to get premiums to support those areas that are more at risk and designated to be covered.
- Designate the area. Mortgage and lenders require the policy. Have to get it, but then it is never paid.
- Never paying and ridiculously tight restrictions of designating it a disaster area for a claim to be paid is in a sense fraudulent to the consumer.
- A lot of people want to get the policies, but do not realize that having it does not do anything.

(Insurance Agent):

- Always been a certain amount of flooding. Lived in the NE Boise area and there was basement flooding every year. All minor.
- Eagle has experienced more flooding due to development from Boise area. That is what changes the floodplain. Been reassessed a few times in the last 20 years, but no major flooding in Boise.
- Snake River does more flooding in Canyon County.
- As long as people want to build close to the river, there will be flooding.
- All depends on snowpack, overflow or irrigation variables for flooding. Zero control over snowpack.
- First thing: Flood determination by address. Usually brought about by getting loan and they find out that they have to have it. Bank/lender will know if it is in the floodplain, they will call him up to determine exactly.
- There are other carriers out there for flood insurance, but not many (Lloyds of London).
- 2 most prevalent (NFIP and Lloyds).
- Second: Need elevation certificate, most time consuming. Need land surveyor or engineer. Based on specific elevation of house, not property.
- Then you can get an accurate quote on insurance. 1 foot below: more expensive and 1 foot above: less expensive.
- Anything between BFE and 1 foot is still expensive, but cheaper than if below.

- Neighbors also come into play. If there grade is higher than you, the water will flow into your yard. Individual structure is not the only variable.
- Areas in Boise are surprising. Municipal Park which acts as a levee, but all properties north of that are below BFE.
- Can't guess by looking. Condos have been on the river (15 ft. away) that were not in the flood zone. Too many factors and that is why elevation certificate is needed.
- Is not a quick process.
- Buyers often do not know this until closing, but others do know. Not paying attention and doing their job. Loan originators, real estate agents are more worried about making money.
- Often times, appraisal will be correct and take the floodplain location into consideration, even though real estate agents miss this.
- Has gotten better, but not good enough. Still get the panic when closing on a home and buyers do not know until the last minute that they need flood insurance.
- Once the premium is paid, will not get a refund. But if you sell or get taken out of floodplain you can. Does not take seasonal factors into play. Not just going to cover you during the hard times.
- Haven't seen the recent maps (Draft maps).
- Garden City has seen so much development, which has changed the flow.
- Premiums more reflective of risk and have risen to reflect this. Will also continue to rise. Presents a hardship for those that are already living in a community and now are placed in the floodplain. Does not present as much of a hardship for those that are choosing to build or move there because they are fully aware of what they are doing and are making the decision.
- 250,000 required by federal program, but you can get excessive coverage.
- Rarely concerned with that not being enough. And for those that are concerned, it will not present a hardship. They obviously have the money.
- The more people that have to purchase, the more level the rates will become. That is the problem now. There is a small group and therefore the rates are higher. Unique to itself, not a big market, but the more that you add to that market, the steadier the rates will be.
- Nobody is going to want this market. No new players will move in as more people are having to purchase flood policies.
- Everyone wants to sell something, but no one wants the risk. It is not just going to be one home. Will not have enough money if all policies present claims at once as in a true flood event. Not enough people will little risk chipping in.
- There are very few that buy for the risk of flooding. Most people get it because they are required to. Going back to Municipal Park, they are protected but below BFE and therefore still have to purchase a policy. Paying for something they will



never see. But still, if it is a requirement, if they chose to live there, they have to follow the rules if they want a loan.

- Will not shift development. Developers are aware now and can make adjustments to not be in the floodplain so they can gain LOMA or LOMR and therefore those living there do not have to purchase flood insurance or those that do have lower rates.
- At-risk populations are going to have a hardship if they have to sell their properties. Older people have lived there forever, and have not had a mortgage, but when they do sell, they might encounter difficulties.
- Garden City is becoming also more industrial and so has not really been a big market to begin with. Also, there are a lot of apartment complexes in the area and that will have no effect on them as the person who owns the building will have to worry about that.
- If the economy is good, people will still buy properties in the floodplain.
- Also, people will come up with cash for properties.
- Things are not going to change drastically, people were required back then to purchase flood insurance and still have to now. Doesn't mean it won't present difficulties, as it did then.
- Lenders are being stricter now, as they would miss the requirement for flood insurance and then get audited.
- More people with cash money today, but not for residential properties. Most commercial businesses will start to bring cash.
- Most commercial businesses will look outside the typical lenders for money and often times, will not require it.
- More residential properties than commercial businesses purchase policies.
- Many people think that if Lucky Dam fails, they will get help from the federal government. Although not as many people think this today. The awareness is better. Real Estate agents are better at disclosing and when they don't, it's often because they are not paying attention. Just want to make their money.
- Hardship occurs more so at the last minute, when those buying do not know they need flood insurance until they close and they have to pay out of pocket.
- The digitizing of maps has helped a ton with designating which properties needs what type of policy.
- Hardship for those properties that technically do not need the insurance as their house is not in the floodplain, but the property is. Have to jump through all the hoops in order to get an LOMA. Often times, in the meantime have purchase the policy until this occurs and often still have to pay after depending on the lender.
- Hold onto certificate, when you sell the house, it will make the process much easier.
- The insurance can be transferred to the new owner, but this is not automatic. They do not have to hand over their elevation certificate if they choose not to.

(Floodplain Specialist and Engineer):

- Last big flood occurred 5 to 10 years ago. The bank was full. 6000 cfs. Flooding in the Greenbelt occurred. Properties in Eagle were most affected, but damage was limited. Lots of sandbagging.
- Also flooding that occurred 2 years ago in Eagle due to agricultural tilling. Set up command center and everyone came together and collaborated with all their resources.
- The question is not if the flooding will occur, but when it will occur. Had a previous experience where worked in an area and 100 year flood occurred 2 years in a row.
- Deals with all unincorporated communities in the County. Reviews applications to make sure that if people are building, they are elevated.
- Has seen the floodplain revisions.
- Not everyone will be financially impacted, but those living in Garden City will be as they did not have to pay for insurance before, but do now.
- There are a lot of mobile homes in the area and rents could increase. Therefore, displacing these at-risk populations.
- Has the potential to affect property values in Garden City, not so much anywhere else.
- People could come in and buy out Garden City properties.
- Or there is the possibility of grading properties, Eagle City does so already.
- Businesses could vacate outside the floodplain.
- Ada County just revised the floodplain ordinance this last year. Made it less attractive. However, no changes based on these maps.
- CRS rating is a 6. Activities for that score include:
  - Public outreach: sending letters every year to those in floodplains, especially in the spring
  - Keep records of requests for research
  - Contact realtor, insurance for information
- A lot higher insurance in the floodway.
- Finished floor elevation is most important.
- FEMA is going to stop subsidizing insurance and slowly increase rates.
- Flood insurance costs will go up as the NFIP is trying to go out of debt.
- Regarding the levees and “seclusion” there is no dedicated entity for maintenance. All they have is the Highway District and they do not care about fixing levees.
- Do they staff themselves and fix them?
- These changes will not affect the whole valley, just the most at-risk populations. The demographics are going to change. Especially in Garden City.

- First there will be blight, then the ground will become desirable and those that realize it is a good central location and have the money will come in a buy or build.
- Mentioned uncertainties in maps. These maps are based on models and a model is only as good based on what you put into it. Based on LIDAR data that was from 2007. Lidar also cannot penetrate if the water is cloudy.
- Cities do not have the money to pay the Army Corp to get new data. Could do land surveys to get better topographic data. Ultimately, if Garden City had the money, they would do so.
- Models also cannot model the specifics of the city, specific buildings, streets, etc. The model used for the floodplains (HEC-RAS) is 1 dimensional.
- Factors that go into modeling floodplains: topography and water flows (water flows are extremely accurate).
- Various options for properties: Grading can help apply for LOMR and elevating structure can help apply for LOMA.

(Insurance Agent)

- No flooding in the past 2 years where he has been an agent.
- Yes, will present a risk in the future. Aging infrastructure, low bridges, clogging hazards.
- Had not seen the map revisions.
- Somebody is notified by lender or is curious or they think they are paying too much. Something stems them to research looking for a policy.
- Been through certain amount of training and therefore is an endorsed agent.
- It is a marketing thing for them.
- There are no agents that specialize in floods, therefore experts are hard to come by. It is not something they do every day.
- The more they do, the better they get at it.
- Certain policies are acceptable and others are not, depending on the lenders, even with adequate coverage. Sometimes will not satisfy the underwriter's standards.
- Comes down to everyone knowing their part, need to know what is required.
- Sometimes they require elevation certificates (NFIP). They are expensive: \$400-\$1200 in cost.
- Real Estate agents are now being proactive with disclosing flood insurance so they are not waiting until the last minute.
- FEMA (NFIP) versus private insurance.
- FHA (Federal Housing Association) loan has more stringent requirements. They are requiring FEMA plan because it is a federally backed loan. Often paying more for worse coverage.

- Wright flood, which is what he is using. Staying away from Write Your Own. For private going through company in Utah that is backed by Lloyds of London.
- Premiums will not go up for existing zones, just will expand.
- Subsidies are sun setting. Rates have been held low, but they are going away as they renew.
- New fees added. If it is not your primary residence, new charge of \$250 per year.
- Will not just raise rates, add new fees.
- Rates may not change concurrent with the changes, but possibly the next year. The risk is being spread over the whole country. Used for those that are in the more at-risk areas.
- Have not sold flood insurance to many businesses. They are not more expensive than residential. Lot of commercial exposure in Garden City. Does not know how commercial loan looks like. Good question. Visit commercial brokerage for information about this. Higgins and Rutledge downtown.
- Doubt that property values will go down. People will still be able to afford those properties on the river. Even if there is any affect, it may be slight. May be a bit harder to sell, but will still sell.
- A lot of manufactured homes in Garden City, where owners just own the land and no interest in properties.
- Infill is already happening in Garden City, new apartment complex (low-income) by these manufactured homes. Could see this occurring more so.
- May or may not affect depending on if they own the home and have no mortgage.
- Middle Class will feel it pretty badly, will most likely lower values, especially due to the age. (Boise Bible College area) That whole area has mortgages.
- Other end of Garden City, upper middle class and there will also be a lot of mortgages there as well.
- Closer to State Street will be most surprised.
- Interesting issue with max coverage. Some people just want the minimum of 250,000 coverage just so they have it. This could happen on a 1 million dollar home. This is what NFIP coverage only allows. Private insurance however allows no cap on coverage. On the other hand, higher class individuals are okay with often paying more.
- There are a lot more private policies than federal. Rates are better and coverage is nearly always better.
- Quotes both, but almost always comes down to cost.
- NFIP can be a little cheaper for a lot loss coverage.
- 2 million dollar (\$460 per year for FEMA for \$250,000 Zone X) for private (\$7,000 per year is actual coverage for full coverage) this home is right on the river.
- Everybody is different.
- Biggest hardships on those middle class.

- People being proactive in buying will depend on marketing. Public education will be important.
- The hardships will occur where they do not know and then all of a sudden they see their mortgages suddenly jump. Will they read their mail?
- Side note: Raising Arrow Rock Dam (2<sup>nd</sup> dam in system) 50 feet because the system is not prepared for a large event. Increasing capacity.
- Heard in terms of fixing levees in Garden City (south side of river), will have to do a whole bunch of eminent domain and property acquisition.
- Wishes he could do another seminar on flooding.
- Really finds the online resources to be helpful.
- Development in Eagle built up and had the money to do so.
- Big question in Garden City regarding development. Is there a market for stilts? It is an expensive option, but it is an option.
- Other than bringing in dirt, this is the only option to get out of the floodplain.
- Possible community assistance plan for Garden City to do these retrofits? Possible tax breaks/tax credits for flood mitigation.
- Some opportunity for contractors to do work but that is all he sees regarding changes in economic sectors.
- There are actually a lot of agents getting out of the flood insurance, but as a new agent he sees it as an opportunity to talk to people and market other insurance.
- He likes to help people. It is a fun and local business to be in. Does a really good job of having options, such as private and not just the federal government option.
- FEMA policies are not local, because the risk pool is not local.
- He quotes both public and private.
- State Farm only does NFIP policies.
- Competitive market.
- Interested in the effects of Canyon County.
- Talked to me about the flood mitigation projects that they already have in Boise (Military Reserve Park)
- Wealthy Eagle folks have money to adapt. Look at Island Woods and Two Rivers Developments in Eagle.
- Private insurance is in a sense more actuarially based, NFIP is actuarially based with more government involvement. Both are still shared risk.
- Use this interview as possible opportunity to market early to these neighborhoods that are expanding. Send mailer to postal routes and time it with announcement. More tempted to market to middle class.

(Assessor) and (Appraisal Division Supervisor)

- 55 years ago possible flooding
- Park Center Blvd flooded at some point

- Greenbelt, SE Boise has flooded occasionally
- Minor damage in Eagle
- Somebody lost his koi fish (was in the media)
- 12-13 years ago, Crane Creek flooded
- For the most part, no major damage
- Future flooding is something we do have to prepare for
- Mismanagement of water could cause the flooding
- Not dams breaking but possible too much water, therefore have to let it flood on purpose.
- Has really changed the hydrologic system in the valley with the dams from the 1800's. Used to be a marshy area.
- Valuation goes back to appraisal principles. What is the value? We follow the market
- These properties in the floodplain versus similar properties not. If they are selling for 20 percent less in the floodplain, they will appraise it based on that.
- But those on the river are willing to pay to live on the river
- Floodway in particular is valuable, as they are grandfathered in and now no longer can build there. Very desirable homes.
- Not going to lose out on tax base if the value goes down, the tax levies will adjust and then shift. Equates to a shuffle in the taxes. Those may end up paying more for those properties that cannot.
- If there is an economic impact, it will be impounded into the price and therefore buyers are not conscious about it. That is often not factored into their decisions at all, even in close proximity to the water.
- Potential to use the floodplain on higher value properties to reduce taxes being paid.
- Are buyers even aware of the risk?
- Concentrate on middle class, could be taken back as they have more of a budget.
- Depends on cost of home and income.
- As there has not been any major flood event, there is no concern. If that were to change, we would see more drastic changes.
- Best to interview those that have bought vacant land or new homes in these areas recently. They are the ones making the adjustments.
- Both knew superficially about changes in the floodplains.
- Might be large concerns of those already existing in the area rather than those coming in
- If they do see things changing, they can run regression analyses and determine the reasons why
- Mobile homes seem to be going away more so, apartment complexes are going up in Garden City. There are still plenty on the side streets. This could present a large problem.

- Could there be a potential for levee for levees

(Deputy Assessor)

- Difference between being in the floodway and floodzone. Floodway no building at all, some does occur due to grandfathering. Although cannot substantially change the footprint.
- Floodzone is much easier to build.
- Would look at similar homes in floodplain and out of floodplain. If there is a marketable difference, you can then value lower. If there is no difference, then the values would not change.
- Typically if the homes are newer and do not need cosmetic changes/additions there are generally no marketable differences. Does however occur with the older homes that do need updates.
- Have not seen the changes, but heard of them.
- Believes that this process and its general results will stay the same with these modifications.
- But must rely on the sales to tell you that. Wait and see.
- Certain areas you cannot bring in dirt, but you can rearrange what is there. Often see lots of ponds, using that to grade the rest of the development.

(Planning Director) and (Civil Engineer, Floodplain)

- Have to go far back to see flooding
- No history of repetitive damages
- 1983 10,000 cfs. Post dam construction.
- No significant damage, more nuisance flooding.
- If we are seeing more variable climate, could present a risk. Even with drought conditions. Particular with foothill gulches.
- Possibility of following Rule Curve too closely and will have to at some point release water. Reservoirs are not only for protection, but for irrigation collection. So could carry too much in the future.
- Both have seen map revisions.
- Definitely will put a strain on businesses and residences, as many of them have not had to purchase flood insurance but now have to. More concerned will the ability to sell properties and their values.
- Planner has already sold a house due to floodplain revisions, before property values drops.
- Most units constructed prior to floodplain, all had crawl space foundations. FEMA is now basing premiums lowest flood elevation on crawl space foundations. This is often 2 to 3 below BFE. Often 2,000 dollars a year in policies.
- Most affected in Garden City.
- Doesn't only affect new development, but remodels and improvements.

- No dedicated flood mitigation funding
- Do a lot of emergency response instead and awareness
- Concerned about flood insurance rates going up
- With that in mind, it is getting harder to participate in CRS program, as there are more activities being required. Could see their rating drop and can no longer get the 20% discount of flood insurance.
- Activity development. He would then lose the ability to have the doors and walkways at ground level. Could take away pedestrian feel.
- Possibility for engineers to get more work out of this, no effect on economic sectors.
- Concerned with accuracy and they want it to present the actual risk in order to protect the people. Don't want to pay for something if you do not have to.
- Could appeal the maps and will have some public comment once the maps come out.
- Do take the flood risk seriously, really proactive, especially during the spring with high release potential.
- Also concerned with the level of detail from the Lidar data. Really hard to make determination of whether the property or structures is in or out. Will be a lot more work for surveyors and engineers.
- The Lidar data is not representative of development that has occurred in the past few years.