Nonstructural Flood Risk Mitigation Assessment along the Platte River

Village of Cedar Creek, NE
City of Louisville, NE

June 2015

U.S. Army Corps of Engineers, Omaha District
- Flood Risk and Floodplain Management Section

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List of Abbreviations

ACE – Annual chance of exceedance
ACR - Acre
BCR – Benefit-to-cost ratio
BFE - Base flood elevation
BCY – Bulk cubic yard
CFS – Cubic feet per second
CCY – Compacted cubic yard
EAD – Expected annual damage
DFE – Design flood elevation
FEMA – Federal Emergency Management Agency
GPH – Gallons per hour
HEC-FDA – Hydrologic Engineering Center – Flood Damage Analysis
HMGP – Hazard Mitigation Grant Program
LF – Linear feet
LS – Lump sum
NFIP – National Flood Insurance Program
NGVD29 – National Geodetic Vertical Datum of 1929
NAVD88 – North American Vertical Datum of 1988
O&MRRR - Operation, maintenance, repair, rehabilitation, and replacement
RIP – Rehabilitation and Inspection Program
SF – Square feet
USACE – U.S. Army Corps of Engineers

Executive Summary

The Cass County nonstructural evaluation is an evaluation of nonstructural flood risk reduction measures for Louisville and Cedar Creek, Nebraska. Nonstructural flood risk management measures are proven methods and techniques for reducing flood risk and flood damages incurred within floodplains. The project was a Silver Jackets cooperative project between USACE, NDNR, LPSNRD, NEMA, and FEMA. The project received IWR funding.

The project had three primary objectives:

- Evaluate the feasibility of nonstructural flood risk reduction
- Evaluate the costs and potential federal interest of nonstructural flood risk reduction
- Evaluate and compare HEC-FDA and FEMA BCA

The results of this study showed that there are numerous structures in the two communities at notable flood risk, and nonstructural measures were both feasible and cost effective. Historic floods in the communities include the 1923 Louisville flood which killed 12 people and the numerous Platte River floods at Cedar Creek where flood fighting of a local berm has prevented repetitive flood damages. The cost benefit analysis identifies that a nonstructural approach incorporating 48+ structures could be built which would have a benefit cost ratio greater than 1.00. These are quite conservative cost estimates and the potential for higher structure inclusion is possible. The analysis identifies individual structures with cost-benefit ratios as high as 7.21.

Another objective of this study was to compare HEC-FDA and FEMA BCA. The results of this evaluation showed that while FEMA BCA and HEC-FDA produce similar results, and generally trend together, they do not produce identical results. A limited number of structures showed notable discrepancies, some of which could be modeled to align more closely.

1.0 Introduction

A nonstructural flood risk management assessment has been conducted by the U.S. Army Corps of Engineers, Omaha District, (USACE) in collaboration with the Nebraska Department of Natural Resources (NDNR), the Lower Platte South Natural Resource District (LPSNRD), Cass County, the Village of Cedar Creek and the City of Louisville. The assessment was completed as an Interagency Project through the USACE Silver Jackets Program. The Nebraska Silver Jackets Team submitted the project proposal (Appendix A) and the project was selected and funded. The Silver Jackets Interagency Projects allow for the completion of studies that result in collaboration in Flood Risk Management. The intent of the study is to analyze and develop nonstructural flood risk mitigation alternatives for structures along the Platte River in Cass County, Nebraska. There are two areas of focus. The first area is the Village of Cedar Creek and the second is the City of Louisville. The assessment study areas are shown in Figure 1.

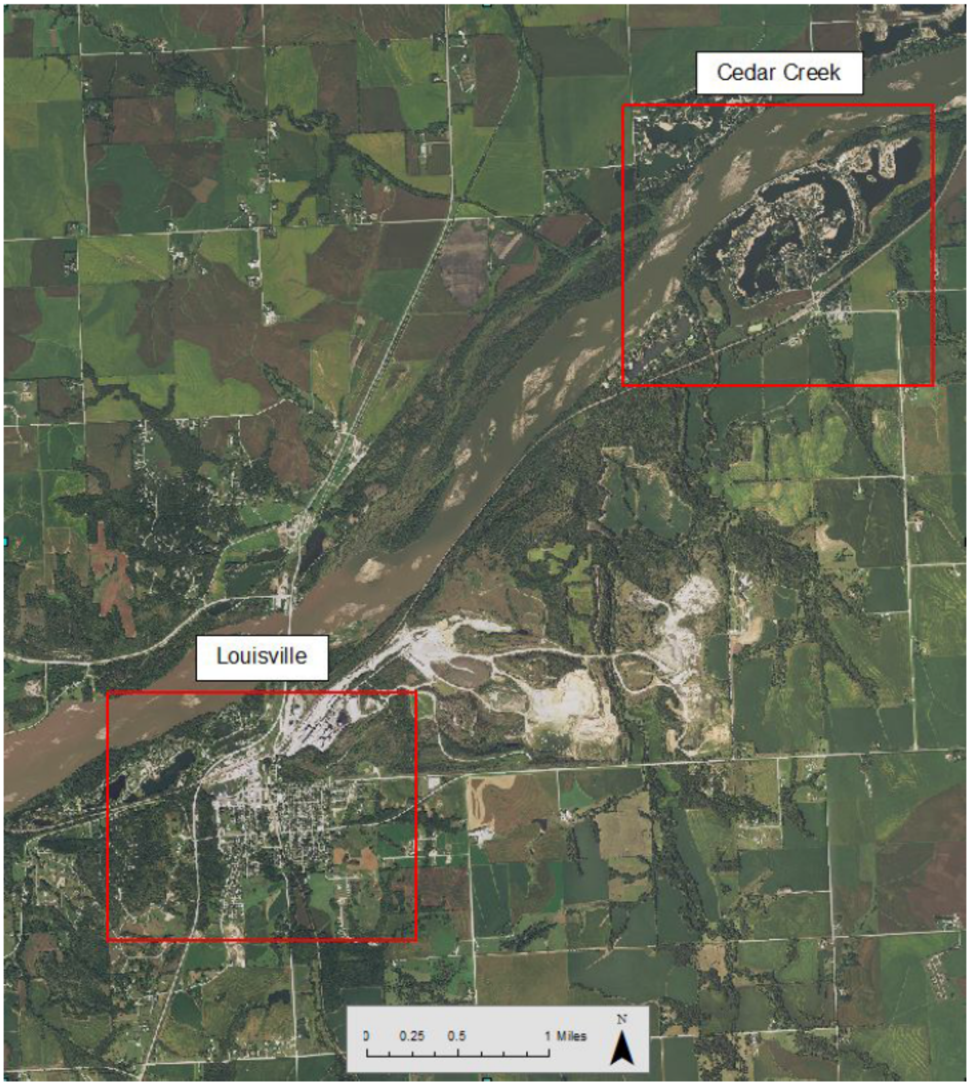


Figure 1
Nonstructural Assessment Study Area

The study areas are located along the right bank of the Platte River. The Platte River is the largest river in the State of Nebraska. The shallow relief of the terrain and natural resources of the basin made it the preferred route for emigrant transportation during the westward expansion of America. These transportation routes eventually resulted in the establishment of a number of communities in the Platte River valley. In more modern times the floodprone lands close to the river have been recognized as a prime location for the sand and gravel mining industry. Deposits greater than 150 feet deep comprised of eroded material carried out of the Rocky Mountains and shallow ground water provide an ideal mining environment. When out-of-production mines are often prepared for real estate development, the remaining sand is formed into broad, sandy beaches and residential lots are sectioned off.

Louisville has flooded multiple times, including the Mill Creek flood in 1923 that claimed the life of 12 people. Almost every business and house [redacted] was flooded to a depth from one to four feet and when the waters subsided it left a coating of mud from four inches to a foot in depth. Other flooding events consist of the Platte River flood in 1960, 1978, and 1993 due to snowmelt runoff and ice jams. The floods damaging Cedar Creek include the Platte River flood in 1960, 1993, and 1994.

This nonstructural assessment focuses on at-risk buildings and contains the detailed technical assessment used for investigating the feasibility of incorporating nonstructural mitigation measures within the project areas. There are a total of 501 structures assessed as part of this study. Elevation and building data was collected for each structure. This information included the depth of flooding, the first floor elevation, the total square footage, structure value and other structure characteristics.

Each building assessed may require a different nonstructural technique. While this nonstructural assessment relies heavily upon an inventory of data collected in the field for implementation. It should be noted that this is a screening level assessment and more detailed review could be needed for implementation. Nonstructural flood mitigation measures include activities that alter the consequence of flooding. Typical nonstructural measures include elevating above flood waters, relocation, and wet flood proofing. These strategies differ from structural measures that alter flood characteristics (levees, floodwall, and dams). Because of the limited nature of this level of investigation, this nonstructural assessment was conducted in reconnaissance level detail.

The study area contains multiple buildings and these buildings can be classified as residential, commercial, industrial, critical facilities, and public (government). For a nonstructural analysis, each building must be examined for purposes of what type of nonstructural measure is most appropriate for that particular building given what it is, where it is located within the floodplain, the flood characteristics and other site characteristics. This study represents the “stand alone” nonstructural alternative consisting of 100-percent nonstructural measures that could be used to provide specific flood risk reduction.

Nonstructural Flood Proofing

Nonstructural measures are proven methods and techniques for reducing flood risk and flood damages in floodplains. Many tens of thousands of buildings located across the nation are reduced or removed from risk and damage due to implementation of nonstructural measures. Besides being very effective for both short and long term flood risk and flood damage reduction, nonstructural measures can be very cost effective when compared to structural measures. A particular advantage of nonstructural measures when compared to structural measures is the ability of nonstructural measures to be sustainable over the long term with minimal costs for operation, maintenance, repair, rehabilitation, and replacement (O&MRRR).

While participation in most nonstructural projects is voluntary, depending upon the needs of the project and the desires of the community, a nonstructural project could be mandatory. Voluntary is always the preferred method of implementation, but could result in a patchwork effect of reduced flood risk due to some owners refusing to participate in the project. The Cass County nonstructural assessment assumes that participation would be voluntary for implementation purposes.

The ability of nonstructural measures to be implemented in very small increments, each increment providing flood risk reduction benefits, and the ability to initiate and close a nonstructural program with relatively minimal costs are important characteristics of this form of flood risk reduction.

2.0 Background of Nonstructural Flood Risk Management

Nonstructural flood risk management measures are proven methods and techniques for reducing flood risk, through reducing flood damages, by adapting to the natural characteristics of flooding within the floodplain. In addition to being very effective for both short and long term flood risk and flood damage reduction, nonstructural measures can be very cost effective when compared to other flood risk management techniques.

$$\textbf{Risk} = f\,[(\textbf{Probability of Flooding}) \times (\textbf{Consequences})]$$

> **Probability of Flooding** is the frequency of flooding or how often does flooding occur in a particular location.
>
> **Consequences** are the potential life loss or damages associated with flooding. Structures (residential, commercial, critical, public, and industrial), land use (agricultural, urban, public), and infrastructure (highways, roads, rail, utilities) are the potentially damageable assets. Reduce the consequences of flooding and risk is reduced. Nonstructural measures are invaluable wherein the goal is to reduce flood damages without modifying the characteristics of the flood event.

2.1 Nonstructural Measures

Nonstructural flood risk management can be categorized as a set of physical or nonphysical measures utilized for mitigating loss of life as well as existing and future flood damages. The physical measures determined to be most commonly implemented are those which adapt to the natural characteristics of the floodplain without adversely affecting or changing those natural flood characteristics. Because of their adaptive characteristics to flood risk, wherein these measures support the National Flood Insurance Program as administered by FEMA and generally cause no adverse affects to the floodplain, flood stages, velocities, or the environment these measures may also be considered as **Flood Risk Adaptive Measures (FRAM)** and can be incorporated into existing or new structures to mitigate for potential future flood damages. The most common FRAM measures are:

2.1.1 Elevation

This nonstructural technique lifts an existing structure to an elevation which is at least equal to or greater than the 1% annual chance flood elevation. In Nebraska, it is recommended that the elevation extend to at least one foot above the 1% annual chance flood elevation; this may be a requirement if the project is a substantial improvement. For projects funded through federal grants, compliance with EO 11988 and the recently signed EO 13690 may carry additional elevation requirements as well. In many elevation scenarios, the cost of elevating a structure an extra foot or two is less expensive than the first foot, due to the cost incurred for mobilizing equipment. Elevation can be performed using fill material, on extended foundation walls, on piers, post, piles and columns. Elevation is also a very successful technique for reinforced slab-on-grade structures.

2.1.2 Fill Basement with Main Floor Addition

This nonstructural technique consists of filling in the existing basement without elevating the remainder of the structure. This could occur if the structure's first floor was located above the base flood elevation. With this measure, placing an addition on to the side of the structure could compensate for the lost basement space to the owner and contain damageable utilities such as the furnace, water heater, water softener, etc . If the addition is prohibited because of limited space within the lot or because the owner does not want it, compensation for the lost basement space should be provided to the owner. This measure is applicable where the design flood depth is moderate and the first floor elevation is already located above the design depth.

2.1.3 Relocation

This nonstructural technique requires physically moving the at-risk structure out of the floodplain and buying the land upon which the structure was located. This ensures that structures are relocated from a high flood hazard area to an area that is located completely out of the floodplain.

2.1.4 Acquisition

This nonstructural technique consists of buying the structure and the land. The structure is either demolished or is sold to others and moved to a site external to the floodplain. Development sites, if needed, can be part of a proposed project in order to provide locations where displaced people can build new homes within an established community.

2.1.5 Wet Floodproofing

This nonstructural technique is applicable as either a stand-alone measure or as a measure combined with other measures such as elevation. As a stand-alone measure, floodwaters are allowed to enter a structure, thereby requiring that all construction materials be water resistant and all utilities must be elevated above the design flood elevation. Wet floodproofing may be applicable to commercial and industrial structures when combined with a flood warning and flood preparedness plan. It should be noted that under Nebraska floodplain management regulations, structures where this technique applies may be limited. This measure is also generally not applicable to locations with high flood depths and high velocity flows.

2.1.6 Dry Floodproofing

This nonstructural technique consists of waterproofing the structure to prevent water from entering. This measure achieves flood insurance premium reduction for commercial structures but is not recognized by the NFIP for flood insurance premium reduction if applied to a residential structure. A “conventional” built structure can generally only be dry floodproofed up to 3-feet in elevation. A structural analysis of the wall strength is required if it is desired to achieve higher protection. A sump pump and drain system should be installed as part of the measure. Closure panels are used at openings. For buildings with basements and/or crawlspaces, the only way that dry floodproofing could be achieved is for the first floor to be made impermeable to the passage of floodwater. In these cases, while flood risk reduction benefits would be achieved, potential flood insurance cost reductions may depend on the overall characteristics of the building after the project is completed.

2.1.7 Berms and Floodwalls

This nonstructural technique is only applicable on a small-scale basis. As nonstructural measures, berms and floodwalls should never be constructed to higher than 5 feet above grade and should not be considered for certification through the NFIP, meaning that flood insurance and floodplain management requirements of the NFIP are still applicable in areas were these berms or floodwalls are constructed. These measures can be placed around a single structure or a small group of structures, but since the application of these measures is considered nonstructural in nature, they should not raise the water surface elevation of the 100-year flood and must comply with all applicable floodplain management requirements. If implementation is through USACE authority all berms and floodwalls must be designed and constructed to USACE engineering standards.

2.2 Nonphysical Nonstructural Measures

Nonphysical nonstructural measures, are generally identified as being management measures for the floodplain. These measures can address flood risk through regulation and best management practices and can be considered separately or as a combination of floodplain management and planning functions. Representative of these nonphysical measures are the following:

2.2.1 Floodplain Mapping

This nonphysical nonstructural measure provides the identification of flood risk, whether in the form of a map which portrays flood boundaries, or as an inundation map illustrating the depth of flooding. This measure is a significant tool when addressing flood risk.

2.2.2 Flood Warning System

This nonstructural measure relies upon stream gages, rain gages, and hydrologic computer modeling to determine the impacts of flooding for areas of potential flood risk. A flood warning system, when properly installed and calibrated, is able to identify the amount of time available for residents to implement emergency measures to protect valuables or to evacuate the area during serious flood events.

2.2.3 Flood Emergency Preparedness Plans

Local officials are encouraged to develop and maintain a flood emergency preparedness plan (FEPP) that identifies hazards, risks and vulnerabilities, and encourages the development of local flood risk mitigation. The FEPP should include the community’s response to flooding, location of evacuation centers, evacuation routes, and flood recovery processes.

2.2.4 Land Use Regulations

Land use regulations are effective tools in reducing flood risk and flood damage. The principles of these tools are based in the National Flood Insurance Program (NFIP) which requires minimum standards of floodplain regulation. Communities can implement voluntary higher standards that encourage further regulation and minimization of floodplain development and flooding risks to development.

2.2.5 Zoning

Zoning is an important land use tool that most communities in Nebraska exercise. Indeed, the state's statues spell out that zoning regulations shall be based on a comprehensive development plan and those regulations should consider reducing flood risk. Both Louisville and Cedar Creek exercise zoning authorities. A community may determine that certain areas are too hazardous for human habitation and restrict development from occurring via amending zoning ordinances. Establishing good zoning regulations for flood risk can help reduce the long-term risk that a community faces from flooding.

2.2.6 Evacuation Plans

This measure requires detailed hydrologic analyses for determining the rate of rise of floodwaters for various rainfall or snowmelt events. When used in conjunction with flood warning systems, this measure can provide significant loss of life avoidance and flood damage reduction benefits. Evacuation planning should consider vertical evacuation as well as the traditional horizontal evacuation. This measure should only be implemented when there is signification response and action time available for floodplain occupants to evacuate. Rally points as well as evacuation routes should be thoughtfully planned and communicated to the public.

2.2.7 Risk Communication

Through the development of and use of educational tools such as presentations, workshops, hand-outs, and pamphlets, flood risk and flood risk reduction measures may be communicated to government entities and floodplain occupants in an effort to reduce the consequences associated with flooding.

2.3 Executive Order 11988; Flood Plain Management

This Executive Order was issued by President Carter on 24 May 1977. In issuing the Executive Order the President stated

> "in order to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative, it is hereby ordered that each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities…".

This nonstructural assessment was conducted in complete compliance with the Executive Order, meaning that any nonstructural measures that are incorporated into alternatives recommended for implementation supports the Executive Order.

During the production of this study, EO11988 was resigned and EO13690 was established. While, this study does not take these updates into account, the results and intent are in line with the updated executive orders.

2.4 Critical Facilities

Any facility which could become inoperable during a flood event and result in additional adverse impacts on the affected population is considered critical. Critical facilities are essential during a flood to provide human safety, health, and welfare. Any facilities that could, if flooded, add to the severity of the disaster are considered critical. Critical facilities are also generally those services required during the flood such as police and fire protection, emergency operations, people evacuation sites, and medical care. Each critical facility within the guidelines should be located at a flood free site. If this is not possible or practicable, the facility should be, at a minimum, protected to the extent that it can function as intended during all floods up to and equal to a 0.2% annual chance (500-year) event.

3.0 Data Development for Nonstructural Assessment

As part of the feasibility study, information was collected within the Platte River study area in the vicinity of Cedar Creek and Louisville. The following section discusses the water surface elevations used as the design flood elevations and the development of the structure inventory.

3.1 Hydrologic Data

Hydrologic data for this assessment came from the existing Flood Insurance Studies (FIS). The first FIS is the Flood Insurance Study for Cass County, Nebraska and Incorporated Areas, Flood Insurance Study number 31023CV000A, November 26, 2010, and map panel numbers 3100310001B and 3100310002B. The other FIS used in this assessment is the Flood Insurance Study for Village of Cedar Creek, Nebraska, Cass and Sarpy Counties, March 1978 and map panel number 3100300005A.

The Platte River drains an area of approximately 90,000 square miles of southeastern Wyoming, northeastern Colorado, and Nebraska. Elevations range from over 13,000 feet in the mountainous headwaters of the basin to approximately 960 feet at the confluence with the Missouri River. In the Cass County vicinity, the Platte River is a broad, shallow stream. Typical flows range from several cubic feet per second (cfs) to several thousand cfs.

The source of the most major historic floods from the Platte River is a combination of rapid snowmelt runoff and precipitation. Because of the characteristics of the Platte River, flood warning time is generally sufficient to enable human intervention to reduce flood damages. Because of the basin characteristics and the characteristics of the Platte River, actual flood duration can last for days or more than a week in extreme circumstances. Ice-jam induced flooding is also a concern. This flood hazard does not provide much warning time.

The economic modeling used in the assessment required 8 water surface profiles in order to determine the economic damages. The 10, 2, 1, and 0.2 percent ACE flood events (10, 50, 100, and 500 year) were available from the flood insurance study. These available profiles were used to determine the 50, 20, 4, and 0.5 percent ACE flood events (2, 5, 25, 200 year).

3.2 Structure Inventory

Structures located near or within the 500-year floodplain in the study areas were identified by utilizing the Cass County Tax Assessor's Database. This data was made available in Geographic Information System (GIS) shapefile format. The FEMA floodplain maps for the study area were overlaid with the assessor data to identify the structures to be included in the study. There were a total of 501 structures identified. For the structures identified engineering field surveys were completed. The survey crew used a total station to survey the first floor elevations and the adjacent ground elevations. Other structure information was collected at the same time as the survey and photographs were taken of the structures. Ground elevations were not collected at all structures, so LiDAR was used supplement field data.

The data from the assessor and the survey crew were used to develop the structure data that were used in the nonstructural analysis and used as the structure inventory for the benefit-cost evaluation of nonstructural flood risk mitigation alternatives.

The floodplain through Cedar Creek and Louisville consists of residential, commercial, industrial, and governmental buildings or facilities. Basements exist in some of the building types, most predominantly residential. The age and condition of existing developments range from new to old and good to poor.

Table 1 is a summary of the number of structures and the type of structures that are damaged by floods at different return periods.

Table 1
Cedar Creek and Louisville Buildings Affected by Platte River Flooding

Annual Chance of Exeedance	Average Return Period	Residential	Commercial
10-percent	10-year	31	9
4-percent	25-year	136	18
2-percent	50-year	198	36
1-percent	100-year	239	50
0.2-percent	500-year	325	76

4.0 Flood Damage Analysis (HEC-FDA) Development

The economic analysis conducted in this study utilized the Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) software, version 1.2.5a. The model was used to calculate expected flood damages various flood events. This data was then used to develop expected annual damages (EAD) for the buildings under consideration for nonstructural measures.

4.1 Problem Identification

The City of Louisville incurs damages beginning at roughly the 20-percent ACE (5 year) event due to the close proximity of structures to Mill Creek and the Tributary to Mill Creek. At roughly the 10-percent ACE (10 year) event flooding from the Platte River begins to cause structural damages to parts of Louisville not affected by Mill Creek and the Tributary to Mill Creek.

Structures in the Village of Cedar Creek incur damages beginning at roughly the 20-percent ACE (5 year) event due to their close proximity to the Tributary of Turkey Creek on the south side of the Burlington Northern Santa Fe Railroad and to the close proximity of structures to the Platte River on the north side of the railroad. The Village of Cedar Creek is similar to the City of Louisville in that minor flooding is able to cause flood damages.

4.2 Risk Analysis

The FDA model is typically used to incorporate uncertainty into flooding scenarios. This reflects the uncertainty around collected data and flood events could be smaller or larger than those modeled. However, this program is limited in that it models damage reduction uncertainty only for an entire study area, not on an individual structure by structure basis within that study area. This nonstructural assessment looked at structures on an individual basis. While the FDA program is able to determine to damage incurred by individual structures, it can only do so without incorporating uncertainty.

The FDA tool also computes expected annual damages (EAD) to compare against the annual cost of proposed alternatives which assists in computing benefit to cost ratios (BCRs). The EAD damage figure is the amount of damages an area could expect in any given year. While there are some years where there are no damages, there are years where that are large amounts of damages. The EAD uses these differing damage points to compute an annual damage figure. However, the tool only annualizes flood damages for the entire study area or by study area reaches. Damage reaches are explained below. Individual structure EADs were computed using Microsoft Excel.

4.3 Analysis Years and Period of Analysis

As part of the planning process an inventory and forecast of existing and future without project conditions is made (ER 1100-2-100). The future-without project condition provides the basis from which various project alternatives will be compared. The base year for a given project is defined as the year a specified project is scheduled to be completed.

For this analysis, as a screening level assessment, no future development was included. For the purposes of this analysis, a 50-year period of analysis was used and it is assumed that the existing level of development will remain the same and that no existing structures will be significantly modified for the period of analysis under future without-project conditions.

The costs were for the modeled nonstructural methods were computed as outlined in Section 6.0. The cost estimating on a structure by structure was completed by the USACE Flood Risk and Floodplain Management Section. A contingency of 10 percent was included and it was assumed the interest during construction cost was included in that contingency.

4.4 Interest Rate and Price Level

The fiscal year (FY) 2015 Federal interest rate of 3.375 percent is used for this analysis based on guidance from Economic Guidance Memorandum 15-01, Federal Interest Rates for Corps of Engineers Projects for Fiscal Year 2015. All of the structure information collected was gathered in the summer of 2014 and was updated using a BCI index to be expressed at FY 15 price levels.

4.5 Selected Reaches and Index Locations

The study area includes four streams: the Platte River, Mill Creek, the Tributary to Mill Creek and the Tributary to Turkey Creek. The streams that potentially flood the City of Louisville are the Platte River, Mill Creek and the Tributary to Mill creek. The streams that potentially flood the City of Cedar Creek are the Platte River and the Tributary to Turkey Creek. Figure 2 displays the streams and their location in respect to the two areas assessed. Other tributaries include X_a and $X_{b.}$ These tributaries were not included in this analysis as they do not impact structures in the inventory.

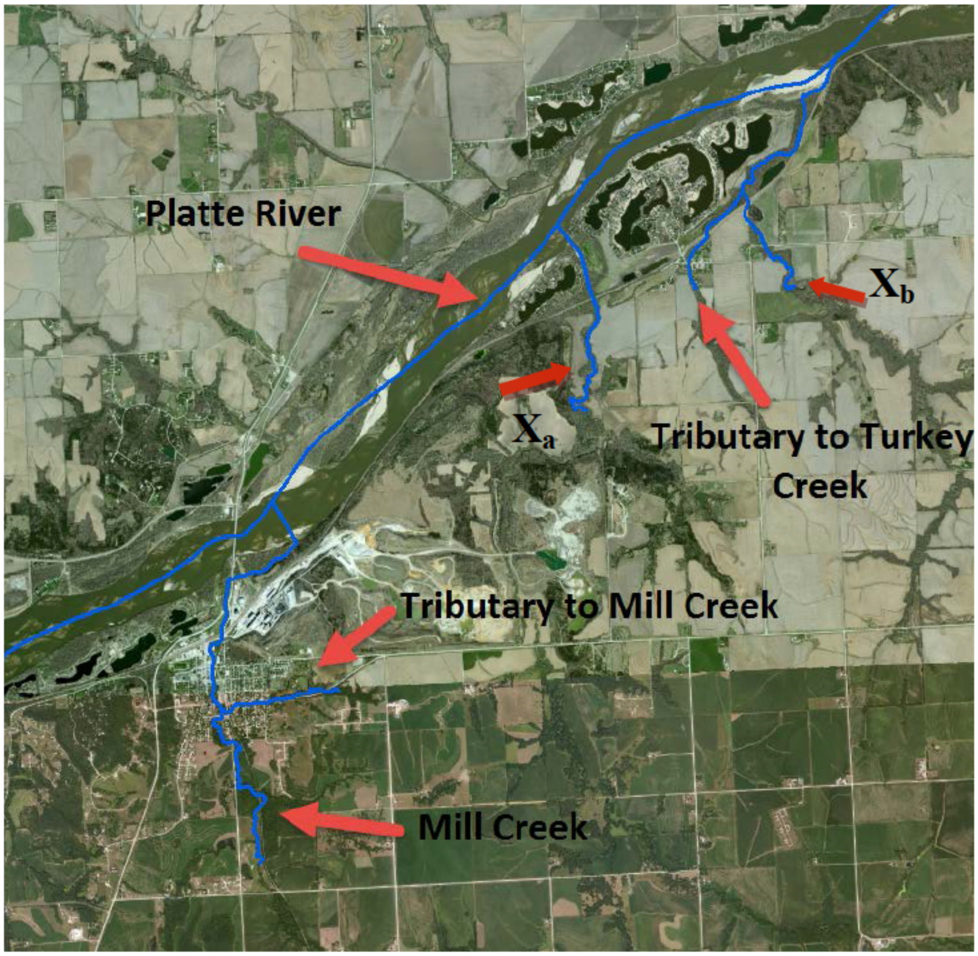


Figure 2
Stream Approximate Location

All four of the streams under study in this analysis were divided into segments to represent damage reaches based on the computed flows for the reach. Bridge locations were the main feature used to distinguish reaches as they tend to affect hydraulic parameters. Reaches are also defined by beginning and ending stations, which include a numbering system used to locate positions along a stream. This distance is measured in feet above the mouth of the river. The Platte River, Mill Creek, Tributary to Mill Creek and Tributary to Turkey Creek were divided into 6, 4, 2 and 3 reaches respectively.

After the damage reaches were identified, a representative index location was chosen within each reach. The hydraulic engineer assigned to the study also provided the proper index location. The index locations are used to relate the computed stage, discharge and damage within each damage reach. Index locations were generally chosen around areas of dense land use to help ensure the accuracy of damage calculations. Table 2 below is a list of the damage reaches and index locations for all four of the streams included in this analysis.

Table 2
Damage Reaches and Index Locations

Platte River				
Reach Name	Location	Beginning (Downstream) Station	Ending (Upstream) Station	Index Location
P1	North of Cedar Creek	60,510	64,859	63,460
P2	North of Cedar Creek	64,860	67,069	66,000
P3	North of Cedar Creek	67,070	69,949	68,340
P4	Between Louisville and Cedar Creek	69,950	79,529	72,470
P5	Between Louisville and Cedar Creek	79,530	83,469	81,260
P6	North of Louisville	83,450	92,245	88,670
Mill Creek				
MC1	North side of Louisville	876	3,125	2,482
MC2	Center of Louisville	3,126	3,584	3,210
MC3	Center of Louisville	3,585	5,812	4,335
MC4	South side of Louisville	5,813	8,052	6,864
Tributary to Mill Creek				
TMC1	East side of Louisville	232	1,345	708
TMC2	East-central portion of Louisville	1,346	2,112	1,901
Tributary to Turkey Creek				
TTC1	South side of Cedar Creek	892	2,042	1,843
TTC2	South side of Cedar Creek	2,043	3,901	3,305
TTC3	South side of Cedar Creek	3,902	4,145	4,024

4.6 Structure Inventory

The economic components of the HEC-FDA model include a structure inventory and a set of occupancy types. The structure inventory contains properties in the floodplain that could be damaged, including homes, businesses and public facilities. A survey of structures was conducted by the Nebraska Department of Natural Resources (NDNR) and USACE in 2013. This information was reviewed for this analysis and updated in mid-2014 to ensure the data was correct and consistent with the current conditions observed in Louisville and Cedar Creek.

The inventory includes all structures within the 0.002 (500 year) ACE floodplain as well as structures lying just outside the floodplain to ensure a complete inventory was included.

Each land use structure is assigned certain attributes required by HEC-FDA. These attributes are listed in the structure inventory and contain the following: a structure identification number, stream station assignment, ground elevation, foundation height, depreciated structure replacement value, the value of contents as a proportion of the structure value, a category name, stream bank location, and an occupancy type.

The stream station assignments for each structure were based on the nearest hydraulic cross-section or interpolated between cross-sections and were assigned by the economist with the assistance of the hydraulic engineer. Ground elevations were shot by the NDNR using a total station system to correctly identify structure elevation and location. The foundation heights (vertical distance between the ground stage and first floor stage at the structure) were shot by the NDNR using the same methodology that was used to derive the ground elevations.

The NDNR provided information pertaining to structure characteristics within the floodplain. Items including structure type, size, and construction material were all provided to the Corps of Engineers based off surveying performed by the NDNR. The Cass County assessor website (http://www.cassne.org/assessor.html) was used to check the data provided to the Corps and fill in items, such as effective age, where needed. Depreciated replacement values (DRV) for buildings in the floodplain were calculated using the Marshall Valuation Service 2014 text for commercial and public structures and the RSMeans Square Foot Costs 2014 text for residential structures. Both valuation services use square foot cost to approximate the value of a new structure, which then has a depreciation and locality factor applied, resulting in a depreciated replacement value. A sampling of 20 percent of the residential buildings was found to be, on average, 91 percent of the assessed value. To account for this, the calculated DRV values were used and the remaining residential structure values provided by the Cass County Assessor were multiplied by 0.91. The DRVs for 22 percent of the commercial structures were calculated using the Marshall Valuation Service 2014. The DRV of the commercial structures were found to be, on average, 8 percent greater than the assessed value. Accordingly, the calculated DRV values were used and the remaining commercial structures assessed values were multiplied by 1.08. None of the public structures in the study area had values that could be provided by the assessor. Accordingly, the DRV for each public structure was calculated using the Marshall Valuation Service.

Each structure was assigned a study damage category and a structure occupancy type formatted for HEC-FDA. Table 3 lists the study damage categories used in the Cass County flood damage analysis.

Table 3
Damage Categories

Category Name	Category Description
C	Commercial
P	Public
R	Residential

A structure occupancy type in HEC-FDA is a subcategory of damage categories and is assigned to structures using the same depth-percent damage functions, first-floor uncertainties, structure value uncertainties and content-to-structure value ratios. The codes and corresponding occupancy types are contained in Table 4.

Table 4
Structure Occupancy Types

R01 Homes - 1WB - (1 Story With Basement)	**NR21** Medical Office Engineered
R02 Homes - 2WB - (2 Story With Basement)	**NR23** Non-Fast Food Restaurant Engineered
R03 Homes - SPL WB - (Split Level With Basement)	**NR25** Office Building Engineered
R04 Homes - 1NB - (1 Story No Basement)	**NR27** Protective Services Engineered
R05 Homes - 2NB - (2 Story No Basement)	**NR29** Recreational Facility Engineered
R06 Homes - SPL NB - (Split Level No Basement)	**NR31** Religious Facility Engineered
R07 Mobile Homes	**NR33** School Engineered
NR03 Convenience Store Engineered	**NR35** Service Station Engineered
NR13 Grocery Engineered	**NR37** Warehouse, Non-Refrigerated Engineered
NR19 Industrial Light Manufacturing Engineered	

4.7 Content Value

The value of contents in a residence was assumed to equal 50 percent of the structure value. This percentage is similar to the percentages used by local casualty insurance companies for homeowners' policies and is consistent with previous survey data from the Omaha District. Mobile homes had a content value equal to 139 percent of the structure value based on professional judgment and the New Orleans district in the "Final Report: Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study." This New Orleans District report was used because the reported damage curve CSVR for mobile homes is applicable across the county. Morton-Style sheds on some residential lots had their contents valued like non-refrigerated warehouses, or 37% of the structure value.

Non-residential contents include assets such as office equipment, major production equipment, and rolling stock, as well as inventory items including raw materials, work in progress, and finished goods. All properties in this analysis were assigned content values in terms of a contents-to-structure-value ratio. Content values ranged from 6.5 percent to 70 percent of a given structure value. The CSVRs were based on the specific type of use of the structure, using survey data taken from the 2008 report "Solicitation of Expert Opinion Depth-Damage Function Calculations for the Benefit-Cost Analysis Tool" prepared by the URS Group Inc. with the assistance of the Federal Emergency Management Agency (FEMA) and USACE.

4. 8 Structures and Investment Value

A summary of the number of structures and investment value for all structures in the 0.02 percent ACE event floodplain (500 year) of Louisville and Cedar Creek are displayed in Table 5 and Table 6 respectively. Table 7 displays the investment value for the entire study area.

Table 5
City of Louisville, Investment Value in the 0.02 Percent ACE Floodplain

Structure Type	Total Structures	Structure Value	Content Value	Total Value
Commercial	36	$18,914,440	$7,249,850	$26,164,290
Public	36	$2,206,600	$1,133,500	$3,340,100
Residential	66	$2,707,340	$1,354,210	$4,061,550
Total	**138**	**$23,828,380**	**$9,737,560**	**$33,565,940**

Table 6
Village of Cedar Creek, Investment Value in the 0.02 Percent ACE Floodplain

Structure Type	Total Structures	Structure Value	Content Value	Total Value
Commercial	14	$2,183,420	$805,200	$2,988,620
Public	3	$39,890	$10,080	$49,970
Residential	346	$37,146,980	$18,615,940	$55,762,920
Total	**363**	**$39,370,290**	**$19,431,220**	**$58,801,510**

Table 7
Total Project Area, Investment Value in the 0.02 Percent ACE Floodplain

Structure Type	Total Structures	Structure Value	Content Value	Total Value
Commercial	50	$21,097,860	$8,055,050	$29,152,910
Public	39	$2,246,490	$1,143,580	$3,390,070
Residential	412	$39,854,320	$19,970,150	$59,824,470
Total	**501**	**$63,198,670**	**$29,168,780**	**$92,367,450**

5.0 FEMA BCA Comparison to HEC-FDA

One goal of the study was to compare the results of HEC-FDA and the FEMA BCA tools on the same structure inventory. The FEMA BCA Toolkit Version 5.0 is another model used to evaluate the flood damages for this assessment, similar to HEC-FDA. The BCA toolkit can evaluate risk for other hazards as well, including earthquakes, hurricanes, tornados, and wildfires. The BCA flood module is the default tool for the FMA and HMGP grant programs. The flood module was used to calculate expected flood damages various flood events. This data was then used to develop expected annual damages (EAD) for the buildings under consideration for nonstructural measures.

To establish risk, the BCA flood module incorporates hydrologic data (primarily from Flood Insurance Study (FIS) data), building type, costs of contents, and costs of loss of function. The inputs for the flood module are on a structure by structure basis and include parameters such as building type, foundation height, structure value, square feet of the structure, first floor elevation, ground elevation, and streambed elevation. These inputs are similar to HEC-FDA.

The computed EAD values showed a positive correlation between FDA and BCA. The results showed lower than expected coefficient of determination (r^2). Upon initial input, the different models (HEC-FDA and BCA) produced some notably different results on select structures. A review of these structure indicated that slight modifications to the structure inventory would produce more similar results between the models. These modifications primarily related to the input of structures containing below ground features.

5.1 HEC-FDA and BCA Discrepancies

There are several discrepancies between the two modeling programs. The majority of the input parameters are the same for structures in each program. BCA has an extra input parameter, streambed elevation, which HEC-FDA does not incorporate. BCA does not compute uncertainty, whereas HEC-FDA can compute uncertainty. HEC-FDA is not as user friendly but is setup for computation of larger structure inventories.

A few of the discrepancies identified in this effort between the two models occur within the depth-damage function Content to Structure Value Ratio (CSVR) percentages with multiple categories (Table 8) especially for the convenience store, grocery store, and the office one-story building types. The FEMA standard values are the same for the building damage percentage, contents value, and project life as in HEC-FDA. HEC-FDA does not incorporate a displacement cost. Another major discrepancy is that the interest rate for HEC-FDA is set at 3.375 percent and BCA has a default rate of 7 percent. For the BCR comparison, the FDA model was adjusted to match the 7 percent interest rate that the FEMA BCA Toolkit uses.

The selection of mitigation types in the BCA model are acquisition, relocation, elevation, reconstruction, dry flood proofing and minor flood reduction projects. BCA does not have a mitigation type of wet flood proofing. Those structures were inputted into BCA as dry flood proofing with the assumption that water free flowing throughout the structure would not cause damage until a certain height. The same concept applies to dry flood proofing as well, therefore dry flood proofing is the closest mitigation type within the BCA program.

The results of this evaluation showed that while FEMA BCA and HEC-FDA produce similar results, and generally trend together (positive correlation) (Figure 3), they do not produce identical results and have an overall low coefficient of determination (r^2). A limited number of structures showed notable discrepancies, some of which could be modeled to align more closely. This evaluation was completed as a functional level comparison. A more technical evaluation of the computations differences between the models was not a part of this project.

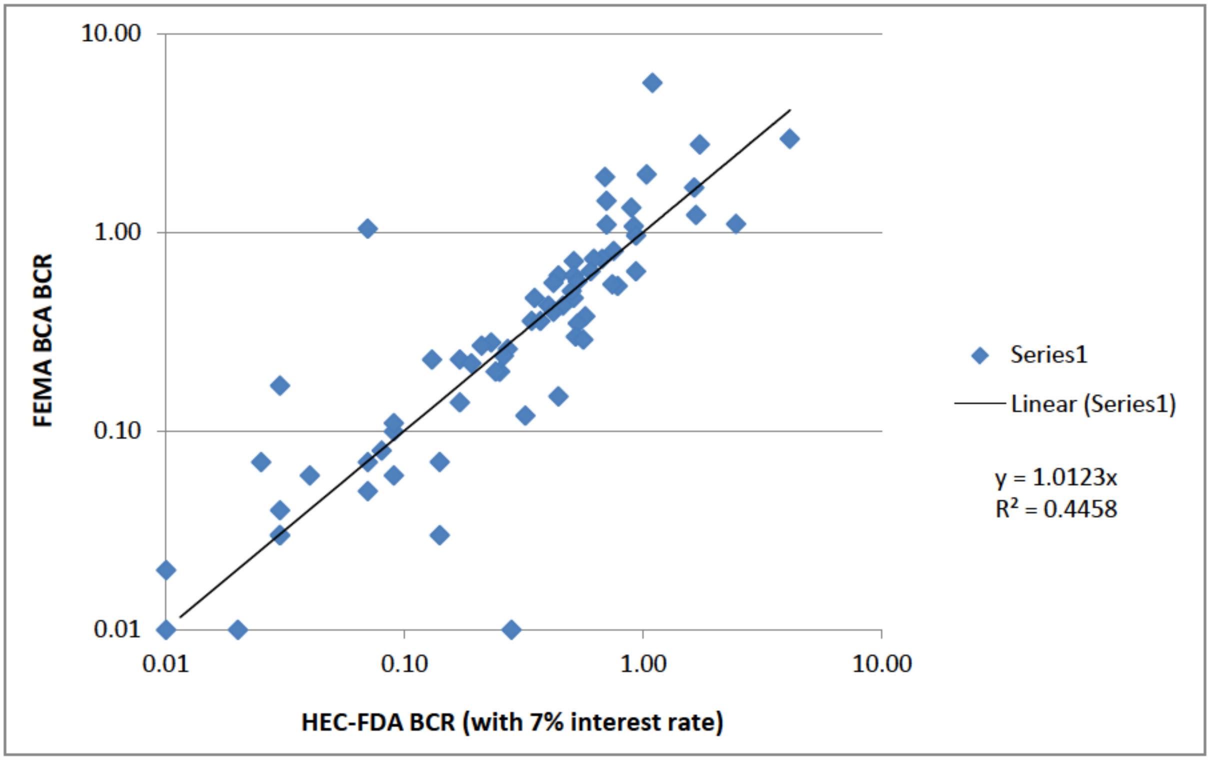


Figure 3
HEC-FDA vs BCA BCR

Table 8
CSVR of Depth-Damage Function Comparison

Non-Residential Depth-Damage Functions	CSVR BCA	CSVR HEC-FDA
Convenience Store	52%	34%
Grocery	85%	70%
Office One-Story	12%	18.1%
Protective Services	69%	69.5%
Recreation	25%	24.6%
Religious Facilities	7%	6.9%
Schools	6%	6.5%
Service Station	66%	66%
Warehouse, Non-Refrigerator	37%	37.4%

6.0 Specific Nonstructural Measures Considered

This nonstructural assessment considered flood risk reduction measures for residential and commercial buildings. Each building shown to be damaged by a flood event was analyzed based upon data collected in the field, available city and county records, and study team assumptions developed to accommodate situations where no data existed. To be considered economically feasible, benefits of a flood risk reduction measure (mainly flood damages prevented) must exceed the costs of the measure. This is also expressed in terms of a Benefit/Cost ratio greater than one.

Because of limited study resources, the entire menu of nonstructural measures was not evaluated for each building for which a detailed benefit/cost analysis was conducted. The methods that were most appropriate were selected based on whether the buildings were residential or non-residential and the physical characteristics of the buildings.

The nonstructural measures considered for residential buildings during this assessment were elevation on extended foundation walls, and filling basements and constructing a main floor addition.

Non-residential buildings (including commercial and public buildings) were assessed for dry flood proofing and wet flood proofing. Dry flood proofing was selected for buildings with furnished interior space that could not be readily made flood resistant, such as offices. Wet flood proofing was selected for buildings that were mostly unfurnished or that had large openings in the exterior walls, such as multiple overhead doors for vehicles.

Quantities for cost estimates were developed for each building that was evaluated for nonstructural measures in detail. Costs for each nonstructural technique were developed in conjunction with nonstructural mitigation efforts occurring in other regions of the United States and are only supported for reconnaissance level purposes for screening various techniques. Detailed cost estimate information is provided in Section 6. Prior to implementing a nonstructural measure, additional detailed design data and costs will be required to be developed.

7.0 Nonstructural Evaluation Plan Alternatives with Cost Calculations

Since nonstructural flood risk reduction measures can be implemented for individual buildings, these measures were evaluated across the entire study area. In order to determine the nonstructural plan that provided the highest net economic benefits, three nonstructural plan alternatives were evaluated across the study area. The three alternatives had the design flood elevation (DFE) set at the profile of the 2-, 1- and 0.2-percent ACE flood events at each building location. The actual DFE varies from downstream to upstream along the Platte River. The height of the DFE above the normal ground will also vary according to the depth of each flood event at a specific location. Cost estimates were completed for each nonstructural measure assessed at each structure. The following sections outline how the costs were determined for each measure.

7.1 Residential Elevation on Extended Foundation

This measure involves elevating the entire building from its original foundation to the design flood elevation. This technique was used on residential buildings, with and without basements. To calculate the vertical distance of rise for each building, the elevation of the DFE was used (2-, 1-, or 0.2-percent ACE flood elevation). For the 2-percent and the 0.2-percent ACE flood event 0.5 foot was added to the elevation height to allow the floor joists and any utilities to be elevated above the design flood event. For the 1-percent ACE flood event 1.5 feet was added to the elevation height. One foot was added in accordance with Nebraska Statutory requirements and 0.5 feet was added to account for elevating the structure to this standard while the analysis evaluated to the first finished floor. The elevation of the first floor was subtracted from the design flood event to determine the flood proofing height required. Since flood depths did not exceed 8-foot, all residential buildings with significant flood damages for flood events less than the 0.2-percent ACE flood event were evaluated. Figure 4 illustrates an example of a residential building without a basement before and after incorporation of this nonstructural flood reduction technique.

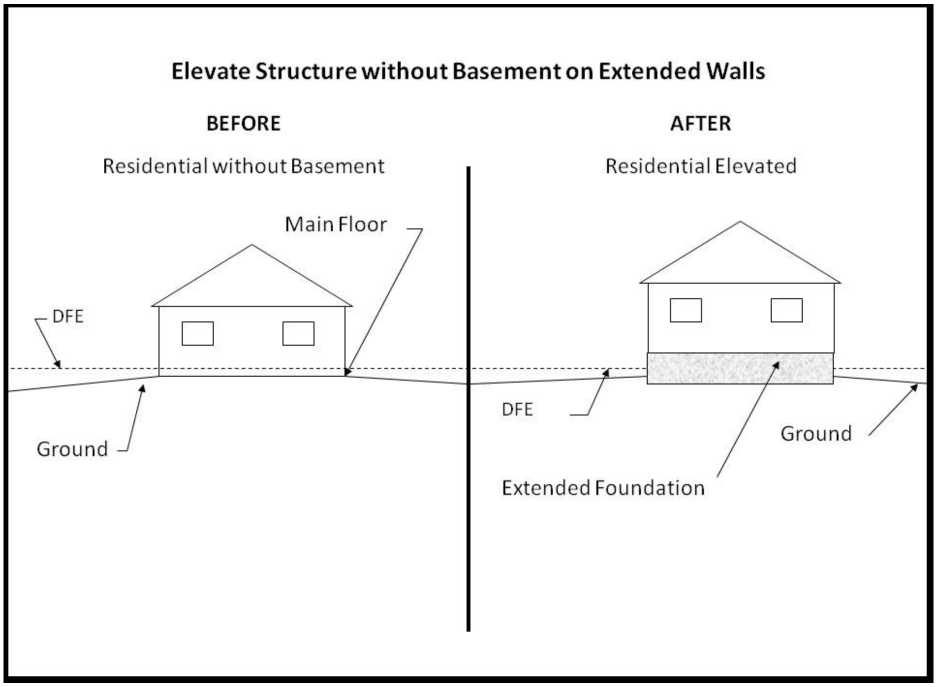


Figure 4
Schematic of Elevated Building without Basement on Extended Foundation

The cost to elevate residential buildings was estimated by utilizing equations based upon building square footage, flood proofing height and foundations type. The equation for computing residential elevation costs was developed by Omaha District Cost Engineering from a cost estimate procedure developed for FEMA's Hazard Mitigation Grant Program (HMGP) and given in:

"Office of Community Development, Disaster Recovery Unit, Hazard Mitigation Grant Program; Procedure Number 1, Revision Number 11; January 15, 2013"

The Omaha District Cost Engineering formula for determining costs for elevating a residential building for flood risk reduction is:

Elevation Cost = (**HCF** + **AUC** + **SRC**) x **ACF** x **SF**

Where: **HCF =** FEMA HMGP cost per square foot, based on foundation type and height of raise, see Table 8

AUC = Additional utility cost per square foot = 1.50

SRC = Site restoration cost per square foot = 3.50

ACF = Area cost factor = 0.99

SF = Footprint of residence to be raised, square feet

Table 9
Residential Elevation Cost Factors (cost per square foot)

	Foundation Type		
Raise, Feet	**Open Foundation**	**Slab Separation**	**Slab Raise**
1.50-2.49	$50.53	$60.53	$70.53
2.50-3.49	$51.58	$61.58	$71.58
3.50-4.49	$52.63	$62.63	$72.63
4.50-5.49	$55.63	$65.63	$75.63
5.50-6.49	$58.63	$68.63	$78.63
6.50-7.49	$61.63	$71.63	$81.63
7.50-8.49	$64.63	$74.63	$84.63

Open foundation elevation costs are applicable to buildings on basements walls or on foundation walls with a crawl space. Slab separation is a technique for raising a slab-on-grade residence by separating the building superstructure from the foundation slab. A slab raise involves raising the foundation slab and the superstructure as one unit. For structures in the study area slab separation type elevation would be more common and was used for cost estimating purposes.

7.2 Basement Fill and Main Floor Utility Addition

Filling in the basement for flood risk reduction is required when elevating residential buildings which have basements. The filled basement resists damage to the building foundation from hydrostatic forces and raises the threshold of flood damages to the main floor elevation, whether existing or elevated. Residential buildings which are subject to flood damages with a main floor elevation above the DFE only need the basement to be filled, assuming the project is not considered a substantial improvement according to floodplain management regulations. The basement is filled with clean sand or other suitable material and the top of the fill is covered with a vapor barrier. To compensate for a portion of the lost basement area and provide a location for relocation of the utilities (furnace, water heater, water softener, washer and dryer) which may reside in the basement, an above ground addition is assumed to be constructed onto the building at the DFE. For purposes of this analysis an addition size of 50 square feet was used. A small, unfinished area of the basement may be able to be left unfilled to be used as a storm shelter, however, this may only be allowable if the project is not a substantial improvement and does not use federal grant funds. If HMGP, PDM, or FMA is used then the FEMA guidance likely would not allow a shelter to remain below the BFE. In these situations a tornado “safe room” may be considered. Hardened storm shelters should be put above the BFE of the first floor to compensate for the lost protection from tornadoes. Figure 5 illustrates a simplified example of removing a basement by adding fill material and constructing an addition to the residence to house utilities.

Relocation of the furnace and water heater provides the property owner an opportunity at his/her expense to replace these items with new units that are more efficient. In that situation, the estimated cost of relocating the existing furnace and water heater would be applied to the cost of installing the replacement units.

Cost estimates for the fill and the loss of the basement are summarized in Table 10. Cost estimates for the addition is summarized in Table 11. The loss of useable basement area is considered an additional cost. The value of a useable basement was estimated based on the total value of the structure. For finished basements their value was estimated to be 37.5% of the total structure value and for unfinished basements their value was estimated to be 13.0% of the total structure value.

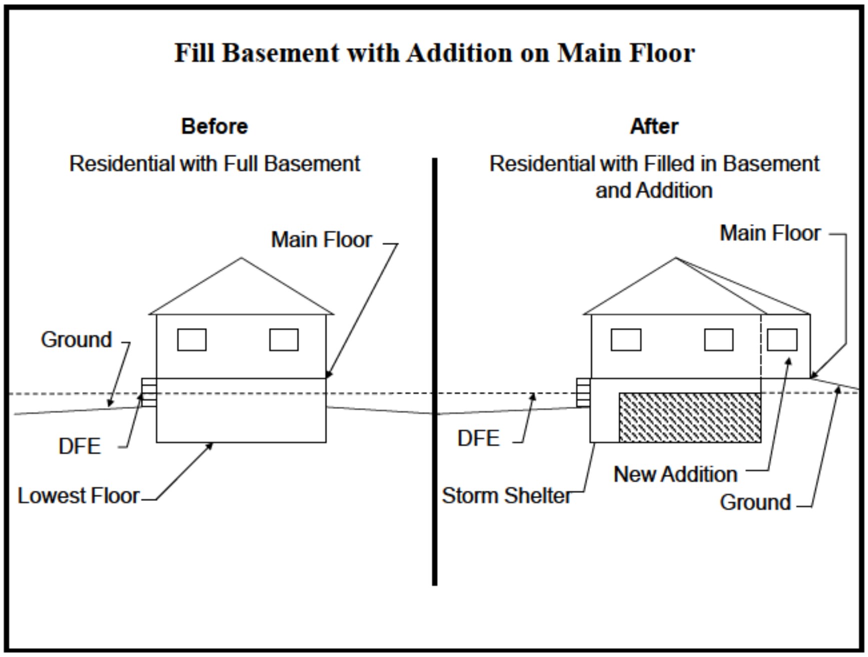


Figure 5
Schematic of Filled Basement with Main Floor Addition

Table 10
Cost Parameter for Filling Residential Basement

Item	Cost/Units	Quantity Calculation
Sand Fill	$1.30/cubic foot	Basement Area x 8 feet

Table 11
Cost for Addition to Residential Buildings

Size	Cost
50 Square Feet	$6,250

7.3 Dry Flood Proofing for Commercial Buildings

Dry flood proofing of commercial and other non-residential buildings involves applying a water resistant sealant around the building to prevent flood water from entering. The sealant layer is then protected with a brick veneer or similar material. Doorways and windows are sealed with flood shields or by similar application. A backflow prevention valve is installed on the sanitary sewer line into the building to prevent floodwaters from backing up through the sewer. A sump pump or skimmer pump (portable pumps may be used) to remove floodwater that leaks into the building. A schematic of the dry flood proofing technique is shown in Figure 6.

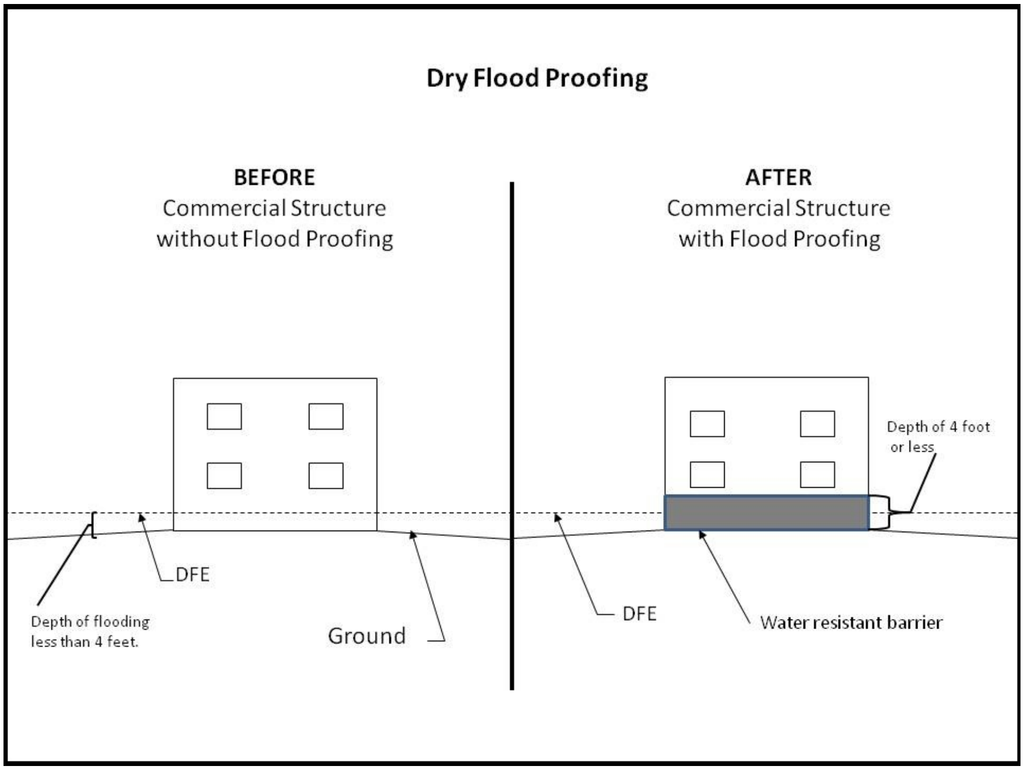


Figure 6
Schematic of Commercial Dry Flood Proofing

Buildings constructed of poured concrete, concrete masonry or brick are most suitable for dry flood proofing. The floodplain building inventory of the study area found a number of non-residential buildings with walls of prefabricated steel panels. Since these panels may not be of sufficient strength to resist the hydrostatic load and may leak through the joints between the steel panels, an alternate method of dry flood proofing was proposed for metal buildings.

To provide sufficient wall strength, new “short walls” of concrete masonry units (CMU) with interiors of the masonry blocks filled with waterproof grout and with steel reinforcements would be built on a new foundation footing immediately outside of the existing steel walls.

The waterproof sealant and brick veneer is applied to the CMU wall. Closures for openings into the building are also built into the CMU wall.

Buildings could be evaluated for nonstructural measures that are designed to be partially dry flood proofed and partially wet flood proofed. In this situation, the interior walls of the dry flood proofed area need to be waterproofed as well as the exterior walls. In this analysis structure were only assessed for one measure or the other. A more detailed analysis would be required to if multiple measures to one structure are to be assessed.

Cost estimates for dry flood proofing were developed for commercial buildings without basements and design flood depths of 3 feet or up to 4 feet with a structural analysis. A structural engineer will be required to thoroughly review the adequacy of the building to withstand hydrostatic and possibly dynamic floodwater loading onto the walls of the building prior to implementation.

The various costs used in the dry flood proofing estimate are summarized in Table 12. The perimeter of the dry flood proofing for evaluated buildings was determined by estimating building dimensions from available data, such as building plans in the county assessors' records. The perimeter was estimated by taking the square root of the area and then multiplying by four. The number and size of closure panels were estimated from photos taken during the structure inventory or from the Google Earth Street View map application. The flood proofing height was calculated by subtracting the foundation elevation from the design flood elevation. Residential buildings cannot be removed from insurance or floodplain management requirements by dry flood proofing. An individual homeowner may choose to flood proof their home, but the lowest floor will not change for insurance or permitting.

Table 12
Cost Parameters for Dry Flood Proofing

Item	Unit of Measure	Unit Cost (Dollars)
Waterproofing	SF	0.93
Masonry Veneer	SF	13.30
Closure Panels	SF	185.20
CMU Wall	SF	14.83
Wall Foundation	LF	109.00
Pumps	GPH	0.24
Sewer Backflow Valve	LS	9,590.00

7.4 Wet Flood Proofing Commercial Buildings.

As a stand-alone measure, wet flood proofing requires all construction materials and finishing materials located below the DFE to be water resistant. Flood vents are installed in the walls to allow floodwaters into the building and equalize the hydrostatic forces. It is recommended that one square inch of flood vent area be provided for each square foot of the wet flood proofing area. All utilities, such as heating, lighting, electrical panels and outlets must be elevated above the DFE or be located inside flood resistant closures.

Since wet flood proofing allows floodwaters into a building, it is not recommended for finished residential buildings. Wet flood proofing is quite applicable to commercial and industrial buildings when combined with a flood warning, preparedness and response plan. While it may be used as a retrofitting technique, wet floodproofing may not be able to be used to achieve compliance of the building for minimum state and federal floodplain management standards. A wet floodproofing proposal should be discussed with the local floodplain manager prior to implementation. At Cedar Creek and Louisville, wet flood proofing was recommended for buildings that were constructed of concrete, masonry, or metal and did not have furnished interiors, such as warehouses and garages. To protect the contents during flooding, damageable items would be elevated permanently or temporarily above the DFE.

The various costs used in the wet flood proofing estimate are summarized in Table 13. The total structure square footage was used along with the unit cost information to determine cost. These costs could vary significantly from structure to structure and would depend on the structure's functional purpose. For estimating purposes the structure perimeter was used to estimate the length of electrical utilities that would need to be relocated. The flood proofing height was calculated by subtracting the foundation elevation from the design flood elevation.

Table 13
Cost Parameters for Wet Flood Proofing

Item	Unit of Measure	Unit Cost (Dollars)
Demo interior wall	SF	1.05
Insulation and wains coat	SF	8.47
Raise electric utilities	LF	12.88
Flood vents	SF	51.34
Sewer backflow valve	LS	9,590.00

7.5 Flood Barriers (Berms and Floodwalls)

Flood barriers include berms, levees and floodwalls. Berms and levees are constructed of compacted soil placed around buildings to prevent damages from flooding. Floodwalls are flood barriers usually constructed of reinforced concrete or masonry. This nonstructural technique is applicable on a small-scale basis. As nonstructural measures, berms and floodwalls should be constructed to no higher than 5 feet above grade and protect a single building or a few adjacent buildings on one property. Nonstructural measures, including berms and floodwalls should not increase the water surface elevation for the design flood or any other flood events. Levees and floodwalls may have openings that require closures to be erected prior to flooding. Levees and floodwalls may require drainage systems and pumps to evacuate seepage and interior drainage from the protected areas. Figure 7 provides a schematic of a nonstructural earthen berm to protect a building.

For purposes of this assessment, levees or floodwalls were not considered and the information provide here for cost estimating is informational purposes only. Berms were not considered because of their relatively large footprint and floodwalls were not considered because of the larger costs to construct.

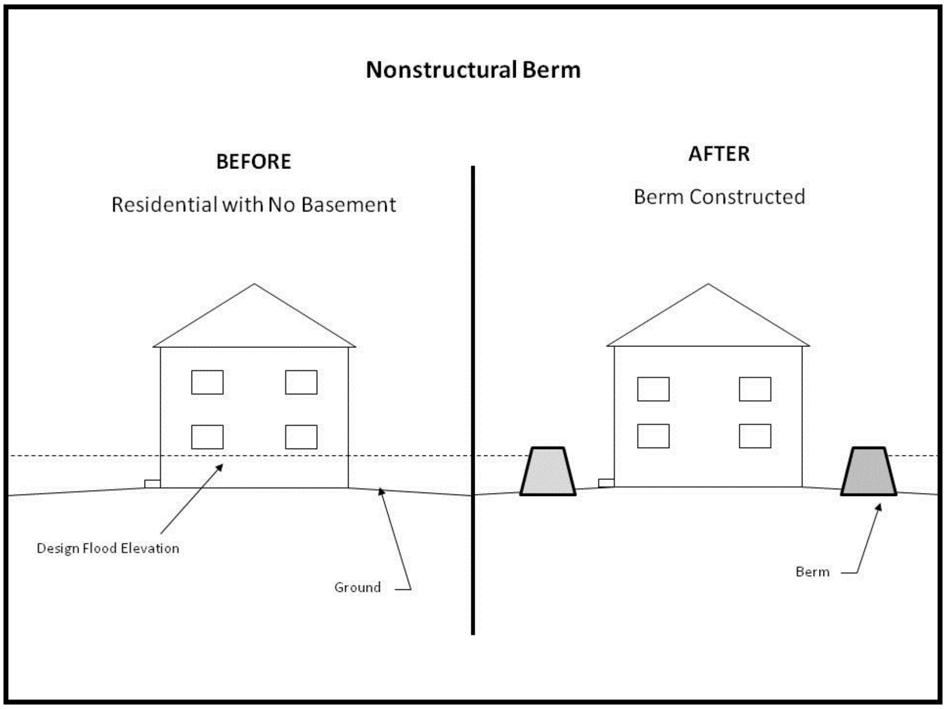


Figure 7
Schematic of Nonstructural Berm

The various costs used in past studies for the berm and floodwall estimates are summarized in Table 14. The perimeter of the levee or floodwalls could be estimated from aerial imagery. The levee or floodwall height would be calculated by subtracting the average ground elevation from the design flood elevation.

Table 14
Cost Parameters for Levees and Floodwalls

Item	Unit of Measure	Unit Cost (Dollars)
Demo pavement	SF	0.69
Clearing and grubbing	ACR	6,613.00
Strip topsoil	BCY	1.39
Compacted random fill	CCY	5.80
Place topsoil	CCY	3.69
Replace paving	SF	5.69
Seeding	ACR	1,947.00
CMU floodwall	SF	14.83
Footing and foundation wall	LF	109.00
Closure panels	SF	185.20

Levees and floodwalls require annual inspection and repair of deficiencies. In addition to the condition of the levee or floodwall, inspections should ensure closures and interior drainage pumps are in good working order. As with other nonstructural measures, the USACE National Nonstructural Flood Proofing Committee (NFPC) advocates buildings with nonstructural flood risk reduction measures, including levees and floodwalls, maintain flood insurance through the NFIP.

Levees and floodwalls are not eligible for the USACE Rehabilitation and Inspection Program (RIP) for flood protection works under Public Law 84-99. Levees, berms and floodwalls, even those that are three feet (or more) above the BFE, are not recognized by the NFIP, meaning that flood insurance and floodplain management requirements of the NFIP are still applicable in the protected area.

8.0 Maintenance and Operations of Nonstructural Measures

The regular maintenance required for elevated residential buildings would be identical to normal building maintenance. The increased maintenance related to the added height of the foundation and steps will be minimal. Since elevated residential buildings have no flood risk reduction features that require operation, there are no operational considerations. Residents of all buildings in a flood hazard area along the Platte River should be encouraged to develop an individual flood preparedness plan.

The maintenance of commercial buildings with wet flood proofing would mainly be periodic inspection and maintenance of the building flood vents, which would be a minor activity compared to normal building maintenance. Operations for wet flood proofed buildings when flooding is imminent would be limited to elevating or removing the building contents that are not permanently located above the design flood elevation. There should be a building flood preparedness plan that is regularly updated by the owners/managers and communicated to the employees.

Buildings with dry flood proofing or properties with levees or floodwalls would require more regular maintenance. Cracks in flood proofed walls, floodwalls and erosion or holes in earthen levee embankments would have to be repaired. Closure panels need to be checked periodically to make sure they fit properly and that gaskets remain water-tight. Drainage systems and pumps would need regular maintenance.

Buildings with dry flood proofing, levees or floodwalls need to install closures and activate the drainage systems when flooding is imminent. Owners/managers should prepare and regularly update a detailed flood preparedness plan for the installation of the closures and operation of the flood proofing measures. The responsible employees should be familiarized with the plan. Installation of closures panels and operation of the flood proofing should be practiced on an annual basis.

While the local sponsor will not directly operate or maintain the nonstructural measures, the sponsor should take the lead in providing flood preparedness information to the community and in dissemination of flood warnings. The sponsor should also specifically monitor properties where nonstructural measures have been installed and through the permitting and inspection process not allow alterations to the nonstructural measures that would degrade the flood risk reduction provided.

9.0 Nonstructural Economic Analysis

After compiling and entering all the necessary data into HEC-FDA, the model can be executed and used to estimate flood damages for future with and without-project scenarios. The model is then calibrated and rerun if necessary, following review and discussion with the team. The following explains what is used to derive the structure damages of this nonstructural assessment.

9.1 Depth Percent Damage Functions

Depth-percent damage functions are used in HEC-FDA to model damages to items such as structures and contents. In addition, depth-percent damage functions exist to estimate damages to appurtenant uses (automobiles, landscaping, etc.), infrastructure (roads, bridges, etc.) and agriculture (crop damages). In this study, only the depth-percent damage functions for structures and contents were considered; as these are the damageable assets for which the nonstructural measures would manage flood risk.

9.1.1 Residential Depth Damages

Each occupancy type has its own stage-percent of value damaged curves for structure and contents. The generic structure and content depth-damage curves for residential structures provided in the Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements (which also contain generic depth-damage relationships for residential structures without basements) represented the depth-damage functions for residential structures in Louisville and Cedar Creek. This EGM summarizes data developed by the Institute for Water Resources (IWR) using post-flood residential damage claim records provided by the Federal Emergency Management Agency (FEMA). The functions account for both structural and content damage to homes. A depth-damage curve for mobile homes is not included in EGM 04-01. Instead, the damage curve for mobile homes was based on 2006 data from the New Orleans district in the “Final Report: Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study.” This curve was used because it is reasonable to assume that mobile homes across the nation would face similar depth-damage functions from various heights of short duration fresh water flooding.

9.1.2 Non-Residential Depth Damages

The damage curves for non-residential structures and contents were taken from the 2008 report “Solicitation of Expert Opinion Depth-Damage Function Calculations for the Benefit-Cost Analysis Tool” prepared by the URS Group Inc. with the assistance of the Federal Emergency Management Agency (FEMA) and USACE.

These damage curves were created through the process of expert-opinion elicitation or the formal process of obtaining information or answers to specific questions about issues such as failure rates, failure consequences and expected service lives. Through this process industry experts gave detailed information in face-to-face meetings with FEMA and USACE officials which was used to construct the non-residential depth damage curves. These damage curves have been used in other USACE studies and were therefore deemed acceptable for this study.

9.2 Entering Alternatives and BCR Computation

As noted earlier, to model nonstructural alternatives in the HEC-FDA software a structure by structure basis is used. The software is primarily used to study structural alternatives and will compile damages by reaches. To model on a structure by structure basis an output file from the software was used to incorporate changes to individual structures. This same output file is then used to identify how these changes affect flood damages to individual structures. It is noteworthy that the particular output file used does not incorporate any risk or uncertainty.

Three different inventories were created for this analysis which were used to model nonstructural alternatives that would likely be implemented for 0.02, 0.01 and 0.002 (50, 100 and 500 year) ACE levels of protection.

The damages that incurred at modeled levels of protection were then annualized and subtracted from the annualized damages from the without-project scenario. The results were the net benefits for each of the differing levels of protection.

The annualized cost of each nonstructural measure was then subtracted from the net benefits. If this calculation was positive it meant that the proposed nonstructural measure had positive net benefits and a BCR greater than 1.0. If negative, it meant that the measure had negative net benefits and a BCR less than 1.0.

9.3 Potential Nonstructural Project Scenarios

Three nonstructural plans were evaluated to determine the plan with the highest net economic benefits. The plans were designated the 0.02, 0.01 and 0.002 ACE nonstructural plans referring to annual probability of the design flood. The flood profile of the design flood established the DFE for each building in each plan through the hydraulic analysis conducted for the feasibility study.

Existing conditions damages were determined for the without-project conditions. A modified with-project conditions HEC-FDA input file was created for each of the three plans which did not compute flood damages for buildings with nonstructural measures until the DFE was exceeded. The input data was modeled in HEC-FDA to determine damages for the with-project conditions. The difference between the without-project and with-project damages was then designated as the project benefits. For each of the three nonstructural plans, the annual benefits and annual costs developed for each building analyzed were used to compute the net benefits and benefit-to-cost ratio (BCR) for each building.

9.4 Existing Conditions

The EAD for without-project conditions was calculated to be $531,192 and is displayed in Table 15 below. This EAD figure captures all of the without-project conditions annualized damages for the 365 structures that were included in the 0.002 ACE event nonstructural measures evaluation.

Table 15
Existing Conditions EAD

Residential Structures	Commercial Structures	Public Structures	Total Structures	EAD
292	35	38	365	$531,192

9.5 Possible Nonstructural Measure Scenarios

To meet the local partnering communities' needs the economist looked at three possible build-up alternatives to determine which structures to study if non-structural alternatives are pursued.

These 3 possible build-up scenarios are listed below:

1. Include all individual structures with a BCR greater than or equal to 1.0.
2. Sort all structures by net benefits, from greatest to least, and move down the list including structures until annual net benefits are equal to annual cost, i.e., a combined BCR of 1.0.
3. Include all structures included in the analysis.

Tables 16, 17 and18 below show the number and type of structures being considered for non-structural remedies, annual benefits, annual costs, annual net benefits and BCR for the particular group of projects.

Table 16
Individual Structures with BCR Greater than or Equal to 1.0

ACE Flood Event	Residential Structures	Commercial Structures	Public Structures	Total Structures	Annual Benefits	Annual Costs	Net Annual Benefits	BCR
0.02	15	4	4	23	$124,653	$71,358	$53,295	1.75
0.01	15	4	4	23	$132,788	$77,271	$55,518	1.72
0.002	13	6	5	24	$122,947	$70,115	$52,832	1.75

Table 17
Combined Structure BCR Greater than or Equal to 1.0

ACE Flood Event	Residential Structures	Commercial Structures	Public Structures	Total Structures	Annual Benefits	Annual Costs	Net Annual Benefits	BCR
0.02	59	9	22	90	$213,601	$213,053	$547	1.00
0.01	60	16	26	102	$243,687	$242,435	$1,252	1.01
0.002	44	28	35	107	$208,504	$207,298	$1,205	1.01

Table 18
All Modeled Nonstructural Solutions

ACE Flood Event	Residential Structures	Commercial Structures	Public Structures	Total Structures	Annual Benefits	Annual Costs	Net Annual Benefits	BCR
0.02	162	10	23	195	$393,492	$734,718	-$341,226	0.54
0.01	203	18	29	250	$481,511	$1,014,559	-$533,048	0.47
0.002	292	35	38	365	$531,183	$1,582,837	-$1,051,654	0.34

There are some results in the above tables that should be expanded upon. When looking at the annual costs on Table 15 these costs increase when moving from the 0.02 to 0.01 ACE flood, but then decrease when considering the 0.002 ACE flood. This seems counterintuitive because as structures are protected against less frequent events it should cost more to protect them. However, two residential structures fall out of the analysis because their BCRs fall under 1.0 when considering 0.002 ACE flood event protection. While three non-residential structures are added, it is much cheaper to dry/wet flood proof non-residential structures than to raise residential structures. For example, the maximum, minimum and average costs for the residential measures for 0.002 ACE flood event protection were roughly $334,000, $32,000 and $124,000 respectively. The maximum, minimum and average costs for the non-residential measures for 0.002 ACE flood event protection were roughly $271,000, $1,000 and $27,000. The economist reviewed each structure and confirmed that the drop in annual price was correct and defendable.

The aim of this document is not to pick a plan for implementation and construction, but rather to assist the partnering communities in deciding if pursuing a potential nonstructural plan is advisable. When comparing differing levels of protection and how many structures to include it appears to be in the best interest of the communities to not include every structure per the negative net benefits for developing protection measures at any of the three modeled ACE flood events. When protecting either all structures with a BCR greater than 1.0 or combining structures based on highest net benefits until reaching a BCR of roughly 1.0 using nonstructural measures to protect up to the 0.01 ACE flood event provides the most net benefits in either scenario and would therefore be the recommended plan.

10.0 Cedar Creek and Louisville Nonstructural Plan Summary

This nonstructural assessment investigated buildings within the 0.2-percent ACE flood inundation area along the Platte River study area in and around Cedar Creek and Louisville. The buildings that were determined to have expected flood damages for floods less than the 0.2-percent ACE event where included in a detailed analysis for nonstructural flood risk reduction. Three nonstructural plans were evaluated for different DFE and a significant number of economically justified buildings were determined for each plan.

This nonstructural assessment has been conducted in support of the Omaha District's efforts to analyze and develop flood risk reduction measures in the Platte River. This study assessed the nonstructural alternatives for Cedar Creek and Louisville based upon existing Platte River flows, flood stages, and an inventory of structural data for individual residential and commercial buildings residing within the 0.2-percent ACE floodplain.

The recommended nonstructural plan with the highest net benefits is that with the DFE at the 0.2-percent ACE flood profile. In addition, the recommended plan supports the objectives of the NFIP by elevating or flood proofing the eligible buildings to above the BFE.

Due to the limitations of the study, the nonstructural measures for specific buildings were evaluated at reconnaissance level detail. During the implementation of the nonstructural measures (preconstruction engineering and design) more detailed evaluations will be conducted for each building that may qualify for nonstructural flood risk reduction. This would include site visits to properties where the owners indicate interest in participating in nonstructural flood risk mitigation.

Site inspections will verify that the technical assumptions used for selecting the recommended nonstructural measure for each building were appropriate or may determine a more appropriate nonstructural measure. A preliminary design for the recommended nonstructural measure for each building will be developed and an analysis of benefits and costs will verify economic feasibility. During this process, some buildings deemed to be feasible for implementation of nonstructural measures in this assessment may drop out of the plan and other buildings may be added. The total cost of the nonstructural plan would remain within the authorized limit.

Table A and Figures A, B, C, and D represent structure specific economical analysis. This data can be used to assist in developing a community's nonstructural flood risk reduction plan, communicate risk, evaluate individual nonstructural implementation, or assist in making other flood risk decisions.

11.0 Funding for Nonstructural Projects

There were three funding options for nonstructural evaluated as a part of this project. The three funding options were FEMA FMA, FEMA HMGP, and USACE Section 205.

FEMA's Flood Mitigation Assistance (FMA) grant program annually provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program. FEMA has determined that the average benefits for any acquisition project are $276,000 and for any elevation project are $175,000. Thus, respective projects that cost under those dollar amounts are considered cost-effective.

FEMA Hazard Mitigation Grant Program (HMGP) helps communities implement hazard mitigation measures following a Presidential major disaster declaration. Hazard mitigation is any action taken to reduce or eliminate long term risk to people and property from natural hazards.

Section 205 of the 1948 Flood Control Act provides authority of the Corps of Engineers to plan and construct small flood damage reduction projects that have not already been specifically authorized by Congress. A project is accepted for construction only after detailed investigation clearly shows its engineering feasibility, environmental acceptability, and economic justification.

12.0 Outreach

The Cass County community outreach meeting was held on February 24, 2015 at the Senior Center in Louisville, Nebraska. There were approximately 56 attendees from the public at the meeting. The meeting presentation included topics on the background and history of flooding in the area, what risk is, the risk assessment process, and ways to manage risk with insurance and/or Flood Risk Adaptive Measures with FEMA, USACE, NEMA or NDNR programs. After the presentation, the community members were encouraged to fill out the provided worksheet (Figure A Attachment) to assess their personal flood risk. The goal of the worksheet was to inform homeowners if they were at risk, what the magnitude of that risk is, what the cost of that risk is, how to lower the flood risk, and the cost of lowering the flood risk. This worksheet was developed with the intent of directing risk informed decisions.

13.0 Conclusion

The results of this study showed that there are numerous structures in the two communities at notable flood risk, and nonstructural measures were both feasible and cost effective. Historic floods in the communities include the 1923 Louisville flood which killed 12 people and the numerous Platte River floods at Cedar Creek where flood fighting of a local berm has prevented repetitive flood damages. The cost benefit analysis identifies that a nonstructural approach incorporating 48+ structures could be built which would have a benefit cost ratio greater than 1.00. These are quite conservative cost estimates and the potential for higher structure inclusion is possible. The analysis identifies individual structures with cost benefit ratios as high as 7.21.

The results of the HEC-FDA and FEMA BCA comparison showed that while FEMA BCA and HEC-FDA produce similar results, and generally trend together, they do not produce identical results. A limited number of structures showed notable discrepancies, some of which could be modeled to align more closely. This evaluation was completed as a functional level comparison. A more technical evaluation of the computations differences between the models was not a part of this project.

14.0 References

Federal Emergency Management Agency, Office of Community Development, Disaster Recovery Unity, Hazard Mitigation Program; Procedure Number 1, Revision Number 11; "Elevation Cost Guide", January 15, 2013

Federal Emergency Management Agency, Flood Mitigation Assistance Program, March 16 2015 https://www.fema.gov/flood-mitigation-assistance-program

Federal Emergency Management Agency; Floodproofing Non-Residential Buildings; FEMA P-936; June 2013

Federal Emergency Management Agency, Hazard Mitigation Grant Program, April 24 2015 https://www.fema.gov/hazard-mitigation-grant-program

URS Group Inc. Solicitation of Expert Opinion Depth-Damage Function Calculations for the Benefit-Cost Analysis Tool. URS Corporation, October 2008.

U.S. Army Corps of Engineers, Economic Guidance Memorandum (EGM) 04-01, Generic Depth-Damage Relationships for Residential Structures with Basements. U.S. Army Corps of Engineers, 10 October 2003.

U.S. Army Corps of Engineers, Engineering Regulation (ER) 1100-2-100, Planning Guidance Notebook. U.S. Army Corps of Engineers, 10 October 2003.

U.S. Army Corps of Engineers, National Flood Proofing Committee; Raising and Moving the Slab on Grade House With the Slab Attached; 1990

U.S. Army Corps of Engineers, Final Report: Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVR) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study. New Orleans District, 7 March 2006.

Table A

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$5,120	1,358	1022.8	Inside	Slab	1026.22	3.42	$2,312.82	$58.98	$104,452.02	$4,353.27	0.01	0.01	-	$117,761.78	$4,908.00	0.01
[redacted]	$5,120	1,216	1026.8	Inside	Mobile	1026.38	-0.42	$0.00	$39.38	-	-	-	-	-	$89,557.27	$3,733.00	0.01
[redacted]	$5,120	1,216	1025.3	Inside	Mobile	1026.49	1.19	$5,366.10	$87.52	$88,166.83	$3,674.55	0.02	0.01	-	$97,502.61	$4,064.00	0.02
[redacted]	$5,120	1,216	1025	Inside	Mobile	1026.56	1.56	$6,240.72	$95.45	$88,166.83	$3,674.55	0.02	0.01	-	$97,502.61	$4,064.00	0.02
[redacted]	$5,120	1,216	1025.8	Inside	Mobile	1026.66	0.86	$4,528.53	$80.12	$86,776.40	$3,616.60	0.01	0.01	-	$97,502.61	$4,064.00	0.02
[redacted]	$5,120	672	1023	Inside	Slab	1026.77	3.77	$3,599.65	$142.26	$51,687.60	$2,154.20	0.06	0.03	-	$58,273.87	$2,429.00	0.06
[redacted]	$87,000	1,400	1024.4	Inside	Block	1026.84	2.44	$56,376.20	$2,575.27	$123,194.70	$5,134.42	0.46	0.27	-	$141,892.50	$5,914.00	0.44
[redacted]	$5,120	866	1022.3	Inside	Slab	1027.01	4.71	$4,060.58	$183.45	$69,438.54	$2,894.01	0.06	0.03	-	$75,096.98	$3,130.00	0.06
[redacted]	$5,120	1,500	1024.2	Inside	Slab	1027.02	2.82	$1,869.44	$44.34	$18,491.17	$770.66	0.04	0.03	0.07	$18,491.17	$771.00	0.06
[redacted]	$5,120	1,216	1026.8	Inside	Mobile	1027.02	0.22	$2,500.31	$62.69	$86,776.40	$3,616.60	0.01	0.01	-	$93,529.94	$3,898.00	0.02
[redacted]	$5,120	1,216	1023.2	Inside	Slab	1027.03	3.83	$8,717.71	$331.20	$93,529.94	$3,898.07	0.08	0.04	-	$105,447.96	$4,395.00	0.08
[redacted]	$5,120	800	1025.4	Inside	Slab	1027.04	1.64	$2,313.48	$38.87	$58,004.50	$2,417.47	0.01	0.01	-	$66,760.06	$2,782.00	0.01
[redacted]	$5,120	1,216	1025.6	Inside	Mobile	1027.04	1.44	$5,965.87	$93.13	$88,166.83	$3,674.55	0.02	0.01	-	$97,502.61	$4,064.00	0.02
[redacted]	$5,120	1,216	1026.1	Inside	Mobile	1027.03	0.93	$4,703.81	$81.81	$86,776.40	$3,616.60	0.01	0.01	-	$97,502.61	$4,064.00	0.02
[redacted]	$5,120	1,216	1025.3	Inside	Mobile	1027.02	1.72	$6,590.24	$98.83	$88,166.83	$3,674.55	0.02	0.01	-	$101,475.29	$4,229.00	0.02
[redacted]	$6,110	75	1022	Inside	Slab	1027.02	5.02	$4,266.75	$171.85	$1,305.61	$54.41	2.88	1.66	1.23	$1,305.61	$54.00	3.16
[redacted]	$5,120	760	1024.7	Inside	Crawlspace	1027.01	2.31	$3,249.34	$146.87	$63,998.45	$2,667.28	0.05	0.03	-	$71,271.49	$2,970.00	0.05
[redacted]	$5,120	250	1022.3	Inside	Slab	1027.01	4.71	$2,664.68	$107.31	$3,612.11	$150.54	0.64	0.37	-	$3,612.11	$151.00	0.71
[redacted]	$624,310	3,840	1028.2	Inside	Slab	1027.32	-0.88	$0.00	$747.36	-	-	-	-	-	$35,074.73	$1,462.00	0.51
[redacted]	$15,530	728	1021.9	Outside	Slab	1019.56	-2.34	-	-	-	-	-	-	-	-	-	-
[redacted]	$54,830	864	1005.9	Inside	Crawlspace	1008.73	2.83	$32,902.09	$1,469.36	$78,823.69	$3,285.16	0.44	0.25	-	$86,225.42	$3,594.00	0.41
[redacted]	$161,410	1,680	1008	Inside	Block	1008.64	0.64	$76,705.79	$3,736.66	$150,769.08	$6,283.64	0.58	0.33	-	$170,306.58	$7,098.00	0.53
[redacted]	$42,180	966	1009.8	Inside	Block	1008.58	-1.22	$12,964.77	$208.78	-	-	-	-	-	$83,273.39	$3,471.00	0.06
[redacted]	$222,050	2,869	1009.7	Inside	Crawlspace	1008.51	-1.19	$0.00	$258.89	-	-	-	-	-	$260,965.95	$10,876.00	0.02
[redacted]	$187,170	2,237	1009.7	Inside	Slab	1008.45	-1.25	$0.00	$212.09	-	-	-	-	-	$201,061.97	$8,380.00	0.03
[redacted]	$140,270	1,748	1022.6	Outside	Block	1019.56	-3.04	-	-	-	-	-	-	-	-	-	-
[redacted]	$147,050	2,415	1018.9	Outside	Crawlspace	1014.72	-4.18	-	-	-	-	-	-	-	-	-	-
[redacted]	$80,190	1,215	1008.5	Inside	Crawlspace	1008.39	-0.11	$0.00	$206.96	-	-	-	-	-	$110,959.48	$4,625.00	0.04
[redacted]	$142,560	2,840	1006.3	Inside	Crawlspace	1008.33	2.03	$71,823.93	$1,828.48	$220,597.64	$9,193.91	0.19	0.11	-	$245,677.74	$10,239.00	0.18
[redacted]	$101,390	1,340	1010.2	Inside	Crawlspace	1008.27	-1.93	$0.00	$63.14	-	-	-		-	$122,665.66	$5,112.00	0.01
[redacted]	$143,150	1,636	1008.8	Inside	Crawlspace	1008.20	-0.60	$0.00	$318.35	-	-	-	-	-	$159,883.65	$6,664.00	0.05
[redacted]	$125,500	1,844	1007.1	Inside	Slab	1008.14	1.04	$46,529.92	$769.28	$147,810.06	$6,160.32	0.11	0.06	-	$152,694.62	$6,364.00	0.12
[redacted]	$100,200	1,528	1023.6	Outside	Block	1019.56	-4.04	-	-	-	-	-	-	-	-	-	-
[redacted]	$81,130	1,232	1027.4	Outside	Block	1021.50	-5.90	-	-	-	-	-	-	-	-	-	-
[redacted]	$119,800	2,046	1007.6	Inside	Slab	1008.07	0.47	$22,483.51	$407.63	$146,007.00	$6,085.17	0.06	0.03	-	$150,686.00	$6,280.00	0.06
[redacted]	$201,010		1007.4	Inside	Slab	1007.96	0.56	$39,573.24	$707.61	-	-	0.13	0.07	-	$183,975.38	$7,668.00	0.09
[redacted]	$71,360	1,032	1005.6	Inside	Slab	1007.90	2.30	$38,278.93	$985.24	$76,005.84	$3,167.72	0.29	0.17	-	$82,748.93	$3,449.00	0.29
[redacted]	$97,200	1,786	1005.8	Inside	Slab	1007.85	2.05	$49,228.81	$1,255.04	$131,537.24	$5,482.11	0.22	0.12	-	$143,206.96	$5,969.00	0.21
[redacted]	$46,890	1,260	1008.1	Inside	Crawlspace	1007.82	-0.28	$0.00	$76.64	-	-	-		-	$100,649.10	$4,195.00	0.02
[redacted]	$65,250	1,064	1003.8	Inside	Slab	1008.63	4.83	$52,470.80	$4,382.18	$85,314.79	$3,555.69	1.22	0.70	1.10	$92,266.96	$3,845.00	1.14
[redacted]	$110,880	1,288	1006.2	Inside	Block	1007.77	1.57	$62,557.75	$4,854.26	$116,826.48	$4,869.01	0.98	0.56	0.29	$127,073.62	$5,296.00	0.92
[redacted]	$137,080	1,932	1005.7	Inside	Crawlspace	1007.74	2.04	$45,902.41	$1,177.91	$142,290.00	$5,930.26	0.19	0.11	-	$154,913.69	$6,456.00	0.18
[redacted]	$173,790	2,885	1005.8	Inside	Slab	1007.71	1.91	$56,135.02	$1,435.32	$209,178.71	$8,718.00	0.16	0.09	-	$231,328.16	$9,641.00	0.15
[redacted]	$145,410	2,018	1006.8	Inside	Slab	1007.68	0.88	$33,096.72	$567.82	$144,008.86	$6,001.89	0.08	0.05	-	$155,216.63	$6,469.00	0.09
[redacted]	$138,280	1,857	1007.9	Inside	Slab	1007.66	-0.24	$0.00	$345.64	-	-	-	-	-	$136,766.32	$5,700.00	0.06
[redacted]	$82,860	1,890	1047.1	Inside	Block	1042.21	-4.89	-	-	-	-	-	-	-	-	-	-
[redacted]	$74,190	2,740	1021.7	Outside	Slab	1020.59	-1.11	$0.00	$16.92	-	-	-	-	-	$32,734.35	$1,364.00	0.01
[redacted]	$51,510	2,044	1033	Inside	Slab	1033.93	0.93	$10,170.70	$200.35	$20,609.29	$858.94	0.19	0.11	0.00	$24,768.56	$1,032.00	0.19
[redacted]	$122,970	1,726	1004.3	Inside	Slab	1008.53	4.23	$63,544.91	$3,235.07	$138,395.98	$5,767.97	0.55	0.32	-	$149,673.66	$6,238.00	0.52

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$155,380	2,012	1008.3	Inside	Slab	1007.63	-0.67	$0.00	$338.56	-	-	-	-	-	$145,881.31	$6,080.00	0.06
[redacted]	$187,160	2,136	1007.4	Inside	Slab	1007.62	0.22	$46,352.98	$875.40	$152,429.60	$6,352.85	0.12	0.07	-	$157,314.41	$6,556.00	0.13
[redacted]	$98,670	1,391	1007	Inside	Slab	1007.59	0.59	$30,070.17	$529.79	$99,264.78	$4,137.08	0.11	0.06	-	$102,445.86	$4,270.00	0.12
[redacted]	$145,360	1,440	1005.8	Inside	Slab	1007.58	1.78	$68,346.43	$1,725.12	$104,408.09	$4,351.44	0.37	0.21	-	$115,463.62	$4,812.00	0.3585
[redacted]	$197,430	1,703	1013.8	Inside	Slab	1007.45	-6.35	-	-	-	-	-	-	-	-	-	-
[redacted]	$81,500	1,308	1005.4	Inside	Slab	1007.56	2.16	$42,283.81	$1,083.71	$96,332.98	$4,014.90	0.26	0.15	-	$104,879.46	$4,371.00	0.25
[redacted]	$179,150	1,948	1013.6	Inside	Block	1007.43	-6.17	-	-	-	-	-	-	-	-	-	-
[redacted]	$73,960	1,848	1030.7	Inside	Poured	1030.20	-0.50	$19,877.21	$553.48	-	-	-	-	-	$148,877.47	$6,205.00	0.09
[redacted]	$35,220	1,152	1029.2	Inside	Slab	1029.69	0.49	$4,183.72	$87.86	$82,209.22	$3,426.26	0.02	0.01	-	$84,843.73	$3,536.00	0.02
[redacted]	$156,670	2,064	1027.8	Inside	Slab	1027.32	-0.48	$0.00	$262.38	-	-	-	-	-	$24,998.35	$1,042.00	0.25
[redacted]	$57,920	933	1004.6	Inside	Slab	1007.52	2.92	$35,373.97	$1,594.59	$68,714.58	$2,863.84	0.54	0.31	-	$77,858.92	$3,245.00	0.49
[redacted]	$157,530	1,658	1012	Inside	Block	1007.41	-4.59	-	-	-	-	-	-	-	-		-
[redacted]	$185,250	1,661	1009.7	Inside	Block	1007.52	-2.18	$42,527.35	$1,128.82	-	-	-	-	-	$170,322.25	$7,099.00	0.16
[redacted]	$159,320	1,683	1010.7	Inside	Block	1007.40	-3.30	-	-	-	-	-	-	-	-	-	-
[redacted]	$84,900	1,552	1004.5	Inside	Slab	1007.51	3.01	$35,575.79	$1,612.26	$119,373.74	$4,975.17	0.32	0.18	-	$129,514.51	$5,398.00	0.30
[redacted]	$108,080	1,676	1004.2	Inside	Slab	1007.41	3.21	$69,555.57	$3,284.07	$128,911.33	$5,372.67	0.60	0.34	-	$139,862.32	$5,829.00	0.56
[redacted]	$137,350	1,732	1004.5	Inside	Slab	1007.51	3.01	$57,575.86	$2,609.82	$133,218.63	$5,552.19	0.46	0.26	0.24	$144,535.52	$6,024.00	0.43
[redacted]	$188,510	1,642	1004	Inside	Slab	1007.41	3.41	$125,365.78	$6,072.04	$160,607.94	$6,693.70	0.89	0.51	-	$187,645.71	$7,821.00	0.78
[redacted]	$73,600	1,044	1004.1	Inside	Slab	1007.51	3.41	$48,961.30	$2,365.88	$80,300.38	$3,346.70	0.69	0.40	0.43	$87,121.87	$3,631.00	0.65
[redacted]	$74,810	1,064	1032.6	Inside	Poured	1030.31	-2.29	$0.00	$146.26	-	-	-	-	-	$116,223.66	$4,844.00	0.03
[redacted]	$44,150	2,508	1031.6	Inside	Slab	1030.44	-1.16	$0.00	$24.41	-	-	-	-	-	$30,085.49	$1,254.00	0.02
[redacted]	$74,120	1,855	1044.2	Inside	Block	1042.21	-1.99	-	-	-	-	-	-	-	-	-	-
[redacted]	$37,150	760	1036.8	Inside	Slab	1034.68	-2.12	-	-	-	-	-	-	-	-	-	-
[redacted]	$61,370	780	1004.6	Inside	Slab	1008.54	3.94	$44,263.60	$2,239.08	$59,994.53	$2,500.41	0.88	0.51	0.72	$67,639.31	$2,819.00	0.79
[redacted]	$121,610	1,644	1004.6	Inside	Slab	1007.49	2.89	$73,952.94	$3,325.49	$121,079.07	$5,046.24	0.64	0.37	-	$137,191.92	$5,718.00	0.58
[redacted]	$116,650	1,508	1009.8	Inside	Crawlspace	1007.39	-2.41	$0.00	$63.71	-	-	-	-	-	$140,473.42	$5,855.00	0.01
[redacted]	$128,890	2,673	1003.9	Inside	Slab	1007.49	3.59	$60,018.55	$2,904.28	$205,596.66	$8,568.71	0.33	0.19	-	$223,062.04	$9,297.00	0.31
[redacted]	$174,440	1,742	1014.2	Inside	Poured	1007.37	-6.83	-	-	-	-	-		-	-		-
[redacted]	$123,510	1,772	1004.8	Inside	Slab	1007.48	2.68	$71,894.59	$3,128.64	$130,506.15	$5,439.14	0.56	0.32	-	$147,873.52	$6,163.00	0.51
[redacted]	$102,820	1,462	1003.6	Inside	Slab	1007.47	3.87	$73,441.65	$3,705.21	$112,451.29	$4,686.66	0.77	0.45	-	$126,780.36	$5,284.00	0.70
[redacted]	$331,990	3,312	1007	Inside	Slab	1007.34	0.34	$26,973.55	$764.75	$39,243.64	$1,635.57	0.16	0.09	0.00	$39,243.64	$1,636.00	0.47
[redacted]	$331,990	4,800	1007.5	Inside	Slab	1007.33	-0.17	$0.00	$466.78	-	-	-	-	-	$56,074.42	$2,337.00	0.20
[redacted]	$331,990	5,280	1007.4	Inside	Slab	1007.26	-0.14	$0.00	$471.39	-	-	-	-	-	$61,480.87	$2,562.00	0.18
[redacted]	$331,990	6,720	1007.4	Inside	Slab	1007.20	-0.20	$0.00	$459.76	-	-	-	-	-	$77,653.01	$3,236.00	0.14
[redacted]	$331,990	7,680	1007.4	Inside	Slab	1007.14	-0.26	$0.00	$448.09	-	-	-	-	-	$88,403.39	$3,684.00	0.12
[redacted]	$197,130	2,728	1004.1	Inside	Slab	1007.48	3.38	$88,520.11	$4,199.17	$209,827.04	$8,745.02	0.47	0.27	-	$227,651.79	$9,488.00	0.44
[redacted]	$44,560	1,036	1020.6	Outside	Slab	1015.82	-4.78	-	-	-	-	-	-	-	-	-	-
[redacted]	$56,980	1,361	1024.4	Outside	Slab	1021.50	-2.90	-	-	-	-	-	-	-	-	-	-
[redacted]	$76,070	2,058	1016.9	Outside	Poured	1012.37	-4.53	-	-	-	-	-	-	-	-	-	-
[redacted]	$132,430	2,173	1003.5	Inside	Slab	1007.49	3.99	$65,976.15	$3,301.40	$167,138.62	$6,965.88	0.46	0.27	-	$188,436.19	$7,854.00	0.42
[redacted]	$98,210	1,794	1003.5	Inside	Slab	1007.54	4.04	$49,273.72	$2,472.54	$143,848.43	$5,995.21	0.40	0.23	-	$155,570.42	$6,484.00	0.38
[redacted]	$60,680	1,525	1009.8	Inside	Block	1007.46	-2.34	$13,236.95	$528.49	-	-	-	-	-	$129,773.85	$5,409.00	0.10
[redacted]	$118,090	2,487	1003.6	Inside	Slab	1007.59	3.99	$85,902.68	$4,366.03	$191,290.27	$7,972.45	0.54	0.31	-	$215,665.35	$8,988.00	0.49
[redacted]	$75,050	1,008	1006.3	Inside	Crawlspace	1007.65	1.35	$20,358.89	$511.23	$88,684.65	$3,696.13	0.13	-	-	$90,812.24	$3,785.00	0.14
[redacted]	$81,730	1,567	1004.8	Inside	Slab	1007.72	2.92	$49,958.67	$2,238.79	$115,408.09	$4,809.89	0.45	0.26	-	$130,766.26	$5,450.00	0.41
[redacted]	$57,160	1,322	1045.9	Inside	Block	1042.21	-3.69	-	-	-	-	-	-	-	-	-	-
[redacted]	$35,100	694	1035.9	Inside	Slab	1035.34	-0.56	$0.00	$56.62	-	-	-	-	-	$49,525.35	$2,064.00	0.03
[redacted]	$132,650	1,849	1004.5	Inside	Slab	1008.51	4.01	$96,732.53	$4,921.74	$175,119.40	$7,298.50	0.66	0.38	-	$203,305.40	$8,473.00	0.58
[redacted]	$97,880	1,904	1019.1	Outside	Crawlspace	1013.77	-5.33	-	-	-	-	-	-	-	-	-	-
[redacted]	$104,210	1,344	1025.2	Outside	Block	1021.50	-3.70	-	-	-	-	-	-	-	-	-	-
[redacted]	$257,010	3,518	1010.5	Inside	Block	1007.78	-2.72	$39,344.27	$2,237.86	-	-	-	-	-	$324,386.44	$13,520.00	0.17

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$116,140	2,036	1004.4	Inside	Slab	1007.89	3.49	$38,613.79	$1,693.98	$156,601.12	$6,526.71	0.25	0.15	-	$169,904.34	$7,081.00	0.24
[redacted]	$59,790	1,140	1004	Inside	Slab	1007.95	3.95	$43,231.94	$2,173.35	$87,684.32	$3,654.44	0.58	0.34	-	$98,857.46	$4,120.00	0.53
[redacted]	$46,790	936	1029.6	Inside	Crawlspace	1032.33	2.73	$27,547.35	$1,485.14	$83,016.30	$3,459.89	0.42	0.24	-	$88,703.90	$3,697.00	0.40
[redacted]	$169,460	5,245	1021.6	Outside	Slab	1014.68	-6.92	-	-	-	-	-	-	-	-	-	-
[redacted]	$53,790	759	1004.9	Inside	Slab	1008.01	3.11	$34,043.67	$1,556.26	$73,363.72	$3,057.60	0.50	0.29	-	$76,469.26	$3,187.00	0.49
[redacted]	$61,570	784	1005.4	Inside	Slab	1008.10	2.70	$36,000.81	$1,538.62	$57,740.87	$2,406.48	0.62	0.36	-	$65,424.85	$2,727.00	0.56
[redacted]	$83,950	1,112	1004.3	Inside	Slab	1008.14	3.84	$40,797.59	$1,991.69	$85,530.67	$3,564.68	0.55	0.32	-	$96,429.38	$4,019.00	0.50
[redacted]	$65,500	1,216	1004.4	Inside	Slab	1008.27	3.87	$46,798.57	$2,339.55	$93,529.94	$3,898.07	0.59	0.34	-	$105,447.96	$4,395.00	0.53
[redacted]	$67,180	1,400	1020.7	Outside	Slab	1020.01	-0.69	$0.00	$37.34	-	-	-	-	-	$17,330.32	$722.00	0.05
[redacted]	$52,600	864	1003.5	Inside	Slab	1008.50	5.00	$43,142.67	$3,707.14	$72,100.86	$3,004.97	1.22	0.7	1.45	$74,923.55	$3,123.00	1.19
[redacted]	$67,830	1,277	1003.8	Inside	Slab	1008.55	4.75	$37,715.21	$2,995.76	$102,393.78	$4,267.49	0.69	0.40	-	$110,737.70	$4,615.00	0.65
[redacted].	$74,180	1,739	1023.5	Outside	Slab	1020.85	-2.65	-	-	-	-	-	-	-	-	-	-
[redacted]	$54,730	936	1031.2	Inside	Block	1034.02	2.82	$37,450.33	$3,694.44	$98,901.45	$4,121.94	0.89	0.51	0.61	$103,572.41	$4,317.00	0.86
[redacted]	$281,580	8,670	1037.8	Inside	Poured	1036.21	-1.59	$0.00	$0.62	-	-	-	-	-	$99,469.34	$4,146.00	0.00
[redacted]	$56,450	997	1028	Inside	Block	1027.31	-0.69	$19,953.80	$540.26	-	-	-	-	-	$88,899.61	$3,705.00	0.15
[redacted]	$126,900	5,628	1038.3	Inside	Slab	1036.28	-2.02	-	-	-	-	-	-	-	-	-	-
[redacted]	$61,500	1,408	1029.4	Inside	Block	1027.30	-2.10	$11,164.95	$183.57	-	-	-	-	-	$110,473.68	$4,604.00	0.04
[redacted]	$65,220	2,116	1038.3	Inside	Slab	1036.36	-1.94	-	-	-	-	-	-	-	-	-	-
[redacted]	$129,220	2,900	1038.1	Inside	Slab	1036.44	-1.66	-	-	-	-	-	-	-	-	-	-
[redacted]	$57,740	1,984	1027	Inside	Slab	1027.28	0.28	$9,806.75	$185.47	$148,470.53	$6,187.84	0.02	0.01	0.02	$160,876.61	$6,705.00	0.03
[redacted]	$57,700	1,278	1029.4	Inside	Block	1027.25	-2.15	$10,337.80	$170.56	-	-	-	-	-	$100,836.79	$4,203.00	0.04
[redacted]	$53,740	1,119	1028.8	Inside	Crawlspace	1027.38	-1.42	$11,673.50	$318.17	-	-	-	-	-	$97,223.55	$4,052.00	0.08
[redacted]	$58,210	1,196	1029.2	Inside	Block	1027.37	-1.83	$14,987.55	$405.75	-	-	-	-	-	$102,837.50	$4,286.00	0.09
[redacted]	$63,130	1,435	1028.5	Inside	Block	1027.38	-1.12	$14,756.88	$401.59	-	-	-	-	-	$124,664.41	$5,196.00	0.08
[redacted]	$50,870	1,282	1024.7	Inside	Crawlspace	1027.28	2.58	$28,978.06	$716.43	$94,418.11	$3,935.09	0.15	0.09	0.11	$111,171.28	$4,633.00	0.15
[redacted]	$61,950	1,422	1037.7	Inside	Block	1033.93	-3.77	-	-	-	-	-		-	-	-	-
[redacted]	$76,850	13,886	1028.2	Inside	Slab	1020.76	-7.44	-	-	-	-	-	-	-	-	-	-
[redacted].	$37,720	137	1022.9	Outside	Crawlspace	1019.97	-2.93	-	-	-	-	-	-	-	-	-	-
[redacted]	$33,400	3,600	1021.4	Inside	Slab	1021.50	0.10	$809.05	$43.29	$42,511.37	$1,771.76	0.00	0.00	0.00	$42,511.37	$1,772.00	0.02
[redacted]	$92,450	1,344	1008.3	Inside	Crawlspace	1008.33	0.03	$20,273.89	$399.62	-	-	-	-	-	$124,366.70	$5,183.00	0.08
[redacted]	$59,850	948	1004.9	Inside	Slab	1008.37	3.47	$40,189.28	$1,940.74	$72,916.43	$3,038.96	0.62	0.36	-	$79,110.67	$3,297.00	0.59
[redacted]	$127,230	1,922	1007	Inside	Slab	1008.33	1.33	$52,214.60	$1,289.28	$139,355.80	$5,807.97	0.21	0.12	-	$147,832.69	$6,161.00	0.21
[redacted]	$77,270	1,435	1007.9	Inside	Crawlspace	1008.45	0.55	$15,144.58	$270.97	$114,952.41	$4,790.90	0.05	0.03	0.17	$117,084.96	$4,880.00	0.06
[redacted]	$116,200	2,123	1007.1	Inside	Slab	1008.29	1.19	$45,447.20	$741.00	$153,929.43	$6,415.36	0.10	0.06	-	$163,292.82	$6,806.00	0.11
[redacted]	$122,280	1,800	1007.4	Inside	Crawlspace	1008.49	1.09	$30,283.45	$507.07	$150,369.96	$6,267.01	0.07	0.04	0.06	$163,904.30	$6,831.00	0.07
[redacted]	$63,320	712	1006.5	Inside	Slab	1008.24	1.74	$29,417.45	$740.79	$51,624.00	$2,151.55	0.32	0.19	-	$57,090.35	$2,379.00	0.31
[redacted]	$90,620	1,397	1007	Inside	Slab	1008.20	1.20	$35,636.85	$873.18	$101,290.35	$4,221.50	0.19	0.11	-	$107,451.75	$4,478.00	0.19
[redacted]	$64,180	1,233	1017.3	Outside	Slab	1013.10	-4.20	-	-	-	-	-	-	-	-	-	-
[redacted]	$47,480	1,136	1045.8	Inside	Slab	1032.81	-12.99	-	-	-	-	-	-	-	-	-	-
[redacted]	$51,080	1,084	1040.8	Inside	Crawlspace	1041.31	0.51	$23,670.66	$622.71	$92,132.23	$3,839.82	0.16	0.09	0.06	$92,745.81	$3,865.00	0.16
[redacted]	$62,140	1,497	1020	Outside	Block	1014.52	-5.48	-	-	-	-	-	-	-	-	-	-
[redacted]	$77,520	1,296	1039.2	Inside	Block	1038.60	-0.60	$0.00	$25.61	-	-	-	-	-	$16,120.17	$672.00	0.04
[redacted]	$33,220	1,152	1039.5	Inside	Slab	1038.65	-0.85	$0.00	$8.98	-	-	-	-	-	$14,439.05	$602.00	0.01
[redacted]	$189,380	2,012	1026.8	Outside	Poured	1020.17	-6.63	-	-	-	-	-	-	-	-	-	-
[redacted]	$94,730	1,560	1005.2	Inside	Slab	1008.46	3.26	$61,426.91	$2,894.61	$119,989.07	$5,000.82	0.57	0.33	-	$130,182.11	$5,426.00	0.53
[redacted]	$49,250	768	1006.3	Inside	Slab	1008.57	2.27	$26,241.46	$674.73	$56,562.49	$2,357.37	0.27	0.16	-	$61,580.60	$2,567.00	0.26
[redacted]	$147,240	1,604	1006.1	Inside	Block	1008.17	2.07	$65,947.57	$1,766.04	$173,425.05	$7,227.88	0.23	0.14	-	$150,500.51	$6,272.00	0.28
[redacted]	$73,300	1,080	1004.6	Inside	Slab	1008.61	4.01	$53,426.81	$2,723.64	$104,548.62	$4,357.30	0.61	0.35	0.47	$111,605.34	$4,651.00	0.59
[redacted]	$88,080	1,299	1004.3	Inside	Slab	1008.15	3.85	$62,690.76	$3,117.31	$99,913.97	$4,164.14	0.73	0.42	0.56	$112,645.47	$4,695.00	0.664
[redacted]	$53,590	720	1008.3	Inside	Slab	1008.69	0.39	$14,670.66	$267.00	$66,315.13	$2,763.83	0.08	0.05	-	$65,815.96	$2,743.00	0.10
[redacted]	$233,900	2,046	1004.1	Inside	Slab	1008.11	4.01	$137,749.24	$12,814.90	$197,357.28	$8,225.31	1.54	0.89	1.34	$221,897.38	$9,248.00	1.3857

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$122,390	2,250	1008.2	Inside	Slab	1008.73	0.53	$23,715.19	$425.77	$169,671.23	$7,071.43	0.05	0.03	0.03	$171,438.92	$7,145.00	0.06
[redacted]	$75,680	1,749	1009.5	Inside	Slab	1008.03	-1.47	$0.00	$54.30	-	-	-	-	-	$124,812.44	$5,202.00	0.01
[redacted]	$135,140	2,312	1013.2	Inside	Slab	1008.00	-5.20	-	-	-	-	-	-	-	-	-	-
[redacted]	$37,330	600	1024.1	Outside	Slab	1021.50	-2.60	-	-	-	-	-	-	-	-	-	-
[redacted]	$115,680	2,108	1007.1	Inside	Slab	1008.36	1.26	$46,361.64	$1,139.91	$152,841.85	$6,370.03	0.17	0.10	-	$162,139.08	$6,758.00	0.17
[redacted]	$8,650	1,500	1027.4	Inside	Slab	1029.46	2.06	$3,028.71	$109.80	$18,491.17	$770.66	0.13	0.07	0.05	$18,491.17	$771.00	0.14
[redacted]	$2,610	1,080	1028.1	Inside	Slab	1029.25	1.15	$585.79	$12.88	$13,595.75	$566.63	0.02	0.01	-	$13,595.75	$567.00	0.02
[redacted]	$43,590	1,320	1009.9	Inside	Crawlspace	1008.97	-0.93	$0.00	$85.50	-	-	-	-	-	$111,536.47	$4,649.00	0.02
[redacted]	$50,540	925	1014.6	Inside	Slab	1007.98	-6.62	-	-	-	-	-	-	-	-	-	-
[redacted]	$86,160	1,400	1010.7	Inside	Crawlspace	1009.01	-1.69	$0.00	$57.90	-	-	-	-	-	$124,801.27	$5,201.00	0.0111
[redacted]	$97,720	961	1012.1	Inside	Block	1009.08	-3.02	$16,500.64	$630.09	-	-	-	-	-	$114,720.02	$4,781.00	0.13
[redacted]	$78,340	1,266	1017.1	Inside	Slab	1007.97	-9.13	-	-	-	-	-	-	-	-	-	-
[redacted]	$155,890	2,100	1009.9	Inside	Block	1009.12	-0.78	$53,880.11	$1,436.40	-	-	-	-	-	$207,105.57	$8,632.00	0.17
[redacted]	$64,370	960	1017.1	Inside	Slab	1008.00	-9.10	-	-	-	-	-	-	-	-	-	-
[redacted]	$72,740	960	1008.9	Inside	Slab	1009.17	0.27	$18,624.60	$346.80	$84,116.02	$3,505.73	0.08	0.05	-	$83,898.22	$3,497.00	0.10
[redacted]	$92,830	1,620	1019.7	Inside	Block	1008.05	-11.65	-	-	-	-	-	-	-	-	-	-
[redacted]	$2,340	432	1019	Outside	Slab	1014.41	-4.59	-	-	-	-	-	-	-	-	-	-
[redacted]	$126,780	2,940	1038.5	Inside	Block	1039.21	0.71	$20,690.14	$342.90	$13,348.05	$556.31	0.48	0.28	0.01	$21,484.45	$895.00	0.38
[redacted]	$145,450	1,860	1007.9	Inside	Slab	1008.38	0.48	$41,844.34	$749.21	$132,733.64	$5,531.97	0.12	0.07	-	$136,987.27	$5,709.00	0.13
[redacted]	$74,190	1,170	1007.9	Inside	Slab	1009.24	1.34	$30,559.86	$768.10	$84,831.58	$3,535.55	0.20	0.12	-	$89,991.80	$3,751.00	0.20
[redacted]	$38,960	602	1015.8	Inside	Slab	1008.11	-7.69	-	-	-	-	-	-	-	-	-	-
[redacted]	$102,340	1,188	1010.9	Inside	Crawlspace	1009.30	-1.60	$0.00	$70.61	-	-	-	-	-	$109,692.59	$4,572.00	0.02
[redacted]	$58,050	1,056	1011.6	Inside	Slab	1008.15	-3.45	-	-	-	-	-	-	-	-	-	-
[redacted]	$63,500	832	1006	Inside	Slab	1009.35	3.35	$41,833.35	$2,022.73	$63,994.17	$2,667.10	0.74	0.43	-	$69,430.46	$2,894.00	0.70
[redacted]	$54,140	1,037	1008.3	Inside	Slab	1008.19	-0.11	$0.00	$139.88	-	-	-	-	-	$76,374.09	$3,183.00	0.04
[redacted]	$87,430	1,008	1006.1	Inside	Slab	1009.40	3.30	$57,068.56	$2,740.79	$77,531.40	$3,231.30	0.83	0.48	-	$84,117.67	$3,506.00	0.78
[redacted]	$61,740	1,291	1008.9	Inside	Slab	1008.23	-0.67	$0.00	$133.60	-	-	-	-	-	$93,604.76	$3,901.00	0.03
[redacted]	$100,070	1,400	1012.4	Inside	Slab	1008.28	-4.12	-	-	-	-	-	-	-	-	-	-
[redacted]	$44,440	1,018	1041.3	Inside	Slab	1038.82	-2.48	-	-	-	-	-	-	-	-	-	-
[redacted]	$49,710	768	1009	Inside	Slab	1008.31	-0.69	$0.00	$106.78	-	-	-	-	-	$55,684.32	$2,321.00	0.05
[redacted]	$133,810	2,048	1004.4	Inside	Slab	1009.47	5.07	$77,604.61	$6,596.76	$170,905.74	$7,122.88	0.92	0.53	0.57	$177,596.56	$7,402.00	0.89
[redacted]	$102,310	1,550	1012.6	Inside	Slab	1008.33	-4.27	-	-	-	-	-	-	-	-	-	-
[redacted]	$115,480	1,696	1004.9	Inside	Slab	1009.53	4.63	$90,784.44	$7,449.83	$135,990.49	$5,667.71	1.30	0.75	0.81	$147,072.15	$6,130.00	1.22
[redacted]	$65,870	864	1012.4	Inside	Slab	1008.35	-4.05	-	-	-	-	-	-	-	-	-	-
[redacted]	$155,730	1,486	1012.3	Inside	Block	1008.41	-3.89	-	-	-	-	-	-	-	-	-	-
[redacted]	$71,240	1,020	1006.5	Inside	Slab	1009.65	3.15	$45,414.22	$2,126.21	$78,454.39	$3,269.76	0.63	0.37	-	$85,119.07	$3,548.00	0.60
[redacted]	$85,130	1,800	1009	Inside	Slab	1008.47	-0.53	$0.00	$193.46	-	-	-	-	-	$130,510.12	$5,439.00	0.04
[redacted]	$75,810	1,200	1006.9	Inside	Crawlspace	1008.56	1.66	$34,476.54	$865.67	$105,382.57	$4,392.06	0.18	0.11	-	$112,843.28	$4,703.00	0.18
[redacted]	$111,550	1,752	1010	Inside	Slab	1009.70	-0.30	$0.00	$113.18	-	-	-	-	-	$127,029.85	$5,294.00	0.02
[redacted]	$54,520	896	1005.2	Inside	Slab	1008.54	3.34	$35,853.55	$1,713.34	$68,916.80	$2,872.26	0.58	0.34	0.36	$74,771.26	$3,116.00	0.55
[redacted]	$107,780	1,348	1006	Inside	Crawlspace	1008.62	2.62	$41,531.77	$1,784.78	$120,065.65	$5,004.01	0.35	0.20	-	$131,216.18	$5,469.00	0.33
[redacted]	$52,730	1,579	1023.9	Outside	Slab	1020.03	-3.87	-	-	-	-	-	-	-	-	-	-
[redacted]	$15,440	1,460	1020.1	Outside	Crawlspace	1014.29	-5.81	-	-	-	-	-	-	-	-	-	-
[redacted]	$71,440	3,980	1038.8	Inside	Block	1039.33	0.53	$17,368.04	$270.08	$14,252.67	$594.01	0.37	0.21	0.00	$25,026.71	$1,043.00	0.26
[redacted]	$51,340	1,568	1025.1	Outside	Slab	1021.50	-3.60	-	-	-	-	-	-	-	-	-	-
[redacted]	$156,090	2,467	1009	Inside	Slab	1008.32	-0.68	$0.00	$337.06	-	-	-	-	-	$178,871.36	$7,455.00	0.05
[redacted]	$63,290	1,036	1006	Inside	Slab	1009.85	3.85	$45,048.38	$2,262.17	$79,685.05	$3,321.05	0.67	0.38	-	$89,838.88	$3,744.00	0.60
[redacted]	$65,790	960	1006	Inside	Slab	1008.60	2.60	$37,632.22	$1,611.56	$70,703.11	$2,946.71	0.53	0.31	-	$76,975.75	$3,208.00	0.50
[redacted]	$40,320	972	1010.7	Inside	Crawlspace	1008.66	-2.04	$0.00	$24.25	-	-	-	-	-	$82,377.95	$3,433.00	0.01
[redacted]	$55,380	1,032	1007	Inside	Slab	1009.90	2.90	$33,740.44	$1,511.70	$76,005.84	$3,167.72	0.46	0.27	-	$86,120.47	$3,589.00	0.42
[redacted]	$74,610	1,056	1004.5	Inside	Slab	1008.64	4.14	$55,299.77	$2,857.17	$84,673.32	$3,528.95	0.79	0.46	-	$91,573.23	$3,817.00	0.7486

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	**Property Value** (From Assesor)	**Total Square Feet**	**First Floor Elevation** 2013 (NAVD 88)	**100 yr Floodplain Location**	**Found Type**	**NFIP Base Flood Elevation** (NAVD 88)	**100 yr Depth**	**100 yr Damage**	**Annualized Risk (EAD)**	**Cost of FRAM to the BFE + 1 foot**	**Annualized Cost of FRAM**	**FDA 3.375% BCR**	**FDA 7% BCR**	**BCA 7% BCR**	**Cost of FRAM to the 500 yr**	**Annualized Cost of FRAM**	**BCR**
I.a	**I.c**	**I.d**	**I.g**	**II.a**	**NA**	**II.b**	**III.a**	**III.b**	**III.c**	**V.b**	**V.c**	**NA**			**NA**	**NA**	**NA**
[redacted]	$151,380	1,536	1015.2	Inside	Block	1008.73	-6.47	-	-	-	-	-	-	-	-	-	-
[redacted]	$105,230	1,355	1009.4	Inside	Crawlspace	1009.97	0.57	$31,669.75	$557.99	$119,363.88	$4,974.76	0.10	0.06	-	$127,804.63	$5,327.00	0.10
[redacted]	$58,990	728	1006	Inside	Slab	1008.70	2.70	$34,468.64	$1,507.73	$53,616.52	$2,234.59	0.66	0.38	-	$58,373.27	$2,433.00	0.6197
[redacted]	$159,040	1,913	1013	Inside	Block	1008.81	-4.19	-	-	-	-	-	-	-	-	-	-
[redacted]	$43,830	640	1007.4	Inside	Slab	1008.76	1.36	$18,162.43	$450.09	$46,403.60	$1,933.98	0.22	0.12	-	$49,226.28	$2,052.00	0.2194
[redacted]	$258,850	2,826	1006.2	Inside	Slab	1010.14	3.94	$127,878.19	$6,320.41	$257,043.90	$10,712.89	0.58	0.33	-	$333,676.09	$13,907.00	0.45
[redacted]	$51,870	784	1008	Inside	Slab	1008.86	0.86	$17,850.39	$301.78	$55,947.94	$2,331.76	0.11	0.07	-	$60,302.20	$2,513.00	0.12
[redacted]	$57,360	1,366	1007	Inside	Slab	1008.80	1.80	$27,152.80	$687.32	$99,042.68	$4,127.83	0.16	0.09	-	$109,530.07	$4,565.00	0.1506
[redacted]	$127,370	1,036	1013.9	Inside	Block	1010.21	-3.69	-	-	-	-	-	-	-	-	-	-
[redacted]	$52,540	744	1009.5	Inside	Slab	1008.89	-0.61	$0.00	$76.69	-	-	-	-	-	$53,944.18	$2,248.00	0.03
[redacted]	$68,030	891	1005.6	Inside	Slab	1008.99	3.39	$45,120.26	$2,186.52	$68,532.22	$2,856.24	0.75	0.43	-	$74,354.01	$3,099.00	0.71
[redacted]	$36,380	1,353	1020.2	Outside	Slab	1015.98	-4.22	-	-	-	-	-	-	-	-	-	-
[redacted]	$166,370	2,878	1010.8	Inside	Slab	1008.26	-2.54	$0.00	$54.00	-	-	-	-	-	$205,380.33	$8,560.00	0.01
[redacted]	$70,130	1,118	1005.1	Inside	Slab	1008.84	3.74	$49,086.25	$2,454.13	$85,992.17	$3,583.92	0.67	0.39	-	$96,949.68	$4,041.00	0.6074
[redacted]	$100,430	1,488	1004.6	Inside	Slab	1010.28	5.68	$62,571.21	$5,636.81	$124,173.70	$5,175.22	1.08	0.62	0.74	$129,035.00	$5,378.00	1.05
[redacted]	$79,300	1,447	1006	Inside	Slab	1009.01	3.01	$49,347.79	$2,269.84	$111,297.55	$4,638.58	0.48	0.27	0.26	$120,752.25	$5,033.00	0.45
[redacted]	$48,770	660	1005.6	Inside	Slab	1009.04	3.44	$32,574.62	$1,586.25	$50,764.61	$2,115.73	0.73	0.42	-	$55,077.05	$2,296.00	0.69
[redacted]	$168,570	1,596	1004.8	Inside	Block	1008.86	4.06	$99,884.86	$5,522.46	$205,260.10	$8,554.68	0.64	0.37	-	$257,131.30	$10,717.00	0.52
[redacted]	$73,250	1,056	1004.8	Inside	Slab	1010.34	5.54	$63,267.85	$5,881.04	$88,123.27	$3,672.74	1.59	0.91	1.08	$91,573.23	$3,817.00	1.54
[redacted]	$41,180	500	1006.7	Inside	Slab	1009.08	2.38	$22,460.58	$583.48	$36,824.54	$1,534.75	0.36	0.21	-	$40,091.54	$1,671.00	0.35
[redacted]	$136,440	1,536	1009	Inside	Block	1010.44	1.44	$75,201.05	$2,008.93	$138,599.35	$5,776.44	0.33	0.19	-	$155,831.66	$6,495.00	0.31
[redacted]	$136,440	1,400	1008.3	Inside	Poured	1010.37	2.07	$69,405.38	$1,769.69	$103,108.70	$4,297.29	0.39	0.22	-	$112,256.30	$4,679.00	0.38
[redacted]	$217,210	1,778	1011.6	Inside	Block	1009.11	-2.49	$44,971.73	$1,201.60	-	-	-	-	-	$294,042.08	$12,255.00	0.10
[redacted]	$128,270	928	1004.9	Inside	Block	1008.88	3.98	$75,193.91	$7,035.59	$93,662.68	$3,903.60	1.79	1.03	1.97	$95,916.22	$3,998.00	1.76
[redacted]	$97,720	1,482	1004	Inside	Crawlspace	1010.40	6.40	$90,726.88	$15,234.69	$128,514.70	$5,356.14	2.83	1.63	1.69	$128,514.70	$5,356.00	2.84
[redacted]	$119,470	2,032	1005.8	Inside	Slab	1009.13	3.33	$53,105.53	$2,517.65	$156,293.45	$6,513.88	0.38	0.22	-	$169,570.54	$7,067.00	0.36
[redacted]	$174,160	1,611	1011.8	Inside	Block	1009.19	-2.61	$0.00	$340.44	-	-	-	-	-	$165,246.03	$6,887.00	0.05
[redacted]	$61,880	1,296	1004.9	Inside	Slab	1008.86	3.96	$44,770.71	$2,280.15	$99,683.23	$4,154.52	0.54	0.31	-	$112,385.32	$4,684.00	0.49
[redacted]	$75,650	1,302	1005.4	Inside	Slab	1010.40	5.00	$62,033.00	$5,302.86	$108,651.99	$4,528.32	1.16	0.67	0.74	$112,905.63	$4,706.00	1.13
[redacted]	$65,860	720	1006.5	Inside	Slab	1009.18	2.68	$38,353.54	$1,682.53	$53,027.33	$2,210.03	0.74	0.43	-	$57,731.81	$2,406.00	0.70
[redacted]	$6,470	1,176	1009	Inside	Crawlspace	1010.65	1.65	$2,928.67	$73.56	$93,713.62	$3,905.73	0.02	0.01	-	$99,063.15	$4,129.00	0.02
[redacted]	$246,840	3,051	1006.2	Inside	Slab	1009.28	3.08	$155,335.29	$7,234.87	$234,670.93	$9,780.44	0.72	0.42	0.40	$254,606.16	$10,611.00	0.68
[redacted]	$86,860	1,768	1004.9	Inside	Slab	1008.84	3.94	$42,953.96	$2,147.62	$135,987.61	$5,667.59	0.37	0.21	0.27	$153,315.78	$6,390.00	0.34
[redacted]	$120,890	1,296	1015.4	Inside	Block	1010.40	-5.00	-	-	-	-	-	-	-	-	-	-
[redacted]	$97,820	2,100	1005	Inside	Block	1009.26	4.26	-	-	$179,191.51	$7,468.21	1.03	0.59	1.05	$194,591.50	-	-
[redacted]	$97,820	1,100	1004.8	Inside	Slab	1009.26	4.46	$75,384.94	$5,985.21	$88,201.38	$3,675.99	1.61	0.93	0.97	$95,388.78	$3,976.00	1.51
[redacted]	$86,900	1,394	1006.3	Inside	Slab	1009.40	3.10	$54,935.16	$2,571.45	$107,221.00	$4,468.68	0.56	0.32	-	$116,329.40	$4,848.00	0.53
[redacted]	$118,470	1,458	1009.5	Inside	Slab	1008.27	-1.23	$0.00	$204.78	-	-	-	-	-	$105,713.19	$4,406.00	0.05
[redacted]	$166,800	2,344	1010.9	Inside	Block	1010.40	-0.50	$44,869.20	$3,100.85	-	-	-	-	-	$207,205.17	$8,636.00	0.36
[redacted]	$95,030	1,620	1016.5	Inside	Block	1009.34	-7.16	-	-	-	-	-	-	-	-	-	-
[redacted]	$39,150	1,056	1006.6	Inside	Slab	1010.40	3.80	$27,663.39	$1,367.76	$81,223.37	$3,385.17	0.40	0.23	0.28	$91,573.23	$3,817.00	0.36
[redacted]	$28,830	629	1015.8	Inside	Slab	1009.41	-6.39	-	-	-	-	-	-	-	-	-	-
[redacted]	$110,800	1,844	1009.8	Inside	Slab	1009.48	-0.32	$0.00	$269.84	-	-	-	-	-	$133,700.36	$5,572.00	0.05
[redacted]	$106,020	1,314	1007.6	Inside	Slab	1010.38	2.78	$62,993.86	$2,728.27	$96,774.88	$4,033.31	0.66	0.38	-	$105,360.55	$4,391.00	0.62
[redacted]	$207,420	2,128	1006	Inside	Slab	1009.49	3.49	$94,934.06	$4,576.90	$163,677.40	$6,821.63	0.66	0.38	-	$177,581.75	$7,401.00	0.62
[redacted]	$74,580	1,147	1009.2	Inside	Slab	1009.59	0.39	$20,392.44	$371.06	$81,852.41	$3,411.38	0.09	0.05	-	$84,475.48	$3,521.00	0.11
[redacted]	$188,100	2,167	1013.7	Inside	Poured	1010.29	-3.41	-	-	-	-	-	-	-	-	-	-
[redacted]	$173,420	1,600	1006.5	Inside	Block	1009.57	3.07	$90,318.43	$4,844.10	$200,754.86	$8,366.91	0.57	0.33	-	$244,115.71	$10,174.00	0.48
[redacted]	$46,150	840	1005.9	Inside	Slab	1009.63	3.73	$32,275.27	$1,611.83	$64,609.50	$2,692.75	0.59	0.34	-	$72,842.34	$3,036.00	0.53
[redacted]	$80,830	720	1007.5	Inside	Slab	1010.18	2.68	$47,074.20	$2,018.71	$53,027.33	$2,210.03	0.89	0.51	0.47	$57,731.81	$2,406.00	0.84
[redacted]	$151,000	2,217	1011.8	Inside	Slab	1009.69	-2.11	$0.00	$87.89	-	-	-	-	-	$158,209.93	$6,594.00	0.01

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$133,130	2,447	1006.4	Inside	Crawlspace	1009.71	3.31	$59,014.68	$2,778.11	$203,322.78	$8,473.94	0.32	0.18	-	$226,640.95	$9,446.00	0.29
[redacted]	$49,010	750	1009.7	Inside	Slab	1008.21	-1.49	$0.00	$34.87	-	-	-	-	-	$53,521.63	$2,231.00	0.02
[redacted]	$167,860	2,016	1012.3	Inside	Block	1009.77	-2.53	$0.00	$88.51	-	-	-	-	-	$291,442.31	$12,147.00	0.01
[redacted]	$38,770	669	1013.9	Inside	Slab	1009.87	-4.03	-	-	-	-	-	-	-	-	-	-
[redacted]	$38,860	576	1005.7	Inside	Slab	1009.89	4.19	$28,970.46	$1,498.10	$46,185.45	$1,924.88	0.76	0.44	-	$49,949.03	$2,082.00	0.72
[redacted]	$109,770	1,000	1013	Inside	Slab	1009.94	-3.06	$0.00	$40.01	-	-	-	-	-	$71,362.17	$2,974.00	0.01
[redacted]	$14,710	400	1007.3	Inside	Slab	1009.90	2.60	$8,414.32	$358.90	$29,459.63	$1,227.80	0.28	0.16	-	$32,073.23	$1,337.00	0.27
[redacted]	$77,810	1,780	1007.8	Inside	Slab	1010.02	2.22	$40,934.20	$1,056.40	$131,095.34	$5,463.70	0.18	0.11	-	$142,725.86	$5,948.00	0.18
[redacted]	$133,480	1,976	1010.4	Inside	Slab	1010.00	-0.40	$0.00	$316.05	-	-	-	-	-	$165,504.85	$6,898.00	0.05
[redacted]	$110,730	1,751	1007.4	Inside	Slab	1010.06	2.66	$64,259.49	$2,758.24	$128,959.52	$5,374.68	0.50	0.29	-	$140,400.56	$5,852.00	0.47
[redacted]	$143,200	2,026	1006.7	Inside	Slab	1010.09	3.39	$94,834.41	$4,527.36	$184,298.86	$7,681.07	0.58	0.33	-	$218,546.76	$9,108.00	0.50
[redacted]	$54,540	1,292	1026.3	Inside	Slab	1027.65	1.35	$14,802.14	$378.14	$104,394.56	$4,350.88	0.08	0.05	-	$109,188.15	$4,551.00	0.08
[redacted]	$62,510	2,737	1038.7	Inside	Block	1039.35	0.65	$10,344.56	$172.98	$16,341.18	$681.06	0.20	0.12	0.00	$23,303.15	$971.00	0.18
[redacted]	$123,150	2,360	1007.8	Inside	Poured	1010.20	2.40	$58,140.26	$3,017.48	$217,088.50	$9,047.65	0.33	0.19	-	$231,899.15	$9,665.00	0.31
[redacted]	$93,820	1,242	1007.1	Inside	Block	1010.27	3.17	$67,318.71	$3,608.38	$117,876.92	$4,912.79	0.72	0.41	-	$130,848.83	$5,453.00	0.66
[redacted]	$186,520	1,477	1013.4	Inside	Poured	1010.32	-3.08	$25,536.16	$1,420.05	-	-	-	-	-	$134,609.65	$5,610.00	0.25
[redacted]	$165,670	1,761	1006.8	Inside	Slab	1010.32	3.52	$76,284.76	$3,619.38	$135,449.20	$5,645.15	0.63	0.36	-	$146,955.57	$6,125.00	0.59
[redacted]	$113,070	1,772	1038.9	Inside	Slab	1039.34	0.44	$11,975.93	$198.99	$15,667.92	$653.00	0.24	0.14	0.03	$21,636.94	$902.00	0.22
[redacted]	$64,570	3,480	1019.6	Outside	Slab	1014.17	-5.43	-	-	-	-	-	-	-	-	-	-
[redacted]	$29,150	2,600	1038.8	Inside	Block	1039.37	0.57	$3,823.69	$64.71	$20,609.29	$858.94	0.06	0.03	0.00	$24,768.56	$1,032.00	0.06
[redacted]	$69,460	1,008	1029.1	Outside	Crawlspace	1021.50	-7.60	-	-	-	-	-	-	-	-	-	-
[redacted]	$32,170	1,072	1031.8	Outside	Slab	1022.54	-9.26	-	-	-	-	-	-	-	-	-	-
[redacted]	$191,790	3,134	1009	Inside	Slab	1008.18	-0.82	$0.00	$259.84	-	-	-	-	-	$237,289.68	$9,890.00	0.03
[redacted]	$138,050	1,498	1017.1	Inside	Block	1008.12	-8.98	-	-	-	-	-	-	-	-	-	-
[redacted]	$86,130	1,932	1038.7	Inside	Block	1039.40	0.70	$13,892.97	$230.87	$23,480.59	$978.61	0.15	0.09	0.00	$21,524.19	$897.00	0.26
[redacted]	$60,060	1,358	1026.5	Inside	Block	1027.88	1.38	$23,186.70	$2,165.79	$107,626.07	$4,485.56	0.48	0.27	-	$111,399.61	$4,643.00	0.47
[redacted]	$121,900	1,120	1009.7	Inside	Block	1008.12	-1.58	$33,835.58	$893.55	-	-	-	-	-	$143,734.43	$5,991.00	0.15
[redacted]	$54,680	720	1014.3	Inside	Slab	1008.06	-6.24	-	-	-	-	-	-	-	-	-	-
[redacted]	$86,150	2,112	1038.2	Inside	Block	1039.50	1.30	$24,305.10	$564.97	$15,626.62	$651.27	0.77	0.44	0.15	$21,731.58	$906.00	0.62
[redacted]	$66,340	672	1009.8	Inside	Block	1008.05	-1.75	$0.00	$56.01	-	-	-		-	$73,589.43	$3,067.00	0.02
[redacted]	$172,680	1,240	1017.6	Inside	Block	1008.00	-9.60	-	-	-	-	-	-	-	-	-	-
[redacted]	$59,480	1,338	1028.3	Inside	Block	1028.04	-0.26	$16,843.39	$1,407.75	-	-	-	-	-	$108,584.19	$4,526.00	0.31
[redacted]	$102,160	3,000	1040.2	Outside	Block	1039.64	-0.56	$0.00	$26.47	-	-	-	-	-	$18,930.62	$789.00	0.03
[redacted]	$133,000	1,421	1012.6	Inside	Block	1008.00	-4.60	-	-	-	-	-	-	-	-	-	-
[redacted]	$1,317,110	10,586	1039.5	Inside	Block	1039.60	0.10	$43,882.42	$1,417.75	$18,040.57	-	0.44	0.25	0.20	$31,877.46	$1,329.00	1.07
[redacted]	$137,600	1,421	1012.5	Inside	Block	1007.93	-4.57	-	-	-	-	-	-	-	-	-	-
[redacted]	$90,310	2,233	1016.9	Inside	Block	1007.91	-8.99	-	-	-	-	-	-	-	-	-	-
[redacted]	$39,510	897	1025.7	Inside	Crawlspace	1028.11	2.41	$21,729.33	$959.60	$79,081.50	$3,295.90	0.28	0.16	-	$84,360.55	$3,516.00	0.27
[redacted]	$78,560	875	1015	Inside	Poured	1007.91	-7.09	-	-	-	-	-	-	-	-	-	-
[redacted]	$101,680	1,596	1028.5	Inside	Slab	1028.28	-0.22	$0.00	$155.50	-	-	-	-	-	$19,603.28	$817.00	0.19
[redacted]	$73,790	960	1038.6	Inside	Slab	1040.24	1.64	$15,327.12	$346.06	$12,185.53	$507.86	0.55	0.32	0.12	$12,185.53	$508.00	0.68
[redacted]	$285,900	5,740	1041	Inside	Slab	1040.61	-0.39	$0.00	$182.91	-	-	-	-	-	$23,511.95	$980.00	0.19
[redacted]	$63,330	1,800	1020.6	Inside	Slab	1021.50	0.90	$22,222.50	$340.53	$128,451.91	$5,353.52	0.06	0.03	0.03	$130,510.12	$5,439.00	0.06
[redacted]	$126,540	2,640	1006.8	Inside	Slab	1010.35	3.55	$85,971.03	$4,155.15	$203,058.42	$8,462.92	0.48	0.28	-	$220,308.18	$9,182.00	0.45
[redacted]	$75,440	961	1007.2	Inside	Slab	1010.33	3.13	$47,908.64	$2,194.38	$92,107.81	$3,838.80	0.56	0.32	-	$97,966.26	$4,083.00	0.54
[redacted]	$23,350	483	1006.5	Inside	Pile	1010.31	3.81	$16,536.20	$820.12	$47,630.16	$1,985.10	0.40	0.23	-	$50,637.76	$2,110.00	0.39
[redacted]	$137,910	1,280	1012.8	Inside	Crawlspace	1010.11	-2.69	$0.00	$61.34	-	-	-	-	-	$124,165.62	$5,175.00	0.01
[redacted]	$34,300	1,449	1018	Inside	Crawlspace	1009.33	-8.67	-	-	-	-	-	-	-	-	-	-
[redacted]	$121,750	1,826	1011.3	Inside	Slab	1010.04	-1.26	$0.00	$205.79	-	-	-	-	-	$163,919.19	$6,832.00	0.03
[redacted]	$113,960	1,974	1012.4	Inside	Slab	1009.96	-2.44	$0.00	$57.60	-	-	-	-	-	$140,868.92	$5,871.00	0.01
[redacted]	$123,770	1,328	1012	Inside	Slab	1009.91	-2.09	$0.00	$71.87	-	-	-	-	-	$94,768.96	$3,950.00	0.02

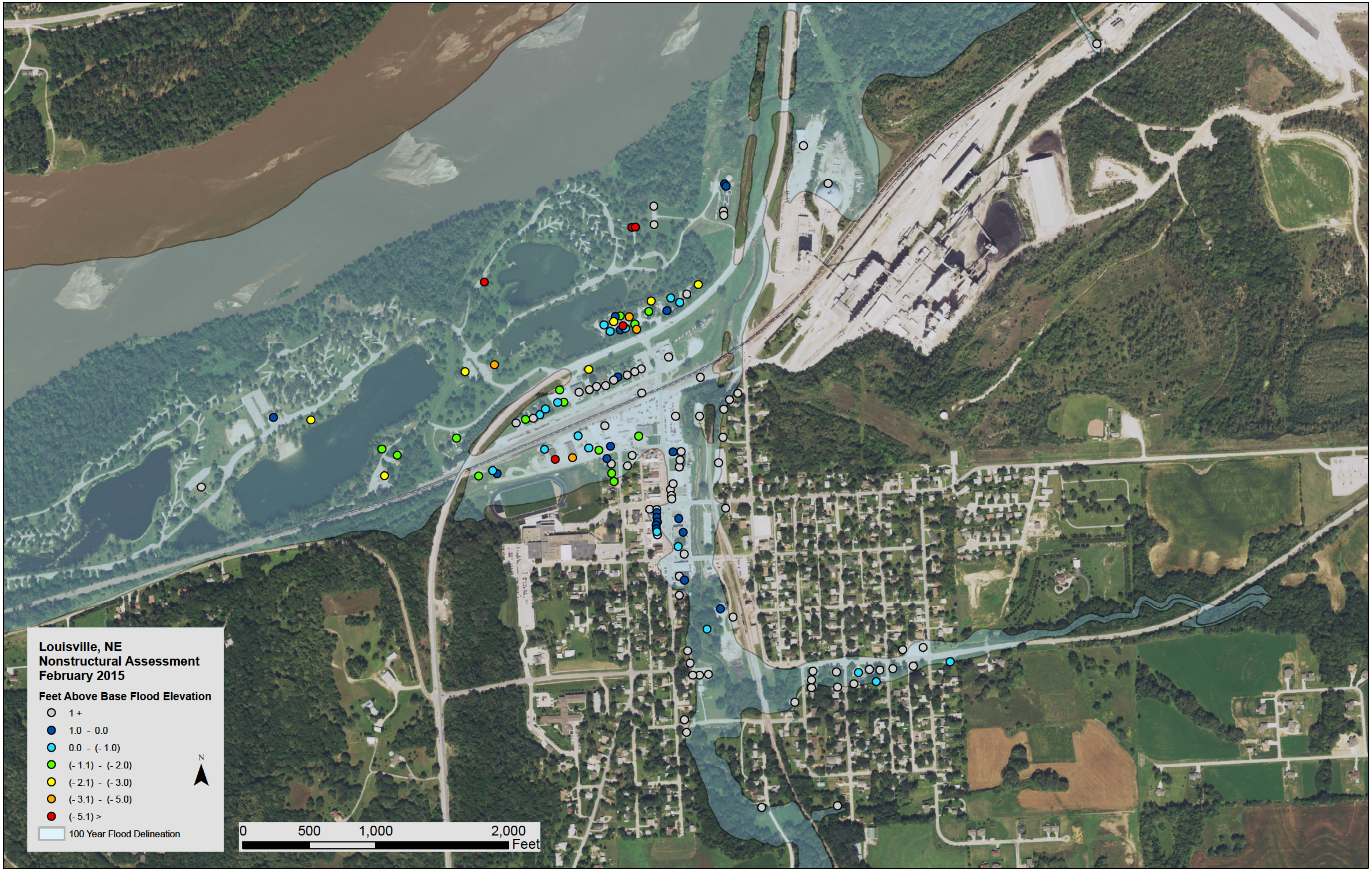
Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$93,220	1,198	1010.5	Inside	Slab	1009.84	-0.66	$0.00	$201.81	-	-	-	-	-	$110,365.52	$4,600.00	0.04
[redacted]	$48,660	616	1007.9	Inside	Slab	1009.76	1.86	$23,391.22	$598.53	$44,663.46	$1,861.45	0.30	0.17	-	$49,392.77	$2,059.00	0.29
[redacted]	$100,760	1,200	1013.3	Inside	Block	1009.45	-3.85	-	-	-	-	-	-	-	-	-	-
[redacted]	$130,650	1,632	1007.1	Inside	Slab	1009.70	2.60	$50,017.78	$2,143.65	$120,195.28	$5,009.41	0.42	0.24	0.20	$130,858.77	$5,454.00	0.39
[redacted]	$100,560	1,500	1009.3	Inside	Slab	1009.62	0.32	$17,447.10	$323.88	$107,043.26	$4,461.27	0.06	0.04	-	$110,473.61	$4,604.00	0.07
[redacted]	$94,050	1,516	1007.1	Inside	Slab	1009.55	2.45	$52,091.60	$2,187.48	$111,651.99	$4,653.35	0.46	0.26	-	$121,557.53	$5,066.00	0.43
[redacted]	$79,280	1,044	1017.1	Inside	Slab	1009.38	-7.72	-	-	-	-	-	-	-	-	-	-
[redacted]	$74,770	1,140	1012.4	Inside	Slab	1009.51	-2.89	$0.00	$30.85	-	-	-	-	-	$81,352.87	$3,391.00	0.01
[redacted]	$115,760	2,320	1040.8	Inside	Block	1041.11	0.31	$7,906.15	$184.69	-	$1,164.24	0.07	0.04	0.00	$27,934.58	$1,164.00	0.16
[redacted]	$31,120	476	1006.8	Inside	Slab	1009.18	2.38	$16,990.99	$442.37	$35,056.96	$1,461.08	0.29	0.17	0.23	$38,167.14	$1,591.00	0.28
[redacted]	$89,380	1,380	1007	Inside	Slab	1009.66	2.66	$51,788.93	$2,249.88	$101,635.72	$4,235.90	0.52	0.30	-	$110,652.64	$4,612.00	0.49
[redacted]	$256,700	13,020	1042.2	Inside	Slab	1041.09	-1.11	-	-	-	-	-	-	-	-	-	-
[redacted]	$5,140	1,407	1063.7	Inside	Slab	1065.36	1.66	$1,307.34	$47.75	$17,393.45	$3,645.12	0.07	0.04	-	$17,411.67	$726.00	0.07
[redacted]	$21,490	600	1006.6	Inside	Slab	1008.97	2.37	$11,700.29	$303.23	$44,189.44	$1,841.70	0.16	0.09	-	$48,109.84	$2,005.00	0.15
[redacted]	$100,840	1,108	1006.6	Inside	Slab	1009.51	2.91	$61,536.38	$2,792.57	$81,603.17	$3,401.00	0.80	0.46	0.43	$92,462.68	$3,854.00	0.72
[redacted]	$71,060	1,536	1008.7	Inside	Slab	1008.89	0.19	$7,713.33	$143.85	$109,612.29	$4,568.34	0.03	0.02	-	$113,124.97	$4,715.00	0.03
[redacted]	$23,750	480	1006.7	Inside	Poured	1009.30	2.60	$13,610.07	$590.35	$35,351.55	$1,473.36	0.39	0.22	-	$38,487.87	$1,604.00	0.37
[redacted]	$3,920	600	1005.6	Inside	Slab	1008.83	3.23	$2,530.75	$119.92	$46,149.64	$1,923.39	0.06	0.04	-	$50,070.04	$2,087.00	0.06
[redacted]	$122,140	1,854	1012.4	Inside	Slab	1009.01	-3.39	-	-	-	-	-	-	-	-	-	-
[redacted]	$9,850	1,248	1007.6	Inside	Crawlspace	1008.77	1.17	$3,834.36	$62.59	$99,456.96	$4,145.09	0.01	0.01	-	$105,310.53	$4,389.00	0.01
[redacted]	$19,550	980	1011.7	Inside	Slab	1008.90	-2.80	$0.00	$8.54	-	-	-	-	-	$69,934.93	$2,915.00	0.00
[redacted]	$68,730	1,384	1053.5	Inside	Block	1041.21	-12.29	-	-	-	-	-	-	-	-	-	-
[redacted]	$74,860	1,200	1006.2	Inside	Slab	1008.73	2.53	$42,200.17	$1,793.49	$88,378.88	$3,683.39	0.47	0.27	-	$96,219.68	$4,010.00	0.45
[redacted]	$16,900	834	1010.7	Inside	Slab	1008.82	-1.88	$0.00	$10.71	-	-	-	-	-	$59,516.05	$2,481.00	0.00
[redacted]	$142,420	2,040	1007.5	Inside	Block	1008.76	1.26	$37,509.65	$939.32	$168,014.84	$7,002.40	0.12	0.07	-	$183,488.57	$7,647.00	0.12
[redacted]	$129,990	2,144	1008.7	Inside	Slab	1009.45	0.75	$42,636.30	$731.81	$153,000.49	$6,376.64	0.10	0.06	-	$164,908.05	$6,873.00	0.11
[redacted]	$43,430	920	1007.6	Inside	Crawlspace	1009.27	1.67	$19,823.26	$506.08	$80,296.66	$3,346.55	0.14	0.08	-	$83,857.44	$3,495.00	0.14
[redacted]	$83,180	1,455	1010.5	Outside	Slab	1009.45	-1.05	$0.00	$155.48	-	-	-	-	-	$113,956.78	$4,749.00	0.03
[redacted]	$64,490	825	1010.9	Inside	Slab	1009.43	-1.47	$0.00	$46.17	-	-	-	-	-	$73,810.75	$3,076.00	0.02
[redacted]	$108,880	1,071	1016	Inside	Block	1009.38	-6.62	-	-	-	-	-	-	-	-	-	-
[redacted]	$139,900	1,362	1015.9	Inside	Block	1009.27	-6.63	-	-	-	-	-	-	-	-	-	-
[redacted]	$85,960	1,110	1018.2	Inside	Block	1009.31	-8.89	-	-	-	-	-	-	-	-	-	-
[redacted]	$143,220	1,548	1020.6	Outside	Poured	1009.22	-11.38	-	-			-	-	-	-	-	-
[redacted]	$69,600	1,200	1018.4	Outside	Slab	1009.16	-9.24	-	-			-	-	-	-	-	-
[redacted]	$132,910	1,818	1011.2	Inside	Crawlspace	1009.17	-2.03	$0.00	$52.55	-	-	-	-	-	$157,915.68	$6,582.00	0.01
[redacted]	$72,890	1,233	1015.5	Outside	Slab	1009.11	-6.39	-	-			-	-	-	-	-	-
[redacted]	$62,190	1,152	1011.6	Inside	Crawlspace	1009.03	-2.57	$0.00	$30.30	-	-	-	-	-	$82,209.22	$3,426.00	0.01
[redacted]	$31,360	656	1007.1	Inside	Slab	1009.03	1.93	$15,395.31	$393.80	$47,563.69	$1,982.32	0.19	0.11	-	$52,600.09	$2,192.00	0.18
[redacted]	$72,360	1,020	1008.6	Inside	Crawlspace	1008.98	0.38	$19,742.54	$359.71	$90,572.89	$3,774.83	0.08	0.05	-	$93,112.48	$3,881.00	0.09
[redacted]	$71,190	1,101	1010.8	Inside	Crawlspace	1008.95	-1.85	$0.00	$45.54	-	-	-	-	-	$97,258.67	$4,054.00	0.01
[redacted]	$56,430	1,620	1009.9	Inside	Crawlspace	1008.88	-1.02	$0.00	$106.57	-	-	-		-	$138,297.68	$5,764.00	0.02
[redacted]	$54,050	1,120	1003.4	Inside	Block	1008.81	5.41	$49,738.82	$9,237.88	$116,844.30	$4,869.75	1.89	1.09	5.70	$110,693.27	$4,613.00	2.00
[redacted]	$104,120	1,148	1004.1	Inside	Crawlspace	1008.69	4.59	$46,402.16	$3,088.54	$92,050.16	$3,836.40	0.80	0.46	-	$99,551.20	$4,149.00	0.74
[redacted]	$37,100	480	1002.8	Inside	Slab	1008.75	5.95	$33,266.06	$5,014.31	$40,056.03	$1,669.43	2.99	1.72	2.79	$41,624.19	$1,735.00	2.89
[redacted]	$42,400	888	1005.2	Inside	Slab	1008.50	3.30	$27,690.85	$1,314.24	$68,301.47	$2,846.62	0.45	0.26	-	$74,103.66	$3,088.00	0.43
[redacted]	$109,570	1,580	1005.1	Inside	Slab	1008.66	3.56	$74,565.23	$3,658.93	$121,527.39	$5,064.93	0.71	0.41	-	$131,851.11	$5,495.00	0.67
[redacted]	$100,380	1,714	1005.8	Inside	Slab	1008.60	2.80	$59,917.91	$2,654.48	$126,234.51	$5,261.11	0.49	0.28	-	$143,033.42	$5,961.00	0.45
[redacted]	$173,390	2,000	1015.8	Inside	Poured	1011.07	-4.73	-	-	-	-	-	-	-	-	-	-
[redacted]	$48,570	1,008	1039.9	Inside	Crawlspace	1041.44	1.54	$27,262.07	$739.27	$87,460.57	$3,645.12	0.20	0.12	-	$87,516.14	$3,647.00	0.20
[redacted]	$49,220	1,188	1005.6	Inside	Crawlspace	1008.60	3.00	$30,560.05	$1,393.46	$102,061.96	$4,253.66	0.32	0.18	-	$115,028.77	$4,794.00	0.29
[redacted]	$208,170	2,275	1010.6	Inside	Poured	1008.43	-2.17	$47,969.54	$810.88	-	-	-	-	-	$238,198.09	$9,927.00	0.08

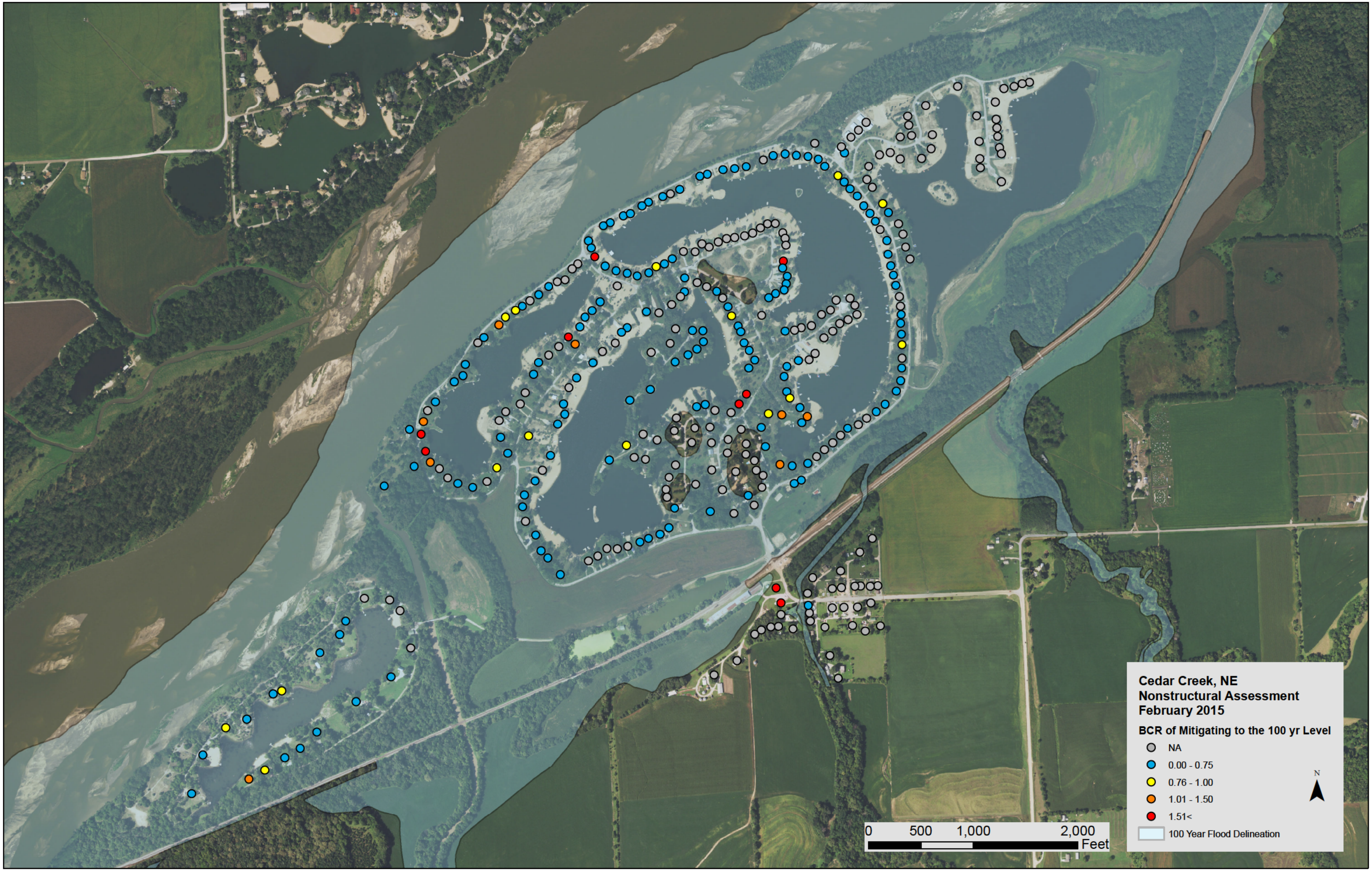
Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$138,970	2,164	1005.1	Inside	Slab	1008.60	3.50	$93,769.73	$4,570.59	$166,446.38	$6,937.03	0.64	0.37	-	$180,585.95	$7,526.00	0.61
[redacted]	$123,160	2,024	1005.9	Inside	Slab	1008.58	2.68	$48,097.17	$2,082.43	$163,591.88	$6,818.06	0.30	0.17	-	$177,802.96	$7,410.00	0.28
[redacted]	$163,180	2,592	1006.5	Inside	Slab	1008.57	2.07	$34,260.15	$936.02	$213,747.81	$8,908.42	0.10	0.06	-	$249,911.76	$10,416.00	0.09
[redacted]	$127,690	1,565	1005.1	Inside	Block	1008.55	3.45	$95,087.45	$5,175.54	$146,220.35	$6,094.06	0.83	0.48	-	$166,525.40	$6,940.00	0.75
[redacted]	$100,780	1,452	1005.1	Inside	Slab	1008.53	3.43	$45,614.08	$2,166.66	$111,682.13	$4,654.61	0.46	0.26	-	$121,169.50	$5,050.00	0.43
[redacted]	$81,250	2,234	1009.8	Inside	Slab	1008.51	-1.29	$0.00	$90.25	-	-	-	-	-	$156,330.38	$6,515.00	0.01
[redacted]	$96,480	1,726	1007.6	Inside	Slab	1008.50	0.90	$33,853.74	$568.89	$123,171.11	$5,133.43	0.10	0.06	-	$132,757.14	$5,533.00	0.10
[redacted]	$130,950	1,964	1009.2	Inside	Slab	1008.52	-0.68	$0.00	$282.48	-	-	-	-	-	$186,711.49	$7,782.00	0.04
[redacted]	$23,050	1,344	1008.6	Inside	Crawlspace	1008.54	-0.06	$0.00	$60.24	-	-	-	-	-	$111,028.58	$4,627.00	0.01
[redacted]	$148,530	1,500	1015	Inside	Block	1011.07	-3.93	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	2,200	1014.6	Inside	Slab	1011.18	-3.42	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	900	1009	Inside	Slab	1011.35	2.35	$45,432.68	$1,176.73	$66,284.16	$2,762.54	0.41	0.23	-	$72,164.76	$3,008.00	0.39
[redacted]	$199,540	1,686	1017.6	Inside	Poured	1006.51	-11.09	-	-	-	-	-	-	-	-	-	-
[redacted]	$122,100	2,100	1007.3	Inside	Slab	1011.43	4.13	$62,171.81	$4,611.07	$168,384.45	$7,017.80	0.65	0.37	0.36	$182,105.85	$7,590.00	0.61
[redacted]	$272,130	2,593	1013.8	Inside	Poured	1006.65	-7.15	-	-	-	-	-	-	-	-		-
[redacted]	$83,710	2,400	1010.9	Inside	Slab	1011.60	0.70	$26,808.93	$457.07	$171,269.21	$7,138.03	0.06	0.03	-	$176,757.77	$7,367.00	0.06
[redacted]	$190,540	1,538	1017.6	Inside	Poured	1006.56	-11.04	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	900	1008.4	Inside	Slab	1011.92	3.52	$56,649.13	$2,829.48	$69,224.46	$2,885.09	0.96	0.55	-	$75,105.06	$3,130.00	0.90
[redacted]	$179,550	1,675	1017.4	Inside	Poured	1006.59	-10.81	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	1,200	1010.5	Inside	Slab	1011.97	1.47	$35,918.15	$905.85	$87,006.74	$3,626.20	0.23	0.14	-	$92,299.28	$3,847.00	0.24
[redacted]	$216,490	2,143	1017.8	Inside	Poured	1006.61	-11.19	-	-	-	-	-	-	-	-	-	-
[redacted]	$206,360	1,861	1017	Inside	Poured	1006.72	-10.28	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	1,000	1010.3	Inside	Crawlspace	1012.19	1.89	$40,572.48	$1,042.43	$72,505.62	$3,021.84	0.33	0.19	0.22	$76,916.07	$3,206.00	0.33
[redacted]	$262,810	2,137	1017.7	Inside	Poured	1006.64	-11.06	-	-	-	-	-	-	-	-		-
[redacted]	$83,710	1,200	1008.6	Inside	Slab	1012.31	3.71	$58,363.12	$2,993.74	$92,299.28	$3,846.78	0.76	0.44	0.61	$100,140.08	$4,174.00	0.72
[redacted]	$209,740	1,964	1018.6	Inside	Poured	1006.65	-11.95	-	-	-	-	-	-	-	-	-	-
[redacted]	$230,970	1,776	1019	Inside	Poured	1006.77	-12.23	-	-	-	-	-	-	-	-	-	-
[redacted]	$122,100	1,300	1010.3	Inside	Slab	1012.52	2.22	$42,731.06	$1,818.51	$95,743.79	$3,990.34	0.44	0.25	-	$104,237.99	$4,344.00	0.42
[redacted]	$230,760	2,050	1019.8	Inside	Poured	1006.80	-13.00	-	-	-	-	-	-	-	-	-	-
[redacted]	$83,710	1,250	1010	Inside	Slab	1012.72	2.72	$49,155.46	$2,288.20	$92,061.34	$3,836.86	0.58	0.34	-	$100,228.84	$4,177.00	0.55
[redacted]	$83,710	1,600	1007.9	Inside	pile	1012.41	4.51	$64,882.89	$5,609.05	$128,292.91	$5,346.90	1.04	0.60	0.64	$138,747.31	$5,783.00	0.97
[redacted]	$28,680	1,296	1043.6	Inside	Slab	1041.96	-1.64	-	-	-	-	-	-	-	-	-	-
[redacted]	$1,820	351	1043.6	Inside	Slab	1041.76	-1.84	-	-	-	-	-	-	-	-	-	-
[redacted]	$212,020	2,108	1017.4	Inside	Poured	1006.73	-10.67	-	-	-	-	-		-	-	-	-
[redacted]	$83,710	1,600	1008.3	Inside	Slab	1012.31	4.01	$60,997.32	$4,738.65	$128,292.91	$5,346.90	0.88	0.50	0.51	$133,520.11	$5,565.00	0.85
[redacted]	$83,710	1,400	1010.9	Inside	Slab	1012.17	1.27	$33,673.48	$842.67	$101,507.87	$4,230.57	0.19	0.11	-	$107,682.50	$4,488.00	0.19
[redacted]	$83,710	1,000	1009.2	Inside	Crawlspace	1012.07	2.87	$50,620.50	$2,348.18	$73,649.07	$3,069.49	0.75	0.43	-	$80,183.07	$3,342.00	0.70
[redacted]	$154,360	2,100	1011.8	Inside	Block	1011.93	0.13	$47,839.18	$5,006.17	$178,820.04	$7,452.73	0.66	0.38	-	$205,696.01	$8,573.00	0.58
[redacted]	$173,390	2,300	1010	Inside	Block	1011.63	1.63	$69,823.10	$1,884.48	$197,409.70	$8,227.50	0.22	0.13	0.23	$234,827.98	$9,787.00	0.19
[redacted]	$83,710	1,100	1010.2	Inside	Slab	1011.38	1.18	$32,608.20	$804.60	$79,756.18	$3,324.02	0.23	0.13	-	$84,607.68	$3,526.00	0.23
[redacted]	$83,710	1,600	1013.1	Inside	Crawlspace	1011.17	-1.93	$0.00	$48.78	-	-	-	-	-	$114,179.47	$4,759.00	0.01
[redacted]	$166,450	1,792	1015.5	Inside	Block	1007.31	-8.19	-	-	-	-	-	-	-	-	-	-
[redacted]	$180,720	1,734	1017.9	Inside	Poured	1007.21	-10.69	-	-	-	-	-	-	-	-	-	-
[redacted]	$214,150	1,663	1019	Inside	Poured	1007.16	-11.84	-	-	-	-	-	-	-	-	-	-
[redacted]	$201,240	2,241	1016.3	Inside	Poured	1007.15	-9.15	-	-	-	-	-	-	-	-	-	-
[redacted]	$140,930	1,617	1020.4	Inside	Poured	1007.05	-13.35	-	-	-	-	-	-	-	-	-	-
[redacted]	$160,900	1,831	1020.2	Inside	Poured	1007.00	-13.20	-	-	-	-	-	-	-	-	-	-
[redacted]	$210,040	1,573	1014.7	Inside	Block	1007.07	-7.63	-	-	-	-	-	-	-	-	-	-
[redacted]	$163,730	1,512	1023.8	Inside	Poured	1006.97	-16.83	-	-	-	-	-	-	-	-	-	-
[redacted]	$244,440	2,168	1018.7	Inside	Block	1006.99	-11.71	-	-	-	-	-	-	-	-	-	-
[redacted]	$141,670	1,722	1024.6	Inside	Block	1006.93	-17.67	-	-	-	-	-	-	-	-	-	-

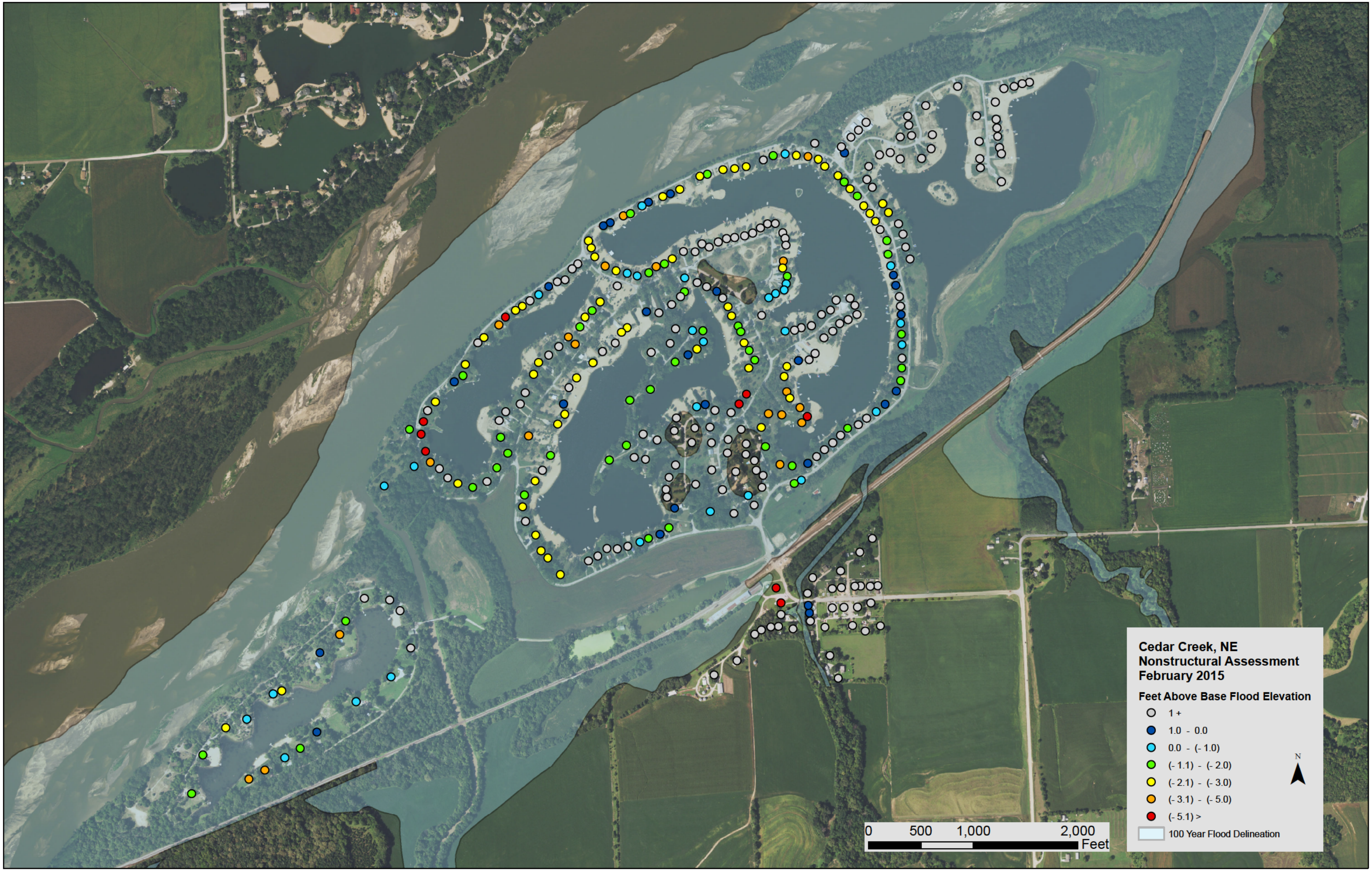
Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$190,270	1,457	1014	Inside	Poured	1006.92	-7.08	-	-	-	-	-	-	-	-	-	-
[redacted]	$76,110	1,728	1053.1	Inside	Block	1054.73	1.63	$43,355.95	$2,501.70	$139,056.76	$5,795.51	0.43	0.25	-	$142,278.35	$5,930.00	0.42
[redacted]	$54,730	936	1050.8	Inside	Block	1049.84	-0.96	-	-	-	-	-	-	-	-	-	-
[redacted]	$47,510	798	1061.7	Inside	Block	1057.50	-4.20	-	-	-	-	-	-	-	-	-	-
[redacted]	$202,700	2,057	1019	Inside	Poured	1006.81	-12.19	-	-	-	-	-	-	-	-	-	-
[redacted]	$202,700	2,156	1011.1	Inside	Poured	1006.60	-4.50	-	-	-	-	-	-	-	-	-	-
[redacted]	$53,830	906	1054	Inside	Block	1052.39	-1.61	-	-	-	-	-	-	-	-	-	-
[redacted]	$114,510	2,134	1017.9	Inside	Poured	1006.41	-11.49	-	-	-	-	-	-	-	-	-	-
[redacted]	$236,710	2,156	1017.4	Inside	Poured	1006.35	-11.05	-	-	-	-	-	-	-	-	-	-
[redacted]	$181,910	1,730	1014	Inside	Poured	1006.30	-7.70	-	-	-	-	-	-	-	-	-	-
[redacted]	$185,460	1,683	1017.3	Inside	Poured	1006.25	-11.05	-	-	-	-	-	-	-	-	-	-
[redacted]	$55,630	967	1056.9	Inside	Block	1055.81	-1.09	-	-	-	-	-	-	-	-	-	-
[redacted]	$70,470	1,710	1057.8	Inside	Block	1056.40	-1.40	-	-	-	-	-	-	-	-	-	-
[redacted]	$910	1,040	1055.2	Inside	Slab	1056.40	1.20	$183.95	$14.06	$13,126.36	$547.07	0.02	0.01	0.01	$13,126.36	$547.00	0.03
[redacted]	$62,650	1,444	1053	Inside	Block	1052.43	-0.57	$0.00	$28.94	-	-	-	-	-	$114,208.18	$4,760.00	0.01
[redacted]	$44,130	624	1051.9	Inside	Slab	1049.44	-2.46	-	-	-	-	-	-	-	-	-	-
[redacted]	$51,700	840	1055.7	Inside	Block	1049.17	-6.53	-	-	-	-	-	-	-	-	-	-
[redacted]	$50,970	1,080	1055.3	Inside	Crawlspace	1054.44	-0.86	-	-	-	-	-	-	0.00	-	-	-
[redacted]	$40,700	747	1047.9	Inside	Block	1042.77	-5.13	-	-	-	-	-	-	-	-	-	-
[redacted]	$74,380	1,008	1009.2	Inside	Crawlspace	1009.03	-0.17	$0.00	$189.08	-	-	-	-	-	$92,389.09	$3,851.00	0.05
[redacted]	$51,700	1,236	1010.7	Inside	Block	1009.16	-1.54	$14,539.44	$387.75	-	-	-	-	-	$104,632.65	$4,361.00	0.09
[redacted]	$113,560	1,485	1007.2	Inside	Slab	1009.04	1.84	$54,283.57	$1,384.38	$107,670.85	$4,487.43	0.29	0.17	0.14	$119,071.86	$4,963.00	0.28
[redacted]	$117,710	1,456	1010.1	Inside	Crawlspace	1009.15	-0.95	$0.00	$228.84	-	-	-	-	-	$137,752.15	$5,741.00	0.04
[redacted]	$139,700	1,707	1010.5	Outside	Crawlspace	1009.03	-1.47	$0.00	$99.95	-	-	-	-	-	$163,729.98	$6,824.00	0.01
[redacted]	$17,090	1,000	1062.1	Outside	Slab	1058.95	-3.15	-	-	-	-	-	-	-	-	-	-
[redacted]	$139,900	1,140	1012	Inside	Poured	1009.14	-2.86	$25,253.95	$1,125.09	-	-	-	-	-	$111,661.37	$4,654.00	0.24
[redacted]	$101,100	1,351	1009.4	Inside	Slab	1009.01	-0.39	$0.00	$241.39	-	-	-	-	-	$97,955.09	$4,083.00	0.06
[redacted]	$84,920	1,137	1010.7	Inside	Crawlspace	1008.97	-1.73	$0.00	$56.37	-	-	-	-	-	$102,446.37	$4,270.00	0.01
[redacted]	$92,960	1,292	1009.6	Inside	Slab	1009.06	-0.54	$0.00	$211.10	-	-	-	-	-	$93,677.26	$3,904.00	0.05
[redacted]	$38,050	672	1046.6	Inside	Block	1043.07	-3.53	-	-	-	-	-	-	-	-	-	-
[redacted]	$56,540	1,260	1061.4	Inside	Slab	1060.29	-1.11	-	-	-	-	-	-	-	-	-	-
[redacted]	$58,950	775	1004	Inside	Block	1008.78	4.78	$47,169.34	$3,922.19	$77,872.98	$3,245.53	1.20	0.69	1.91	$81,040.11	$3,378.00	1.16
[redacted]	$53,220	1,800	1010.1	Inside	Block	1008.90	-1.20	$16,476.11	$721.81	-	-	-	-	-	$152,073.94	$6,338.00	0.11
[redacted]	$122,040	1,265	1011.2	Outside	Poured	1008.92	-2.28	$27,175.74	$723.12	-	-	-	-	-	$119,920.32	$4,998.00	0.14
[redacted]	$96,640	1,632	1005.9	Inside	Crawlspace	1008.81	2.91	$58,905.79	$2,663.24	$141,787.40	$5,909.31	0.44	0.25	-	$166,516.57	$6,940.00	0.38
[redacted]	$135,580	1,440	1011.7	Outside	Block	1008.90	-2.80	$25,034.30	$665.85	-	-	-			$138,347.16	$5,766.00	0.12
[redacted]	$111,730	1,664	1005	Inside	Slab	1008.77	3.77	$78,601.63	$3,939.17	$127,988.34	$5,334.20	0.72	0.42	-	$144,297.20	$6,014.00	0.66
[redacted]	$105,340	1,500	1009.5	Outside	Slab	1008.93	-0.57	$0.00	$236.10	-	-	-	-	-	$108,758.43	$4,533.00	0.05
[redacted]	$92,650	1,260	1009.1	Outside	Slab	1008.89	-0.21	$0.00	$232.92	-	-	-	-	-	$117,059.51	$4,879.00	0.05
[redacted]	$75,300	1,160	1010.4	Inside	Crawlspace	1008.88	-1.52	$0.00	$35.06	-	-	-	-	-	$93,123.44	$3,881.00	0.01
[redacted]	$44,430	860	1047	Inside	Slab	1044.89	-2.11	-	-	-	-	-	-	-	-	-	-
[redacted]	$53,720	1,068	1051.6	Outside	None	1029.93	-21.67	-	-			-	-	-	-	-	-
[redacted]	$44,380	864	1013.2	Outside	Slab	1018.36	5.16	$19,155.26	$3,321.46	$11,052.46	$460.64	7.13	4.10	2.98	$11,052.46	$461.00	7.21
[redacted]	$66,310	7,200	1013.2	Outside	Slab	1018.36	5.16	$36,597.69	$5,953.00	$7,028.88	$292.94	20.09	11.56	-	$7,028.88	$293.00	20.32

Structure Information				Risk Identification			Risk Assessment			100 Year Cost					500 Year Cost		
Structure	Property Value (From Assesor)	Total Square Feet	First Floor Elevation 2013 (NAVD 88)	100 yr Floodplain Location	Found Type	NFIP Base Flood Elevation (NAVD 88)	100 yr Depth	100 yr Damage	Annualized Risk (EAD)	Cost of FRAM to the BFE + 1 foot	Annualized Cost of FRAM	FDA 3.375% BCR	FDA 7% BCR	BCA 7% BCR	Cost of FRAM to the 500 yr	Annualized Cost of FRAM	BCR
I.a	I.c	I.d	I.g	II.a	NA	II.b	III.a	III.b	III.c	V.b	V.c	NA			NA	NA	NA
[redacted]	$107,110	7,200	1036.5	Inside	Slab	1030.78	-5.72	-	-	-	-	-	-	-	-	-	-
[redacted]	$910	2,287	1051.8	Inside	None	1030.01	-21.79	-	-	-	-	-	-	-	-	-	-
[redacted]	$910	80	1050.3	Inside	Slab	1030.37	-19.93	-	-	-	-	-	-	-	-	-	-
[redacted]	$116,530	1,408	1009.7	Inside	Poured	1008.94	-0.76	$40,501.71	$1,076.20	-	-	-	-	-	$133,199.93	$5,551.00	0.19
[redacted]	4,460,180	625	1038.2	Inside	Slab	1024.44	-13.76	-	-	-	-	-	-	-	-	-	-
[redacted]	$14,940	2,300	1027.2	Inside	Slab	1028.71	1.51	$3,546.01	$78.91	$27,705.51	$1,154.69	0.05	0.03	-	$27,705.51	$1,155.00	0.07
[redacted]	$1,620	250	1030	Inside	Pile	1030.75	0.75	$243.54	$5.40	$3,612.11	$150.54	0.02	0.01	-	$3,612.11	$151.00	0.04
[redacted]	$3,600	555	1029.7	Inside	Slab	1030.75	1.05	$666.60	$17.47	$7,364.72	$306.94	0.04	0.02	-	$7,364.72	$307.00	0.06
[redacted]	$7,300	250	1028.4	Inside	Slab	1030.75	2.35	$2,804.14	$153.96	$3,612.11	$150.54	0.95	0.54	-	$3,612.11	$151.00	1.02
[redacted]	$11,620	398	1030.8	Inside	Slab	1028.47	-2.33	$0.00	$1.57	-	-	-	-	-	$5,454.55	$227.00	0.01
[redacted]	$2,190	75	1028.9	Inside	Slab	1028.12	-0.78	$0.00	$1.68	-	-	-	-	-	$1,305.61	$54.00	0.03
[redacted]	$37,690	2,000	1021.5	Outside	Slab	1018.06	-3.44	-	-	-	-	-	-	-	-	-	-
[redacted]	$654,780	7,330	1031.4	Inside	Block	1027.15	-4.25	$0.00	$1.43	-	-	-	-	-	$16,163.48	$674.00	0.00
[redacted]	$1,100	70	1007	Inside	Slab	1008.72	1.72	$332.30	$8.23	$1,234.65	$51.46	0.12	0.07	-	$1,234.65	$51.00	0.16
[redacted]	$1,360	240	1023.6	Inside	Slab	1026.80	3.20	$668.19	$38.16	$3,485.36	$145.26	0.24	0.14	0.07	$3,485.36	$145.00	0.26
[redacted]	$4,870	900	1024.4	Inside	None	1026.90	2.50	$1,955.44	$83.48	$11,477.92	$478.37	0.15	0.09	0.10	$11,477.92	$478.00	0.17
[redacted]	$14,890	483	1021.2	Inside	Slab	1026.58	5.38	$8,688.42	$399.07	$6,492.89	$270.61	1.36	0.78	0.54	$6,492.89	$271.00	1.47
[redacted]	$15,320	541	1021.1	Inside	Slab	1026.55	5.45	$8,989.11	$419.60	$7,195.68	$299.90	1.29	0.74	0.55	$7,195.68	$300.00	1.40
[redacted]	$13,790	340	1028.4	Inside	Slab	1026.35	-2.05	$0.00	$9.07	-	-	-	-	-	$4,738.80	$198.00	0.05
[redacted]	$13,790	340	1028.2	Inside	Slab	1026.26	-1.94	$0.00	$10.80	-	-	-	-	-	$4,738.80	$198.00	0.05
[redacted]	$6,170	200	1023.8	Inside	Slab	1027.23	3.43	$2,784.43	$67.08	$2,974.30	$123.96	0.44	0.25	0.20	$2,974.30	$124.00	0.54
[redacted]	$28,320	780	1022.8	Inside	Slab	1027.19	4.39	$11,014.62	$463.31	$10,056.82	$419.14	1.00	0.57	0.38	$10,056.82	$419.00	1.11
[redacted]	$6,170	200	1021.4	Inside	Slab	1027.15	5.75	$3,711.00	$212.45	$2,974.30	$123.96	1.61	0.93	0.64	$2,974.30	$124.00	1.71
[redacted]	$24,910	3,366	1024.3	Inside	Slab	1027.38	3.08	$11,753.53	$288.73	$39,856.78	$1,661.12	0.14	0.08	0.08	$39,856.78	$1,661.00	0.17
[redacted]	$148,530	1,685	1025.2	Inside	Crawlspace	1027.35	2.15	$92,062.83	$2,424.78	$153,140.22	$6,382.47	0.33	0.19	-	$184,204.16	$7,677.00	0.32
[redacted]	$38,050	1,234	1028.9	Inside	Slab	1027.59	-1.31	$0.00	$46.31	-	-	-	-	-	$15,397.19	$642.00	0.07
[redacted]	$64,990	2,246	1027.1	Inside	Slab	1027.47	0.37	$6,834.44	$219.26	$27,086.75	$1,128.90	0.06	0.03	0.00	$27,086.75	$1,129.00	0.19
[redacted]	$16,340	530	1024.3	Inside	Slab	1027.43	3.13	$6,951.64	$162.44	$22,296.48	$929.26	0.12	0.07	0.07	$25,705.64	$1,071.00	0.15
[redacted]	$3,890	441	1024.9	Inside	Slab	1027.37	2.47	$1,300.01	$30.51	$843,668.05	$35,161.77	0.00	0.00	-	$5,981.22	$249.00	0.12
[redacted]	$52,440	7,440	1027.4	Inside	Slab	1031.99	4.59	$19,826.93	$3,250.86	$85,717.77	$3,572.48	0.90	0.52	0.30	$85,717.77	$3,573.00	0.91
[redacted]	$16,150	3,120	1027.4	Inside	Slab	1032.48	5.08	$8,835.50	$1,436.73	$37,061.77	$1,544.63	0.92	0.53	0.35	$37,061.77	$1,545.00	0.93
[redacted]	$4,130	976	1030.1	Inside	Pile	1031.11	1.01	$746.82	$18.79	$12,373.93	$515.71	0.03	0.02	0.01	$12,373.93	$516.00	0.04
[redacted]	$320,660	8,257	1027.5	Inside	Slab	1030.50	3.00	$147,163.70	$12,878.77	$70,601.14	$2,942.46	4.24	2.44	1.11	$94,855.21	$3,953.00	3.26
[redacted]	$20,460	2,450	1028.8	Inside	Slab	1029.55	0.75	$3,603.88	$70.75	$29,422.36	$1,226.24	0.03	0.02	0.00	$29,422.36	$1,226.00	0.06
[redacted]	$11,270	1,350	1028.9	Inside	Slab	1028.73	-0.17	$0.00	$16.25	-	-	-	-	-	$16,748.91	$698.00	0.02
[redacted]	$13,330	1,200	1051	Inside	Slab	1046.78	-4.22	-	-	-	-	-	-	-	-	-	-
[redacted]	$49,860	572	1026.7	Inside	Slab	1024.46	-2.24	$0.00	$19.60	-	-	-	-	-	$7,569.71	$315.00	0.06
[redacted]	$35,180	1,036	1034.3	Inside	Mobile	1030.65	-3.65	-	-	-	-	-	-	-	-	-	-
[redacted]	$203,000	10,800	1038.4	Inside	Slab	1035.07	-3.33	-	-	-	-	-	-	-	-	-	-
[redacted]	$3,630	338	1025.2	Inside	Slab	1027.34	2.14	$1,306.48	$40.61	$4,714.00	$196.47	0.17	0.10	-	$4,714.00	$196.00	0.21
[redacted]	$38,120	4,180	1025.7	Inside	Slab	1027.37	1.67	$11,214.75	$286.61	$49,076.28	$2,045.37	0.11	0.06	-	$49,076.28	$2,045.00	0.14
[redacted]	$59,970	4,764	1062.4	Inside	Slab	1061.65	-0.75	-	-	-	-	-	-	-	-	-	-
[redacted]	$7,540	900	1053.3	Inside	Slab	1047.79	-5.51	-	-	-	-	-	-	-	-	-	-
[redacted]	$54,650	1,324	1027.9	Outside	Block	1018.52	-9.38	-	-	-	-	-	-	-	-	-	-
[redacted]	$1,640	1,008	1019.3	Outside	Slab	1018.11	-1.19	$0.00	$0.27	-	-	-	-	-	$12,750.37	$531.00	0.00
[redacted]	$34,320	4,845	1044	Inside	Slab	1041.38	-2.62	-	-	-	-	-	-	-	-	-	-
[redacted]	$1,100	70	1006.2	Inside	Slab	1008.77	2.57	$450.23	$13.82	$1,234.65	$51.46	0.23	0.13	-	$1,234.65	$51.00	0.27
[redacted]	$32,660	482	1026.2	Inside	Slab	1025.59	-0.61	$0.00	$60.80	-	-	-	-	-	$6,480.74	$270.00	0.22
[redacted]	$13,760	203	1026	Inside	Poured	1025.61	-0.39	$0.00	$28.06	-	-	-	-	-	$3,012.88	$126.00	0.22
[redacted]	$103,270	1,079	1025.3	Inside	Slab	1025.44	0.14	$4,381.33	$194.31	$13,584.02	-	0.05	0.03	0.04	$13,584.02	$566.00	0.34
[redacted]	$38,420	567	1025.1	Inside	Slab	1025.44	0.34	$3,853.37	$125.67	$7,509.45	-	0.12	0.07	0.00	$7,509.45	$313.00	0.40

Louisville, NE
Nonstructural Assessment
February 2015


Louisville, NE
Nonstructural Assessment
February 2015
Feet Above Base Flood Elevation
1 +
1.0 - 0.0
0.0 - (- 1.0)
(- 1.1) - (- 2.0)
(- 2.1) - (- 3.0)
(- 3.1) - (- 5.0)
(- 5.1) >
100 Year Flood Delineation
N
0
500
1,000
2,000
Feet

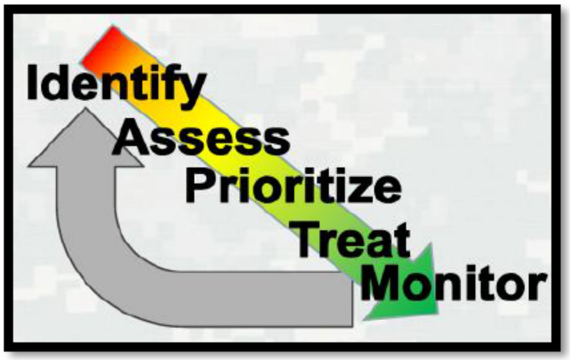

Cedar Creek, NE
Nonstructural Assessment
February 2015
BCR of Mitigating to the 100 yr Level
NA
0.00 - 0.75
0.76 - 1.00
1.01 - 1.50
1.51<
100 Year Flood Delineation
N
0
500
1,000
2,000
Feet



Cedar Creek, NE
Nonstructural Assessment
February 2015

Figure E
Making Risk Informed Decisions Worksheet
Cass County Outreach Meeting February 24, 2015

I. Structure Information
   a. Structure ID
   b. Structure Address
   c. Value
   d. Square Footage
   e. Structure Type
   f. What year was the structure built
   g. First floor elevation (NAVD88)
   h. What are the first three things that you would evacuate from the structure if a flood was going to occur?
   i. How/where would you evacuate in the event of a flood?



II. Risk Identification
   a. Is structure located in Special Flood Hazard Area (SFHA) (Y/N)
   b. What is the structure's Base Flood Elevation (BFE) (ft NAVD88)

III. Risk Assessment
   a. What is the structures BFE depth (item II.b – item I.g)
   b. What is the structures 100-yr event Damage (from study or below link) (http://www.floodsmart.gov/floodsmart/pages/flooding_flood_risks/the_cost_of_flooding.jsp)
   c. What is the structures Expected Annual Damage (EAD) (from study)

IV. Risk Transfer (NFIP)
   a. Is structure Pre-Firm or Post-Firm (compare with item I.f)
      (Cedar Creek – 1978, Louisville – 1980)
   b. What are the estimated annual costs for insurance?
      The following link can be used to estimate insurance costs for some properties as well as identify a local insurance agent.
      (http://www.floodsmart.gov/floodsmart/pages/faqs/what-will-my-flood-insurance-premium-cost.jsp)

V. Risk Reduction through Flood Risk Adaptive Measures (FRAM)
   a. What are the likely useful strategies of FRAM?
   b. What is the estimated 1 time cost of implementing a FRAM measure?
   c. What is the estimated annual cost of implementing a FRAM measure?
   d. What would insurance after the implementation of a FRAM cost?

VI. What is the lowest annual cost option? (compare item III.c, IV.b, and V.c + V.d)

VII. What other consequences are important but not accounted for financially?