# APPENDIX F

## Fremont Flood Risk Reduction Plan and Parcel Level Flood Risk Assessment


JEO CONSULTING GROUP INC

(Revision 2)

*May 2020*

# Flood Risk Reduction Plan and Parcel Level Flood Risk Assessment

## Fremont, Nebraska

**JEO Project 170337.00**

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# 1 PLAN PURPOSE AND BACKGROUND

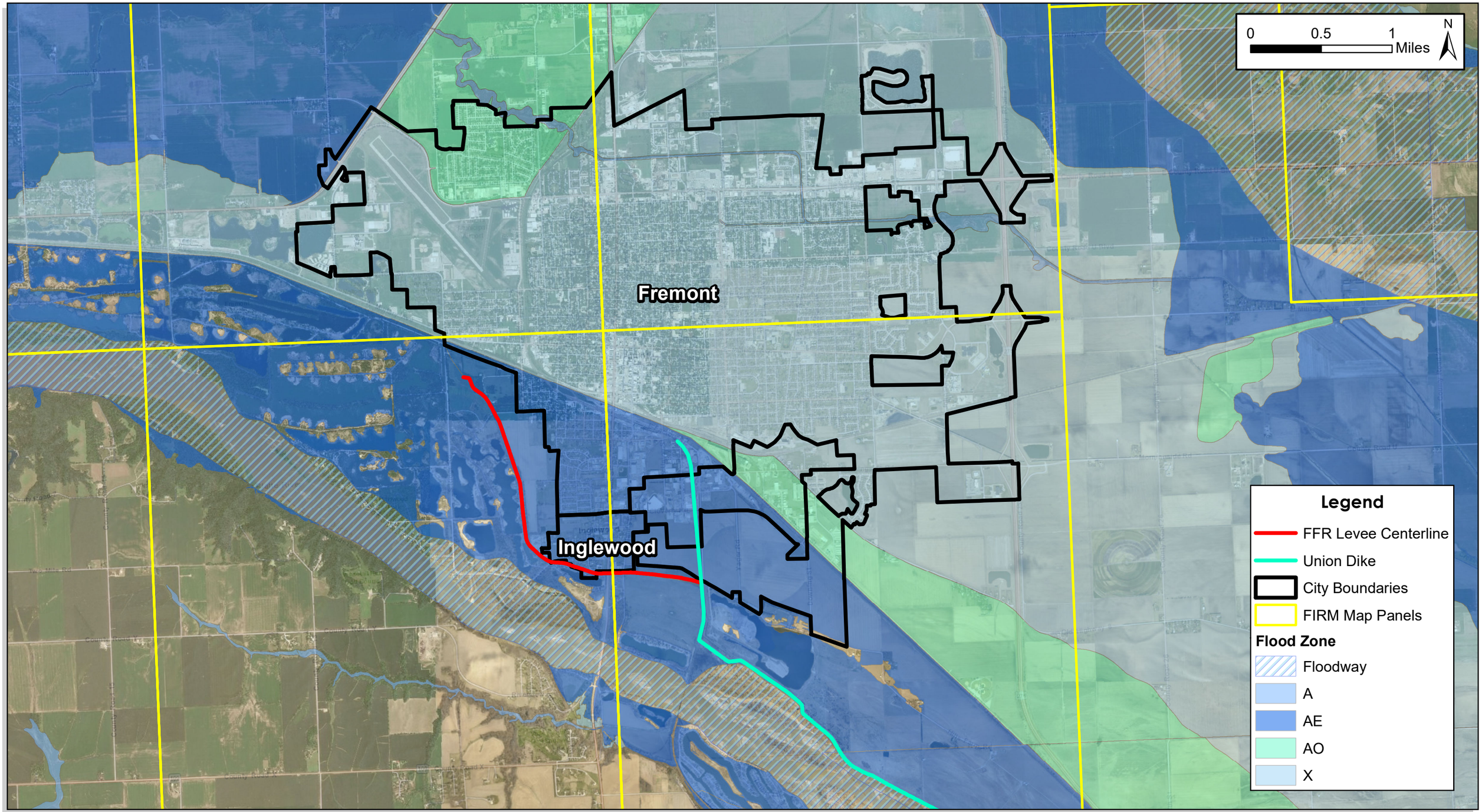
The City of Fremont participates in the Lower Platte North Natural Resources District (NRD) Multi-Jurisdictional Hazard Mitigation Plan (HMP). As part of this planning effort for the 2020 HMP update, additional funding was requested and allocated through the FEMA Pre-Disaster Mitigation Grant (PDM) program to provide the opportunity for participating communities to complete additional risk assessments for select floodprone properties within interested communities. The selected properties are intended to provide an example of flood risk types and risk characteristics in each community. Fremont, located in Dodge County, cost-shared this funding with the NRD to conduct targeted risk assessments for floodprone areas of the community and the community's Extraterritorial Jurisdiction (ETJ) as shown on the effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). An overview of Special Flood Hazard Area (SFHA) flood risk areas identified on the effective FIRM is shown in Figure 1. The SFHA is the land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year. Based on parcel data analyzed for the City of Fremont participant section in the HMP, the value of improvements within the SFHA community-wide is approximately $175 million. This valuation is based on assessor data and includes primary structures and outbuildings only; it does not include business inventory values.

In March 2019, significant flooding was experienced on many river systems throughout Nebraska. Rare circumstances, including significant snowpack, deep frost, extended cold weather, untimely rain events, and rapid warming, created record flows in the Platte and Elkhorn Rivers. For the City of Fremont, this resulted in significant flood damage impacts to public and private infrastructure within the flood hazard areas of the community located along these rivers. Flood risk for the Platte River is located in the southern part of Fremont, while flood risk from the Elkhorn River occurs east of Fremont. Within the Platte River floodplain, the Fremont, Farmland, and Railroad Levee (levee) provides an undetermined level of risk reduction to a portion of the flood risk area. While this levee has the potential to provide flood risk reduction benefits, it was not constructed to a current flood risk design standard. The levee is not certified for flood risk reduction purposes; therefore it is not accredited on the FIRM. During the March 2019 flooding, this levee failed and was breached at multiple locations, causing significant impacts near the breach locations. The levee is currently being evaluated for the purposes of assessing repair and improvement to support improved performance in future flood events, however, levee failure risk will remain. An overview of key flood risk regions of the City of Fremont within the Platte River floodplain is shown on Figure 2. These flood risk regions are based on sections of the SFHA with different risk characteristics. Red is based on the floodway on the effective FIRM along with areas of the floodplain landward of the levee. While not necessarily limited to red areas, locations in the red have also commonly experienced ice jam flooding impacts in the past. Areas in the orange are high risk areas within the SFHA that may not flood quite as frequently due to being outside the floodway. Locations in the yellow are behind the levee and are at risk of levee failure impacts.

In support of risk assessment objectives of the HMP update and considering the significant impacts of the March 2019 flood event, JEO has completed an in-depth review of selected properties for the purposes of identifying flood risk and flood insurance premium reduction strategies for individual properties at risk of flooding from the Platte River and Elkhorn Rivers. These properties were selected to provide a sample of flood risk profiles considering flood risks from the Platte River and Elkhorn River. However, they do not represent all possible flood risks within Fremont. This assessment also will support decision making by the City of Fremont in conjunction with additional flood risk reduction planning actions that have previously been completed or are ongoing. These include but are not limited to the Fremont Repetitive Loss Area

Analysis (NeDNR and City of Fremont, 2014); mitigation actions anticipated by Fremont residents through funding obtained through an anticipated application for assistance through the Hazard Mitigation Grant Program (HMGP) (ongoing); evaluation and potential improvement of the Fremont, Farmland, and Railroad Levee (ongoing); and potential additional individual property mitigation actions identified through an U.S. Army Corps of Engineers (USACE) Section 205 study (ongoing). Further details regarding these other flood risk reduction actions that coordinate with the outcomes of this assessment and plan can be found in Section 6 of this report.

The overall purpose of this assessment and resulting plan is to identify and prioritize flood risk reduction alternatives on a property by property basis for selected structures in the SFHA. The plan also identifies programmatic actions that can be taken by the community to reduce flood risks and flood insurance premium costs for all property owners with floodprone property based on the effective FIRM. Ultimately, this assessment and resulting mitigation actions can be used to both reduce flood damage impacts of future flood events and reduce flood insurance premium costs for both individual homeowners and the community in general. Findings of the assessment, in conjunction with other ongoing mitigation actions, can be used by Fremont as a planning tool to prioritize flood risk reduction actions within the community. The results of the assessment and relative flooding risk information can also be used as a public engagement tool by the City to convey relative flood risk information to community residents.

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# Figure 1: Effective FIRM Overview

Fremont, NE

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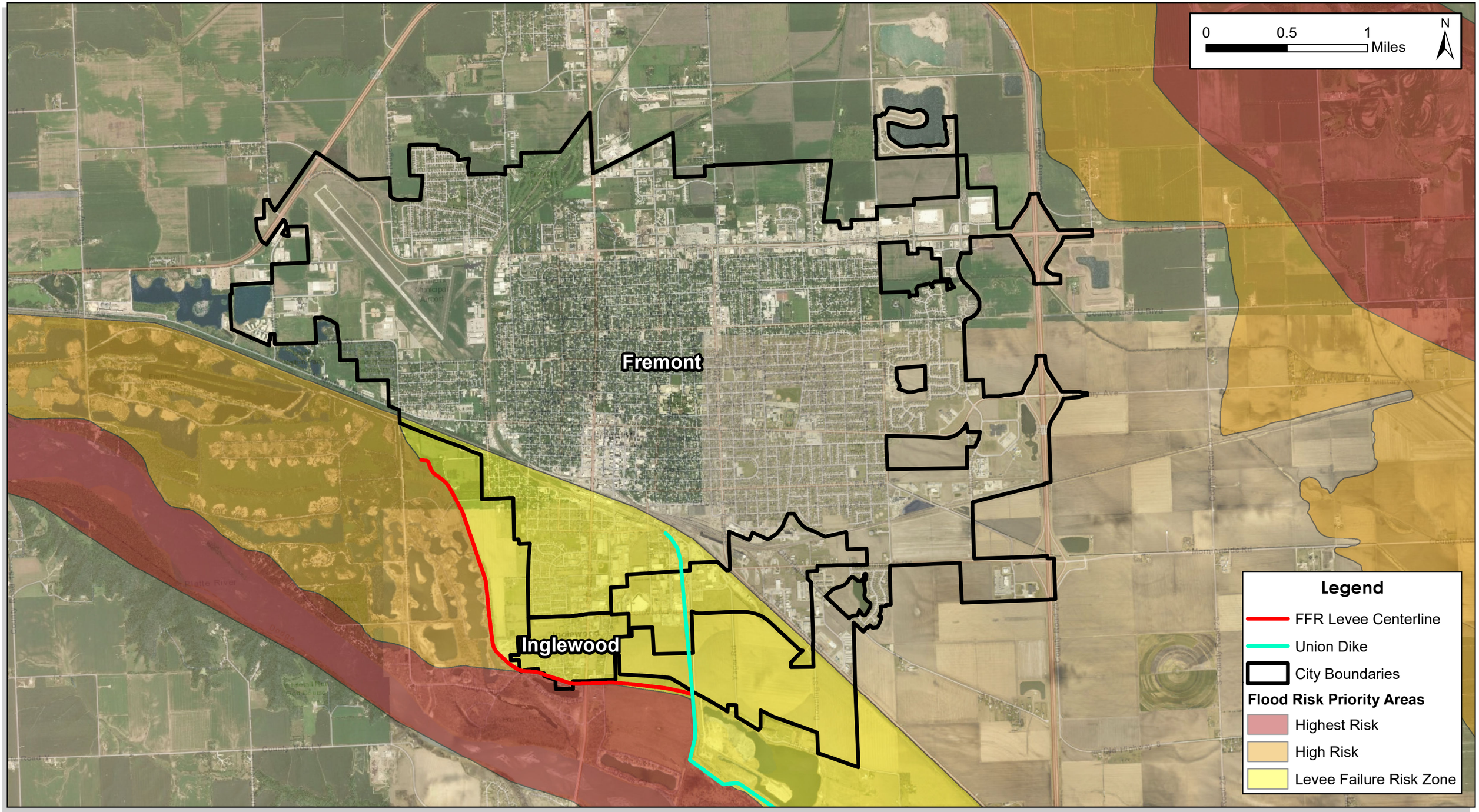


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# Figure 2: Flood Risk Priority Areas

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# 2 FLOOD RISK ASSESSMENT

To identify and summarize the relative risk of flooding for properties within the SFHA of the Platte and Elkhorn Rivers, a flood risk assessment was developed for selected properties that represents a sample of flood risk profiles for the study area. The purpose of the flood risk assessment is to evaluate how deep flood water will be on the selected properties and the anticipated flood risk to the structures on the properties during certain flooding events.

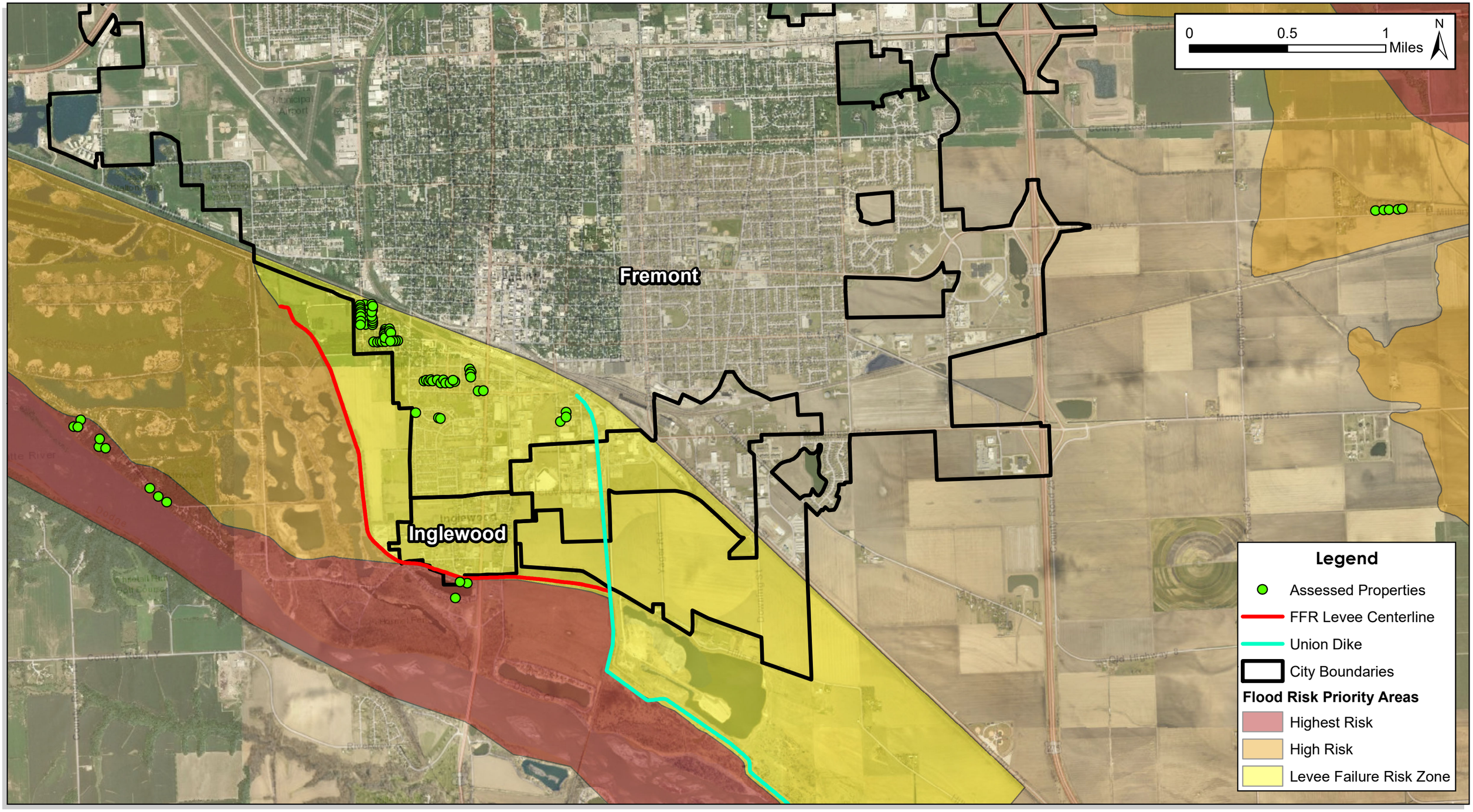
Key steps of the flood risk assessment included:

1. Property selection and field data collection to identify key property features. Properties were selected considering factors such as: variation in flood risk profiles/location in the floodplain, March 2019 flooding impacts, property owners interested in taking mitigation action considering recent flooding impacts.
2. Development of criteria to review and identify flood risk and potential flood damage factors for each property. These criteria are based on the effective FIRM and other known flood damage risks, such as flood impacts from the March 2019 flood event.
3. Development of a flood risk property score based on the flood risk and potential damage factors. This score will be used in conjunction with a mitigation action prioritization process to identify mitigation actions with the most flood risk reduction benefits for the selected properties.

The following sections outline in more detail the steps of the flood risk assessment process.

## 2.1 Property Selection and Field Data Collection

As a result of the March 2019 flooding, the City of Fremont is coordinating with local residents to identify property owners interested in taking immediate mitigation action using funding available through FEMA's HMGP program as a result of the widespread flooding impacts in Nebraska. Through this process, several residents expressed initial interest to participate during the fall of 2019. The number of properties on this list has changed over time; currently 8 property owners are on the interest list and will potentially be included in the anticipated HMGP application. This does not include property owners from Doves Cove; these properties were added to the interest list in February 2020 and therefore were not included in the initial property selection process. The locations of properties on the initial HMGP interest list, along with a range of flood risk circumstances based on the effective FIRM combined with observations of key flood risk areas from the March 2019 flooding, were used to guide the locations of the properties selected for individual property flood risk assessment. This resulted in the identification of 82 properties for further review, including the initial HMGP interest list properties. The selected properties are located in specific areas of the Platte River and Elkhorn River SFHA and share similar risk characteristics with nearby properties; while not all properties in these areas were evaluated in general the flood risk for structures in the vicinity of an evaluated property will be similar. The selected properties include five in the Elkhorn River SFHA and 77 in the Platte River SFHA. An overview of the selected property locations can be seen in Figure 3.

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# Figure 3: Assessed Properties Overview

Fremont, NE

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For the selected properties, a field visit was conducted on August 20th and 21st, 2019. Observations were collected using Collector for ArcGIS regarding the current conditions on the property at the time of the field visit and building characteristics. Key data collected included property photos, approximate location of lowest adjacent grade (LAG) and highest adjacent grade (HAG), number of steps from the ground at the location of the steps (typically the HAG) to the first floor, foundation type, location of utilities, and general condition. The field data collection information was used in conjunction with flood risk data to determine the relative risk of flooding for each property, which was then used to inform mitigation action recommendations. Further details are provided in the following sections.

## 2.2 Flood Risk Review Criteria

To assess the relative risk of flooding for structures on each property selected, the effective Dodge County, NE FIRM and Flood Insurance Study (FIS) dated 1/2/2008 were utilized to develop flood elevations for specified frequencies of flooding, including the 10-year (10% annual chance), 50-year (2% annual chance), and 100-year (1% annual chance). The effective FIRM was utilized because it will be the baseline requirement for any short-term mitigation projects such as structure elevations. However, it should be noted that future flood studies for the Platte and Elkhorn Rivers may alter the flood risk elevation data. Since the evaluation was completed within GIS using best available data, if the flood risk component of this data is adjusted based on a new study the risk assessment can easily be updated using building elevations and other data used for the assessment.

For the Platte River at Fremont, flood elevations for each return period for the selected properties were derived from water surface rasters developed using the effective FIRM cross section GIS data set. Within the Platte River floodplain, the Fremont, Farmland, and Railroad Levee is maintained by the City of Fremont. This levee provides an undetermined level of risk reduction to a portion of the flood risk area and is not currently shown as accredited on the FIRM for Fremont. During the March 2019 flooding, this levee failed and was breached at multiple locations, causing significant impacts near the breach locations. The levee is currently being evaluated for the purposes of assessing potential repairs and improvements to support improved performance in future flood events, however, levee failure risk will remain. Within the effective FIS, the Platte River has two profiles – one 'with levee' profile that assumes the levee is in place and holds for the duration of the flood event and a 'levee failure' profile that assumes that the levee is not in place and does not provide flood risk reduction for properties on the land side of the levee. While the difference varies, the 'levee failure' flood profile is approximately 2-3 feet lower than the 'with levee' flood profile, because it assumes that water can flow within the entire levee protected area. However, in the effective FIRM GIS cross section data set, the regulatory flood elevation is the 'with levee' flood elevation. For the purposes of this evaluation, the flood elevations used are the 'with levee' flood elevations. The primary reasons for using this flood elevation is that it results in conservative actions for flood risk reduction purposes, and that real flood elevations during a flood event if the levee fails will likely be in between the 'with levee' and 'levee failure' flood elevations. Since a full analysis of levee failure scenarios is not available the conservative flood elevation was chosen.

For the Elkhorn River at Fremont, flood elevations for the assessed properties were determined on an individual property basis using the effective FIS profiles.

## 2.3 Flood Risk Review Process and Results

To develop flood risk exposure results for the selected properties, 2016 Eastern Urban Area LiDAR was used to develop building footprints for the primary structures (residential or non-residential structures) on each property. Building footprint boundaries were reviewed vs. aerial photographs and refined as needed. These building footprints along with field observations for each property were used to determine

an estimated first floor elevation. This first-floor elevation was then compared to the flood elevations for the relevant flood frequencies developed from the effective FIRM to determine the depth of flooding for the structure for each return period, respectively. In general, if the building is flooded during a more frequent flood event such as the 10% annual chance flood, and/or has high flood depths for less frequent flooding such as the 1% annual chance flood, the greater the chance of recurring or significant flood damage impacts from future flooding.

In addition to flood depths for the primary structure based on the effective FIRM, additional flood depth considerations were also reviewed. These included visually estimated external utilities elevations, primarily HVAC equipment, based on photographs and site elevations. Also included were estimates of flood elevations from the March 2019 flood event. These estimates were based primarily on high water mark (HWM) observations collected by the U.S. Geological Survey (USGS) along with visual estimates of HWM available from field visit photographs. These flood elevations should be considered approximate due to the limited amount of data available. However, they do provide valuable insight into the scope of the 2019 flood, with actual flood elevations being consistent with the 1% annual chance flood elevation published in the effective FIS. Finally, using depth grids produced from the effective FIS water surface rasters and 2016 LiDAR along with parcel data, a data set showing the highest depth of flooding on all properties in the area of interest surrounding the selected properties in the Platte River SFHA was developed. For properties that were not selected for parcel assessment, this provides additional information regarding relative flood risk and frequency of flooding.

The results of the flood risk assessment and related observations regarding flood risk and the depth of flooding based on estimated first floor elevations for the assessed structures are provided in a summary table, which can be found in Appendix A.

## 2.4 Flood Risk Property Score

Using the results of the flood risk assessment for each property, a Flood Risk Property Score was developed. This was completed using selected criteria that describe the potential flooding impacts that could be experienced on each property. Heavier weighting (higher point values) was assigned to certain criteria such as flooding above the first floor of the building, critical facilities, and buildings that have been repetitively flooded or substantially damaged. A summary of the criteria used, and the point values assigned to each criterion can be found in the following Table 1.

Table 1: Flood Risk Property Score Criteria

| Criteria | Property Flood Impacts | Base Points | % of possible total |
|---|---|---|---|
| **1** | Flooding above the first floor of a building | 100 | 20.0% |
| **2** | Flooding of electrical and/or mechanical equipment | 40 | 8.0% |
| **3** | Flood water is touching a portion of the building (likely crawlspace or unfinished basement being impacted) | 40 | 8.0% |
| **4** | Property is completely surrounded by flood water (ingress/egress off of flooded property is not possible during flooding) | 20 | 4.0% |
| **5** | Structure is completely surrounded by flood water (ingress/egress from building is not possible during flooding) | 30 | 6.0% |
| **6** | Structure is completely surrounded by flood water AND is a Critical Facility | 100 | 20.0% |
| **7** | Structure is completely surrounded by flood water AND is multi-family residential (additional people, vehicles) | 50 | 10.0% |
| **8** | Flood water is touching a portion of the building AND has damage or substantial damage (subsidence, shifting, cracking) as a result of recent or cumulative flooding | 100 | 20.0% |
| **9** | Flooding of exterior property improvements which are deemed functional necessities to reasonable use of single family or multi-family residential property (detached garage or shed) | 20 | 4.0% |
| | Total Points Possible | 500 | 100% |

For each property, these criteria were reviewed, and points were assigned to generate the initial Flood Risk Property Score with a maximum initial score of 500. These scores were then supplemented by taking into account flood frequency factors as well as flood impact factors such as flow velocity, ice jam frequency, and levee breach risk. By incorporating these factors, the overall flood risk circumstances for each property can be differentiated. For example, a property in the floodway or flooded during the 10% annual chance flood has a much higher risk of being frequently flooded. Likewise, a property in the floodway has a higher risk of debris impacts due to higher flooding velocities and is more likely to be impacted by ice jam flooding due to proximity to the river channel. By incorporating these factors, properties with otherwise similar flooding characteristics can be further prioritized based on relative risk of flooding impacts. A summary of these factors is provided in Table 2 and Table 3.

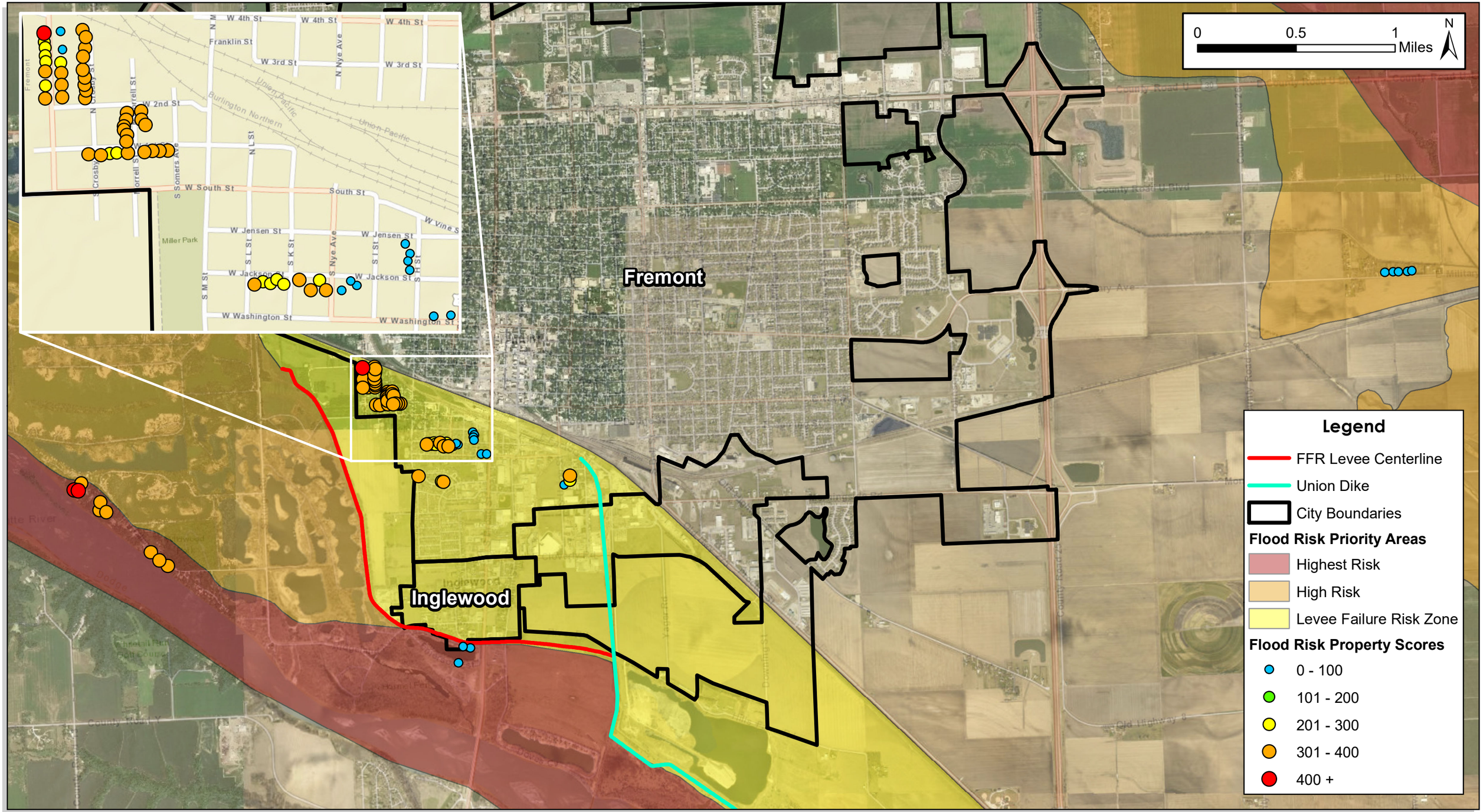
Table 2: Flooding Frequency Risk

| Flooding Frequency Risk | Multiplier |
|---|---|
| Floodway | 1 |
| 10% Annual Chance | 1 |
| 2% Annual Chance | 0.2 |
| 1% Annual Chance | 0.1 |

Table 3: Flooding Impact Risk Factors

| Factor | Description | Multiplier |
|---|---|---|
| Flow velocity risk | Higher flow velocities and debris impacts likely to be experienced closer to the river channel and riverward of the levee. | 1.5 |
| Ice jam flood risk area | Ice jam flooding risk and ice impact risk more likely to be experienced closer to the river channel and riverward of the levee. | 1.5 |
| Levee breach risk area | Potential impacts due to a levee breach | 1.3 |

An overview of the Flood Risk Property Scores is provided in Figure 4. These results show which properties have the highest potential impacts based on flood depth, flooding frequency, and location within the floodplain. Background data supporting the Flood Risk Property Scores is also provided in Appendix A.




# Figure 4: Flood Risk Property Scores

Fremont, NE

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# 3 FLOOD RISK REDUCTION ACTION RECOMMENDATIONS

Flood risk reduction actions provide the opportunity for a community and property owners to achieve both flood damage and flood risk reduction as well as a potential decrease in flood insurance premium costs through actions that reduce the potential impacts of future flooding. To achieve this objective, thirteen potential nonstructural (building modification) flood risk reduction actions were identified, along with eight potential programmatic (policy or program implementation) actions. The overall objective of these potential actions is to both reduce real flood damage risk and reduce the costs of a key programmatic flood risk reduction action all property owners can take which is obtaining flood insurance.

The following outlines the potential flood risk reduction actions reviewed for each property and the recommendations. Nonstructural actions are property specific, with a planning level feasibility evaluation completed for each individual property using field observations and flood risk data. Similar nearby properties will have similar flood risk profiles and will likely benefit from similar flood risk reduction actions. Programmatic flood risk reduction actions apply to all parts of the community. Overall optimum flood risk reduction actions are likely a combination of one or more individual property actions plus programmatic actions taken at the community level.

## 3.1 Flood Risk Reduction Alternatives

### 3.1.1 Nonstructural

Nonstructural flood risk reduction actions represent building or property modifications that reduce the risk of flooding and flood damages for an individual property. Certain alternatives also offer the opportunity to reduce flood insurance premium costs for the applicable structures, in addition to the flood damage avoidance benefits. Potential flood risk reduction alternatives at the individual property or community level are outlined below. For each individual property alternative, a summary description of each action, flood risk reduction effectiveness, typical cost range, and potential funding sources are noted along with whether the action could potentially gather additional points for the community through Fremont's participation in the National Flood Insurance Program's (NFIP's) Community Rating System (CRS) program, which provides flood insurance discounts community wide as a result of certain flood risk reduction actions taken by the community. For more information on the CRS program and flood insurance, see Section 5. For more information on ongoing related studies and potential funding sources, see sections 6 and 7, respectively.

An overview of potential actions is provided in the following Table 4.

**Table 4: Potential Nonstructural Mitigation Actions**

| Alternative ID | Nonstructural Alternative | Description | Flood Risk Reduction Effectiveness | Funding | Relative cost range | Potential Flood Insurance Premium Cost Reduction Benefit | Potential CRS Benefits |
|---|---|---|---|---|---|---|---|
| 1 | Property Acquisition and Structure Demolition | Acquire property and demolish structures. If funded by FEMA grants, the property must remain open space. | Very High - removes structure from floodplain. | FEMA HMA, Local, Property Owner | Varies by property value and structure size. Typical cost in study area $50,000 - $175,000 | Yes | Yes, Activity 420 and 520 |
| 2 | Structure Demolition and Rebuild (Mitigation Reconstruction) | Demolish structure and re-build in compliance with local floodplain management requirements. This option is available for buildings that cannot be elevated for structural reasons. | High - reduces potential for flood damage, but structure remains in floodplain. | FEMA HMA, Local, Property Owner | Varies by property value and structure size. Typical cost in study area $50,000 - $175,000 | Yes | Yes, Activity 530 |
| 3 | Property Acquisition and Structure Relocation | Acquire property and move structures to a non-floodprone location. If funded by FEMA grants, the floodprone property must remain open space. | Very High - removes structure from floodplain. | FEMA HMA, Local, Property Owner | Varies by property value and structure size. Typical cost in study area $50,000 - $175,000 | Yes | Yes, Activity 420 and 520 |
| 4 | Property Acquisition, Demolition or Relocation, and Re-sale | Acquire property and demolish or move existing structures. This option is specifically locally funded, and provides an opportunity for the community to purchase the property for re-development in compliance with floodplain management requirements. | High - reduces potential for flood damage, but future development remains in floodplain. | Local | Varies by property value and structure size. Typical cost in study area $50,000 - $175,000 | Yes | Yes, Activity 530 |
| 5 | Structure Elevation | Elevation of the existing structure in place, potentially with a garage space and unfinished storage underneath that has flood vents installed. Requires abandonment of the existing basement, if applicable. Add vertical or lateral addition with safe room if possible; for structures with attached garages the garage space can be used for this. Should also include backflow prevention. | High - reduces potential for flood damage, but structure remains in floodplain. | FEMA HMA, Local, FHA 203(k) loan, Property Owner | Varies by structure size. Typical cost in study area $50,000 - $75,000 | Yes | Yes, Activity 530 |
| 6 | Abandon Basement and Fill | Typically involves adding flood vents. Should also include backflow prevention. Add vertical or lateral addition with safe room if possible. | Moderate - reduces potential for flood damage, but structure remains in floodplain. | FEMA HMA, Local, FHA 203(k) loan, Property Owner | Varies by structure size. Typical cost in study area $20,000 - $30,000 | Yes | Yes, Activity 530 |
| 7 | Dry Floodproofing of Structures | Retrofitting to make a structure watertight. Typically requires construction of a perimeter wall or sealant for existng walls combined with door closures. Also requires a plan for implementation of closures.Generally used only for non-residential; flood insurance benefits can only be obtained for this property type. Should also include backflow prevention. | Moderate - reduces potential for flood damage, but structure remains in floodplain. | FEMA HMA, Local, Property Owner | Varies by structure size. Typical cost in study area $10,000 - $30,000 | Yes | Yes, Activity 530 |
| 8 | Wet Floodproofing of Structures | Add flood vents to re-constructed or existing enclosed space below the first floor. Ideally combined with elevation or basement fill, but can be considered as a retrofitting technique for non-filled unfinished basements (helps prevent structural damage during flooding). Add backflow prevention. | Moderate - reduces potential for flood damage, but structure remains in floodplain. | FEMA HMA, Local, FHA 203(k) loan, Property Owner | Varies by structure size. Typical cost in study area $5,000 - $10,000. Included in the costs of a typical elevation project. | Yes | Yes, Activity 530 |
| 9 | Levee/Floodwall Protection for Multiple Structures | Construction of a levee or floodwall for groups of structures. Generally applicable only to relatively small groups of structures requiring flood risk reduction. | Moderate - reduces potential for flood damage, but structure remains in floodplain. Failure or overtopping of the levee or floodwall can result in catastrophic damage. | FEMA HMA, Local, Property Owner | Not applicable to study area. | Yes, but requires levee certification | Yes, Activity 530 |
| 10 | Utility Elevation/Backflow prevention | Elevate utilities and install backflow prevention devices on sanitary sewer services. | Low - reduces severity of damage/utility down time but structure remains at risk. | FEMA HMA, Local, FHA 203(k) loan, Property Owner | Varies by individual property requirements. Typical cost in study area $5,000 - $10,000. | Yes | Yes, Activity 530 |
| 11 | Partial Dry Floodproofing | Partial dry floodproofing retrofit to reduce risk from higher frequency flooding. | Moderate to Low, depending on elevation of risk reduction action - reduces potential for flood damage, but structure remains in floodplain. | Local, Property Owner | Varies by structure size. Typical cost in study area $10,000 - $30,000 | No | Yes, Activity 530 |
| 12 | Partial Wet Floodproofing | Partial wet floodproofing retrofit to reduce risk from higher frequency flooding. | Moderate to Low, depending on elevation of risk reduction action - reduces potential for flood damage, but structure remains in floodplain. | Local, Property Owner | Varies by structure size. Typical cost in study area $5,000 - $10,000. Included in the costs of a typical elevation project. | No | Yes, Activity 530 |
| 13 | Levee/Wall/Berm for a Single Structure | Construction of a levee or floodwall for a single structure. Generally considered a last option if other alternatives are not feasible. | Moderate - reduces potential for flood damage, but structure remains in floodplain. Failure or overtopping of the levee or floodwall can result in catastrophic damage. | FEMA HMA, Local, Property Owner | Not applicable to study area. | Yes, but requires levee certification | Yes, Activity 530 |

### 3.1.2 Programmatic

Programmatic flood risk reduction actions represent planning or policy actions that reduce the risk of flooding and flood damages community wide. Typically, these actions promote awareness of flooding risk, potential mitigation actions for property owners, flood preparedness and flood warning planning, and floodplain management planning and policy. Implementation of these planning actions may also involve a combination of nonstructural and structural flood mitigation project construction. Most of these actions, if implemented, would provide additional CRS point credit to the City, resulting in potential flood insurance discounts for property owners community wide. For more information on the CRS program and flood insurance, see Section 5.

An overview of potential actions is provided in the following Table 5.

## 3.2 Flood Risk Reduction Recommendations

Each individual property in the group of properties selected for review was assessed for potential mitigation action, considering the nonstructural mitigation actions identified in Table 4 as well as the flood risk factors reviewed as part of development of the flood risk assessment. For each property, potential recommendations were considered along with relative effectiveness to develop a summary of potential actions for each property. An overview of the summary is provided in Table 6. Highly effective, recommended actions are green; recommended actions are yellow, and actions that are not recommended are red. Certain actions are also identified as needing further evaluation (blue); typically, this is due to lack of data regarding the property relative to the action evaluated. Typically, further evaluation in these cases would require more in-depth property data such as field survey or structure inspection. It should also be emphasized that the recommendations are planning level and generally will require further evaluation as a next step; for example, elevation of a structure as a recommendation will require additional information on structural condition to confirm that elevation is possible. If this is not possible, an alternative flood risk reduction action should be considered.

For each property, a primary recommendation was identified based on the review of the flood risk and potential mitigation actions. This primary recommendation was carried through to the next step of evaluation as part of the development of flood mitigation priority scores. An overview of the primary mitigation action recommendations for each evaluated property is provided in Figure 5. For most properties, structure elevation is the recommended primary alternative. However, it was noted through review of this alternative that for many properties it would potentially be cheaper to acquire the property and demolish the structure than it would be to elevate the structures due to low property values. Pursuing a strategic acquisition alternative would provide more overall flood risk reduction. If this strategy were implemented using local money rather than FEMA grants, this would also allow for the potential for significant re-development of certain regions; for example, certain residential property in the levee failure risk zone could be removed or re-located and replaced with industrial/commercial development built with flood risk reduction considerations in mind.

**Table 5: Potential Programmatic Actions**

| Alternative ID | Programmatic Alternative | Description | Potential CRS Benefits |
|---|---|---|---|
| **1** | Audible Flood Warning System | An audible flood warning system for the most floodprone areas of the community. Implementation can be coordinated with development of a Flood Preparedness and Response Plan. | Yes, Activity 610 |
| **2** | Public Education | Promote flood risk awareness through the City's website as well as other outreach efforts. These actions can be incorporated into other floodplan management/flood preparedness planning efforts. | Yes, Activity 320 and 330 |
| **3** | Flood Insurance | Flood insurance as a mitigation action is the easiest way to reduce risk, especially while additional actions are in development. Promotion of flood insurance as a mitigation action will result in more Increased Cost of Compliance (ICC) coverage, which can be used to support the cost of mitigation if flood damage occurs again. | Yes, Activity 370 |
| **4** | CRS Program Participation - Floodplain Management Plan | The City of Fremont currently participates in the NFIP's Community Rating Sytem (CRS). The City has completed a Repetitive Loss Area Analysis (RLAA); this could be supplemented with a community wide floodplain management plan. This plan can incorporate existing planning tools such as the RLAA, this flood risk reduction plan, and the Hazard Mitigation Plan along with planning team coordination to develop a comprehensive floodplain management plan. | Yes, Activity 510 |
| **5** | Flood Preparedness and Response Plan | The purpose of this plan is to develop a community wide response plan in the event of another significant flood. The planning process helps the community identify key contacts, and determine the best approach to respond to flooding, including prioritizing preparedness actions taken before and during the flood. | Yes, Activity 610 |
| **6** | Flood Study Updates | The effective flood study for Fremont uses older analysis techniques, and would also benefit from incorporation of flood data obtained as a result of the March 2019 flood. This action would develop revised flood studies for use as part of other programmatic actions and to promote risk informed decision making. | Yes, Activity 410 |
| **7** | Floodplain Management Policy Revisions - Planning and Zoning/Comprehensive Planning | This activity involves a comprehensive review of floodplain management requirements and potential adoption of higher standards. This also involves integration of floodplain management into the comprehensive plan. This can be incorporated with a floodplain management planning effort, if applicable. | Yes, Activity 430 |
| **8** | Natural Resource Protection/Recreation | This activity involves identifying and maintaining open space to support the natural and beneficial functions of the floodplain. This can involve both open space preservation as well as comprehensive planning to coordinate this effort with natural floodplain functions. | Yes, Activity 420 and 510 |

**Table 6: Potential Mitigation Actions**

| Property ID | Property Acquisition and Structure Demolition | Structure Demolition and Rebuild (Mitigation Reconstruction) | Property Acquisition and Structure Relocation | Property Acquisition, Demolition or Relocation, and Re-sale | Structure Elevation | Abandon Basement and Fill | Dry Floodproofing of Structures | Wet Floodproofing of Structures | Levee/Floodwall Protection for Multiple Structures | Utility Elevation/Backflow prevention | Partial Dry Floodproofing | Partial Wet Floodproofing | Levee/Wall/Berm for a Single Structure |
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| Alternative Key |
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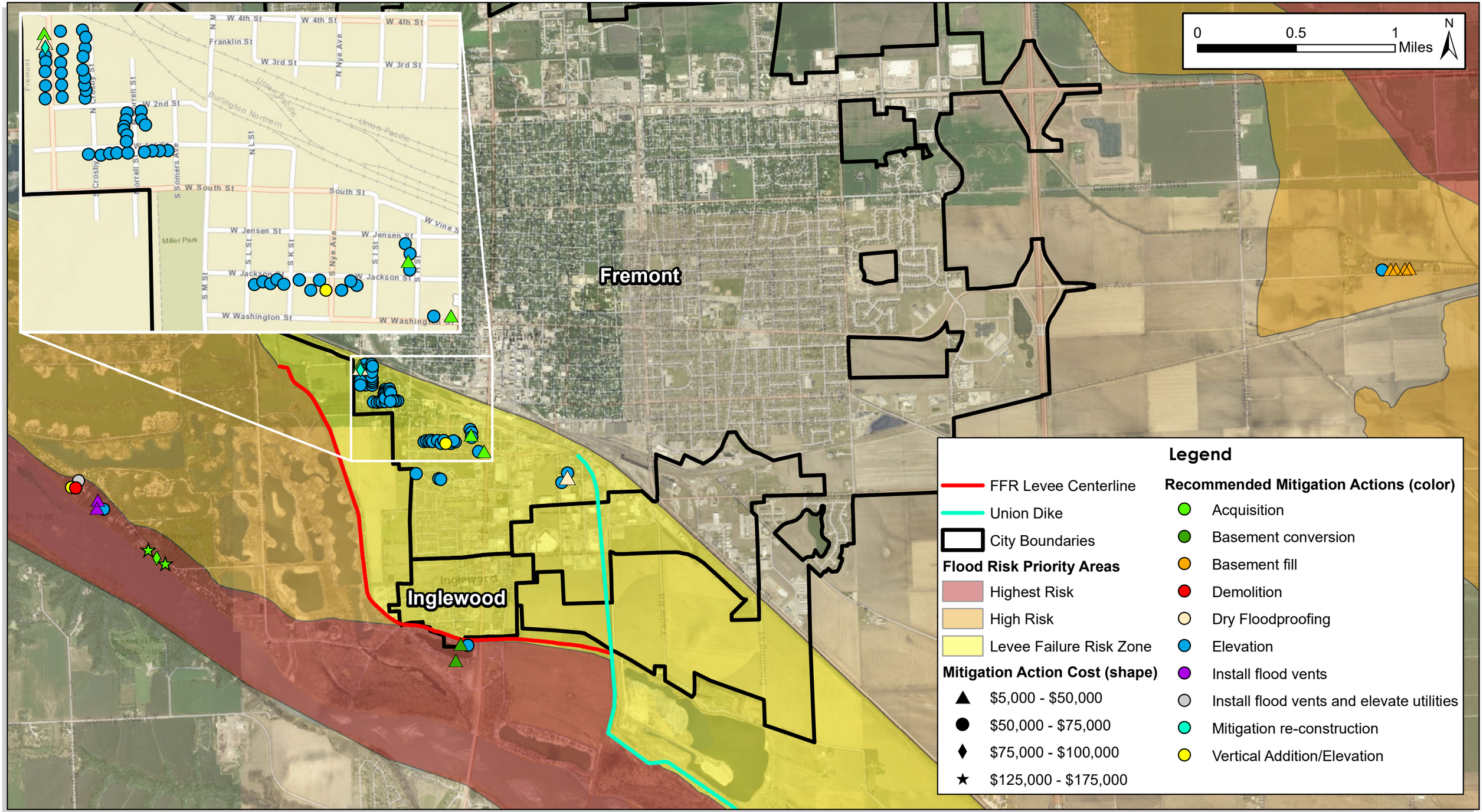
| |
| Highly Effective, Recommended |
| Effective |
| Not Recommended |
| Further Evaluation Needed |
| N/A (incomplete data) |

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# Figure 5: Primary Mitigation Action Recommendations

Fremont, NE

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# 4 FLOOD MITIGATION PRIORITY SCORES

Flood mitigation priority scores are used to further prioritize flood risk reduction actions by determining how these actions provide additional benefits such as impact beyond minimum flood risk reduction objectives.

## 4.1 Scoring Approach

A scoring system similar to the flood risk property scores was developed to determine Flood Mitigation Priority Scores. However, in contrast to the Flood Risk Property Scores, the priority scores are used to determine which properties are highest priority to take mitigation action on based on specific property and mitigation action characteristics. Factors considered include but are not limited to benefits to repetitively flooded properties and proximity to other mitigation projects. This information can then be used to further differentiate projects. For example, if a property is repetitive loss, a mitigation action has higher priority than a similar action for a non-repetitive loss property. An overview of the factors considered, and point values assigned is provided in Table 7.

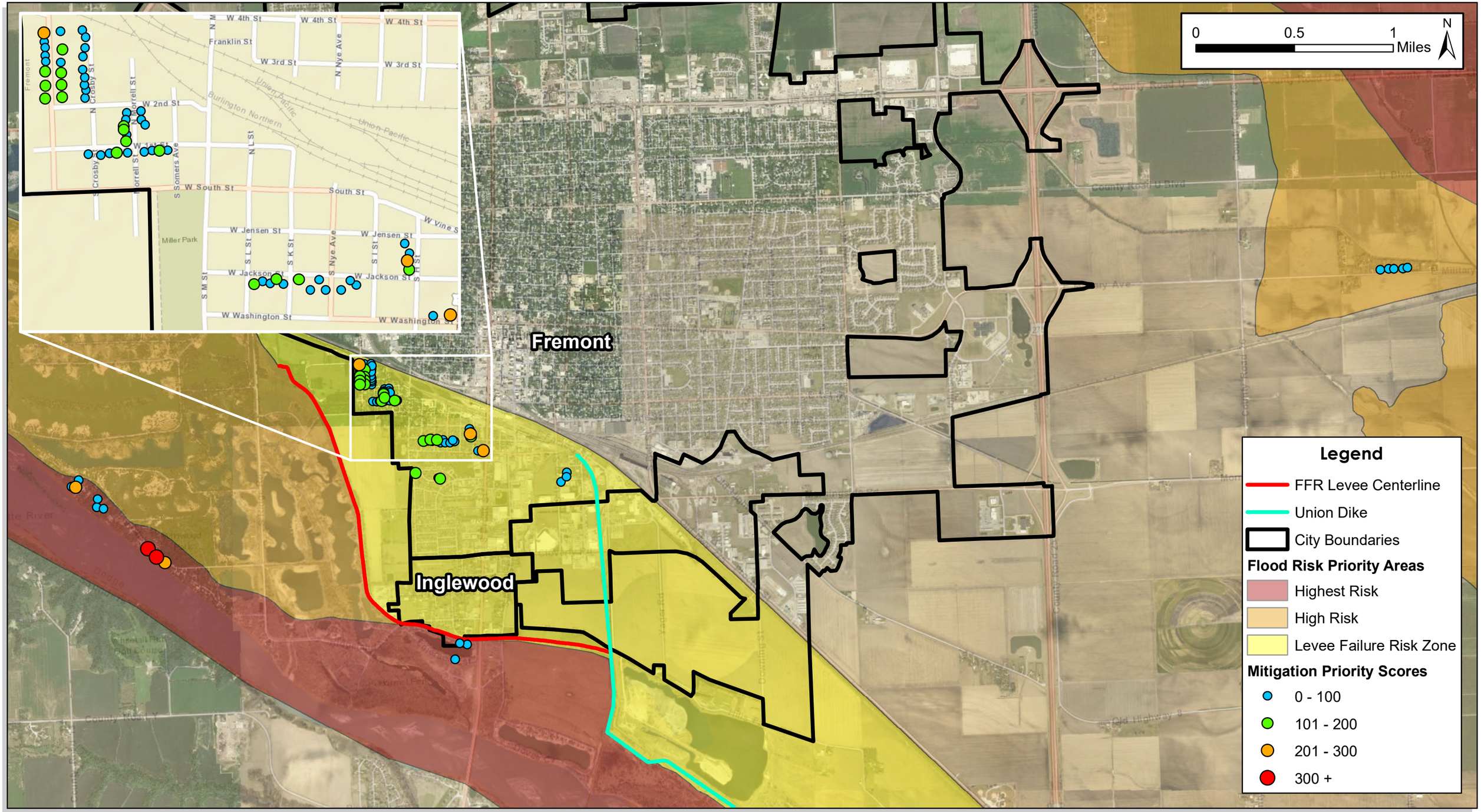
For any individual property, the maximum risk assessment score for flood mitigation priority scoring is 500 points. A multiplier is determined based on the number of points assigned divided by 500; this is then multiplied by the Flood Risk Property Score to get the final Flood Mitigation Property Score. A higher multiplier indicates that the factors considered result in the property being a higher priority for mitigation action. When combined with the Flood Risk Property Score, the higher a resulting Flood Mitigation Property Score the higher priority the property is overall to mitigate.

## 4.2 Scoring Results

Results of the scoring are provided on the following Figures 6 and 7. The final Flood Mitigation Property Scores on Figure 7 indicate the overall combination of the Flood Risk Property Score, recommended mitigation action, and Flood Mitigation Priority Score and can be used to set relative priority for mitigation action decision purposes. The higher the score, the higher priority the property is to mitigate considering the flood risk and effectiveness of the recommended flood risk reduction action. The final score for each property is heavily driven by relative flood risk and potential for flooding impacts, with additional considerations accounted for as noted using the Flood Mitigation Priority Score multiplier.

**Table 7: Flood Mitigation Priority Scoring**

| Factor | Points | Criteria | Applicable Mitigation Actions |
|---|---|---|---|
| **Life and human safety** | 80 | Project involves the permanent removal of habitable structure from flood hazard area. | Property Acquisition and Structure Demolition<br>Property Acquisition and Structure Relocation<br>Property Acquisition, Demolition/Relocation, and Re-sale |
| **Relative cost effectiveness** | 80 | Very cost effective - Mitigation action meets automatic BC threshold for HMA grants and will provide significant risk reduction for a cost lower than the cost to acquire the property. | Property Acquisition and Structure Demolition<br>Property Acquisition and Structure Relocation<br>Property Acquisition, Demolition/Relocation, and Re-sale<br>Structure Elevation<br>Dry Floodproofing of Structures<br>Wet Floodproofing of Structures |
| | 40 | Moderately cost effective - Mitigation action is effective at reducing risk and flood insurance costs but does not meet the automatic BC threshold for HMA grants or will not provide significant risk reduction for a cost lower than the cost to acquire the property. | |
| | 0 | Undetermined or not cost effective | |
| **Proximity to other mitigation projects** | 65 | Project is located adjacent to other previously implemented or planned mitigation projects | Property Acquisition and Structure Demolition<br>Property Acquisition and Structure Relocation<br>Property Acquisition, Demolition/Relocation, and Re-sale<br>Structure Elevation |
| **Property recently added to floodplain with prior floodplain map revision** | 50 | Property was not located in a mapped floodplain at the time of purchase by current owner | Any |
| **Repetitive loss structure** | 50 | Severe Repetitive Loss Structure | Any |
| | 50 | Repetitive Loss Structure | |
| | 0 | N/A | |
| **Property adjacent to publicly owned land** | 25 | Property touches publicly owned land | Property Acquisition and Structure Demolition<br>Property Acquisition and Structure Relocation<br>Property Acquisition, Demolition/Relocation, and Re-sale |
| **Natural Resource protection benefits/recreation access** | 50 | Property has or is adjacent to naturally beneficial areas, or provides recreation access. | Property Acquisition and Structure Demolition<br>Property Acquisition and Structure Relocation<br>Property Acquisition, Demolition/Relocation, and Re-sale |
| **Historic preservation and cultural asset protection** | 20 | Property includes historic structure(s) or is in proximity to areas of historic or cultural significance | Any |
| **Other** | 80 | High | Any |
| | 40 | Medium | |
| | 0 | Low | |

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# Figure 6: Flood Mitigation Priority Scores

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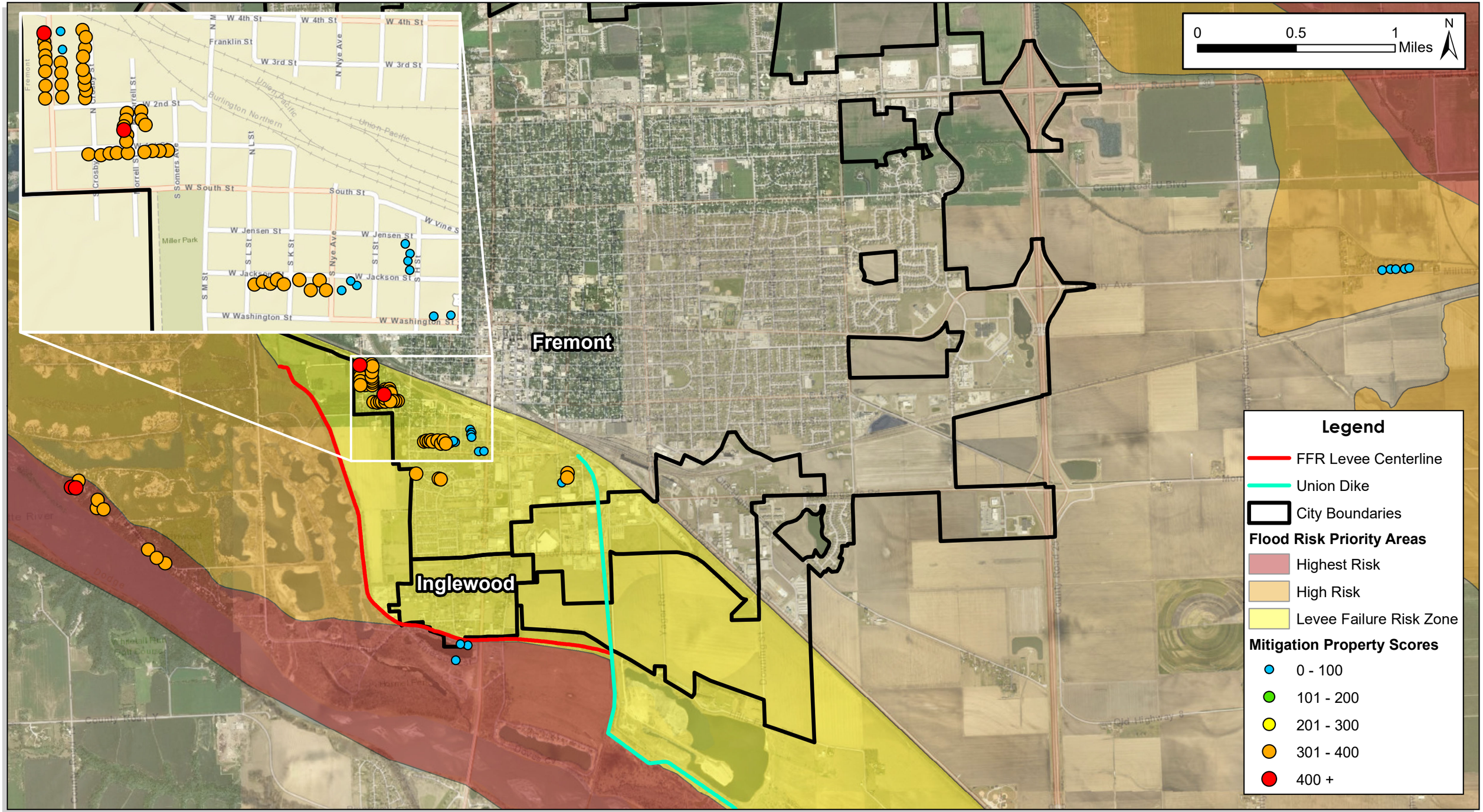


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# Figure 7: Flood Mitigation Property Scores

Fremont, NE

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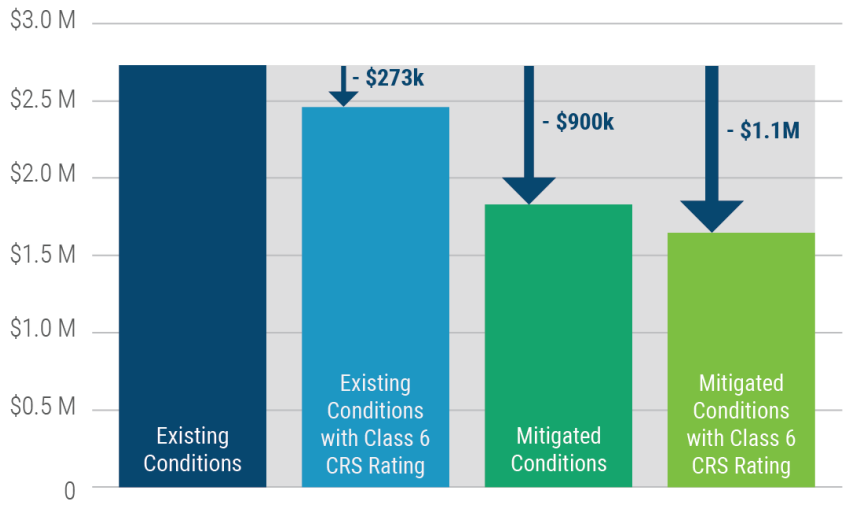
# 5 FLOOD INSURANCE AND THE COMMUNITY RATING SYSTEM (CRS)

Flood insurance is an essential programmatic mitigation action and it is recommended that all property owners within flood risk areas in the community obtain flood insurance whether required as part of a mortgage loan or not. While flood insurance is legally required for properties with a federally backed mortgage, it is available to all property owners in Fremont as a result of the community's participation in the National Flood Insurance Program. By covering a property through both structure and contents coverage, property owners can both have protection from the financial consequences of flooding and be covered by the Increased Cost of Compliance (ICC) provision of flood insurance policies, which will provide funding for certain flood risk reduction projects in the event the covered structure is substantially damaged (damage exceeding 50% of the pre-damage market value) in a future flood. According to the Fremont RLAA developed by NeDNR in 2014, at the time Fremont had 1,050 flood insurance policies with $150 million of insurance coverage in force. At the time over 200 claims had been made and around $1.5 million paid to policy holders. In contrast, as of July 31, 2019 (best publicly available data) total policies and coverage had decreased to 820 and about $130 million, respectively – however, total losses had increased to just under 500 with almost $7.0 million in claims paid. This drastic increase is certainly due to the significant flooding event of March 2019 and likely does not capture the details of all related claims. Also, an unknown number of properties were likely not covered by flood insurance during the March 2019 flood and may remain without flood insurance coverage. The buildings on these properties are vulnerable to both future damages and the potential for significant losses due to the lack of flood insurance coverage.

Based on current conditions of the floodprone properties evaluated for this assessment, JEO completed a planning level evaluation of current flood insurance costs to those properties compared with what the cost will be once mitigated according to the primary mitigation action recommendation. This assessment is approximate as it depends on a number of assumptions including the level of coverage for structure and contents. For the purposes of this evaluation, it was assumed that the existing properties are generally rated as Pre-FIRM, which means they were either constructed before 8/15/1978 or before being identified in the floodplain as shown on the effective FIRM dated 1/2/2008. It was also assumed the coverage level is 80% of the assessed value and $20,000 in contents coverage. Pre-FIRM rating is currently a subsidized rating option, meaning it costs less than the actuarial, or elevation-based rate. For properties that have a floor lower than the base flood elevation, actuarial (elevation based) rating will result in a much higher rate than the Pre-FIRM rate. For proposed conditions, it was assumed the primary structure on the property is either elevated one foot above the base flood elevation or floodproofed to two feet above the base flood elevation. Based on these assumptions and using actuarial rates, the benefits of mitigation for just the assessed properties is approximately $30,000 - $40,000 per year in lower premiums which is approximately $900,000 - $1.2 million dollars in premium savings over a 30-year period, as shown in Figure 8. Assuming flood mitigation through elevation is completed for all floodprone residential properties in the SFHA within the community, this would result in a potential premium savings of over $14 million over a 30 year period assuming a savings of approximately $350.00/property/year and considering 1,339 applicable properties. It is worth noting that the significance of the premium difference is impacted by the subsidized rating structure of Pre-FIRM policy rates; these rates are anticipated to transition to full actuarial risk (elevation based) rates in the future, which will result in a more significant benefit for elevation projects that both reduce flood damage risk and flood insurance premium rates.

Figure 8: Hypothetical Flood Insurance Costs Over 30-Years – Assessed Properties




Currently the NFIP is moving towards a new rating structure called Risk Rating 2.0, which is anticipated to be implemented on October 1, 2021. While full details have not been released, this flood insurance rating structure is anticipated to take into account distance from the flooding source along with depth and frequency of flooding. Likely this could result in higher flood insurance rates for the highest risk properties, such as the properties in the floodway/highest flood risk priority areas of Fremont. Under Risk Rating 2.0, it is anticipated that mitigation actions such as elevation of structures, wet floodproofing, and elevating utilities will be credited with flood insurance cost reductions, similar to the current rating structure. The overall rating structure is anticipated to put a focus on reducing flood damage risk to properties that are in the highest risk areas such as high velocity or high flood depth regions of the floodplain. By taking mitigation action now, property owners can avoid potentially significant future flood insurance cost increases.

As previously noted, the community participates in the NFIP's CRS program. Through this program, the community receives flood insurance discounts for floodplain management related activities and policies the community implements. Fremont is currently a Class 8 and receives a 10% flood insurance discount for all property owners in the community. However, there are several other activities Fremont could implement to obtain more points, including the mitigation actions outlined in this assessment. Based on a review of potential activities and points Fremont could obtain it appears likely Fremont could move to a Class 6 (20% flood insurance discount). Based on a current written premium of approximately $700,000 community wide, moving to a Class 6 would result in an annual flood insurance savings of approximately $70,000. This annual savings could translate to $2.1 million or more in savings over a 30-year period.

# 6 Related Studies and Flood Risk Reduction Projects

In addition to performing routine floodplain management through participation in the NFIP and additional activities through the NFIP's CRS program, the City of Fremont continues to pursue multiple floodplain management and flood risk reduction actions that collectively will reduce the risk of flooding and potential damages from flooding for Fremont property owners. A summary of these historical and ongoing actions is provided in Table 8. An overview of these projects for the areas covered by this parcel level mitigation action assessment is also shown on Figure 9.

**Table 8: Related Plans and Studies**

| Action | Timeline | Objective | Outcome |
|---|---|---|---|
| **Repetitive Loss Area Analysis (RLAA)** | 2014 | Identify potential flood risk reduction actions for the repetitive loss properties within the City of Fremont. | The RLAA was adopted by the City of Fremont and points received through the CRS program which helped the City achieve a class change. This helped reduce flood insurance premiums by 5% for property owners. The City is considering potential flood risk reduction actions as part of reducing flood risk for these properties considering the impacts of the March 2019 flooding. |
| **Hazard Mitigation Grant Program (HMGP) Application** | Ongoing | Grant application being prepared by the City of Fremont to be submitted to NEMA. The purpose of the application is to take immediate mitigation action for interested property owners considering the impacts of March 2019 flooding. | If the application is approved by NEMA and FEMA, it is anticipated this will result in elevation or retrofitting of multiple structures using the grant funds. |
| **Levee Evaluation** | Ongoing | Evaluate the Fremont, Farmland, and Railroad levee for the purposes of the levee system joining the U. S. Army Corps of Engineers Public Law 84-99 Rehabilitation Program. | Recommendations for improvement to the levee necessary to join the PL 84-99 program. If the program is successfully joined, USACE will provide rehabilitation and inspection assistance for the levee system under the rules of the program. |
| **U.S. Army Corps of Engineers Section 205 Project** | Ongoing | Identify potential flood risk reduction actions for selected floodprone properties within the City of Fremont. | USACE has completed a draft assessment of the identified properties. Within the Platte River floodplain, a number of properties have been idenfitied for potential elevation ( residential) or floodproofing (non-residential). |
| **Platte River Corridor Evaluation** | Possible Future Project | The City of Fremont has joined with the Dodge County Area Joint Water Management Advisory Board to seek funding to evaluate flood risk for a longer reach of the Platte River, including the reach from North Bend to Fremont. The coverage area would also include Rawhide Creek and local drainage ditches in the region of Fremont. | Additional flood modeling, prioritization, and development of flood risk reduction actions for the City of Fremont, Dodge County, and surrounding communities. An overarching goal of this effort is to ensure that further identificaiton and prioritization of structural and non-structural mitigation actions is informed by stakeholder input and the best available flood risk modeling. It is also a goal of this effort that any proposed structural actions do not result in unintended impacts. |
| **Local Drainage Evaluations** | Possible Future Project | Depending on the funding status of the Platte River Corridor Evaluation, the City may elect to separately evaluate the Rawhide Creek corridor and ditches and/or localized drainage basins and historical localized flood risk problem areas. | Flood modeling and mitigation action identification for the identified study area. |

0 0.5 1 Miles

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Fremont

Inglewood

**Legend**

- FFR Levee Centerline
- Union Dike
- City Boundaries
- Parcel Assessment Properties

**Related Plans and Studies**

- Levee Evaluation
- Repetitive Loss Area Analysis
- Hazard Mitigation Grant Program Project
- Doves Cove Mitigation Interest

**USACE Section 205 Assessment**

- Floodproofing
- Elevation

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# Figure 9: Related Plans and Studies

Fremont, NE

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# 7 RECOMMENDED FLOOD RISK REDUCTION ACTIONS PRIORITY

Based on the findings of the parcel assessment and a review of recent and ongoing flood risk reduction mitigation actions to date, recommendations have been developed to promote flood risk reduction action by property owners within Fremont. The recommendations are reflected in the flood mitigation property scores shown on Figure 7 as well as the content of Tables 4, 5, and 6. A summary of these recommendations in priority order are:

1. Continue pursuit of a flood risk reduction mitigation action strategy program through FEMA Hazard Mitigation Assistance funding sources, starting with the HMGP program application that is in development. Mitigation actions should focus generally on potential acquisition of floodprone properties or elevation of floodprone residential structures and dry floodproofing of floodprone non-residential structures.
    a. First priority should be placed on structures in the highest risk Flood Risk Priority Area, which generally includes the floodway. Additional priority should be placed on repetitively flooded or substantially damaged structures in these areas. These actions would be consistent with the Fremont RLAA and associated recommendations. However, any flood risk reduction action driven by property owner interest is beneficial to pursue, regardless of property location in the floodplain.
    b. The City should consider acquisition and removal or acquisition and re-development for low value structures within the assessment area.
    c. USACE Section 205 or other USACE funding may be able to supplement the mitigation strategy.
2. The City should consider incorporating all ongoing flood risk reduction efforts into a comprehensive long-term flood risk mitigation and recovery plan. Doing this will allow for consistent and prioritized coordination of outcomes of all activities over the long term, resulting in the optimum flood risk reduction action implementation process for the City. Completing this plan will also likely improve the City's CRS class. Additionally, Economic Development Administration (EDA) funds can potentially be used for development and implementation of this plan.
3. The City should consider development of a Flood Preparedness and Response Plan, to include the potential for development of a more robust flood warning system and flood warning procedures.
4. The City should continue participating on the NFIP's community rating system and consider evaluation of alternatives to increase public education regarding flooding and promotion of flood insurance that will also improve the City's CRS class. Along with these efforts the City should evaluate ongoing or potential activities that will result in a CRS class improvement and associated flood insurance cost reductions for community property owners.
5. The City should continue evaluation of the Fremont, Farm, and Railroad levee and consider results of the evaluation and the ability of the levee to reduce flood risk within the overall flood risk reduction action plan for the City. Since this levee is not certified and accredited on the FIRM and considering the recent levee failure, at this time it should be assumed that there will continue to be a significant risk of flood damages for the property behind the levee. Levee emergency preparedness operations should be incorporated into the Flood Preparedness and Response Plan.

# 8 FUNDING

Given the significant costs to potentially implement large scale flood risk reduction mitigation actions such as those presented in these recommendations, the City should seek additional funding support beyond the general budget. Several potential funding options are summarized below, generally in order of complexity and effort needed to procure funding.

## 8.1 Lower Platte North NRD

Historically, the LPNRD has assisted communities within the NRD with flood risk reduction improvements as well as flood risk reduction planning. A typical cost share has ranged from 25-50% of project costs and may or may not include cost share assistance for engineering studies and design related to the projects. The NRD's ability to cost share on any specific project may vary based on other NRD project priorities and available funding year to year. Because of this, it is recommended that the City initiate discussions with the LPNRD regarding cost share opportunities and feasibility as soon as possible if the City wishes to pursue one or more potential projects.

## 8.2 Community Development Block Grants (CDBG)

Under the CDBG Program, DED has several funding categories to address housing, downtown revitalization, water and wastewater, public works, planning, and economic development. One such category is Emergent Threat (EM). The purpose of the EM Category is to assist communities with situations that pose a serious and immediate threat to public health, safety, or welfare. Priority is given to those projects that are meeting the emergent threat criteria. All activities proposed in applications for CDBG funding in the EM Category must meet the national objective of benefitting low-and moderate- income persons (through the subcategories LMI Area Benefit and LMI Limited Clientele), aid in the prevention or elimination of slums or blight in either an area (SBA) or spot basis (SBS), and/or through urgent need (UN). The City's low- and moderate-income (LMI) percentage is 43.72% (American Community Survey 5-Year Estimate 2011-2015), therefore, the City will need to apply for this funding using the CDBG National Objective of preventing or eliminating of slum and blight or urgent need. Respondent to the current threats associated with disaster declarations throughout the state, this category also allows for the State and communities to respond to and address emergent issues and needs as they are identified. Given disaster is transitory in nature and future events likely, application must identify the cause of the situation, such as: flooding, tornado, fire, or other natural or man-made disaster.

On December 4, 2019, Governor Ricketts issued a news release announcing that the U.S Department of Housing and Urban Development (HUD) awarded the State of Nebraska $108.9 million to aid Nebraska in its long-term disaster recovery efforts. The rules, policies, and application guidelines governing this supplemental allocation of CDBG funds are expected to be released in Spring 2020. Fremont should consider this funding source for flood risk reduction improvements, once available.

## 8.3 Economic Development Administration (EDA)

EDA funding can be utilized to help communities recover from disasters such as the March 2019 flooding. The highest potential for funding through this program is for actions that will promote economic development and job creation. Potentially eligible activities relevant to the City of Fremont include restoration or enhancement of damaged infrastructure such as the levee system; disaster resilience,

mitigation, and recovery planning; and industry diversification/economic re-development. The City could consider EDA funding for a number of potential planning and recovery actions, including potential re-development of the levee failure flood risk area.

## 8.4 FEMA Hazard Mitigation Assistance (HMA)

FEMA Hazard Mitigation Assistance funding opportunities include Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation Assistance (PDM), and Hazard Mitigation Grant Program (HMGP) opportunities. FMA and PDM are annual grant funding opportunities that are nationally competitive, while HMGP funding is associated with post-disaster circumstances and therefore is variable, although funding is state specific. FMA is administered by NeDNR and PDM and HMGP are administered by NEMA While project eligibility and approval criteria are similar across each grant program, certain programs carry additional stipulations. For example, FMA will not fund levee improvements. Obtaining funding through these programs requires a detailed application process and must meet cost-benefit requirements.

For a summary of potential grants and eligibility by project, see Table 9 below. Shaded entries indicate the potential for the noted funding source to be used for the specified mitigation action.

Table 9: Funding Alternatives Summary

| | Potential Funding Sources | | | | | |
|---|---|---|---|---|---|---|
| | **LPNRD** | **FEMA HMA** | **CDBG - EM** | **EDA** | **USACE** | **Local** |
| **Priority 1 - Acquisition and Elevation Projects** | | | | | | |
| **Priority 2 - Long Term Flood Mitigation and Recovery Plan** | | | | | | |
| **Priority 3 - Flood Preparedness and Response Plan** | | | | | | |
| **Priority 4 - Public Outreach and CRS Class Improvement** | | | | | | |
| **Priority 5 - Levee Evaluation and Associated Risk Reduction Actions** | | | | | | |

[1] FEMA HMA funding may be more difficult to attain for a Flood Preparedness Plan based on recent attempts to fund similar plans around the state.

# APPENDIX A – PARCEL LEVEL FLOOD RISK AND MINIMUM REQUIRED ELEVATION INCREASE DATA

**Appendix A: Parcel Level Flood Risk and Minimum Required Elevation Increase Data**

| | | | | | | | | *Positive Depth = flooding risk* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Property ID | Foundation (Field observations) | Estimated Lowest Adacent Grade (LAG) | Estimated Lowest Adacent Grade (LAG) | 10% Annual Chance Flood Elevation | 2% Annual Chance Flood Elevation | 1% Annual Chance Flood Elevation | Estimated First Floor Elevation | 10% Annual Chance Flood Depth at First Floor | 2% Annual Chance Flood Depth at First Floor | 1% Annual Chance Flood Depth at First Floor | Minimum Recommended Elevation Increase of First Floor (New Lowest Floor) | Required Lowest Floor Elevation Based on 1% Annual Chance Flood Elevation |
| **1** | Slab on Grade | 1164.85 | 1166.29 | 1160.30 | 1162.70 | 1164.40 | 1166.79 | -6.49 | -4.09 | -2.39 | 0.00 | 1166.79 |
| **2** | Basement | 1165.68 | 1166.95 | 1160.30 | 1162.70 | 1164.40 | 1167.53 | -7.23 | -4.83 | -3.13 | 0.00 | 1167.53 |
| **3** | Basement | 1166.21 | 1167.62 | 1160.30 | 1162.70 | 1164.40 | 1170.54 | -10.24 | -7.84 | -6.14 | 0.00 | 1170.54 |
| **4** | Basement | 1166.62 | 1168.08 | 1160.30 | 1162.70 | 1164.40 | 1169.83 | -9.53 | -7.13 | -5.43 | 0.00 | 1169.83 |
| **5** | Basement | 1165.20 | 1168.15 | 1160.30 | 1162.70 | 1164.40 | 1169.65 | -9.35 | -6.95 | -5.25 | 0.00 | 1169.65 |
| **6** | Crawl Space | 1196.33 | 1197.95 | 1194.14 | 1197.09 | 1200.88 | 1199.20 | -5.06 | -2.11 | 1.68 | 2.68 | 1201.88 |
| **7** | Basement | 1192.52 | 1200.52 | 1194.24 | 1197.23 | 1201.17 | 1201.52 | -7.28 | -4.29 | -0.35 | 0.65 | 1202.17 |
| **8** | Basement | 1194.62 | 1202.62 | 1194.24 | 1197.23 | 1201.17 | 1203.62 | -9.38 | -6.39 | -2.45 | 0.00 | 1203.62 |
| **9** | Basement | 1191.45 | 1191.99 | 1192.69 | 1195.50 | 1199.10 | 1194.91 | -2.22 | 0.59 | 4.19 | 5.19 | 1200.10 |
| **10** | Basement | 1190.78 | 1190.96 | 1192.60 | 1195.40 | 1199.00 | 1192.21 | 0.39 | 3.19 | 6.79 | 7.79 | 1200.00 |
| **11** | Slab on Grade | 1190.45 | 1191.03 | 1192.62 | 1195.42 | 1199.02 | 1191.03 | 1.59 | 4.39 | 7.99 | 8.99 | 1200.02 |
| **12** | Slab on Grade | 1193.26 | 1193.86 | 1194.20 | 1197.18 | 1201.05 | 1194.36 | -0.16 | 2.82 | 6.69 | 7.69 | 1202.05 |
| **13** | Crawl Space | 1193.32 | 1193.97 | 1194.12 | 1197.07 | 1200.83 | 1195.97 | -1.85 | 1.10 | 4.86 | 5.86 | 1201.83 |
| **14** | Basement | 1193.98 | 1194.35 | 1194.37 | 1197.42 | 1201.53 | 1195.85 | -1.48 | 1.57 | 5.68 | 6.68 | 1202.53 |
| **15** | Basement | 1193.81 | 1195.12 | 1194.35 | 1197.38 | 1201.47 | 1195.12 | -0.77 | 2.26 | 6.35 | 7.35 | 1202.47 |
| **16** | NA | 1193.61 | 1194.83 | 1194.36 | 1197.40 | 1201.50 | 1194.83 | -0.47 | 2.57 | 6.67 | 7.67 | 1202.50 |
| **17** | Slab on Grade | 1193.61 | 1194.83 | 1194.36 | 1197.40 | 1201.50 | 1199.50 | -5.14 | -2.10 | 2.00 | 3.00 | 1202.50 |
| **18** | Slab on Grade | 1194.36 | 1194.76 | 1198.08 | 1200.68 | 1203.79 | 1194.76 | 3.32 | 5.92 | 9.03 | 10.03 | 1204.79 |
| **19** | Slab on Grade | 1192.98 | 1193.26 | 1195.89 | 1198.73 | 1202.67 | 1193.26 | 2.63 | 5.47 | 9.41 | 10.41 | 1203.67 |
| **20** | Slab on Grade | 1192.84 | 1193.50 | 1195.72 | 1198.59 | 1202.58 | 1193.50 | 2.22 | 5.09 | 9.08 | 10.08 | 1203.58 |
| **21** | Slab on Grade | 1204.10 | 1205.04 | 1204.82 | 1207.32 | 1210.13 | 1206.54 | -1.72 | 0.78 | 3.59 | 4.59 | 1211.13 |
| **22** | Crawl Space | 1204.69 | 1205.48 | 1204.78 | 1207.28 | 1210.06 | 1207.98 | -3.20 | -0.70 | 2.08 | 3.08 | 1211.06 |
| **23** | Slab on Grade | 1204.38 | 1205.32 | 1204.76 | 1207.26 | 1210.03 | 1205.32 | -0.56 | 1.94 | 4.71 | 5.71 | 1211.03 |
| **24** | Crawl Space | 1203.48 | 1205.36 | 1204.32 | 1206.82 | 1209.14 | 1207.86 | -3.54 | -1.04 | 1.28 | 2.28 | 1210.14 |
| **25** | Slab on Grade | 1206.31 | 1207.60 | 1204.40 | 1206.90 | 1209.30 | 1207.60 | -3.20 | -0.70 | 1.70 | 2.70 | 1210.30 |
| **26** | Crawl Space | 1204.32 | 1206.82 | 1204.13 | 1206.65 | 1208.90 | 1209.49 | -5.35 | -2.84 | -0.58 | 0.42 | 1209.90 |
| **27** | Crawl Space | 1202.92 | 1204.78 | 1202.57 | 1205.17 | 1207.34 | 1205.28 | -2.71 | -0.11 | 2.06 | 3.06 | 1208.34 |
| **28** | Crawl Space | 1202.93 | 1203.78 | 1202.88 | 1205.48 | 1207.57 | 1204.61 | -1.73 | 0.87 | 2.96 | 3.96 | 1208.57 |
| **29** | Slab on Grade | 1202.73 | 1203.70 | 1202.71 | 1205.31 | 1207.44 | 1203.70 | -0.99 | 1.61 | 3.74 | 4.74 | 1208.44 |
| **30** | Basement | 1194.82 | 1195.65 | 1198.69 | 1201.29 | 1204.05 | 1197.65 | 1.04 | 3.64 | 6.40 | 7.40 | 1205.05 |
| **31** | Basement | 1193.96 | 1194.62 | 1198.37 | 1200.97 | 1203.91 | 1195.87 | 2.50 | 5.10 | 8.04 | 9.04 | 1204.91 |
| **32** | Crawl Space | 1193.67 | 1194.30 | 1197.93 | 1200.53 | 1203.72 | 1196.05 | 1.88 | 4.48 | 7.67 | 8.67 | 1204.72 |
| **33** | Basement | 1194.10 | 1194.97 | 1197.60 | 1200.20 | 1203.58 | 1196.22 | 1.38 | 3.98 | 7.36 | 8.36 | 1204.58 |
| **34** | Basement | 1193.92 | 1194.75 | 1197.39 | 1199.99 | 1203.48 | 1195.92 | 1.47 | 4.07 | 7.57 | 8.57 | 1204.48 |
| **35** | Basement | 1193.95 | 1194.70 | 1196.95 | 1199.60 | 1203.26 | 1196.45 | 0.50 | 3.15 | 6.81 | 7.81 | 1204.26 |
| **36** | Slab on Grade | 1193.79 | 1194.96 | 1196.66 | 1199.36 | 1203.10 | 1196.46 | 0.20 | 2.90 | 6.64 | 7.64 | 1204.10 |
| **37** | Basement | 1194.23 | 1195.10 | 1196.29 | 1199.06 | 1202.90 | 1195.93 | 0.36 | 3.13 | 6.97 | 7.97 | 1203.90 |
| **38** | Slab on Grade | 1193.70 | 1194.49 | 1196.15 | 1198.94 | 1202.81 | 1194.49 | 1.66 | 4.45 | 8.32 | 9.32 | 1203.81 |
| **39** | Basement | 1194.03 | 1195.00 | 1195.61 | 1198.50 | 1202.52 | 1197.00 | -1.39 | 1.50 | 5.52 | 6.52 | 1203.52 |

**Appendix A: Parcel Level Flood Risk and Minimum Required Elevation Increase Data**

| | | | | | | | | *Positive Depth = flooding risk* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Property ID | Foundation (Field observations) | Estimated Lowest Adacent Grade (LAG) | Estimated Lowest Adacent Grade (LAG) | 10% Annual Chance Flood Elevation | 2% Annual Chance Flood Elevation | 1% Annual Chance Flood Elevation | Estimated First Floor Elevation | 10% Annual Chance Flood Depth at First Floor | 2% Annual Chance Flood Depth at First Floor | 1% Annual Chance Flood Depth at First Floor | Minimum Recommended Elevation Increase of First Floor (New Lowest Floor) | Required Lowest Floor Elevation Based on 1% Annual Chance Flood Elevation |
| **40** | Basement | 1194.42 | 1195.14 | 1195.10 | 1198.09 | 1202.23 | 1196.89 | -1.79 | 1.20 | 5.34 | 6.34 | 1203.23 |
| **41** | Basement | 1194.31 | 1195.07 | 1195.28 | 1198.23 | 1202.33 | 1196.74 | -1.46 | 1.50 | 5.60 | 6.60 | 1203.33 |
| **42** | Crawl Space | 1198.85 | 1199.56 | 1202.66 | 1205.26 | 1207.40 | 1200.06 | 2.60 | 5.20 | 7.34 | 8.34 | 1208.40 |
| **43** | Basement | 1199.59 | 1200.70 | 1202.64 | 1205.24 | 1207.40 | 1204.03 | -1.39 | 1.21 | 3.36 | 4.36 | 1208.40 |
| **44** | Basement | 1198.62 | 1199.31 | 1202.62 | 1205.22 | 1207.38 | 1200.64 | 1.98 | 4.58 | 6.74 | 7.74 | 1208.38 |
| **45** | Basement | 1199.92 | 1200.62 | 1202.72 | 1205.32 | 1207.45 | 1200.95 | 1.77 | 4.37 | 6.50 | 7.50 | 1208.45 |
| **46** | Crawl Space | 1198.72 | 1199.41 | 1202.61 | 1205.21 | 1207.37 | 1200.41 | 2.20 | 4.80 | 6.96 | 7.96 | 1208.37 |
| **47** | Slab on Grade | 1199.45 | 1200.52 | 1202.72 | 1205.32 | 1207.45 | 1200.52 | 2.20 | 4.80 | 6.93 | 7.93 | 1208.45 |
| **48** | Crawl Space | 1198.33 | 1199.14 | 1202.60 | 1205.20 | 1207.36 | 1199.14 | 3.46 | 6.06 | 8.22 | 9.22 | 1208.36 |
| **49** | Basement | 1194.17 | 1200.17 | 1202.70 | 1205.30 | 1207.43 | 1200.17 | 2.53 | 5.13 | 7.26 | 8.26 | 1208.43 |
| **50** | Basement | 1198.54 | 1199.28 | 1202.57 | 1205.17 | 1207.34 | 1201.61 | 0.96 | 3.56 | 5.73 | 6.73 | 1208.34 |
| **51** | Basement | 1198.98 | 1200.03 | 1202.68 | 1205.28 | 1207.42 | 1202.03 | 0.65 | 3.25 | 5.39 | 6.39 | 1208.42 |
| **52** | Basement | 1198.39 | 1199.10 | 1202.47 | 1205.07 | 1207.27 | 1201.10 | 1.37 | 3.97 | 6.17 | 7.17 | 1208.27 |
| **53** | Crawl Space | 1199.07 | 1200.00 | 1202.68 | 1205.28 | 1207.42 | 1200.83 | 1.84 | 4.44 | 6.59 | 7.59 | 1208.42 |
| **54** | Basement | 1198.14 | 1198.80 | 1202.49 | 1205.09 | 1207.28 | 1200.30 | 2.19 | 4.79 | 6.98 | 7.98 | 1208.28 |
| **55** | Basement | 1199.18 | 1199.65 | 1202.69 | 1205.29 | 1207.43 | 1201.15 | 1.54 | 4.14 | 6.28 | 7.28 | 1208.43 |
| **56** | Basement | 1197.92 | 1198.47 | 1202.50 | 1205.10 | 1207.29 | 1200.47 | 2.03 | 4.63 | 6.82 | 7.82 | 1208.29 |
| **57** | Basement | 1198.05 | 1198.89 | 1202.66 | 1205.26 | 1207.41 | 1200.14 | 2.52 | 5.12 | 7.27 | 8.27 | 1208.41 |
| **58** | Slab on Grade | 1197.86 | 1198.65 | 1202.52 | 1205.12 | 1207.30 | 1200.65 | 1.87 | 4.47 | 6.65 | 7.65 | 1208.30 |
| **59** | Basement | 1198.58 | 1199.56 | 1202.63 | 1205.23 | 1207.39 | 1201.64 | 0.99 | 3.59 | 5.74 | 6.74 | 1208.39 |
| **60** | Basement | 1198.71 | 1199.30 | 1202.53 | 1205.13 | 1207.31 | 1201.30 | 1.23 | 3.83 | 6.01 | 7.01 | 1208.31 |
| **61** | Slab on Grade | 1198.73 | 1199.26 | 1202.56 | 1205.16 | 1207.33 | 1199.26 | 3.30 | 5.90 | 8.07 | 9.07 | 1208.33 |
| **62** | Crawl Space | 1198.08 | 1198.70 | 1202.55 | 1205.15 | 1207.33 | 1200.70 | 1.85 | 4.45 | 6.63 | 7.63 | 1208.33 |
| **63** | Basement | 1199.22 | 1199.99 | 1202.58 | 1205.18 | 1207.35 | 1201.16 | 1.42 | 4.02 | 6.19 | 7.19 | 1208.35 |
| **64** | Slab on Grade | 1198.92 | 1199.75 | 1202.58 | 1205.18 | 1207.35 | 1201.00 | 1.58 | 4.18 | 6.35 | 7.35 | 1208.35 |
| **65** | Basement | 1198.60 | 1199.35 | 1202.34 | 1204.94 | 1207.18 | 1194.3 | 7.99 | 10.59 | 12.83 | 13.83 | 1208.18 |
| **66** | Basement | 1197.34 | 1197.99 | 1202.31 | 1204.91 | 1207.15 | 1200.49 | 1.82 | 4.42 | 6.66 | 7.66 | 1208.15 |
| **67** | Basement | 1197.14 | 1197.59 | 1202.29 | 1204.89 | 1207.13 | 1199.92 | 2.36 | 4.96 | 7.21 | 8.21 | 1208.13 |
| **68** | Basement | 1197.31 | 1198.42 | 1202.30 | 1204.90 | 1207.15 | 1199.67 | 2.63 | 5.23 | 7.48 | 8.48 | 1208.15 |
| **69** | Basement | 1198.21 | 1199.02 | 1202.28 | 1204.88 | 1207.13 | 1200.77 | 1.51 | 4.11 | 6.36 | 7.36 | 1208.13 |
| **70** | Basement | 1197.11 | 1197.96 | 1202.27 | 1204.87 | 1207.12 | 1199.63 | 2.65 | 5.25 | 7.50 | 8.50 | 1208.12 |
| **71** | Basement | 1198.21 | 1199.02 | 1202.28 | 1204.88 | 1207.13 | 1200.52 | 1.76 | 4.36 | 6.61 | 7.61 | 1208.13 |
| **72** | Slab on Grade | 1197.43 | 1198.46 | 1202.25 | 1204.85 | 1207.11 | 1200.13 | 2.12 | 4.72 | 6.98 | 7.98 | 1208.11 |
| **73** | Basement | 1196.97 | 1197.64 | 1202.25 | 1204.85 | 1207.11 | 1200.14 | 2.11 | 4.71 | 6.97 | 7.97 | 1208.11 |
| **74** | Basement | 1197.56 | 1198.02 | 1202.20 | 1204.80 | 1207.08 | 1199.69 | 2.52 | 5.12 | 7.39 | 8.39 | 1208.08 |
| **75** | Basement | 1197.20 | 1198.63 | 1202.26 | 1204.86 | 1207.11 | 1200.38 | 1.88 | 4.48 | 6.73 | 7.73 | 1208.11 |
| **76** | Basement | 1197.03 | 1197.93 | 1202.25 | 1204.85 | 1207.11 | 1201.26 | 0.98 | 3.58 | 5.84 | 6.84 | 1208.11 |
| **77** | Basement | 1196.50 | 1197.62 | 1201.97 | 1204.57 | 1206.83 | 1198.87 | 3.10 | 5.70 | 7.96 | 8.96 | 1207.83 |
| **78** | Slab on Grade | 1196.75 | 1197.92 | 1202.23 | 1204.83 | 1207.10 | 1197.92 | 4.31 | 6.91 | 9.18 | 10.18 | 1208.10 |
| **79** | Basement | 1197.08 | 1199.14 | 1202.09 | 1204.69 | 1206.99 | 1200.81 | 1.29 | 3.89 | 6.18 | 7.18 | 1207.99 |

**Appendix A: Parcel Level Flood Risk and Minimum Required Elevation Increase Data**

| | | | | | | | | *Positive Depth = flooding risk* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Property ID** | **Foundation (Field observations)** | **Estimated Lowest Adacent Grade (LAG)** | **Estimated Lowest Adacent Grade (LAG)** | **10% Annual Chance Flood Elevation** | **2% Annual Chance Flood Elevation** | **1% Annual Chance Flood Elevation** | **Estimated First Floor Elevation** | **10% Annual Chance Flood Depth at First Floor** | **2% Annual Chance Flood Depth at First Floor** | **1% Annual Chance Flood Depth at First Floor** | **Minimum Recommended Elevation Increase of First Floor (New Lowest Floor)** | **Required Lowest Floor Elevation Based on 1% Annual Chance Flood Elevation** |
| **80** | Basement | 1196.61 | 1197.31 | 1202.22 | 1204.82 | 1207.09 | 1199.06 | 3.16 | 5.76 | 8.03 | 9.03 | 1208.09 |
| **81** | Slab on Grade | 1195.82 | 1196.91 | 1202.12 | 1204.72 | 1207.02 | 1197.91 | 4.21 | 6.81 | 9.11 | 10.11 | 1208.02 |
| **82** | Basement | 1195.71 | 1196.78 | 1202.16 | 1204.76 | 1207.04 | 1197.78 | 4.38 | 6.98 | 9.26 | 10.26 | 1208.04 |