# Emmet County, Iowa

## Multi-Jurisdictional Hazard Mitigation Plan

2018 Plan Update



Developed by Emmet County with professional assistance from
Wood Environment & Infrastructure Solutions, Inc.
Homeland Security and Emergency Management

# SPECIAL THANKS AND ACKNOWLEDGEMENTS

## Emmet County Hazard Mitigation Planning Committee

Jurisdictional Representatives

| Name | | Title | Department | Jurisdiction / Organization |
|---|---|---|---|---|
| Richard | Beaver | Fire Chief | Estherville Fire Department | Estherville |
| Elizabeth | Burton | City Clerk & Finance Director | City of Estherville | Estherville |
| Gregory | Buum | Mayor | City of Armstrong | Armstrong |
| Penny | Clayton | City Administrator | City of Estherville | Estherville |
| Jarrod | Fischer | Mayor & Fire Chief | City of Wallingford | Wallingford |
| Brett | Grems | | City Council & Gruver Fire | Gruver |
| Laura | Haburn | Facilities Specialist | Iowa Lakes Community College | Iowa Lakes Community College |
| Delaine | Hiney | Executive Director | Facilities Management | Iowa Lakes Community College |
| Dan | Jorgenson | | | Ringsted |
| Bev | Juhl | Supervisor | Board of Supervisors | Emmet County |
| Barb | Mack | Community Development Director | City of Estherville | Estherville |
| Mike | Martens | Sheriff | Emmet County Sheriff's Office | Emmet County |
| Christy | Mintah | Emergency Preparedness Coordinator | Avera Holy Family Hospital-Estherville | Estherville |
| Mary | Moorman | Office Manager | Emmet Public Health/City of Wallingford | Wallingford |
| Kathy | Preston | Nurse Administrator | Emmet County Public Health | Emmet County |
| Terry | Reekers | Emergency Management Coordinator | Emmet County Emergency Management | Emmet County |
| Brent | Shatto | Chief | Estherville Police Department | Estherville |
| Cathy | Wikert | City Clerk | City of Ringsted | Ringsted |

Stakeholder Representatives

| Name | | Title | Department | Agency |
|---|---|---|---|---|
| Ben | Krambees | Engineer | | Iowa Lakes Electric Cooperative |

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Emmet County and participating jurisdictions developed this multi-jurisdictional local hazard mitigation plan update to reduce future losses to the County and its communities as a result of hazard events. The plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 and to achieve eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grant Programs.

The Emmet County Multi-Jurisdictional Hazard Mitigation Plan covers the following jurisdictions that participated in the planning process:

- Emmet County
- Armstrong
- Estherville
- Gruver
- Ringsted
- Wallingford
- North Union Public School District
- Iowa Lakes Community College

Emmet County, the incorporated areas, and community college listed above developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on October 30, 2013 (hereafter referred to as the *2013 Emmet County Hazard Mitigation Plan*). Therefore, this current planning effort serves to update the previous plan. The City of Dolliver was also a participant in the *2013 Emmet County Hazard Mitigation Plan* and was invited to be a part of this plan update but declined to participate. The Estherville-Lincoln School District was also invited to join this plan update but declined to participate. Both jurisdictions will be invited to join the planning effort again when the next 5-year update process begins.

Additional stakeholders were also invited to include private businesses, community groups, private non-profit entities, adjacent communities, state and federal agencies, academia, and local regional agencies that have a stake in mitigation planning in Emmet County.

The plan update process followed a methodology prescribed by FEMA, which began with the assembly of the Hazard Mitigation Planning Committee (HMPC) comprised of representatives from Emmet County, participating jurisdictions, and stakeholders. The HMPC updated the risk assessment that identified and profiled hazards that pose a risk to the Emmet County planning area, assessed the vulnerability to these hazards, and examined the capabilities in place to mitigate them. The planning area is vulnerable to several hazards that are identified, profiled, and analyzed in this plan.

Based upon the risk assessment, the HMPC reviewed the previously developed goals for reducing risk from hazards. The committee determined that all three previous goals remain valid, but updated Goal 2 to expand the focus of county operations to include jurisdictions. The validated goals are listed below:

- Goal 1: Natural hazards that cause injuries, illness, deaths, property loss, utility service disruption and economic loss will be reduced and mitigated against by planning for the protection of property and life.

- Goal 2: Protect critical facilities, infrastructure, and jurisdictional operations from disruptions due to hazard impacts.
- Goal 3: Educate the public on natural hazards and what necessary information is needed to protect themselves and their property.

The recommended mitigation action details to meet the identified goals are in Chapter 4. The HMPC developed an implementation plan for each action, which identifies priority level, background information, responsible agency, timeline, cost estimate, potential funding sources, and more.

***44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.***

***Note to Reviewers:*** *When this plan has been reviewed and approved pending adoption by FEMA Region VII the adoption resolutions will be signed by the participating jurisdictions and added to Appendix D. A model resolution is provided.*

The following jurisdictions participated in the development of this plan and have adopted the multi-jurisdictional plan. Resolutions of Adoptions are included in Appendix D.

- Emmet County
- Armstrong
- Estherville
- Gruver
- Ringsted
- Wallingford
- North Union Public School District
- Iowa Lakes Community College

Resolution # _____

**Adopting the Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan**

**Whereas**, the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) recognizes the threat that natural hazards pose to people and property within our community; and

**Whereas**, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

**Whereas**, the U.S Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

**Whereas**, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

**Whereas**, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

**Whereas**, the (Name of Government/District/Organization) fully participated in the hazard mitigation planning process to prepare this Multi-Jurisdictional Local Hazard Mitigation Plan; and

**Whereas**, the Iowa Homeland Security and Emergency Management Department and the Federal Emergency Management Agency Region VII officials have reviewed the "Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan," and approved it contingent upon this official adoption of the participating governing body; and

**Whereas**, the (Name of Government/District/Organization) desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan; and

**Whereas**, adoption by the governing body for the (Name of Government/District/Organization) demonstrates the jurisdictions' commitment to fulfilling the mitigation goals outlined in this Multi-Jurisdictional Local Hazard Mitigation Plan;

**Whereas**, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan;

**Now, therefore, be it resolved**, that the (Name of Government/District/Organization) adopts the "Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan" as an official plan; and

**Be it further resolved**, the (Name of Government/District/Organization) will submit this Adoption Resolution to the Iowa Homeland Security and Emergency Management Department and Federal Emergency Management Agency Region VII officials to enable the plan's final approval.

Date: _____

Certifying Official: _____

# 1 INTRODUCTION AND PLANNING PROCESS



## 1.1 Purpose

Emmet County, its participating cities and public school district, and the community college prepared this Multi-Jurisdictional Hazard Mitigation Plan update to guide hazard mitigation planning to better protect the people and property of the planning area from the effects of hazard events.

This plan demonstrates the jurisdictions' commitments to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This plan was also developed to make Emmet County and the participating jurisdictions eligible for certain federal grant programs, specifically the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) grants including the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program.

## 1.2 Background and Scope

Each year in the United States, disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society $6 in avoided future losses, in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2017).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. Emmet County and the incorporated cities and community college that participated in this plan update developed a Multi-Jurisdictional Hazard Mitigation Plan that was approved by FEMA on October 30, 2013 (hereafter referred to as the *2013 Emmet County Hazard Mitigation Plan*). Therefore, this current planning effort serves to update the previous plan.

This plan documents the hazard mitigation planning process undertaken by the Emmet County Hazard Mitigation Planning Committee (HMPC). It identifies relevant hazards and vulnerabilities in the planning

area and sets forth an updated mitigation strategy to decrease vulnerability and increase resiliency and sustainability in Emmet County.

The Emmet County Multi-Jurisdictional Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers the participating jurisdictions within Emmet County's boundaries (hereinafter referred to as the planning area). The following jurisdictions officially participated in the planning process:

- Emmet County
- Armstrong
- Estherville
- Gruver
- Ringsted
- Wallingford
- North Union Public School District
- Iowa Lakes Community College

This plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002 (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.) Additionally, this plan is prepared in accordance with the *2013 Local Mitigation Planning Handbook* published by FEMA.

While the Disaster Mitigation Act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288).

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The Emmet County planning area has been affected by hazards in the past and the participating jurisdictions are therefore committed to reducing future impacts from hazard events and becoming eligible for mitigation-related federal funding.

## 1.3 Plan Organization

This Emmet County Multi-Jurisdictional Hazard Mitigation Plan update is organized as follows:

- Executive Summary
- Chapter 1: Introduction and Planning Process
- Chapter 2: Planning Area Profile and Capabilities
- Chapter 3: Risk Assessment
- Chapter 4: Mitigation Strategy
- Chapter 5: Plan Implementation and Maintenance

- Appendices

This is the same general order that was used for the 2013 Emmet County Hazard Mitigation Plan. However, several chapters from the previous plan have been condensed for the plan update. Table 1-1 below provides details on changes that were made to the plan format:

**Table 1-1 Changes in Organization 2013 Plan Vs. 2018 Update**

| 2013 Plan | 2018 Plan Update |
|---|---|
| Section 1 Planning, Participation and Adoption | Executive Summary<br>Chapter 1: Introduction and Planning Process<br>Appendix D – Adoption Resolutions |
| Section 2 Background | Chapter 2: Planning Area Profile and Capabilities |
| Section 3 Identifying Hazards | Chapter 3: Risk Assessment |
| Section 4 Profiling Hazards and Risk Assessment | |
| Section 5 Vulnerability | |
| Section 6 Hazard Mitigation Goals | Chapter 4: Mitigation Strategy |
| Section 7 National Flood Insurance Program | Integrated into Risk Assessment and Mitigation Strategy |
| Section 8 Plan Maintenance and Continued Involvement | Chapter 5: Plan Implementation and Maintenance |
| Section 9 County/City Information | Integrated throughout all plan chapters |
| **Appendices** | |
| Appendix – Tables, Figures | Integrated throughout all plan chapters |

## 1.4 Planning Process

***44 CFR Requirement 201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.***

In February 2017, the State of Iowa Homeland Security and Emergency Management Department contracted with Wood, Environment & Infrastructure, Inc. to facilitate the update of the Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan. Wood's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA),
- Ensure the updated plan meets the DMA requirements as established by federal regulations and following FEMA's planning guidance,
- Facilitate the entire planning process,
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in facilitating the public input process,
- Produce the draft and final plan update documents, and
- Coordinate the Iowa Homeland Security and Emergency Management Department and FEMA plan reviews.

### 1.4.1 Multi-Jurisdictional Participation

***44 CFR Requirement §201.6(a)(3): Multi-jurisdictional plans may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan.***

Emmet County invited the incorporated cities, public school districts, and various other stakeholders in mitigation planning (identified in Appendix B) to participate in the Emmet County Multi-Jurisdictional Hazard Mitigation Plan update process. The jurisdictions that elected to participate in this plan are listed above in section 1.2. The DMA requires that each jurisdiction that participates in the planning process must officially adopt the multi-jurisdictional hazard mitigation plan. Each jurisdiction that chose to participate in the planning process and development of the plan was required to meet plan participation requirements defined at the first planning meeting, which includes the following:

- Designate a representative to serve on the HMPC;
- Participate in at least one of the three HMPC planning meetings by either direct representation or authorized representation;
- Provide data for and assist in the development of the updated risk assessment that describes how various hazards impact their jurisdiction;
- Provide data to describe current capabilities;
- Develop/update mitigation actions (at least one) specific to each jurisdiction;
- Provide comments on plan drafts as requested;
- Inform the public, local officials, and other interested parties about the planning process and provide opportunities for them to comment on the plan; and
- Formally adopt the mitigation plan.

All of the jurisdictions listed as official participants in this plan met all of these participation requirements. Table 1-2 shows the representation of each participating jurisdiction at the planning meetings, provision of Data Collection Guides, and update/development of mitigation actions. Sign-in sheets are included in Appendix B: Planning Process Documentation.

**Table 1-2 Jurisdictional Participation in Planning Process**

| Jurisdiction | Kick-off Meeting | Planning Meeting #2 | Planning Meeting #3 | Data Collection Guide | Status of Previous Actions | Mitigation Action Plans | Implementation Worksheet |
|---|---|---|---|---|---|---|---|
| Emmet County | X | X | X | X | X | X | X |
| Armstrong | | | X | X | X | X | |
| Estherville | X | X | X | X | X | X | X |
| Gruver | | | X | X | X | X | X |
| Ringsted | X | X | X | X | X | X | X |
| Wallingford | | X | X | X | X | X | X |
| North Union PSD | | | | | | X | |
| Iowa Lakes Community College | X | X | X | X | X | X | X |

### 1.4.2 The Planning Steps

Wood and Emmet County worked together to establish the framework and process for this planning effort using FEMA's *Local Mitigation Planning Handbook* (March 2013). The plan update was completed utilizing the 9-task approach within a broad four-phase process:

1) Organize resources,
2) Assess risks,
3) Develop the mitigation plan, and
4) Implement the plan and monitor progress.

Into this process, Wood integrated a detailed 10-step planning process adapted from FEMA's Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the process used for this plan meets the requirements of the Disaster Mitigation Act of 2000 as well as the basic requirements for activity 510 under the Community Rating System. Table 1-3 shows how the process followed fits into FEMA's original four-phase DMA process as well as the revised Nine Task Process outlined in the *2013 Local Mitigation Planning Handbook* and the 10-step CRS process.

**Table 1-3 Mitigation Planning Process Used to Develop the Emmet County Multi-Jurisdictional Local Hazard Mitigation Plan**

| Phase | Community Rating System (CRS) Planning Steps (Activity 510) | Local Mitigation Planning Handbook Tasks (44 CFR Part 201) |
|---|---|---|
| Phase I | Step 1. Organize | Task 1: Determine the Planning Area and Resources |
| | | Task 2: Build the Planning Team 44 CFR 201.6(c)(1) |
| | Step 2. Involve the public | Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1) |
| | Step 3. Coordinate | Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) & (3) |
| Phase II | Step 4. Assess the hazard | Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) & (iii) |
| | Step 5. Assess the problem | |
| Phase III | Step 6. Set goals | Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii) |
| | Step 7. Review possible activities | |
| | Step 8. Draft an action plan | |
| Phase IV | Step 9. Adopt the plan | Task 8: Review and Adopt the Plan |
| | Step 10. Implement, evaluate, revise | Task 7: Keep the Plan Current |
| | | Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4) |

## Phase I Organize Resources

### *Step 1: Organize the Planning Team (Handbook Tasks 1 & 2)*

The planning process resulting in the preparation of this plan document officially began with an initial coordination Conference Call/Webinar on September 28, 2017. Participants of the meeting included the Emmet County Emergency Management Coordinator; Iowa Homeland Security and Emergency Management Department Hazard Mitigation Office, Hazard Mitigation Planner, and GIS Coordinator; and the Wood Mitigation Planners and GIS Technician. The purpose of this meeting was to determine the jurisdictions and other stakeholders that would be invited to participate on the HMPC (Step 1), set tentative planning meeting dates, identify GIS needs and resources, discuss the hazards to be included in the plan update and options for the flood risk assessment methodology, and develop an initial public participation strategy. Detailed meeting minutes are included in Appendix B.

After the initial coordination meeting, a formal Kick-off planning conference call/webinar was held on December 11, 2017 followed by two additional planning meetings held on January 23, 2018 and April 24, 2018. A complete list of all representatives of the agencies and organizations that participated on the Emmet County HMPC is provided in Appendix B.

The HMPC communicated during the planning process with a combination of webinars, face-to-face meetings, phone interviews, and email correspondence. The meeting schedule and topics are listed in Table 1-4. The meeting minutes for each of the meetings are included in Appendix B.

**Table 1-4 Schedule of HMPC Meetings**

| Meeting | Topic | Date |
|---|---|---|
| Informational Meeting | General overview of planning process/requirements and schedule. | September 28, 2017 |
| Kick-off Meeting | Introduction to DMA, the planning process, hazard identification and public input strategy. Distribution of data collection guide to jurisdictions. Preliminary hazard data. Discussion critical facility inventory. | December 11, 2017 |
| Planning Meeting #2 | Review of draft Risk Assessment, update plan goals, instructions to update status of previous mitigation actions | January 23, 2018 |
| Planning Meeting #3 | Development of new mitigation actions, mitigation action planning and prioritization. Determine process to monitor, evaluate, and update plan. | April 24, 2018 |

During the kick-off meeting Wood presented information on the scope and purpose of the plan, participation requirements of HMPC members, and the proposed project work plan and schedule. Plans for public involvement (Step 2) and coordination with other agencies and departments (Step 3) were discussed. Wood also introduced hazard identification requirements and data needs. The HMPC discussed potential hazards as well as past events and impacts and refined the identified hazards to be relevant to Emmet County. The hazard ranking methodology utilized by Iowa Homeland Security and Emergency Management Department in the State Hazard Mitigation Plan was introduced and preliminary information was presented for each hazard identified.

Participants were given the Wood Data Collection Guide to facilitate the collection of information needed to support the plan, such as data on historic hazard events, values at risk, and current capabilities. Each participating jurisdiction completed and returned the worksheets in the Data Collection Guide to Wood. Wood integrated this information into the plan, supporting the development of Chapters 2 and 3.

***Step 2: Plan for Public Involvement (Handbook Task 3)***

44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (1) an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

At the kick-off meeting, the HMPC discussed options for soliciting public input on the mitigation plan. To provide an opportunity for the public to comment during the drafting stage, the committee determined that the most effective method would be dissemination of a survey. The survey was announced in via a press release from the County and was posted on community websites. A screenshot of the survey on the City of Estherville's website is included in Appendix B.

The public survey was developed specific to the Emmet County Mitigation Plan and provided a brief plan summary as well as a questionnaire to capture public and stakeholder input. The survey was made available online and in post offices throughout the County. A copy of the survey is provided in Appendix B.

In addition to notification through media outlets described above, committee members distributed the survey link to members of the public and key stakeholders in their own jurisdiction. In all, 150 surveys were completed.

The survey asked the public and stakeholders to indicate their opinion on the likelihood for each hazard to impact their jurisdiction. They were asked to rate the probability of each hazard profiled in this plan as 1-unlikely, 2-occasional, 3-likely, and 4-highly likely. The summary results of this question are provided in Figure 1-1.

**Figure 1-1 Survey Results—Probability of Hazards in Jurisdiction**

| | UNLIKELY | OCCASIONAL | LIKELY | HIGHLY LIKELY | TOTAL | WEIGHTED AVERAGE |
|---|---|---|---|---|---|---|
| Animal/Plant/Crop Disease | 17.45%<br>26 | 33.56%<br>50 | 33.56%<br>50 | 15.44%<br>23 | 149 | 2.47 |
| Dam/Levee Failure | 85.71%<br>126 | 8.16%<br>12 | 6.12%<br>9 | 0.00%<br>0 | 147 | 1.20 |
| Drought | 12.84%<br>19 | 44.59%<br>66 | 29.73%<br>44 | 12.84%<br>19 | 148 | 2.43 |
| Earthquake | 96.60%<br>142 | 3.40%<br>5 | 0.00%<br>0 | 0.00%<br>0 | 147 | 1.03 |
| Expansive Soils | 44.12%<br>60 | 44.85%<br>61 | 8.82%<br>12 | 2.21%<br>3 | 136 | 1.69 |
| Extreme Heat | 7.38%<br>11 | 40.94%<br>61 | 33.56%<br>50 | 18.12%<br>27 | 149 | 2.62 |
| Flash Flood | 14.09%<br>21 | 44.97%<br>67 | 24.83%<br>37 | 16.11%<br>24 | 149 | 2.43 |
| Grass or Wildland fire | 22.82%<br>34 | 38.93%<br>58 | 23.49%<br>35 | 14.77%<br>22 | 149 | 2.30 |
| Hazardous Materials Incident | 17.01%<br>25 | 42.86%<br>63 | 24.49%<br>36 | 15.65%<br>23 | 147 | 2.39 |
| Human Disease | 11.56%<br>17 | 39.46%<br>58 | 34.01%<br>50 | 14.97%<br>22 | 147 | 2.52 |
| Infrastructure Failure | 30.82%<br>45 | 43.84%<br>64 | 19.18%<br>28 | 6.16%<br>9 | 146 | 2.01 |
| Landslide | 85.03%<br>125 | 11.56%<br>17 | 2.72%<br>4 | 0.68%<br>1 | 147 | 1.19 |
| Radiological Incident | 71.62%<br>106 | 20.95%<br>31 | 6.76%<br>10 | 0.68%<br>1 | 148 | 1.36 |
| River Flooding | 18.92%<br>28 | 24.32%<br>36 | 22.97%<br>34 | 33.78%<br>50 | 148 | 2.72 |
| Severe Winter Storm | 0.67%<br>1 | 15.33%<br>23 | 29.33%<br>44 | 54.67%<br>82 | 150 | 3.38 |
| Sinkholes | 66.22%<br>98 | 27.03%<br>40 | 4.73%<br>7 | 2.03%<br>3 | 148 | 1.43 |
| Terrorism | 64.14%<br>93 | 24.14%<br>35 | 9.66%<br>14 | 2.07%<br>3 | 145 | 1.50 |
| Thunderstorm/Lightning/Hail | 2.67%<br>4 | 12.00%<br>18 | 24.67%<br>37 | 60.67%<br>91 | 150 | 3.43 |
| Tornado/Windstorm | 2.00%<br>3 | 22.00%<br>33 | 34.00%<br>51 | 42.00%<br>63 | 150 | 3.16 |
| Transportation Incident | 17.45%<br>26 | 36.91%<br>55 | 24.16%<br>36 | 21.48%<br>32 | 149 | 2.50 |

Source: SurveyMonkey Results

The survey also asked the public and stakeholders to indicate their opinion on the potential magnitude of each hazard on their jurisdiction. They were asked to rate the probability of each hazard profiled in this plan as 1-negligible, 2-limited, 3-critical, and 4-catastrophic. The summary results of this question are provided in Figure 1-2.

**Figure 1-2 Survey Results—Magnitude of Hazards in Jurisdiction**

| | NEGLIGIBLE | LIMITED | CRITICAL | CATASTROPHIC | TOTAL | WEIGHTED AVERAGE |
|---|---|---|---|---|---|---|
| Animal/Plant/Crop Disease | 17.69%<br>26 | 44.90%<br>66 | 27.21%<br>40 | 10.20%<br>15 | 147 | 2.30 |
| Dam/Levee Failure | 67.35%<br>99 | 27.21%<br>40 | 4.76%<br>7 | 0.68%<br>1 | 147 | 1.39 |
| Drought | 12.93%<br>19 | 39.46%<br>58 | 35.37%<br>52 | 12.24%<br>18 | 147 | 2.47 |
| Earthquake | 75.84%<br>113 | 15.44%<br>23 | 6.04%<br>9 | 2.68%<br>4 | 149 | 1.36 |
| Expansive Soils | 41.30%<br>57 | 48.55%<br>67 | 7.25%<br>10 | 2.90%<br>4 | 138 | 1.72 |
| Extreme Heat | 8.78%<br>13 | 41.89%<br>62 | 43.24%<br>64 | 6.08%<br>9 | 148 | 2.47 |
| Flash Flood | 12.84%<br>19 | 45.27%<br>67 | 33.78%<br>50 | 8.11%<br>12 | 148 | 2.37 |
| Grass or Wildland Fire | 15.54%<br>23 | 43.24%<br>64 | 31.76%<br>47 | 9.46%<br>14 | 148 | 2.35 |
| Hazardous Materials Incident | 13.51%<br>20 | 41.89%<br>62 | 34.46%<br>51 | 10.14%<br>15 | 148 | 2.41 |
| Human Disease | 11.41%<br>17 | 43.62%<br>65 | 37.58%<br>56 | 7.38%<br>11 | 149 | 2.41 |
| Infrastructure Failure | 24.16%<br>36 | 43.62%<br>65 | 28.19%<br>42 | 4.03%<br>6 | 149 | 2.12 |
| Landslide | 71.92%<br>105 | 25.34%<br>37 | 2.05%<br>3 | 0.68%<br>1 | 146 | 1.32 |
| Radiological Incident | 45.27%<br>67 | 33.11%<br>49 | 18.92%<br>28 | 2.70%<br>4 | 148 | 1.79 |
| River Flooding | 16.11%<br>24 | 37.58%<br>56 | 38.26%<br>57 | 8.05%<br>12 | 149 | 2.38 |
| Severe Winter Storm | 0.68%<br>1 | 22.97%<br>34 | 60.14%<br>89 | 16.22%<br>24 | 148 | 2.92 |
| Sinkholes | 56.85%<br>83 | 36.30%<br>53 | 5.48%<br>8 | 1.37%<br>2 | 146 | 1.51 |
| Terrorism | 39.86%<br>59 | 32.43%<br>48 | 16.22%<br>24 | 11.49%<br>17 | 148 | 1.99 |
| Thunderstorm/Lightning/Hail | 2.04%<br>3 | 29.25%<br>43 | 54.42%<br>80 | 14.29%<br>21 | 147 | 2.81 |
| Tornado/Windstorm | 1.35%<br>2 | 15.54%<br>23 | 52.03%<br>77 | 31.08%<br>46 | 148 | 3.13 |
| Transportation Incident | 18.79%<br>28 | 48.32%<br>72 | 23.49%<br>35 | 9.40%<br>14 | 149 | 2.23 |

Source: SurveyMonkey Results

In the survey, the public was also asked to review 11 types of mitigation actions considered by the Iowa Homeland Security and Emergency Management Department for FEMA funding. The HMPC also considered these types of projects in the Emmet County Multi-Jurisdictional Hazard Mitigation Plan. The

survey asked the public to place a check next to the mitigation project types that they felt could benefit their community. Figure 1-3 provides the compiled results of this question.

**Figure 1-3 Survey Results—Types of Projects**

| ANSWER CHOICES | RESPONSES | |
|---|---|---|
| Flood-prone Property Acquisition & Structure Demolition/Relocation | 42.47% | 62 |
| Flood-prone Structure Elevation | 33.56% | 49 |
| Floodproofing of Historical and/or Non-residential Structures | 26.03% | 38 |
| Minor Localized Flood Reduction Projects (stormwater management or other localized flood control projects) | 62.33% | 91 |
| Structural Retrofitting of Existing Buildings to Add a Tornado Saferoom | 54.11% | 79 |
| Retrofitting of Existing Buildings and Facilities to Prevent Wind Damage | 38.36% | 56 |
| New Tornado Safe Room Construction | 58.90% | 86 |
| Electrical Utilities Infrastructure Retrofit (i.e. strengthening lines/connections to withstand ice/wind damages, burying power lines) | 80.14% | 117 |
| Soil Erosion Stabilization | 45.21% | 66 |
| Wildfire Mitigation | 33.56% | 49 |
| Total Respondents: 146 | | |

Source: SurveyMonkey Results

The public was also asked to comment on any other issues that the Emmet County HMPC should consider in developing a strategy to reduce future losses caused by natural hazard events. The comments received from the public concerning additional issues in need of attention are provided below:

- Tornado safe room - we have our churches to go to
- I'm not sure if this falls into the categories but the release of fluids into the river from the ethanol plant is a defenite hazard to our water systems and to depletion of aquifers. I call it a release of hazardous materials into our waterways, with no one to monitor it but the industry themselves. Maybe not in the hazard mitigation area but very important for one of our most used resources.
- Have cropland very close to houses, if it would catch on fire with the correct wind direction
- Possible air quality testing with reports daily.
- Animal waste spills from large lot livestock production
- Prevent river flooding
- Gasoline shortage. Forest fire at Fort Defiance State park, that would be catastrophic, possible total destruction of estherville.
- Can you check to see how info is updated for 911? We moved from the farm to Wallingford in May 2010. When I called for an ambulance in Aug. 2016 911 still had our old address on file.
- Hog confinements matrix needs to be reevaluated; builders of new and existing confinements; need to meet ALL of the matrix guidelines; not just some to meet the passing score. Hog confinements are causing the deterioration of farm living; mostly due to farmers are usually not the owners of the confinements; and the money does not all stay in Emmet co.
- During winter storms, plows should be out more often clearing roadways, to allow for safe travel for those of whom have to be out in that weather i.e. emergency personnel, hospital/nursing

home/caregiver staff (before snow packs down). I feel both solid and liquid ice melt material should be laid down in preparation for a snow storm. I also feel there should be underground or fortified above ground storm shelters at some of the local parks.

- Louder sirens, hard to hear on south side of town when the wind is blowing from the south.
- We need to always be updating our present plan
- The river floods usually twice a year.
- tornado strike is going to happen someday.
- Enlarging storm sewers west of hospital
- Tornado and Blizzard are the two most likely hazards from my perspective.
- More rural water systems-for rural/county-access to ready water supply in cases of extreme county fires; crops fires, ect. when limited fire equipment with limited water supplies are issues due to declining tax base within the county.
- Back up generator for entire school in case of major power outage in community and for the school being a relocation emergency center.
- fire walls in attics of down town blgs
- Our service does use mutual aid availability, however, our service in the county seat of Emmet County in IA is called for giving more mutual aid to other services than our service asking for mutual aid.

The public was also given an opportunity to provide input on the final draft of the complete plan. The entire plan draft was made available on the Emmet County Emergency Management website as a PDF document. In addition, two hard copies were made available at the Emmet County Auditors Office and the Armstrong City Hall.

Emmet County announced the availability of the entire final draft plan and the two-week final public comment period on the County website and via the following media outlets: Armstrong Journal, Estherville Newspaper. Copies of the announcements are provided in Appendix B. The final public comment period was from December 10 to December 21, 2018.

The HMPC invited other targeted stakeholders to comment on the draft plan via an e-mail letter, which is described in greater detail in Step 3: Coordinate with Other Departments and Agencies. Minor comments were received and incorporated.

### *Step 3: Coordinate with Other Departments and Agencies and Incorporate Existing Information (Handbook Task 3)*

***44 CFR Requirement 201.6(b): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.***

There are numerous organizations whose goals and interests interface with hazard mitigation in Emmet County. Coordination with these organizations and other community planning efforts is vital to the success of this plan. Many stakeholder agencies were contacted throughout the planning process to obtain data in preparation of the Risk Assessment. This included contact with specific representatives of

stakeholder agencies, as well as accessing stakeholder data that has been made available to the public via the internet. These sources have been identified where data is presented. In addition, Emmet County invited neighboring counties, other local, state, and federal departments and agencies, as well as institutions of higher learning to review and comment on the final draft of the *Emmet County Multi-Jurisdictional Hazard Mitigation Plan* prior to final submittal to FEMA. The stakeholders that were invited to comment on the final plan draft are included in Table 1-5.

**Table 1-5 Stakeholder Involvement**

| Stakeholder | Type | Provided Data for Risk Assessment | Invited to Comment on Final Draft |
|---|---|---|---|
| Iowa State University, Iowa Flood Center | Academia | x | x |
| Kossuth County | Adjacent County | | x |
| Palo Alto County | Adjacent County | | x |
| Dickinson County | Adjacent County | | x |
| Jackson County, Minnesota | Adjacent County | | x |
| Martin County, Minnesota | Adjacent County | | x |
| Iowa Lakes Electric Cooperative | Business | | x |
| Environmental Protection Agency | Federal Agency | x | x |
| Federal Emergency Management Agency | Federal Agency | x | x |
| National Weather Service | Federal Agency | x | x |
| U.S. Army Corps of Engineers | Federal Agency | x | x |
| U.S. Geological Survey | Federal Agency | x | x |
| Northwest Iowa Planning and Development Commission | Regional Planning | | x |
| Iowa Department of Agriculture and Land Stewardship | State Agency | x | x |
| Iowa Department of Natural Resources | State Agency | x | x |
| Iowa Homeland Security and Emergency Management | State Agency | x | x |

*Integration of Other Data, Reports, Studies, and Plans*

In addition, input was solicited from many other agencies and organizations that provided information. As part of the coordination with other agencies, the HMPC collected and reviewed existing technical data, reports, and plans. These included:

- *Iowa Hazard Mitigation Plan* (September 2013);
- *Emmet County Hazard Mitigation Plan* (October 2013);
- National Flood Insurance Program Policy and Loss Statistics;
- Flood Insurance Administration, Repetitive/Severe Repetitive Loss Property Data;
- Flood Insurance Rate Maps for all of Emmet County;
- Iowa Department of Natural Resources, Dam Safety Program Inventory of Dams for Emmet County;
- National Inventory of Dams;
- National Levee Database;
- Wildland/Urban Interface and Intermix areas from the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin;
- Various local plans such as Comprehensive Plans, Economic Development Plans, Capital Improvement Plans, etc. For a complete list of local plans that were reviewed and incorporated, see Chapter 2;

- US Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics

This information was used in the development of the hazard identification, vulnerability assessment, and capability assessment and in the formation of goals, objectives, and mitigation actions. These sources, as well as additional sources of information, are documented throughout the plan and in Appendix A, References.

## Phase 2 Assess Risk (Handbook Task 5)

### *Step 4: Assess the Hazard: Identify and Profile Hazards*

Wood assisted the HMPC in a process to identify/update the hazards that have impacted or could impact communities in Emmet County. At the kick-off meeting, the HMPC examined the history of disaster declarations in Emmet County, the list of hazards considered in the 2013 Iowa State Hazard Mitigation Plan, and the hazards identified in the previous Emmet County Hazard Mitigation Plan. The committee then worked through this list of all potential hazards that could affect the planning area. They discussed past hazard events, types of damage, and where additional information might be found. Additional information on the hazard identification process and which hazards were identified for each jurisdiction is provided in Chapter 3.

During the kick-off meeting, the HMPC discussed past events and impacts on a county-wide basis to contribute to the risk assessment update. After the kick-off meeting, each jurisdiction completed a Data Collection Guide, including information on previous hazard events in their community. Utilizing the information from the Data Collection Guides as well as existing plans, studies, reports, and technical information as well as information available through internet research and GIS analysis, a profile was developed for each hazard identified. More information on the methodology and resources used to identify and profile the hazards can be found in Chapter 3.

### *Step 5: Assess the Problem: Identify Assets and Estimate Losses*

Assets for each jurisdiction were identified through a combination of several resources. Emmet County supplied datasets with corporate boundaries and transportation layers and the Department of Natural Resources GIS Repository (NRGIS) supplied school district boundaries, and other available GIS layers. Emmet County building data was extracted from Hazus. Population data was obtained from the U.S. Census Bureau. Critical facilities were supplemented with data available from the NRGIS as well as data available from the Homeland Security Infrastructure Program (HSIP) Freedom 2015 dataset. Methodologies and results of the critical facility analysis are provided in Chapter 3 and Appendix E.

Additional assets such as historic, cultural, and economic assets as well as specific vulnerable populations and structures were obtained from a variety of sources as described in Chapter 3.

The HMPC also analyzed development since the last plan update and future development trends from data provided by each jurisdiction on the Data Collection Guide as well as minutes of the annual review meetings. Data was also obtained from the U.S. Census Bureau and from jurisdictions through other planning mechanisms such as Comprehensive Plans and Future Development Plans.

After profiling the hazards that could affect Emmet County and identifying assets, the HMPC collected information to describe the likely impacts of future hazard events on the participating jurisdictions. For each hazard, there is a discussion regarding future development as well as climate change impacts regarding how vulnerability to that specific hazard might be impacted in the future.

Existing mitigation capabilities were also considered in developing loss estimates. This assessment consisted of identifying the existing mitigation capabilities of participating jurisdictions. This involved collecting information about existing government programs, policies, regulations, ordinances, and plans

that mitigate or could be used to mitigate risk from hazards. Participating jurisdictions collected information on their regulatory, personnel, fiscal, and technical capabilities, as well as previous and ongoing mitigation initiatives. This information is included in Chapter 2, Planning Area Profile and Capabilities.

Specific capabilities such as participation in the National Flood Insurance Program as well as designation as Fire Wise Communities or Storm Ready Communities and placement of storm sirens are incorporated in the vulnerability analysis discussions, where applicable.

Taking into consideration the vulnerability and capability assessments, and where sufficient information was available, a variety of methods was used to estimate losses for each profiled hazard. For riverine flooding, Hazus was used to determine assets/areas at risk and determine loss estimates. For other geographic hazards such as fixed chemical facilities and grass/wildland fire, assets/areas at risk were determined through GIS analysis. For other hazards such as weather-related hazards, loss estimates were developed based on statistical analysis of historic events. For some human-caused hazards, loss estimates were scenario-based. The methodologies for each loss estimate are described in detail in Chapter 3. Within each hazard section, the text provides details on how the hazard varies by jurisdiction, where applicable. In addition, at the conclusion of each hazard section, a summary table indicates the specific probability, magnitude, warning time, and duration rating of the hazard for each jurisdiction, to show how the hazard varies. Where applicable, introductory text preceding the table highlights noted variables.

Results of the preliminary risk assessment were presented at Meeting #2 and the Draft Risk Assessment (Chapter 3) was provided to the HMPC for review and comment. Several comments, corrections, and suggestions were provided to Wood and incorporated into the risk assessment as appropriate.

## Phase 3 Develop the Mitigation Plan (Handbook Task 6)

### *Step 6: Set Goals*

Wood facilitated a discussion session with the HMPC during Meeting #2 to review and update goals. Common categories of mitigation goals were presented as well as the 2013 State Hazard Mitigation Plan goals.

This planning effort is an update to an existing hazard mitigation plan. As a result, the goals from the *2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan* were reviewed.

The revised/validated goals for this plan update are provided below:

- Goal 1: Natural hazards that cause injuries, illness, deaths, property loss, utility service disruption and economic loss will be reduced and mitigated against by planning for the protection of property and life.
- Goal 2: Protect critical facilities, infrastructure, and jurisdictional operations from disruptions due to hazard impacts.
- Goal 3: Educate the public on natural hazards and what necessary information is needed to protect themselves and their property.

### *Step 7: Review Possible Activities*

At meeting #2, a handout of previous actions was provided to all jurisdictions with instructions to provide updates for each action. Jurisdictions were encouraged to maintain a focused approach and continue forward only those actions that are aimed at implementing long-term solutions to prevent losses from hazards. The focus of Meeting #3 was to update the mitigation strategy by discussing relevant new actions considered necessary as a result of the updated risk assessment. The HMPC reviewed the

following: plan goals, previous actions from the 2013 plan, key issues from the risk assessment, Iowa Homeland Security and Emergency Management's HMA funding priorities, public opinion survey results on types of actions desired, and FEMA's Mitigation Action Ideas publication.

The group discussed the types of mitigation actions/projects that could be done by the jurisdictions in Emmet County. Consideration was given to the analysis results provided in the risk assessment and the anticipated success for each project type. Projects relating to emergency response were discussed, but participants were encouraged to focus on long-term mitigation solutions since response-related mitigation actions occur on a routine basis as requirements of other plans. Complex projects that would necessitate use of large numbers of county resources were also discussed. This opportunity to discuss a broad range of mitigation alternatives allowed the jurisdictions to understand the overall priorities of the committee and to allow for discussion of the types of project most beneficial to each jurisdiction. As part of this discussion, consideration was given to the potential cost of each project in relation to the anticipated future cost savings.

The jurisdictions were also provided instructions for completing the Mitigation Action Plan for each continuing and newly developed action. The details from the Action Plan for each Continuing and New action are provided in Chapter 4. The completed and deleted actions are provided in Appendix C. Chapter 4 provides additional details regarding the process undertaken to refine the mitigation strategy to make Emmet County and its jurisdictions more disaster resistant.

***Step 8: Draft an Action Plan***

A complete draft of the plan was made available online and in hard copy for review and comment by the public, other agencies and interested stakeholders. This review period was from xx to xx. Methods for inviting interested parties and the public to review and comment on the plan were discussed in Steps 2 and 3, and materials are provided in Appendix B. Comments were integrated into a final draft for submittal to the Iowa Homeland Security and Emergency Management Division and FEMA.

## Phase 4 Implement the Plan and Monitor Progress

***Step 9: Adopt the Plan (Handbook Task 8)***

To secure buy-in and officially implement the plan, the governing bodies of each participating jurisdiction adopted the plan. Scanned copies of resolutions of adoption are included in Appendix D of this plan.

***Step 10: Implement, Evaluate, and Revise the Plan (Handbook Tasks 7 & 9)***

The HMPC developed and agreed upon an overall strategy for plan implementation and for monitoring and maintaining the plan over time during Meeting #3. This strategy is described in Chapter 5, Plan Maintenance Process.

# 2 PLANNING AREA PROFILE AND CAPABILITIES



This chapter provides a general profile of Emmet County and participating jurisdictions, including details on existing capabilities, plans, and programs that enhance their ability to implement mitigation strategies.

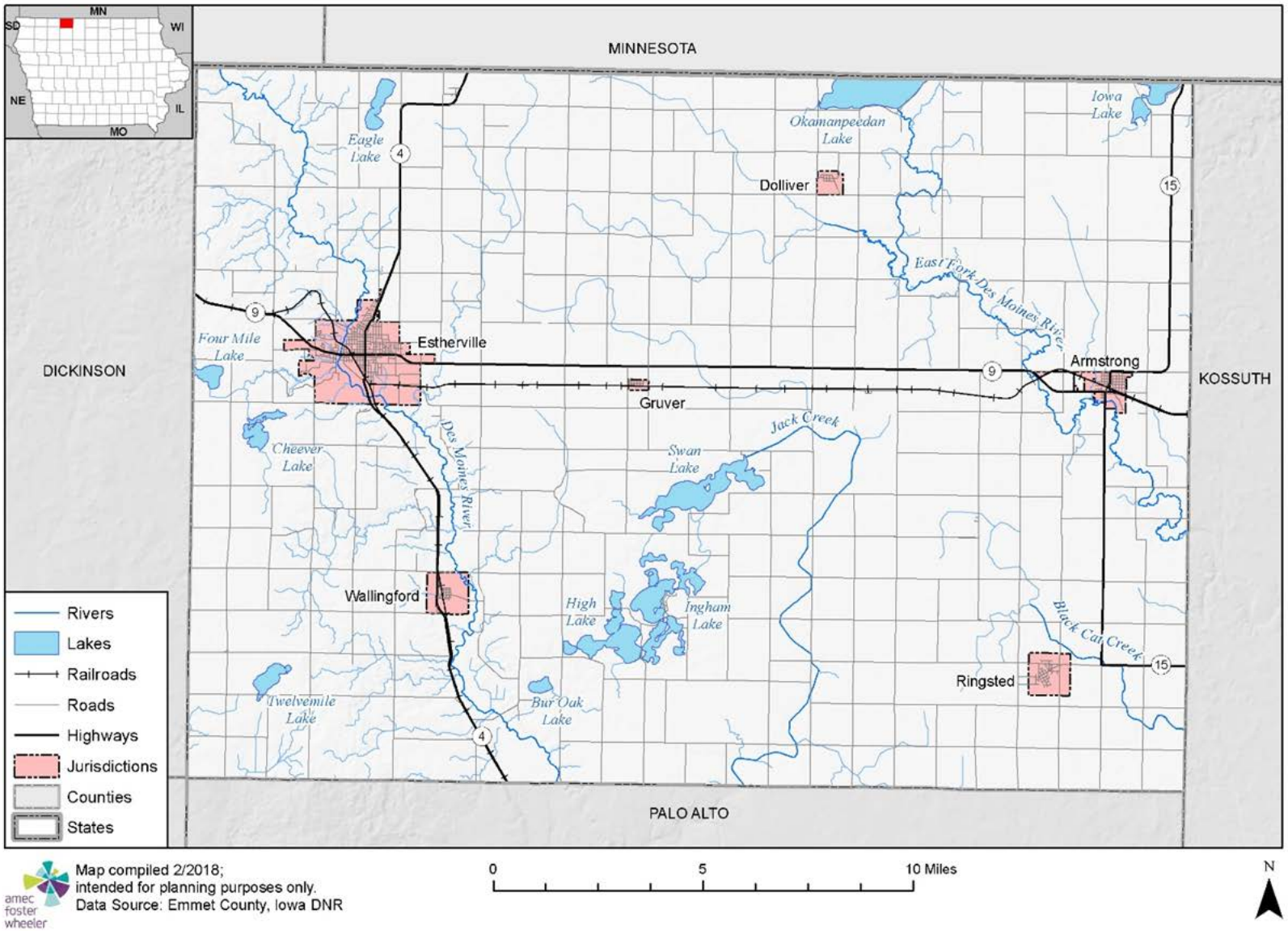
## 2.1 Emmet County Planning Area Profile

Figure 2-1 provides a map of the Davis County planning area. The planning area boundaries include the unincorporated areas of Davis County as well as the following incorporated cities:

- Emmet County
- Armstrong
- Estherville
- Gruver
- Ringsted
- Wallingford

North Union Public School District, Estherville-Lincoln Public School District, and Iowa Lakes Community College participated in development of this plan and are also included in the planning area. They are discussed in additional detail in Section 2.3.

**Figure 2-1: Emmet County Planning Area**



### 2.1.1 Geography and Topography

Emmet County is located in northwestern Iowa along the border with MInnesota. The County has a total area of 408 square miles. There are several highways that run through the County including Iowa Highway 4, which travels north and sourth thorugh the western portion of the county and through the cities of Estherville and Wallingford; Iowa Highway 9, which travels east and west through the central portion of the county and through the cities of Estherville, Gruver, and Armstrong; and Iowa Highway 15, which travels north and south through the eastern portion of the county and passes through the city of Armstrong. The rest of the roads in the county are county highways and local roads.

Adjacent counties:

- Jackson County, Minnesota (northwest)
- Martin County, Minnesota (northeast)
- Kossuth County (east)
- Palo Alto County (south)
- Dickinson County (west)

The soils that are found within Emmet County are well suited to agricultural uses, including crop production and pasture. The principal crops are corn and soybeans. Predominant soils in the County range from poorly drained to moderately well drained. Though agriculture is now the predominant land use, it was originally restricted to high areas because much of the county was covered in swamps; however, drainage and reclamation of these lands began in 1882, converting much of these lands to agricultural use. Much of the county's landscape is comprised of rolling prairie. Elevation in the county ranges from 1,225 to 1,480 feet above sea level. (Source: Natural Resources Conservation Service, Soil Survey).

### 2.1.2 Major Rivers and Watersheds

The primary waterway features in Emmet County are the Des Moines River and the East Fork Des Moines River. As depicted in Figure 2-2, Emmet County crosses four watersheds as follows:

- 07020009 Blue Earth
- 07100002 Upper Des Moines
- 07100003 East Fork Des Moines
- 10230003 Little Sioux

**Figure 2-2 Emmet County, Iowa Watersheds (Emmet County is red square)**


Source: Environmental Protection Agency, https://cfpub.epa.gov/surf/locate/index.cfm

### 2.1.3 History

The Third General Assembly of 1851 created or established 50 counties in Iowa. When this session closed, every part of Iowa was included in some designated county for the first time. Emmet County was created by this wholesale legislation. At that time, Emmet County was attached to Webster County for governmental purposes because the area was so sparsely settled by non-Natives. The first white settlers began to arrive in 1856. In 1859 a petition was circulated and Emmet County separated from Webster County.

Emmet County was named after the Irish orator, nationalist, and poet, Robert Emmet, who was executed in 1803 for his activity in the Irish rebellion. The county seat was originally established in Estherville despite opposition from some parts of the county. A courthouse was partially constructed in Estherville before financing was stopped. The courthouse was instead established in a schoolhouse until 1876 when it was destroyed in a fire. In 1879, Swan Lake was chosen in an election to decide the new county seat, a position it held until another election in 1882 moved the county seat back to Estherville where it has since remained.

In 1882, a rail connection was made to Estherville by the Burlington, Cedar Rapids & Northern Railroad. Additionally, a courthouse and a public library were built in Estherville. In 1903, a Carnegie library was built.

In 1954, a grand jury voted to recommend construction of a new courthouse, which was considered long overdue. Construction began on the current courthouse in June 1957 and completed in July of the following year. (Source: Dorothy Mergen, Emmet County Recorder via 2013 Emmet County Multi-jurisdictional Hazard Mitigation Plan).

Emmet County has several properties listed in the National Register of Historic Places, detailed in Table 2-1 below.

**Table 2-1 Emmet County Listings in National Register of Historic Places**

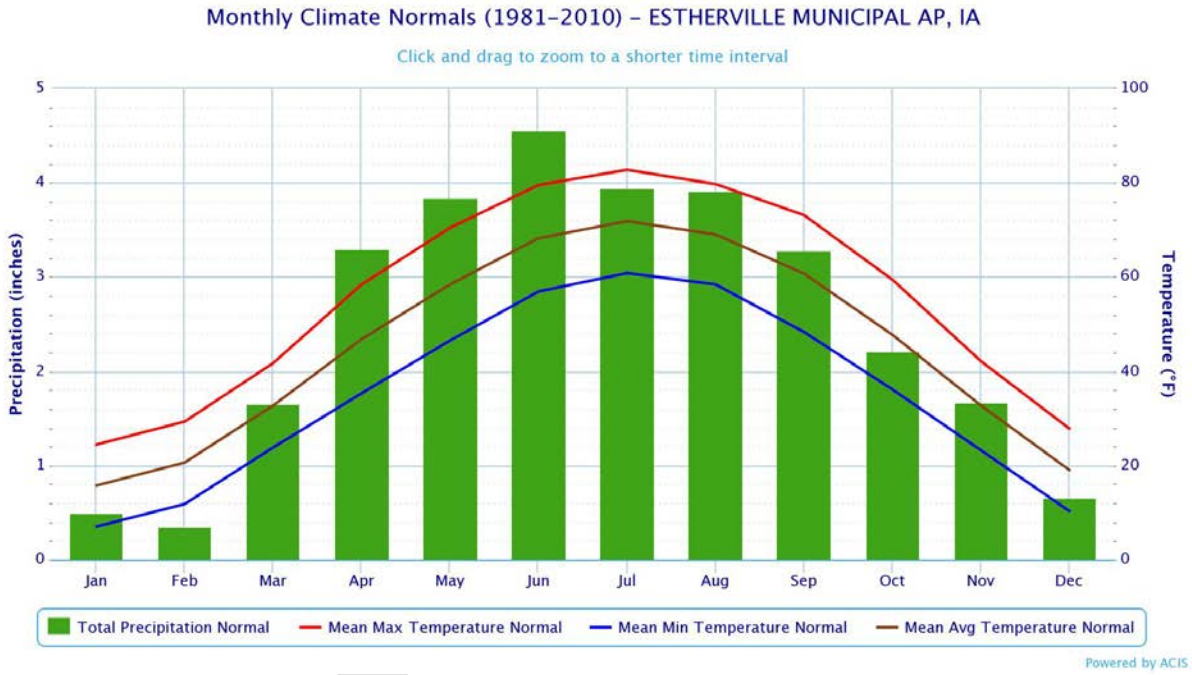
| Listing | Date Listed | Location |
|---|---|---|
| Brugjeld-Peterson Family Farmstead District | April 6, 2000 | Wallingford |
| Ellsworth Ranch Bridge | July 15, 1998 | Armstrong |
| Thomsen Round Barn | June 30, 1986 | Armstrong |

Source: National Register of Historic Places

### 2.1.4 Climate

The climate in Emmet County is described as hot-summer humid continental with cold winters and hot and humid summers. The average winter temperature is 18.8 degrees Fahrenheit. The average summer temperature is 69.7 degrees Fahrenheit, with an average annual rainfall of 30 inches.
The coldest winter month is January with an average low of 7.0 degrees Fahrenheit and the hottest summer month is July with an average high of 82.7 degrees Fahrenheit. Seasons fluctuate from being very wet to very dry, with a peak precipitation normal of 4.56 inches in June to a minimum precipitation normal of 0.50 inches in January. Figure 2-3 and Table 2-2 provide monthly climate normals for Estherville, Iowa from 1981 to 2010.

**Figure 2-3 Monthly Climate Normals (1981-2010), Estherville, IA**




Source: High Plains Regional Climate Center, http://climod.unl.edu/

**Table 2-2 Monthly Climate Normals (1981-2010), Estherville, IA**

| Month | Total Precipitation Normal (inches) | Mean Max Temperature Normal (°F) | Mean Min Temperature Normal (°F) | Mean Avg Temperature Normal (°F) |
|---|---|---|---|---|
| January | 0.50 | 24.4 | 7.0 | 15.7 |
| February | 0.35 | 29.3 | 11.8 | 20.6 |
| March | 1.65 | 41.7 | 23.8 | 32.7 |
| April | 3.30 | 58.4 | 35.3 | 46.8 |
| May | 3.84 | 70.4 | 46.5 | 58.4 |
| June | 4.56 | 79.5 | 56.9 | 68.2 |
| July | 3.95 | 82.7 | 60.8 | 71.8 |
| August | 3.92 | 79.7 | 58.4 | 69.0 |
| September | 3.28 | 73.1 | 48.3 | 60.7 |
| October | 2.21 | 59.4 | 36.1 | 47.7 |
| November | 1.67 | 42.1 | 23.2 | 32.7 |
| December | 0.66 | 27.8 | 10.3 | 19.0 |
| Annual | 29.89 | 55.7 | 34.9 | 45.3 |

Source: High Plains Regional Climate Center, http://climod.unl.edu/

### 2.1.5 Population/Demographics

According to the U.S. Census Bureau, the Emmet County population declined by 4.7 percent from 2010 to 2016 overall. Over this period, the Cities of Dolliver, Gruver, and Ringsted experienced significant growth. The greatest absolute population decline was seen in the City of Estherville and the unincorporated county, yet the City of Wallingford experienced the greatest relative decline, with an 8.6 percent drop in population. Table 2-3 provides the populations for each city and the unincorporated county for the 2010 decennial census and the 2016 American Community Survey (ACS) 5-Year Estimates with the number and percent change from 2010 to 2016.

**Table 2-3 Emmet County Population 2010-2016 by Jurisdiction**

| Jurisdiction | 2010 Census Population | 2016 Population Estimate | # Change 2010-2016 | % Change 2010-2016 |
|---|---|---|---|---|
| Armstrong | 926 | 898 | -28 | -3.0% |
| Dolliver | 66 | 81 | 15 | 22.7% |
| Estherville | 6,360 | 6,027 | -333 | -5.2% |
| Gruver | 94 | 105 | 11 | 11.7% |
| Ringsted | 422 | 479 | 57 | 13.5% |
| Wallingford | 197 | 180 | -17 | -8.6% |
| Unincorporated Emmet County | 2,237 | 2,120 | -117 | -5.2% |
| Total | 10,302 | 9,820 | -482 | -4.7% |

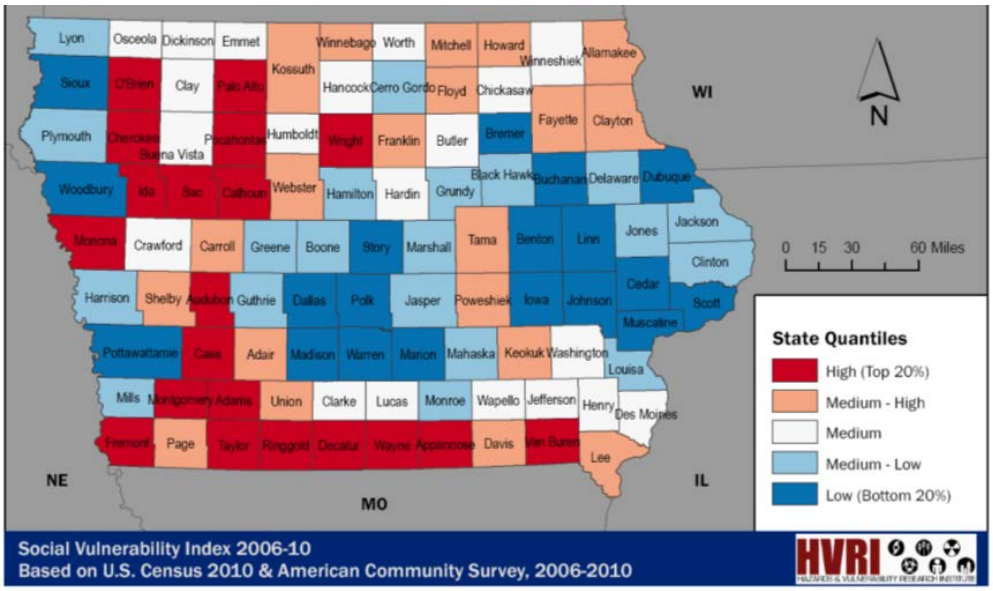
Source: U.S. Census Bureau: 2010 Decennial Census, ACS 2012-2016 5-Year Estimates. Unincorporated Emmet County Population was estimated by subtracting populations of incorporated cities from the total Emmet County populations.

According to the ACS 2016 5-Year Estimates, 5.3 percent of the population is under age 5 and 19.7 percent of the population is over age 65 in Emmet County. In total, there were 4,773 households with an average household size of 2.19 people.

The Hazards and Vulnerability Research Institute at the University of South Carolina developed the Social Vulnerability Index (SoVI ®) to evaluate and rank the ability to respond to, cope with, recover from, and adapt to disasters. The index synthesizes 30 socioeconomic variables, which the research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI ® data sources include primarily those from the United States Census Bureau.

Figure 2-4 shows that Emmet County has a medium Social Vulnerability Index. The medium index indicates that Emmet County is generally less able to cope and recover from disasters as counties with a lower index. It should be noted that SoVI does not reveal variations in social vulnerability each county; however, some portions of Emmet County may experience more difficulty coping and recovering from disasters than others.

**Figure 2-4 County Comparison Within the State for Social Vulnerability Index, 2006-2010**




Source: Hazards and Vulnerability Research Institute, http://webra.cas.sc.edu/hvri/products/sovi2010_img/PDF/Iowa_0610.pdf
http://webra.cas.sc.edu/hvri/products/sovi2010_data.aspx

Table 2-4 and Table 2-5 provide additional demographic and economic indicators for Emmet County. The Emmet County values are for the whole County, including the incorporated cities.

**Table 2-4 Unemployment, Income, and Poverty Demographics, Emmet County, Iowa**

| Jurisdiction | Population 16 Years and Over | Population 16 Years and Over in the Labor Force | Unemployment Rate | Median Household Income ($) | Percent Below Poverty Level |
|---|---|---|---|---|---|
| Emmet County, Iowa | 7,971 | 5,157 | 5.3% | 45,536 | 13.6 |
| Armstrong | 755 | 455 | 3.5% | 41,949 | 8.3 |
| Dolliver | 66 | 52 | 11.5% | 52,500 | 18.5 |
| Estherville | 4,810 | 3,157 | 6.5% | 42,691 | 16.0 |
| Gruver | 88 | 53 | 0.0% | 45,000 | 9.5 |
| Ringsted | 349 | 225 | 8.9% | 35,833 | 17.1 |
| Wallingford | 159 | 114 | 2.6% | 55,833 | 10.6 |

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates

**Table 2-5 Educational Attainment, Emmet County, Iowa**

| Geography | Population 25 years and over | Percent less than 9th grade* | Percent high school graduate or higher* | Percent bachelor's degree or higher* |
|---|---|---|---|---|
| Emmet County, Iowa | 6,711 | 3.9 | 89.6 | 17.5 |

| | | | | |
|---|---|---|---|---|
| Armstrong | 660 | 3.5 | 89.5 | 12.9 |
| Dolliver | 59 | 8.5 | 64.4 | 3.4 |
| Estherville | 3,847 | 4.7 | 88.0 | 20.4 |
| Gruver | 84 | 7.1 | 88.1 | 10.7 |
| Ringsted | 318 | 0.6 | 95.9 | 12.6 |
| Wallingford | 143 | 3.5 | 91.6 | 9.1 |

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates *percentage of population 25 years and over

### 2.1.6 Occupations/Employers

Table 2-6 provides occupation statistics for the incorporated cities and the county as a whole for the civilian employed population 16 years and over.

**Table 2-6 Occupation Statistics, Emmet County, Iowa**

| Geography | Civilian employed population 16 years and over | Management, business, science, and arts occupations | Service occupations | Sales and office occupations | Natural resources, construction, and maintenance occupations | Production, transportation, and material moving occupations |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4,884 | 29.0% | 16.9% | 20.8% | 12.7% | 20.6% |
| Armstrong | 439 | 24.4% | 21.0% | 23.5% | 8.0% | 23.2% |
| Dolliver | 46 | 17.4% | 17.4% | 23.9% | 21.7% | 19.6% |
| Estherville | 2,953 | 27.3% | 18.9% | 21.6% | 13.7% | 18.5% |
| Gruver | 53 | 24.5% | 13.2% | 11.3% | 17.0% | 34.0% |
| Ringsted | 205 | 21.5% | 16.6% | 15.6% | 14.6% | 31.7% |
| Wallingford | 111 | 26.1% | 24.3% | 20.7% | 11.7% | 17.1% |

Source: U.S. Census, 2016 American Community Survey, 5-year Estimates

Table 2-7 lists the major employers in Emmet County according to data provided by the Iowa Lakes Corridor Development Corporation. This list was supplemented by input from County and jurisdiction representatives as reported in Data Collection Guides.

**Table 2-7 Major Employers, Emmet County, Iowa**

| Employer | Industry | Estimated # of Employees | Jurisdiction |
|---|---|---|---|
| Dakota Pack | Pork Processing | 126 | Estherville |
| GKN Wheel | Agricultural & Construction Equipment | 460 | Armstrong & Estherville |
| Art's Way Manufacturing | Agricultural Equipment | 111 | Armstrong |
| Iowa Lakes Community College | Higher Education | 370 | Estherville |
| Avery Holy Family Health | Medical | 150 | Esterville |
| Estherville Foods | Egg Products | >50 | Estherville |
| Daybreak Foods | Egg-breaking Facility | >50 | Estherville |
| Bank Plus | Financial Services | >50 | Estherville |
| North Star Bank | Financial Services | >50 | Estherville |

| | | | |
|---|---|---|---|
| Iowa Lakes Electric Cooperative | Energy Utility | >50 | Estherville |
| Estherville Community Schools | Education | >50 | Estherville |
| Stateline Coop | -- | 11 | Ringsted |

Source: Iowa Lakes Corridor Development Corporation

### 2.1.7 Agriculture

Because of the fertility of the soils in Emmet County and the climate conditions, agricultural crops and livestock are important contributors to the economy of Emmet County.

According to the 2012 Census of Agriculture there were 475 farms in the County covering 218,987 acres of land (83.9 percent of the 408 sq. miles of land area (261,120 acres) in the County). Crop and livestock production are visible parts of the agricultural economy, but many related businesses contribute by producing, processing, and marketing farm and food products. These businesses generate income, employment and economic activity throughout the region. Farms on average were 461 acres. Emmet County agriculture and agriculture-related industries provide 2,461 jobs, representing 39.2 percent of the County's workforce. Emmet County agriculture and economy contributions are summarized in additional detail in Section 3.2.2 of Chapter 3.

### 2.1.8 FEMA Hazard Mitigation Assistance Grants in Planning Area

According to the Iowa Homeland Security and Emergency Management Department, Emmet County has received one Hazard Mitigation Assistance Grant since 1996. The grant was for a property acquisition and the project was officially completed on August 16, 1996. Data was not available for any grants that may have been received prior to 1996.

## 2.2 City/County Capabilities

Unincorporated Emmet County is governed by a five-member Board of Supervisors. Each incorporated city is governed by a six-member Mayor/City Council. Emmet County has an active Emergency Management Office that coordinates emergency management capabilities in the County. The Emmet County Emergency Notification System (ECENS) provides emergency notifications for weather, emergency, and public safety warnings throughout the County. This service is part of the Alert Iowa statewide emergency messaging system. Table 2-8 that follows provides additional capability information for the unincorporated county and incorporated cities.

**Table 2-8 Mitigation Capabilities**

| | Emmet County | Armstrong | Estherville | Gruver | Ringsted | Wallingford |
|---|---|---|---|---|---|---|
| **Planning Capabilities** | | | | | | |
| Comprehensive Plan | Annually, called Basic Plan | No | yes, 2017 | N/A | Aug-03 | No |
| Builder's Plan | N/A | No | no | No | Apr. 1998, Housing Asset & Action Plan | No |
| Capital Improvement Plan | N/A | No | no | No | Apr. 1998, Strategic Plan / update each year | No |
| Local Emergency Operations Plan | N/A | Yes, 2017 | yes, 2017 | No | no - County | Currently updating |
| County Emergency Operations Plan | Reviewed annually, 15 different annexes | N/A | N/A | N/A | N/A | N/A |
| Local Recovery Plan | N/A | N/A | no | N/A | no - County | No |
| County Recovery Plan | July 2014, ESF 14 | N/A | N/A | N/A | N/A | N/A |
| City Mitigation Plan | N/A | 2015 | no | 2013 | Feb-04 | 2013 |
| County Mitigation Plan | 2013 | N/A | N/A | 2013 | N/A | N/A |
| Debris Management Plan | N/A - Some cities have started | N/A | no | No | no | No |
| Economic Development Plan | N/A | N/A | no | No | no | No |
| Transportation Plan | 2015, ESF 1 | N/A | no | No | no | No |
| Land-use Plan | 2005 | Yes | yes | Yes | no - County | Yes |
| Flood Mitigation Assistance (FMA) Plan | N/A | N/A | no | No | no | No |
| Watershed Plan | N/A | N/A | | No | no | No |
| Firewise or other fire mitigation plan | N/A | N/A | no | No | no | No |

| | Emmet County | Armstrong | Estherville | Gruver | Ringsted | Wallingford |
|---|---|---|---|---|---|---|
| Critical Facilities Plan (Mitigation/Response/Recovery) | 2015 - currently updating | N/A | no | No | no | No |
| **Policies/Ordinances** | | | | | | |
| Zoning Ordinance | Yes | Yes | yes, 2017 | Yes | updated 12/4/91 | Yes |
| Building Code | N/A | 2012 | no | Current - State codes | no | |
| Floodplain Ordinance | 2016 | N/A | yes, 2000 | 2000 | no | No |
| Subdivision Ordinance | Yes | Yes | yes, 2017 | No | updated 12/4/91 | N/A |
| Tree Trimming Ordinance | No | Yes | yes, 2015 | Yes | 2013 | Yes |
| Nuisance Ordinance | N/A | Yes | yes, 2015 | Yes | 2013 | Yes |
| Storm Water Ordinance | N/A | Yes | no | Yes - Iowa Lakes Regional Water | 2013 | No |
| Drainage Ordinance | N/A | Yes | no | No | 2013 | No |
| Site Plan Review Requirements | Yes | N/A | yes | No | no | N/A |
| Historic Preservation Ordinance | Yes | N/A | no | No | no | N/A |
| Landscape Ordinance | Yes | Yes | no | Yes | no | Yes - falls under zoning |
| Iowa Wetlands and Riparian Areas Conservation Plan | N/A - State and Federal Government | N/A | no | N/A | no | N/A |
| **Programs** | | | | | | |
| Zoning/Land Use Restrictions | Yes | Yes | yes | Yes | no | Yes |
| Codes Building Site/Design | Yes | Yes - State Code | yes | Yes | no | No |
| National Flood Insurance Program | Yes | N/A | yes | No | no | N/A |
| | Yes | N/A | yes | Yes | no | N/A |
| NFIP Community Rating System (CRS) Participating Community | N/A | N/A | | Yes | no | N/A |
| Hazard Awareness Program | Completed, waiting for public notice from NWS | N/A | no | N/A | no | N/A |
| National Weather Service (NWS) Storm Ready | No | N/A | no | No | no | N/A |
| Firewise Community Certification | No | N/A | no | No | no | N/A |
| Building Code Effectiveness Grading (BCEGs) | Each City has one | 7 | 05/5x | 9 | | 9 |
| ISO Fire Rating | Yes | N/A | yes | No | no | N/A |

| | Emmet County | Armstrong | Estherville | Gruver | Ringsted | Wallingford |
|---|---|---|---|---|---|---|
| Economic Development Program | Yes | N/A | yes | Yes | no | N/A |
| Land Use Program | Yes - talks, radio, news releases, etc. | Yes | no | Yes | no | Yes - radio, newspaper, social media |
| Public Education/Awareness | Yes - City of Estherville 1993 | Yes - Radio, Classroom, Newspaper | no | Yes | no | Yes - radio, newspaper, social media |
| Property Acquisition | Yes, Commission | Yes | yes | Yes | yes | Yes - radio, newspaper, social media |
| Planning/Zoning Boards | No | N/A | N/A | No | no | N/A |
| Stream Maintenance Program | No | Yes | yes | No | no | Yes - radio, newspaper, social media |
| Tree Trimming Program | No | N/A | no | No | no | N/A |
| Engineering Studies for Streams (Local/County/Regional) | Yes, many are verbal | Yes - written | yes | Yes | no | Yes |
| Mutual Aid Agreements | Yes | Yes | yes | Yes | no | Yes |
| **Studies/Reports/Maps** | | | | | | |
| Hazard Analysis/Risk Assessment (City) | N/A | N/A | yes | Yes | no | Yes |
| Hazard Analysis/Risk Assessment (County) | Yes, 2013 | N/A | N/A | N/A | N/A | N/A |
| Flood Insurance Maps | Yes, 1988 | No | Yes, 1977 | No | No | Yes, 1987 |
| FEMA Flood Insurance Study (Detailed) | No | No | Yes, 1977 | No | No | No |
| Evacuation Route Map | Yes, in Hazmat Plan | Yes | no | No | no | N/A |
| Critical Facilities Inventory | Yes | Yes | yes | Yes | no | Yes |
| Vulnerable Population Inventory | Yes | N/A | yes | Yes | no | No |
| Land Use Map | Yes | Yes | yes | Yes | no | Yes |
| **Staff/Department** | | | | | | |
| Building Code Official | Yes - State | Yes - Zoning | no | Yes | no | Yes |
| Building Inspector | Yes - State | Yes - State | no | No | no | No - State |
| Mapping Specialist (GIS) | Yes - Assessor's office | Yes - County | no | No | no | No - State |
| Engineer | Yes | No | no | No | no | No - State |

| | Emmet County | Armstrong | Estherville | Gruver | Ringsted | Wallingford |
|---|---|---|---|---|---|---|
| Development Planner | Yes, Northwest Iowa Planning & Development Commission | No | no | No | no | No - State |
| Public Works Official | No | Yes | yes | Yes - Iowa Lakes Regional Water | no | Yes |
| Emergency Management Coordinator | Yes | Yes | N/A | Yes | no | Yes - County |
| NFIP Floodplain Administrator | Yes - Assessor's office | Yes - County | yes | N/A | no | No - State |
| Bomb and/or Arson Squad | Yes - State Fire Marshall's Office | Yes - State | yes | Yes - State | no | Yes - State |
| Emergency Response Team | Yes - H.E.A.T Team | Yes - Mason City / Armstrong Fire | yes | Yes - Mason City | no | Yes - Mason City, Fire Dept., EMA |
| Hazardous Materials Expert | Yes - Mason City Haz Mat Response Team | Yes - Mason City | yes | Yes - Armstrong Fire | no | Yes - Mason City, Fire Dept. |
| Local Emergency Planning Committee | Yes - NCRERC | Yes - Fire Dept. | yes | Yes | no | Yes - Fire Dept. City Con |
| County Emergency Management Commission | Yes | Yes | N/A | Yes | N/A | Yes |
| Sanitation Department | Yes, Amy | Yes | yes | Yes - Iowa Lakes Regional Water | yes | No |
| Transportation Department | Yes, Iowa Department of Transportation | N/A | yes | No | no | No |
| Economic Development Department | Yes, Lyle Havern | N/A | yes | No | no | No |
| Housing Department | No | N/A | yes | No | no | No |
| Planning Consultant | | | | | | |
| Regional Planning Agencies | Northwest Iowa Planning & Development Commission | | | | | |
| Historic Preservation | Yes, Historical Society | Yes | no | No | no | No |
| **Non-Governmental Organizations (NGOs)** | | | | | | |

| | Emmet County | Armstrong | Estherville | Gruver | Ringsted | Wallingford |
|---|---|---|---|---|---|---|
| American Red Cross | No - we are covered by Sioux City | No | no | No - Sioux City | | No - Sioux City |
| Salvation Army | No - we are covered by Sioux Falls | No | no | No - Sioux Falls | | No - Sioux Falls |
| Veterans Groups | Yes | Yes | yes | No | | No |
| Local Environmental Organization | No | N/A | no | No | | No |
| Utility Companies | No | N/A | yes | No | | No |
| Homeowner Associations | No | N/A | no | No | | No |
| Neighborhood Associations | Yes, very active | N/A | yes | No | | No |
| Chamber of Commerce | Yes, very active | Yes | yes | No | | No |
| Community Organizations (Lions, Kiwanis, etc. | No - we are covered by Sioux City | No | no | No - Sioux City | | No - Sioux City |
| **Financial Resources** | | | | | | |
| Ability to apply for Community Development Block Grants | Not sure | Yes | yes | Yes | | No |
| Ability to fund projects through Capital Improvements funding | No | No | yes | Yes | | No |
| Authority to levy taxes for a specific purpose | Yes | Yes | yes | Yes | | Yes |
| Fees for water, sewer, gas, or electric services | No | Yes | yes | Yes | | Yes |
| Impact fees for new development | No | No | no | No | | Yes |
| Ability to incur debt through general obligation bonds | No | Yes | yes | No | | N/A |
| Ability to incur debt through special tax bonds | No | Yes | yes | No | | N/A |
| Ability to incur debt through private activities | No | No | no | No | | N/A |
| Ability to withhold spending in hazard prone areas | No | No | | No | | N/A |

## 2.3 Public School District and Community College Profiles and Mitigation Capabilities

This section includes general profile information for the two Emmet County school districts that are participants of this plan and Iowa Lakes Community College. The school districts with buildings in the planning area are as follows:

- Estherville-Lincoln Public School District
- North Union Public School District
- Graettinger-Terril Public School District

Figure 2-5 provides the boundaries of the school districts in Emmet County and Table 2-9 that follows provides location and enrollment information for each participating school district.

**Figure 2-5 Emmet County, Iowa Public School Districts**

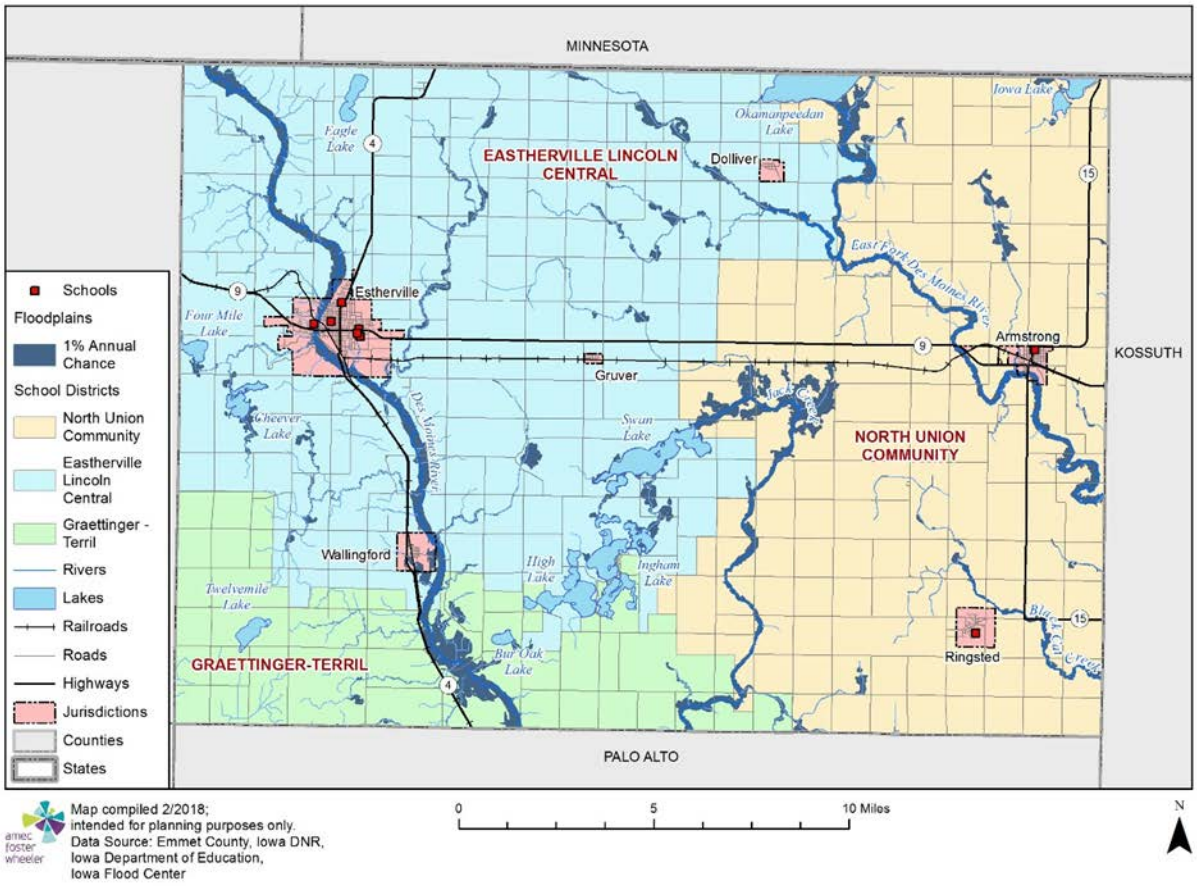


**Table 2-9 Emmet County School Buildings and Enrollment Data, 2015-2016**

| District Name/Building Name | Total Enrollment |
|---|---|
| Estherville-Lincoln | 1,410 |
| District Level Enrollment | 30 |
| Estherville Lincoln Central High School | 365 |
| Roosevelt Elementary | 204 |
| Demoney Elementary School | 410 |
| Estherville Lincoln Central Middle School | 401 |
| North Union | 374 |
| North Union High School | 189 |
| North Union Elementary | 185 |
| Grand Total | 1,784 |

Source: Iowa Department of Education, Bureau of Planning, Research and Evaluation
http://educateiowa.gov/index.php?option=com_content&view=article&id=346&Itemid=4439

Potential capabilities to implement mitigation programs and projects can vary among school districts. To determine mitigation capabilities, each of the participating school districts and the community college completed a Data Collection Guide to report planning, personnel, fiscal, and other capabilities related to implementation of mitigation programs and projects. Table 2-10 provides a summary of the reported capabilities for each participating school district.

**Table 2-10 Summary of Mitigation Capabilities, Emmet County Public School Districts**

| | Iowa Lakes Community College |
|---|---|
| **Planning Elements** | |
| Master Plan | yes, 9/15/2017 |
| Capital Improvement Plan | yes 2/2016 |
| School Emergency Plan | yes, 7/5/2016 |
| Weapons Policy | yes, 12/2015 |
| **Personnel Resources** | |
| Full-time building official (i.e. principal) | yes, Campus Dean |
| Emergency Manager | yes, Facilities Management |
| Grant Writer | yes, Grants |
| Public Information Officer | yes, Marketing |
| **Financial Resources** | |
| Capital Improvements project funding | yes |
| Local funds | yes |
| General obligation bonds | yes |
| Special tax bonds | no |
| Private activities/donations | yes |
| State and federal funds | yes |
| **Other** | |
| Public Address/Emergency Alert System | no; emergency alert system through RAVE to send via voice, text, and email |
| NOAA Weather Radios | yes |
| Mitigation Programs to reduce losses / Public Education Programs | |
| Tornado Shelter/Saferoom | yes |
| Campus Police | no |

Source: Data Collection Guides completed by school district – 2017; North Union School District is a participant of this plan but did not complete a Data Collection Guide

# 3 RISK ASSESSMENT

***44 CFR Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.***

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property and infrastructure within Emmet County, Iowa to these hazards. The goal of the risk assessment is to estimate the potential loss in the planning area, including loss of life, personal injury, property damage and economic loss, from a hazard event. The risk assessment process allows communities in the planning area to better understand their potential risk to the identified hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

The risk assessment for Emmet County and participating jurisdictions followed the methodology described in the 2013 FEMA Local Mitigation Planning Handbook, which includes a four-step process:

Step 1 - Describe Hazards

Step 2 - Identify Community Assets

Step 3 - Analyze Risks

Step 4 - Summarize Vulnerability

This chapter is divided into six main parts:

- Section 3.1 Hazard Identification identifies the hazards that threaten the planning area and the methodology utilized to score or rank the hazards;
- Section 3.2 Assets at Risk provides the planning area's total exposure to natural hazards, considering critical facilities and other community assets at risk;
- Section 3.3 Development Since 2013 Plan Update discusses what changes in development have occurred since the previous Hazard Mitigation Plan;
- Section 3.4 Future Land Use and Development discusses areas of planned future development;
- Section 3.5 Hazard Profiles and Vulnerability for each hazard; this section is divided into two parts: 1) Hazard Profile discusses the threat to the planning area, the geographic location/extent at risk, previous occurrences of hazard events and probability of future occurrence; and 2) Vulnerability Assessment further discusses specific assets at risk as well as loss estimates. Specifically, where data is available, this section defines and quantifies populations, buildings, critical facilities and other community assets at risk to natural hazards with estimates of potential losses to those assets, where possible;
- Section 3.6 Hazard Analysis Summary provides a tabular summary of the hazard ranking for each jurisdiction in the planning area.

## 3.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The hazards identified for this plan update are listed below in alphabetical order

- Animal/Plant/Crop Disease
- Dam/Levee Failure

- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flash Flooding
- Grass/Wildland Fire
- Hazardous Materials
- Human Disease
- Infrastructure Failure
- Landslide
- Radiological Incident
- River Flooding
- Severe Winter Storm
- Sinkholes
- Terrorism
- Thunderstorm/Lightning/Hail
- Tornado/Windstorm
- Transportation Incident

Sections 3.1.1 through 3.1.3 describe how these hazards were identified for this plan update.

### 3.1.1 Review of Existing Mitigation Plans

Prior to 2012, Hazard Mitigation Planning in Emmet County was implemented on a jurisdictional basis. In 2012 the unincorporated county and incorporated municipalities came together to coordinate multi-jurisdictional mitigation planning for the entire Emmet County planning area. This coordinated effort resulted in the Emmet County, Iowa Multi-Jurisdictional Hazard Mitigation Plan, approved by FEMA on October 30, 2013. To identify hazards to include in the Risk Assessment update, a comparison was performed between the hazard identification in the 2013 Iowa State Hazard Mitigation Plan and the 2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan. Table 3-1 provides the details of the comparison.

**Table 3-1 Hazard Comparison Chart**

| | 2013 State Plan | 2013 Emmet County Plan |
|---|---|---|
| NATURAL HAZARDS | Animal/Crop/Plant Disease | |
| | Dam/Levee Failure | Dam Failure |
| | | Levee Failure |
| | Drought | Drought |
| | Earthquake | |
| | Expansive Soils | |
| | Extreme Heat | Extreme Heat |
| | Flash Flood | Flash Flood |
| | River Flooding | River Flooding |
| | Grass or Wildland Fire | Grass or Wildland Fire |
| | Landslide | Landslide |
| | Severe Winter Storm | Severe Winter Storms |
| | Sinkholes | |
| | Thunderstorm/Lightning/Hail | Hailstorm |
| | | Thunderstorm & Lightning |
| | Tornado/Windstorm | Tornado |
| | | Windstorm |
| TECHNOLOGICAL HAZARDS | Hazardous Materials | |
| | Human Disease | |
| | Infrastructure Failure | |
| | Radiological | |
| | Transportation Incident | |
| HUMAN-CAUSED HAZARDS | Terrorism | |

### 3.1.2 Review Disaster Declaration History

Information utilized to identify hazards relevant for inclusion in the Emmet County plan update was obtained by examining events that triggered federal disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. If the disaster is so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

Table 3-2 lists federal disaster declarations that included Emmet County for the period from 1965 to 2016. One declaration occurred subsequent to approval of the previous plan; the July 2015 declaration for severe storms, tornadoes, straight-line winds, and flooding.

**Table 3-2 Disaster Declarations that included Emmet County, Iowa, 1965-2017**

| Disaster Number | Declaration Date | Title | Incident Begin Date | Incident End Date |
|---|---|---|---|---|
| 193 | 4/22/1965 | FLOODING | 4/22/1965 | 4/22/1965 |
| 259 | 4/25/1969 | FLOODING | 4/25/1969 | 4/25/1969 |
| 269 | 8/14/1969 | HEAVY RAINS, FLOODING | 8/14/1969 | 8/14/1969 |
| 911 | 7/12/1991 | FLOODING, SEVERE STORM | 6/1/1991 | 6/15/1991 |
| 928 | 12/26/1991 | ICE STORM | 10/31/1991 | 11/29/1991 |
| 996 | 7/9/1993 | SEVERE STORMS & FLOODING | 4/13/1993 | 10/1/1993 |
| 1230 | 7/2/1998 | SEVERE STORMS, TORNADOES AND FLOODING | 6/13/1998 | 7/15/1998 |
| 1877 | 2/25/2010 | SEVERE WINTER STORMS AND SNOWSTORM | 12/23/2009 | 12/27/2009 |
| 1880 | 3/2/2010 | SEVERE WINTER STORM | 1/19/2010 | 1/26/2010 |
| 1930 | 7/29/2010 | SEVERE STORMS, FLOODING, AND TORNADOES | 6/1/2010 | 8/31/2010 |
| 4184 | 7/24/2014 | SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING | 6/14/2014 | 6/24/2014 |

Source: Federal Emergency Management Agency, www.fema.gov/

The U.S. Department of Agriculture's Secretary of Agriculture is authorized to designate counties as disaster areas to make emergency loans (EM) to producers suffering losses in those counties, and in counties that are contiguous to a designated county. In addition to EM eligibility, other emergency assistance programs, such as Farm Service Agency (FSA) disaster assistance programs, have historically used disaster designations as an eligibility requirement trigger.

Table 3-3 provides the USDA Secretarial disaster declarations that included Emmet County from 2012 to 2016. Details on USDA declarations prior to 2012 are not available.

**Table 3-3 USDA Secretarial Disaster Declarations Including Emmet Co. (2012-2017)**

| County | Crop Year | Desig. No. | Drought | Wind, High Winds | Fire, Wildfire | Heat, Excessive heat High temp. (incl. low humidity) | Frost, Freeze | Insects | Begin Date | Description of disaster |
|---|---|---|---|---|---|---|---|---|---|---|
| Emmet | 2012 | S3337 | 1 | 1 | 1 | 1 | 0 | 1 | 8/7/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3361 | 1 | 1 | 1 | 1 | 0 | 1 | 8/21/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3375 | 1 | 1 | 1 | 1 | 0 | 1 | 8/28/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3390 | 1 | 1 | 1 | 1 | 0 | 1 | 7/17/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3390 | 1 | 1 | 1 | 1 | 0 | 1 | 7/17/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3398 | 1 | 1 | 1 | 1 | 0 | 1 | 7/24/2012 | Drought-FAST TRACK |
| Emmet | 2012 | S3446 | 0 | 0 | 0 | 0 | 1 | 0 | 4/9/2012 | Frosts, freezes |
| Emmet | 2013 | S3498 | 1 | 1 | 1 | 1 | 0 | 1 | 3/15/2013 | Drought-FAST TRACK |
| Emmet | 2013 | S3553 | 0 | 0 | 0 | 0 | 1 | 0 | 1/1/2013 | Heavy rainfall followed by freezing temperatures, and multiple periods of thawing and refreezing, resulting in winterkill |

Source: U.S. Department of Agriculture; https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index

### 3.1.3 Research Additional Sources

Additional data on locations and past impacts of hazards in the planning area was collected from the following sources:

- Emmet County Flood Insurance Rate Map, FEMA
- Emmet County Emergency Management
- Emmet County Flood Insurance Study, FEMA
- *Emmet County Multi-Jurisdictional Hazard Mitigation Plan*, 2013
- Data Collection Guides completed by jurisdictions
- Environmental Protection Agency
- Federal Emergency Management Agency (FEMA)
- Flood Insurance Administration
- Hazards US (HAZUS)
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Education, Bureau of Information and Analysis Services
- Iowa Department of Natural Resources
- Iowa Department of Public Safety
- Iowa Department of Transportation, Office of Traffic and Safety
- *Iowa State Hazard Mitigation Plan* (September 2013)
- Iowa State University
- Iowa Utilities Board
- National Drought Mitigation Center Drought Reporter
- National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information
- SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin
- U.S. Army Corps of Engineers, National Levee Database
- U.S. Department of Agriculture's (USDA) Risk Management Agency Crop Insurance Statistics
- U.S. Department of Transportation
- United States Geological Survey
- Various articles and publications available on the internet (sources are indicated where data is cited)

### 3.1.4 Hazards Identified

Through the hazard identification review process, it was determined that all hazards profiled in the 2013 plan and all additional hazards profiled in the 2013 State plan would be included in the plan update. The hazards identified for this plan update are listed below in alphabetical order

- Animal/Plant/Crop Disease

- Dam/Levee Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flash Flood
- Grass/Wildland Fire
- Hazardous Materials
- Human Disease
- Infrastructure Failure
- Landslide
- Radiological Incident
- River Flooding
- Severe Winter Storm
- Sinkholes
- Terrorism
- Thunderstorm/Lightning/Hail
- Tornado/Windstorm
- Transportation Incident

To maintain consistency and to facilitate the roll-up or summarization of hazards in the next State Plan Update, it was agreed that the hazard grouping/hazard naming for this update will be consistent with the 2013 State Plan.

### 3.1.5 Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional plan, the risks are assessed for each jurisdiction where they deviate from the risks facing the entire planning area. The planning area is fairly uniform in terms of climate and topography as well as building construction characteristics. Accordingly, the geographic areas of occurrence for weather-related hazards do not vary greatly across the planning area for most hazards. The more urbanized areas within the planning area have more assets that are vulnerable to the weather-related hazards, and varied development trends impact the future vulnerability. Similarly, more rural areas have more assets (crops/livestock) that are vulnerable to drought. These differences are discussed in greater detail in the vulnerability sections of each hazard.

Although 20 hazards with the potential to significantly affect the planning area were identified and selected for additional analysis, not all hazards impact every jurisdiction. Table 3-4 provides a summary of the jurisdictions impacted by each hazard. An “x” indicates the jurisdiction is impacted by the hazard. A "-" indicates the hazard is not applicable to that jurisdiction.

**Table 3-4 Hazards Identified for Each Jurisdiction**

| Jurisdiction | Animal/Crop/Plant Disease | Dam/Levee Failure | Drought | Earthquake | Expansive Soils | Extreme Heat | Flash Flood | Grass or Wildland Fire | Hazardous Materials | Human Disease | Infrastructure Failure | Landslide | Radiological Incident | River Flooding | Severe Winter Storm | Sinkholes | Terrorism | Thunderstorm/Lightning/Hail | Tornado/Windstorm | Transportation Incident |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emmet County | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Armstrong | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Dolliver | X | - | X | X | X | X | X | X | X | X | X | X | X | - | X | X | X | X | X | X |
| Estherville | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Gruver | X | - | X | X | X | X | X | X | X | X | X | X | X | - | X | X | X | X | X | X |
| Ringsted | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Wallingford | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| North Union Community Schools | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Estherville-Lincoln Schools | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Iowa Lakes Community College | X | - | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

## 3.1.6 Hazard Scoring Methodology

To maintain a reporting format consistent with the 2013 Iowa State Hazard Mitigation Plan, the Emmet County Hazard Mitigation Planning Committee (HMPC) used the same methodology to score and prioritize the hazards. This prioritization was based on a hazard scoring system that considers four elements of risk: probability, magnitude/severity, warning time, and duration. Table 3-5 provides definitions for each of the four elements along with associated rating levels.

**Table 3-5Hazard Score Element Definitions and Rating Scales**

| Element/Score | Definitions |
|---|---|
| Probability: Reflects the likelihood of the hazard occurring again in the future, considering both the hazard's historical occurrence and the projected likelihood of the hazard occurring in any given year. | |
| 1—Unlikely | Less than 10% probability in any given year (up to 1 in 10 chance of occurring), history of events is less than 10% likely or the event is unlikely but there is a possibility of its occurrence. |
| 2—Occasional | Between 10% and 20% probability in any given year (up to 1 in 5 chance of occurring), history of events is greater than 10% but less than 20% or the event could possibly occur. |
| 3—Likely | Between 20% and 33% probability in any given year (up to 1 in 3 chance of occurring), history of events is greater than 20% but less than 33% or the event is likely to occur. |
| 4—Highly Likely | More than 33% probability in any given year (event has up to a 1 in 1 chance of occurring), history of events is greater than 33% likely or the event is highly likely to occur. |
| Magnitude / Severity: Assessment of severity in terms of injuries and fatalities, personal property, and infrastructure and the degree and extent with which the hazard affects the jurisdiction. | |

| Element/Score | Definitions |
|---|---|
| 1—Negligible | Less than 10% of property severely damaged, shutdown of facilities and services for less than 24 hours, and/or injuries /illnesses treatable with first aid. |
| 2—Limited | 10% to 25% of property severely damaged, shutdown of facilities and services for more than a week, and/or injuries/illnesses that do not result in permanent disability. |
| 3—Critical | More than 25% to 50% of property severely damaged, shutdown of facilities and services for at least 2 weeks, and/or injuries/illnesses that result in permanent disability. |
| 4—Catastrophic | More than 50% of property severely damaged, shutdown of facilities and services for more than 30 days, and/or multiple deaths. |
| Warning Time: Rating of the potential amount of warning time that is available before the hazard occurs. This should be taken as an average warning time. | |
| 1 | More than 24 hours warning time |
| 2 | More than 12 to 24 hours warning time |
| 3 | 6 to 12 hours warning time |
| 4 | Minimal or no warning time (less than 6 hours warning) |
| Duration: A measure of the duration of time that the hazard will affect the jurisdiction. | |
| 1 | Less than 6 hours |
| 2 | More than 6 hours but Less than 1 day |
| 3 | More than 1 day but Less than 1 week |
| 4 | More than one week |

Using the rating scales described in the table above, the formula used to determine each hazard's score, including weighting factors, is provided below:

**(Probability x .45) + (Magnitude/Severity x .30) + (Warning Time x .15) + (Duration x .10) = SCORE**

Based on the hazard's overall weighted score, the hazards are categorized as follows: High (3.0-4.0), Moderate (2.0-2.9), and Low (1.0-1.9).

These terms relate to the level of planning analysis to be given to the particular hazard in the risk assessment process and are not meant to suggest that a hazard would have only limited impact. In order to focus on the most critical hazards, those assigned a level of high or moderate were given more extensive attention in the remainder of the risk assessment (e.g., quantitative analysis or loss estimation), while those with a low planning significance were addressed in more general or qualitative ways.

The HMPC determined overview hazard ranking scores for the planning area as a whole. The results of this overview are provided below in Table 3-6. Additionally, the hazard ranking overview is provided at the beginning of each hazard profile and vulnerability section. A detailed hazard summary by jurisdiction for participating jurisdictions is provided at the conclusion of each hazard profile and vulnerability section to provide a summary of how the hazard varies by jurisdiction.

**Table 3-6 Emmet County Planning Area Hazard Ranking Results**

| Hazard | Probability | Magnitude | Warning Time | Duration | CPRI | Planning Significance |
|---|---|---|---|---|---|---|
| Tornado/Windstorm | 4 | 4 | 4 | 1 | 3.70 | High |
| Transportation Incident | 4 | 4 | 4 | 1 | 3.70 | High |
| Infrastructure Failure | 4 | 2 | 4 | 3 | 3.30 | High |
| River Flooding | 4 | 3 | 1 | 4 | 3.25 | High |
| Severe Winter Storm | 4 | 2 | 3 | 4 | 3.25 | High |
| Drought | 4 | 2 | 1 | 4 | 2.95 | Moderate |
| Thunderstorm/Lightning/Hail | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| Flash Flood | 4 | 2 | 3 | 1 | 2.95 | Moderate |

| Hazard | Probability | Magnitude | Warning Time | Duration | CPRI | Planning Significance |
|---|---|---|---|---|---|---|
| Grass or Wildland Fire | 4 | 2 | 4 | 1 | 3.10 | High |
| Terrorism | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| Human Disease | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| Hazardous Materials | 3 | 1 | 4 | 1 | 2.35 | Moderate |
| Animal/Plant/Crop Disease | 1 | 3 | 4 | 4 | 2.35 | Moderate |
| Extreme Heat | 2 | 2 | 1 | 4 | 2.05 | Moderate |
| Radiological Incident | 1 | 1 | 4 | 4 | 1.75 | Low |
| Earthquake | 1 | 1 | 4 | 1 | 1.45 | Low |
| Expansive Soils | 2 | 1 | 1 | 1 | 1.45 | Low |
| Landslide | 1 | 1 | 2 | 1 | 1.15 | Low |
| Sinkholes | 1 | 1 | 2 | 1 | 1.15 | Low |
| Dam/Levee Failure | 1 | 4 | 4 | 1.75 | Low | N/A |

### 3.1.7 Climate Change

In accordance with FEMA Administrator Policy 2011-OPPA-01, where possible, this plan update has considered the potential impacts of climate change on the hazards profiled. In 2010, the Iowa Climate Change Advisory Council reported to the Governor and the Iowa General Assembly on Climate Change Impacts in Iowa. The Report summarized the following climate changes Iowa is already experiencing:

#### More Precipitation

- Increased frequency of precipitation extremes that lead to flooding.
- Increase of 8 percent more precipitation from 1873 to 2008.
- A larger increase in precipitation in eastern Iowa than in western Iowa.

#### Higher Temperatures

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa's humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago, as indicated by a 3 - 5-degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

#### Agricultural Challenges

- Climate extremes, not averages, have the greater impact on crop and livestock productivity.
- Increased soil erosion and water runoff.
- Increased challenges associated with manure applications.
- Favorable conditions for survival and spread of many unwanted pests and pathogens.

#### Habitat Changes

- Plants are leafing out and flowering sooner.
- Birds are arriving earlier in the spring.
- Particular animals are now being sighted farther north than in the past.

### Public Health Effects

- Increases in heart and lung programs from increasing air pollutants of ozone and fine particles enhanced by higher temperatures.
- Increases in infectious diseases transmitted by insects that require a warmer, wetter climate.
- An increase prevalence of asthma and allergies.

## 3.2 Assets at Risk

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in the planning area that may be at risk to hazards.

### 3.2.1 Total Exposure of Population and Structures

### Unincorporated County and Incorporated Cities

Table 3-7 shows the total population and building/improvement counts and values for the county and each city. Building exposure information was derived from inventory data associated with FEMA's loss estimation software HAZUS-MH contained in Census Blocks. Content values were also included and were estimated as a percentage of building value based on their property type, using FEMA/HAZUS estimated content replacement values. Those content values are 50% for residential, 100% for agriculture, commercial, education, government, and religion, and 150% for industrial. It should be noted that all values are in thousands of dollars and a value of $0 does not necessarily mean $0 but less than $1,000.

The methodology employed to extract the summary of building/improvement counts and values from the Hazus inventory is provided below:

- General Building Stock and Building Count layers were extracted from Hazus by Property Types (Agriculture, Commercial, Education, Government, Industrial, Religion, Residential).
- Census Blocks were spatially attributed based on jurisdiction boundaries.
- Census Blocks were summarized by Building Counts and Improved Values by Jurisdiction and Property Types.

Population data is based on the U.S. Census Bureau's annual population estimates. The contents exposure values were calculated based on usage type. The contents multipliers were derived from HAZUS and are defined below in Table 3-7. Land values have been purposely excluded from the tables because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Additionally, state and federal disaster assistance programs generally do not address loss of land or its associated value (other than crop insurance).

**Table 3-7 Population and Building Exposure by Jurisdiction-Unincorporated County and Incorporated Cities**

| Jurisdiction & Population | Property Type | Building Counts | Improved Value* | Content Value* | Total Value* |
|---|---|---|---|---|---|
| Armstrong 898 | Agriculture | 4 | $1,274 | $1,274 | $2,548 |
| | Commercial | 45 | $28,337 | $28,337 | $56,674 |
| | Education | 5 | $13,798 | $13,798 | $27,596 |
| | Government | 5 | $1,650 | $1,650 | $3,300 |
| | Industrial | 19 | $63,251 | $94,877 | $158,128 |

| Jurisdiction & Population | Property Type | Building Counts | Improved Value* | Content Value* | Total Value* |
|---|---|---|---|---|---|
| | Religion | 6 | $6,736 | $6,736 | $13,472 |
| | Residential | 422 | $157,637 | $78,819 | $236,456 |
| | Total | 506 | $272,683 | $225,490 | $498,173 |
| Dolliver 81 | Agriculture | 1 | $644 | $644 | $1,288 |
| | Commercial | 2 | $1,008 | $1,008 | $2,016 |
| | Education | 0 | $0 | $0 | $0 |
| | Government | 1 | $372 | $372 | $744 |
| | Industrial | 2 | $936 | $1,404 | $2,340 |
| | Religion | 0 | $0 | $0 | $0 |
| | Residential | 43 | $17,607 | $8,804 | $26,411 |
| | Total | 49 | $20,567 | $12,232 | $32,799 |
| Estherville 6,027 | Agriculture | 17 | $5,296 | $5,296 | $10,592 |
| | Commercial | 237 | $249,774 | $249,774 | $499,548 |
| | Education | 10 | $34,649 | $34,649 | $69,298 |
| | Government | 9 | $13,227 | $13,227 | $26,454 |
| | Industrial | 47 | $77,424 | $116,136 | $193,560 |
| | Religion | 21 | $26,948 | $26,948 | $53,896 |
| | Residential | 2,551 | $775,720 | $387,860 | $1,163,580 |
| | Total | 2,892 | $1,183,038 | $833,890 | $2,016,928 |
| Gruver 105 | Agriculture | 1 | $432 | $432 | $864 |
| | Commercial | 2 | $430 | $430 | $860 |
| | Education | 0 | $0 | $0 | $0 |
| | Government | 0 | $0 | $0 | $0 |
| | Industrial | 1 | $328 | $492 | $820 |
| | Religion | 0 | $0 | $0 | $0 |
| | Residential | 43 | $16,959 | $8,480 | $25,439 |
| | Total | 47 | $18,149 | $9,834 | $27,983 |
| Ringsted 479 | Agriculture | 7 | $2,846 | $2,846 | $5,692 |
| | Commercial | 21 | $13,968 | $13,968 | $27,936 |
| | Education | 2 | $6,000 | $6,000 | $12,000 |
| | Government | 1 | $186 | $186 | $372 |
| | Industrial | 3 | $3,182 | $4,773 | $7,955 |
| | Religion | 3 | $4,758 | $4,758 | $9,516 |
| | Residential | 220 | $77,762 | $38,881 | $116,643 |
| | Total | 257 | $108,702 | $71,412 | $180,114 |
| Wallingford 180 | Agriculture | 0 | $0 | $0 | $0 |
| | Commercial | 5 | $2,830 | $2,830 | $5,660 |
| | Education | 0 | $0 | $0 | $0 |
| | Government | 3 | $3,779 | $3,779 | $7,558 |
| | Industrial | 3 | $750 | $1,125 | $1,875 |

| Jurisdiction & Population | Property Type | Building Counts | Improved Value* | Content Value* | Total Value* |
|---|---|---|---|---|---|
| | Religion | 1 | $932 | $932 | $1,864 |
| | Residential | 88 | $30,010 | $15,005 | $45,015 |
| | Total | 100 | $38,301 | $23,671 | $61,972 |
| Unincorporated 2,050 | Agriculture | 136 | $49,040 | $49,040 | $98,080 |
| | Commercial | 70 | $48,708 | $48,708 | $97,416 |
| | Education | 0 | $184 | $184 | $368 |
| | Government | 0 | $0 | $0 | $0 |
| | Industrial | 38 | $83,481 | $125,222 | $208,703 |
| | Religion | 7 | $9,044 | $9,044 | $18,088 |
| | Residential | 1,007 | $375,183 | $187,592 | $562,775 |
| | Total | 1,258 | $565,640 | $419,789 | $985,429 |
| Pop Total: 9,820 | Grand Total | 5,109 | $2,207,080 | $1,596,317 | $3,803,397 |

*All values are in thousands of dollars, a value of $0 does not necessarily mean $0 but less than $1,000.

Sources: Population Estimate, U.S. Census Bureau, American Community Survey 2016 5-Year Estimates; Building/Improvement Count and Values, Hazus MH 4.0. Contents Exposure derived by applying multiplier to Building Exposure based on HAZUS MH 2.2 standard contents multipliers per usage type as follows: Residential (50%), Agricultural, Commercial, Education, Government, Religion (100%), Industrial (150%).

**Table 3-8 Year Structure Built**

| Jurisdiction | Total Housing Units | Built 2014 or later | Built 2010 to 2013 | Built 2000 to 2009 | Built 1990 to 1999 | Built 1980 to 1989 | Built 1970 to 1979 | Built 1960 to 1969 | Built 1950 to 1959 | Built 1940 to 1949 | Built 1939 or earlier |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Emmet County | 4,773 | 0 | 48 | 218 | 205 | 289 | 564 | 581 | 746 | 407 | 1,715 |
| Armstrong | 483 | 0 | 5 | 15 | 16 | 36 | 94 | 52 | 26 | 36 | 203 |
| Dolliver | 34 | 0 | 0 | 0 | 0 | 0 | 7 | 2 | 7 | 7 | 11 |
| Estherville | 2,744 | 0 | 11 | 106 | 135 | 110 | 256 | 408 | 558 | 222 | 938 |
| Gruver | 57 | 0 | 4 | 2 | 0 | 8 | 6 | 0 | 15 | 5 | 17 |
| Ringsted | 232 | 0 | 0 | 0 | 9 | 10 | 25 | 18 | 41 | 25 | 104 |
| Wallingford | 92 | 0 | 0 | 8 | 0 | 11 | 16 | 4 | 4 | 14 | 35 |

Source: U.S. Census Bureau 2016 American Community Survey 5-Year Estimates

### Public School Districts

The 2015-2016 enrolled number of students at the participating public school districts is provided in Table 3-9, as well as the number of buildings, building values (building exposure) and contents value (contents exposure).

**Table 3-9 Enrollment and Building Exposure by Jurisdiction-Public School Districts**

| Public School District | Enrollment | Building Count | Building Exposure ($) | Contents Exposure ($) | Total Exposure ($) |
|---|---|---|---|---|---|
| Estherville-Lincoln Schools | 374 | 6 | $58,225,808 | $6,386,299 | $64,612,107 |
| North Union Schools | 1,410 | 11* | $55,292,222 | $8,044,230 | $63,336,452 |

Source: Enrollment Statistics from 2015-2016 Iowa Public School PreK-12 Enrollments by District – Iowa Department of Education, Bureau of Information and Analysis Services; Building Count and Exposure from Data Collection Guides from Public School Districts; *includes non-school buildings/assets such as administration building, bus barns, sport complexes.

## 3.2.2 Critical and Essential Facilities and Infrastructure

As part of the update to the *Emmet County Multi-Jurisdictional Hazard Mitigation Plan*, participating jurisdictions assessed the vulnerability of the following types of facilities below:

- Critical Facilities: Those facilities that are essential in providing utility or direction either during the response to an emergency or during the recovery operation.
- Essential Facilities: Those facilities that if damaged, would have devastating impacts on disaster response and/or recovery.
- High Potential Loss Facilities: Those facilities that would have a high loss or impact on the community.
- Transportation and Lifeline Facilities: Those facilities and infrastructure that are critical to transportation, communications, and necessary utilities.

Table 3-10 is a summary of the inventory of critical and essential facilities and infrastructure in the planning area. This inventory was compiled from the *2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan* and was updated by the Emmet County GIS Department for this plan update. The full list of critical facilities is included in Appendix E. This is a non-public appendix and is maintained by Emmet County Emergency Management.

**Table 3-10 Inventory of Critical/Essential Facilities and Infrastructure by Jurisdiction**

| Facility Type | Emmet County | Armstrong | Dolliver | Estherville | Gruver | Ringsted | Wallingford | Grand Total |
|---|---|---|---|---|---|---|---|---|
| Air Facility | - | - | - | 1 | - | - | - | 1 |
| College/University | - | - | - | 1 | - | - | - | 1 |
| Communications | 13 | 4 | - | 8 | - | - | - | 25 |
| Day Care Center | - | 1 | - | 4 | - | 1 | - | 6 |
| EMS | - | 1 | - | 2 | - | - | 1 | 4 |
| Fire Station | - | - | 1 | 1 | 1 | 1 | 1 | 5 |
| Hospital | - | - | - | 1 | - | - | - | 1 |
| Law Enforcement | - | 1 | - | 1 | - | - | - | 2 |
| Local EOC | - | - | - | 1 | - | - | - | 1 |
| National Shelter System Facility | - | - | - | 1 | - | - | - | 1 |
| Nursing Home | - | 1 | - | 2 | - | - | - | 3 |
| Power Plant | - | - | - | 1 | - | - | - | 1 |
| Public Health Department | - | - | - | 1 | - | - | - | 1 |
| School K-12 | - | 2 | - | 6 | - | 1 | - | 9 |
| Tier II Facility | 13 | 2 | 1 | 8 | 1 | 1 | 1 | 27 |
| Wastewater Treatment Plant | 6 | 2 | 1 | - | - | 1 | 1 | 11 |
| Grand Total | 32 | 14 | 3 | 39 | 2 | 5 | 4 | 99 |

Source: *HSIP Freedom 2015*

## Other Assets

Assessing the vulnerability of the planning area to disaster also involves inventorying the natural, historic, cultural and economic assets of the area. This is important for the following reasons:

- The plan participants may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing about them ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.
- Losses to economic assets (e.g., major employers or primary economic sectors) could have severe impacts on a community and its ability to recover from disaster.

In the planning area, specific assets include the following:

**Threatened and Endangered Species:** Table 3-11 includes Federally Threatened, Endangered, Proposed and Candidate Species in Emmet County, Iowa.

**Table 3-11 Threatened and Endangered Species in Emmet County**

| Common Name | Scientific Name | Status |
|---|---|---|
| Northern long-eared bat | *Myotis septentrionalis* | Threatened |
| Poweshiek skipperling | *Oarisma Poweshiek* | Endangered and Critical Habitat |
| Prairie bush clover | *Lespedeza leptostachya* | Threatened |
| Western prairie fringed orchid | *Platanthera praeclara* | Threatened |

Source: U.S. Fish and Wildlife Service, http://www.fws.gov/midwest/endangered/lists/iowa_cty.html

**Natural Resources:** The Emmet County Conservation Board manages the following parks and nature preserve areas in Emmet County:

- Emmet County Nature Center
- Peterson Point Historic Farmstead: 40 acres, included on National Register of Historic Places
- Wolden Rec Area: 65 acres
- Wolden Arboretum: 2 acres, features over 50 species of trees
- Tuttle Lake Recreation Area: 2,294 acres (981 in Iowa)
- Pappy's Lakeside: 4 acres
- Jim Hall Habitat Area: 37 acres of water, 46 acres of upland and timber, wildlife refuge
- Ringham Habitat Area: 76 acres
- Iowa Lake Wildlife Area: on Iowa Lake, 802 acres (308 in Iowa)
- North Trailhead: 4 acres
- Peterson Access: 3 acres

Additional details about managed areas listed above can be found at https://www.emmetcountyconservationboard.com/.

**Historic Resources:** The National Register of Historic Places is the official list of the Nation's cultural resources worthy of preservation. Authorized under the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources. The National Register is administered by the National Park Service under the Secretary of the Interior. Properties listed in the National Register include districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering and culture. Table 3-12 provides the list of properties on the National Register in Emmet County.

**Table 3-12 Properties/Landmarks on the National Register of Historic Places, Emmet County**

| City | Resource | Address | Year Listed |
|---|---|---|---|
| Wallingford | Brugjeld-Peterson Family Farmstead District | 2349 450th Ave. | 2000 |
| Armstrong | Ellsworth Ranch Bridge | 130th St., over E fork of Des Moines River | 1998 |
| Armstrong | Thompson Round Barn | Off IA 15 | 1986 |

Source: National Park Service, https://www.nps.gov/nr/research/index.htm

**Agriculture and the Economy:** Agriculture plays an important role in the Emmet County economy (see Table 3-13).

**Table 3-13 Agricultural Statistics for Emmet County**

| 2012 Census of Agriculture | |
|---|---|
| Total Land in Farms (acres) | 218,987 |
| Number of Farms | 475 |
| Average Farm Size (acres) | 461 |
| Average Age of Farmers | 56.5 |
| Market Value of All Farm Products | $292,171,000 |
| Market Value of All Crops | $156,881,000 |
| Market Value of All Livestock | $135,290,000 |
| Production Expenses | $223,043,000 |
| Hogs & Pigs Inventory (head) | 191,652 |
| **Cattle as of January 1, 2015** | |
| All Cattle and Calves (State Rank 49 (tied)) | 22,000 |
| **Crops-2014 Acreage, Yield, and Production** | **Harvested Acres** |
| Corn for Grain (State Rank 69) | 119,000 |
| Soybeans (State Rank 69) | 88,900 |

Source: Iowa Agricultural Statistics Bulletin, USDA, National Agricultural Statistics Service

## 3.3 Development Since 2013 Plan Update

This section provides information on development that has occurred since the 2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan Update.

According to data from the U.S. Census Bureau, Emmet County's population is shrinking. From 2010 to 2016, the population of the State of Iowa grew 2.9 percent, but the population of Emmet County declined by 6.3 percent. Similarly, employment grew from 2014 to 2015 by 1.7 percent for the State but declined by 1.4 percent in Emmet County.

According to the U.S. Census Bureau, the Emmet County population decreased 4.7 percent from 2010 to 2016 overall. Table 3-14 provides the population change statistics for all cities in Emmet County as well as the county as a whole.

**Table 3-14 Emmet County Population Change, 2010-2016**

| Jurisdiction | 2000 Census Population | 2010 Census Population | 2016 ACS Population Estimate | # Change 2010-2016 | % Change 2010-2016 |
|---|---|---|---|---|---|
| Emmet County, Iowa | 11,027 | 10,302 | 9,820 | -482 | -4.7% |
| Armstrong city, Iowa | 979 | 926 | 898 | -28 | -3.0% |
| Dolliver city, Iowa | 77 | 66 | 81 | 15 | 22.7% |
| Estherville city, Iowa | 6,656 | 6,360 | 6,027 | -333 | -5.2% |
| Gruver Center city, Iowa | 106 | 94 | 105 | 11 | 11.7% |
| Ringsted city, Iowa | 436 | 422 | 479 | 57 | 13.5% |
| Wallingford city, Iowa | 210 | 197 | 180 | -17 | -8.6% |

Source: U.S. Census Bureau: 2000 Decennial Census, 2010 Decennial Census, American Community Survey 2012-2016 5-Year Estimates.

Table 3-15 provides the change in numbers of housing units in the planning area from 2010 to 2016.

**Table 3-15 Change in Housing Units, 2010-2016**

| Jurisdiction | 2010 Housing Units | 2016 Housing Units | # Change 2010-2016 | % Change 2010-2016 |
|---|---|---|---|---|
| Unincorporated Emmet County | 1,037 | 1,131 | 94 | 9.1% |
| Armstrong | 439 | 483 | 44 | 10.0% |
| Dolliver | 42 | 34 | -8 | -19.0% |
| Estherville | 2,892 | 2,744 | 148 | 5.1% |
| Gruver | 40 | 57 | 17 | 42.5% |
| Ringsted | 221 | 232 | 11 | 5.0% |
| Wallingford | 87 | 92 | 5 | 5.7% |

Source: U.S. Census Bureau: 2010 Decennial Census and 2016 American Community Survey, 5-year Estimates,

Note: Unincorporated Emmet County Housing Units were estimated by subtracting populations of incorporated cities from the total Emmet County populations.

The tables below provide information on the number of buildings and structure values for privately-owned residential building permits from 2012-2016.

**Table 3-16 Privately-owned Residential Building Permits, 2012**

| Place Name | 1-unit Units | | | 2-unit Units | | | 3-4 unit Units | | | 5+ unit Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value |
| Unincorporated | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Armstrong | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dolliver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Estherville | 5 | 5 | $1,055,292 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gruver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ringsted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wallingford | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: U.S. Census Bureau, https://www.census.gov/construction/bps/

**Table 3-17 Privately-owned Residential Building Permits, 2013**

| Place Name | 1-unit Units | | | 2-unit Units | | | 3-4 unit Units | | | 5+ unit Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value |
| Unincorporated | 4 | 4 | $1,185,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Armstrong | 1 | 1 | $180,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dolliver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Estherville | 1 | 1 | $350,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gruver | 1 | 1 | $90,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ringsted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wallingford | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: U.S. Census Bureau, https://www.census.gov/construction/bps/

**Table 3-18 Privately-owned Residential Building Permits, 2014**

| Place Name | 1-unit Units | | | 2-unit Units | | | 3-4 unit Units | | | 5+ unit Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value |
| Unincorporated | 5 | 5 | $833,200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Armstrong | 2 | 2 | $470,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dolliver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Estherville | 1 | 1 | $150,000 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 40 | $4,250,000 |
| Gruver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ringsted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wallingford | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: U.S. Census Bureau, https://www.census.gov/construction/bps/

**Table 3-19 Privately-owned Residential Building Permits, 2015**

| Place Name | 1-unit Units | | | 2-unit Units | | | 3-4 unit Units | | | 5+ unit Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value |
| Unincorporated | 7 | 7 | $1,155,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Armstrong | 4 | 4 | $1,055,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dolliver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Estherville | 5 | 5 | $1,085,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gruver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ringsted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wallingford | 1 | 1 | $250,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: U.S. Census Bureau, https://www.census.gov/construction/bps/

**Table 3-20 Privately-owned Residential Building Permits, 2016**

| Place Name | 1-unit Units | | | 2-unit Units | | | 3-4 unit Units | | | 5+ unit Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value | Buildings | Units | Value |
| Unincorporated | 1 | 1 | $200,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Armstrong | 3 | 3 | $775,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dolliver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Estherville | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | $530,000 | 0 | 0 | 0 |
| Gruver | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ringsted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wallingford | 1 | 1 | $250,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: U.S. Census Bureau, https://www.census.gov/construction/bps/

As demonstrated in the above tables, the City of Estherville has had the greatest amount of new residential construction, followed by the unincorporated county and the City of Armstrong. Since the last plan update, the following development was reported by participating school districts.

*North Union Schools*
None reported.

*Estherville-Lincoln Schools*
None reported.

## 3.4 Future Land Use and Development

The following sections provide details regarding future growth, land use and development. The information in this section comes from the *Emmet County 2013 Multi-jurisdictional Hazard Mitigation Plan*, information provided by each of the participating jurisdictions as well as other sources, cited throughout.

Table 3-21 provides the Population projections for Emmet County by Woods & Poole Economics, Inc. It should be noted that the Emmet County population is decreasing at a higher rate than projected. The American Community Survey 5-Year Estimate for 2016 population of 9,820 is already below the 2020 projection and has nearly reached the 2025 projection.

***Emmet County***

**Table 3-21 Emmet County 2010 Population and Population Projections, 2020-2040**

| 2010 Population | 2020 Population Projection | 2025 Population Projection | 2030 Population Projection | 2035 Population Projection | 2040 Population Projection |
|---|---|---|---|---|---|
| 10,302 | 10,004 | 9,839 | 9,677 | 9,516 | 9,358 |

Source: 2010 Population from the U.S. Census Bureau 2010 Decennial Census; Population Projections from the "2010 State Profile: Iowa", Woods & Poole Economics, Inc, Inc., www.woodsandpoole.com Prepared by: State Library of Iowa, State Data Center Program

*Unincorporated County*
The Unincorporated County areas are not expected to see significant growth in the near future. The County did not report any specific plans for future development and does not anticipate growth in any known hazard areas, including the 1% annual chance floodplain. Between 2012 and 2016, only 17 new residential building permits were issued for construction in the unincorporated areas.

*City of Armstrong*
None reported.

*City of Dolliver*
None reported.

*City of Estherville*
The City of Estherville updated their Comprehensive Plan in 2017 and has experience the most residential construction in the county, with 55 permits for new residential construction issued between 2012 and 2016. However, the City does not anticipate any future development in the floodplain or other hazard areas.

It was noted that a significant percentage of new home construction are homes without basements.

No new City facilities or infrastructure are planned at this time.

*City of Gruver*
The City does not anticipate any growth occurring in hazard areas, nor are any new facilities or infrastructure planned for construction within the next five years. Critical facilities and exposure are expected to remain the same.

*City of Ringsted*
None reported

***School Districts' Future Development***
This section summarizes future development for the participating school districts:

*North Union Schools*
None reported.

*Estherville-Lincoln Schools*
None reported.

*Iowa Lakes Community College*
The following projects are planned for within the next five years:

- Performing Arts addition in Estherville in 2018-2019
- Renovation of old business/financial aid/admissions offices in Emmetsburg

None of these projects are located in hazardous areas.

## 3.5 Hazard Profiles and Vulnerability

### Hazard Profiles

***Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.***

Each hazard identified in Section 3.1.4 is profiled individually in this section in alphabetical order.

The level of information presented in the profiles varies by hazard based on the information available. With each update of this plan, new information will be incorporated to provide for better evaluation and prioritization of the hazards that affect the planning area. Detailed profiles for each of the identified hazards include information categorized as follows:

### Hazard Description
This section consists of a general description of the hazard and the types of impacts it may have on a community. It also includes the ratings assigned to the hazard relative to typical warning times and duration of hazard events as described in Table 3-5.

### Geographic Location/Extent
This section describes the geographic location of the hazard in the planning area. Where available, maps are utilized to indicate the specific locations of the planning area that are vulnerable to the subject hazard. This section also provides information as to the extent of the hazard (i.e. the size or degree of impacts).

### Previous Occurrences
This section includes information on historic incidents and their impacts.

### Probability of Future Occurrence
The frequency of past events is used to gauge the likelihood of future occurrences. Where possible, the probability or chance of occurrence was calculated based on historical data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period, which suggests a 10 percent chance of a drought occurring in any given year. For each hazard, the probability is assigned a rating as defined in Table 3-5.

### Vulnerability Assessments
***Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.***

***Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.***

***Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.***

***Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.***

***Requirement §201.6(c)(2)(ii): (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged in floods.***

Following the hazard profile for each hazard is the vulnerability assessment. The vulnerability assessment further defines and quantifies populations, buildings, critical facilities and other community assets at risk to natural hazards. The vulnerability assessments were conducted based on the best available data and the significance of the hazard.

Detailed profiles for each of the identified hazards include information categorized as follows:

### Vulnerability Overview
This section consists of a general overview narrative of the planning area's vulnerability to the hazard. Within this section, the magnitude/severity of the hazard is discussed. The magnitude of the impact of a hazard event (past and perceived) is related directly to the vulnerability of the people, property and the

environment it affects. This is a function of when the event occurs, the location affected, the resilience of the community and the effectiveness of the emergency response and disaster recovery efforts.

For each hazard, the magnitude/severity is assigned a rating as defined in Table 3-5.

### Potential Losses to Existing Development

This section provides the potential losses to existing development. Where data is available, this section provides estimated financial losses as well as the methodology used. For hazards with an overall "Low" rating, potential losses may not be discussed.

### Future Development

This section provides information on how vulnerability to this hazard will be impacted by planned future development, as well as information for jurisdictions to consider in planning future development.

### Climate Change Impacts

This section will discuss any potential impacts to this hazard as a result of climate change.

### Hazard Summary by Jurisdiction

For hazards that vary by jurisdiction, this section will provide an overview of how the hazard varies, followed by a table indicating the probability, magnitude, warning time and duration rankings for each participating jurisdiction with the resulting hazard score and level.

## 3.5.1 Animal/Plant/Crop Disease

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 3 | 4 | 4 | 2.35 | Moderate |

### Profile

#### *Hazard Description*

Agricultural infestation is the naturally occurring infection of vegetation, crops or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption or use. Because of Iowa's overall substantial agricultural industry and related facilities and locations, the potential for infestation of crops or livestock poses a significant risk to the economy of the State. Iowa cropland is vulnerable to disease and other agricultural pests.

Some level of agricultural infestation is normal in Iowa. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. The levels and types of agricultural infestation appear to vary by many factors, including cycles of heavy rains and drought.

*Animal Disease*

Agricultural incidents are naturally occurring infection of livestock with insects, vermin, or diseases that render the livestock unfit for consumption or use. The livestock inventory for the state of Iowa includes nearly 4 million cattle and calves. According to the USDA National Agricultural Statics Service, as of January 1, 2015, Emmet County ranked 49th in the state with 22,000 head of cattle and calves. According to the 2012 Census of Agriculture, there were also 191,652 head of hogs and pigs in Emmet County.

With this substantial agricultural industry and related facilities throughout the County, the potential for infestation of livestock poses a significant risk to the economy in the planning area.

The Iowa Department of Agriculture and Land Stewardship (IDALS) monitors and reports on the following animal reportable diseases in Iowa:

- Avian Influenza
- Bovine Spongiform Encephalopathy (BSE) Disease
- Chronic Wasting Disease
- Exotic Newcastle Disease
- Foot and Mouth Disease
- Johne's Disease
- Pseudo rabies
- Scrapie, and
- West Nile Virus.

Producers are required by state law to report any of the reportable animal diseases to the IDALS's Bureau of Animal Industry. The IDALS's Bureau of The Center for Agriculture Security is the lead coordinating bureau for any emergency response for an agriculture incident.

**Avian influenza** continues to be of concern in Iowa as the State is number one in poultry egg layers (approximately 40 million). Source: Iowa Poultry Association, 2014.

**Bovine Spongiform Encephalopathy (BSE)** "mad cow" disease is a chronic, degenerative disease affecting the central nervous system of cattle. Cases have been found world-wide since 1986, but in Canada and the U.S. only a single cow was reported with BSE in 2003.

**Chronic Wasting Disease (CWD)** is a fatal, neurological disease of farmed and wild deer and elk. The disease has been identified in wild and captive mule deer, white-tailed deer and North American elk, and in captive black-tailed deer. The first case of CWD in Iowa was found in 2012 on a hunting preserve in the southeastern part of the State.

**Exotic Newcastle disease (END)** is a contagious and fatal viral disease affecting all species of birds. There was an epidemic of END in California in 2003 that is resulting in the death of millions of chickens and other birds, and costing millions of dollars. END is probably one of the most infectious diseases of poultry in the world. END is so virulent that many birds die without showing any clinical signs.

**Johne's (yo-knees) disease** is a contagious, chronic and eventually fatal infection that affects the small intestine of ruminants, including cattle, sheep and goats. Johne's, also called Para tuberculosis, is a slow progressive wasting disease with an incubation period of usually 2 or more years. Johne's is a reportable disease, but not a quarantinable disease.

**Pseudo rabies** is a viral disease most prevalent in swine, often causing newborn piglets to die. Older pigs can survive infection, becoming carriers of the pseudo rabies virus for life. Other animals infected from swine die from pseudo rabies, which is also known as Aujeszky's disease and "mad itch." Infected cattle and sheep can first show signs of pseudo rabies by scratching and biting themselves. In dogs and cats, pseudo rabies can cause sudden death. The virus does not cause illness in humans. Due to an extensive eradication program, Iowa and the rest of United States are free of pseudo rabies.

**Scrapie** is a fatal, degenerative disease affecting the central nervous system of sheep and goats that is very similar to BSE (mad cow disease), although it does not cause disease in humans, and has been present in the U.S. for over 50 years. Infected flocks that contain a high percentage of susceptible animals can experience significant production losses. In these flocks, over a period of several years, the number of infected animals increases and the age at onset of clinical signs decreases making these flocks

economically unviable. Animals sold from infected flocks spread scrapie to other flocks. The presence of scrapie in the U.S. also prevents the export of breeding stock, semen and embryos to many other countries. Currently there is a national program underway to eradicate scrapie in the U.S.

Disease outbreaks can also occur in wild animal populations. The IDALS's Bureau of Animal Industry also monitors wild animal species and game throughout the state as well as diseases that may impact them.

*Crop Pests/Diseases*

A plant disease outbreak or a pest infestation could negatively impact crop production and agriculturally dependent businesses. An extreme outbreak or infestation could potentially result in billions of dollars in production losses across the U.S. The cascading net negative economic effects could result in wide-spread business failures, reduction of tax revenues, harm to other state economies, and diminished capability for this country to compete in the global market.

Many factors influence disease development in plants, including hybrid/variety genetics, plant growth stage at the time of infection, weather (e.g., temperature, rain, wind, hail, etc.), single versus mixed infections, and genetics of the pathogen populations. The two elements of coordination and communication are essential when plant diseases or pest infestations occur. The United States Department of Agriculture/ Animal Plant Health Inspection Service, Iowa Department of Agriculture and Land Stewardship, local producers, local government, assessment teams and state government entities must work together to effectively diagnose the various plant hazards to determine if immediate crop quarantine and destruction is required.

Iowa State University, College of Agriculture and Life Sciences, has The Plant and Insect Diagnostic Clinic http://www.ipm.iastate.edu/ipm/info/insects that provides diagnosis of plant problems (plant diseases, insect damage, and assessment of herbicide damage) and the identification of insects and weeds from the field, garden, and home. Specific plant pests can vary from year to year. For complete details of all insects and diseases that can impact crops in Emmet County, see the website above.

*Emerald Ash Borer*

The Hazard Mitigation Planning Team is also aware of the emerald ash borer pest that threatens Iowa's forests and urban landscape. This pest is a slender, emerald green beetle that is ½ inch long, and responsible for the destruction of approximately 20 million ash trees in Ohio, Michigan, Indiana, Illinois, and Ontario, Canada. Emerald Ash Borer has made its way into Iowa and has become an increasing threat.

*Wildlife*

Iowa farmers lose a significant amount of crops each year as a result of wildlife foraging. This can be particularly problematic in areas where natural habitat has been diminished or in years where weather patterns such as early/late frost deep snow, or drought has caused the wild food sources to be limited.

**Warning Time Score:** 4 - minimal or no warning time

**Duration Score:** 4 - more than 1 week

## Geographic Location/Extent

All of Emmet County is subject to animal/livestock incidents and agricultural infestations. According to the 2012 Census of Agriculture there were 475 farms in the County covering 218,987 acres of land (73.3 percent of the 467 sq. miles of land area (298,880 acres) in the County).

Table 3-22 provides a summary of the value of agricultural products sold in the planning area. Agricultural infestation of crops or livestock in the planning area would severely affect the economy.

**Table 3-22 Market Value of Agricultural Products Sold, 2012 - Emmet County, IA**

| | |
|---|---|
| **Market Value of Products Sold** | $292,171,000 |
| **Market Value of Crops** | $156,881,000 (53.7 percent) |
| **Market Value of Livestock** | $135,290,000 (46.3 percent) |
| **Average Per Farm** | $615,096 |

Source: USDA National Agricultural Statistics Service, 2012 Census of Agriculture.

### *Animal Location/Extent*

In addition to the animal farm operations, there are also confined and open feeding operations in Emmet County. According to data from the Iowa NRGIS Repository, there are 130 Animal Feeding Operations listed in the Iowa Department of Natural Resources Animal Feeding Operations Database. This includes 92 Confined Animal Feeding Operations and 26 Open Feedlots, and 12 combination Confined/Open feedlot. There are also two registered Captive Cervid Herd in Emmet County (deer and elk).

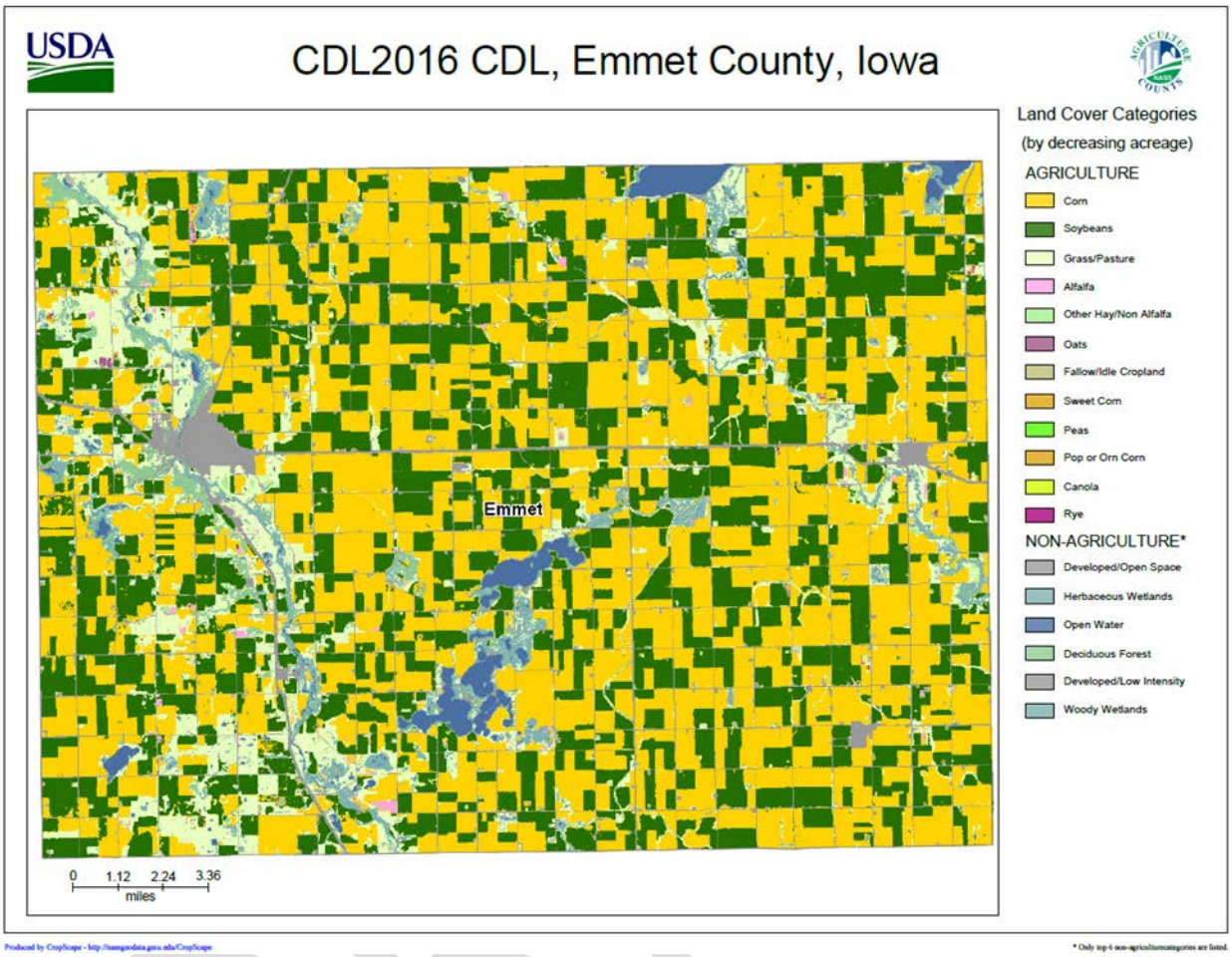
### *Crop Location/Extent*

According to the National Agricultural Statistics Service, in 2014 Emmet County's top crop items included the following:

- Corn for Grain (State Rank 69)-119,000 acres harvested
- Soybeans (State Rank 69)-898,900 acres harvested

As can be seen in the USDA Cropland Data Layer (CDL) in Figure 3-1, the majority of land in Emmet County outside the incorporated areas is in agricultural use, with primary crops of corn and soybeans.

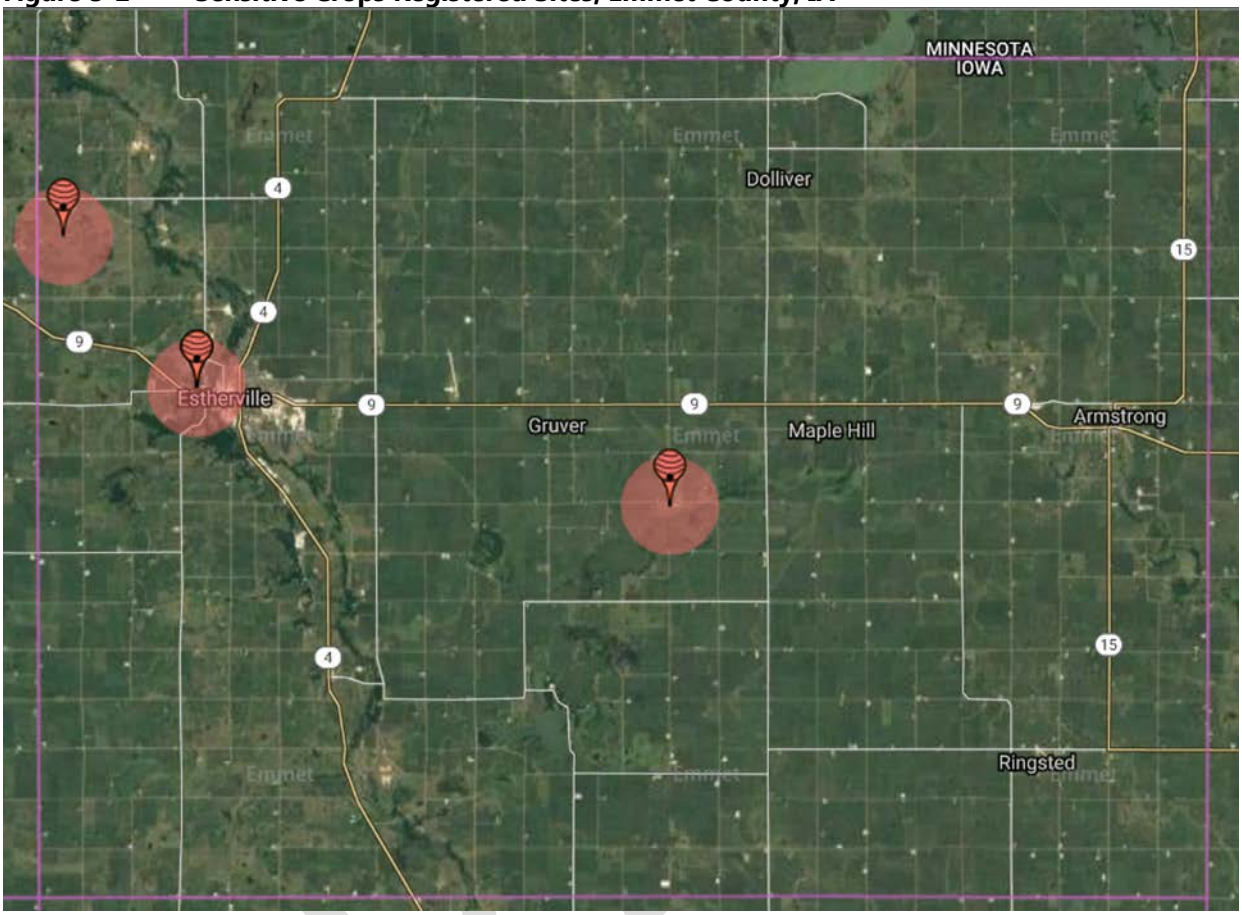
**Figure 3-1 Emmet County Cropland Data Layer**




Source: USDA, produced by CropScape, https://nassgeodata.gmu.edu/CropScape/

Figure 3-2 provides the locations of the sites included on the Sensitive Crops Registry according to the Iowa Department of Agriculture and Land Stewardship, Pesticide Bureau. The types of sensitive crops in the county include berries, orchard, non-specified organic, and beehives.

**Figure 3-2 Sensitive Crops Registered Sites, Emmet County, IA**

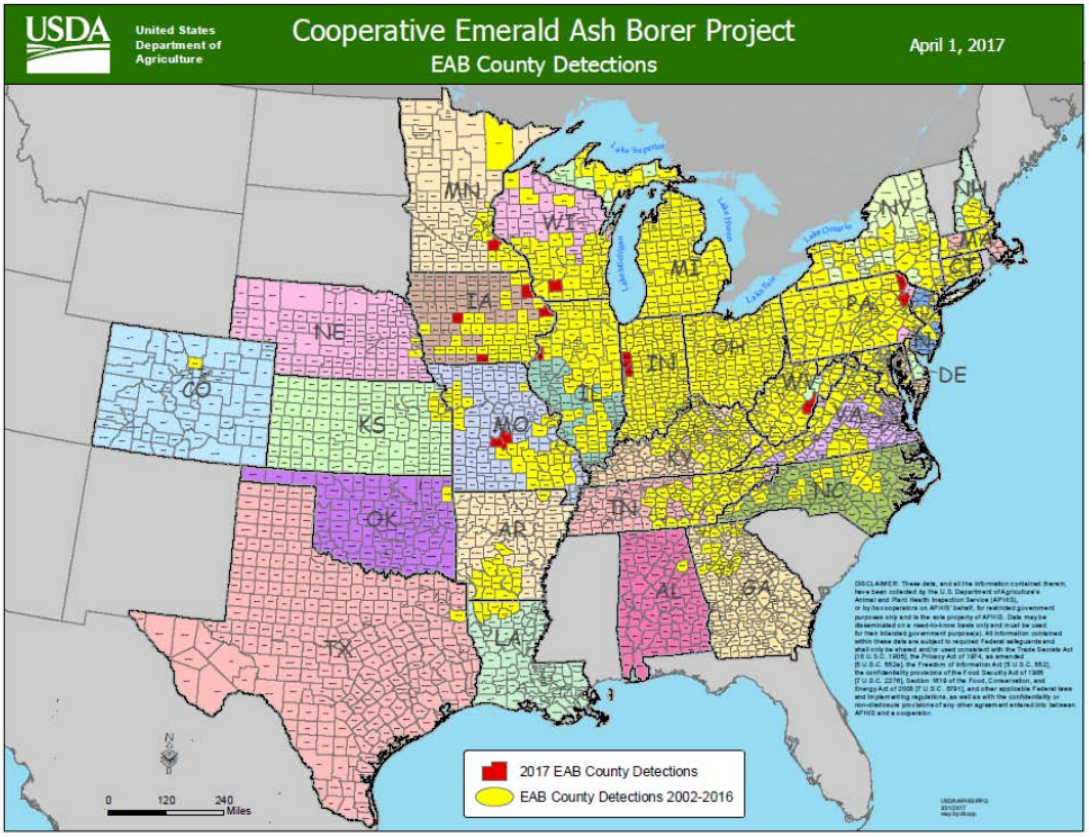


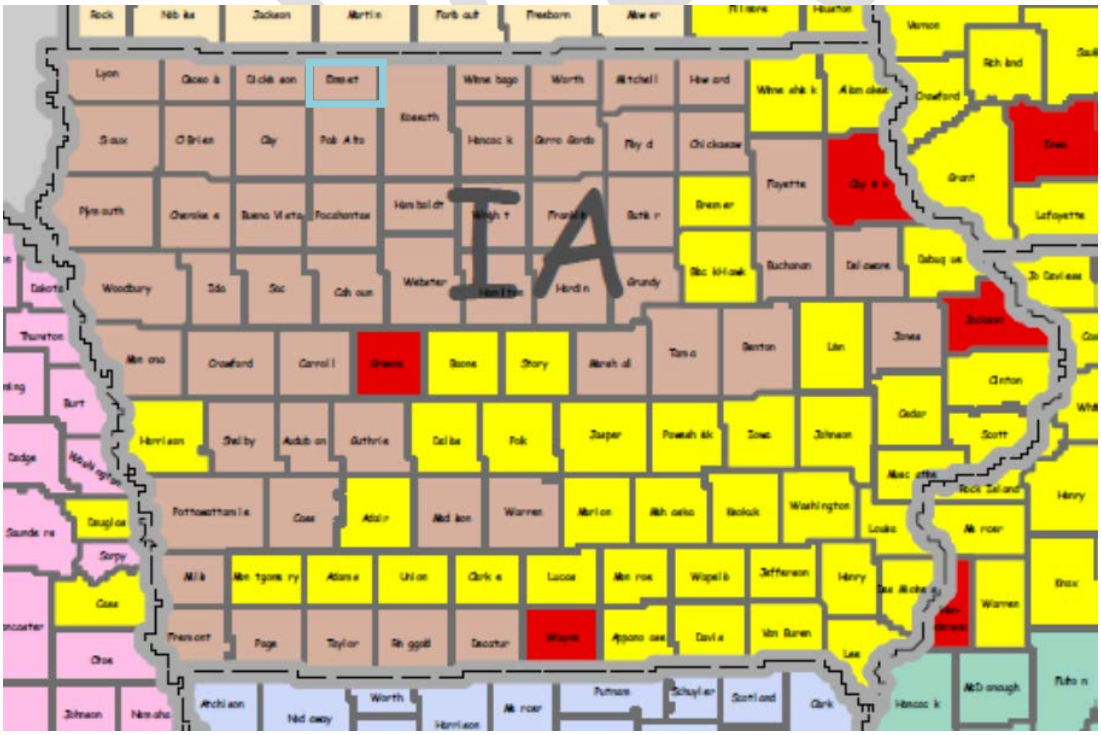

Source: Iowa Specialty Crop Site Registry, https://ia.driftwatch.org/map

### *Emerald Ash Borer Location/Extent*

Figure 3-3 shows the counties in the U.S. in which the Emerald Ash Borer has been detected. Emmet County is not shaded yellow or red, indicating there has not been any Emerald Ash Borer detected in the County between 2002 and 2017.

**Figure 3-3 USDA Emerald Ash Borer County Detection Map**



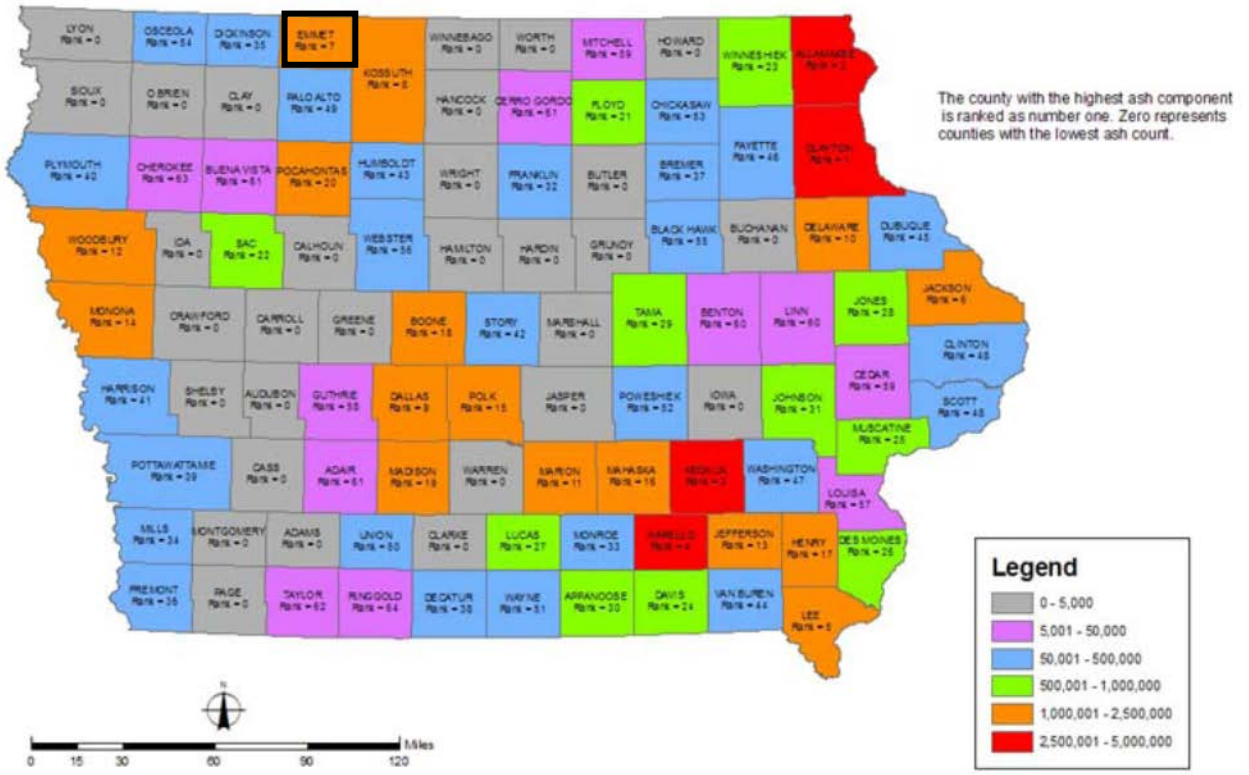

Source: http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/index.shtml;

Blue square identifies Emmet County

It is estimated by the Iowa Department of Natural Resources – Forestry Bureau that approximately 15-20 percent of public trees in Iowa cities are green ash. In some communities, ash comprises more than 60 percent of the public trees. Statewide, there are over 50 million ash trees (green, white and black) in bottomland and upland forests (2005 USDA Forest Service, Forest Inventory Data) and another 30 million urban ash trees (Iowa Department of Natural Resources – Forestry Bureau).

As seen in Figure 3-4 below, Emmet County ranks 7th in the state with up to 2,500,000 ash trees in the County according to data from the U.S. Forest Service. Also, a cooperative state and federal effort has developed the "Iowa Emerald Ash Borer Readiness Plan" http://www.extension.iastate.edu/pme/EAB%20other%20forms/IA%20EAB%20Readiness%20Plan%2010MAY2010.pdf to help stop this pest by education, monitoring, surveillance, containment and communication.

**Figure 3-4 Distribution of Ash Trees in Iowa**




Source: Iowa State University Extension Office
http://www.extension.iastate.edu/pme/EAB%20other%20forms/Iowa%20Ash%20Tree%20Distribution%202006%20map.jpg

Note: Emmet County is outlined in black.

## Previous Occurrences

Beginning in April of 2015, there were a significant number of confirmed diagnoses of avian influenza in the State of Iowa. As a result, on Friday May 1, 2015, Governor Branstad declared a state of emergency. The last positive flock was detected on June 16, 2015. Confirmed cases occurred in the following counties: Buena Vista, Calhoun, Cherokee, Clay, Hamilton, Kossuth, Lyon, Madison, O'Brien, Osceola, Palo Alto, Plymouth, Pocahontas, Sac, Sioux, Webster, and Wright. Infected flocks were depopulated and composted and clean up and disinfection occurred. There were 77 total premises and 34 million birds affected. This

included 35 commercial turkey flocks, 22 commercial egg production flocks, 13 pullet flocks, 1 breeding flock for a mail order hatchery, and 6 backyard flocks. More than 2,300 USDA staff and contractors were dispatched to Iowa to assist with the response to the avian influenza situation, including a USDA Incident Management Team (IMT). More than 300 state employees also participated in the disaster response (http://www.iowaagriculture.gov/AvianInfluenza.asp). There were no reported infected flocks in Emmet County.

*Bovine Spongiform Encephalopathy (BSE) (A.K.A. Mad Cow Disease)*

To date, BSE has been confirmed in Great Britain, Belgium, France, Germany, Spain, Switzerland, Japan, Canada, and the United States. In the United States, the first positive BSE cow was discovered in Washington. As a result of a surveillance program from June 2004 to March 2006, two additional positive domestic cows were found; one each in Texas and Alabama. Since 1997 FDA implemented a feed ban prohibiting the feeding of feedstuff derived from ruminants to other ruminants. The results of this ban and enhanced surveillance indicate that while BSE is present, it is at an extremely low level in U.S. cattle.

*Chronic Wasting Disease*

The first case of CWD in Iowa was found in 2012 on a hunting preserve in the southeastern part of the state. In that case, it was determined the CWD-positive mature buck had been transferred to the hunting preserve from a deer farm in north central Iowa. Subsequent testing found CWD at the deer farm. The farm was placed under quarantine, but the owners sued for compensation. The litigation prevented the farm from being depopulated of deer until August 2014. The Iowa Department of Agriculture and Land Stewardship conducted testing. Results were released in early October 2014, stating that 284 of 356 deer (80 percent) from a captive herd in north-central Iowa tested positive for chronic wasting disease. This finding represents the highest number of CWD-positive animals detected at a facility, according to wildlife health officials (Milwaukee-Wisconsin Journal Sentinel, October 4, 2014). In 2014, the first case of CWD was found in a wild deer in Allamakee County. Then in 2015, two wild deer tested positive for CWD in Allamakee County.

*Scrapie*

There has been a total of 37 sheep flocks in Iowa that have been found to be infected with Scrapie since the accelerated national Scrapie Eradication Program started in November 2001. Of those, 10 have been depopulated and 27 have completed, or are currently completing a genetic flock plan. Iowa's last infected flock was found in June 2010.

*Rabies*

According to the Iowa Department of Public Health, Center for Acute Disease Epidemiology, there were 12 confirmed animal rabies cases in Iowa in 2015. In 2014, there were 15. In 2013, there were 12. In 2012, there were 31 and in 2011 there were 25. In 2016, there were 16 confirmed cases in the state.

In Emmet County, there has been one confirmed cases of rabies since 2011. Table 3-23 summarizes the occurrence of rabies in Emmet County from 2011-2016.

**Table 3-23 Rabies Cases in Emmet County, 2011-2016**

| Year | Confirmed Rabies Cases #/Animal |
|---|---|
| 2016 | 0 |
| 2015 | 0 |
| 2014 | 0 |
| 2013 | 0 |
| 2012 | 1/Skunk |
| 2011 | 0 |

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology, https://idph.iowa.gov/rabies/resources

The HMPC noted that the county had experienced problems with Asian Beetle, but mitigated the issue through a spraying program. The HMPC also noted that they were not impacted during the Avian Flu outbreak in 2015.

According to the U.S. Department of Agriculture's Risk Management Agency, during the 10-year period from 2007-2016, combined crop insurance payments for damages resulting from disease $48,135 in Emmet County. The Iowa Statewide average for insurable crop acres with insurance is 89 percent (USDA Risk Management Agency, 2015 Iowa Crop Insurance Profile.) Table 3-24 provides a summary of insured crop losses as a result of crop infestations

**Table 3-24 Crop Insurance Payments for Crop Pests/Diseases 2007-2016**

| Damage Cause | Sum of Indemnity Amount | Sum of Determined Acres |
|---|---|---|
| **Asian Soybean Rust** | **$22,108.00** | **312** |
| 2014 | $22,108.00 | 312 |
| **Plant Disease** | **$12,420.00** | **58** |
| 2010 | $3,416.00 | 5 |
| 2014 | $9,004.00 | 53 |
| **Mycotoxin (Aflatoxin)** | **$13,607.00** | **42** |
| 2010 | $13,607.00 | 42 |
| **Grand Total** | **$48,135.00** | **412** |

Source: USDA Risk Management Agency

## Probability of Future Occurrence

The planning area experiences some level of agricultural loss every year as a result of naturally-occurring diseases that impact animals/livestock. The concern is when the level of an infestation escalates suddenly, or a new infestation appears, overwhelming normal control efforts. Normal control efforts include crop insurance and employment of various other agricultural practices that limit impact. For purposes of determining probability of future occurrence, the HMPC defined "occurrence" as an infestation occurring suddenly, a new infestation, or infestation that overwhelmed normal control efforts. Research did not reveal any infestations in Emmet County that have reached this level of defined "occurrence". Therefore, it was determined that the probability of this defined "occurrence" of agricultural infestation is "Unlikely".

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Overview*

A widespread infestation of animals/livestock and crops could impact the economy of the County. According to the USDA 2012 Census of Agriculture, Emmet County agriculture provides 2,461 jobs representing 39.2 percent of Emmet County's total workforce (Source: Coalition to Support Iowa's Farmers, http://www.supportfarmers.com/Assets/2014/cntydata/Emmet.pdf).

In 2012 the total market value of Emmet County's agricultural products sold was $156,900,000. With this contribution of agriculture to the economy, a wide-scale agricultural infestation could severely impact the economic stability of the County.

**Magnitude Score:** 3 - Critical

### *Potential Losses to Existing Development*

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. Its impacts are primarily economic and environmental, rather than structural effects.

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-75 percent of livestock receipts. The market value of all livestock in Emmet County in 2012 was $135,300,000. Based on a worst-case scenario where 75 percent of livestock is lost in a given year due to agricultural infestations, the total direct costs could exceed $101 million.

Table 3-25 provides the annual crop losses for insurable crops. The insurable loss is adjusted to estimate losses to all insurable crops by considering that 89 percent of insurable crops in the State were insured (2015 Iowa Crop Insurance Profile from USDA's Risk Management Agency).

**Table 3-25 Estimated Insurable Crop Losses Resulting from Disease, Infestation, and Wildlife**

| Crop Insurance Paid-10 yrs. | Adjusted 10-year Losses | Annual Estimated Losses |
|---|---|---|
| $48,135.00 | $54,084 | $5,408 |

Source: USDA Risk Management Agency; adjust loss calculation by Amec Foster Wheeler

Rough estimates of potential direct losses from a maximum threat event fall in a range of 1-50 percent of annual crop receipts. The market value of all crops sold in Emmet County in 2012 was $156,900,000. Based on a worst-case scenario where 50 percent of crop production is lost in a given year due to agricultural infestations, the total direct costs could exceed $78 million.

The U.S. Forest Service estimates that Emmet County has up to 2,500,000 ash trees in the County. Removal of debris if an infestation would occur would be challenging and costly. If only 10 percent of the Ash trees were impacted in Emmet County that could translate to 250,000. It is estimated that it costs $682 to replace each Ash tree. In Emmet County, this translates to over $170 million.

## Future Development

Future development is not expected to significantly impact the planning area's vulnerability to this hazard. However, if crop production and numbers of animals/livestock increases, the amount vulnerable to infestation also increases. Regarding the Emerald Ash Borer, the Iowa Department of Natural Resources recommends that other native tree species be planted in lieu of Ash trees to avoid increasing vulnerability to infestation of the Emerald Ash Borer.

## Climate Change Impacts

The climate change impacts below are excerpted from the 2010 Report on Climate Change Impacts on Iowa developed by the Iowa Climate Change Impacts Committee.

### *Crops*

Despite great improvements in yield potential over the last several years, crop production remains highly dependent on climate in conjunction with other variables. The overall effect of climate change on crop productivity in Iowa remains unclear, as positive climatic events could be overridden by the impacts of poor management or genetics, or favorable management and genetics could override negative climate events.

Regardless of these interactions, it is certain that climate changes will affect future crop production. Greenhouse and growth chamber studies suggest increases in atmospheric carbon dioxide (CO2) will generally have a substantial positive effect on crop yields by increasing plant photosynthesis and biomass accumulation.

Greater precipitation during the growing season, as we have been experiencing in Iowa, has been associated with increased yields; however, excessive precipitation early in the growing season adversely affects crop productivity. Waterlogged soil conditions during early plant growth often result in shallower root systems that are more prone to diseases, nutrient deficiencies and drought stress later in the season.

An increase in temperature, especially during nighttime, reduces corn yield by shortening the time in which grain is accumulating dry matter (the grain fill period). According to research, Iowa's nighttime temperatures have been increasing more rapidly than daytime temperatures.

The current changes in precipitation, temperature, wind speeds, solar radiation, dew-point temperatures, and cloud cover imply less ventilation of crops and longer dew periods. Soybean plants in particular readily absorb moisture, making harvest problematic. One adaptive approach to these conditions involves farmers purchasing larger harvesting equipment to speed harvest, compensating for the reduced daily time suitable for soybean harvest.

The recent extreme weather events involving greater intensity and amount of rainfall have increased the erosive power of Iowa's precipitation, resulting in significant erosion of topsoil. The impact of climate change on the erosive force of precipitation in the U.S. is expected to increase by as much as 58%. These rates are expected to increase exponentially as precipitation continues to rise.

Plant disease can also increase as temperature, soil wetness, and humidity increase as these conditions favor the development of various plant diseases.

#### *Animals*

Despite the fact that Iowa ranks first in hog and fifth in cattle production nationwide, there is a lack of information about the effects of climate change on animal production in Iowa. Nevertheless, our general knowledge and principles pertaining to livestock and extreme weather events are applicable to Iowa's changing climate conditions.

High temperatures have been shown to reduce summer milk production, impair immunological and digestive functions of animals, and increase mortality rates among dairy cattle.

In general, domestic livestock can adapt to gradual changes in environmental conditions; however, extended periods of exposure to extreme conditions greatly reduce productivity and is potentially life threatening.

### Animal/Crop/Plant Disease Hazard Summary by Jurisdiction

The magnitude determinations discussed in the vulnerability overview sections were factored into the following hazard summary table to show how this hazard varies by jurisdiction. It has been determined that the magnitude of animal/crop/plant disease would be slightly less in the cities and for the school districts due to less agriculture within city limits. However, an infestation of the Emerald Ash Borer would likely have a larger impact in the incorporated areas and the economy of incorporated areas is heavily dependent on agriculture. As a result, the magnitude in the unincorporated area was determined to be a 3 and the magnitude in the incorporated areas was determined to be a 2. School districts would have limited Ash trees to dispose of in the event of infestation. Therefore, the magnitude was determined to be a 1.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 3 | 4 | 4 | 2.35 | Moderate |
| City of Armstrong | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| City of Dolliver | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| City of Estherville | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| City of Gruver | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| City of Ringsted | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| City of Wallingford | 1 | 2 | 4 | 4 | 2.05 | Moderate |
| North Union Schools | 1 | 1 | 4 | 4 | 1.75 | Low |
| Estherville-Lincoln Schools | 1 | 1 | 4 | 4 | 1.75 | Low |
| Iowa Lakes Community College | 1 | 1 | 4 | 4 | 1.75 | Low |

### 3.5.2 Dam/Levee Failure

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 1 | 4 | 4 | 1.75 | N/A |

## Profile

### *Hazard Description*

Many of Iowa's community settlements were founded along rivers and streams due to their reliance on water resources. Often, these streams or rivers later needed a dam or levee for flood control or a reservoir for a constant water source. This section discusses both dam and levee failure.

*Dam Failure*

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. Dam failure is the uncontrolled release of impounded water resulting in downstream flooding, affecting both life and property. Dam failure can be caused by any of the following: flooding; earthquakes, flow blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or terrorism.

*Levee Failure*

Levee Failure is the uncontrolled release of water resulting from a structural failure. Possible causes of the failure could include flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, terrorism, erosion, piping, saturation, or under seepage.

**Warning Time Score:** 4 - Minimal or no warning (up to 6 hrs. warning)

**Duration Score:** 4 - More than 1 week

### *Geographic Location/Extent*

*Dams in Planning Area*

The thresholds for when a dam falls under State regulation are outlined in Iowa Administrative Code 567-71.3 and are listed below. The thresholds are primarily based on both dam height and water storage volumes. State regulated dams are those dams that meet the following:

In rural areas:

a. *Any dam designed to provide a sum of permanent and temporary storage exceeding 50 acre-feet at the top of dam elevation, or 25 acre-feet if the dam does not have an emergency spillway, and which has a height of 5 feet or more.*

b. *Any dam designed to provide permanent storage in excess of 18 acre-feet and which has a height of 5 feet or more.*

c. *Any dam across a stream draining more than 10 square miles.*

d. *Any dam located within 1 mile of an incorporated municipality, if the dam has a height of 10 feet or more, stores 10 acre-feet or more at the top of dam elevation and is situated such that the discharge from the dam will flow through the incorporated area.*

In urban areas:

*Any dam which exceeds the thresholds in 71.3 (1) "a", "b", or "d".*

Low head dams:

*Any low head dam on a stream draining 2 or more square miles in an urban area, or 10 or more square miles in a rural area.*

Dams are classified by the State of Iowa into three categories based on the potential risk to people and property in the event of failure (see Table 3-26). The classification can change over time due to changes in development downstream from the dam. In addition, older dams may not have been built to the standards of their updated classification when this occurs. The Iowa Department of Natural Resources performs annual inspections on all high hazard dams in the State.

**Table 3-26 Dam Hazard Classification Definitions**

| Hazard Class | Definition |
|---|---|
| High | A structure shall be classified as high hazard if located in an area where failure may create a serious threat of loss of human life or result in serious damage to residential, industrial, or commercial areas, important public utilities, public buildings, or major transportation facilities. |
| Moderate (Significant)* | A structure shall be classified as moderate hazard if located in an area where failure may damage isolated homes or cabins, industrial or commercial buildings, moderately traveled roads or railroads, or interrupt major utility services, but without substantial risk of loss of human life. In addition, structures where the dam and its impoundment are of themselves of public importance, such as dams associated with public water supply systems, industrial water supply or public recreation, or which are an integral feature of a private development complex, shall be considered moderate hazard for design and regulatory purposes unless a higher hazard class is warranted by downstream conditions. |
| Low | A structure shall be classified as low hazard if located in an area where damages from a failure would be limited to loss of the dam, loss of livestock, damages to farm outbuildings, agricultural lands, and lesser used roads, and where loss of human life is considered unlikely. |

Source: Iowa Department of Natural Resources; *the term "moderate" is used by the Iowa Department of Natural Resources. However, the National Inventory of Dams uses the term "significant" to identify the same general hazard classification

For this plan update, both the National Inventory of Dams as well as the State-regulated dam inventory were consulted. There are five dams inside the county boundaries of Emmet County, and all five are Low Hazard dams.

Table 3-27 provides the names, locations, and other pertinent information for all dams in the planning area. There are no dams upstream of the County that could be expected to impact County assists.

**Table 3-27 Dams in the Emmet County Planning Area**

| Dam Name | NID # | Hazard Class | EAP | Dam Ht. (ft.) | Max Storage (acre-ft.) | Normal Storage (acre-ft.) | River | Nearest Downstream City/Distance (miles) |
|---|---|---|---|---|---|---|---|---|
| Burg Dam | IA03922 | L | N/A | 35 | 19 | 9 | TR- West Fork Des Moines River | Graettinger (N/A) |
| Koekenhoff Dam | IA03654 | L | N/A | 13 | 108 | 22 | TR- Des Moines River | Armstrong (N/A) |
| Quastad Dam | IA01554 | L | N/A | 35 | 64 | 53 | TR- West Fork Des Moines | Estherville (N/A) |
| Schacherer Dam | IA02124 | L | N/A | 33 | 60 | 35 | TR- West Des Moines River | Graettinger (5) |
| Tonderum Dam | IA01509 | L | N/A | 21 | 69 | 34 | TR- East Fork Des Moines River | Graettinger (7) |

Source: Iowa Department of Natural Resources; L= Low; NR= Not Required; N/A = Not Available; EAP = Emergency Action Plan

*Levees in Planning Area*

The National Levee Database (NLD) was consulted to identify levees in the planning area. The NLD does not list any levees in Emmet County. In the 2013 Emmet County Hazard Mitigation Plan, unincorporated Emmet County and the Cities of Estherville, Ringsted, and Wallingford identified levee failure as a hazard in their jurisdictions. The County defined agricultural ditches as levees, and the Cities defined sewer lagoons as levees. The Cities of Armstrong and Gruver did not consider their wastewater lagoons to be levees, and the City of Dolliver does not have wastewater lagoons.

### *Previous Occurrences*

*Dam Failure*

To determine previous occurrences of dam failure within Emmet County, the 2013 Emmet County Iowa Multi-Jurisdictional Hazard Mitigation Plan, the Iowa State Hazard Mitigation Plan, and Stanford University's National Performance of Dams Program (https://npdp.stanford.edu/) were reviewed for historical dam failures. No record of dam failure within Emmet County boundaries was found, though the HMPC noted a total dam failure in 1993 that wiped out a county road.

### *Probability of Future Occurrence*

Based on past performance, the Hazard Mitigation Planning Committee determined that the probability of future occurrence of dam failure is unlikely. Similarly, levee failure is unlikely given that the structures identified as levees are mostly drainage ditches. However, flooding of these drainage ditches can occur.

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Overview*

*Dam Failure*

Dam or levee failure is typically an additional or secondary impact of another disaster such as flooding or earthquake.

Low Hazard state-regulated dams are not necessarily inspected regularly by the Iowa Department of Natural Resources. These structures are not expected to cause serious damage or any loss of life in the event of a failure, however, because they are not regularly inspected, it is unknown whether increased settlement since the dam's construction may have resulted in increased exposure and hazard risk.

A magnitude rating of "negligible" is appropriate due to the lack of physical vulnerability to dam or levee failure and the improbability of a dam or levee failure resulting in the loss of life.

**Magnitude/Severity Score:** 1 - Negligible

### *Potential Losses to Existing Development*

There are no high or moderate hazard dams or any regulated levees in Emmet County. Although minor flooding and damages could result from the failure of a low hazard dam, the extent of such flooding has not been determined. Therefore, there is no specific information on the vulnerability of physical structures to this hazard.

### *Future Development*

Future development located downstream from dams in floodplains or inundation zones and/or in levee protected areas would increase vulnerability to dam or levee failure. Emmet County has experienced a population decrease of 6.3% from 2010 to 2016, therefore it is unlikely that exposure will increase in the near future as a result of development.

### *Climate Change Impacts*

Increased frequency of precipitation and precipitation extremes leading to flooding could cause additional stress on dam and levee structures.

### *Dam/Levee Failure Hazard Summary by Jurisdiction*

For jurisdictions that would be impacted by failure of low hazard dams or levees or that would not by impacted by any dams or levees, this hazard was determined to be "not applicable".

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Armstrong | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Dolliver | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Estherville | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Gruver | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Ringsted | 1 | 1 | 4 | 4 | N/A | N/A |
| City of Wallingford | 1 | 1 | 4 | 4 | N/A | N/A |
| North Union Schools | 1 | 1 | 4 | 4 | N/A | N/A |
| Estherville Lincoln Schools | 1 | 1 | 4 | 4 | N/A | N/A |
| Iowa Lakes CC | 1 | 1 | 4 | 4 | N/A | N/A |

### 3.5.3 Drought

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 1 | 4 | 2.95 | Moderate |

## Profile

### *Hazard Description*

Drought is generally defined as a condition of moisture levels significantly below normal for an extended period of time over a large area that adversely affects plants, animal life, and humans. There are four types of drought conditions relevant to Iowa:

**Meteorological** drought is defined on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. A meteorological drought must be considered as region-specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region.

**Hydrological** drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (e.g., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system. Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts are out of phase with impacts in other economic sectors.

**Agricultural** drought focus is on soil moisture deficiencies, differences between actual and potential evaporation, reduced ground water or reservoir levels, and so forth. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil.

**Socioeconomic** drought refers to when physical water shortage begins to affect people.

The four different types of drought can all occur in Iowa. A meteorological drought is the easiest to determine based on rainfall data and is an easier drought to monitor from rain gauges and reports. A hydrological drought means that stream and river levels are low, which also has an impact for surface water and ground water irrigators. In addition, in-stream discharges that fall below a pre-required level also place the State in regulatory difficulty with U.S. Fish and Wildlife and with neighboring states over cross-border flowage rights. An agricultural drought represents difficulty for Iowa's agricultural-based economy and is also relatively easy to monitor based on crop viabilities for different regions.

The National Drought Mitigation Center (NDMC) located at the University of Nebraska in Lincoln provides a clearinghouse for information on the effects of drought, based on reports from media, observers and other sources. NDMC's website is found at http://www.drought.unl.edu/. Specific drought impacts by county are recorded at http://droughtreporter.unl.edu/.

The NDMC categorizes impacts of drought as economic, environmental, or social. Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease and wind erosion. Droughts also bring increased problems with insects and disease to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in

turn places both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected.

Although drought is not predictable, long-range outlooks may indicate an increased chance of drought, which can serve as a warning. A drought period can last for months, years, or even decades. It is rarely a direct cause of death, though the associated heat, dust and stress can all contribute to increased mortality.

**Warning Time Score:** 1 - 24+ Hours

**Duration Score:** 4 - more than 1 week

### *Geographic Location/Extent*

According to the 2012 Census of Agriculture, of the 253,364 acres of land area in Emmet County, 86.4 percent (218,987 acres) is utilized for agricultural purposes. There were 475 farms with an average size of 461 acres per farm. Although the entire planning area in Emmet County is at risk to drought, the agricultural areas are more vulnerable to the immediate effects of drought. The map in Figure 3-1 in the Animal/Plant/Crop Disease hazard section displays the locations of various cropland uses in Emmet County.

### *Previous Occurrences*

According to the Iowa Environmental Mesonet, the mean annual precipitation for Emmet County is 28.91 inches. This total is lower than the state's average of approximately 34 inches per year, but on average still represents enough rainfall to prevent drought. However, successive years of below-average rainfall are the cause of drought impacts in the planning area.

Table 3-28 provides the rainfall history at the Estherville weather station from 1951 to December 2017. Complete years with less than 30 inches of rain include 1952, 1953, 1955, 1956, 1957, 1958, 1961, 1963, 1966, 1967, 1969, 1970, 1972, 1974, 1976, 1978, 1979, 1980, 1981, 1983, 1985, 1988, 1989, 1990, 1992, 1996, 1997, 2000, 2002, 2003, 2008, 2011, 2012, 2013, and 2014. The lowest annual precipitation on record occurred in 1976 with 15.64 inches.

**Table 3-28 Monthly and Annual Precipitation Totals, 1951 to December 2017, Estherville, Iowa Weather Station**

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1951 | 0.45 | 2.58 | 3.45 | 3.30 | 6.55 | 7.97 | 4.85 | 5.11 | 5.33 | 1.35 | 0.85 | 0.79 | 42.58 |
| 1952 | 2.04 | 0.45 | 2.07 | 1.00 | 2.23 | 8.10 | 4.72 | 5.83 | 0.12 | 0.00 | 1.07 | 0.55 | 28.18 |
| 1953 | 0.75 | 1.05 | 2.57 | 3.01 | 2.69 | 6.70 | 2.22 | 4.15 | 1.32 | 0.41 | 2.30 | 1.52 | 28.69 |
| 1954 | 0.42 | 1.35 | 1.80 | 2.95 | 2.70 | 8.48 | 4.61 | 5.30 | 3.41 | 3.01 | 0.15 | 0.50 | 34.68 |
| 1955 | 0.00 | 0.75 | 0.00 | 4.34 | 1.25 | 2.91 | 1.27 | 3.26 | 1.45 | 1.59 | 0.35 | 0.90 | 18.07 |
| 1956 | 0.00 | 0.70 | 1.20 | 1.85 | 2.31 | 3.10 | 5.35 | 4.30 | 0.48 | 0.53 | 2.85 | 0.20 | 22.87 |
| 1957 | 0.25 | 0.50 | 1.75 | 0.85 | 5.45 | 4.55 | 3.55 | 3.73 | 2.23 | 2.95 | 2.52 | 0.37 | 28.70 |
| 1958 | 0.50 | 0.60 | 0.30 | 4.00 | 0.85 | 3.01 | 3.03 | 1.35 | 1.30 | 0.28 | 0.53 | 0.30 | 16.05 |
| 1959 | 0.40 | 1.50 | 0.80 | 0.35 | 10.10 | 3.00 | 0.08 | 4.53 | 4.60 | 2.55 | 1.35 | 1.80 | 31.06 |
| 1960 | 0.60 | 0.00 | 1.16 | 3.30 | 9.35 | 3.70 | 2.10 | 4.90 | 6.00 | 0.10 | 1.45 | 1.25 | 33.91 |
| 1961 | 0.00 | 1.60 | 4.00 | 1.15 | 3.75 | 4.20 | 2.00 | 1.90 | 4.10 | 0.00 | 2.00 | 1.10 | 25.80 |
| 1962 | 0.00 | 3.05 | 1.50 | 1.55 | 2.45 | 5.50 | 6.90 | 7.10 | 2.50 | 1.00 | 0.35 | 0.25 | 32.15 |
| 1963 | 0.30 | 0.60 | 1.30 | 0.95 | 3.65 | 3.55 | 7.60 | 0.93 | 3.95 | 1.48 | 0.20 | 0.45 | 24.96 |
| 1964 | 0.20 | 0.10 | 1.70 | 6.10 | 3.72 | 2.93 | 7.30 | 4.35 | 8.05 | 0.70 | 0.85 | 1.40 | 37.40 |
| 1965 | 0.70 | 3.25 | 2.50 | 3.75 | 9.07 | 2.25 | 1.50 | 1.76 | 6.35 | 0.85 | 0.35 | 0.80 | 33.13 |
| 1966 | 0.45 | 1.70 | 2.20 | 1.15 | 2.50 | 3.28 | 3.11 | 3.91 | 1.36 | 0.91 | 0.02 | 1.29 | 21.88 |
| 1967 | 2.23 | 0.61 | 0.53 | 3.16 | 2.09 | 5.61 | 0.64 | 2.63 | 0.67 | 1.63 | 0.93 | 0.27 | 21.00 |
| 1968 | 1.40 | 0.12 | 0.03 | 3.27 | 1.53 | 5.18 | 4.46 | 3.15 | 7.90 | 4.56 | 0.22 | 0.79 | 32.61 |
| 1969 | 1.85 | 0.92 | 1.27 | 1.68 | 3.98 | 7.66 | 4.03 | 2.69 | 1.00 | 2.93 | 0.31 | 1.20 | 29.52 |
| 1970 | 0.08 | 0.03 | 1.36 | 1.84 | 3.61 | 2.19 | 2.56 | 1.69 | 3.56 | 4.65 | 1.78 | 0.52 | 23.87 |
| 1971 | 0.55 | 3.41 | 1.34 | 1.19 | 2.21 | 6.49 | 1.54 | 1.04 | 2.34 | 6.60 | 2.04 | 1.35 | 30.10 |
| 1972 | 0.63 | 0.59 | 0.91 | 2.66 | 3.47 | 1.98 | 6.63 | 1.69 | 3.08 | 3.09 | 1.69 | 1.77 | 28.19 |
| 1973 | 2.25 | 0.99 | 1.94 | 2.85 | 5.19 | 1.74 | 3.33 | 2.75 | 6.05 | 1.59 | 3.33 | 1.96 | 33.97 |
| 1974 | 0.56 | 0.37 | 2.06 | 2.01 | 3.41 | 3.45 | 1.75 | 5.84 | 1.64 | 0.75 | 0.00 | 0.64 | 22.48 |
| 1975 | 2.84 | 0.43 | 2.17 | 7.67 | 3.88 | 5.35 | 0.33 | 4.36 | 1.50 | 0.58 | 5.34 | 0.53 | 34.98 |
| 1976 | 0.25 | 0.41 | 0.00 | 2.76 | 1.24 | 3.91 | 1.04 | 1.79 | 2.97 | 0.78 | 0.08 | 0.41 | 15.64 |
| 1977 | 0.35 | 0.70 | 3.27 | 3.77 | 2.33 | 3.65 | 1.88 | 4.27 | 5.76 | 3.17 | 2.34 | 0.69 | 32.18 |
| 1978 | 0.65 | 0.21 | 0.34 | 4.41 | 3.58 | 4.11 | 6.80 | 3.85 | 1.00 | 0.58 | 1.18 | 0.79 | 27.50 |
| 1979 | 0.72 | 0.00 | 3.45 | 1.57 | 2.02 | 3.30 | 4.56 | 0.00 | 3.52 | 2.05 | 0.88 | 0.00 | 22.07 |
| 1980 | 0.21 | 0.60 | 0.90 | 0.62 | 3.05 | 1.85 | 1.31 | 8.44 | 2.25 | 0.95 | 0.05 | 0.14 | 20.37 |
| 1981 | 0.00 | 1.35 | 0.98 | 0.83 | 2.77 | 5.53 | 4.44 | 3.99 | 1.32 | 3.31 | 0.10 | 0.97 | 25.59 |
| 1982 | 0.00 | 0.27 | 0.52 | 1.12 | 7.16 | 2.85 | 4.62 | 6.21 | 4.11 | 3.07 | 2.51 | 0.43 | 32.87 |
| 1983 | 0.08 | 0.60 | 2.94 | 2.43 | 3.00 | 6.50 | 1.74 | 1.37 | 2.31 | 2.04 | 3.20 | 0.30 | 26.51 |
| 1984 | 1.14 | 0.10 | 1.57 | 4.10 | 3.68 | 9.39 | 1.92 | 1.91 | 0.24 | 3.77 | 1.39 | 1.39 | 30.60 |
| 1985 | 0.14 | 0.02 | 2.52 | 4.01 | 2.43 | 3.51 | 0.84 | 4.99 | 6.04 | 1.63 | 0.27 | 0.00 | 26.40 |
| 1986 | 0.31 | 0.23 | 1.60 | 5.61 | 3.83 | 5.63 | 2.69 | 4.26 | 3.42 | 2.57 | 1.20 | 0.04 | 31.39 |
| 1987 | 0.21 | 0.00 | 2.45 | 1.24 | 3.23 | 1.93 | 10.50 | 3.63 | 5.75 | 0.46 | 1.24 | 0.34 | 30.98 |
| 1988 | 0.00 | 0.51 | 0.58 | 4.41 | 1.47 | 1.42 | 2.14 | 3.03 | 3.96 | 0.20 | 1.18 | 0.15 | 19.05 |
| 1989 | 0.48 | 0.24 | 0.95 | 3.90 | 1.15 | 1.89 | 3.32 | 4.22 | 2.10 | 0.12 | 0.17 | 0.02 | 18.56 |
| 1990 | 0.11 | 0.13 | 3.45 | 1.73 | 4.07 | 5.09 | 3.14 | 4.19 | 1.15 | 1.94 | 0.35 | 0.60 | 25.95 |
| 1991 | 0.24 | 0.62 | 3.28 | 5.99 | 4.47 | 7.66 | 2.84 | 3.46 | 2.37 | 1.74 | 3.93 | 0.55 | 37.15 |
| 1992 | 0.74 | 0.53 | 1.78 | 3.42 | 2.23 | 2.43 | 5.44 | 4.87 | 1.67 | 3.46 | 1.50 | 0.95 | 29.02 |
| 1993 | 0.80 | 0.51 | 0.97 | 3.83 | 7.36 | 13.49 | 9.02 | 6.57 | 3.58 | 0.54 | 0.91 | 0.70 | 48.28 |
| 1994 | 0.50 | 0.26 | 0.08 | 3.47 | 1.18 | 10.65 | 3.38 | 2.73 | 4.40 | 1.65 | 1.25 | 0.77 | 30.32 |
| 1995 | 0.05 | 0.04 | 2.27 | 3.74 | 5.10 | 6.06 | 3.00 | 4.60 | 2.84 | 2.93 | 0.60 | 0.35 | 31.58 |
| 1996 | 1.83 | 0.10 | 1.72 | 0.91 | 4.61 | 2.95 | 2.53 | 3.51 | 1.76 | 1.80 | 3.24 | 0.69 | 25.65 |
| 1997 | 0.83 | 0.63 | 0.79 | 1.95 | 3.43 | 2.46 | 2.85 | 1.99 | 2.75 | 1.32 | 0.62 | 0.72 | 20.34 |
| 1998 | 1.41 | 0.96 | 1.86 | 4.04 | 2.50 | 3.92 | 2.39 | 5.73 | 1.55 | 5.27 | 1.94 | 0.29 | 31.86 |

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1999 | 1.06 | 0.27 | 0.94 | 5.77 | 6.38 | 8.36 | 4.99 | 0.22 | 0.94 | 1.34 | 0.39 | 0.26 | 30.92 |
| 2000 | 0.82 | 0.82 | 1.43 | 1.78 | 4.54 | 4.06 | 5.93 | 3.22 | 0.80 | 2.99 | 2.08 | 1.19 | 29.66 |
| 2001 | 0.93 | 1.05 | 0.71 | 6.63 | 5.72 | 4.68 | 4.63 | 1.61 | 1.43 | 1.13 | 2.99 | 0.40 | 31.91 |
| 2002 | 0.24 | 0.71 | 1.38 | 3.16 | 2.37 | 3.64 | 2.01 | 6.35 | 1.64 | 2.90 | 0.27 | 0.05 | 24.72 |
| 2003 | 0.42 | 0.64 | 2.40 | 2.14 | 4.14 | 4.31 | 3.27 | 1.49 | 2.44 | 0.17 | 0.85 | 0.89 | 23.16 |
| 2004 | 0.74 | 0.87 | 2.53 | 1.73 | 5.49 | 1.72 | 7.45 | 2.24 | 9.66 | 2.86 | 1.92 | 0.10 | 37.31 |
| 2005 | 0.73 | 1.13 | 1.32 | 3.31 | 9.34 | 3.70 | 3.63 | 3.20 | 7.58 | 0.54 | 2.18 | 1.11 | 37.77 |
| 2006 | 0.54 | 0.57 | 2.36 | 6.67 | 1.27 | 3.42 | 0.26 | 8.14 | 4.17 | 0.57 | 1.94 | 1.75 | 31.66 |
| 2007 | 1.20 | 1.98 | 3.99 | 2.54 | 3.04 | 2.24 | 2.75 | 10.30 | 2.86 | 4.98 | 0.07 | 1.14 | 37.09 |
| 2008 | 0.57 | 0.78 | 1.29 | 4.00 | 4.29 | 4.76 | 2.90 | 0.85 | 2.54 | 3.43 | 1.11 | 1.68 | 28.20 |
| 2009 | 0.92 | 0.95 | 2.35 | 2.09 | 1.63 | 1.92 | 6.13 | 1.98 | 2.16 | 7.15 | 1.17 | 2.69 | 31.14 |
| 2010 | 1.53 | 1.08 | 1.62 | 2.69 | 1.82 | 7.82 | 5.89 | 3.62 | 5.98 | 1.35 | 1.58 | 1.68 | 36.66 |
| 2011 | 0.95 | 1.55 | 1.34 | 2.67 | 7.18 | 6.11 | 3.79 | 1.81 | 0.74 | 0.51 | 0.12 | 1.16 | 27.93 |
| 2012 | 0.87 | 2.13 | 1.17 | 3.53 | 5.72 | 3.04 | 1.00 | 1.22 | 0.94 | 1.19 | 0.82 | 1.12 | 22.75 |
| 2013 | 0.27 | 1.00 | 1.68 | 3.87 | 6.29 | 4.07 | 1.04 | 1.51 | 0.60 | 2.94 | 0.40 | 0.28 | 23.95 |
| 2014 | 0.45 | 0.62 | 0.52 | 3.03 | 1.93 | 9.67 | 2.16 | 3.28 | 1.52 | 1.42 | 0.46 | 0.87 | 25.93 |
| 2015 | 0.48 | 1.20 | 0.54 | 1.88 | 4.37 | 2.62 | 2.10 | 6.88 | 2.34 | 1.66 | 3.95 | 3.51 | 31.53 |
| 2016 | 0.61 | 1.01 | 2.06 | 3.62 | 4.85 | 2.90 | 4.48 | 2.36 | 6.86 | 4.24 | 1.11 | 1.44 | 35.54 |
| 2017 | 1.09 | 1.01 | 1.86 | 1.92 | 5.45 | 4.34 | 1.04 | 7.30 | 3.46 | 3.91 | 0.51 | 0.54 | 32.43 |
| MEAN | 0.67 | 0.83 | 1.64 | 2.97 | 3.88 | 4.57 | 3.48 | 3.66 | 3.07 | 2.01 | 1.30 | 0.83 | 28.91 |

Source: Iowa Environmental Mesonet, Report generated January 3, 2018, Site information: IA2724 Estherville, https://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACLIMATE&station=IA2724&report=17

According to the National Drought Mitigation Center's Drought Impact Reporter, during the 10-year period from January 2008 through December 2017, 117 listed drought impacts were noted for the State of Iowa. Of these impacts, 10 were reported to affect Emmet County. The following are the categories and reported number of impacts. Note: some impacts have been assigned to more than one category:

- Agriculture – 8
- Relief, Response & Restrictions – 7
- Society & Public Health – 1
- Water Supply & Quality – 4

Impacts of recent drought periods in Iowa that affected Emmet County are provided below. Unless otherwise indicated, these impacts are from the National Climatic Data Center (NCDC).

**July 6, 2016** — According to the Drought Impact Reporter, corn yield potential down in Iowa

**August 1-31, 2013** – Serious drought conditions gripped the state through the summer months. Initial sub-soil moisture was good at the beginning of the growing season. The recharged soil was sufficient to maintain the crops through a good part of the summer. Rainfall remained low through August as well and crops deteriorated rapidly under the warmer than normal and very dry conditions. Rainfall for the summer was between 1/3 and 2/3rds of normal across much of the Des Moines CWA. A large part of the CWA received under 5% of normal rainfall in August, with most areas under 20%. Crop loss through the month was around 10%. This translated to over $600 million in crop loss for the corn crop, and about $350 million for soybeans.

**January 9 – May 16, 2013** – According to the Drought Impact Reporter, there were drought-related USDA disaster declarations in 2013.

**May 12 – July 1, 2013** – According to the Drought Impact Reporter, drought-stressed crops left unused fertilizer in Iowa fields, impacting water quality.

**September 1, 2012 - June 11, 2013** – According to the Drought Impact Reporter, groundwater levels remain low in much of northwestern Iowa after blistering drought in 2012.

**September 19, 2012** – According to the Drought Impact Reporter, The U.S. Department of Agriculture on Sept. 19, 2012, designated six counties in Iowa as disaster areas due to damages and losses caused by the recent drought. Farmers in adjacent counties in Iowa, Minnesota, and Missouri were also eligible for low-interest emergency loans from the Farm Service Agency.

**August 29, 2012** – According to the Drought Impact Reporter, The U.S. Department of Agriculture (USDA) designated three counties in Iowa as primary natural disaster areas due to damages and losses caused by the recent drought. Farmers in adjacent counties in Iowa and Minnesota were also eligible for low-interest emergency loans from the Farm Service Agency.

**September 12, 2012** – According to the Drought Impact Reporter, The U.S. Department of Agriculture on Sept. 12, 2012, designated 23 counties in Minnesota, Iowa, North Dakota, South Dakota and Wisconsin as disaster areas due to drought, which means that low-interest loans are available to farmers in those counties who meet eligibility requirements.

**September 5, 2012** – The U.S. Department of Agriculture (USDA) on Sept. 5, 2012, designated Palo Alto County in Iowa as a primary natural disaster area due to damages and losses caused by the recent drought. Farmers there and in seven contiguous counties are eligible for low interest emergency loans from the Farm Service Agency. All other Iowa counties that would be eligible under 7 CFR 759.5 (a), already have been designated as primary natural disaster counties.

**January 29, 2012** – According to the Drought Impact Reporter, some private wells in northwestern Iowa went dry.

**October 1-13, 2012** – Drought conditions that began in late June continued through the summer and into October. Very warm and dry weather that began in the spring continued through the summer. Temperatures remained well above normal into August but began to temper during the latter portion of the month. Temperatures cooled in October with the month averaging near to a little below normal. It was the first cooler than normal month in 13 months across the CWA. More widespread rainfall began by the middle of the month with a fairly widespread event on the 13th. The rapid deterioration of the corn and soybean crop that took place in July slowed as much of the damage had already occurred in July. No significant damage occurred in September in spite of the dry conditions and early freeze across much of the state on the 23rd. Harvest activities continued at a fast pace with nearly all activities complete by the middle of October. This was three to four weeks ahead of normal. Indications were that yields of the corn crop were around 140 bu/ac and 43.5 bu/ac for the bean crop. These values were about 20% and 15% below normal for corn and beans respectively. At the current price, the loss total was in excess of $2.6 billion. By late September, the USDA reported that Secretarial Primary Drought Designations had been listed for all 51 of the counties in the Des Moines CWA. The drought conditions continued through the month and into November as it will take many months to recharge the soil. No significant damage occurred in October and it is unlikely that water restrictions would occur before the spring, thus this will be the final entry unless conditions worsen.

**September 1-30, 2012** – Drought conditions that began in late June continued through the summer and into September. Very warm and dry weather that began in the spring continued through the summer. Temperatures remained well above normal into August but began to temper during the latter portion of the month. September began well above normal for the first week, but the fall transition began after that. For the month of September, temperatures averaged fairly close to normal. Rainfall was in short supply

across the state. Much of the state recorded less than 50% of normal rainfall for the month, with a few locations under 25% of normal. The rapid deterioration of the corn and soybean crop that took place in July slowed as much of the damage had already occurred in July. No significant damage occurred in September in spite of the dry conditions and early freeze of much of the state on the 23rd. Harvest activities were more than 2 weeks ahead of normal. Indications were that yields of the corn crop were around 140 bu/ac and 43.5 bu/ac for the bean crop. These values were about 20% and 15% below normal for corn and beans respectively. At the current price, the loss total was in excess of $2.6 billion. As of 03 October, the USDA reported that Secretarial Primary Drought Designations had been listed for all 51 of the counties in the Des Moines CWA. The drought conditions continued into October.

**August 1-31, 2012** – Drought conditions that began in late June continued through July and into August. Very warm and dry weather that began in the spring continued through the summer. Temperatures warmed sharply the last few days of June. The heat persisted into August. Temperatures for the month of August were cooler than July, and in fact, just above normal. For the three summer months of June, July, and August, temperatures were among the top 10 warmest on record. Rainfall was in short supply across the state. Much of the state recorded less than 50% of normal rainfall for the month, with a few locations under 25% of normal. The south quarter fared a little better with a few locations receiving close to normal rainfall for the month. In addition, extended periods of temperatures above 90 F combined with dewpoint temperatures falling into the 50s at times, resulted in additional stress. The rapid deterioration of the corn and soybean crop that took place in July slowed as much of the damage had already occurred in July. By the end of the month, officials estimated that 15% of the soybean crop and 20% of the corn crop yield had been lost to the drought. At the current price, the loss total was in excess of $2.6 billion. As of 31 August, the USDA reported that Secretarial Primary Drought Designations had been listed for 42 of the counties in the Des Moines CWA, with the remaining 9 receiving Contiguous Designations. The drought conditions continued into September.

**July 1-31, 2012** – Very warm and dry weather that began in the spring continued into the summer. Temperatures warmed sharply the last few days of June. The heat persisted into July. Temperatures for the month of July were among the warmest on record. In Des Moines, the monthly mean temperature was the second highest of record, only eclipsed by July of 1936. Rainfall was in short supply across the state. Much of the state recorded less than 50% of normal rainfall for the month, with a few locations under 10% of normal. In addition, extended periods of temperatures above 95 F resulted in problems with pollination of the crops. Rapid deterioration of the corn and soybean crop took place with several periods of temperatures in excess of 100 degrees. By the end of the month, officials estimated that 20% of the crop yield had been lost to the drought. At the current price, the loss total was in excess of $2.25 billion. As of 31 July, the USDA reported that Secretarial Primary Drought Designations had been listed for 21 counties in the Des Moines CWA, with 11 receiving Contiguous Designation. The primary counties were Butler, Bremer, Hamilton, Hardin, Grundy, Black Hawk, Boone, Story, Marshall, Tama, Polk, Jasper, Poweshiek, Marion, Mahaska, Lucas, Monroe, Wapello, Wayne, Appanoose, and Davis. Contiguous counties included Wright, Franklin, Webster, Greene, Dallas, Madison, Warren, Clarke, Taylor, Ringgold, and Taylor. The drought conditions continued into August.

**August 1-31, 2003** – Dry weather settled in over Iowa during the month. The last widespread rain occurred on 09 July. With the increasingly dry conditions became a primary concern as the month progressed. An extended period of heat and humidity from the 15th to 25th saw highs into the 90s to over 100 degrees F. in some locations. By month's end drought indices had worsened to severe to extreme drought across south central Iowa and at least moderate drought over the remainder of the HSA. Waterloo had its driest August on record, Des Moines its 3rd driest and Ottumwa its 8th driest. A cold front brought only a brief respite from the intense heat, as temperatures rebounded into the 90s to near 100 degrees F. on the 24-26th. Des Moines Airport reached the century mark for the first time since July

29, 1999, reaching 100 F. on the 24th and 101 F. on the 25th. This was followed by a slow cool down as several pushes of cooler air traversed the state. Unfortunately, there was only widely scattered convection across the HSA on the 27th and 28th, providing little significant drought relief. Light to moderate rainfall on the 31st fell across primarily the southern one half of the HSA, with the heaviest amounts in the southeast. The end of the month saw numerous records approached or established for an all-time record dry August. At Waterloo, the 0.08" broke the previous dry August record of 0.37" set in 1955, while Des Moines had its 3rd driest August ever with 0.31" (driest 0.14" in 1909). Many stations had from 10 to 25 percent of normal rainfall. The drought in south central Iowa as shown by the Palmer Drought Index reached the Extreme category (-4.09) for the first time in this event by August 30th. Statewide NWS Cooperative station data compiled by the Iowa State Climatologist's office showed August temperatures averaged 74.3 F. or 3.0 degrees above the 30-year (1971-2000) mean, ranking as the 18th warmest in 131 years. Precipitation statewide was 0.96" or 3.23" below than normal, ranking as the driest August on record. For the summer as a whole (June-August) it was the 65th warmest (72.0 F. or 0.4 degrees above normal) and the 18th driest (9.55" or 1.93" below normal). The dry conditions caused deterioration in the states crops. Estimates place yield reductions of about 10% on the corn crop, or a loss of about $210 million. Losses on the soybean crop were around 30%, or a loss of about $435 million.

**August 1-23, 2001** – In what became a rather tough growing season, drought developed in Iowa during the month of July, and became serious in August. During the early part of the growing season, excessive rainfall caused significant planting delays across the state. Once the crop was planted, cool and cloudy weather settled into the state slowing crop maturation. Once the warm weather finally arrived, rainfall tailed off significantly. Very little rainfall was reported during the month of July, however crops flourished with the moisture that was available. During the last half of July, temperatures began to soar into the 90s quite regularly. Temperatures were in the 90s to around 100 for most of the first 10 to 12 days of August with virtually no rainfall. Moisture reserves ran out during the critical time of pod filling for the soybeans and at the tasseling for the corn. Another factor that complicated the situation was the soil moisture profile over central and southwest Iowa. After two years of drought, rain began falling during the last fall of 2000 and continued into the spring of 2001. Though soil moisture was replenished in part, a layer of dry soil remained below the moistened layer, preventing root development below the moist layer. Reports indicate losses estimated between one third and one half in parts of central and southwest Iowa. A few locations had verifiable corn crop losses approaching 80%. Overall, losses for the season were closer to the 15% range. Damage to the corn crop was a little over $350 million, with about $225 million in losses to the soybean crop, and about a two million dollar loss to the oat crop.

Losses due to drought reported on the NCDC Storm Events database total $12.65 million in property damage and $83.35 million in crop damage.

Table 3-29 below provided by the U.S. Drought Monitor, summarizes the historical drought conditions for Iowa by intensity and percent area from 2008 through 2017. Portions of Emmet County were in extreme drought intensity in 2012 and 2013 during this 10-year timeframe.

**Table 3-29 Historic Drought Intensity (Percent Area) Emmet County, Iowa 2008-2017**

| Drought Intensity | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2008 - 2017 Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| None | 90.02 | 93.92 | 100.0 | 66.90 | 0.65 | 13.62 | 53.03 | 69.74 | 9.58 | 89.12 | 67.68 |
| D0 Abnormally Dry | 9.82 | 6.08 | 0.00 | 9.45 | 12.82 | 20.15 | 3.63 | 30.24 | 0.42 | 10.44 | 10.28 |
| D1 - Moderate | 0.16 | 0.00 | 0.00 | 5.62 | 7.69 | 35.47 | 43.34 | 0.02 | 0.00 | 0.44 | 9.32 |
| D2 - Severe | 0.00 | 0.00 | 0.00 | 18.03 | 55.44 | 5.76 | 0.00 | 0.00 | 0.00 | 0.00 | 7.89 |
| D3 - Extreme | 0.00 | 0.00 | 0.00 | 0.00 | 23.41 | 25.01 | 0.00 | 0.00 | 0.00 | 0.00 | 4.82 |
| D4 - Exceptional | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Source: U.S. Drought Monitor, http://droughtmonitor.unl.edu/Data/DataDownload/ComprehensiveStatistics.aspx

The Emmet County Emergency Management Agency recorded the following photo of severe drought conditions causing the East Fork of the Des Moines River to stop flowing. The conditions affected irrigation for crops and cattle watering.


Source: Emmet County Emergency Management Agency

According to the USDA's Risk Management Agency, payments for insured crop losses in Emmet County as a result of drought conditions occurred in nine of the ten years from 2007-2016 and totaled $10,806,534 (see Table 3-30). With the extensive drought conditions during the years of 2012 and 2013, 83.4 percent of the 10-year crop losses came from these two years alone.

**Table 3-30 Crop Insurance Claims Paid from Drought, 2007-2016**

| Year | Insurance Paid |
|---|---|
| 2007 | $191,055.00 |
| 2008 | $1,297,907.00 |
| 2009 | $2,189.00 |
| 2011 | $223,508.00 |
| 2012 | $2,084,982.00 |
| 2013 | $6,935,657.00 |
| 2014 | $36,264.00 |
| 2015 | $20,998.00 |
| 2016 | $13,974.00 |
| Insurance Paid | $10,806,534.00 |

Source: USDA Risk Management Agency

### *Probability of Future Occurrence*

NOAA's National Climatic Data Center uses the U.S. Palmer Drought Indices and the Standardized Precipitation Index to monitor and predict drought conditions. Lack of precipitation for a given area is the primary contributor to drought conditions. Since precipitation levels cannot be predicted in the long term, the following indices can be used to determine the probability of future occurrences of drought.

The following are the indices:

- **Palmer Z Index** monitors short-term monthly moisture conditions when depart from normal,
- **Palmer Drought Severity Index** measures the duration and intensity of the long-term (meteorological) drought patterns,
- **Palmer Hydrological Drought Index** measures long-term (hydrological) drought and wet conditions reflecting groundwater and reservoir levels.
- **Standardized Precipitation Index** is a probability index that considers only precipitation. This is important to farmers to estimate soil moisture.

In the past 10 years, there have been nine years with crop insurance claims as a result of drought in Emmet County. If this trend continues, this results in a probability of 90% that drought will result in agricultural impacts in any given year. The probability rating for this hazard is "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Overview*

Emmet County jurisdictions are impacted by drought because it is an expensive weather disaster; it reduces agricultural productivity and causes a strain on urban water supplies. In Emmet County, farmers bear the most direct stress from drought as wells may run dry; crops wilt and die, and forage for livestock becomes scarce and costly.

Emmet County has 475 farms in the County that cover 218,987 acres of land. This translates to 86.4 percent of the surface land in the County being used for agriculture. Therefore, the planning area has a high exposure to this hazard. Aside from agricultural impacts, other losses related to drought include increased costs of fire suppression and damage to roads and structural foundations due to the shrink dynamic of expansive soils during excessively dry conditions. Drought also presents hazards to public health in extreme cases, where drinking water production cannot keep up with demand. Water wells

become less productive during drought and a failure of remaining productive wells (due to power outage, etc.) can cause public drinking water supplies to become compromised.

According to the *2013 Iowa Hazard Mitigation Plan*, of the 8 hazards for which data was available to estimate annualized losses, drought ranked 2nd with $424 million in annualized losses based on data spanning an 18-year period. Losses associated with this hazard can be very high, particularly associated with agriculture. Crop insurance coverage mitigates the adverse economic impacts somewhat.

**Magnitude Score:** 2 - Limited

### *Potential Losses to Existing Development*

Areas associated with agricultural use are vulnerable to drought conditions which could result in a decrease in crop production or a decrease in available grazing area for livestock. Drought has no real effect on houses and buildings. The impacts would be minimal in terms of landscaping. Rationing water supplies would most likely be the worst case scenario impact.

According to the USDA's Risk Management Agency, during the ten-year period from 2007-2016, the amount of claims paid for crop damage as a result of drought in Emmet County was $10,806,534. According to the 2016 Iowa Crop Insurance Profile from USDA's Risk Management Agency, 89 percent of the insurable crops in Iowa are insured with USDA Crop Insurance. To factor in estimated losses to insurable crops that are not insured, the 89 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total $1,214,217 (see Table 3-31).

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from drought was determined minimal compared to the value of the insurable crops.

**Table 3-31 Estimated Insurable Annual Crops Lost Resulting from Drought**

| 10-Year Drought Insurance Paid | Adjusted 10-Year Drought Losses (considering 89% insured) | Estimated Annualized Losses | 2012 Value of Crops | Annualized Crop Loss Ratio (Losses/Value) |
|---|---|---|---|---|
| $10,806,534 | $12,142,173 | $1,214,217 | $156,881,000 | 0.77% |

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDAs 2016 State Crop Insurance Profile for Iowa

### *Future Development*

Increases in acreage planted with crops would increase the exposure to drought-related agricultural losses. In addition, increases in population add additional strain on water supply systems to meet the growing demand for treated water.

### *Climate Change Impacts*

For the most part, climate change studies have shown increases in precipitation, rather than decreases. However, drought cycles still continue. Climate change studies have also shown some increases in average temperatures and decreases in the overall number of days with precipitation. If this occurs during a drought cycle, the drought impacts will be exacerbated and increased agricultural losses will be sustained.

### *Drought Hazard Summary by Jurisdiction*

As discussed in the drought previous occurrences and vulnerability sections, the majority of the damages seen historically as a result of drought are to crops and other agriculture-related activities. Therefore, the magnitude of the impacts is greater in the unincorporated areas. In the cities, the frequency of drought conditions would be the same, but the magnitude would be less with lawns and local gardens affected

and leading to expansive soil problems around foundations. If drought conditions are severe and prolonged, water supplies could also be affected.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 1 | 4 | 2.95 | Moderate |
| City of Armstrong | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| City of Dolliver | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| City of Estherville | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| City of Gruver | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| City of Ringsted | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| City of Wallingford | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| North Union Schools | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| Estherville Lincoln Schools | 4 | 1 | 1 | 4 | 2.65 | Moderate |
| Iowa Lakes CC | 4 | 1 | 1 | 4 | 2.65 | Moderate |

### 3.5.4 Earthquake

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 1 | 4 | 1 | 1.45 | Low |

## Profile

### *Hazard Description*

An earthquake is a sudden motion or trembling that is caused by a release of energy accumulated within or along the edge of Earth's tectonic plates. Earthquakes occur primarily along fault zones, tears in the Earth's crust, along which stresses build until one side of the fault slips, generating compressive and shear energy that produces the shaking and damage to the built environment. Heaviest damage generally occurs nearest the epicenter which is that point on the Earth's surface directly above the point of fault movement. The composition of geologic materials between these points is a major factor in transmitting the energy to buildings and other structures on the Earth's surface.

**Warning Time Score:** 4 - less than 6 hours

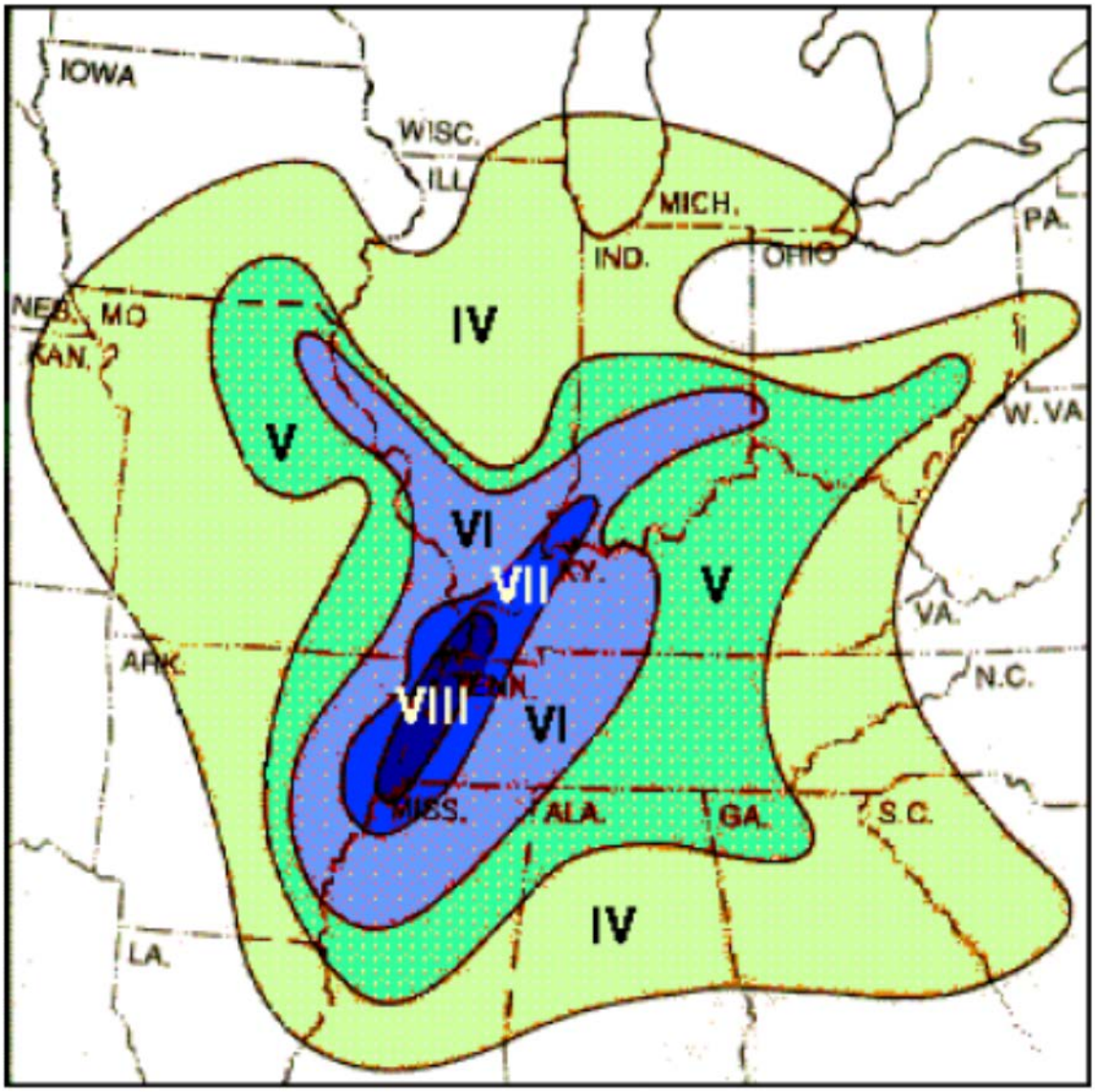
**Duration Score:** 1 - less than 6 hours

### *Geographic Location/Extent*

While geologists often refer to the Midwest as the "stable midcontinent," because of its lack of major crustal movements, there are two regions of active seismicity, the Nemaha Ridge and the New Madrid Fault Zone. The Nemaha Ridge in Kansas and Nebraska, associated with the Humboldt Fault, is characterized by numerous small earthquakes that release stresses before they build to dangerous levels. The fault is not considered a threat to Iowa. The New Madrid Fault Zone, on the other hand, has greater destructive potential. It is located along the valley of the Mississippi River, from its confluence with the Ohio River southward, and includes portions of Illinois, Kentucky, Tennessee, Missouri, Arkansas, and Mississippi. The Earth's crust in the midcontinent is older, and therefore thicker, cooler, and more brittle than that in California for example. Consequently, earthquake shock waves travel faster and farther in the Midwest, making quakes here potentially more damaging than similar sized events in other geologic settings.

Iowa counties are located in low risk zones as a whole. The southeastern part of the State is more at risk to earthquake effects from the New Madrid Fault Zone. Figure 3-5 shows the estimated effects of a 6.5 Richter magnitude earthquake scenario along the New Madrid Fault Zone. It suggests that Iowans in four southeast counties could experience trembling buildings, some broken dishes and cracked windows, movement and falling of small unstable objects, abrupt openings or closing doors, and liquids spilling from open containers. About 29 other counties, from Page to Polk to Muscatine, could experience vibrations similar to the passing of a heavy truck, rattling of dishes and windows, creaking of walls, and swinging of suspended objects. These effects will vary considerably with differences in local geology and construction techniques. There is also a minor fault in Southwest Iowa located near Fremont County.

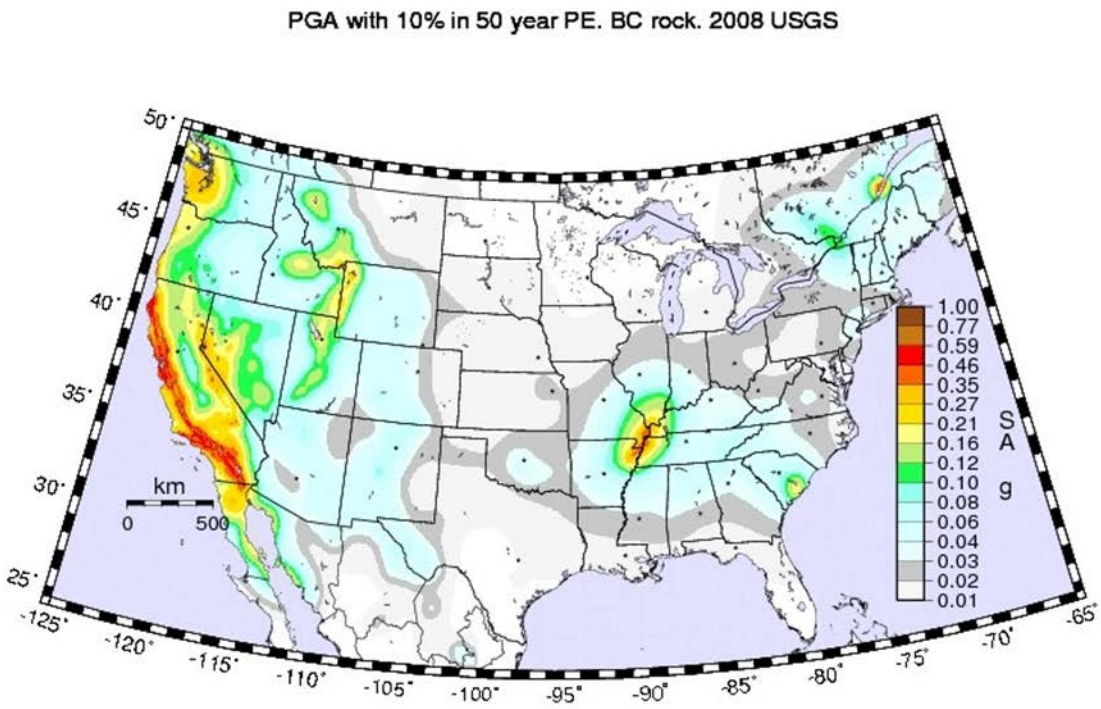
**Figure 3-5 6.5 Richter Magnitude Earthquake Scenario, New Madrid Fault Zone**




Source: http://www.igsb.uiowa.edu/Browse/quakes/quakes.htm

Figure 3-6 shows the Seismic Hazard Map for the U.S. showing the peak ground acceleration of 10 percent in a 50-year timeframe.

**Figure 3-6 United States Seismic Hazard Map**




Source: United States Geological Survey, http://earthquake.usgs.gov/hazards/products/conterminous/2008/maps/

The extent or severity of earthquakes is generally measured in two ways: 1) Magnitude Measurement utilizes the Richter Magnitude Scale and 2) Severity Measurement utilizes the Modified Mercalli Intensity Scale.

*Richter Magnitude Scale*

The Richter Magnitude Scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

*Modified Mercalli Intensity Scale*

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity that range from

imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

### *Previous Occurrences*

Iowa has experienced minor effects from only a few earthquakes in the past 175 years. The epicenters of 13 earthquakes have been located in the State with the majority along the Mississippi River. The strongest earthquake in Iowa occurred in Davenport in 1934. The 1934 Davenport earthquake resulted in only slight damage. (Source: State of Iowa Hazard Mitigation Plan, 2013). Details of the 13 Iowa Earthquakes are provided below:

**Table 3-32 Historical Earthquakes in Iowa**

| Date | Nearest Town | Mercalli Intensity |
|---|---|---|
| 7/16/2004 | Shenandoah, IA | III |
| 4/20/1948 | Oxford, IA | IV |
| 11/24/1939 | Davenport, IA / Rock Island, IL | II-III |
| 11/8/1938 | Dubuque, IA | -II |
| 10/11/1938 | Inwood, IA | V |
| 2/26/1935 | Burlington, IA | III |
| 1/5/1935 | Rock Island, IL / Davenport, IA | III |
| 1/5/1935 | Rock Island, IL / Davenport, IA | IV |
| 11/12/1934 | Davenport, IA \ Rock Island, IL | VI |
| 1/26/1925 | Waterloo, IA | II |
| 4/13/1905 | Wayland, MO / Keokuk, IA | IV-V |
| 12/9/1875 | Sidney, IA / Nebraska City, NE | III |
| 4/28/1867 | Sidney, IA / Nebraska City, NE | IV |

Source: State of Iowa Hazard Mitigation Plan, 2013

### *Probability of Future Occurrence*

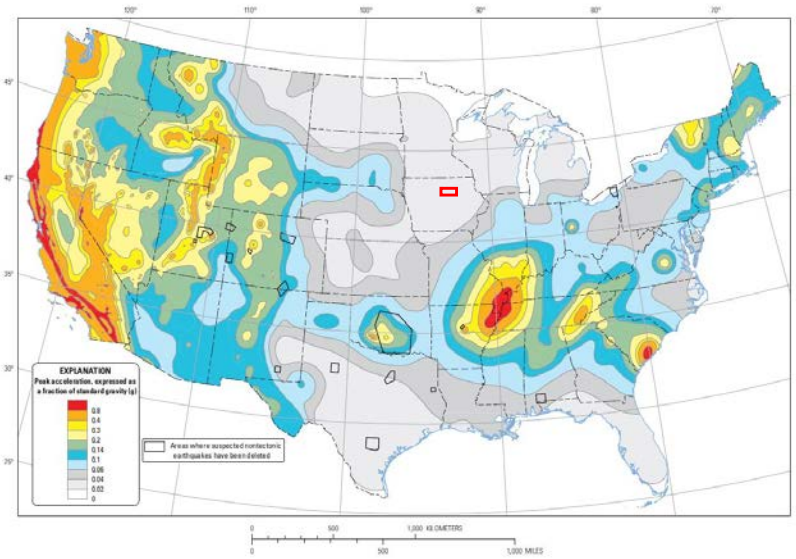
Figure 3-7 demonstrates the probabilistic ground motions with a 2 percent probability of exceedance. The red square shows the approximate Emmet County boundary. As shown in this graphic, the probabilistic ground motions with a 2 percent probability of exceedance in the next 50 years is 0.04 peak acceleration, expressed as a fraction of standard gravity (g). The probability of a significant earthquake in any given year is "Unlikely".

The 2014 U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, seismicity, and geodesy. The USGS National Seismic Hazard Mapping Project developed these maps by incorporating information on potential earthquakes and associated ground shaking obtained from interaction in science and engineering workshops involving hundreds of participants, review by several science organizations and State surveys, and advice from

expert panels and a Steering Committee. The new probabilistic hazard maps represent an update of the seismic hazard maps; previous versions were developed by Petersen and others (2008) and Frankel and others (2002), using the methodology developed Frankel and others (1996). Algermissen and Perkins (1976) published the first probabilistic seismic hazard map of the United States which was updated in Algermissen and others (1990).

The National Seismic Hazard Maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions. Data and maps from the 2014 U.S. Geological Survey National Seismic Hazard Mapping Project are available for download below. Maps for available periods (0.2 s, 1 s, PGA) and specified annual frequencies of exceedance can be calculated from the hazard curves. Figures depict probabilistic ground motions with a 2 percent probability of exceedance. Spectral accelerations are calculated for 5 percent damped linear elastic oscillators. All ground motions are calculated for site conditions with Vs30=760 m/s, corresponding to NEHRP B/C site class boundary.

**Figure 3-7 Two-percent probability of exceedance in 50 years map of peak ground acceleration**




Source: United States Geological Survey, https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf
Note: Red square shape is approximate location of Emmet County, IA

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Overview*

As discussed under the probability section, the probability of a 5.0 Magnitude or greater earthquake in the next 100 years is one percent. Although a damaging event is unlikely, the potential impacts could be costly in the more urban areas of the County. Most structures in Emmet County are not built to withstand earthquake shaking, but because of the relatively low magnitude of a possible quake, property damage would likely be very minor damage.

The main impacts to Emmet County from a New Madrid Earthquake would be related to incoming evacuees from areas more heavily damaged by the event. This could result in a shortage of short-term lodging, such as hotel rooms and extended stay establishments. Depending on the magnitude of the earthquake, shelters may be designated in Emmet County as evacuee shelter locations. If this occurred,

assistance would be coordinated through the Emergency Management Assistance Compact (EMAC) between the State of Iowa and State governments of impacted areas.

**Magnitude Score:** 1 - Negligible

***Potential Losses to Existing Development***

FEMA's loss estimation software, HAZUS was utilized to analyze a 2,500-year probabilistic scenario earthquake event. This earthquake scenario is equivalent to a 2 percent probability of exceedance in 50 years. The earthquake scenario utilized is based on a probabilistic scenario, rather than a deterministic scenario. Therefore, this is not a magnitude-based scenario, but is rather based on ground shaking using the probabilistic mapping done by USGS (see http://earthquake.usgs.gov/hazards/products/conterminous/). The HAZUS Earthquake module reports earthquake damage by census tract. As a result, it is not possible to separate the resulting damage amounts by incorporated area, as the census tract boundaries are not the same as the incorporated area boundaries. Table 3-33 below provides the results of the HAZUS analysis for Emmet County. This analysis estimates that the total direct structural damage would be nearly $570,000. The combined building, contents and related economic losses such as lost wages, rental, and relocation costs are calculated to be nearly $1.8 million.

**Table 3-33 Emmet County, Iowa Estimated Economic Losses—2,500 Year Probabilistic Earthquake Event**

| | Single Family | Other Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|
| Income Losses | | | | | | |
| Wage | - | $10,000 | $110,000 | $10,000 | $10,000 | $140,000 |
| Capital-Relocated | - | - | $90,000 | $10,000 | - | $100,000 |
| Rental | $20,000 | $20,000 | $60,000 | - | - | $110,000 |
| Relocation | $70,000 | $10,000 | $80,000 | $10,000 | $50,000 | $220,000 |
| **Subtotal** | **$90,000** | **$50,000** | **$330,000** | **$40,000** | **$70,000** | **$570,000** |
| Capital Stock Losses | | | | | | |
| Structural | $130,000 | $40,000 | $90,000 | $40,000 | $70,000 | $380,000 |
| Non-Structural | $360,000 | $80,000 | $120,000 | $50,000 | $60,000 | $670,000 |
| Content | $70,000 | $10,000 | $40,000 | $30,000 | $20,000 | $180,000 |
| Inventory | - | - | - | $10,000 | - | $10,000 |
| **Subtotal** | **$560,000** | **$120,000** | **$260,000** | **$140,000** | **$160,000** | **$1,240,000** |
| **Total** | **$640,000** | **$170,000** | **$590,000** | **$170,000** | **$230,000** | **$1,800,000** |

Source: HAZUS-MH 2.2, January 2018

Table 3-34 provides the anticipated numbers of buildings by type and damage category that would result according to the HAZUS analysis. The estimated building types and counts are from the HAZUS damage outputs utilizing census block data. According to this analysis, 2 buildings would have extensive damage, 22 would have moderate damage and 85 would have slight damage. The majority of buildings in the planning area (over 5,000) would not be damaged.

**Table 3-34 Expected Building Damage by Building Occupancy Type**

| Use Type | None | Slight | Moderate | Extensive | Complete |
|---|---|---|---|---|---|
| Agricultural | 157 | 6 | 2 | 0 | 0 |
| Commercial | 364 | 13 | 5 | 1 | 0 |
| Education | 16 | 1 | 0 | 0 | 0 |
| Government | 18 | 1 | 0 | 0 | 0 |
| Industrial | 108 | 4 | 1 | 0 | 0 |
| Other Residential | 202 | 8 | 3 | 0 | 0 |
| Religious | 36 | 1 | 1 | 0 | 0 |
| Single Family | 4,099 | 51 | 10 | 1 | 0 |
| Total | 5,000 | 85 | 22 | 2 | 0 |

Source: HAZUS-MH 2.2

Based on the estimate of 11 single-family and 3 other residential buildings with moderate, extensive, or complete damage, and considering the average household size in the county of 2.2, the displaced population would be approximately 30 people.

### *Future Development*

Overall the planning area has a low vulnerability to earthquake risk. Future development is not expected to increase the risk other than contributing to the overall exposure of what could become damaged as a result of an unlikely event.

### *Climate Change Impacts*

No information was available to discuss the impacts that climate change might have on the frequency or severity of earthquakes.

### *Earthquake Hazard Summary by Jurisdiction*

The following hazard summary table shows that this hazard does not significantly vary by jurisdiction. Although damage amounts would be higher in the more urban areas, damage ratios would be relatively the same.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Armstrong | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Dolliver | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Estherville | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Gruver | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Ringsted | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Wallingford | 1 | 1 | 4 | 1 | 1.45 | Low |
| North Union Schools | 1 | 1 | 4 | 1 | 1.45 | Low |
| Estherville-Lincoln Schools | 1 | 1 | 4 | 1 | 1.45 | Low |

### 3.5.5 Expansive Soils

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| Probability | Magnitude/Severity | Warning Time | Duration | Weighted Score | Level |
| 2 | 1 | 1 | 1 | 1.45 | Low |

## Profile

### *Hazard Description*

A relatively widespread geologic hazard for Iowa is the presence of soils that expand and shrink in relation to their water content. Expansive soils can cause physical damage to building foundations, roadways, and other components of the infrastructure when clay soils swell and shrink due to changes in moisture content. The effects of expansive soils are most prevalent in regions of moderate to high precipitation where prolonged periods of drought are followed by long periods of rainfall. These conditions can exist in Emmet County from time to time.

**Warning Time Score:** 1 - 24+ hours

The warning time for expansive soils is consistent with other geologic hazards that occur slowly overtime.

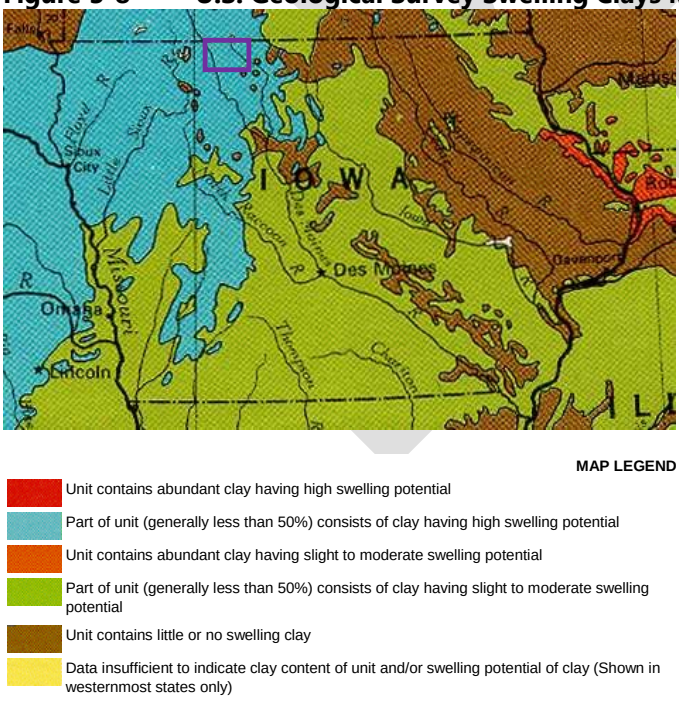
**Duration Score:** 1 - Less than 6 hours

The duration of response to this hazard is limited in the State of Iowa. Although prolonged periods of drought are a primary indicator of risk followed by forecasted periods of precipitation, the response to expansive soils in Iowa is limited and is in large part coupled with response to flash flooding and river flooding.

### *Geographic Location/Extent*

Figure 3-8 shows a map of the swelling potential of soils in Iowa. All of Emmet County is located in an area where generally less than 50 percent of the soil unit consists of clay having high swelling potential.

**Figure 3-8 U.S. Geological Survey Swelling Clays Map of Iowa**




Source: U.S. Geological Survey publication "Swelling Clays Map of the Conterminous United States" by W.W. Olive, A.F. Chleborad, C.W. Frahme, Julius Schlocker, R.R. Schneider, and R.L. Shuster, 1989: Purple square indicates approximate location of Emmet County.

### *Previous Occurrences*

As reported in the 2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan, the planning committees and community leaders report that Emmet County has no history of expansive soils or incidents relating to any damages or problems resulting from soil subsidence. However, according to the U.S. Geological Survey map of swelling clays, Emmet County does contain some soils with high swelling potential. Damages from expansive soils are likely isolated incidents and can be associated with the cycles of drought and heavy rainfall, which reflect changes in moisture content. Affected property owners, local governments, and businesses generally make any necessary repairs.

### *Probability of Future Occurrence*

Although there is little historical record of damages from expansive soils, will likely be some damage to paved areas and foundations in Emmet County due to swelling soils, it is unlikely that these damages will become greater in the future unless new development occurs in areas where the hazard is more severe. Certain buildings and construction practices could be put in place to lessen these impacts.

**Probability Score:** 2 - Occasional

## Vulnerability

### *Overview*

While the entire planning area is vulnerable to some structural damage as a result of shrinking and expanding soils, there is no data available to determine damage estimates for this hazard. In most cases, individual property owners, local governments, and businesses pay for repairs to damages caused by this hazard. Underground utility lines such as water and sewer pipes are also at risk to damages associated with expansive soils. Damages may occur gradually over time. There is no data to support damages and costs associated with this hazard at this time. This hazard does not impact human safety.

**Magnitude Score:** 1 - Negligible

### *Potential Losses to Existing Development*

Existing development may continue to be vulnerable to expansive soils, depending on location and soil conditions.

### *Future Development*

Additional future development in the planning area may also be vulnerable to this hazard.

### *Expansive Soils Hazard Summary by Jurisdiction*

This hazard does not vary substantially among jurisdictions.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Armstrong | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Dolliver | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Estherville | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Gruver | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Ringsted | 2 | 1 | 1 | 1 | 1.45 | Low |
| City of Wallingford | 2 | 1 | 1 | 1 | 1.45 | Low |
| North Union Schools | 2 | 1 | 1 | 1 | 1.45 | Low |
| Estherville-Lincoln Schools | 2 | 1 | 1 | 1 | 1.45 | Low |

### 3.5.6 Extreme Heat

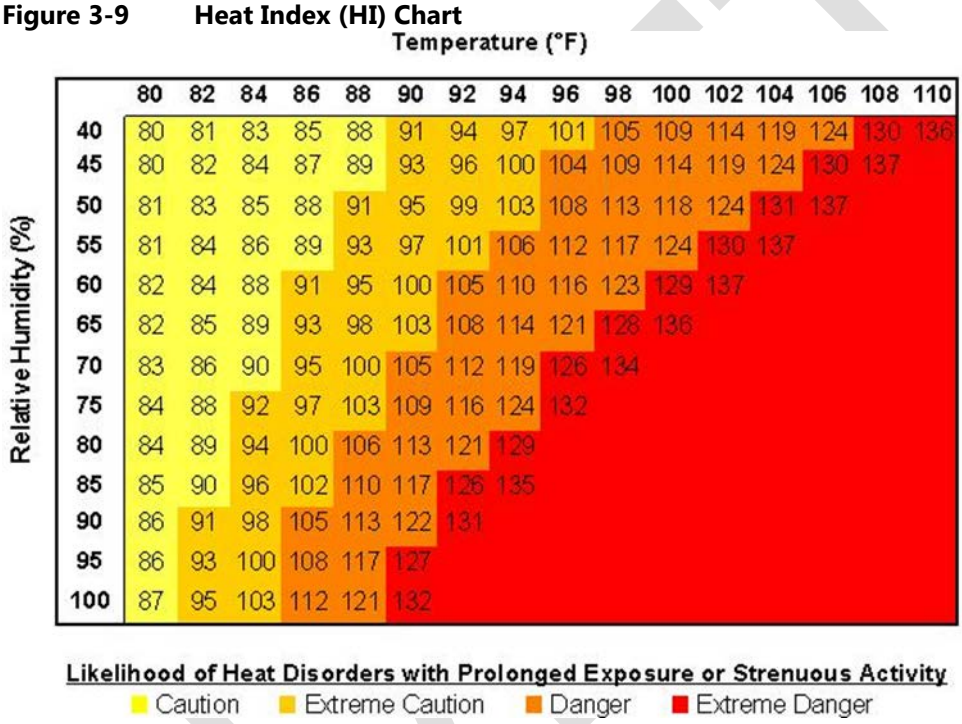
| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 3 | 2 | 1 | 4 | 2.50 | Moderate |

## Profile

### *Hazard Description*

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Ambient air temperature is one component of heat conditions, with relative humidity being the other. The relationship of these factors creates what is known as the apparent temperature. The Heat Index Chart in Figure 3-9 uses both of these factors to produce a guide for the apparent temperature or relative intensity of heat conditions.

**Figure 3-9 Heat Index (HI) Chart**




Source: National Weather Service (NWS) http://www.nws.noaa.gov/os/heat/heat_index.shtml

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to a HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

During these conditions, the human body has difficulties cooling through the normal method of the evaporation of perspiration. Health risks rise when a person is over exposed to heat.

The most dangerous place to be is in a permanent home, with little or no air conditioning. Those at greatest risk for heat-related illness include people 65 years of age and older, young children, people with chronic health problems such as heart disease, people who are obese, people who are socially isolated, and people who are on certain medications, such as tranquilizers, antidepressants, sleeping pills, or drugs for Parkinson's disease. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather or are not acclimated to hot weather. In agricultural areas, the exposure of farm workers, as well as livestock, to extreme heat is a major concern. Table 3-35 lists typical symptoms and health impacts of exposure to extreme heat.

**Table 3-35 Typical Health Impacts of Extreme Heat**

| Heat Index (HI) | Disorder |
|---|---|
| 80-90° F (HI) | Fatigue possible with prolonged exposure and/or physical activity |
| 90-105° F (HI) | Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity |
| 105-130° F (HI) | Heatstroke/sunstroke highly likely with continued exposure |

Source: National Weather Service Heat Index Program, www.weather.gov/os/heat/index.shtml

The National Weather Service has a system in place to initiate alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. A common guideline for issuing excessive heat alerts is when the maximum daytime Heat Index is expected to equal or exceed 105 degrees Fahrenheit (°F) and the night time minimum Heat Index is 80°F or above for two or more consecutive days. A heat advisory is issued when temperatures reach 105 degrees and a warning is issued at 115 degrees.

**Warning Time Score:** 1 - More than 24 hours warning time

**Duration Score:** 4 - More than one week

### *Geographic Location/Extent*

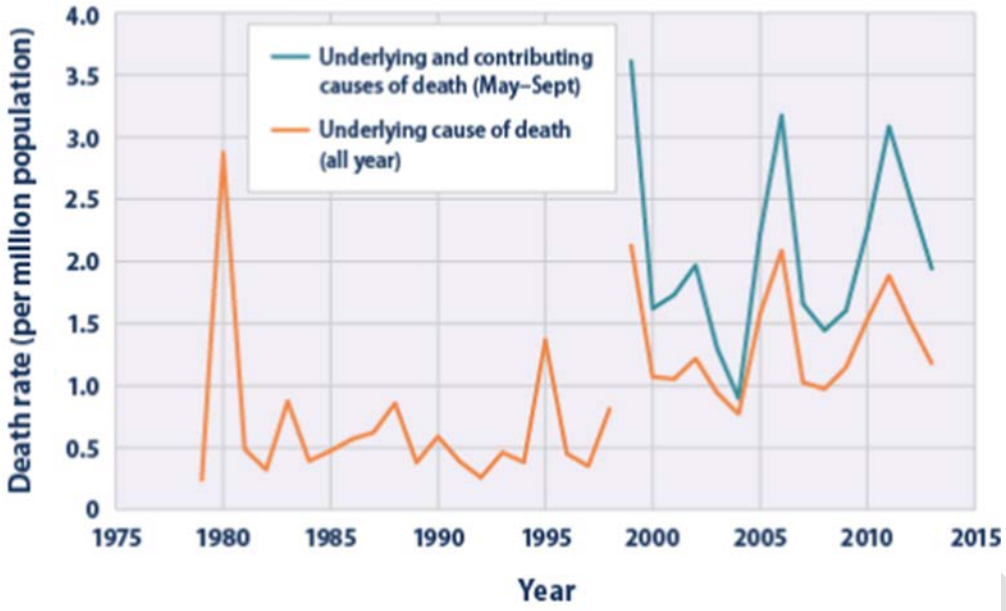
The entire planning area is subject to extreme heat and all participating jurisdictions are affected.

### *Previous Occurrences*

Figure 3-10 shows heat-related deaths in the United States using two methodologies. One method shows deaths for which excessive natural heat was stated as the underlying cause of death from 1979 to 2013. The other data series shows deaths for which heat was listed as either the underlying cause or a contributing cause, based on a broader set of data that at present can only be evaluated back to 1999. For example, in a case where cardiovascular disease was determined to be the underlying cause of death, heat could be listed as a contributing factor because it can make the individual more susceptible to the effects of this disease. Because excessive heat events are associated with summer months, the 1999–2013 analysis was limited to May through September.

According to the National Weather Service, in 2015, 45 people died nationally as a result of extreme heat. In 2014, there were 20 heat-related deaths. In 2013 there were 92 and in 2012, there were 155 deaths. The 10-year average for heat related fatalities is 124. Only one heat-related death has been reported for Iowa within the last 10 years, occurring in 2006. (Source: http://www.nws.noaa.gov/om/hazstats.shtml).

**Figure 3-10 Deaths Classified as "Heat Related" in the United States, 1979-2015**




Source: Environmental Protection Agency, https://www3.epa.gov/climatechange/pdfs/print_heat-deaths-2015.pdf

The 2013 Iowa State Hazard Mitigation Plan reports the following additional instances of agricultural losses due to extreme heat:

- **July 2011** – The Iowa Cattlemen's Association reported that approximately 4,000 cattle died due to extreme heat.
- **1995** – livestock-related economic losses due to heat stress were estimated to be $31 million in Iowa.

On average, the hottest months of the year are July and August. According to the High Plains Regional Climate Center, the average temperature in Emmet County for the month of July is 71.4 degrees Fahrenheit (°F) with an average maximum temperature of 82.6 °F; and the average temperature for the month of August is 68.8 °F with an average maximum temperature of 79.9 °F. (Source: http://climod.unl.edu/)

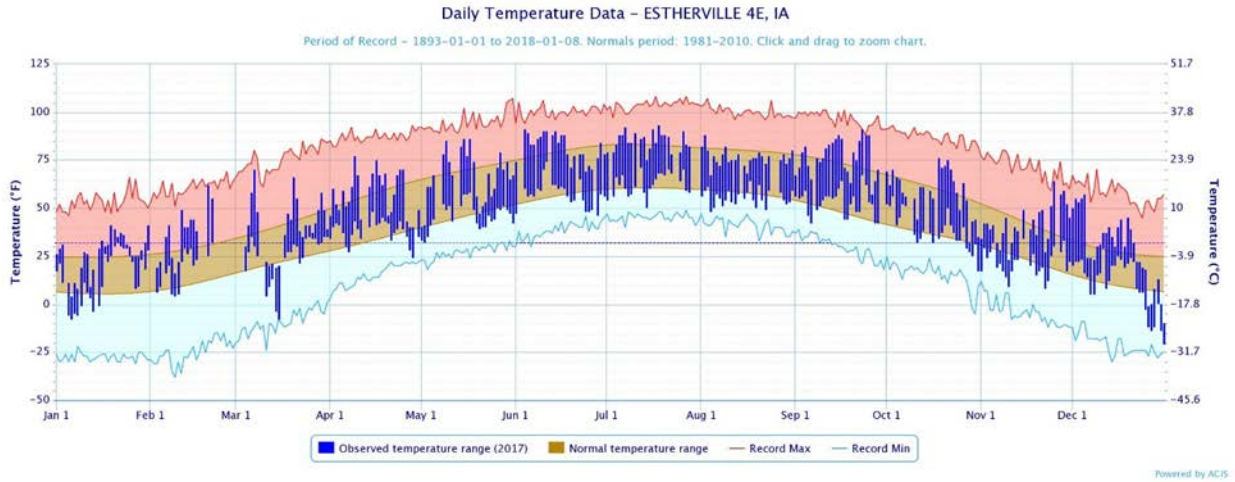
According to data from High Plains RCC, from 1996 to 2017, there were 74 days with temperatures 93 degrees Fahrenheit or above (at least 10 degrees above normal). When looking at only those events with a high temperature of 93 degrees Fahrenheit and higher that lasted for 3 consecutive days or more, there were two occurrences during the 20-year period from 1996 through 2017.

The following summarizes the National Weather Service Advisories, Watches, and Warnings for Heat or Excessive Heat in Emmet County from 1996 through 2017 (22 years of data).

- 14 Advisories
- 4 Watches
- 3 Warnings

Figure 3-11 provides the daily temperature averages and extremes at the Estherville, Iowa weather station for the period from 1981 to 2010 along with actual observed temperatures for 2017 from the High Plains Regional Climate Center.

**Figure 3-11 Daily Temperature Averages and Extremes, Estherville, Iowa (1981 – 2010)**




Source: High Plains Regional Climate Center, http://climod.unl.edu/

The National Climatic Data Center reported one regional heat event and two regional excessive heat events in and around the Emmet County planning area:

**August 5, 2001 – Regional Heat Event** - Very warm and humid conditions that began in the last part of July continued into August. Temperatures during the day warmed into the 90s, with overnight lows remaining in the 70s. Dew point temperatures held in the mid-70s to low 80s through most of the time. An elderly woman passed away in Des Moines on the 5th. She was found in her home with the windows closed and temperatures in the house in excess of 100 degrees F. She had succumbed to the heat.

**July 15-28, 2011 – Regional Excessive Heat Event** - A large area of high pressure developed in the upper atmosphere by the middle of July. Heat built up over Iowa, aided by the severe drought to the south across Kansas, Oklahoma, and Texas. Temperatures rose into the 90s each day through the period. Though most days did not see 100-degree heat, the dewpoint and overnight lows were very significant. Low temperatures during most of the nights were in the 70s, with many of the nights in the mid to upper 70s. Dewpoint temperatures failed to fall below 70 through most of the period, with frequent excursions in the upper 70s to low 80s. These conditions caused considerable stress on livestock. Reports indicated that at least 4000 head of cattle and thousands of turkeys were killed by the suffocating heat. Livestock losses were estimated in the $5 to $10 million-dollar range.

**July 20-23, 2016 – Regional Excessive Heat Event** - A warm front lifted through the state on the 20th, allowing southerly winds to bring about high temperatures in the low 90s along with dew points in the upper 70s to 80 at times. As a result, heat index values easily eclipsed the 100-105-degree range and at times exceeded 110. Additionally, overnight lows did not provide much in the way of relief with many areas seeing lows in the mid and even upper 70s at times.

According to the USDA's Risk Management Agency, insured payments in Emmet County for damages to crops as a result of heat and hot wind from 2007-2016 totaled $61,708.

Table 3-36 shows the insurable crop insurance claims paid in Emmet County as a result of heat and hot wind.

**Table 3-36 Claims Paid in Emmet County for Crop Loss as a Result of Heat and Hot Wind (2007-2016)**

| Year | Hazard | Insurance Paid |
|---|---|---|
| 2007 | Hot Wind | $399.00 |
| 2009 | Heat | $3,728.00 |
| 2011 | Heat | $16,633.00 |
| 2012 | Heat | $40,948.00 |
| **Insurance Paid** | | **$61,708.00** |

Source: Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016;

Note: There were no claims paid as a result of Hot Wind in 2008 through 2016; or Heat in 2007, 2008, 2010, or 2013 through 2016.

### *Probability of Future Occurrence*

Based on seven National Weather Service Heat/Excessive Heat Warnings and Watches from 1996 to 2017 (22 years), the probability of occurrence is 31.8 percent. This translates to a probability rating of "Likely".

**Probability Score:** 3 - Likely

## Vulnerability

### *Overview*

Those at greatest risk for heat-related illness and deaths include people 65 years of age and older, young children, people who are obese, and people who are ill or on certain medications. To determine jurisdictions within the planning area with populations that may be more vulnerable to extreme heat, demographic data was obtained from the U.S. Census Bureau on numbers of people in each jurisdiction that are over the age of 65 are seen in Table 3-37. Data was not available on rates of obesity or those on certain medications.

Overall, Iowa is already older than the country as a whole. About 15 percent of its population is over 65 years, compared with 13 percent nationally. Emmet County's population over 65 years is even higher than the national and state average at 19.7 percent. The participating jurisdictions with the highest percent of adults 65 and over in descending order are the cities of Armstrong, Gruver, and Estherville.

**Table 3-37 Emmet County Population 65 years and Over, 2011-2015 American Community Survey 5-Year Estimates**

| Jurisdiction | Total Population | Population 65 yrs. and over | Percent 65 yrs. and over |
|---|---|---|---|
| Emmet County, Iowa | 9,820 | 1,938 | 19.7 |
| City of Armstrong | 898 | 258 | 28.7 |
| City of Dolliver | 81 | 13 | 16.0 |
| City of Estherville | 6,027 | 998 | 16.6 |
| City of Gruver | 105 | 24 | 22.9 |
| City of Ringsted | 479 | 68 | 14.2 |
| City of Wallingford | 180 | 28 | 15.6 |
| North Union Schools | N/A | N/A | N/A |
| Estherville Lincoln Schools | N/A | N/A | N/A |
| Iowa Lakes CC | N/A | N/A | N/A |

Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates

1 – City boundaries are within multiple counties

**Magnitude Score:** 2 - Limited

### *Estimated Losses to Existing Development*

According to the USDA's Risk Management Agency, during the ten-year period from 2007-2016, the sum of claims paid for crop damages as a result of heat and hot wind was $61,708.00. According to the 2016

Iowa Crop Insurance Profile Report issued by the USDA's Risk Management Agency, 89 percent of Iowa insurable crops were insured. To factor in estimated losses to insurable crops that are not insured, the 89 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total $19,446 (see Table 3-38).

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from heat and hot wind was determined to be negligible (less than 0.00%) compared to the value of the insurable crops.

**Table 3-38 Estimated Insurable Annual Crops Lost Resulting from Heat**

| 10-Year Extreme Heat Insurance Paid | Adjusted 10-Year Heat Losses (considering 89% insured) | Estimated Annualized Losses | 2012 Value of Crops | Annualized Crop Loss Ratio (Losses/Value) |
|---|---|---|---|---|
| $61,708 | $69,335 | $6,934 | $156,881,000 | <0.00% |

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDA's 2016 State Crop Insurance Profile for Iowa

Extreme heat can also cause a strain on electricity delivery infrastructure which can be overloaded during peak use of electricity to power air conditioning during extreme heat events. Another type of infrastructure damage that can occur as a result of extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots. According to Iowa DOT, repairs and replacement of pavement due to heat-caused buckling and rupture costs an average of $400,000 annually across the State.

### *Future Development*

Since Emmet County has experienced overall population decline of 6.3 percent from 2010 to 2016, the number of people vulnerable to extreme heat is not increasing.

### *Climate Change Impacts*

The following climate change impacts relative to Extreme Heat were included in the 2010 Climate Change Impacts on Iowa report developed by the Iowa Climate Change Impacts Committee.

- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Iowa's humidity has risen substantially, especially in summer, which now has 13 percent more atmospheric moisture than 35 years ago as indicated by a 3 - 5 degree F rise in dew-point temperature. This fuels convective thunderstorms that provide more summer precipitation.

Both of these impacts could increase the number extreme heat events in the planning area as well as the potential for negative impacts on people and agriculture.

### *Extreme Heat Hazard Summary by Jurisdiction*

This hazard does not vary substantially by jurisdiction.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Armstrong | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Dolliver | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Estherville | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Gruver | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Ringsted | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| City of Wallingford | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| North Union Schools | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| Estherville Lincoln Schools | 3 | 2 | 1 | 4 | 2.50 | Moderate |
| Iowa Lakes CC | 3 | 2 | 1 | 4 | 2.50 | Moderate |

### 3.5.7 Flash Flooding

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 3 | 1 | 2.95 | Moderate |

## Profile

### *Hazard Description*

A flash flood is an event that occurs when water levels rise at an extremely fast rate as a result of intense rainfall over a brief period, sometimes combined with rapid snowmelt, ice jam release, frozen ground, saturated soil or impermeable surfaces.

Ice jam flooding is a form of flash flooding that occurs when ice breaks up in moving waterways, and then stacks on itself where channels narrow. This creates a natural dam, often causing flooding within minutes of the dam formation.

Riverine Flooding is discussed separately in Section 3.5.14 and flooding caused by dam failure is discussed in Section 3.5.2 respectively.

Most flash flooding is caused by slow-moving thunderstorms or thunderstorms repeatedly moving over the same area. Flash flooding is an extremely dangerous form of flooding which can reach full peak in only a few minutes and allows little or no time for protective measures to be taken by those in its path. Flash flood waters move at very fast speeds and can move boulders, tear out trees, scour channels, destroy buildings, and obliterate bridges. Flash flooding often results in higher loss of life, both human and animal, than slower developing river and stream flooding.

In some cases, flooding may not be directly attributable to a river, stream, or lake overflowing its banks. Rather, it may simply be the combination of excessive rainfall or snowmelt, saturated ground, and inadequate drainage. With no place to go, the water will find the lowest elevations–areas that are often not in a floodplain. This type of flooding, often referred to as sheet flooding, is becoming increasingly prevalent as development outstrips the ability of the drainage infrastructure to properly carry and disburse the water flow.

In certain areas, aging storm sewer systems are not designed to carry the capacity currently needed to handle the increased storm runoff. Typically, the result is water backing into basements, which damages mechanical systems and can create serious public health and safety concerns. This combined with rainfall trends and rainfall extremes all demonstrate the high probability, yet generally unpredictable nature of flash flooding in the planning area.

Although flash floods are somewhat unpredictable, there are factors that can point to the likelihood of flash floods occurring. Weather surveillance radar is being used to improve monitoring capabilities of intense rainfall. This, along with knowledge of the watershed characteristics, modeling techniques, monitoring, and advanced warning systems increases the warning time for flash floods.

**Warning Time Score:** 3 - 6 to 12 hours warning time. This refers to the period of time prior to the event with heightened awareness that a flash flood could occur, not the issuance of a "flash flood warning" by the National Weather Service.

**Duration Score:** 1 - Less than 6 hours

### *Geographic Location/Extent*

Emmet County is located in northwestern Iowa. The primary sources of flooding are the Des Moines River and the East Fork Des Moines River. Both the Des Moines and East Fork Des Moines Rivers flow from northwest to southeast across the county.

Flash flooding occurs in those locations of the planning area that are low-lying and/or do not have adequate drainage to carry away the amount of water that falls during intense rainfall events. According to NCDC and specific reports from planning committee members, the following locations have a history of flash flooding events: Unincorporated Emmet County, Estherville and Wallingford. The HMPC identified that there are flash flooding issues throughout the county, and that basement flooding issues are prevalent. The county's Wastewater Treatment Plant can be taxed and has experienced jumps from normal loads of 2 million gallons to 6-8 million gallons after heavy, concentrated rain.

The National Weather Service has various flash flooding products that are issued to the public to provide information regarding upcoming and current flash flood threats (see Table 3-39).

**Table 3-39 National Weather Service Flash Flooding Products**

| Product | What It Means | You Should… |
|---|---|---|
| Hazardous Weather Outlook | Will there be any threat of flash flooding in the next several days? | If there is a threat of flash flooding, check back later for updated forecasts and possible watches and warnings. Latest Hazardous Weather Outlook |
| Flash Flood Watch | There is a threat of flash flooding within the next 48 hours, either as a result of heavy rain, ice jams, or the threat of a dam break. | Monitor weather conditions closely, especially if you live in an area prone to flash flooding. |
| Flash Flood Warning | There is an immediate threat for flash flooding in the warned area, especially in low-lying and poor drainage areas. These warnings are updated frequently with Flash Flood Statements. | If you live in an area susceptible to flash flooding, be prepared to evacuate and head to higher ground. Be very cautious when driving in the warned area, especially at night or while it is still raining. You may not be able to see a flooded road until it is too late! |
| A *Flash Flood Emergency* may be declared when a severe threat to human life and catastrophic damage from a flash flood is imminent or ongoing. The declaration of a *Flash Flood Emergency* would typically be found in either a Flash Flood Warning or Flash Flood Statement. People are strongly encouraged to avoid the geographic area of concern in a *Flash Flood Emergency*. The *Flash Flood Emergency* wording is used very rarely and is reserved for exceptionally rare and hazardous events. | | |
| Areal Flood Warning | The threat of flash flooding is over, but there is still significant standing water in the affected area. | Areal flood warnings will typically list locations and roads impacted by the flooding. Try to avoid these locations until the water has receded. |

Source: National Weather Service, website accessed 8/26/2013 http://www.crh.noaa.gov/dmx/?n=prepare floodproducts

### *Previous Occurrences*

Table 3-40 provides details regarding the flashflood and areal flood watches and warnings issued for Emmett County and the Emmett County forecast zone by National Weather Service. Areal flooding is a type of flash flooding that is generally over a large area usually due to the amount and duration of rainfall.

**Table 3-40 Flash Flood-Related National Weather Service Watches and, Warnings Issued for Emmett County and Emmett County, Iowa Forecast Zone (1986 to 2017)**

| Type of Flood / Product Issued | 1991 | 1993 | 2000 | 2004 | 2006 | 2007 | 2008 | 2009 | 2010 | 2013 | 2014 | 2015 | 2016 | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Areal Flood** | | | | | | | | | | | | | | |
| Advisory | | | | | | | 1 | | 4 | | | | | 5 |
| Warning | | | | | | | 2 | | | | 1 | | | 3 |
| Watch | | | | | 3 | 2 | | | | | | | | 5 |
| **Flash Flood** | | | | | | | | | | | | | | |
| Warning | 1 | 5 | 3 | 4 | 1 | 4 | | 1 | 6 | 2 | 3 | | 1 | 31 |
| Watch | | | | | 1 | 7 | 8 | | 10 | 6 | 8 | 3 | 6 | 49 |
| **Grand Total** | **1** | **5** | **3** | **4** | **5** | **13** | **11** | **1** | **20** | **8** | **12** | **3** | **7** | **93** |

Source: Iowa State University Department of Agronomy http://mesonet.agron.iastate.edu/vtec/search.php

As discussed in the Description Section, flash flooding can be caused by intense rainfall over a brief period. Table 3-41 provides the top 30 rainfall events at the Estherville Climate Station from January 1, 1951 to July 2017.

**Table 3-41 Top 30 Rainfall Events, Estherville Climate Station, 1951 to November 2017**

| Date | Amount (inches) |
|---|---|
| 2004-09-15 | 6.45 |
| 1962-08-30 | 5.8 |
| 2006-08-02 | 5.47 |
| 2005-05-07 | 4.95 |
| 1964-09-09 | 4.75 |
| 1991-06-04 | 3.89 |
| 1987-09-15 | 3.7 |
| 1951-05-01 | 3.5 |
| 1954-06-18 | 3.5 |
| 1953-06-08 | 3.5 |
| 1994-06-13 | 3.37 |
| 1969-06-29 | 3.26 |
| 1965-05-08 | 3.25 |
| 1993-06-30 | 3.19 |
| 1960-05-21 | 3 |

| Date | Amount (inches) |
|---|---|
| 1961-06-13 | 3 |
| 1960-05-16 | 3 |
| 2014-06-17 | 2.95 |
| 2009-07-10 | 2.9 |
| 2007-08-20 | 2.87 |
| 2005-09-25 | 2.84 |
| 1955-08-24 | 2.75 |
| 1951-09-12 | 2.75 |
| 1985-09-05 | 2.68 |
| 1977-09-30 | 2.58 |
| 2001-06-13 | 2.52 |
| 1952-06-15 | 2.5 |
| 1962-07-04 | 2.5 |
| 1960-09-21 | 2.5 |
| 1977-08-16 | 2.5 |

Source: Iowa State University Department of Agronomy
http://mesonet.agron.iastate.edu/climodat/index.phtml?network=IACLIMATE&station=IA6566&report=02

Information from the NCDC was obtained from 1996 to 2017 to determine previous occurrences for flash flood in the planning area. This search did not reveal any flash flood incidents recorded from 1996 to 1999. Between 2000 and 2017, there were 13 flash flood events and 17 heavy rain events for a total of 33 flash flood related events. During this time-frame, there were no injuries or deaths reported. Total property damages for these events were estimated to be $1,635,000. There were an additional $140,000 in crop losses reported. Table 3-42 provides a summary of the NCDC data.

**Table 3-42 NCDC Emmett County, Iowa Flash Flood Events Summary, 1993-2017**

| Date | Property Loss | # Events |
|---|---|---|
| **Flash Flood** | | |
| 7/9/2000 | $50,000 | 1 |
| 6/13/2001 | $50,000 | 1 |
| 9/15/2004 | $200,000 | 1 |
| 5/7/2005 | $25,000 | 1 |
| 8/1/2006 | $25,000 | 1 |
| 3/14/2007 | $25,000 | 1 |
| 3/16/2010 | $10,000 | 1 |
| 6/25/2010 | $150,000 | 1 |
| 6/26/2010 | $500,000 | 1 |
| 7/14/2011 | $100,000 | 1 |
| 6/19/2014 | $500,000 | 1 |
| 7/17/2016 | 0 | 2 |
| | $1,635,000 | 13 |
| **Heavy Rain** | | |
| 7/14/2009 | 0 | 1 |
| 6/25/2010 | 0 | 1 |
| 8/31/2010 | 0 | 1 |
| 6/18/2011 | 0 | 1 |
| 7/11/2011 | 0 | 1 |
| 7/25/2012 | 0 | 1 |
| 6/22/2013 | 0 | 1 |
| 6/19/2014 | 0 | 2 |
| 7/25/2014 | 0 | 3 |
| 12/12/2015 | 0 | 2 |
| 7/16/2016 | 0 | 3 |
| 9/15/2016 | 0 | 1 |
| 7/26/2017 | 0 | 2 |
| | 0 | 20 |
| **Grand Total** | **$1,635,000** | **33** |

Source: NCDC

Of the 33 flash flood events recorded in NCDC for the 24-year period:

- 2 were located in Armstrong
- 10 were located in Estherville
- 2 were located in ARPT
- 8 were located in Ringsted
- 8 were located in Wallingford
- 3 were reported countywide

Flash flood events with significant property loss include the following:

- June 26, 2010
- June 19, 2014
- September 15, 2004

- July 14, 2011
- July 9, 2000
- June 13, 2001
- May 7, 2005
- August 1, 2006
- March 14, 2007

The Emmet County Emergency Management Agency recorded the following photo of flash flooding along a road in the County.

Source: Emmet County Emergency Management Agency

The US Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CRREL) maintains a database of historic ice jams. According to a query of that database from 1950 to the present, six ice jams have occurred in the Emmet County planning area (Source: http://rsgisias.crrel.usace.army.mil/apex/f?p=524:1:0::NO).

### *Probability of Future Occurrence*

The frequency of past events is used to gauge the likelihood of future occurrences. The flash flood and heavy rain events from NCDC that occurred on the same day were combined to determine the total number of 24 damaging flash flooding events in the planning area over the 22-year period from 1996 to 2017. This translates to over a 100-percent likelihood of flash flooding somewhere in the planning area in any given year. Therefore, the probability rating is "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Vulnerability Overview*

Water over low-lying roads and bridges is the most frequent impact associated with flash flooding that has occurred in the planning area. This can cause washout of bridge abutments and erosion/scour damage on roads. There is potential for loss of life if motorists drive into moving water. However, public education campaigns have helped to educate citizens about not driving through moving water. Building damage is generally limited to water in basements where rain is too intense for drainage systems and

natural drainage to carry water away from the structure. In addition, when combined storm/sanitary sewer systems are overloaded, this can result in sewer back-up. Generally, flash-flooding is short in duration and government services and business operations are not impacted.

Based on the number of historical occurrences, 33 flash flooding events within a 24-year period; the magnitude was determined to be limited.

**Magnitude Score:** 2 - Limited

### *Potential Losses to Existing Development*

When roads and bridges are inundated by water, damage often occurs as the water scours materials around bridge abutments and gravel roads.

The water can also cause erosion undermining road beds. In some instances, steep slopes that are saturated with water may cause mud or rock slides onto roadways. These damages can cause costly repairs for state, county, and city road/bridge maintenance departments. When sewer back-up occurs, this can result in costly clean-up for home and business owners as well as present a health hazard.

Based on loss estimates reported by NCDC, property losses averaged $74,318 per year over the 22-year period from 1996 to 2017.

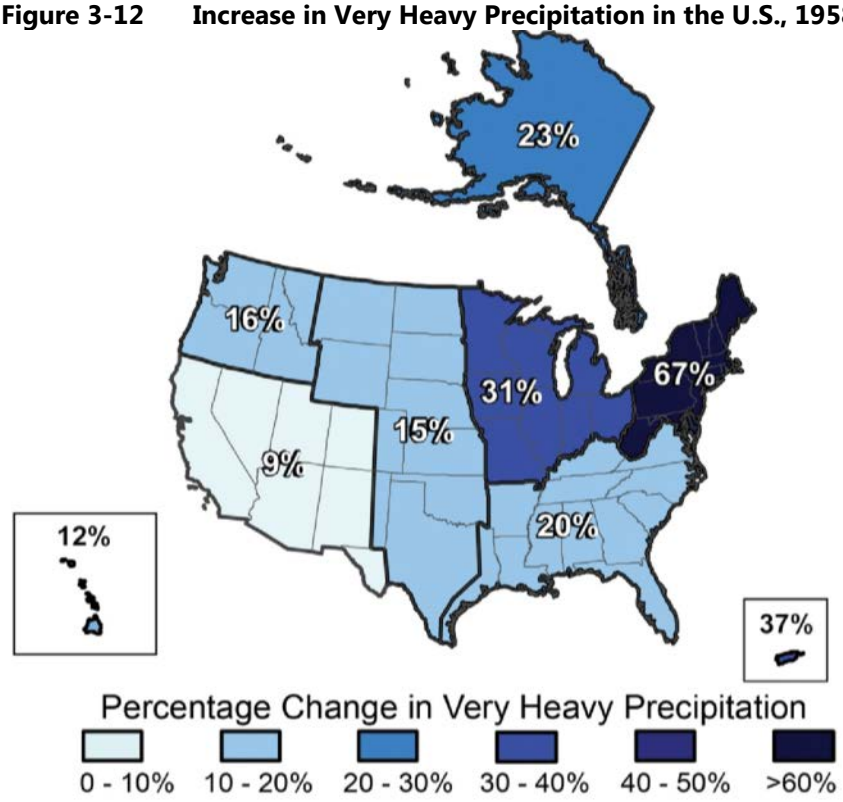
### *Future Development*

In planning future development, jurisdictions in the planning area should avoid development in low-lying areas near rivers and streams or where interior drainage systems are not adequate to provide drainage during heavy rainfall events. Future development should also take into consideration the impact of additional impervious surfaces to water run-off and drainage capabilities during heavy rainfall events. In Estherville, where most new residential development is occurring, the majority of new homes do not have basements, which limits the potential for flood damage of these new structures.

### *Climate Change Impacts*

One of the climate change impacts noted in the *2010 Climate Change Impacts on Iowa* report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. Figure 3-12 shows that all of Iowa is in the region with a 31% increase in very heavy precipitation from 1958 to 2007. For this study, very heavy precipitation was defined as the heaviest 1% of all events.

**Figure 3-12 Increase in Very Heavy Precipitation in the U.S., 1958-2007**




Source: Karl, T.R., J.M. Melillo, and T.C. Peterson(eds). 2009. Global Climate Change Impacts in the United States. U.S. Global Climate Change Research Program. Cambridge University Press and http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts as cited in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee

If this trend increases, flash flooding events and their associated impacts will likely occur more often in the planning area.

### *Flash Flood Hazard Summary by Jurisdiction*

For those jurisdictions with flash flooding events reported in NCDC and by planning representatives, the magnitude was determined to be limited. For the remaining jurisdictions, the magnitude was determined to be negligible due to the small number of reported flash flooding events or no flash flooding events reported for these areas.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 3 | 1 | 2.95 | Moderate |
| City of Armstrong | 4 | 2 | 3 | 1 | 2.95 | Moderate |
| City of Dolliver | 4 | 1 | 3 | 1 | 2.65 | Moderate |
| City of Estherville | 4 | 2 | 3 | 1 | 2.95 | Moderate |
| City of Gruver | 4 | 1 | 3 | 1 | 2.65 | Moderate |
| City of Ringsted | 4 | 2 | 3 | 1 | 2.95 | Moderate |
| City of Wallingford | 4 | 2 | 3 | 1 | 2.95 | Moderate |
| North Union Schools | 4 | 1 | 3 | 1 | 2.65 | Moderate |
| Estherville-Lincoln Schools | 4 | 1 | 3 | 1 | 2.65 | Moderate |

### 3.5.8 Grass or Wildland Fire

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 4 | 1 | 3.10 | High |

## Profile

### *Hazard Description*

Iowa's urban/rural interface (areas where development occurs within or immediately adjacent to wildland, near fire-prone trees, brush, and/or other vegetation), is growing as metro areas expand into natural forest, prairies and agricultural areas that are in permanent vegetative cover through the Conservation Reserve Program (CRP). The State has the largest number of CRP contracts in the nation, totaling over 1.5 million acres. Most of this land is planted in cool and warm season grass plantings, tree plantings and riparian buffer strips. There is an additional 230,000 acres in federal ownership and conservation easements.

Wildfires are frequently associated with lightning and drought conditions, as dry conditions make vegetation more flammable. As new development encroaches into the wildland/urban interface more and more structures and people are at risk. On occasion, ranchers and farmers intentionally set fire to vegetation to restore soil nutrients or alter the existing vegetation growth. Also, individuals in rural areas frequently burn trash, leaves and other vegetation debris. These fires have the potential to get out of control and turn into wildfires.

The risk of wildfires is a real threat to landowners across the State. The National Weather Service monitors the conditions supportive of wildfires in the State on a daily basis so that wildfires can be predicted, if not prevented.

The risk factors considered are:

- High temperature
- High wind speed
- Fuel moisture (greenness of vegetation)
- Low humidity
- Little or no cloud cover

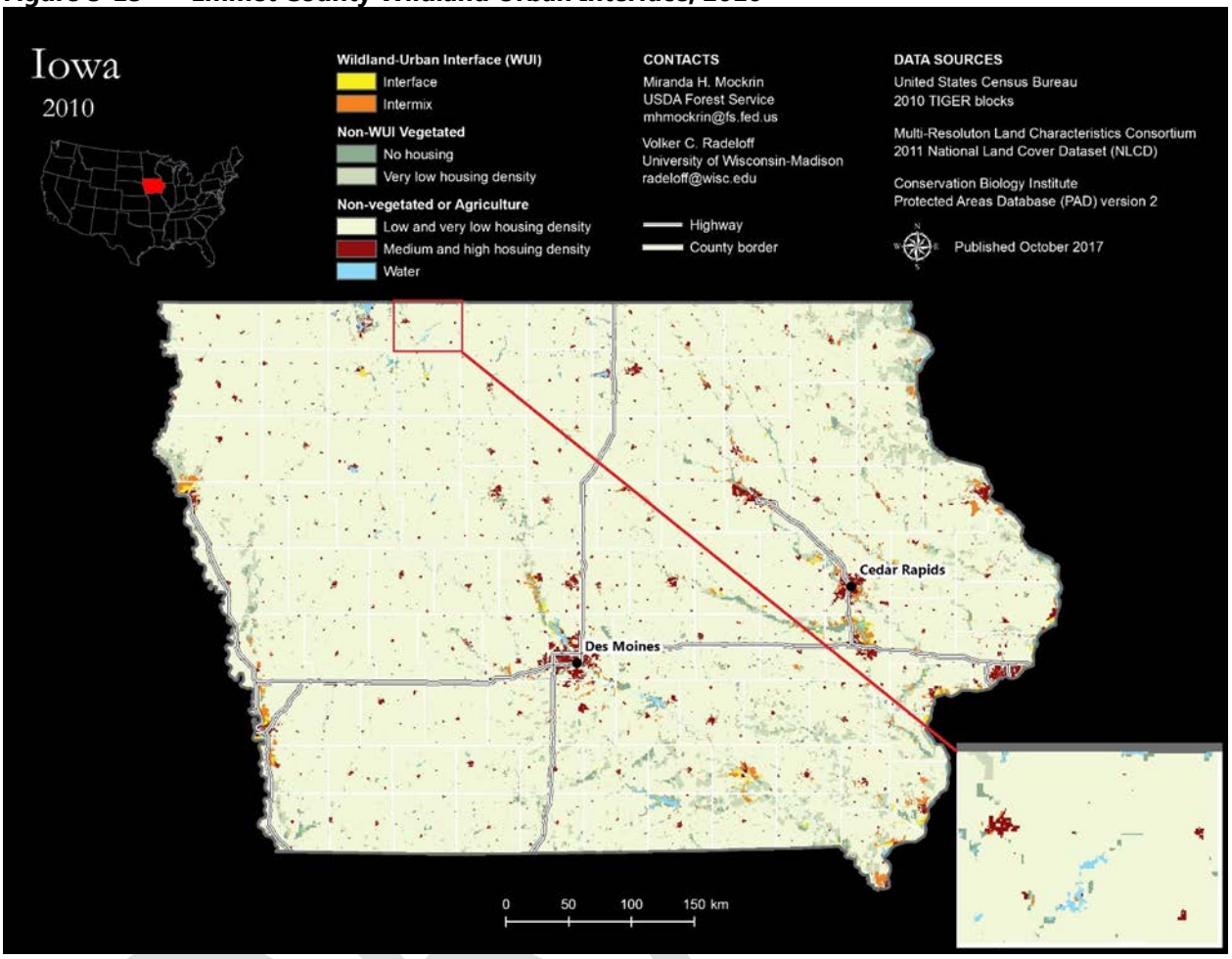
**Warning Time Score:** 4 - Minimal or no warning time.

**Duration Score:** 1 - Less than 6 hours

### *Geographic Location/Extent*

Wildland/Grass fires are most likely to occur in the Wildland Urban Interface (WUI). This is the area where houses meet or intermingle with undeveloped wildland vegetation. Within the WUI, there are two specific areas identified: 1) Interface and 2) Intermix. The interface areas are those areas that abut wildland vegetation and the Intermix areas are those areas that intermingle with wildland areas. As can be seen in Figure 3-13, Emmet County has a moderate amount of intermix areas (orange) in Estherville as well as sprinkled throughout other parts of the county.

**Figure 3-13 Emmet County Wildland Urban Interface, 2010**




Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, http://silvis.forest.wisc.edu/maps/wui/state10

### *Previous Occurrences*

Data was requested from the Iowa Department of Public Safety, State Fire Marshal Division to provide information on previous occurrences of grass/wildland fires in the planning area. Through the National Fire Incident Reporting System (NFIRS), the Iowa State Fire Marshal's Office collects and reports fire incidents throughout the State. NFIRS is a repository of statistical data reported by participating fire departments. The State Fire Marshal's Division was unable to provide the historical grass/wildland fire data at this time.

### *Probability of Future Occurrence*

Updated historical data was not available to document the average number of wildland/grass fires per year. Since updated statistical data was unavailable to determine a quantitative probability, a qualitative probability is based on the anecdotal descriptions from the HMPC. For the 2013 plan, the planning committee determined that all communities with fire departments experience grass and wildland fires and estimated that each fire department responds to at least 4 calls per year, typically in the fall when farmers are harvesting crops. Therefore, the probability rating for damaging events for this hazard is "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Overview*

Areas that are most vulnerable to wildfire are agricultural areas where land is burned, rural areas where trash and debris are burned, and the wildland-urban interface/intermix areas.

To demonstrate how vulnerability to this hazard varies by jurisdiction, the 2010 spatial data indicating acreage of Wildland Urban Interface/Intermix areas from the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison was compared against the corporate boundary layer for the planning area. Table 3-43 and Table 3-44 provide additional details.

**Table 3-43 Emmet County Wildland/Urban Interface and Intermix Acres**

| Jurisdiction | Intermix (acres) | Interface (acres) |
|---|---|---|
| Armstrong | 0 | 0 |
| Dolliver | 0 | 0 |
| Estherville | 193 | 0 |
| Gruver | 0 | 0 |
| Ringsted | 0 | 0 |
| Wallingford | 0 | 0 |
| Unincorporated | 151 | 0 |
| **Total** | **344** | **0** |

Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, http://silvis.forest.wisc.edu/maps/wui/2010/download

**Table 3-44 Wildland Urban Intermix / Interface Acreage by WUI Class**

| WUI Class | Acres |
|---|---|
| High Density Interface | 2.2 |
| Medium Density Intermix | 140 |
| Low Density Intermix | 202 |
| **Total** | **344** |

Source: SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison; WUI 2010, http://silvis.forest.wisc.edu/maps/wui/2010/download

### *Potential Losses to Existing Development*

Wildfires can be responsible for extensive damage to crops, the environment and occasionally residential or business facilities. Homes built in rural areas are more vulnerable since they are in closer proximity to land that is burned, and homeowners are more likely to burn trash and debris in rural locations. The vulnerability of structures in rural areas is exacerbated due to the lack of hydrants in these areas for firefighting and the distance required for firefighting vehicles and personnel to travel to respond. Potential losses to crops and rangeland are additional concerns.

**Magnitude Score:** 2 - Limited

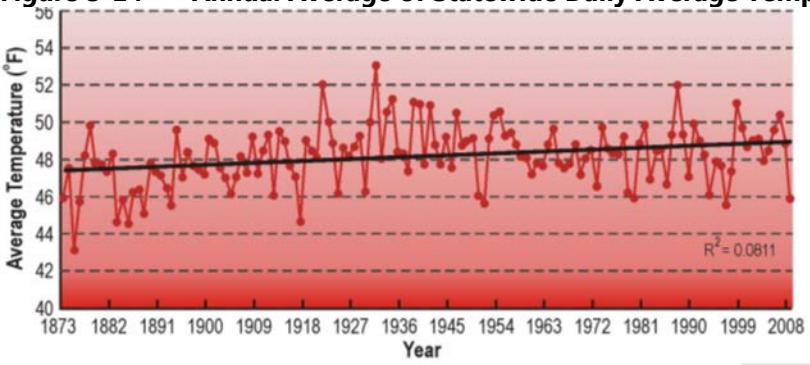
### *Future Development*

Future development in the wildland-urban interface/intermix areas would increase vulnerability to this hazard.

### *Climate Change Impact*

According to the 2010 Climate Change Impacts on Iowa report, by the Iowa Climate Change Impacts Committee, the annual average temperature has been increasing over the last 136 years. Figure 3-14 shows this data graphically.

**Figure 3-14 Annual Average of Statewide Daily Average Temperatures (0 F)**




Source: 2010 Climate Change Impacts on Iowa report, by the Iowa Climate Change Impacts Committee, Data from the Iowa Climatology Bureau, 2010

If Iowa were to experience a severe drought, as has occurred frequently in the past, the slow and steady rise in statewide annual mean temperature, masked in summer by moist surface conditions during non-drought years, could lead to an abrupt switch to extreme summer heat comparable to the summers of 1983 or 1988. If these conditions occur, the occurrence of wildfire would be expected to increase as was seen recently in 2012.

### *Grass or Wildland Fires Hazard Summary by Jurisdiction*

Grass or Wildland fires can occur in all jurisdictions. However, the magnitude is potentially worse in jurisdictions with more wildland/urban intermix areas. Jurisdictions with more than 100 acres of intermix/interface were assigned a magnitude of 2, limited and jurisdictions with less than 100 acres of intermix/interface were assigned a magnitude of 1, negligible. There is less potential for wildland/grass fires impacting schools due to general locations away from Wildland Urban Interface Areas. Again, if a wildland/grass fire were to occur near school buildings, the magnitude would be lower due to close proximity to firefighting services.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 4 | 1 | 3.10 | High |
| City of Armstrong | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Dolliver | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Estherville | 4 | 2 | 4 | 1 | 3.10 | High |
| City of Gruver | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Ringsted | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Wallingford | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| North Union Public Schools | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| Estherville-Lincoln Schools | 4 | 1 | 4 | 1 | 2.80 | Moderate |

### 3.5.9 Hazardous Materials

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 1 | 4 | 1 | 2.80 | Moderate |

## Profile

### *Hazard Description*

A hazardous substance is one that may cause damage to persons, property, or the environment when released to soil, water, or air. Chemicals are manufactured and used in increasing types and quantities. Each year over 1,000 new synthetic chemicals are introduced and as many as 500,000 products pose physical or health hazards and can be defined as "hazardous chemicals". Hazardous substances are categorized as toxic, corrosive, flammable, irritant, or explosive. Hazardous material incidents generally affect a localized area.

### *Fixed Hazardous Materials Incident*

A fixed hazardous materials incident is the accidental release of chemical substances or mixtures during production or handling at a fixed facility.

#### *Transportation Hazardous Materials Incident*

A transportation hazardous materials incident is the accidental release of chemical substances or mixtures during transport. Transportation Hazardous Materials Incidents in Emmet County can occur during highway or air transport. Highway accidents involving hazardous materials pose a great potential for public exposures. Both nearby populations and motorists can be impacted and become exposed by accidents and releases. If airplanes carrying hazardous cargo crash, or otherwise leak contaminated cargo, populations and the environment in the impacted area can become exposed.

#### *Pipeline Incident*

A pipeline transportation incident occurs when a break in a pipeline creates the potential for an explosion or leak of a dangerous substance (oil, gas, etc.) possibly requiring evacuation. An underground pipeline incident can be caused by environmental disruption, accidental damage, or sabotage. Incidents can range from a small, slow leak to a large rupture where an explosion is possible. Inspection and maintenance of the pipeline system along with marked gas line locations and an early warning and response procedure can lessen the risk to those near the pipelines.

**Warning Time Score:** 4 - Less than six hours warning time

**Duration Score:** 1 - Less than 6 hours

### *Geographic Location/Extent*

This section provides geographic locations within Emmet County impacted by each type of potential hazardous materials incident.

#### *Fixed Hazardous Materials Incident*

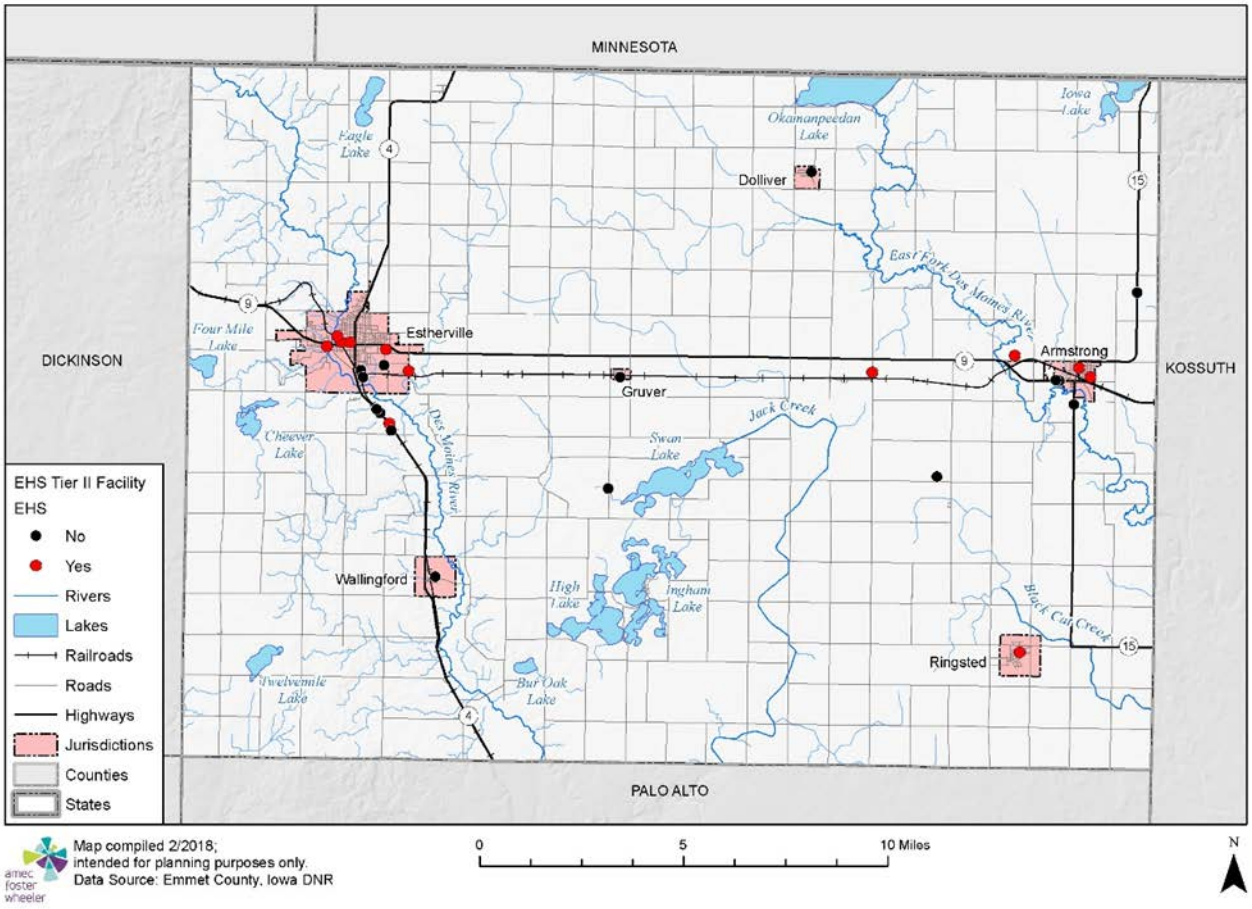
According to the Iowa Department of Natural Resources, there are 26 sites in Emmet County that because of the volume or toxicity of the materials on site were designated as Tier II Facilities under the Superfund Amendments and Reauthorization Act.

Table 3-45 provides the number of Tier II Facilities for each jurisdiction in the planning area. Note: The jurisdiction is assigned from the address. Some facilities do fall within the unincorporated areas but are identified with the nearest city. Figure 3-15 that follows is a map showing the locations of Tier II Facilities.

**Table 3-45 Number of Tier II Facilities by Jurisdiction**

| Jurisdiction | # of Facilities | # of EHS Facilities |
|---|---|---|
| Armstrong | 9 | 4 |
| Dolliver | 1 | 0 |
| Estherville | 12 | 6 |
| Gruver | 2 | 0 |
| Ringsted | 1 | 1 |
| Wallingford | 1 | 0 |

**Figure 3-15 Tier II Facilities in Emmet County**



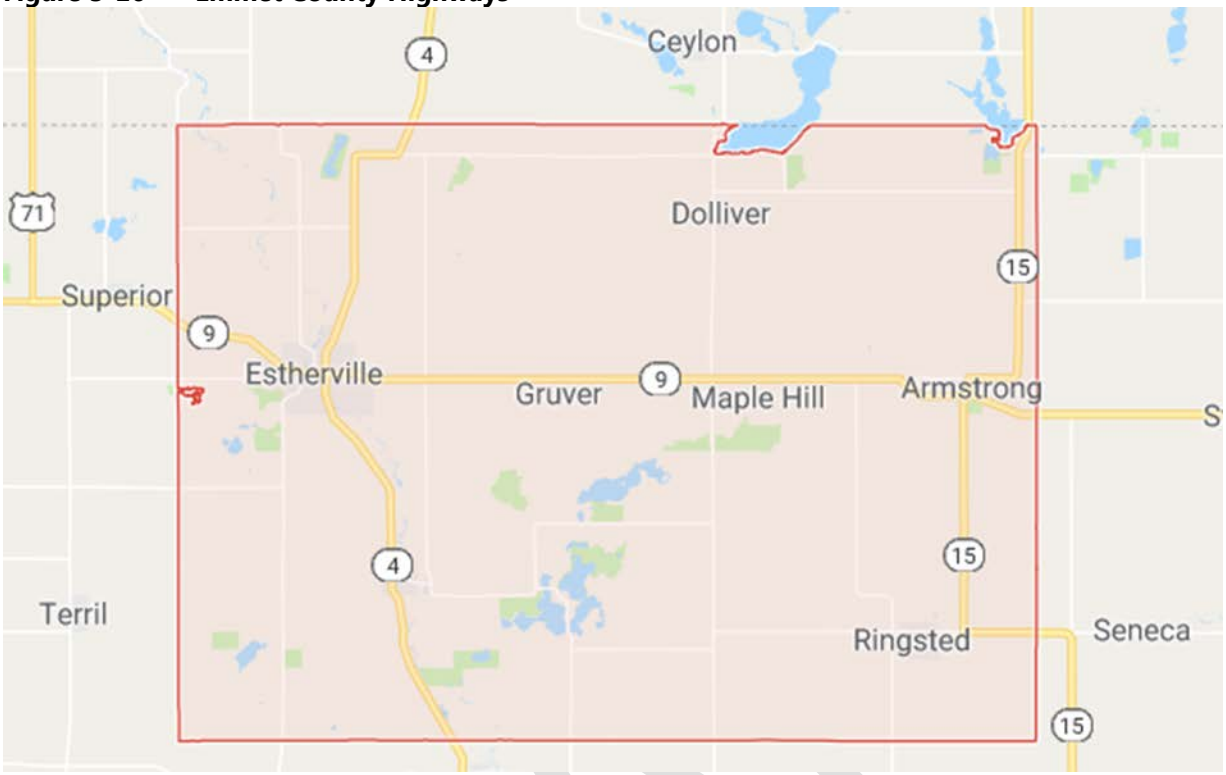

### *Transportation Hazardous Materials Incident*

The transport of hazardous materials in Emmet County occurs via trucks on the highways/roads and airplanes carrying hazardous cargo.

*Truck Transport*

Hazardous materials can be transported on any of the roads in Emmet County. Main conduits of transport include Iowa Highway 9, Iowa Highway 4, and Iowa Highway 15. Agriculture is important to the economy of Emmet County As a result, chemicals utilized in agriculture are frequently transported along county and local roadways.

**Figure 3-16 Emmet County Highways**




Source: Google Maps

*Rail Transport*

Union Pacific Railroad, Ltd. (UP) operates in Emmet County with a line running east-west from Estherville, through Gruver, Maple Hill, and Armstrong. A line also runs northwest-southeast through Estherville and Wallingford.

*Air Freight*

Estherville Municipal Airport is a publicly owned airport located 4 miles west of the city of Estherville.

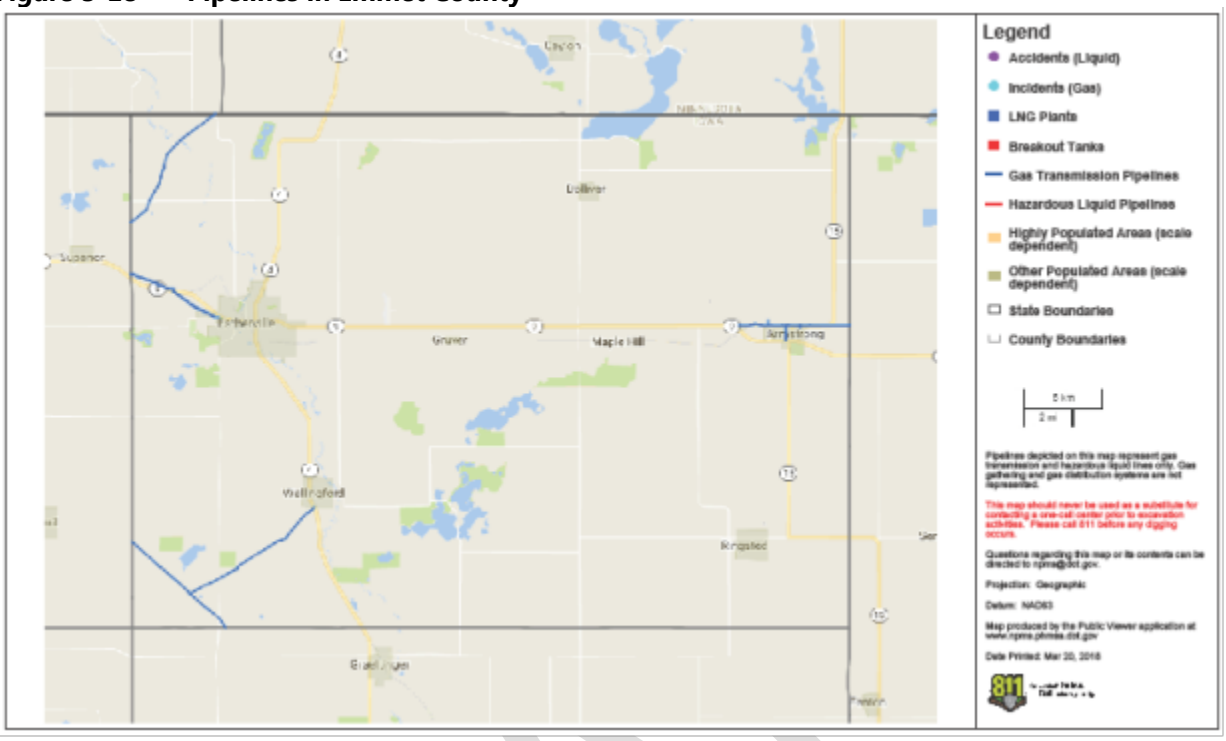
**Figure 3-17 Estherville Municipal Airport**


Source: Iowa Department of Transportation, http://www.iowadot.gov/aviation/airports/municipal.aspx

*Pipeline Incident*

Figure 3-18 provides the locations of pipelines in Emmet County. The data for this map consists of gas transmission pipelines and hazardous liquid trunklines. It does not contain gathering or distribution pipelines, such as lines which deliver gas to a customer's home. Therefore, not all pipelines in the County will be visible.

**Figure 3-18 Pipelines in Emmet County**




Source: Pipeline and Hazardous Materials Safety Administration, National Pipeline Mapping System, https://www.npms.phmsa.dot.go/PublicViewer/

Any type of hazardous materials incident within a city that includes a large release of hazardous materials could affect large areas of the city in the right conditions, possibly even the entire city. This could necessitate evacuation of large areas. In the rural unincorporated areas where population densities are low, even in the event of a large release the number of homes that may need to be evacuated would be significantly lower than in an urban environment.

Immediate dangers from hazardous materials include fires and explosions. The release of some toxic gases may cause immediate death, disablement, or sickness if absorbed through the skin, injected, ingested, or inhaled. Contaminated water resources may be unsafe and unusable, depending on the amount of contaminant. Some chemicals cause painful and damaging burns if they come in direct contact with skin. Contamination of air, ground, or water may result in harm to fish, wildlife, livestock, and crops. The release of hazardous materials into the environment may cause debilitation, disease, or birth defects over a long period of time. Loss of livestock and crops may lead to economic hardships within the community. The occurrence of a hazmat incident many times shuts down transportation corridors for hours at a time while the scene is stabilized, the product is off-loaded, and reloaded on a replacement container.

### *Previous Occurrences*

In Iowa, hazardous materials spills are reported to the Department of Natural Resources. According to Iowa Administrative Code Chapter 131, Notification of Hazardous Conditions, any person manufacturing, storing, handling, transporting, or disposing of a hazardous substance must notify the Department of Natural Resources and the local police department or the office of the sheriff of the affected county of the occurrence of a hazardous condition as soon as possible but not later than six hours after the onset of the hazardous condition or the discovery of the hazardous condition. The Department of Natural Resources maintains a database of reported spills.

According to the DNR database, from 2000 to 2016 (17 years), there have been 109 hazardous materials spills reported in Emmet County. Table 3-46 provides a summary of the reported spills during this time period for each jurisdiction indicated in the database as well as the mode of the spill. According to this data, the most spills occurred in the Estherville (35) and most spills involved manure (58). Table 3-47 that follows summarizes the spills by material type. Inorganic chemical is the most common material type spilled with 27 spills of this type.

**Table 3-46 Emmet County Hazardous Materials Spills Reported to Iowa DNR, 2000-2016 by Jurisdiction and Mode**

| Jurisdiction | Dumping | Handling and Storage | Manure | Other | Pipeline | Theft | Transformer | Transportation | Not Reported | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Armstrong | 2 | 4 | 20 | 1 | | 1 | | 4 | | 32 |
| Dolliver | | | 4 | | | | | 3 | | 7 |
| Estherville | | 9 | 13 | 1 | 1 | | | 12 | | 35 |
| Graettinger | | | 6 | | | | | 3 | | 0 |
| Ringsted | | | 13 | | | | 1 | | | 14 |
| Wallingford | | 1 | 1 | | | | | 5 | | 7 |
| Unincorporated County | | | 1 | | | | | 3 | | 4 |
| **Grand Total** | **2** | **14** | **58** | **2** | **1** | **1** | **1** | **30** | | **109** |

Source: Iowa Department of Natural Resources, http://www.iowadnr.gov/InsideDNR/RegulatoryLand/EmergencyPlanningEPCRA/SpillReporting.aspx

**Table 3-47 Emmet County Hazardous Materials Spills Reported to Iowa DNR, 2000-2016 by Material Type**

| Jurisdiction | Acids / Bases | Animal / Vegetable Product | Fertilizer / Pesticide | Inorganic Chemical | Manure | Organic Chemical | Petroleum | Propane / LPG / Natural Gas | Transformer oil / PCB | Not Reported | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Armstrong | | 2 | 3 | 7 | 9 | | 5 | | | 7 | 33 |
| Dolliver | | | | 2 | | | 3 | | | 2 | 7 |
| Estherville | 2 | 1 | | 5 | 6 | | 13 | 2 | | 6 | 35 |
| Graettinger | | | 1 | 3 | 1 | | | | | 4 | 9 |
| Ringsted | | | | 10 | | | | | 1 | 3 | 14 |
| Wallingford | | 1 | | | 1 | 1 | 4 | | | | 7 |
| Unincorporated County | | | 2 | | 1 | | 1 | | | | 4 |
| **Grand Total** | **2** | **4** | **6** | **27** | **18** | **1** | **26** | **2** | **1** | **22** | **109** |

Source: Iowa Department of Natural Resources, http://www.iowadnr.gov/InsideDNR/RegulatoryLand/EmergencyPlanningEPCRA/SpillReporting.aspx

The Emmet County Emergency Management Agency documented the following photo of a hazardous materials incident in which a semi-truck rolled over, spilling 600+ marine batteries. The incident required major environmental cleanup and assistance from a HazMat team from Mason City.

Source: Emmet County Emergency Management Agency

*Pipelines*

The U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration maintains a database of pipeline incidents and mileage reports. From 1996 to 2015, there were no reported pipeline incidents in Emmet County.

### *Probability of Future Occurrence*

From 2000 to 2016 (17 years), there have been 109 spills reported to Iowa DNR. This computes to an annual average of over 6.4 hazardous materials spills per year. Therefore, the probability of future occurrence of hazardous materials incidents is determined to be "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Vulnerability Overview*

A hazardous materials incident can occur almost anywhere. So, all jurisdictions are considered to have at least some vulnerability to this hazard. People, pets, livestock, and vegetation in close proximity to facilities producing, storing, or transporting hazardous substances are at higher risk. Populations downstream, downwind, and downhill of a released substance are particularly vulnerable. Depending on the characteristics of the substance released, more people, in a larger area may be in danger from explosion, absorption, injection, ingestion, or inhalation.

Most of the hazardous materials incidents that have occurred in Emmet County are localized and are quickly contained or stabilized. Depending on the characteristic of the hazardous material or the volume of product involved, the affected area can be as small as a room in a building or as large as 5 square miles or more. Many times, additional regions outside the immediately affected area are evacuated for precautionary reasons. More widespread effects occur when the product contaminates the municipal water supply or water system such as river, lake, or aquifer. Spills can be costly to clean up due to the specialized equipment and training, and disposal sites that are necessary. Since the majority of spills in the

county are small and quickly maintained within existing capabilities, the magnitude was determined to be "Negligible".

**Magnitude Score:** 1 - Negligible

### *Potential Losses to Existing Development*

The impact of this type of disaster will likely be localized to the immediate area surrounding the incident. The initial concern will be for people, then the environment. If contamination occurs, the spiller is responsible for the cleanup actions and will work closely with responders in the local jurisdiction, the Iowa Department of Natural Resources, and the Environmental Protection Agency to ensure that cleanup is done safely and in accordance with federal and state laws.

As mentioned, it is difficult to determine the potential losses to existing development because of the variable nature of a hazardous materials spill. For example, a spill of a toxic airborne chemical in a populated area could have greater potential for loss of life. By contrast a spill of a very small amount of a chemical in a remote rural area would be much less costly and possibly limited to remediation of soil.

Data provided by the Iowa Department of Natural Resources did not provide information relative to costs associated with cleaning up any of the spills or of any property damage that occurred. Without data on costs of previous events, it is not possible to determine potential costs associated with future spills.

To analyze critical facilities at risk in the planning area, the inventory of critical and essential facilities and infrastructure in the planning area was compiled from various sources including Emmet County, the Department of Natural Resources NRGIS, and HSIP Freedom 2015. The compiled inventory consisted of 99 critical facilities. A comparison was made of the critical facilities with the locations of Tier II Facilities to determine those critical/essential facilities/functions (other than Tier II facilities themselves) that are within ½ mile of Tier II fixed chemical facilities. This analysis revealed 48 critical or essential facilities within ½ mile of fixed chemical facilities with the Tier II reporting requirement. Appendix E contains the results of analysis. This Appendix is redacted from the public version of this plan. To obtain access for official use, contact the Emmet County Emergency Manager.

### *Future Development*

The number and types of hazardous chemicals stored and transported through Emmet County will likely continue to increase. As populations grow, this also increases the number of people vulnerable to the impacts of hazardous materials spills. Population and business growth along major transportation corridors increases the vulnerability to transportation hazardous materials spills.

### *Hazardous Materials Hazard Summary by Jurisdiction*

Although spills do occur in the unincorporated area, they are primarily recorded in the database associated with the nearest city. The probability score was based on the number of spills for each jurisdiction during this period. Jurisdictions that recorded more than 20 spills correspond to a probability score of 4, 10-20 spills correspond to a score of 3, 0-10 spills correspond to a score of 2, and jurisdictions with no spills receive a score of 1. The magnitude was determined to be "negligible" based on the general types and quantities of spills that have occurred. Probability and magnitude for the schools and community college were unlikely and negligible as hazardous materials are not generally stored on site.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 4 | 1 | 1.45 | Low |
| City of Armstrong | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Dolliver | 2 | 1 | 4 | 1 | 1.90 | Low |
| City of Estherville | 4 | 1 | 4 | 1 | 2.80 | Moderate |
| City of Gruver | 1 | 1 | 4 | 1 | 1.90 | Low |
| City of Ringsted | 3 | 1 | 4 | 1 | 2.35 | Moderate |
| City of Wallingford | 2 | 1 | 4 | 1 | 1.90 | Low |
| North Union Schools | 1 | 1 | 4 | 1 | 1.45 | Low |
| Estherville-Lincoln Schools | 1 | 1 | 4 | 1 | 1.45 | Low |

### 3.5.10 Human Disease

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 2 | 3 | 2 | 4 | 2.50 | Moderate |

## Profile

#### *Hazard Description*

A human disease outbreak is a medical, health or sanitation threat to the general public (such as contamination, epidemic, plague and insect infestation). The outbreak may be spread by direct contact with an infected person or animal, ingesting contaminated food or water, vectors such as mosquitoes or ticks, contact with contaminated surroundings such as animal droppings, infected droplets, or by aerosolization.

Iowa's public health and health care communities work to protect Iowans from infectious diseases and preserve the health and safety of Iowans by rapidly identifying and containing a wide range of biological agents. Local public health departments and the Iowa Department of Public Health, Center for Acute Epidemiology investigate disease "outbreaks" of routine illnesses. There are a number of biological diseases/agents that are of concern to the State of Iowa such as vaccine preventable disease, foodborne disease and community associated infections having significant impact on the morbidity of Iowans. The following descriptions are general, and it should be noted that individuals may experience more or less severe consequences.

#### *Vaccine Preventable Disease*

In the U.S., there are common infectious diseases that include polio, measles, diphtheria, pertussis, rubella, mumps, tetanus and *Haemophilus influenzae* type b that are now rare because of widespread use of vaccines. Routine childhood immunizations have helped protect both individuals and communities each year saving nearly $14 billion in direct medical costs and $69 billion in costs to society according to the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

The immunization rates in Iowa are consistent with national average (see Table 3-51). Vaccine preventable diseases continue to threaten the health of Iowans when children, adolescents and adults are un-immunized or under-immunized.

*Influenza*

Influenza (flu) is a viral infection of the nose, throat, bronchial tubes, and lungs. There are two main types of virus: A and B. Each type includes many different strains, which tend to change each year. In Iowa, influenza occurs most often in the winter months. Illnesses resembling influenza may occur in the summer months, but these are usually the result of other viruses that exhibit symptoms commonly referred to as influenza-like illness or ILI.

Influenza is highly contagious and is easily transmitted through contact with droplets from the nose and throat of an infected person during coughing and sneezing. Typical symptoms include headache, fever, chills, cough, and body aches. Although most people are ill for only a few days some may have secondary infections, such as pneumonia, and may need to be hospitalized. Anyone can get influenza, but it is typically more serious in the elderly and people with chronic illnesses such as cancer, emphysema, or diabetes or weak immune systems. It is estimated that thousands of people die each year in the United States from flu or related complications.

In 2016, influenza and pneumonia combined was the 8th leading causes of death in Iowa with 483 deaths, followed by all infective and parasitic diseases with 429 deaths. In 2008, there were over 800

influenza/pneumonia deaths. See Table 3-49 under Previous Occurrence for the number of deaths and rate from 2007-2016 in Emmet County and throughout Iowa.

*Pandemic Influenza*

A pandemic is a global disease outbreak. A pandemic flu is a human flu that causes a global outbreak, or pandemic, of serious illness. A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine.

This disease spreads easily person-to-person, causing serious illness, and can sweep across the country and around the world in a very short time. The Centers for Disease Control and Prevention (CDC) has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of influenza that might cause a pandemic and to assist with pandemic planning and preparation.

During 2009 and 2010, health professionals around the globe worked to combat the H1N1 influenza virus. This relatively mild and stable influenza virus circulated across the globe and caused one of the most robust worldwide vaccination campaigns since the 1970s. Health professionals continue to monitor the possibility of an avian (bird) flu pandemic associated with a highly pathogenic avian H5N1 virus. Since 2003, avian influenza has been spreading through Asia. A growing number of human H5N1 cases contracted directly from handling infected poultry have been reported in Asia, Europe, and Africa, and more than half the infected people have died. There has been no sustained human-to-human transmission of the disease, but the concern is that H5N1 will evolve into a virus capable of human-to-human transmission.

An especially severe influenza pandemic could lead to high levels of illness, death, social disruption, and economic loss. Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines.

Pandemics are generally thought to be the result of novel strains of viruses. Because of the process utilized to prepare vaccines, it is impossible to have vaccine pre-prepared to combat pandemics. A portion of the human and financial cost of a pandemic is related to lag time to prepare a vaccine to prevent future spread of the novel virus. In some cases, current vaccines may have limited activity against novel strains.

*Foodborne Disease*

There are several agents that can cause illness when consumer in contaminated food, beverages or water. Foodborne illness (food poisoning) can also be spread person-to-person as well as from contact with animals. Table 3-48 is a list of common foodborne diseases.

**Table 3-48 Common Foodborne Diseases**

| Organism | Onset of Symptoms | Associated Food(s) |
|---|---|---|
| Botulism | 12 - 36 hours | Canned fruits and vegetables |
| Campylobacter | 2 - 5 days, range 1 - 10 days | Undercooked chicken or pork, unpasteurized milk |
| Cholera | 12 - 72 hours | Undercooked or raw seafood, especially oysters |
| Cryptosporidium | 7 days, range 1 - 12 days | Unpasteurized beverages, contaminated food or water, person-to-person |
| E. coli (shiga-toxin) | 3 - 4 days, range 2 - 10 days | Undercooked ground meats, unpasteurized milk, contaminated fruits or vegetables, person-to-person |
| Giardia | 7 - 10 days, range 3 - 25 days | Contaminated water, person-to-person |
| Hepatitis A | 28 - 30 days, range 15 - 50 days | Raw produce, undercooked foods, person-to-person |
| Listeria | 3 weeks, range 3 - 70 days | Soft cheeses, unpasteurized milk, ready-to-eat deli meats, hot dogs, undercooked poultry, unwashed raw vegetables |

| Organism | Onset of Symptoms | Associated Food(s) |
|---|---|---|
| Norovirus | 24 - 48 hours, range 10 - 50 hours | Contaminated ready-to-eat food, undercooked shellfish, person-to-person |
| Salmonella | 12 - 36 hours, range 6 - 72 hours | Contaminated eggs, poultry, beef, raw fruits and vegetables, unpasteurized milk or juice, cheese |
| Shigella | 1 - 3 days, range 12 - 96 hours | Contaminated food or water, person-to-person |
| Trichinosis | 8 - 15 days, range 5 - 45 days | Raw or undercooked pork or wild game meat |

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology http://www.idph.state.ia.us/Cade/Foodborne.aspx).

**Warning Time Score:** 2 - 12-24 hours

**Duration Score:** 4 - More than 1 week

### *Geographic Location/Extent*

A human disease outbreak has no geographic boundaries. Because of our highly mobile society, disease can move rapidly through a school, business and across the nation within days, weeks or months. Many of the infectious diseases that are designated as notifiable at the national level result in serious illness if not death. Some are treatable, for others only the symptoms are treatable.

### *Previous Occurrences*

The World Health Organization tracks and reports on epidemics and other public health emergencies through the Global Alert and Response (see historic epidemics at www.who.int/en/).

There have been four acknowledged pandemics in the past century:

**2009 H1N1 Influenza** - The 2009 H1N1 Pandemic Influenza caused 659 hospitalizations with lab confirmed H1N1 since 9/1/09 and resulting in 41 fatalities. Typically, people who became ill were the elderly, the very young and people with chronic medical conditions and high risk behaviors.

**1968–69 Hong Kong flu (H3N2)** - This strain caused approximately 34,000 deaths in the United States and more than 700,000 deaths worldwide. It was first detected in Hong Kong in early 1968 and spread to the United States later that year. Those over age 65 were most likely to suffer fatal consequences. This virus returned in 1970 and 1972 and still circulates today.

**1957–58 Asian flu (H2N2)** - This virus was quickly identified because of advances in technology, and a vaccine was produced. Infection rates were highest among school children, young adults and pregnant women. The elderly had the highest rates of death. A second wave developed in 1958. In total, there were about 70,000 deaths in the United States. Worldwide deaths were estimated between one and two million.

**1918–19 Spanish flu (H1N1)** - This flu is estimated to have sickened 20-40 percent of the world's population. Over 20 million people lost their lives. Between September 1918 and April 1919, 500,000 Americans died. The flu spread rapidly; many died within a few days of infection, others from secondary complications. The attack rate and mortality were highest among adults 20-50 years old; the reasons for this are uncertain.

### *Other Reportable Diseases*

Table 3-49 shows the historical reported deaths in Emmet County from Influenza and Pneumonia as well as Infective and Parasitic Disease.

**Table 3-49 Deaths by Year 2007-2016, Influenza and Pneumonia and Infective and Parasitic Disease, Emmet County and State of Iowa**

| Year | Influenza/Pneumonia Deaths, Emmet County | Influenza/Pneumonia Deaths, Iowa | Infective/Parasitic Disease Deaths, Emmet County | Infective/Parasitic Disease Deaths, Iowa |
|---|---|---|---|---|
| 2016 | * | 483 | * | 429 |
| 2015 | * | 592 | * | 488 |
| 2014 | * | 549 | * | 448 |
| 2013 | * | 755 | * | 511 |
| 2012 | * | 656 | * | 511 |
| 2011 | * | 657 | 0 | 464 |
| 2010 | 0 | 557 | 0 | 441 |
| 2009 | * | 633 | * | 457 |
| 2008 | 4 | 825 | * | 493 |
| 2007 | 4 | 748 | * | 427 |

Source: Iowa Department of Public Health, Bureau of Health Statistics-Vital Statistics of Iowa in Brief, http://idph.iowa.gov/health-statistics/data

* Counts are suppressed to protect confidentiality.

Table 3-50 lists the number of common reportable diseases in Emmet County from 2007 to 2016 from the Iowa Department of Public Health, Center for Acute Epidemiology Annual Reports.

**Table 3-50 Iowa Common Reportable Diseases by Year in Emmet County**

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| AIDS (Diagnosis) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | N/A | N/A |
| HIV (Diagnosis) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | N/A | N/A |
| Campylobacteriosis | 1 | 3 | 3 | 7 | 3 | 0 | 1 | 1 | 3 | 4 |
| Chlamydia | 20 | 17 | 24 | 34 | 21 | 37 | 30 | 28 | N/A | N/A |
| Cryptospora | 9 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 1 |
| E. Coli | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Ehrlich (HME) | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Giardia | 3 | 1 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| Gonorrhea | 0 | 0 | 0 | 4 | 1 | 1 | 4 | 1 | N/A | N/A |
| HUS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hep A | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Hep B, Acute | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hep B, Chron | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| Legion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Listeria | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lyme | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Meningo.Inf | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mumps | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Pertussis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rabies (Animal) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | N/A | N/A |
| RMSF | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Salmonellosis | 1 | 2 | 1 | 3 | 0 | 2 | 0 | 3 | 2 | 1 |
| Shigella | 0 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Syphilis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N/A | N/A |
| TB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | N/A | N/A |
| West Nile Virus | N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: Iowa Department of Public Health, Center for Acute Disease Epidemiology Annual Reports. 2007-2016, *only 1-3 HIV diagnoses reported, http://idph.iowa.gov/CADE

During discussion of this hazard, the HMPC expressed concern regarding the data for West Nile Virus, Lyme Disease and E. Coli, stating that the numbers were too low.

### *Probability of Future Occurrence*

For purposes of determining probability of future occurrence, the HMPT defined "occurrence" of human disease outbreak as a medical, health or sanitation threat to the general public (such as contamination, epidemic, or plague). In the last century, there have been four pandemic flu events. With the swine flu (H1N1) outbreak in 2009-2010 within the last 10 years), the HMPT determined the possibility of a human disease outbreak causing a threat to the general public to be "Occasional".

**Probability Score:** 2 - Occasional

## Vulnerability

### *Overview*

Although infectious diseases do not respect geographic boundaries, several populations in Emmet County are at specific risk to infectious diseases. Communicable diseases are most likely to spread quickly in institutional settings such as nursing home facilities, day care facilities, and schools. According to the critical facilities inventory provided by Emmet County GIS, there are 3 nursing homes, 10 school facilities (including a college/university) and 6 group day care centers in the county.

According to the Iowa Department of Public Health 2014 Immunization Program Annual Report, Emmet County had 98.91 percent with immunization certificates in kindergarten through 12th grade. The County Immunization Assessment for 2-year old and 13-15-year old coverage from the 2016 Annual Report is provided in Table 3-51. The percent of up-to-date children is close to the state average of 69 percent, but the percent of adolescents up-to-date is far below the state average of 58 percent.

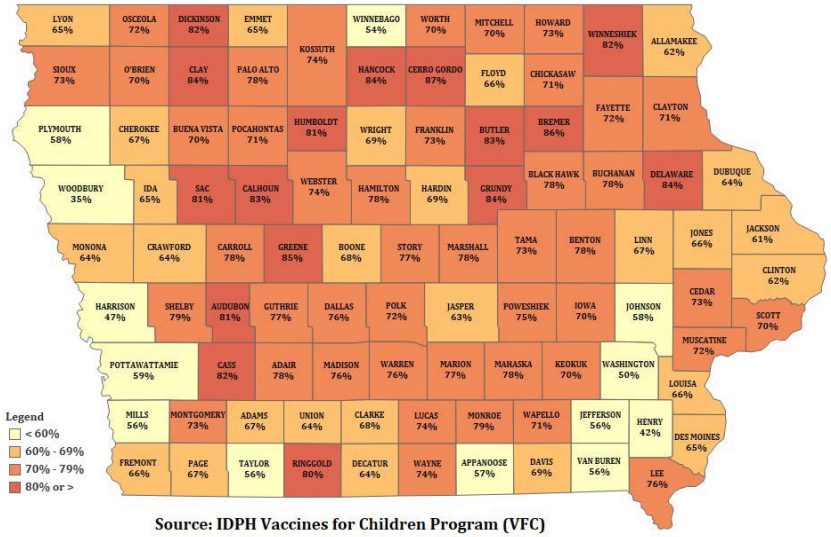
**Table 3-51 2016 Vaccination Coverage Percent of Individual Vaccines and Selected Vaccination Series in Emmet County (2-year old coverage and 13-15 year old coverage)**

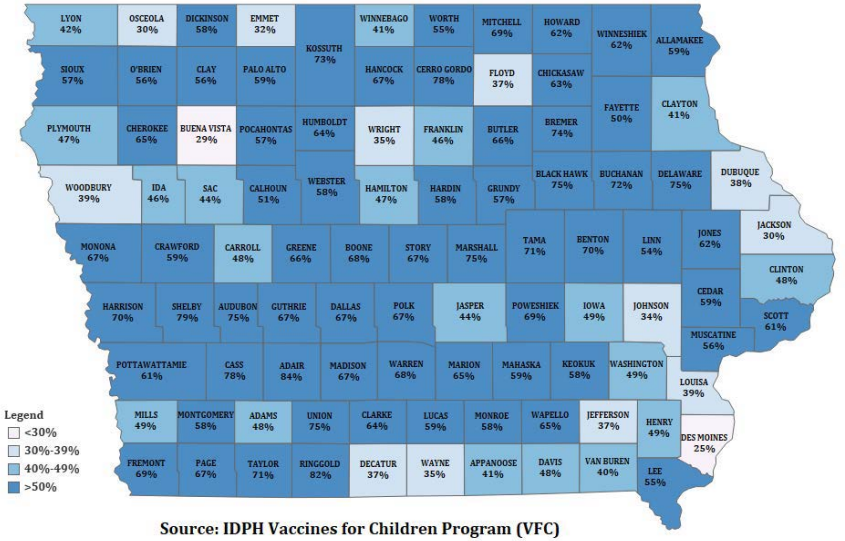
| | County Population Born 2014 Estimate | Total Records Analyzed from IRIS | Percent of Population in IRIS | 4 DTaP Coverage Percent | 3 Polio Coverage Percent | 1 MMR Coverage Percent | 3 Hib Coverage Percent | 3 Hep B Coverage Percent | 1 Varicella Coverage Percent | 4 PCV Coverage Percent | Up-To-Date 4-3-1-3-3-1-4 Coverage Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Year Old Coverage | 115 | 125 | 108.7 | 70 | 85 | 84 | 76 | 85 | 84 | 69 | 65 |
| | **County Population 2014 Estimate** | **Total Records Analyzed from IRIS7** | **Percent of Population in IRIS** | **3 Hep B Coverage Percent** | **1 Meningitis Coverage Percent** | **2 MMR Coverage Percent** | **1 Td/Tdap Coverage Percent** | **2 Varicella Coverage Percent** | **Up-to-Date 3-1-2-1-2 Coverage Percent** | **3 HPV Female Coverage Percent** | **3 HPV Male Coverage Percent** |
| 13-15 Year Old Coverage | 350 | 407 | 116.3 | 80 | 48 | 75 | 88 | 54 | 32 | 26 | 26 |

Source: Iowa Department of Public Health, Iowa Immunization Program 2016 Annual Report, 2016 County Immunization Assessment, http://www.idph.state.ia.us/ImmTB/Immunization.aspx?prog=Imm&pg=ImmHome

* Note: Up-to-date are 2-year old children who have completed the 4 DTaP, 3 Polio, 1 MMR, 3 Hib, 3 Hep B, 1 Varicella, 4 PCV by 24 months of age or adolescents 13- to 15-year-olds who have completed the 3 Hep B, 1 Meng, 2 MMR, 1 Td or Tdap, 2 Varicella series.

**Figure 3-19 County Immunization Assessment Maps (2-year Old Coverage-left, 13-15-year Old Coverage-right)**




Source: Iowa Department of Public Health, Iowa Immunization Program Annual Report 2016 County Immunization Assessment, http://www.idph.state.ia.us/ImmTB/Immunization.aspx?prog=Imm&pg=ImmHome

Human disease outbreak could be catastrophic based on a pandemic scenario. The magnitude of an infectious disease outbreak is related to the ability of the public health and medical communities to stop the spread of the disease. Most disease outbreaks that cause critical numbers of deaths are communicable in nature, meaning that they are spread from person to person. The key to reducing the critical nature of the event is to stop the spread of disease. This is generally done in three ways:

1. identification and isolation of the ill,
2. quarantine of those exposed to the illness to prevent further spread, and
3. education of the public about methods to prevent transmission.

The public health and health care providers in Emmet County routinely utilize all three methods to reduce morbidity and mortality from infectious disease.

Spread of disease is also limited by Emmet County's low population density of 26.0 people per square mile, which is far below the national average of 87.4 people per square mile and suggests that the opportunity for disease to spread from person to person in the County would be low.

**Magnitude Score:** 3 - Critical

***Potential Losses to Existing Development***

According to *The Annual Impact of Seasonal Influenza in the US: Measuring Disease Burden and Costs* by Molinari et al., nationally the economic burden of influenza medical costs, medical costs plus lost earnings, and the total economic burden was $10.4 billion, $26.8 billion and $87.1 billion respectively. The financial burden of healthcare-associated infections nationally has been estimated at $33 billion annually. Specific amounts for Emmet County are not available.

The pandemic predictions for Iowa from the *Iowa Pandemic Influenza Annex*, 2006 are that 15-35 percent of the population may be affected with a "medium level" case scenario with no vaccine and no antiviral drugs, which could cause 900-2,000 deaths and 3,000-7,000 hospitalizations statewide. Also, the predictions state that if a pandemic were to occur, it is likely that it would not be a worst-case scenario. Most agricultural-related jobs could continue, and school and other congregating activities could be cancelled, resulting in less spreading of a disease outbreak.

Based upon 2011 research on foodborne pathogens, the U.S. Centers for Disease Control and Prevention (CDC) estimates that 48 million people suffer foodborne illnesses each year in the United States, accounting for 128,000 hospitalizations and 3,000 deaths. Salmonella and norovirus cause the most illnesses and hospitalizations. Foodborne disease is extremely costly. According to 2013 estimates from the USDA's Economic Research Service, the 15 major pathogens that cause over 95 percent of the illnesses and deaths from foodborne illnesses in the U.S. cost over $15 billion per year in direct medical expenses and lost productivity. Infections with the bacteria Salmonella alone account for over $3.5 billion yearly in direct and indirect medical costs.

Buildings, infrastructure, and critical facilities are not vulnerable to this hazard. It affects only persons susceptible to the illness. The impacts and potential losses are largely economic and are dependent on the type, extent and duration of the illness.

***Future Development***

The population in Emmet County is declining, falling from 10,389 in 2010 to 9,820 in 2016. Thus, there are not as many people to potentially fall ill from a human disease. However, 19.7 percent of the population is over 65 years old. Those over 65 are more susceptible to health complications as a result of disease. Therefore, while the overall number of people at risk may be declining, those who remain face higher than average vulnerability to human disease.

### *Climate Change Impacts*

The following is an excerpt from the *2010 Climate Change Impacts on Iowa* Report.

> *Investigations of the past two decades indicate that the health effects of climate change can be serious. The World Health Organization estimated that in 2002, 2.4% of worldwide diarrhea cases, 6% of malaria cases, 7% of dengue fever cases, and 170,000 deaths (0.3% of worldwide deaths) were attributed to climate change (Beggs and Bambrick 2005, WHO 2002). A major 2010 study included a range of diseases in its listing of potential effects of climate change, ranging from obvious illnesses such as asthma and vector-borne disease to less obvious cancer and neurological disease (Portier 2010).*

The report details the following as climate change contributors to negative consequences for public health in Iowa:

- Extreme Precipitation Events, Rising Humidity, and Associated Disease
- Illness and Death Associated with Extreme Heat and Heat Waves
- Warming, Air Quality and Respiratory Problems
- Pollen Production and Allergies
- Diseases Transferred by Food, Water, and Insects

### *Human Disease Hazard Summary by Jurisdiction*

Due to disease spreading more quickly in areas with high density, the community school districts were given a magnitude of 4. Due to their small populations and low population densities, the unincorporated county and cities, which all have with populations less than 2,000, were given a magnitude of 3. The rest of the elements are not varied across jurisdictions.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Armstrong | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Dolliver | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Estherville | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Gruver | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Ringsted | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| City of Wallingford | 2 | 3 | 2 | 4 | 2.50 | Moderate |
| North Union Schools | 2 | 4 | 2 | 4 | 2.80 | Moderate |
| Estherville Lincoln Schools | 2 | 4 | 2 | 4 | 2.80 | Moderate |
| Iowa Lakes CC | 2 | 4 | 2 | 4 | 2.80 | Moderate |

### 3.5.11 Infrastructure Failure

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 4 | 3 | 3.30 | High |

## Profile

### *Hazard Description*

Critical infrastructure involves several different types of facilities and systems including: electric power, transportation routes, natural gas and oil pipelines, water and sewer systems, storage networks and internet/telecommunications systems. Failure of utilities or other components of the infrastructure in the planning area can seriously impact public health, functioning of communities and the economy. Disruption of any of these services could result from the majority of the natural, technological, and manmade hazards described in this plan. In addition to a secondary or cascading impact from another primary hazard, utilities and infrastructure can fail as a result of faulty equipment, lack of maintenance, degradation over time, or accidental damage such as damage to buried lines or pipes during excavation.

To maintain consistency with the state plan, this hazard encompasses a variety of different types of infrastructure failure, including communications failure, energy failure, structural failure, and structural fire.

*Communications Failure*

Communications failure is the widespread breakdown or disruption of normal communication capabilities. This could include major telephone outages, internet interruption, loss of cellular telephone service, loss of local government radio facilities, long-term interruption of electronic broadcast services, or emergency 911. Law enforcement, fire, emergency medical services, public works, and emergency warning systems are just a few of the vital services which rely on communications systems to effectively protect citizens. In addition, business and industry rely heavily on various modes of communication. Mechanical failure, traffic accidents, power failure, line severance, and weather can all affect communications systems and disrupt service. Disruptions and failures can range from localized and temporary to widespread and long-term.

The types of hazards and impacts to internet and telecommunications infrastructure are very similar to electric power supply. Land line phone lines often utilize the same poles as electric lines. So, when weather events such as windstorm or winter weather cause lines to break, both electricity and telephone services experience outages. With the increasing utilization of cellular phones, hazard events such as tornado that can damage cellular repeaters can cause outages. In addition, during any hazard event, internet and telecommunications systems can become overwhelmed due to the surge in call/usage volume.

*Energy Failure*

Energy failure includes interruption of service to electric, petroleum, or natural gas. Disruption of electric power supply can be a cascading impact of several other hazards. Electric power is the type of energy failure that is most often a secondary impact of other hazard events. The most common hazards analyzed in this plan that disrupt power supply are: flood, tornado, windstorm, and winter weather as these hazards can cause major damage to power infrastructure. To a lesser extent, extreme temperatures, dam failure, lightning, and terrorism can disrupt power. Extreme heat can disrupt power supply when air conditioning use spikes during heat waves which can cause brownouts. Dam failure is similar to flood in that infrastructure can be damaged or made inaccessible by water. Lightning strikes can damage substations and transformers but is usually isolated to small areas of outage. Many forms of terrorism could impact power supply either by direct damage to infrastructure or through cyber-terrorism targeting power supply networks.

Primary hazards that can impact natural gas and oil pipelines are earthquake, expansive soils, land subsidence, landslide, and terrorism.

*Other Utility Failure*

Interruption of other utilities such as water and sewer systems can be a devastating, costly impact. The primary hazards that can impact water supply systems are: drought, flood, hazardous materials, and terrorism. Winter storm can also impact water supply if low temperatures cause failure/breakage of water infrastructure. The primary hazard that impacts sewer systems is flood.

*Structural Failure / Structure Fire*

The collapse (partial or total) of any structure including roads, bridges, towers, and buildings is considered a structural failure. A road, bridge, or building may collapse due to the failure of the structural components or because the structure was overloaded. Natural events such as heavy snow may also cause the roof of a building to collapse (under the weight of snow). In 1983 a KWWL television tower collapsed due to ice buildup. Heavy rains and flooding can undercut and washout a road or bridge. This occurred twice in 2008 when railway bridges failed in Waterloo and Cedar Rapids due to flooding. The age of the structure is sometimes independent of the cause of the failure. Enforcement of building codes can better guarantee that structures are designed to hold-up under normal conditions. Routine inspection of older structures may alert inspectors to weak points. The level of damage and severity of the failure is dependent on factors such as the size of the building or bridge, the number of occupants of the building, the time of day, day of week, amount of traffic on the road or bridge, and the type and number of products stored in the structure. There have been structural failures across the state in the past as mentioned above. They have included homes, commercial structures, and communications towers. There is no central collection point for this information, but news articles document infrastructure failure.

A structural fire is an uncontrolled fire in a populated area that threatens life and property and is beyond normal day-to-day response capability. Structural fires present a far greater threat to life and property and the potential for much larger economic losses. Modern fire codes and fire suppression requirements in new construction and building renovations, coupled with improved fire-fighting equipment, training, and techniques lessen the chance and impact of a major urban fire. Most structural fires occur in residential structures, but the occurrence of a fire in a commercial or industrial facility could affect more people and pose a greater threat to those near the fire or fighting the fire because of the volume or type of the material involved. Less severe structural fires are almost a common occurrence in some communities.

**Warning Time Score:** 4 - less than six hours warning time

**Duration Score:** 3 - less than 1 week

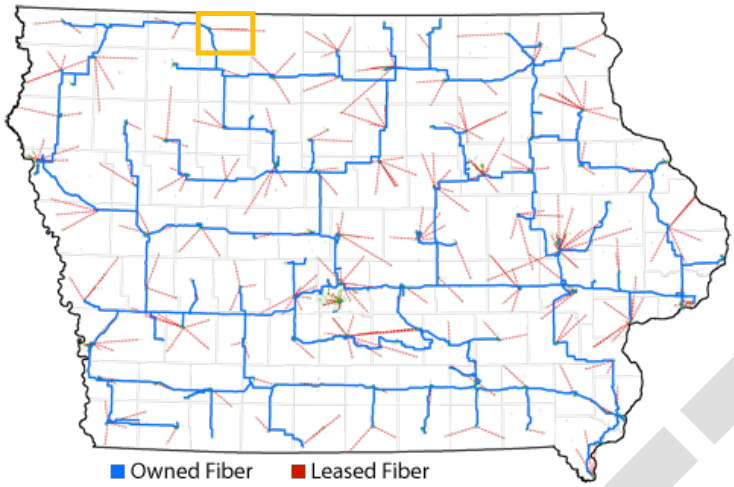
***Geographic Location/Extent***

The entire planning area is at risk to all types of infrastructure failure included in the hazard description section, either from primary failure due to malfunction, degradation, or accidental or intentional damage or as a result of a secondary impact related to another hazard event.

*Communications*

Figure 3-20 shows the Iowa Communications Network (ICN) that administers Iowa's statewide fiber optic telecommunications network.

**Figure 3-20 Map of Iowa Communication Network**



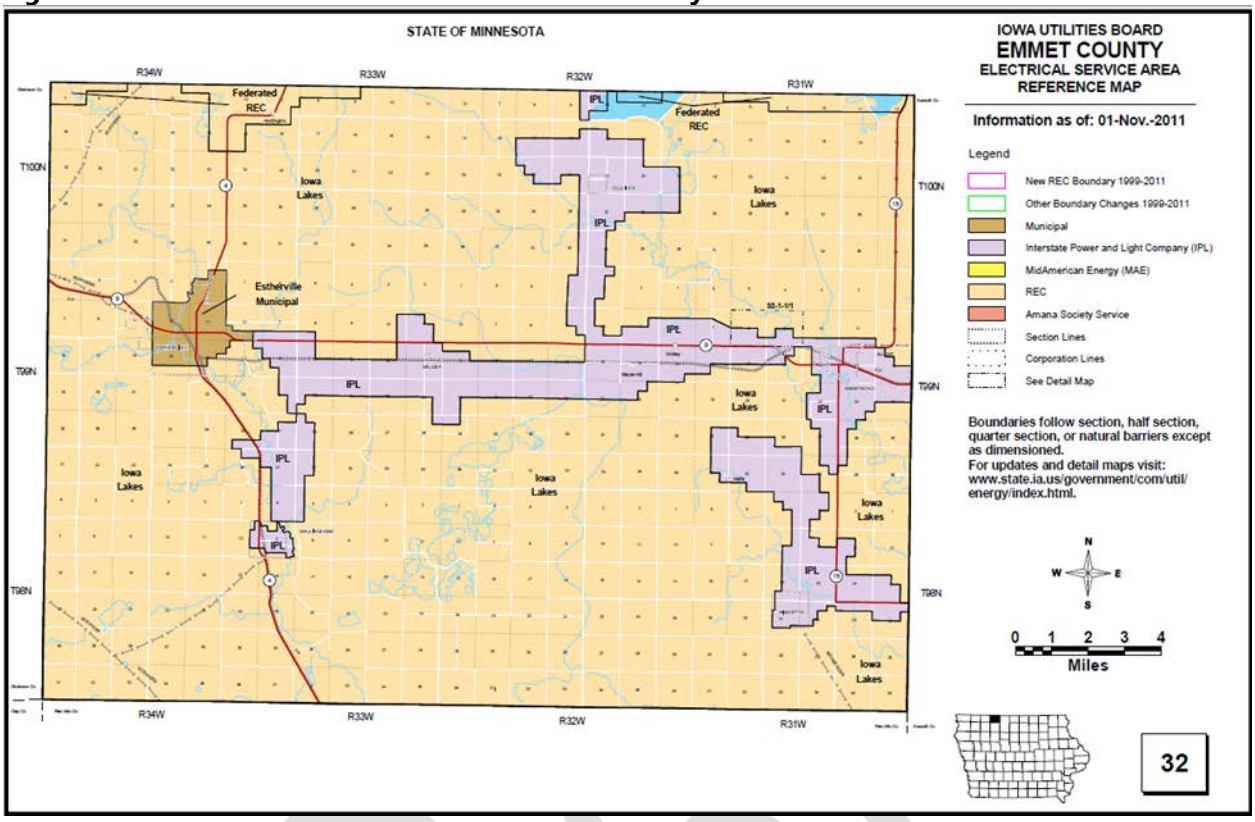

Source: http://icn.iowa.gov/about-icn/agency-information-icn-story
Note: Orange box outlines Emmet County.

*Energy*

Power outages can occur in outlying areas with more frequency than in more developed areas. A loss of electric power can also interrupt supply of water from a well. Food in freezers or refrigerators may also be lost. Power outages can cause problems with computers and other devices as well.

Figure 3-21 is the electrical service area map for Emmet County.

**Figure 3-21 Electrical Service Areas in Emmet County**




Source: http://www.iowadot.gov/maps/msp/electrical/electrical.html

### *Other Utilities (Water/Sewer)*

#### *Water*

There are 8 Water Supply Systems in Emmet County, Iowa as follows:

- Estherville Water Treatment Plant (serves 6,780 people)
- Armstrong Water Supply (serves 986 people)
- Ringsted Water Supply (serves 436 people)
- Wallingford Municipal Waterworks (serves 212 people)
- Iowa Lakes Regional Water – Gruver (serves 126 people)
- Forest Ridge – Center (serves 120 people)
- Dolliver Muni Water Supply (serves 77 people)
- Ridgeroad Development (serves 31 people)

(Source: https://www.nytimes.com/interactive/projects/toxic-waters/contaminants/ia/emmet/index.html)

#### *Sewer*

There are 10 permitted wastewater treatment discharge sites in Emmet County, Iowa according to the Department of Natural Resources (see Table 3-52).

**Table 3-52 Permitted Wastewater Sites in Emmet County**

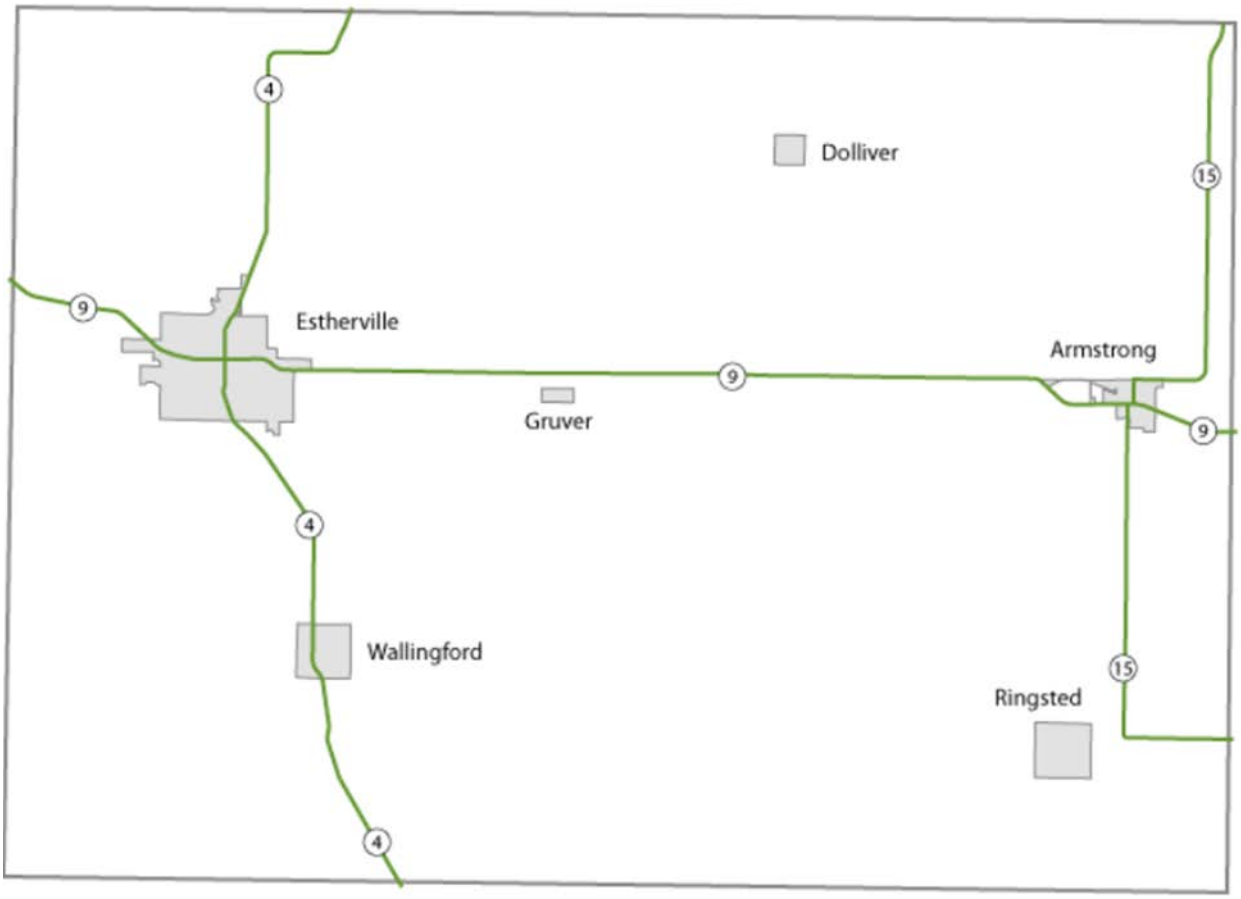
| Facility Name | Facility City | Permit Type | Class | Sic Code | Treatment Type |
|---|---|---|---|---|---|
| Armstrong City of STP | Armstrong | Municipal | Minor | 4952 | Aerated Lagoon |
| Dolliver, City of STP | Dolliver | Municipal | Minor | 4952 | Trickling Filter |
| East Fork Land & Cattle Company, LLC (Formerly Ulrich Feedlot) | Armstrong | Agricultural | Minor | 0211 | |
| Estherville City of STP | Estherville | Municipal | Major | 4952 | Trickling Filter |
| Greig & Company, Inc. | Estherville | Agricultural | Minor | 0211 | |
| Gruver City of (Iowa Lakes Regional Water) | Gruver | Municipal | Minor | 4952 | Waste Stabilization Lagoon |
| Ringsted City of STP | Ringsted | Municipal | Minor | 4952 | Waste Stabilization Lagoon |
| Stateline Cooperative | Armstrong | Industrial | Minor | 2048 | Other |
| Wallingford City of STP | Wallingford | Municipal | Minor | 4952 | Waste Stabilization Lagoon |

Source: Iowa Department of Natural Resources, http://www.iowadnr.gov/Environmental-Protection/Water-Quality/NPDES-Wastewater-Permitting/Current-NPDES-Permits

*Infrastructure/Structures*

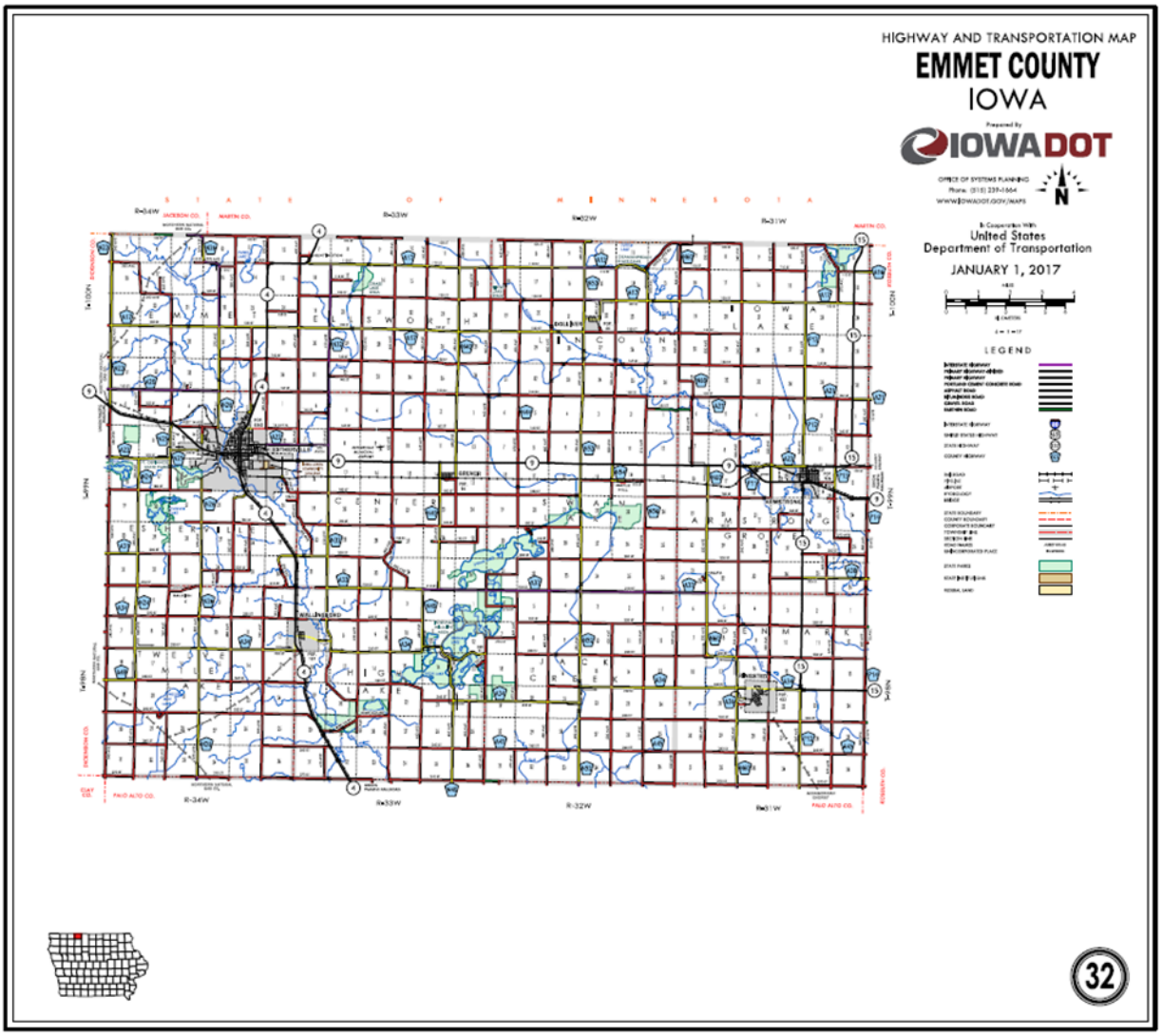
The Highway map for Emmet County is provided in Figure 3-22. The detailed Highway and Transportation Map that includes other transportation infrastructure in the county is provided in Figure 3-23.

**Figure 3-22 Emmet County Highway Map**




Source: Iowa Department of Transportation, http://www.iowadot.gov/maps/msp/pdfview/counties.html

**Figure 3-23 Emmet County Transportation Map**




Source: Iowa Department of Transportation, http://www.iowadot.gov/maps

There is a total of 80 bridge structures in the County as follows:

- 9 state-owned Bridges
- 69 county-owned bridges
- 2 city-owned bridges

### *Previous Occurrences*

As indicated in the Hazard Description Section, Infrastructure Failure often occurs as a secondary impact to other hazard events. For specific descriptions, please see the Previous Occurrences section of the other hazards included in this plan. In addition to failure/impacts as a result of other hazard events, Infrastructure Failure can also occur as a result of lack of maintenance, human error, and age deterioration.

The structural fires that have occurred in Emmet County have been within the normal day-to-day response capability, including use of pre-arranged mutual aid and do not fall into the category of uncontrolled fires in a populated area that threatens life and property.

### *Probability of Future Occurrences*

As discussed in other hazard sections in this plan, infrastructure failure occurs as a secondary or cascading impact from several primary hazards such as winter storm, wind storm, and tornado as well as lack of maintenance and age deterioration and other human-caused incidents such as human error, and various forms of terrorism. Structure fire events also occur annually. Therefore, the HMPC determined the probability of future occurrence of this hazard to be "Highly likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Vulnerability Overview*

Iowa is almost entirely dependent on out-of-state resources for energy. Iowans purchase oil, coal, and natural gas from outside sources. As a result, world and regional fuel disruptions are felt in Iowa.

Every community in the planning area is at risk to some type of utility/infrastructure failure. Business and industry in the urban areas are reliant on electricity to power servers, computers, automated systems, etc. Rural areas of the County are vulnerable as well, as modern agricultural practices are reliant on energy, such as electric milking machines and irrigation pivots.

Generally, the smaller utility suppliers such as small electrical suppliers have limited resources for mitigation. This could mean greater vulnerability in the event of a major, widespread disaster, such as a major flood, severe winter storm or ice storm. The municipal utilities that exist in the County purchase power on the wholesale market for resale to their customers. This may make them more vulnerable to regional shortages of power as well.

In the event of a large-scale event impacting water supply or wastewater treatment, homes and businesses with well-supplied water and septic systems for waste treatment would be largely unaffected. However, these systems may be prone to individual failure and do not have back-up systems in place in the event of failure, as larger systems might.

The Iowa Department of Transportation has conducted inspections of bridges in the state. Table 3-53 provides a summary of the condition of the 80 bridges in Emmet County.

**Table 3-53 Emmet County Bridge Condition, SDFO Ratings, Weight Restrictions**

| Condition Index Rating—State-Owned Bridges | | |
|---|---|---|
| Good | Fair | Poor |
| 8 | 1 | 0 |
| **Condition Index Rating-County-Owned Bridges** | | |
| Good | Fair | Poor |
| 20 | 44 | 5 |
| **Condition Index Rating-City-Owned Bridges** | | |
| Good | Fair | Poor |
| 0 | 2 | 0 |
| **Condition Index Rating—All Bridges in Emmet County** | | |
| Good | Fair | Poor |
| 28 | 47 | 5 |
| **Structurally Deficient/Functionally Obsolete (SDFO) Rating—All Bridges in Emmet County** | | |
| Not Deficient | Structurally Deficient | Functionally Obsolete |
| 75 | 23 | 0 |
| **Weight Restrictions—All Bridges in Emmet County** | | |
| Unrestricted | Restricted | Closed |
| 65 | 13 | 2 |

Source: Iowa Department of Transportation, http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a

**Magnitude Score:** 2 - Limited

### *Potential Losses to Existing Development*

Since utility/infrastructure failure is generally a secondary or cascading impact of other hazards, it is not possible to quantify estimated potential losses specific to this hazard due to the variables associated with affected population, duration of outages, etc.

Although the variables make it difficult to estimate specific future losses, FEMA has developed standard loss of use estimates in conjunction with their Benefit-Cost Analysis methodologies to estimate the cost of lost utilities on a per-person, per-use basis (See Table 3-54).

**Table 3-54 FEMA Standard Values for Loss of Service for Utilities and Roads/Bridges**

| Loss of Electric Power | Cost of Complete Loss of Service |
|---|---|
| Total Economic Impact | $126 per person per day |
| **Loss of Potable Water Service** | **Cost of Complete Loss of Service** |
| Total Economic Impact | $93 per person per day |
| **Loss of Wastewater Service** | **Cost of Complete Loss of Service** |
| Total Economic Impact | $41 per person per day |
| **Loss of Road/Bridge Service** | **Cost of Complete Loss of Service** |
| Vehicle Delay Detour Time | $38.15 per vehicle per hour |
| Vehicle Delay Mileage | $0.55 per mile (or current federal mileage rate) |

Source: FEMA BCA Reference Guide, June 2009, Appendix C

### *Future Development*

Increases in development and population growth would increase the demand for utilities and use of infrastructure as well as the level of impacts when the utilities or infrastructure fail. Emmet County has seen an overall population decrease of about 4.2 percent in the last five years. As technological advances are made, and systems become more and more automated and dependent on power and communications infrastructure, the impacts of infrastructure failure could increase even though population is decreasing slightly.

### *Climate Change Impacts*

Please refer to the Climate Change Impacts sections of the following primary hazards that can cause a cascading or secondary impact of infrastructure failure: River Flood, Severe Winter Storm, Tornado/Windstorm, Thunderstorm/Lightning Hail, Extreme Heat, Flash Flood and Terrorism.

Infrastructure Failure Incident Hazard Summary by Jurisdiction

All jurisdictions within the planning area are at risk to infrastructure failure.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Armstrong | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Dolliver | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Estherville | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Gruver | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Ringsted | 4 | 2 | 4 | 3 | 3.30 | High |
| City of Wallingford | 4 | 2 | 4 | 3 | 3.30 | High |
| North Union Schools | 4 | 2 | 4 | 3 | 3.30 | High |
| Estherville-Lincoln Schools | 4 | 2 | 4 | 3 | 3.30 | High |

## 3.5.12 Landslide

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 1 | 2 | 1 | 1.15 | Low |

### Profile

#### *Hazard Description*

A landslide is the downhill movement of masses of soil and rock by gravity. The basic ingredients for landslides are gravity, susceptible soil or rock, sloping ground and water. Landslides occur when susceptible rock, earth, or debris moves down a slope under the force of gravity and water. Landslides may be very small or very large and can move at slow to very high speeds. A natural phenomenon, small scale landslides have been occurring in slide-prone areas of Iowa long before human occupation. New landslides can occur because of rainstorms, fires, earthquakes and various human activities that modify slope and drainage.

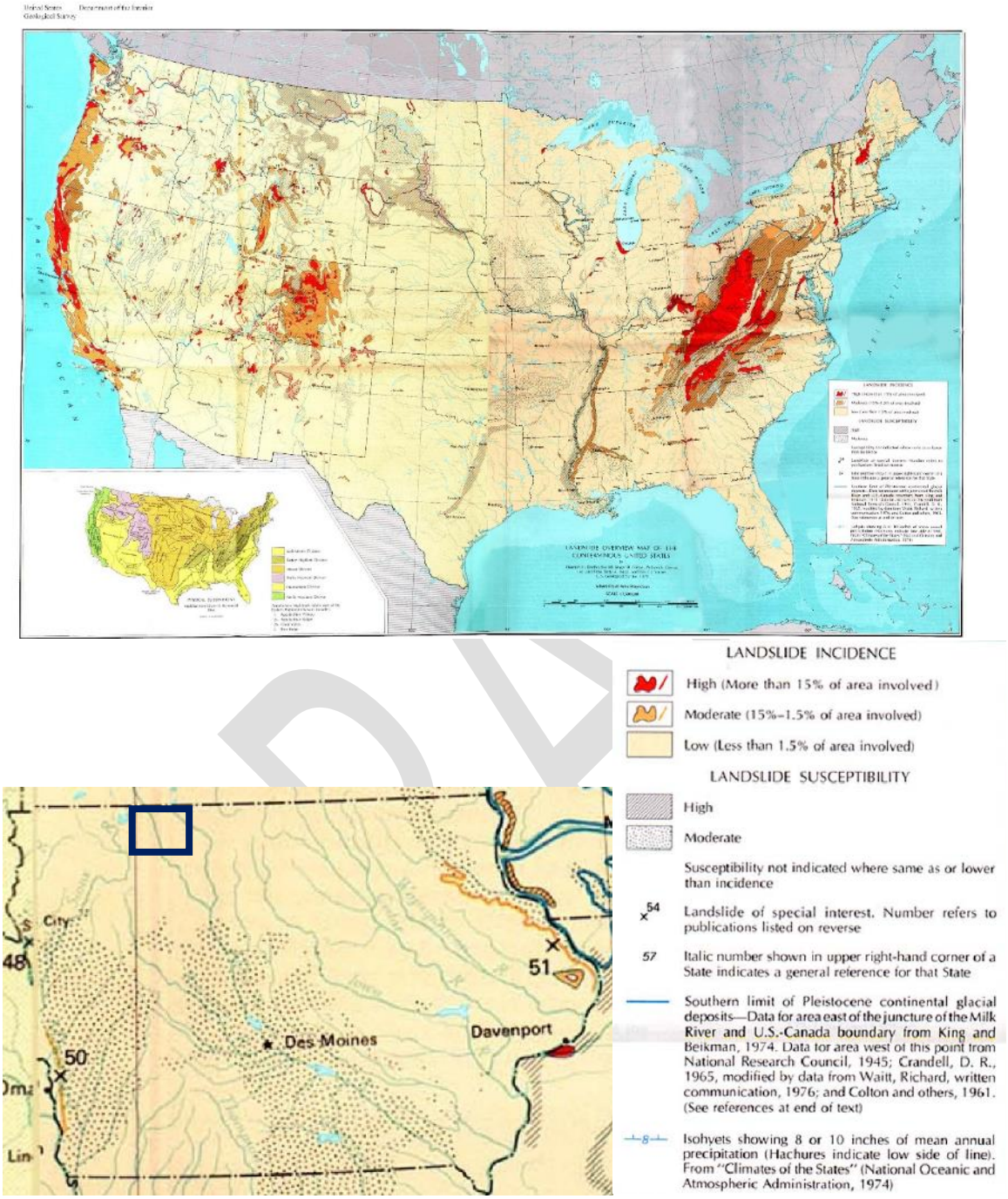
**Warning Time Score:** 2 - 12-24 hours warning time

**Duration Score:** 1 - Less than 6 hours

#### *Geographic Location/Extent*

The map in Figure 3-24 depicts landslide susceptibility and incidents rates in Iowa according to the Iowa Department of Natural Resources. This shows that all of Emmet County has a low susceptibility and low incident rate of landslide.

**Figure 3-24 Landslide Susceptibility and Incident Rates**




Source: U.S. Geological Survey, http://pubs.usgs.gov/pp/p1183/figures/map.jpg; Approximate location of Emmet County is the purple rectangle.

### *Previous Occurrences*

The Emmet County Emergency Management Agency has recorded several incidents of minor landslides. The following photo shows a landslide that occurred as a result of flooding in May 2005. Landslides have occurred on several occasions along roadsides, presenting the possibility for danger to traveling vehicles.


Source: Emmet County Emergency Management Agency

Probability of Future Occurrence

The HMPC determined the probability of future occurrence of landslide in the planning area to be "Occasional".

**Probability Score:** 2 - Occasional

## Vulnerability

### *Vulnerability Overview*

There will continue to be intense rainfall events that may cause landslides in the planning area. But, the damages are relatively minimal and not widespread.

Magnitude Score: 1—Negligible

### *Potential Losses to Existing Development*

The planning committee did not identify any specific assets or areas of development that are vulnerable to landslide.

### *Future Development*

Emmet County's population is shrinking, and new development has been limited in recent years, therefore future development is not likely to increase vulnerability to this hazard, especially given there are not areas with moderate or high susceptibility to landslide in the county.

### *Climate Change Impacts*

One of the climate change impacts noted in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. See the "Climate Change Impacts" discussion in the Flash Flood Hazard Section (3.5.7)

Landslide Hazard Summary by Jurisdiction

This hazard does not vary substantially by jurisdiction.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Armstrong | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Dolliver | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Estherville | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Gruver | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Ringsted | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Wallingford | 1 | 1 | 2 | 1 | 1.15 | Low |
| North Union Schools | 1 | 1 | 2 | 1 | 1.15 | Low |
| Estherville-Lincoln Schools | 1 | 1 | 2 | 1 | 1.15 | Low |

## 3.5.13 Radiological Incident

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 1 | 4 | 4 | 1.75 | Low |

### Profile

#### *Hazard Description*

A radiological incident is an occurrence resulting in the release of radiological material at a fixed facility (such as power plants, hospitals, laboratories, etc.) or in transit.

Radiological incidents related to transportation are described as an incident resulting in a release of radioactive material during transportation. Transportation of radioactive materials through Iowa over the interstate highway system is considered a radiological hazard. The transportation of radioactive material by any means of transport is licensed and regulated by the federal government. As a rule, there are two categories of radioactive materials that are shipped over the interstate highways:

1. Low level waste consists of primarily of materials that have been contaminated by low level radioactive substances but pose no serious threat except through long term exposure. These materials are shipped in sealed drums within placarded trailers. The danger to the public is no more than a wide array of other hazardous materials.
2. High level waste, usually in the form of spent fuel from nuclear power plants, is transported in specially constructed casks that are built to withstand a direct hit from a locomotive.

**Warning Time Score:** 4 - less than six hours warning time

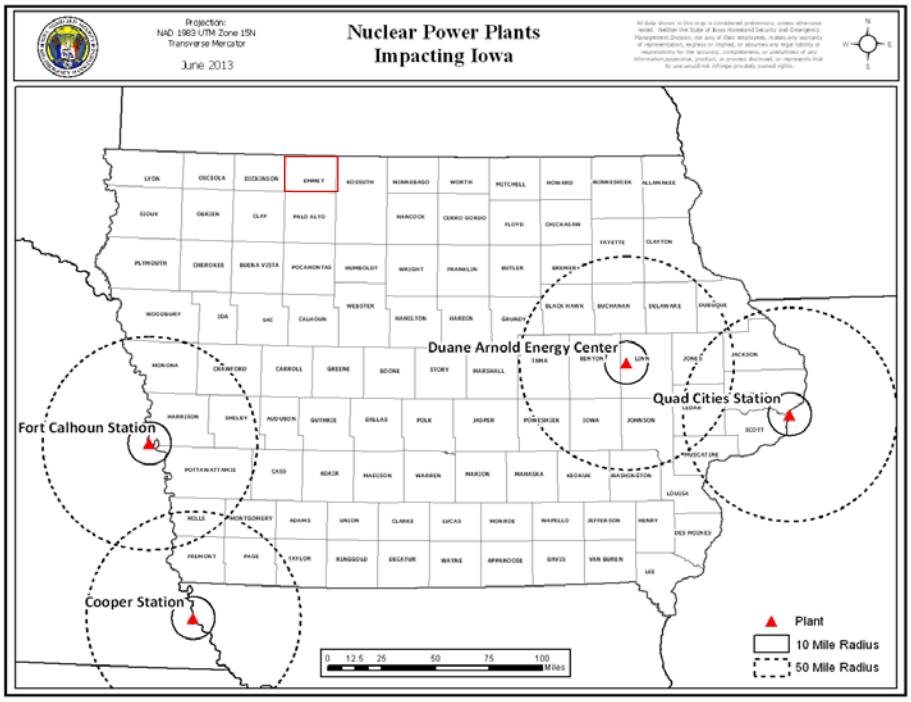
**Duration Score:** 4 - More than 1 week

#### *Geographic Location/Extent*

*Fixed Facilities*

An incident resulting in a release of radiological material at a fixed facility is a fixed radiological incident. There is one nuclear power plant located within Iowa: the Duane Arnold Energy Center near Palo in Linn County. There are three additional nuclear facilities in adjacent states with planning buffer zones that cross into Iowa: Ft. Calhoun Nuclear Power Plant north of Omaha, Nebraska, Cooper Nuclear Power Plant south of Nebraska City, Nebraska, and Quad Cities Nuclear Power Plant in Cordova, Illinois. None of these powerplants are in close proximity to Emmet County.

**Figure 3-25 Map of Nuclear Power Plants Impacting Iowa**




Source: Iowa Homeland Security and Emergency Management; red rectangle is approximate boundary of Emmet County.

Hospitals and some Industrial facilities are other types of fixed facilities that may house radioactive materials. Sources of radioactive materials may include medical products, radioactive waste from hospitals and laboratories, and industrial products. Small amounts of industrial, medical, and lab materials exist in a few locations, all within buildings. Trained people use the equipment and it is properly handled and stored. A few to a few dozen people, in a lab in a hospital, for example, may be impacted by an immediate release with a small amount of contamination.

*Transportation Radiological Incidents*

There is also potential for the transport of radioactive waste within Emmet County.

Since 1990, hundreds of shipments of radiological materials have been made through Iowa. There have been no occurrences of radiological incidents in Iowa due to these transports. Generally, small or minor shipments will go through the community in support of medical facilities with radiology services and other small quantity users. Other major roads near hospitals may have small and rare shipments. The Union Pacific railroad might also carry radiological shipments, but data is not confirmed

### *Previous Occurrences*

According to the Iowa State Hazard Mitigation Plan, 2013, there have been no occurrences of a radiological transportation incident in Iowa since 1990. The events that have occurred in other states have been limited; there have been no known serious radiation exposures resulting from a transportation incident because the nature of the materials being transported, and the use of protective packaging is commensurate with the potential hazard of the radioactive materials contained.

### *Probability of Future Occurrence*

Operators of facilities that use radioactive materials and transporters of radioactive waste are trained in the packaging, handling, and shipment of the radioactive waste; and, since they are closely regulated by a

variety of federal, state, and local organizations, the likelihood of an incident is remote. When these materials are moved across Iowa highways, Iowa officials are notified, and appropriate escorts are provided. The planning team, in light of the tight regulations on transport and the amount of fuels transported, put the annual risk of an incident requiring outside intervention is at less than 1%.

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Vulnerability Overview*

In general, danger to the public in the planning area is less than a wide array of other hazardous materials. Those working with or near sources of radiation are at a greater risk than the general citizens in the planning area. Those responding to a radiological incident should be trained in recognizing a radiological incident and minimize exposure to radioactive materials. The amounts shipped in the county are likely very low and would not cause significant loss. The impact would be a few blocks at best (1,000 feet from the transportation route). The highest risk may be present during unloading at medical facilities such as Avera Holy Family Hospital in Estherville.

**Magnitude Score:** 1 - Negligible

### *Potential Losses to Existing Development*

Responding to the effects of a radiological incident in the planning area would be variable depending on the type and quantity of release. Response may require resources and assistance from several state and federal agencies to determine and evaluate the threat to life and the environment. Due to the variable nature of this hazard, it is not possible to quantify potential losses.

### *Future Development*

Increased development in the planning buffer zones and along transportation corridors would increase the number of people vulnerable to this hazard in the planning area.

### *Climate Change Impacts*

Although, Emmet County is not in the Emergency Planning Zones for any nuclear reactors, generally speaking, drought can impact water levels for intake pipes that carry water from the Mississippi River to cool the reactors. See Section 3.5.3 for discussion of Climate Change Impacts for Drought.

### *Radiological Incident Hazard Summary by Jurisdiction*

Emmet County is not within the 50-mile planning buffer of any power plants. Because the County and jurisdictions are outside the planning buffer, it is extremely unlikely that they would have negative impacts from an event at these fixed facilities. Any events at the hospital or other medical facilities with radiology services would be isolated events with minimal exposure areas. The magnitude for the unincorporated county and jurisdictions is 1.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Armstrong | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Dolliver | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Estherville | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Gruver | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Ringsted | 1 | 1 | 4 | 4 | 1.75 | Low |
| City of Wallingford | 1 | 1 | 4 | 4 | 1.75 | Low |
| North Union Schools | 1 | 1 | 4 | 4 | 1.75 | Low |
| Estherville-Lincoln Schools | 1 | 1 | 4 | 4 | 1.75 | Low |

### 3.5.14 River Flooding

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 3 | 1 | 4 | 3.25 | High |

## Profile

### *Hazard Description*

A flood is characterized by partial or complete inundation of normally dry land areas. Heavy precipitation can cause flooding either in the region of precipitation or in areas downstream. Heavy accumulations of ice or snow can also cause flooding during the melting stage; these events are complicated by the freeze/thaw cycles characterized by moisture thawing during the day and freezing at night. There are two main types of flooding in the planning area: riverine flooding, and flash flooding which includes ice jam flooding. Flash flooding is discussed separately in Section 3.5.7. A specific type of flash flooding can occur as a result of dam failure or levee failure. Flooding caused by dam or levee failure is discussed in Section 3.5.2.

Riverine flooding is defined as the overflow of rivers, streams, drains and lakes due to excessive rainfall, rapid snowmelt or ice melt. The areas adjacent to rivers and stream banks that carry excess floodwater during rapid runoff are called floodplains. A floodplain is defined as the lowland and relatively flat area adjoining a river or stream. The terms "base flood" and "100-year flood" refer to the area in the floodplain that is subject to a one percent or greater chance of flooding in any given year. Floodplains are part of a larger entity called a basin, which is defined as all the land into which a river and its branches/tributaries drain their water.

Gauges along streams and rain gauges throughout the state provide for an early flood warning system. River flooding usually develops over the course of several hours or even days depending on the basin characteristics and the position of the particular reach of the stream. The National Weather Service provides flood forecasts for Iowa. Flood warnings are issued over emergency radio, television messages, through NOAA Weather Radio, and electronically (e.g., online and sometimes via text messages to local citizens). People in the paths of river floods may have time to take appropriate actions to limit harm to themselves and their property.

**Warning Time Score:** 1 - More than 24 hours warning time

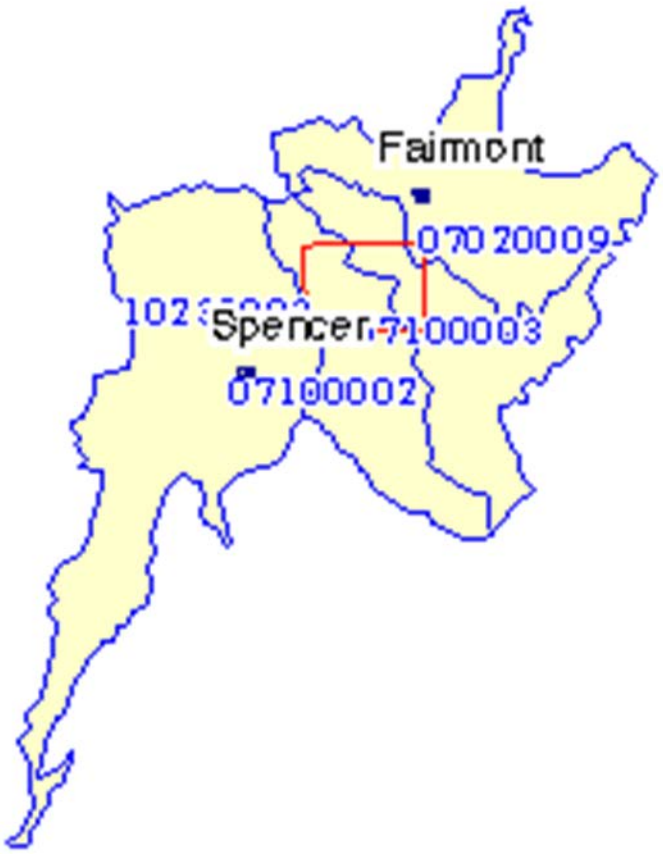
**Duration Score:** 4 - More than one week

## Geographic Location/Extent

Emmet County crosses four HUC-8 watersheds as follows (see Figure 3-26):

- Blue Earth (07020009)—this watershed crosses the county minimally, on the northeast corner.
- Upper Des Moines (07100002)—this watershed covers the majority of the county, in a north to south fashion towards the left of the county.
- East Fork Des Moines (07100003)—this county covers the second largest part of the county, from the northeast to southeast.
- Little Sioux (10230003)—this watershed barely touches the county boundaries, crossing slightly on the southwest corner.

**Figure 3-26 Emmet County, Iowa Watersheds (Emmet County is the red square)**




Source: Environmental Protection Agency, https://cfpub.epa.gov/surf/county.cfm?fips_code=19063

For purposes of this hazard profile and vulnerability analysis, the geographic locations/coverages for river flooding will be considered as those areas at risk to the 100-year flood (also known as the 1-percent annual chance flood). The 1-percent annual chance flood has been adopted by FEMA as the base flood for floodplain management purposes.

*Jurisdictional Flood Hazard Maps*

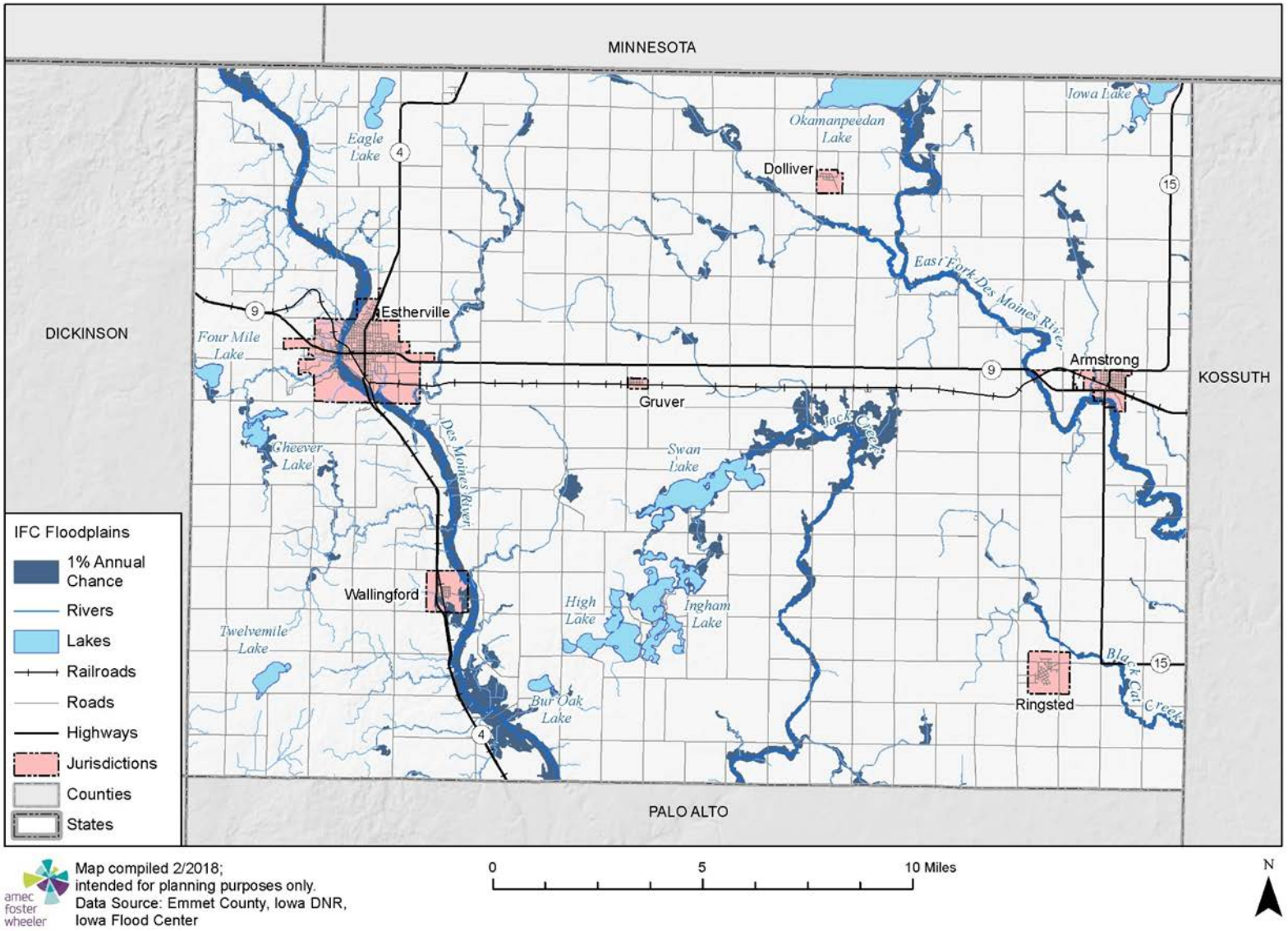
While no FEMA Special Flood Hazard Areas have been identified to date for Emmet County, data from the Iowa Flood Center outlines at-risk areas within the 1-percent annual floodplain (i.e., 100-year floodplain). Estherville is the most affected by flooding from the Des Moines River (in terms of area coverage), with the cities of Wallingford and Armstrong following regarding flooding impacts.

Figures 3-27 to 3-34 provide the 1-percent annual floodplains for all jurisdictions in the planning area affected by this hazard. The county-level map is provided first for context, and city maps are next, in alphabetical order. The map with the 1-percent annual floodplain depth grids comes after, then the School Districts map is provided last. Preceding each map is a general description of the flooding sources applying to each jurisdiction.

*Emmet County*

The main flooding sources in Emmet County include the Des Moines River and the East Fork Des Moines River.

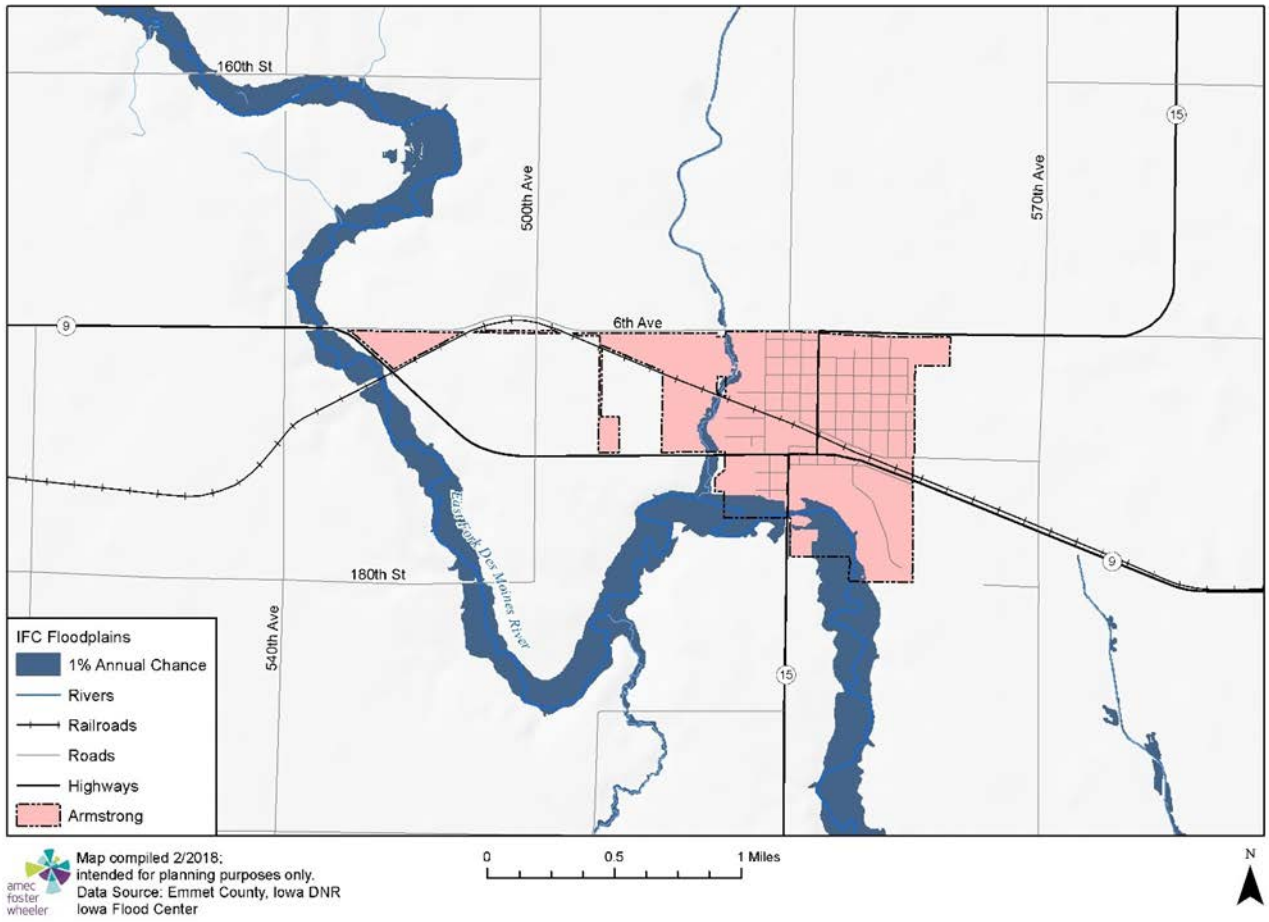
**Figure 3-27 Emmet County 1-Percent Annual Chance Floodplains (100-Year Floodplains)**



*Armstrong*

The City of Armstrong is found within the path of the East Fork Des Moines River 1-percent annual chance floodplain, which touches city boundaries primarily on the south and southwest, and hence poses as a hazard to the jurisdiction. A small tributary floodplain also crosses the city in a north-south fashion, though to a minor extent.

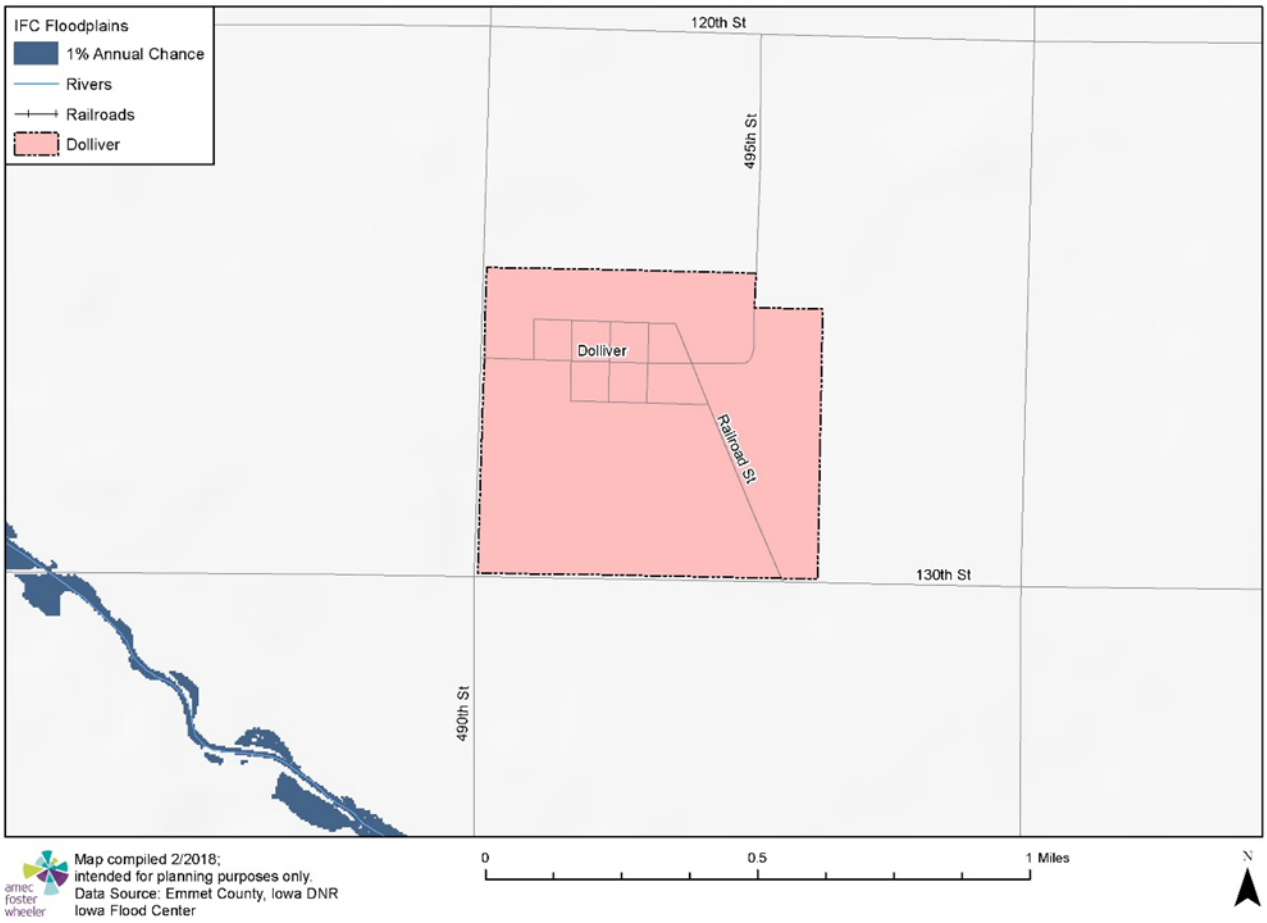
**Figure 3-28 City of Armstrong 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




*Dolliver*

While there is a small floodplain from a minor creek about 0.5 mile to the southwest of the City of Dolliver, no actual crossing occurs with city boundaries. As such, riverine flooding does not pose a direct risk to Dolliver.

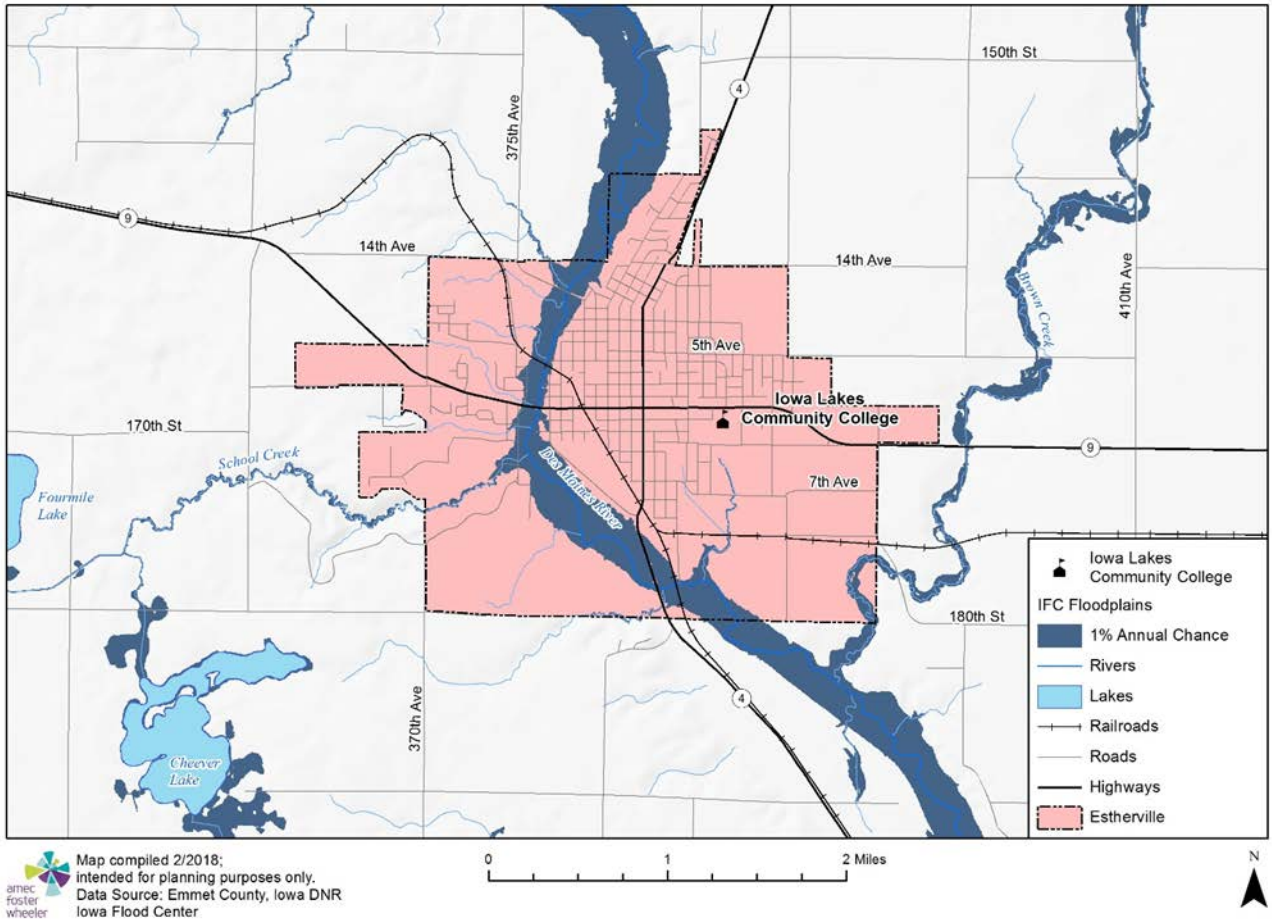
**Figure 3-29 City of Dolliver 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




*Estherville*

The City of Estherville's primary source of riverine flooding is the Des Moines River, which runs north to southeast of the jurisdiction. School Creek to the southwest and Brown Creek to the southeast also pose some flooding hazard, though to a very limited extent.

**Figure 3-30 City of Estherville 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




*Gruver*

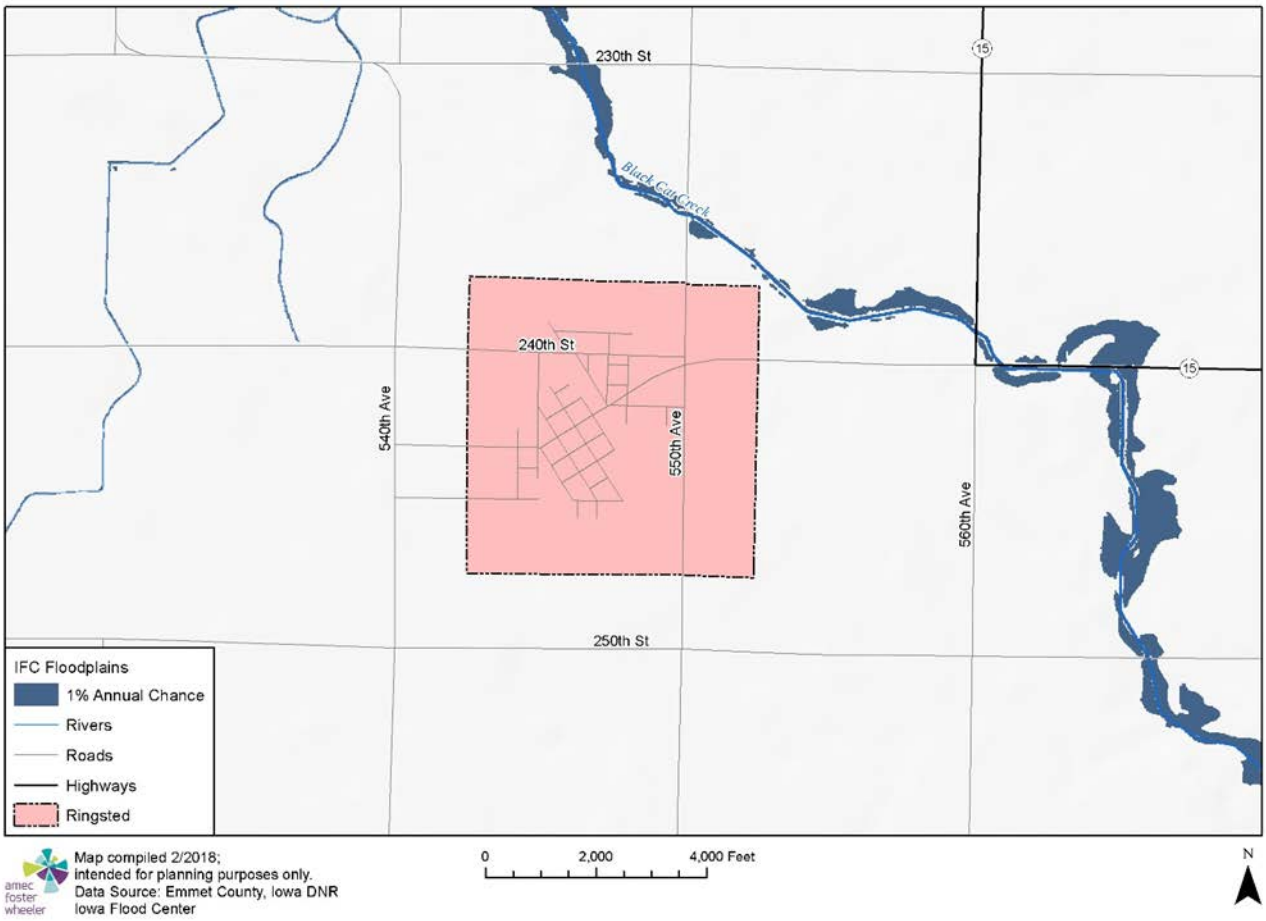
The City of Gruver is not found within the path of any stream or floodplain. As such, there is not apparent risk of riverine flooding for this jurisdiction.

**Figure 3-31 City of Gruver 1-Percent Annual Chance Floodplain (100-Year Floodplain)**


*Ringsted*

Ringsted does not cross the path of the Black Cat Creek 100-year floodplain, though the city's northeast corner almost reaches the creek. As such, Ringsted is not at direct risk of riverine flooding.

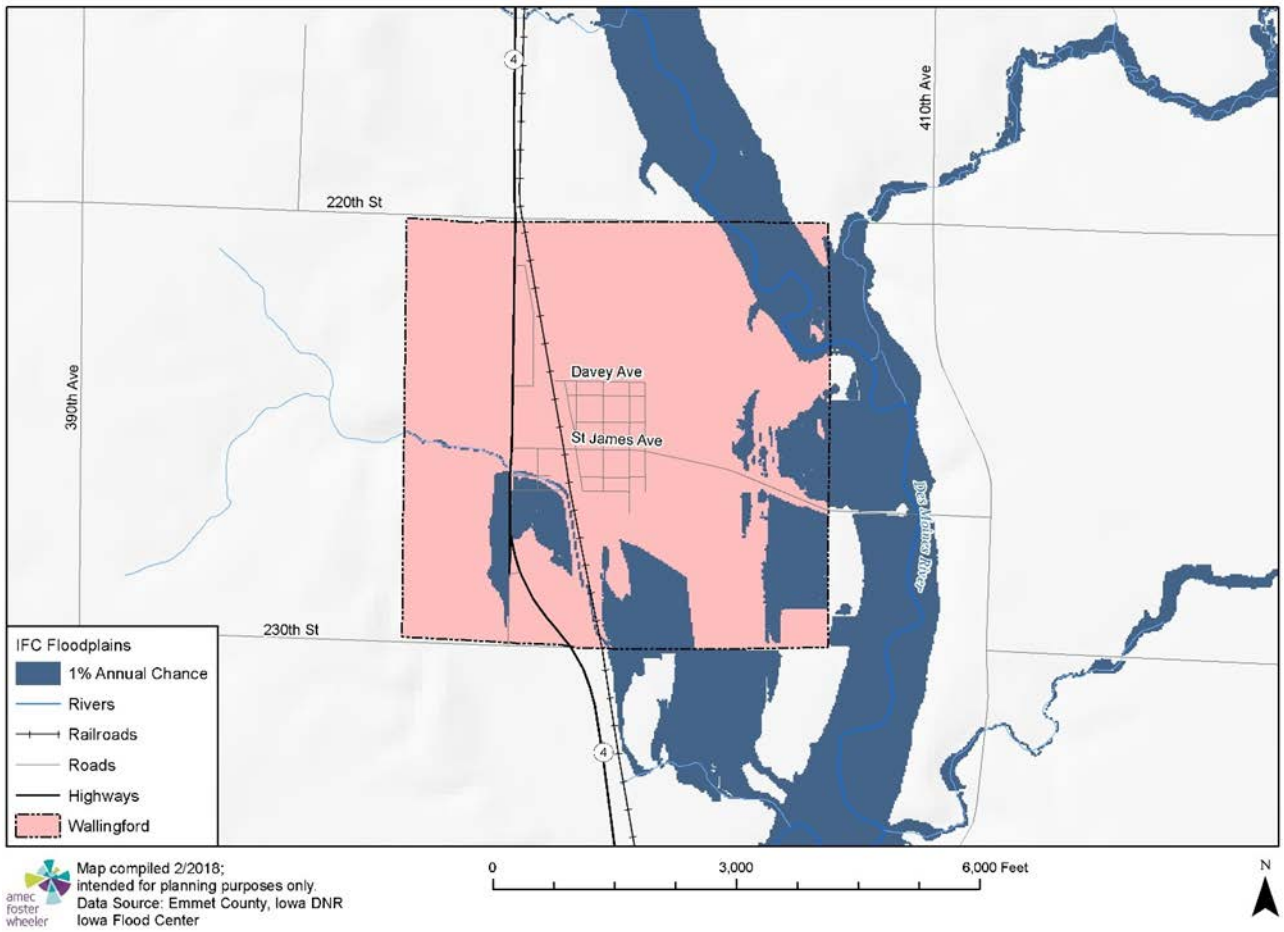
**Figure 3-32 City of Ringsted 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




*Wallingford*

The City of Wallingford is located approximately 5 miles southeast of the City of Estherville, on the path of the Des Moines River (though slightly). This river is the primary flooding source, though minor streams to the west of the city are also present. As shown in the map below, the northeast, east, southeast, and central south areas of the city boundary are most at-risk to the 1-percent annual chance flood.

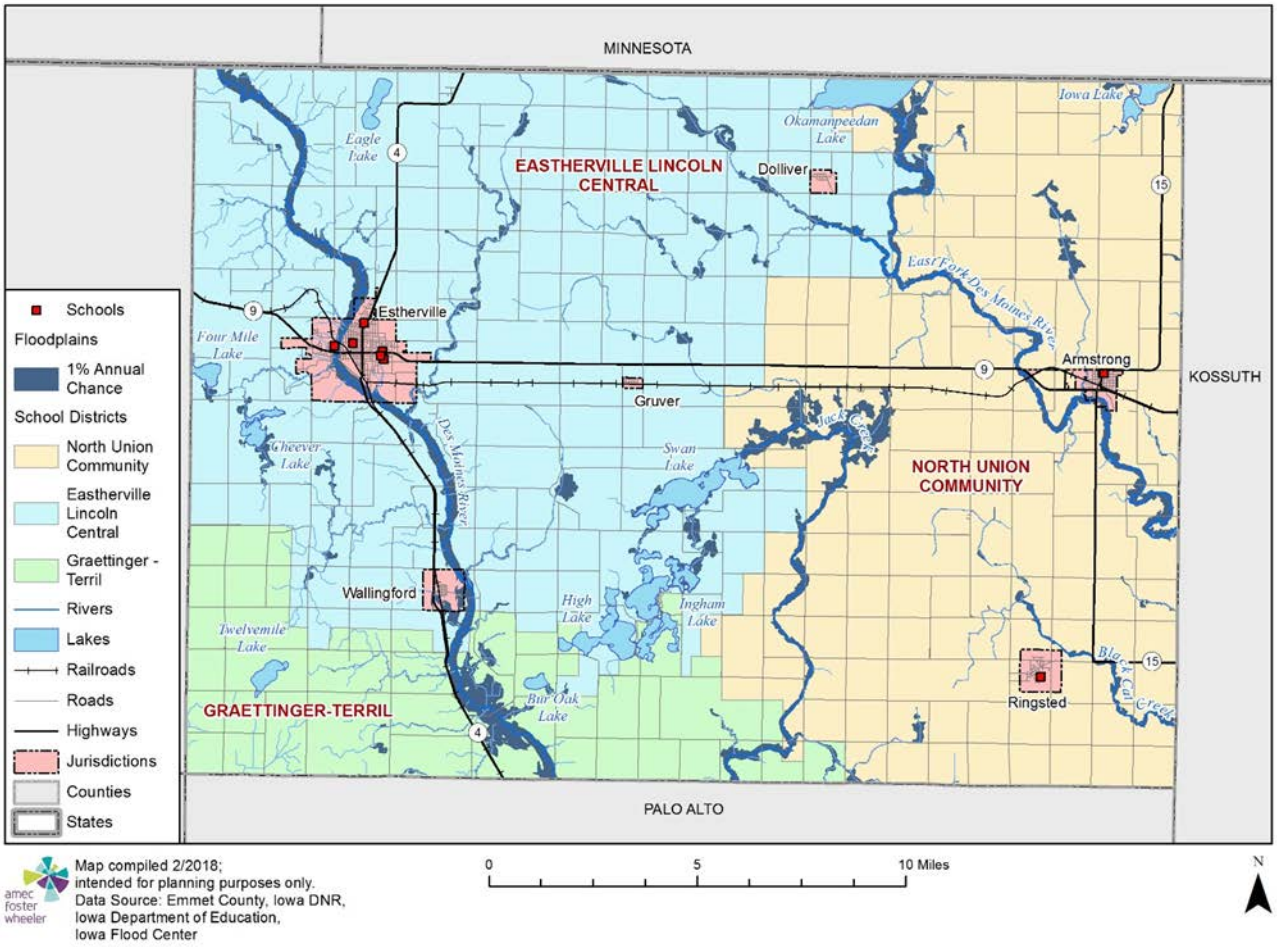
**Figure 3-33 City of Wallingford 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




*Emmet County School Districts*

All three school districts are affected by flooding from the 1-percent annual chance floodplains.

**Figure 3-34 Emmet County School Districts and the 1-Percent Annual Chance Floodplain (100-Year Floodplain)**




### *Previous Occurrences*

This section provides information on previous occurrences of riverine flooding in the planning area.

#### *Presidential Declarations for Flooding in Planning Area*

Since 1965 there have been 8 Presidential Disaster Declarations that included flooding in Emmet County.

#### *General Flooding Events in Planning Area*

According to the National Climatic Data Center, 49 general flood events have taken place from 1997-2017 in the County alone. While no human deaths or injuries were caused from the recorded events during these years, flooding still occurs fairly frequently, and can prove costly. Details are provided below in Table 3-55.

**Table 3-55 NCDC Flood Events in Emmet County, 1997-2017**

| Year of Flooding | Number of Events | Deaths | Injuries | Property Damages |
|---|---|---|---|---|
| 1997 | 2 | 0 | 0 | $200,000 |
| 1998 | 2 | 0 | 0 | $95,000 |
| 1999 | 6 | 0 | 0 | $417,000 |
| 2001 | 6 | 0 | 0 | $292,500 |
| 2003 | 3 | 0 | 0 | $15,000 |
| 2004 | 2 | 0 | 0 | $150,000 |
| 2005 | 3 | 0 | 0 | $65,000 |
| 2006 | 1 | 0 | 0 | $5,000 |
| 2007 | 3 | 0 | 0 | $85,000 |
| 2008 | 1 | 0 | 0 | $50,000 |
| 2010 | 7 | 0 | 0 | $575,000 |
| 2011 | 8 | 0 | 0 | $525,000 |
| 2012 | 1 | 0 | 0 | $15,000 |
| 2016 | 2 | 0 | 0 | $45,000 |
| 2017 | 2 | 0 | 0 | $100,000 |
| **Total** | **49** | **0** | **0** | **$2,634,500** |

Source: NCDC

### *Previous General Flooding Occurrence Details by Jurisdiction*

The following section provides previous occurrences in the jurisdictions and unincorporated places within the planning area. First, historical events for the county are described, followed by reported events for each city/town/location.

#### *Emmet County*

A small flooding event happened through a large part of the northwest and north central Iowa during the beginning of April 2006. This was triggered by a significant rainfall event starting late March, which provided 2 to 4 inches of precipitation to the main river stems in the mentioned region of the County. The flooding affected lowland agricultural areas, though damage was very minor. By the middle of April, the flood had subsided.

#### *Armstrong*

Heavy rains during June of 2010 affected agricultural crops across the State, including in the Armstrong area. While river flooding did not directly affect the crop losses, riverine inundation did occur, affecting many counties nearby. This flood episode caused Emmet and other affected counties in northern and central Iowa to apply for a Presidential Disaster Declaration, though it was not approved.

#### *Estherville*

Three flood events took place in 2007, in March, May, and October. The March event involved the sudden melt of accumulated snow over previous blizzards, causing flooding along the Des Moines River in Estherville, though damage was limited. The May event began on the sixth, triggered by a major contrast in precipitation across the State. Some damage was incurred, although not severe, and the flooding was confused to the Des Moines, Raccoon, Nishnabotna, and Grand Basins. The October event was preceded by a wet few weeks. Bloomfield was also affected, though not to a large extent.

#### *Wallingford*

Three events were noted for Wallingford as well, one in 2016 and two in 2017. Heavy rains mid-May took place in the earliest event, causing riverine flooding on the Des Moines River. This event affected both Wallingford and Estherville. In May of 2017, another flooding event took place, again on the Des Moines

River, but also the Raccoon River. This was triggered by heavy rainfall preceding the event. In October of the same year, another heavy rain flooded the Des Moines River along Wallingford and Estherville.

*Unincorporated Areas*

The Huntington area has had multiple flooding events since 2008, primarily due to heavy rains and/or rapid snow melt occurrences. Other flood events in the unincorporated areas of Emmet County heavily revolve around inundation of various areas of the Des Moines River and range from 1997 to 2017; some of these affected agricultural crops and downstream towns/cities.

### *Previous Agricultural Impacts*

Flooding has historically taken a toll on crop production and harvesting in the planning area. According to the USDA's Risk Management Agency (RMA), payments for insured crop losses in the planning area as a result of riverine flooding alone (without taking into account excess moisture or other related conditions) from 2007-2017 totaled $173,756. This translates to an annual average of $17,375. According to the RMA's 2016 Iowa Crop Insurance Profile, 83% of insurable crops in Iowa were insured. Table 3-56 summarizes the indemnity claims paid by year.

**Table 3-56 Crop Insurance Claims Paid in Emmet County for Crop Losses as a Result of Floods/Flooding Events (2007-2017)**

| Year of Flooding Claim | Indemnity Amount | Determined Acres |
|---|---|---|
| 2008 | $49,843 | 121 |
| 2010 | $48,335 | 170 |
| 2011 | $9,037 | 203 |
| 2012 | $9,158 | 17 |
| 2013 | $7,921 | 57 |
| 2014 | $21,451 | 102 |
| 2017 | $28,010 | 170 |
| **Total** | **$173,756** | **840** |

Source: USDA Risk Management Agency

*National Flood Insurance Program (NFIP) Participation*

Table 3-57 provides details on NFIP participation for the communities in the planning area as well as the number of policies in force, amount of insurance in force, number of closed losses, and total payments for each jurisdiction, where applicable. The claims information is for the period from January 1, 1977 to December 31, 2017.

**Table 3-57 NFIP Participation, Policies, and Claim Statistics**

| Community Name | NFIP Participant | Curr Eff Map Date | Reg Emer Date | Policies In-force | Insurance In-force | Closed Losses | Total Payments |
|---|---|---|---|---|---|---|---|
| Emmet County | Yes | 9/30/88 | 09/30/88 | 7 | $836,000 | 0 | $0 |
| Armstrong | NP | Never Mapped | N/A | N/A | N/A | N/A | N/A |
| Dolliver | NP | N/A | N/A | N/A | N/A | N/A | N/A |
| Estherville | Yes | 10/14/77 | 10/14/77 | 3 | $229,600 | 9 | $19,778 |
| Gruver | NP | N/A | N/A | N/A | N/A | N/A | N/A |
| Ringsted | | | | | | | |
| Wallingford | Yes | 07/01/87 | 07/01/87 | 0 | $0 | 0 | $0 |

Source: FEMA Community Information System; M= No elevation determined – all Zone A, C, and X: NSFHA = No Special Flood Hazard Area; NP = Not Participating; E=Emergency Program: Policy and Loss Statistics from BureauNet, http://bsa.nfipstat.fema.gov/reports/reports.html; *Closed Losses are those flood insurance claims that resulted in payment. Loss statistics are for the period from January 1, 1978 to December 31, 2017.

*Repetitive Loss/Severe Repetitive Loss Properties*

**Repetitive Loss:** Repetitive Loss Properties are those properties with at least two flood insurance payments of $5,000 or more in a 10-year period.

**Severe Repetitive Loss (SRL):** SRL properties are defined as "a single family property" (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding $5,000 and with cumulative amounts of such claims payments exceeding $20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

There are no repetitive loss or severe repetitive loss properties in Emmet County.

### *Probability of Future Occurrence*

With the history of flooding in many areas across Emmet County, it is likely that flooding of various levels will continue to occur. According to the NCDC, 49 general flood events have taken place in the recorded alone (2007-2017). Therefore, the probability rating for Emmet County to suffer from riverine flooding in the future is "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Overview*

To determine vulnerability of people and property to riverine flood, an enhanced flood risk analysis was performed utilizing FEMA's HAZUS software. The analysis used for Emmet County is a Level 1 Plus which is a standard Level 1 process but with Depth Grids imported to enhance the accuracy of flood risk modelling within HAZUS. Depth grids were provided by the Iowa Flood Center (IFC) at the University of Iowa. The Depth grids provided by the IFC were used as the best available data since older FEMA depth grids are difficult to obtain and using the IFC data complements analysis that the Iowa Homeland Security and Emergency Management Department is conducting for the State Hazard Mitigation Plan. It should be noted that, while the IFC depth grids are very similar to the effective FEMA products, there are however some differences in the detailed areas for the 1-percent annual chance floodplain.

Default HAZUS inventories were left intact and the flood depth grids were imported as User Data into HAZUS. After the flood depth grids were imported into HAZUS, analysis was completed to determine potential losses as a result of a 1-percent annual chance flood. The following jurisdictions would have losses as a result of a 1-percent annual chance flood: Armstrong, Estherville, Wallingford, and Unincorporated Emmet County. The most losses would occur in Estherville, followed by the Unincorporated County, Wallingford, and Armstrong. The cities of Dolliver, Gruver, and Ringsted did not have any estimated losses. The detailed results of this analysis are provided in the following section on Potential Losses to Existing Development.

For the planning area ranking, the HMPC determined the magnitude of river flooding to be "Critical". Individual jurisdictional ratings are provided at the end of this hazard section.

**Magnitude Score:** 3 - Critical (from 25% to 50% of property damages and injuries to populations)

### *Potential Losses to Existing Development*

The potential losses to existing development will be provided for the following categories of losses:

- Building/Contents Losses
- Estimated Population Displaced

- Agricultural Impacts
- Critical Facilities and Infrastructure at Risk

Figure 3-35 provides the summary of potential flood loss estimates and impacted populations for the 1-percent annual chance flood by jurisdiction. These results are based on the HAZUS Level 1 Plus Analysis described in the Overview section above.

**Figure 3-35 Emmet County 1-Percent Annual Chance Floodplain with Depth Grids**

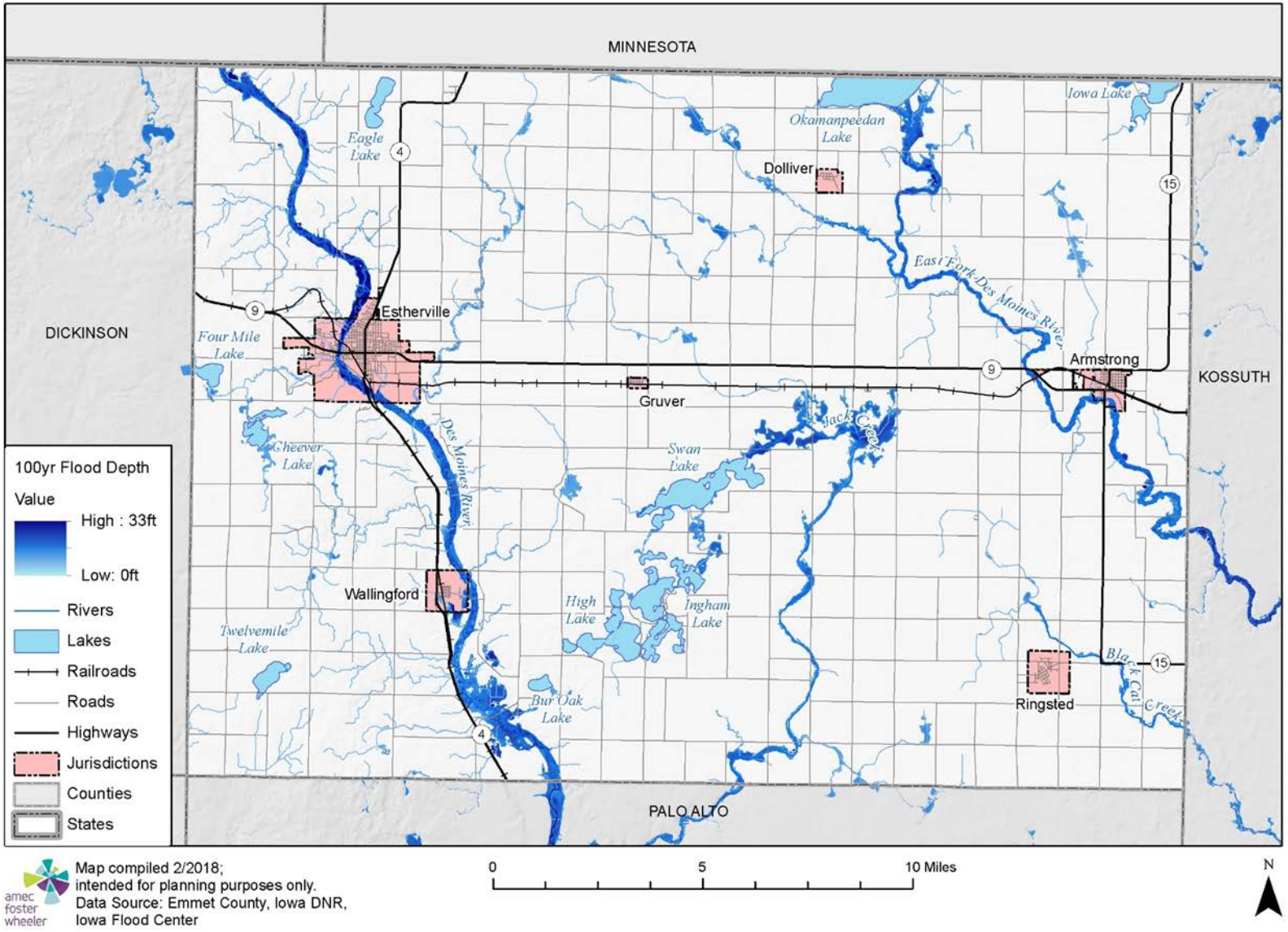


**Table 3-58 Hazus 100-year Flood Estimated Loss by Jurisdiction and Property Type**

| Jurisdiction | Property Type | Building Counts | Building Loss* | Contents Loss* | Inventory Loss* | Relocation Cost* | Income Loss* | Rental Income Loss* | Wage Loss* | Total Loss* |
|---|---|---|---|---|---|---|---|---|---|---|
| Armstrong | Agriculture | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Commercial | 0 | $3 | $17 | $0 | $0 | $0 | $0 | $0 | $20 |
| | Education | 0 | $0 | $1 | $0 | $0 | $0 | $0 | $0 | $1 |
| | Industrial | 0 | $7 | $9 | $2 | $0 | $0 | $0 | $0 | $18 |
| | Religious | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Residential | 0 | $41 | $17 | $0 | $0 | $0 | $0 | $0 | $58 |
| | **Total** | **0** | **$51** | **$44** | **$2** | **$0** | **$0** | **$0** | **$0** | **$97** |
| Estherville | Agriculture | 0 | $8 | $41 | $5 | $0 | $0 | $0 | $0 | $54 |
| | Commercial | 0 | $78 | $278 | $2 | $0 | $2 | $0 | $2 | $362 |
| | Education | 0 | $6 | $38 | $0 | $0 | $1 | $0 | $2 | $47 |
| | Industrial | 0 | $11 | $13 | $2 | $0 | $0 | $0 | $0 | $26 |
| | Religious | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Residential | 20 | $1,066 | $485 | $0 | $1 | $0 | $0 | $0 | $1,552 |
| | **Total** | **20** | **$1,169** | **$855** | **$9** | **$1** | **$3** | **$0** | **$4** | **$2,041** |
| Wallingford | Agriculture | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Commercial | 0 | $2 | $10 | $0 | $0 | $0 | $0 | $0 | $12 |
| | Education | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Industrial | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Religious | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Residential | 3 | $109 | $43 | $0 | $0 | $0 | $0 | $0 | $152 |
| | **Total** | **3** | **$111** | **$53** | **$0** | **$0** | **$0** | **$0** | **$0** | **$164** |
| Unincorporated | Agriculture | 0 | $13 | $77 | $7 | $0 | $0 | $0 | $0 | $97 |
| | Commercial | 1 | $31 | $183 | $0 | $1 | $4 | $1 | $12 | $232 |
| | Education | 0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Industrial | 0 | $75 | $200 | $23 | $0 | $0 | $0 | $0 | $298 |
| | Religious | 0 | $0 | $1 | $0 | $0 | $0 | $0 | $0 | $1 |
| | Residential | 12 | $580 | $222 | $0 | $1 | $0 | $0 | $0 | $803 |
| | **Total** | **13** | **$699** | **$683** | **$30** | **$2** | **$4** | **$1** | **$12** | **$1,431** |
| | **Grand Total** | **36** | **$2,030** | **$1,635** | **$41** | **$3** | **$7** | **$1** | **$16** | **$3,733** |

*All values are in thousands of dollars, a value of $0 does not necessarily mean $0 but less than $1,000.

Source: Hazus MH 4.0, Iowa Flood Center

*Estimated Population Displaced*

To estimate population displaced by a 1-percent annual chance flood, the number of residential structures impacted was multiplied by the average household size for each jurisdiction. Building count data were generated from block group and block level census data within HAZUS. According to the HAZUS Level 1 Plus analysis, there would be a total of 35 residential structures impacted for Emmet County, and 78 people would be displaced during a 100-year flood event. Table 3-59 provides the estimated population impacted for each jurisdiction that had estimated flood losses.

**Table 3-59 Estimated Displaced Population**

| Jurisdiction | Estimated Residential Structures Impacted | Average Household Size | Estimated Displaced Population |
|---|---|---|---|
| Armstrong | 0 | 1.99 | 0 |
| Estherville | 20 | 2.23 | 44.5 |
| Wallingford | 3 | 2.37 | 7.11 |
| Unincorporated | 12 | 2.19 | 26.28 |
| **Total** | **35** | | **78** |

Source: Hazus Analysis, U.S. Census Bureau, American Community Survey 2012-2016 5-Year Estimates

*FEMA's HAZUS Average Annualized Losses*

In 2010, FEMA conducted a Level 1 HAZUS MR4 flood analysis to estimate average annualized losses (AAL). This AAL study examined riverine and coastal flood hazards in the 48 contiguous states (including the District of Columbia) by county. Hawaii, Alaska, and Puerto Rico, and US territories were not analyzed as part of this study. The AAL study estimated flood losses for the following storm events, which were then used to develop the annualized loss estimate: 10% annual chance (10-year), 2% annual chance (50-year), 1% annual chance (100-year), 0.5% annual chance (200-year), and 0.2% annual chance (500-year).

The data from the AAL Study was calculated at the census block level, based on HAZUS' hydrology and hydraulic analysis of streams draining 10 square miles or greater and utilizing 30m Digital Elevation Model (DEM) data. It includes estimated replacement values and flood losses for both buildings and contents, based on 2000 census data, and is aggregated by structure type (residential, commercial, and other). For certain reaches of stream, the hydrology or hydraulics failed during the AAL study, and loss estimates were not able to be calculated. In some of the coastal areas, both riverine and coastal loss estimates were calculated, but may not be distinct in the AAL results. In spite of these known data gaps, the AAL study represents a baseline level of flood risk assessment results which can be used where more refined analyses are not conducted or available.

The AAL Study estimates $600,000 in Average Annual Losses (AAL) for Emmet County, Iowa.

### *Critical Facilities and Infrastructure at Risk*

To analyze critical facilities at risk in the planning area, the inventory of critical and essential facilities and infrastructure in the planning area was compiled by analyzing datasets sourcing from the State of Iowa's Homeland Security and Emergency Management office, as well as the Iowa Flood Center. A comparison was made between Emmet County's 99 critical facilities, bridge infrastructure from the National Bridge Inventory, and the Iowa Flood Center's flood data, to determine which facilities would be damaged in the 1-percent annual chance flood events. This analysis determined that there are 2 critical facilities in the 1-percent annual chance floodplain. Table 3-60 provides a summary of the critical facilities in the 1-percent annual chance floodplain.

**Table 3-60 Critical Facilities at risk to 1-percent Annual Chance Flood**

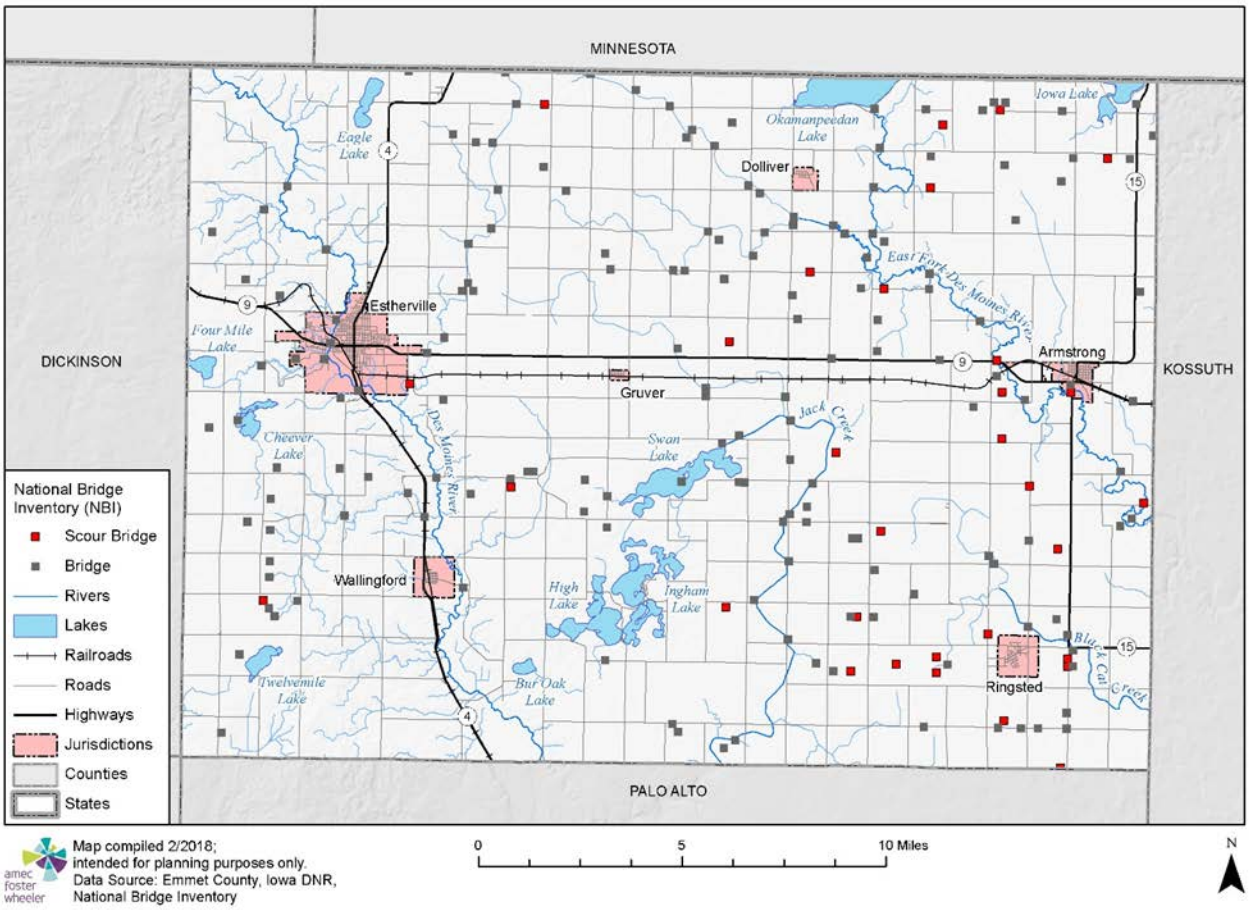
| Jurisdiction | Facility Type | Facility Name |
|---|---|---|
| Estherville | School K-12 | McKinley Elementary School |
| Estherville | Tier II Facility | City of Estherville Swimming Pool |

Source: HSIP Freedom 2015, Iowa Flood Center

Appendix E provides the list of critical facilities that were inventoried and analyzed. This Appendix is redacted from the public version of this plan. To obtain access for official use, contact the Emmet County Emergency Management Agency.

According to the National Bridge Inventory, there are 31 scour critical bridges in Emmet County. These bridges are depicted in Figure 3-36. Note that not every bridge infrastructure will be at risk of the 1-percent annual chance flood.

**Figure 3-36 Emmet County Bridges with Scour Critical Bridges Identified**




### *Future Development*

Any future development in floodplains would increase risk in those areas. For those communities that participate in the National Flood Insurance Program, enforcement of the floodplain management regulations will ensure mitigation of future construction in those areas.

### *Climate Change Impacts*

One of the climate change impacts noted in the 2010 Climate Change Impacts on Iowa report by the Iowa Climate Change Impacts Committee is the increase in frequency of severe precipitation events. This

climate change impact was also noted in the Flash Flood hazard analysis. Although very heavy precipitation does not always result in riverine flooding, it can if/when the very heavy precipitation occurs frequently without enough time for the watershed to drain away the large amounts of water.

Figure 3-12 in the Flash Flood section shows that all of Iowa is in the region with a 31% increase in very heavy precipitation from 1958 to 2007. For this study, very heavy precipitation was defined as the heaviest 1% of all events. If this trend increases, riverine flooding events and their associated impacts will likely occur more often in the planning area.

### *River Flooding Hazard Summary by Jurisdiction*

To demonstrate how river flooding additionally varies by jurisdiction, all were rated in terms of their riverine flooding hazard characteristics. Probability scores are estimated from historical flood events. Magnitude ratings are based on the number of structures present or in very close proximity to the flooding area. Warning times of 24 hours or more (i.e., receiving a rank of 1) are plausible, given the many methods available to communicate hazard warnings thanks to technology and professional emergency management staff efforts. Durations are also estimated from historical flood events and patterns. For those jurisdictions with no floodplain areas found to intersect with city boundaries, all elements indicate Not Applicable (N/A).

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 1 | 2 | 1.1 | Low |
| City of Armstrong | 3 | 2 | 1 | 3 | 2.55 | Moderate |
| City of Dolliver | N/A | N/A | N/A | N/A | N/A | N/A |
| City of Estherville | 4 | 3 | 1 | 4 | 3.25 | High |
| City of Gruver | N/A | N/A | N/A | N/A | N/A | N/A |
| City of Ringsted | 1 | 1 | 1 | 1 | 1 | Low |
| City of Wallingford | 4 | 3 | 1 | 4 | 3.25 | High |
| North Union Schools | 1 | 1 | 1 | 1 | 1 | Low |
| Estherville-Lincoln Schools | 4 | 3 | 1 | 4 | 3.25 | High |

### 3.5.15 Severe Winter Storm

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 3 | 4 | 3.25 | High |

## Profile

### *Hazard Description*

Severe winter storms are an annual occurrence in Iowa. A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, cold temperatures and drifting snow creating blizzards. The National Weather Service describes different types of winter storm events as follows:

- **Blizzard** - Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least three hours.
- **Blowing Snow** - Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls** - Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers** - Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain** - Measurable rain that falls onto a surface with a temperature below freezing. This causes it to freeze to surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet** - Rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects.

Heavy accumulations of ice, often the result of freezing rain, can bring down trees, utility poles, and communications towers and disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians.

Severe winter storms include extreme cold, heavy snowfall, ice, and strong winds which can push the wind chill well below zero degrees in the planning area. Heavy snow can bring a community to a standstill by inhibiting transportation (in whiteout conditions), weighing down utility lines, and causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant. Ice buildup can collapse utility lines and communication towers, as well as make transportation difficult and hazardous. Ice can also become a problem on roadways if the air temperature is high enough so that precipitation falls as freezing rain rather than snow.

Extreme cold often accompanies severe winter storms and can lead to hypothermia and frostbite in people who are exposed to the weather without adequate clothing protection. Cold can cause fuel to congeal in storage tanks and supply lines, stopping electric generators. Cold temperatures can also overpower a building's heating system and cause water and sewer pipes to freeze and rupture. When combined with high winds from winter storms, extreme cold becomes extreme wind chill, which is extremely hazardous to health and safety.

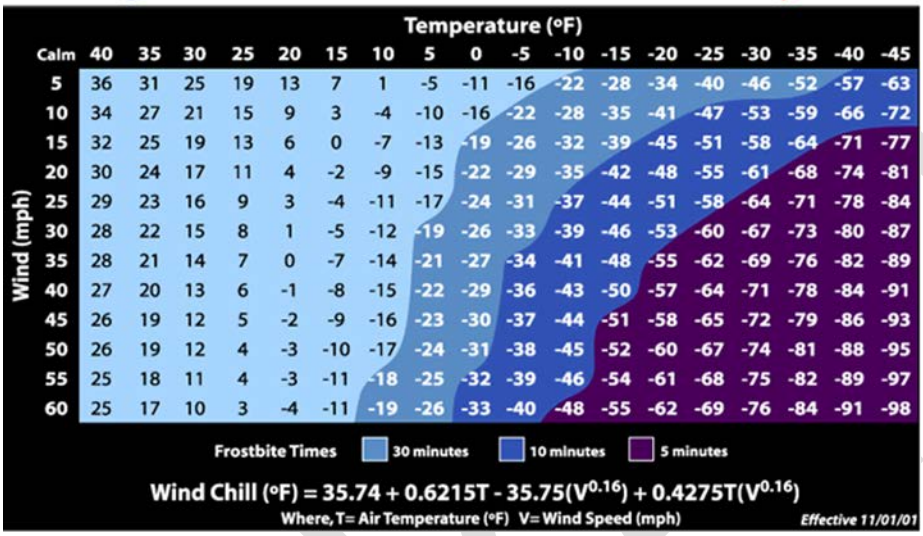
The National Institute on Aging estimates that more than 2.5 million Americans are especially vulnerable to hypothermia, with the isolated elderly being most at risk. About 10 percent of people over the age of

65 have some kind of temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic.

Also at risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters, from household fires, which can be caused by fireplaces and emergency heaters, and from frozen/burst pipes.

Wind can greatly amplify the impact of cold ambient air temperatures. Provided by the National Weather Service, Figure 3-37 below shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.

**Figure 3-37 Wind Chill Chart**




Source: National Weather Service

**Warning Time Score:** 3 - 6-12 hours

**Duration Score:** 4 - more than 1 week

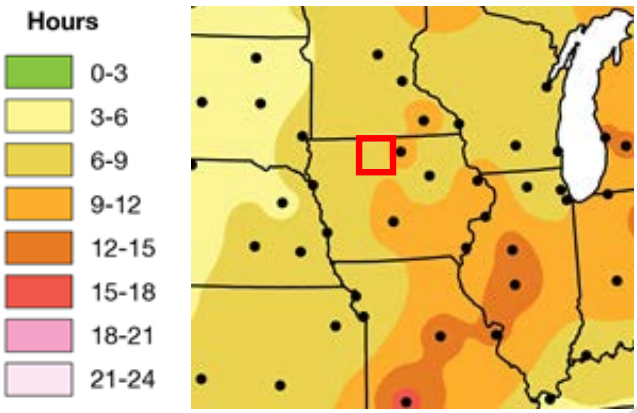
## Geographic Location/Extent

According to the High Plains Regional Climate Center, the planning area has an average maximum temperature of 27.63 °F in December, 24.55 °F in January, and 29.17 °F in February. Average minimum temperatures for those same three months are 10.39 °F, 6.18 °F and 10.92 °F. Average snowfall is highest in December, January, and February with an annual average of 31 inches. (Source: High Plains RCC CLIMOD Monthly Climate Normals)

The entire State of Iowa is vulnerable to heavy snow, extreme cold temperatures and freezing rain. Generally, winter storms occur between the months of November and March but can occur as early as October and as late as April.

Figure 3-38 shows that the planning area (approximated within the red square) is in the light-orange shaded area that receives 9-12 hours of freezing rain per year.

**Figure 3-38 Average Number of Hours per Year with Freezing Rain**




Source: Midwestern Regional Climate Center; http://mcc.sws.uiuc.edu/living_wx/icestorms/index.html

Note: Red square provides approximate location of planning area.

### *Previous Occurrences*

Historically, there have been two Presidential Disaster Declarations for Severe Winter Storms that included Emmet County since 1965; an ice storm in 1991 and a winter storm in 2010 (See Table 3-2 in the Hazard Identification Section).

From 1996 thru 2017, the National Climatic Data Center reports the following 86 severe winter weather events:

- 25 - Blizzard
- 9 - Cold/Wind Chill
- 5 - Extreme Cold/Wind Chill
- 17 - Heavy Snow
- 11 - Ice Storm
- 18 - Winter Storm
- 1 - Winter Weather

During this 22-year period, 43 of the events caused property damage. This translates to roughly two damaging winter storm/cold temperature events each year. The total property damage for these 43 events was $1,751,725 with the most damaging event occurring on February 27, 2007 causing $250,000 in property damage resulting from a winter storm.

NOAA's National Weather Service has issued 366 Advisory, Watch, and/or Warnings concerning winter weather phenomena between 1986 and 2016 (see Table 3-61). The data is kept with Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (http://mesonet.agron.iastate.edu/vtec/search.php).

**Table 3-61 National Weather Service Issuances for Winter Weather in Emmet County, IA**

| Phenomenon/Significance | Advisory | Warning | Watch | Total |
|---|---|---|---|---|
| Blizzard | | 17 | 9 | 26 |
| Blowing Snow | 5 | | | 5 |
| Freeze | | 17 | 4 | 21 |
| Freezing Fog | 1 | | | 1 |
| Freezing Rain | 7 | | | 7 |
| Frost | 16 | | | 16 |
| Heavy Snow | | | | 0 |
| Snow | | | | 0 |
| Snow and Blowing Snow | | | | 0 |
| Wind Chill | 101 | 7 | 2 | 110 |
| Winter Storm | | 27 | 40 | 67 |
| Winter Weather | 113 | | | 113 |
| **Grand Total** | **243** | **68** | **55** | **366** |

Source: Environmental Mesonet, Iowa State University Department of Agronomy website, http://mesonet.agron.iastate.edu/vtec/search.php

The Emmet County Emergency Management Agency recorded the following photo of a snow accumulation on Highway 9 east of Estherville following the blizzard of 2010.

Source: Emmet County Emergency Management Agency

### *Agricultural Impacts*

Winter storms, cold, frost and freeze take a toll on crop production in the planning area. According to the USDA's Risk Management Agency, payments for insured crop losses in the planning area as a result of cold conditions and snow from 2007-2016 totaled $617,777. (see Table 3-62).

**Table 3-62 Crop Insurance Claims Paid in Emmet County as a Result of Cold Conditions and Snow (2007-2016)**

| Year | Cold Wet Weather | Cold Winter Weather | Freeze | Total Insurance Claims Paid |
|---|---|---|---|---|
| 2007 | | | | $0 |
| 2008 | $7,177 | | | $7,177 |
| 2009 | $22,250 | $9,425 | $859 | $32,534 |
| 2010 | | | | $0 |
| 2011 | $1,056 | $14,344 | $507 | $15,907 |
| 2012 | $2,527 | | | $2,527 |
| 2013 | $68,672 | | $3,794 | $72,466 |
| 2014 | $410,801 | $13,248 | | $424,049 |
| 2015 | | | | $0 |
| 2016 | $63,117 | | | $63,117 |
| **Total** | **$575,600** | **$37,017** | **$5,160** | **$617,777** |

Source: USDA Risk Management Agency

### *Probability of Future Occurrence*

According to NCDC, during the 22-year period from 1996 thru 2017, the planning area experienced a total of 43 damaging blizzards, winter storms, ice storms, and extreme cold events. This translates to an annual probability of about two Severe winter weather events per year. Therefore, the probability rating is "Highly Likely".

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Vulnerability Overview*

The entire planning area is vulnerable to the effects of winter storm. Hazardous driving conditions due to snow and ice on highways and bridges lead to many traffic accidents and can impact the response of emergency vehicles. The leading cause of death during winter storms is transportation accidents. About 70 percent of winter-related deaths occur in automobiles due to traffic accidents and about 25 percent are from people caught outside in a storm. Emergency services such as police, fire, and ambulance are unable to respond due to road conditions. Emergency needs of remote or isolated residents for food or fuel, as well as for feed, water and shelter for livestock are unable to be met. The probability of utility and infrastructure failure increases during winter storms due to freezing rain accumulation on utility poles and power lines. People, pets, and livestock are also susceptible to frostbite and hypothermia during winter storms. Those at risk are primarily either engaged in outdoor activity (shoveling snow, digging out vehicles, or assisting stranded motorists), or are the elderly. Schools often close during extreme cold or heavy snow conditions to protect the safety of children and bus drivers. Citizens' use of kerosene heaters and other alternative forms of heating may create other hazards such as structural fires and carbon monoxide poisoning.

According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, severe winter storm ranked 6th with $2.2 million in annualized losses based on data spanning a 13-year period.

**Magnitude Score:** 2 - Limited

### *Potential Losses to Existing Development*

*Vulnerable Buildings, Infrastructure, and Critical Facilities*

Buildings with overhanging tree limbs are more vulnerable to damage during winter storms. Businesses experience loss of income as a result of closure during power outages. In general, heavy winter storms

increase wear and tear on roadways though the cost of such damages is difficult to determine. Businesses can experience loss of income as a result of closure during winter storms.

*Loss of Use*

Overhead power lines and infrastructure are also vulnerable to damages from winter storms. In particular, ice accumulation during winter storm events can cause damages to power lines due to the ice weight on the lines and equipment, as well as damage caused to lines and equipment from falling trees and tree limbs weighted down by ice. Potential losses would include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses. Secondary effects from loss of power could include burst water pipes in homes without electricity during winter storms. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard.

The electric power loss of use estimates provided in Table 3-63 below were calculated using FEMA's Standard Values for Loss of Service for Utilities published in the June 2009 BCA Reference Guide. These figures are used to provide estimated costs associated with the loss of power in relation to the populations in Emmet County's jurisdictions. The loss of use estimates for power failure associated with winter storms is provided as the loss of use cost per person, per day of loss. The estimated loss of use provided for each jurisdiction represents the loss of service of the indicated utility for one day for 10 percent of the population. It is understood that in rural areas, the typical loss of use may be for a larger percentage of the population for a longer time during weather extremes. These figures do not take into account physical damages to utility equipment and infrastructure.

**Table 3-63 Loss of Use Estimates for Power Failure (One Day)**

| Jurisdiction | 2016 Population Estimate | Estimated Affected Population 10% | Electric Loss of Use Estimate ($126 per person per day) |
|---|---|---|---|
| City of Armstrong | 898 | 90 | $ 11,315 |
| City of Dolliver | 81 | 8 | $ 1,021 |
| City of Estherville | 6,027 | 603 | $ 75,940 |
| City of Gruver | 105 | 11 | $ 1,323 |
| City of Ringsted | 479 | 18 | $ 2,268 |
| City of Wallingford | 180 | 205 | $ 25,830 |
| Unincorporated Emmet County | 2,050 | 982 | $ 123,732 |
| **County Total** | **9,820** | **90** | **$ 11,315** |

Source: Loss of Use Estimates from FEMA BCA Reference Guide, 2009; Population Estimates, U.S. Census Bureau, 5-year American Community Survey

### *Property Losses*

The total property loss reported by the NCDC for a total of 43 winter events that impacted the planning area during the 22-year time-period from 1996 thru 2017 was $1,751,725. However, damages for winter and ice storms are reported for all weather zones impacted. So, it is extremely difficult to determine the damages from these events that apply specifically to Emmet County.

USDA crop insurance claims for cold conditions and snow for the ten-year period of 2007-2016 totaled $575,600. The 2015 Iowa Crop Insurance Profile from USDA, RMA shows that 89 percent of crops are insured in Iowa and the adjusted losses calculate to $646,761 for the period and $64,676 in estimated annualized losses.

Considering the $157 million market value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from cold conditions and snow was determined minimal compared to the value of the insurable crops.

*Increased Risk Populations*

Elderly populations are considered to be at increased risk to Winter Storms and associated extreme cold events. Table 3-37 in the Extreme Heat Profile Section provides the number of population over 65 in each jurisdiction in the planning area.

### *Future Development*

Future development could potentially increase vulnerability to this hazard by increasing demand on the utilities and increasing the exposure of infrastructure networks.

### *Climate Change Impacts*

According to the 2010 report on Climate Change Impacts on Iowa, Iowa has experienced a long-term upward trend in temperature.

- Long-term winter temperatures have increased six times more than summer temperatures.
- Nighttime temperatures have increased more than daytime temperatures since 1970.
- Since 1970, daily minimum temperatures have increased in summer and winter; daily maximum temperatures have risen in winter but declined substantially in summer.

If this trend continues, future occurrences of the extreme cold/wind chill aspects of winter storms should decrease. In addition, higher winter temperatures bring higher probability of rain, rather than snow. As a result, the amount of precipitation falling as snow should decrease.

### *Severe Winter Storm Hazard Summary by Jurisdiction*

Although crop loss as a result of winter storm occurs more in the unincorporated portions of the planning area, the crop losses are not high since corn and soybeans are not in the ground during winter months and only get affected from unusual weather events. The density of vulnerable populations is higher in the cities. Transportation incidents related to winter storm could also impact all jurisdictions. With these vulnerabilities that apply to both urban and rural jurisdictions, the magnitude of this hazard is relatively equal. The factors of probability, warning time, and duration are also equal across the planning area. This hazard does not substantially vary by jurisdiction.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Armstrong | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Dolliver | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Estherville | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Gruver | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Ringsted | 4 | 2 | 3 | 4 | 3.25 | High |
| City of Wallingford | 4 | 2 | 3 | 4 | 3.25 | High |
| North Union Schools | 4 | 2 | 3 | 4 | 3.25 | High |
| Estherville-Lincoln Schools | 4 | 2 | 3 | 4 | 3.25 | High |

### 3.5.16 Sinkholes

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 1 | 2 | 1 | 1.15 | Low |

## Profile

#### *Hazard Description*

The loss of surface elevation due to the removal of subsurface support defines a sinkhole. Sinkholes range from broad, regional lowering of the land surface to localized collapse.

Sinkholes are common where the rock below the land surface is limestone, carbonate rock, salt beds, or rocks that can naturally be dissolved by ground water circulating through them. As the rock dissolves, void spaces and caverns develop underground. The sudden collapse of the land surface can be dramatic and range in size from broad, regional lowering of the land surface to localized collapse. Although subsidence can be a naturally occurring hazard, the primary causes of most incidents of subsidence are human activities: underground mining of coal, groundwater or petroleum withdraw, and drainage of organic soils. Land subsidence occurs slowly and continuously over time or on occasion abruptly, as in the sudden formation of sinkholes. Sinkholes can be aggravated by flooding.

Karst is a landscape formed from the dissolution of soluble rocks including limestone, dolomite and gypsum. Sinkholes are a common indication of karst; caves and underground drainage systems are other indicators.

Land subsidence occurs slowly and continuously over time or on occasion abruptly, as in the sudden formation of sinkholes. Sinkholes can be aggravated by flooding.

**Warning Time Score:** 2 - 12-24 hours

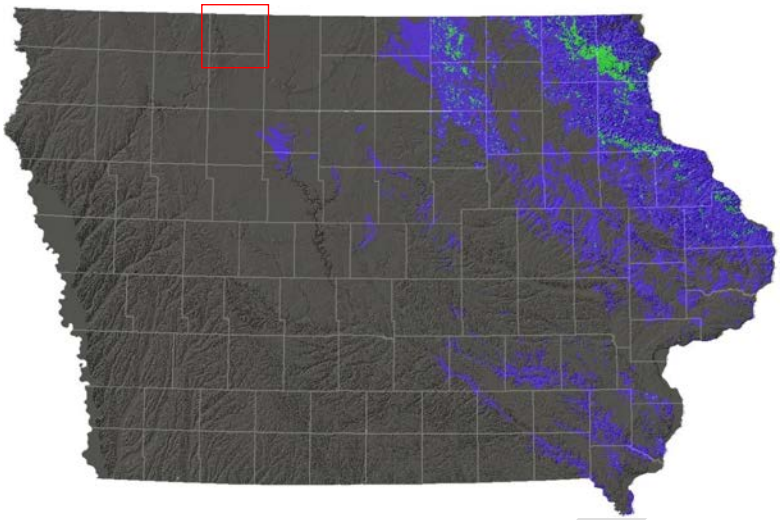
**Duration Score:** 1 - Less than 6 hours

#### *Geographic Location/Extent*

There are three areas in Iowa where large numbers of sinkholes exist: 1) within the outcrop belt of the Ordovician Galena Group carbonates in Allamakee, Clayton, and Winneshiek Counties; 2) in Devonian carbonates in Bremer, Butler, Chickasaw and particularly Floyd and Mitchell Counties; and 3) along the erosional edge of silurian carbonates in Dubuque and Clayton Counties.

According to the Department of Natural Resources, there are no known sinkholes or known potential karst areas in Emmet County. The image in Figure 3-39 shows areas with sinkhole potential in Iowa. Areas identified as green are within 1,000 feet of a known sinkhole and the blue areas show greater than 1,000 feet but less than a mile from a known sinkhole or an area with carbonate bedrock close to the surface.

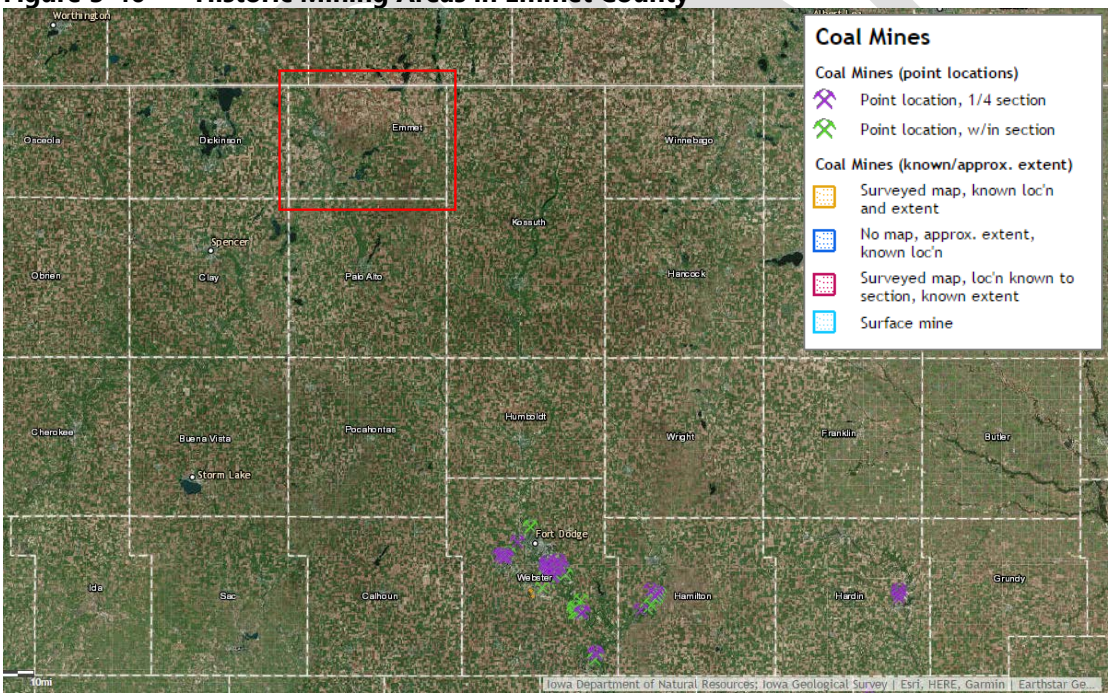
**Figure 3-39 Karst Terrain (Sinkhole Location and Potential, Emmet County)**



Source: Iowa Department of Natural Resources, http://iagiservicebureau.blogspot.com/2013/05/caution-karst-below.html

Mining activity can also lead to sinkhole development. The map in Figure 3-40 shows historic coal mining areas as reported by the Iowa Department of Natural Resources. As shown in this map, there are no locations in Emmet County with historic coal mining areas that could potentially be susceptible to sinkholes (Emmet County is identified by the red rectangle).

**Figure 3-40 Historic Mining Areas in Emmet County**




Source: Iowa Department of Natural Resources

### *Previous Occurrences*

The sinkhole inventory maintained by the Iowa Department of Natural Resources did not include any known previous sinkhole occurrences in Emmet County.

## Probability of Future Occurrence

Based on no known past occurrences, no known historic mine sites, and no known karst terrain in Emmet County, the probability of this hazard is unlikely.

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Vulnerability Overview*

Sinkholes have not historically occurred in Emmet County, and there are no coal mine sites or karst terrain that would present the conditions for sinkholes to occur. However, if subsidence or sinkholes were to occur, it would most likely be an isolated event with localized damages.

**Magnitude Score:** 1 - Limited

### *Potential Losses to Existing Development*

Due to the lack of information regarding previous occurrences of this hazard, it is not possible to estimate potential losses.

### *Future Development*

Future development should avoid areas of known subsurface void spaces such as old coal mines.

### *Climate Change Impacts*

There are no noted trends in climate change that would not have a significant effect on the occurrence of sinkholes.

### *Sinkhole Hazard Summary by Jurisdiction*

The overall risk to sinkholes and land subsidence is low and does not vary substantially among jurisdictions.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Armstrong | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Dolliver | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Estherville | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Gruver | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Ringsted | 1 | 1 | 2 | 1 | 1.15 | Low |
| City of Wallingford | 1 | 1 | 2 | 1 | 1.15 | Low |
| North Union Schools | 1 | 1 | 2 | 1 | 1.15 | Low |
| Estherville Lincoln Schools | 1 | 1 | 2 | 1 | 1.15 | Low |
| Iowa Lakes CC | 1 | 1 | 2 | 1 | 1.15 | Low |

### 3.5.17 Terrorism

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 1 | 4 | 4 | 4 | 2.65 | Moderate |

## Profile

### *Hazard Description*

This hazard encompasses the following sub-hazards: enemy attack, biological terrorism, agro-terrorism, chemical terrorism, conventional terrorism, cyber terrorism, radiological terrorism and public disorder. These hazards can occur anywhere and demonstrate unlawful force, violence, and/or threat against persons or property causing intentional harm for purposes of intimidation, coercion or ransom in violation of the criminal laws of the United States. These actions may cause massive destruction and/or extensive casualties. The threat of terrorism, both international and domestic, is ever present, and an attack can occur when least expected.

Enemy attack is an incident that could cause massive destruction and extensive casualties throughout the world. Some areas could experience direct weapons' effects: blast and heat; others could experience indirect weapons' effect. International political and military activities of other nations are closely monitored by our federal government and the State of Iowa would be notified of any escalating military threats.

The use of biological agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom can be described as biological terrorism. Liquid or solid contaminants can be dispersed using sprayers/aerosol generators or by point of line sources such as munitions, covert deposits and moving sprayers. Biological agents vary in the amount of time they pose a threat. They can be a threat for hours to years depending upon the agent and the conditions in which it exists.

Agro-terrorism consists of acts to intentionally contaminate, ruin, or otherwise make agricultural products unfit or dangerous for consumption or further use. Agriculture is an important industry in Iowa and Emmet County. The introduction of a biological agent into the population of 22,000 cattle and calves, or the 191,652 hogs and pigs, or the 120,500 acres of corn in Emmet County would be financially devastating and would have a major impact on the food supply of the state and the nation. A major attack involving the nation's food supply could be launched in a rural area that has little capacity to respond. Potential terrorists' targets for livestock disease introduction would be concentration points, such as the County's licensed feedlots or livestock markets discussed later in the Geographic Location section.

Chemical terrorism involves the use or threat of chemical agents against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Effects of chemical contaminants are similar to biological agents.

Use of conventional weapons and explosives against persons or property in violation of the criminal laws of the United States for purposes of intimidations, coercion, or ransom is conventional terrorism. Hazard affects are instantaneous; additional secondary devices may be used, lengthening the time duration of the hazard until the attack site is determined to be clear. The extent of damage is determined by the type and quantity of explosive. Effects are generally static other than cascading consequences and incremental structural failures. Conventional terrorism can also include tactical assault or sniping from remote locations.

Electronic attack using one computer system against another in order to intimidate people or disrupt other systems is a cyber-attack. All governments, businesses and citizens that conduct business utilizing computers face these threats. Cyber-security and critical infrastructure protection are among the most

important national security issues facing our country today. As such, the Iowa Division of Criminal Investigation has a Cyber Crime Unit tasked with analysis and retrieval of digital information for investigations.

Radiological terrorism is the use of radiological materials against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion or ransom. Radioactive contaminants can be dispersed using sprayers/aerosol generators, or by point of line sources such as munitions, covert deposits and moving sprayers or by the detonation of a nuclear device underground, at the surface, in the air or at high altitude.

Mass demonstrations, or direct conflict by large groups of citizens, as in marches, protect rallies, riots, and non-peaceful strikes are examples of public disorder. These are assembling of people together in a manner to substantially interfere with public peace to constitute a threat, and with use of unlawful force or violence against another person, or causing property damage or attempting to interfere with, disrupting, or destroying the government, political subdivision, or group of people. Labor strikes and work stoppages are not considered in this hazard unless they escalate into a threat to the community. Vandalism is usually initiated by a small number of individuals and limited to a small target or institution. Most events are within the capacity of local law enforcement.

The Southern Poverty Law Center reports four active hate groups in Iowa: National Socialist Movement (Neo-Nazi, National Socialist); Gallows Tree Wotansvolk Alliance (Neo-Nazi); the Daily Stormer (Neo Nazi); and ACT for America (Anti-Muslim).

**Warning Time Score:** 4 - Minimal or no warning

**Duration Score:** 4 - More than 1 week

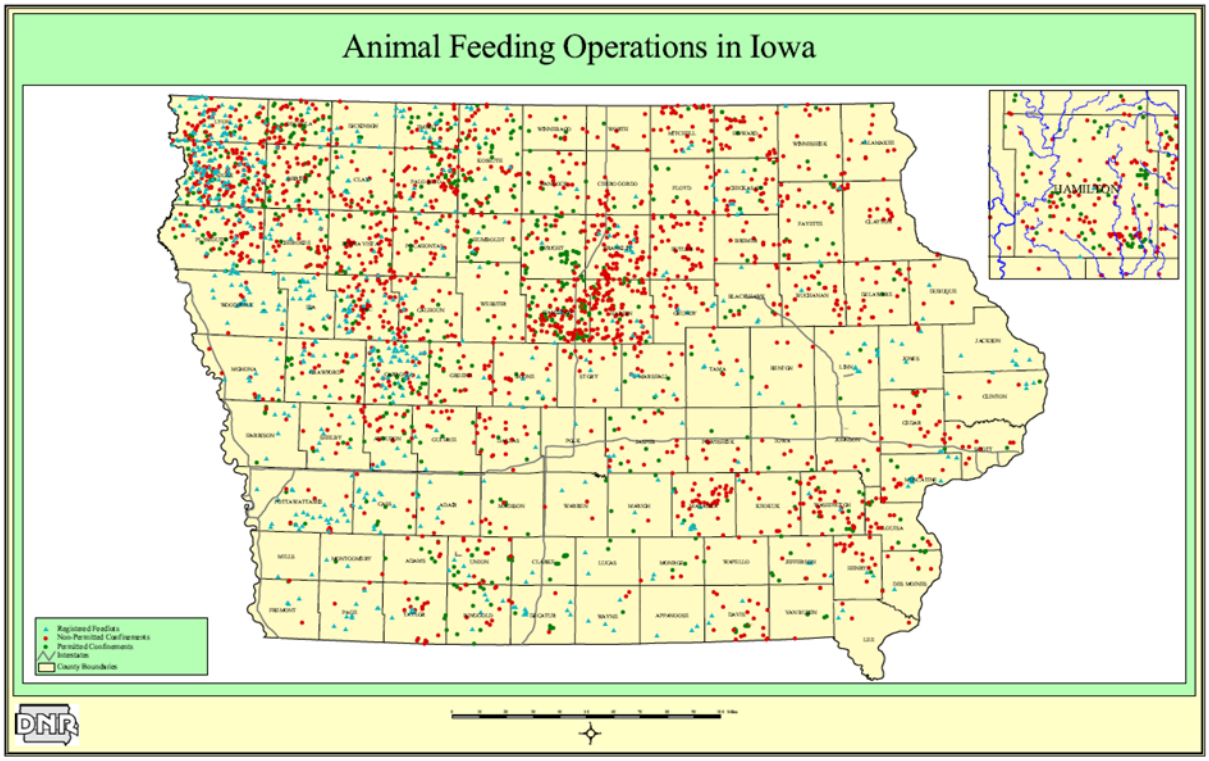
#### *Geographic Location/Extent*

The entire planning area has a low potential for terrorist activity. However, any venue with a large gathering of people could be a potential target for terrorists. The most likely targets of a conventional terrorism attack in Emmet County include public school system facilities, the County Courthouse and law enforcement centers within the County.

In terms of cyber-terrorism, our society is highly networked and interconnected. An attack could be launched from anywhere on earth and could range in impacts from small and localized to a far-reaching global scale. Depending on the attack vector and parameters, a cyber-attack could impact all of Emmet County and its associated municipal jurisdictions.

For agro-terrorism planning, Figure 3-41 shows the locations of animal feeding operations in Emmet County. Additional agricultural assets are discussed in Section 3.5.1, Animal/Plant/Crop Disease.

**Figure 3-41 Animal Feeding Operations in Iowa**




Source: Department of Natural Resources

### *Previous Occurrences*

There have not been any large-scale enemy attacks or acts of radiological terrorism in Iowa. There have been biological and chemical agent threats, animal rights activists' vandalism and many bomb threats. In 2002, pipe bombs were found in 18 states including Iowa and six people were injured in the bombings in Iowa and Illinois. In 2005 and 2006, pipe bombs were used in attempted murder cases in two Iowa cities.

The Iowa Department of Public Safety issued a 2016 Iowa Uniform Crime Report showing 18 hate/bias crimes were reported statewide in 2016.

According to the Southern Poverty Law Center, there were 47 hate incidents reported in Iowa from 2003 to 2016. None of the incidents reported were in Emmet County.

### *Probability of Future Occurrence*

While difficult to estimate, the probability for a terrorist event is "Unlikely" within the next 10 years in Emmet County.

**Probability Score:** 1 - Unlikely

## Vulnerability

### *Overview*

A terrorism event could occur in either limited area of a jurisdiction or over the entire jurisdiction at once. This hazard has the ability to directly cause substantial structural losses and potentially loss of life. Hazard impacts are heavily influenced by the type and parameters of a terrorist attack.

**Magnitude Score:** 4 - Catastrophic

### *Potential Losses to Existing Development*

Potential losses from Terrorism include fatalities to people, damage to property, infrastructure, critical facilities, crops, and animals. The degree of impact would be directly related to the type of incident and the target. Potential losses could include cost of repair or replacement of damaged facilities, lost economic opportunities for businesses, loss of human life, injuries to persons, loss of food supplies, disruption of the food supply chain, and immediate damage to the surrounding environment. Secondary effects of infrastructure failure could include public safety hazards, spread of disease, increased morbidity and mortality among the local and distant populations, public panic and long-lasting damage to the environment. Terrorism events are rare occurrences and specific amounts of estimated losses for previous occurrences are not available due to the complexity and multiple variables associated with these types of hazards. In some instances, information about these events is secure and unavailable to the public in order to maintain national security and prevent future attacks.

As discussed previously, it is difficult to quantify potential losses in terms of the jurisdictions most threatened by CBRNE (chemical, biological, radiological, nuclear, and high yield explosive) attack events due to the many variables and human element. Therefore, for the purposes of this plan, the loss estimates will take into account a hypothetical scenario. The attack scenario is staged at a Friday night high school football game. The hypothetical football stadium has approximately 500 persons in the stadium and concession areas on any home football game nights during the fall.

Analysis of vulnerable populations is aided by a program developed by Johns Hopkins University in 2006 called Electronic Mass Casualty Assessment and Planning Scenarios (EMCAPS) http://www.hopkins-cepar.org/EMCAPS/EMCAPS.html which utilizes scenarios developed by the Department of Homeland Security.

****THE FOLLOWING HYPOTHETICAL SCENARIO IS FOR INSTRUCTIONAL AND ILLUSTRATIVE PURPOSES ONLY****

*Chemical Attack – Toxic Gas – Chlorine Release*

**Scenario Overview:** A bomb is attached to a truck trailer tanker carrying compressed chlorine and enters the high school football stadium parking lot. The entire contents of the tank escape to the atmosphere and the plume spreads to the stadium and the immediate surrounding parking lot area. This particular type of attack would cause harm to humans and could render portions of the stadium unusable for a short time period in order to allow for a costly clean-up. There might also be a fear by the public of long-term contamination of the stadium and the high school, subsequently closing the high school.

**Assumptions:** (1) The population density is approximately 500 persons around the high school stadium. (2) Chlorine is toxic and may damage eyes, skin and respiratory tract. (3) The rate of "worried well" is equal to 9 times the number of infected cases or the full exposed population, whichever is least.

**Table 3-64 Described Losses from a Chemical Attack – Chlorine Scenario**

| | |
|---|---|
| Eye pain & swelling, headache, restricted airflow – difficulty breathing, possible chemical burns | 22 persons |
| Eye pain & swelling, headache, rapid breathing, skin irritation | 42 persons |
| Eye pain & swelling, headache, rapid breathing, coughing, chest pain, skin irritation | 86 persons |
| Eye irritation, headache, throat irritation, coughing, skin irritation | 119 persons |
| Eye irritation, headache, coughing, skin irritation | 82 persons |
| Total "Worried Well" Cases (total exposed population) | 500 persons |

| | |
|---|---|
| Deaths | 16 persons |
| Cost of Decontamination @ $12/person (assumes all persons with skin injuries will require decontamination and approximately 1/10 of the worried well will demand to be decontaminated) - total persons =417 | $5,004 |

Notes: Victims will require decontamination and both long and short-term treatment.

*Improvised Explosive Device Attack – ANFO*

**Scenario Overview:** An Improvised Explosive Device (IED) utilizing an ammonium nitrate/fuel oil (ANFO) mixture is carried in a panel van to a high school parking area at the beginning of a home football game when people are leaving their cars and entering the stadium. Potential losses with this type of scenario include both human and structural assets.

**Assumptions:** (1) The population density in the parking lot during the beginning and ending of the game is high, at least 1 person /1 square feet. (2) The quantity of ANFO used is 500 lbs.

**Table 3-65 Described Losses from an Improvised Explosive Device Attack – ANFO**

| | |
|---|---|
| Total Dead | 86 persons |
| Total Traumatic Injuries | 151 persons |
| Total Urgent Care Injuries | 745 persons |
| Injuries not Requiring Hospitalization | 279 persons |
| Structures and Other Physical Assets<br>(Damages would certainly occur to vehicles and depending on the proximity of other structures, damages would occur to the stadium complex itself. The exact amount of these damages is difficult to predict because of the large numbers of factors, including the type of structures nearby and the amount of insurance held by vehicle owners.) | Vehicles –<br>Replacement cost for approximately 350 vehicles @ $10,000 per vehicle inside the 200 ft. BATF described Lethal Air Blast range = $ 3,500,000<br>Repair / repainting cost for approximately 70 vehicles @ $ 4,000 per vehicle inside the BATF described Falling Debris Hazard = $280,000 |

Note: These are the numbers of persons that could be injured from an IED Attack if they are in the area.

### *Future Development*

As public events are held at various venues in the County, the potential may exist for these locations to become targets of attack. With human-caused hazards such as this that can have multiple variables involved, increase in development is not always a factor in determining risk, although the physical damages of the event may increase with the increased or newly developed areas.

### *Climate Change Impacts*

There are no known climate change impacts relevant to this hazard.

### *Terrorism Hazard Summary by Jurisdiction*

The overall rating for any type of terrorism in the County is 2.65 "Moderate". This rating score applies to all jurisdictions in the planning area due to the variables and unknowns involved in terrorism events. If a wide scale event occurred in any jurisdiction, it could have devastating consequences.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Armstrong | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Dolliver | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Estherville | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Gruver | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Ringsted | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| City of Wallingford | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| North Union Schools | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| Estherville Lincoln Schools | 1 | 4 | 4 | 4 | 2.65 | Moderate |
| Iowa Lakes CC | 1 | 4 | 4 | 4 | 2.65 | Moderate |

### 3.5.18 Thunderstorm with Lightning and Hail

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 2 | 2 | 2 | 2.90 | Moderate |

## Profile

### *Hazard Description*

A thunderstorm is defined as a storm that contains lightning and thunder which is caused by unstable atmospheric conditions. When the colder upper air sinks and warm moist air rises, storm clouds or 'thunderheads' develop, resulting in thunderstorms. This can occur singularly, in clusters or in lines. Severe thunderstorms most often occur in Iowa in the spring and summer, during the afternoon and evenings, but can occur at any time. Other hazards associated with thunderstorms and lightning include: heavy rains causing flash flooding (discussed separately in Section 3.5.7) and tornadoes and windstorms (discussed further in Section 3.5.19).

*Lightning*

All thunderstorms produce lightning, which often strikes outside of the area where it is raining and is known to fall more than 10 miles away from the rainfall area. Thunder is simply the sound that lightning makes. Lightning is a huge discharge of electricity. When lightning strikes, electricity shoots through the air and causes vibrations creating the sound of thunder. Nationwide, lightning kills 75 to 100 people each year. Lightning strikes can also start building fires and wildland fires, and damage electrical systems and equipment.

*Hail*

According to the National Oceanic and Atmospheric Administration (NOAA), hail is precipitation that is formed when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere causing them to freeze. The raindrops form into small frozen droplets and then continue to grow as they come into contact with super-cooled water which will freeze on contact with the frozen rain droplet. This frozen rain droplet can continue to grow and form hail. As long as the updraft forces can support or suspend the weight of the hailstone, hail can continue to grow.

At the time when the updraft can no longer support the hailstone, it will fall down to the earth. For example, a ¼" diameter or pea sized hail requires updrafts of 24 mph, while a 2 ¾" diameter or baseball sized hail requires an updraft of 81 mph. The largest hailstone recorded in the United States was found in Vivian, South Dakota on July 23, 2010, measuring eight inches in diameter, almost the size of a soccer ball. Soccer-ball-sized hail is the exception, but even small pea sized hail can do damage.

Hailstorms in Iowa cause damage to property, crops, and the environment, and kill and injure livestock. In the United States, hail causes more than $1 billion in damage to property and crops each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are the other things most commonly damaged by hail. Hail has been known to cause injury to humans; occasionally, these injuries can be fatal.

Table 3-66 below describes typical damage impacts of the various sizes of hail.

**Table 3-66 Tornado and Storm Research Organization Hailstorm Intensity Scale**

| Intensity Category | Diameter (mm) | Diameter (inches) | Size Description | Typical Damage Impacts |
|---|---|---|---|---|
| Hard Hail | 5-9 | 0.2-0.4 | Pea | No damage |
| Potentially Damaging | 10-15 | 0.4-0.6 | Mothball | Slight general damage to plants, crops |
| Significant | 16-20 | 0.6-0.8 | Marble, grape | Significant damage to fruit, crops, vegetation |
| Severe | 21-30 | 0.8-1.2 | Walnut | Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored |
| Severe | 31-40 | 1.2-1.6 | Pigeon's egg > squash ball | Widespread glass damage, vehicle bodywork damage |
| Destructive | 41-50 | 1.6-2.0 | Golf ball > Pullet's egg | Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries |
| Destructive | 51-60 | 2.0-2.4 | Hen's egg | Bodywork of grounded aircraft dented, brick walls pitted |
| Destructive | 61-75 | 2.4-3.0 | Tennis ball > cricket ball | Severe roof damage, risk of serious injuries |
| Destructive | 76-90 | 3.0-3.5 | Large orange > Soft ball | Severe damage to aircraft bodywork |
| Super Hailstorms | 91-100 | 3.6-3.9 | Grapefruit | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |
| Super Hailstorms | >100 | 4.0+ | Melon | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |

Source: Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brookes University

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity.

The onset of thunderstorms with lightning and hail is generally rapid. However, advancements in meteorological forecasting allow for some advance warning.

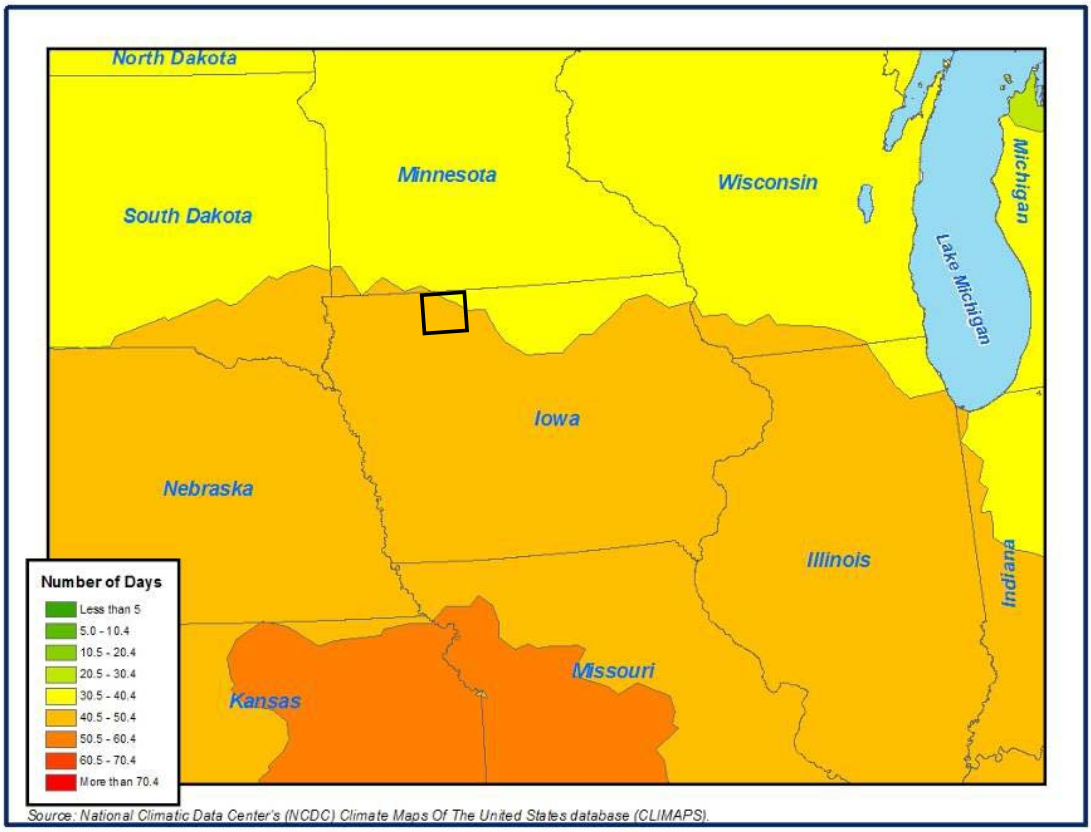
**Warning Time Score:** 2 - 12-24 hours

**Duration Score:** 2 - Less than 1 day

## Geographic Location/Extent

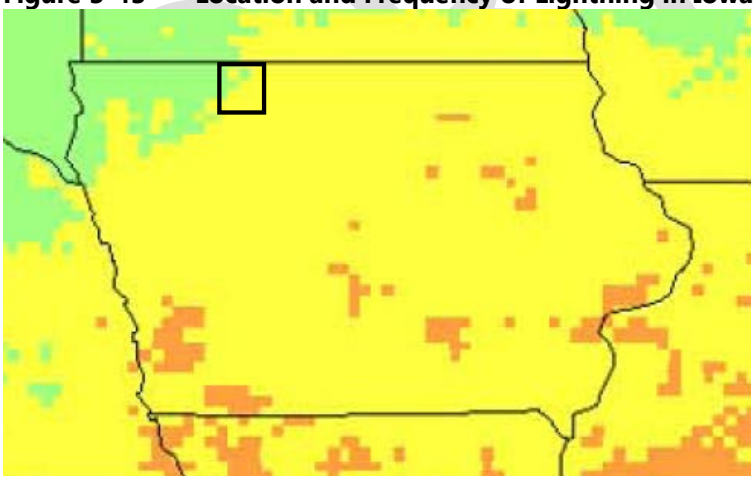
Thunderstorms and the associated hail and lightning impact the entire County with relatively similar frequency. Although these events occur similarly throughout the planning area, they are more frequently reported in more urbanized areas. In addition, damages are more likely to occur in more densely developed urban areas as well as to cropland. Figure 3-42 displays the average number of days with thunder experienced throughout different areas of the county each year, showing most of the County experiences between 40.5 to 50.4 days with thunder per year per the orange shaded area, and portions to the east (shaded in yellow) experience 30.5 to 40.4 days with thunder per year. Figure 3-43 shows 1 to 4 lightning strikes per square kilometer per year with the green and yellow shaded areas.

**Figure 3-42 Distribution and Frequency of Thunderstorms**




Note: Black Square indicates approximate location of Emmet County

**Figure 3-43 Location and Frequency of Lightning in Iowa**




Source: National Weather Service, www.lightningsafety.noaa.gov/lightning_map.htm

Note: Black Square indicates approximate location of Emmet County

### *Previous Occurrences*

Since 1965, Emmet County has been included in six Presidential Disaster declarations that included severe storms/weather (see Table 3-2 in the Hazard Identification Section). Some of the damages that resulted in the declarations were from tornadoes and flooding that accompanied the severe weather.

The NCDC reported 175 total thunderstorm events for the Emmet County planning area from January 1996 through December 2017. Of the reported events, there was $1,593,000 in total property damage and no injuries or fatalities.

**Table 3-67 Thunderstorm Summary for Emmet County (1996-2017)**

| Hazard type | Total Events | Events with Damage | Property Damage | Injuries | Fatalities |
|---|---|---|---|---|---|
| Hail | 90 | 50 | $280,000 | 0 | 0 |
| Lightning | 4 | 4 | $85,000 | 0 | 0 |
| Thunderstorm Wind | 81 | 69 | $1,228,000 | 0 | 0 |
| **Totals** | **175** | **123** | **$1,593,000** | **0** | **0** |

Source: NCDC

*Hail*

Table 3-68 shows the number of hail events 0.75 inches and larger by the size of the hail.

**Table 3-68 Hail Events Summarized by Hail Size**

| Hail Size (inches) | # of Events 1996-2017 |
|---|---|
| 3.00 | 1 |
| 2.75 | 2 |
| 2.00 | 2 |
| 1.75 | 8 |
| 1.50 | 5 |
| 1.25 | 1 |
| 1.00 | 19 |
| 0.88 | 30 |
| 0.75 | 22 |
| **Grand Total** | **90** |

Source: NCDC

*Thunderstorm Winds*

Information concerning tornadoes and windstorms, separate from thunderstorms, can be found in Section 3.5.19.

The National Weather Service (NWS) will issue a Severe Thunderstorm Warning whenever a thunderstorm is forecasted to produce wind gusts to 58 miles per hour (50 knots) or greater and/or hail size one-inch (quarter-size) diameter which can produce significant damage (source: http://www.nws.noaa.gov/oneinchhail/). The data is kept on Iowa Environmental Mesonet, Iowa State University Department of Agronomy website, (http://mesonet.agron.iastate.edu/vtec/search.php). During the 32-year period from 1986 through 2017, there were 75 severe thunderstorm watches and 149 warnings. This calculates to an annual average of 2.3 watches and 4.7 warnings.

The Emmet County Emergency Management Agency recorded one incident of a lightning strike hitting U.S. 9 east of Estherville and causing a hole in the road surface nearly 2 feet deep and over 10 inches wide.


Source: Emmet County Emergency Management Agency

Although NCDC provides estimates of crop losses, crop insurance payment statistics are considered a more accurate resource for this data. According to the USDA Risk Management Agency, insured crop losses in Emmet County as a result of hail from 2007 to 2016 totaled $7,441,956.85 (see Table 3-69) and $300,063.00 from windstorms. There was no crop damage reported from lightning.

**Table 3-69 Crop Insurance Claims Paid in Emmet County from Hailstorms and Windstorms, 2007-2016**

| Year | Hail | Wind/Excess Wind | Insurance Paid |
|---|---|---|---|
| 2007 | $14,441.00 | $40,929.00 | $55,370.00 |
| 2008 | $26,929.00 | $247,390.00 | $274,319.00 |
| 2009 | $556,389.00 | | $556,389.00 |
| 2010 | $25,874.00 | | $25,874.00 |
| 2011 | | | |
| 2012 | $41,772.00 | $7,766.00 | $49,538.00 |
| 2013 | $146,642.00 | | $146,642.00 |
| 2014 | $6,612,223.85 | | $6,612,223.85 |
| 2015 | $1,836.60 | | $1,836.60 |
| 2016 | $15,849.40 | $3,978.00 | $19,827.40 |
| **Total** | **$7,441,956.85** | **$300,063.00** | **$7,742,019.85** |

Source: USDA Risk Management Agency

### *Probability of Future Occurrence*

NCDC-reported damaging lightning events occurred four times from 1996 through 2017. Since lightning accompanies thunderstorms, it can be assumed that lightning occurs more often than damages are reported. These rates of occurrence are expected to continue in the future.

Based on NCDC data, there have been 50 damaging hail events and 69 damaging thunderstorm wind events. This translates to an annual average of 2.4 and 3.3 damaging events per year, respectively. Based on this history, damaging hail and thunderstorm wind occur in the planning area multiple times each year making the probability for damaging events "Highly Likely" in any given year.

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Overview*

In general, assets in the County are vulnerable to thunderstorms, winds, lightning and hail including people, crops, vehicles, and built structures. According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, thunderstorm with lightning and hail ranked 4th with $30 million in annualized losses based on data spanning a 17-year period. Although this hazard results in high annual losses, generally private property insurance and crop insurance cover the majority of losses. Considering insurance coverage as a recovery capability and therefore mitigation of devastating impacts to the economy, the overall impact on jurisdictions is reduced; therefore, this hazard's magnitude score to the planning area is "limited".

**Magnitude Score:** 2 - Limited

### *Potential Losses to Existing Development*

Most lightning damages occur to electronic equipment located inside buildings. But structural damage can also occur when a lightning strike causes a building fire. In addition, lightning strikes can cause crop damages if fields light on fire. Communications equipment and warning transmitters and receivers can also be knocked out by lightning strikes. There have not been any fatalities in Emmet County from lightning strikes. Thunderstorm winds and hail can cause damage to property, vehicles, trees, and crops.

### *Property and Crop Losses*

Table 3-70 provides the estimated annualized property damages resulting from thunderstorms, including lightning, hail and wind.

**Table 3-70 Estimated Annualized Property Damages Resulting from Severe Thunderstorms (Hail/Lightning/Wind, 1996-2017)**

| Hail/Lightning/Thunderstorm Wind Property Damages | | Annualized Property Damages |
|---|---|---|
| Hail | $280,000 | |
| Lightning | $85,000 | |
| Thunderstorm Wind | $1,228,000 | |
| **Total** | **$1,593,000** | **$75,857** |

Source: NCDC

Table 3-71 provides the insured crop losses resulting from hail and wind. The insured loss has been adjusted to estimate losses to all insurable crops by considering that 89 percent of insurable crops in the State were insured (2016 Iowa Crop Insurance Profile from USDA's Risk Management Agency).

**Table 3-71 Estimated Insurable Annualized Crop Damages Resulting from Severe Thunderstorms (Hail//Wind)**

| Crop Exposure (2012) | Insurance Paid (2007-2016) | | Adjusted Crop Damages Considering 89% Insured | Annualized Adjusted Crop Damages |
|---|---|---|---|---|
| $156,881,000 | Hail | $7,441,956.85 | $8,698,899 | $869,890 |
| | Wind/Excess Wind | $300,063.00 | | |
| | Total | $7,742,019.85 | | |

Source: Crop Exposure Value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA's Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDAs 2016 State Crop Insurance Profile for Iowa

### *Future Development*

Any additional future development will result in more property being vulnerable to damages from severe thunderstorms, lightning and hail. To minimize vulnerability, protective measures could be implemented such as wind-resistant construction, lightning rods, surge protection, and use of materials less prone to hail/wind damage.

### *Climate Change Impacts*

According to the 2010 Climate Change Impacts on Iowa report, growing evidence points to stronger summer storm systems in the Midwest. Studies have not been done to conclusively say that severe storms, including hail, lightning, and strong winds, are increasing. However, with summer temperatures becoming warmer and humidity levels increasing, an increase in the likelihood of these hazards is plausible.

### *Thunderstorm, Lightning and Hail Hazard Summary by Jurisdiction*

The following hazard summary table shows that this hazard does not vary significantly by jurisdiction. Although structural property damages are higher in the urban areas, the rural areas have higher damages to agriculture.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Armstrong | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Dolliver | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Estherville | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Gruver | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Ringsted | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| City of Wallingford | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| North Union Schools | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| Estherville Lincoln Schools | 4 | 2 | 2 | 2 | 2.90 | Moderate |
| Iowa Lakes CC | 4 | 2 | 2 | 2 | 2.90 | Moderate |

## 3.5.19 Tornado/Windstorm

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 4 | 4 | 1 | 3.70 | High |

### Profile

#### *Hazard Description*

This hazard section discusses both tornado and windstorm.

**Tornado:** The NWS defines a tornado as "a violently rotating column of air extending from a thunderstorm to the ground." It is usually spawned by a thunderstorm and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Often, vortices remain suspended in the atmosphere as funnel clouds. When the lower tip of a vortex touches the ground, it becomes a tornado and a force of destruction.

Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 miles per hour, and damage paths can be more than one mile wide and 50 miles long. Tornadoes have been known to lift and move objects weighing more than 300 tons a distance of 30 feet, toss homes more than 300 feet from their foundations, and siphon millions of tons of water from water bodies. Tornadoes also generate a tremendous amount of flying debris or "missiles," which often become airborne shrapnel that causes additional damage. If wind speeds are high enough, missiles can be thrown at a building with enough force to penetrate windows, roofs, and walls. However, the less spectacular damage is much more common.

**Windstorm:** Windstorms for purposes of this plan refer to other non-tornadic damaging winds of thunderstorms including downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Straight-line winds are generally any thunderstorm wind that is not associated with rotation. It is these winds, which can exceed 100 mph, which represent the most common type of severe weather and are responsible for most wind damage related to thunderstorms. Since thunderstorms do not have narrow tracks like tornadoes, the associated wind damage can be extensive and affect entire (and multiple) counties. Objects like trees, barns, outbuildings, high-profile vehicles, and power lines/poles can be toppled or destroyed, and roofs, windows, and homes can be damaged as wind speeds increase.

Strong winds can occur year-round in Iowa. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems are, (one high pressure, one low pressure) the stronger the pressure gradient and, therefore, the stronger the winds are. Downbursts can be particularly dangerous to aviation.

The NWS issues High Wind Watch, High Wind Warning, and Wind Advisory to the public. The following are the definitions of these issuances:

- **High Wind Watch** - This is issued when there is the potential of high wind speeds developing that may pose a hazard or are life-threatening.
- **High Wind Warning** - The 1-minute surface winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds gusting to 50 knots (58 mph) or greater, regardless of duration, that are either expected or observed over land.

- **High Wind Advisory** - This is issued when high wind speeds may pose a hazard. Sustained winds 25 to 39 mph and/or gusts to 57 mph.

**Warning Time Score:** 4 - Minimal or no warning time (up to 6 hours warning)

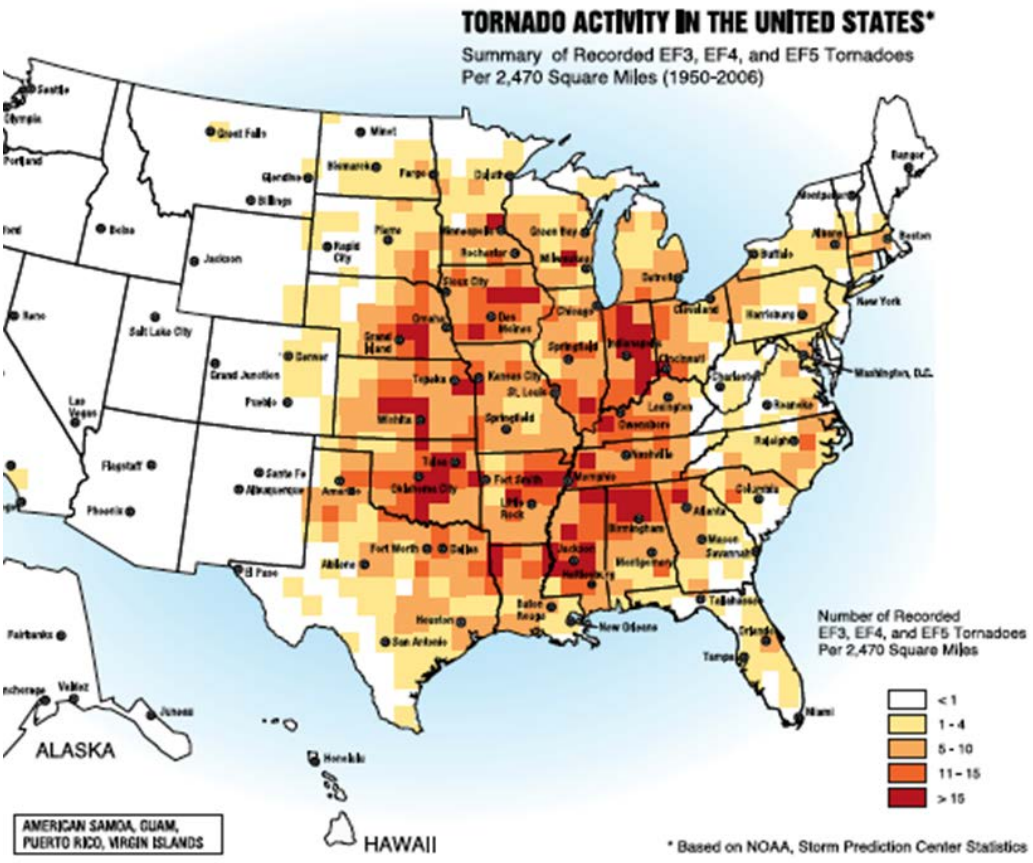
**Duration Score:** 1 - less than 6 hours

### *Geographic Location/Extent*

Iowa is located in a part of the United States where tornadoes are a common occurrence. According to The Tornado History Project.com, Iowa has experienced 2,468 tornadoes from 1950 through 2016 (67-year period) Only one F5 rated tornado has occurred in Iowa during this timeframe (Parkersburg in 2008). Since 1950, there have been on average 37 tornadoes per year in Iowa. Most tornadoes occurred in May and June but can occur during any month. Also, mid-afternoon until around sunset is the peak time of day for tornado activity. Since 1950 there have been 2,274 injuries and 87 deaths attributable to tornadoes (source: http://www.tornadohistoryproject.com/tornado/Iowa/map).

Tornadoes can occur in the entire planning area. Figure 3-44 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 3,700 square miles between 1950 and 2006. Emmet County is in the section with light orange shading, indicating between 5 and 10 tornadoes of this magnitude during this 57-year period.

**Figure 3-44 Tornado Activity in the United States**




Source: FEMA 320, Taking Shelter from the Storm, 3rd edition

Note: Blue arrow is approximate location of Emmet County

Tornadoes are classified according to the EF Scale. The Enhanced F Scale (see Table 3-72) attempts to rank tornadoes according to wind speed based on the damage caused. This update to the original F scale was implemented in the U.S. on February 1, 2007.

**Table 3-72 Enhanced F Scale for Tornado Damage**

| Fujita Scale | | | Derived EF Scale | | Operational EF Scale | |
|---|---|---|---|---|---|---|
| F Number | Fastest 1/4-mile (mph) | 3 Second Gust (mph) | EF Number | 3 Second Gust (mph) | EF Number | 3 Second Gust (mph) |
| 0 | 40-72 | 45-78 | 0 | 65-85 | 0 | 65-85 |
| 1 | 73-112 | 79-117 | 1 | 86-109 | 1 | 86-110 |
| 2 | 113-157 | 118-161 | 2 | 110-137 | 2 | 111-135 |
| 3 | 158-207 | 162-209 | 3 | 138-167 | 3 | 136-165 |
| 4 | 208-260 | 210-261 | 4 | 168-199 | 4 | 166-200 |
| 5 | 261-318 | 262-317 | 5 | 200-234 | 5 | Over 200 |

Source: The National Weather Service, www.spc.noaa.gov/faq/tornado/ef-scale.html

The wind speeds for the EF scale and damage descriptions are based on information on the NOAA Storm Prediction Center as listed in Table 3-73. The damage descriptions are summaries. For the actual EF scale, it is necessary to look up the damage indicator (type of structure damaged) and refer to the degrees of damage associated with that indicator. Information on the Enhanced Fujita Scale's damage indicators and degrees of damage is located online at www.spc.noaa.gov/efscale/ef-scale.html.

**Table 3-73 Enhanced Fujita Scale with Potential Damage**

| Scale | Wind Speed (mph) | Relative Frequency | Potential Damage |
|---|---|---|---|
| EF0 | 65-85 | 53.5% | Light. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e. those that remain in open fields) are always rated EF0). |
| EF1 | 86-110 | 31.6% | Moderate. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken. |
| EF2 | 111-135 | 10.7% | Considerable. Roofs torn off well constructed houses; foundations of frame homes shifted; mobile homes complete destroyed; large trees snapped or uprooted; light object missiles generated; cars lifted off ground. |
| EF3 | 136-165 | 3.4% | Severe. Entire stores of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance. |
| EF4 | 166-200 | 0.7% | Devastating. Well-constructed houses and whole frame houses completely levelled; cars thrown, and small missiles generated. |
| EF5 | >200 | <0.1% | Explosive. Strong frame houses levelled off foundations and swept away; automobile-sized missiles fly through the air in excess of 300 ft.; steel reinforced concrete structure badly damaged; high rise buildings have significant structural deformation; incredible phenomena will occur. |

Source: NOAA Storm Prediction Center

All of Emmet County is susceptible to high wind events. The County is located in Wind Zone IV, which is susceptible to winds up to 250 mph. All of the participating jurisdictions are vulnerable to this hazard. Figure 3-45 shows the wind zones of the United States based on maximum wind speeds; the entire state of Iowa is located within wind zone IV, the highest inland category.

**Figure 3-45 Wind Zones in the United States**


Source: FEMA; http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm

Note: Black square indicates approximate location of Emmet County

The advancement in weather forecasting has provided for the ability to predict severe weather that is likely to produce tornadoes days in advance. Tornado watches can be delivered to those in the path of these storms several hours in advance. Lead time for actual tornado warnings is about 30 minutes. Tornadoes have been known to change paths very rapidly, thus limiting the time in which to take shelter. Tornadoes may not be visible on the ground if they occur after sundown or due to blowing dust or driving rain and hail.

## Previous Occurrences

### *Tornadoes*

According to NOAA statistics Emmet County had 19 recorded tornado events from 1950 to 2016. Of these, one was an F3; three were rated F2; five were rated F1/EF1; eight were rated F0/EF0; and two received no rating. These tornadoes caused no fatalities or injuries, over $3 million in property damages and $8,000 in damage to crops. Historically, tornadoes in the county have occurred in undeveloped areas and had relatively little impact. Table 3-74 summarizes these events.

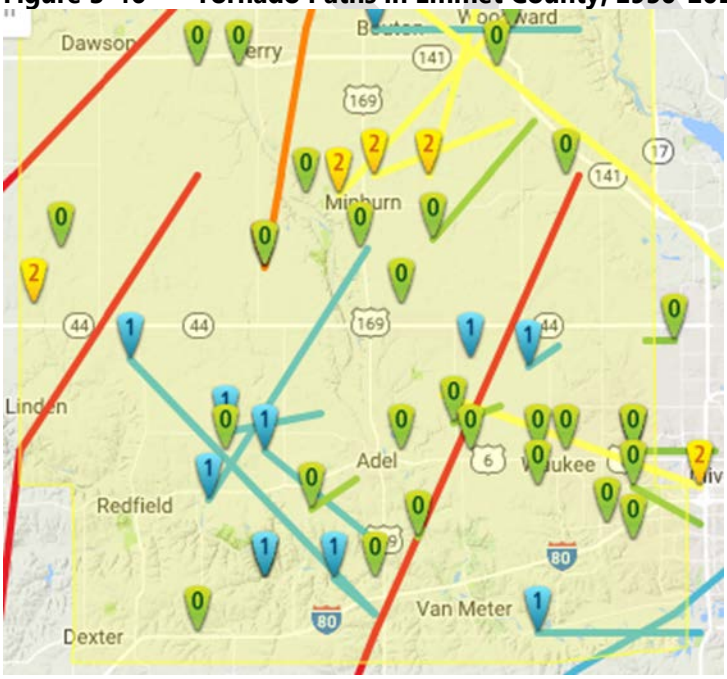
**Table 3-74 Recorded Tornadoes in Emmet County, 1950 - 2016**

| Location | Date | Magnitude | Deaths | Injuries | Property Damage | Crop Damage | Length | Width |
|---|---|---|---|---|---|---|---|---|
| Emmet County | 3/21/1953 | F3 | 0 | 0 | $250,000 | $0 | 31.8 | 400 |
| Emmet County | 5/30/1959 | F1 | 0 | 0 | $2,500 | $0 | 2 | 200 |
| Emmet County | 4/30/1967 | F2 | 0 | 0 | $2,500,000 | $0 | 8.2 | 300 |
| Emmet County | 4/30/1967 | F2 | 0 | 0 | $250,000 | $0 | 1 | 200 |
| Emmet County | 6/14/1976 | F2 | 0 | 0 | $2,500 | $0 | 18.3 | 33 |
| Emmet County | 7/14/1978 | N/A | 0 | 0 | $25,000 | $0 | 5 | 100 |
| Emmet County | 7/14/1978 | N/A | 0 | 0 | $0 | $0 | 0.5 | 30 |
| Emmet County | 6/28/1979 | F0 | 0 | 0 | $0 | $0 | 0.5 | 30 |
| Emmet County | 6/28/1979 | F1 | 0 | 0 | $25,000 | $0 | 2.3 | 40 |
| Emmet County | 8/18/1980 | F1 | 0 | 0 | $25,000 | $0 | 0.2 | 30 |
| Emmet County | 6/13/1983 | F0 | 0 | 0 | $30 | $0 | 0.1 | 10 |
| Emmet County | 7/16/1984 | F0 | 0 | 0 | $0 | $0 | 0.1 | 3 |
| Dolliver | 5/4/1994 | F1 | 0 | 0 | $5,000 | $0 | 7.5 | 45 |
| Swea City | 8/13/1995 | F0 | 0 | 0 | $1,000 | $1,000 | 0.2 | 25 |
| Wallingford | 7/14/2003 | F0 | 0 | 0 | $0 | $1,000 | 0.1 | 25 |
| Ringsted | 6/11/2004 | F1 | 0 | 0 | $5,000 | $5,000 | 6 | 200 |
| Gruver | 6/20/2005 | F0 | 0 | 0 | $0 | $0 | 0.2 | 30 |
| Armstrong | 8/10/2010 | EF0 | 0 | 0 | $0 | $0 | 0.18 | 40 |
| Maple Hill | 8/17/2014 | EF0 | 0 | 0 | $0 | $1,000 | 0.83 | 25 |

Source: NOAA

The map in Figure 3-46 shows the paths of the previous events. Note: Not all events had available latitude and longitude coordinates. As a result, not all events are displayed.

**Figure 3-46 Tornado Paths in Emmet County, 1950-2016**




Source: tornadohistoryproject.com

Emmet County has been included in three Presidential Disaster Declarations that involved tornadoes since 1965. See Table 3-2 in the Hazard Identification Section for additional details. Descriptions of notable previous tornado events are provided below:

**April 30, 1967** – An F2 tornado touched down near Gruver at approximately 4 PM, traveling a total of seven miles and causing an estimated $250,000 in property damage northeast of Gruver and in Dolliver. An additional F2 tornado touched down north of Emmetsburg at approximately 4:10 PM and traveled eight miles to the area west of Ringsted. Total property damages for both tornadoes were estimated at **$2.5 million.**

**June 28, 1979** – A small F1 tornado touched down in an open field east of Armstrong, causing $25,000 in crop and property damage.

**August 18, 1980** – An F1 tornado briefly touched down 10 miles south of Estherville, destroying a barn and twisting the tops of trees; the incident caused an estimated $25,000 in crop damage.

*Windstorms*

***Previous Occurrences***

According to the NCDC database, there were 39 high wind events in Emmet County from 1996 to 2016. During this time period, there were no reported deaths or injuries. There were an estimated $1.366M in property damages, and over $55,000 in crop damages recorded. Recorded wind gusts ranged from a high of 70 knots (80.55 mph) to a low of 35 knots (40.28 mph). Table 3-75 provides a summary of the wind speeds reported for the wind events.

**Table 3-75 Reported Wind Speeds, NCDC Events from 1996 to 2016**

| Wind Speed | # of Events |
|---|---|
| 35-40 | 10 |
| 41-45 | 1 |
| 46-50 | 8 |
| 51-55 | 13 |
| 56-60 | 3 |
| 60+ | 3 |
| N/A | 2 |
| **Total** | **39** |

Source: NCDC; N/A – data not available

***Probability of Future Occurrence***

NOAA reported 19 tornadoes in Emmet County in a 67-year time period, which calculates to

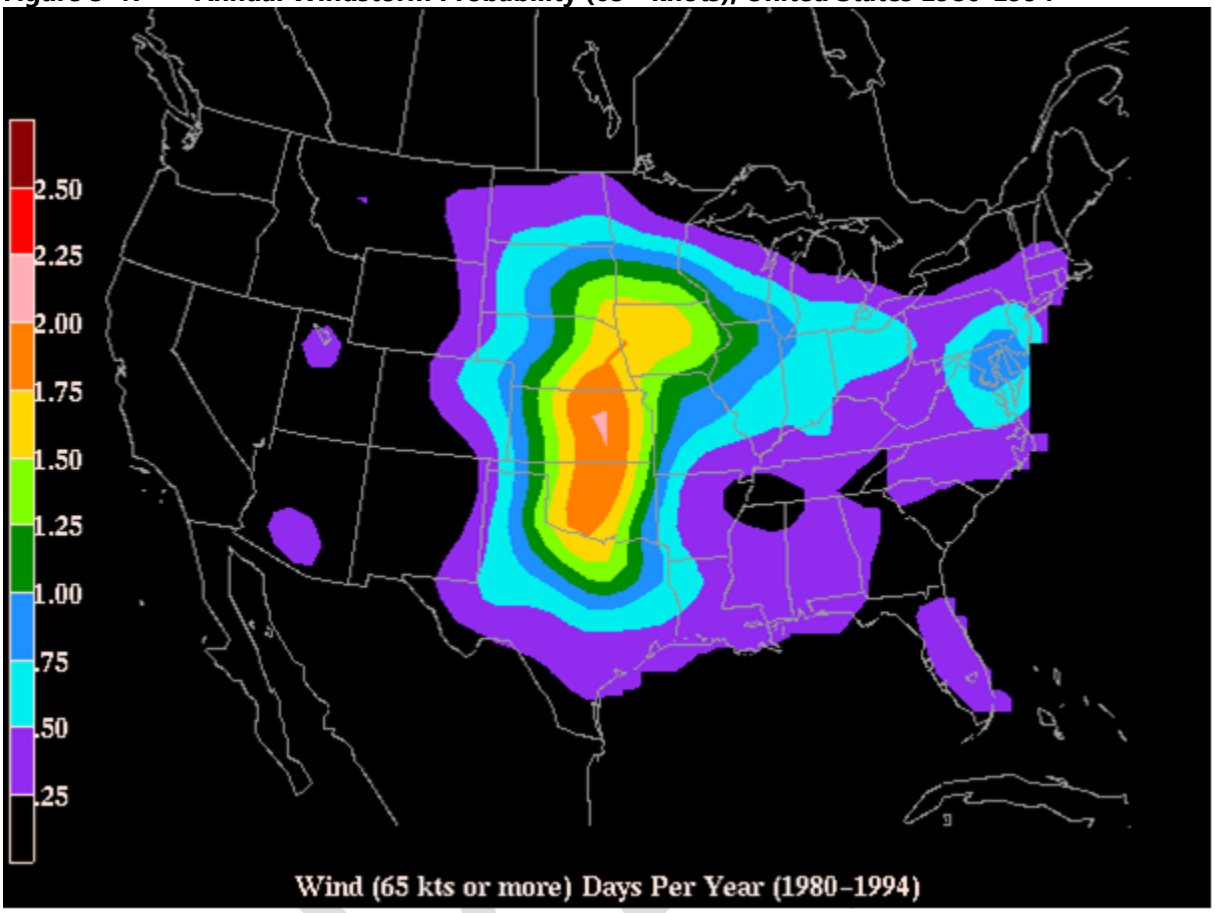
28% chance of a tornado occurring somewhere in the County in any given year. Therefore, it is a likely probability that some portion of Emmet County will experience tornado activity in any given year.

According to NCDC, there were 39 separate high wind events from 1996 to 2016 (21-year period) in Emmet County. Based on this data there is an over 100-percent annual probability of high wind events in any given year. Therefore, the probability rating is "Highly Likely".

**Probability Score:** 4 - Highly Likely

Figure 3-47 below shows the probability of a windstorm event (65 knots or greater) in the U.S. The Emmet County planning area is colored yellow, showing that 65+ knot winds are probable to occur 1.50 to 1.75 times a year.

**Figure 3-47 Annual Windstorm Probability (65+ knots), United States 1980-1994**




Source: NSSL, http://www.nssl.noaa.gov/users/brooks/public_html/bigwind.gif;
Note: Blue square indicates approximate location of Emmet County

## Vulnerability

### *Overview*

Emmet County is located within a region of the U.S. with high frequency of dangerous and destructive tornadoes and is referred to as "Tornado Alley". Figure 3-48 is based on areas where dangerous tornadoes are most likely to take place.

**Figure 3-48 Tornado Alley in the U.S.**


Source: http://www.tornadochaser.net/tornalley.html

Light frame structures, such as mobile homes, outbuildings and sheds are considered especially vulnerable to damage from tornadoes. Those most at risk from tornadoes include people living in mobile homes, campgrounds, and other dwellings without secure foundations or basements. People in automobiles are also very vulnerable to twisters. According the US Census Bureau American Community Survey results for 2016, 3.3% of homes in Iowa are considered mobile homes. In Emmet County, there are four designated mobile home parks – three in Estherville and one in Gruver.

The elderly (65 and older), young (less than 18 years old), and the physically and mentally handicapped are most vulnerable to tornadoes and wind due to lack of mobility to escape the path of destruction. People who may not understand watches and warnings due to language barriers are also at risk.

According to the 2013 Iowa Hazard Mitigation Plan, of the 8 hazards for which data was available to estimate annualized losses, tornadoes ranked 3rd with $36 million in annualized losses based on data spanning a 63-year period.

Due to the potential for damaging tornadoes in the planning area, the magnitude was determined to be "Catastrophic."

**Magnitude Score:** 4 - Catastrophic

### *Potential Losses to Existing Development*

In Emmet County, the NCDC estimate for past property damages resulting from tornadoes from 1950 – 2016 (67 years) was $3,091,030. This translates to an annualized loss of over $46,134.

For windstorms, NCDC loss estimates were $1,365,630 from 1996 to 2016 (21 years). This translates to an annualized loss of over $65,030.

### *Loss of Use*

Overhead power lines and infrastructure are also vulnerable to damages from windstorms. Potential losses would include cost of repair or replacement of damaged facilities and lost economic opportunities for businesses. Public safety hazards include risk of electrocution from downed power lines. Specific amounts

of estimated losses are not available due to the complexity and multiple variables associated with this hazard. Refer to the electric power loss of use estimates provided in Table 3-63 in the Winter Storm hazard section.

*Crop Losses*

Crop insurance payments for wind damage are discussed in Section 3.5.18, Thunderstorms with Lightning and Hail.

### *Future Development*

Given that the County's overall population has been declining and development in recent years has been minimal, development trends in the coming years are not anticipated to increase vulnerability to tornados. Future development that does occur in growing cities such as Dolliver, Gruver, and Ringsted should consider tornado hazards at the planning, engineering and architectural design stages. Public buildings such as schools, government offices, as well as other buildings with a high occupancy and mobile home parks, should consider inclusion of a tornado saferoom to shelter occupants in the event of a tornado.

Windstorm is primarily a public safety and economic concern, and the planning area is located in a region with very high frequency of occurrence. Windstorm can cause damage to structures and power lines which in turn create hazardous conditions for people. Debris flying from high wind events can shatter windows in structures and vehicles and can harm people that are not adequately sheltered.

Although windstorms occur frequently in the planning area and damages to property occur, much of the damage is generally covered by private insurance. This results in less impact to individuals and the community since recovery is facilitated by insurance.

### *Climate Change Impacts*

According to the 2010 Climate Change Impacts on Iowa report, growing evidence points to stronger summer storm systems in the Midwest. Studies have not been done to conclusively say that severe storms, including tornadoes, are increasing. However, with summer temperatures becoming warmer and humidity levels increasing, an increase in the likelihood of tornadic activity is plausible.

### *Tornado/Windstorm Hazard Summary by Jurisdiction*

This hazard does not substantially vary by jurisdiction. The factors of magnitude, probability, warning time, and duration are all considered equal across the planning area.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Armstrong | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Dolliver | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Estherville | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Gruver | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Ringsted | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Wallingford | 4 | 4 | 4 | 1 | 3.70 | High |
| North Union Public Schools | 4 | 4 | 4 | 1 | 3.70 | High |
| Estherville-Lincoln Schools | 4 | 4 | 4 | 1 | 3.70 | High |
| Iowa Lakes Community College | 4 | 4 | 4 | 1 | 3.70 | High |

## 3.5.20 Transportation Incident

| Hazard Score Calculation | | | | | |
|---|---|---|---|---|---|
| **Probability** | **Magnitude/Severity** | **Warning Time** | **Duration** | **Weighted Score** | **Level** |
| 4 | 4 | 4 | 1 | 3.70 | High |

### Profile

#### *Hazard Description*

This hazard encompasses the following: air transportation, highway transportation, and rail transportation. The transportation incidents can involve any mode of transportation that directly threatens life, and which results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services. Incidents involving buses and other high occupancy vehicles could trigger a response that exceeds the normal day-to-day capabilities of response agencies.

An air transportation incident may involve a military, commercial or private aircraft. Air transportation is playing a more prominent role in transportation as a whole. Airplanes and helicopters are used to transport passengers for business and recreation as well as thousands of tons of cargo. A variety of circumstances can result in an air transportation incident; mechanical failure, pilot error, enemy attack, terrorism, weather conditions and on-board fire can all lead to an air transportation incident.

Highway transportation incidents are very complex. Contributing factors can include a roadway's design and/or pavement conditions (e.g. rain, snow and ice), a vehicle's mechanical condition (e.g. tires, brakes, lights), a driver's behavior (e.g. speeding, inattentiveness and seat belt usage), the driver's condition (e.g. alcohol use, age-related conditions, physical impairment) and driver inattention by using a wireless device. In fact, the driver's behavior and condition factors are the primary cause in an estimated 67 percent of highway crashes and a contributing factor in an estimated 95 percent of all crashes.

A railway transportation incident is a train accident that directly threatens life and/or property, or adversely impacts a community's capabilities to provide emergency services. Railway incidents may include derailments, collisions and highway/rail crossing accidents. Train incidents can result from a variety of causes; human error, mechanical failure, faulty signals, and/or problems with the track. Results of an incident can range from minor "track hops" to catastrophic hazardous material incidents and even human/animal casualties. With so many miles of track in Iowa, vehicles must cross the railroad tracks at numerous at-grade crossings.

**Warning Time Score:** 4 - Minimal or no warning

**Duration Score:** 1 - Less than 6 hours

#### *Geographic Location/Extent*

*Highways/Roads*

Though there are not any interstates or federal highways, there are a few major state highways that run through Emmet County. Iowa Highway 9 runs east-west through Armstrong, Maple Hill, Gruver and Estherville. Iowa Highway 4 north-south through Estherville, and Iowa Highway 15 runs north-south across the Minnesota border through Armstrong and Ringstead. Numerous paved county roads connect all of the incorporated cities and unincorporated towns throughout the county.

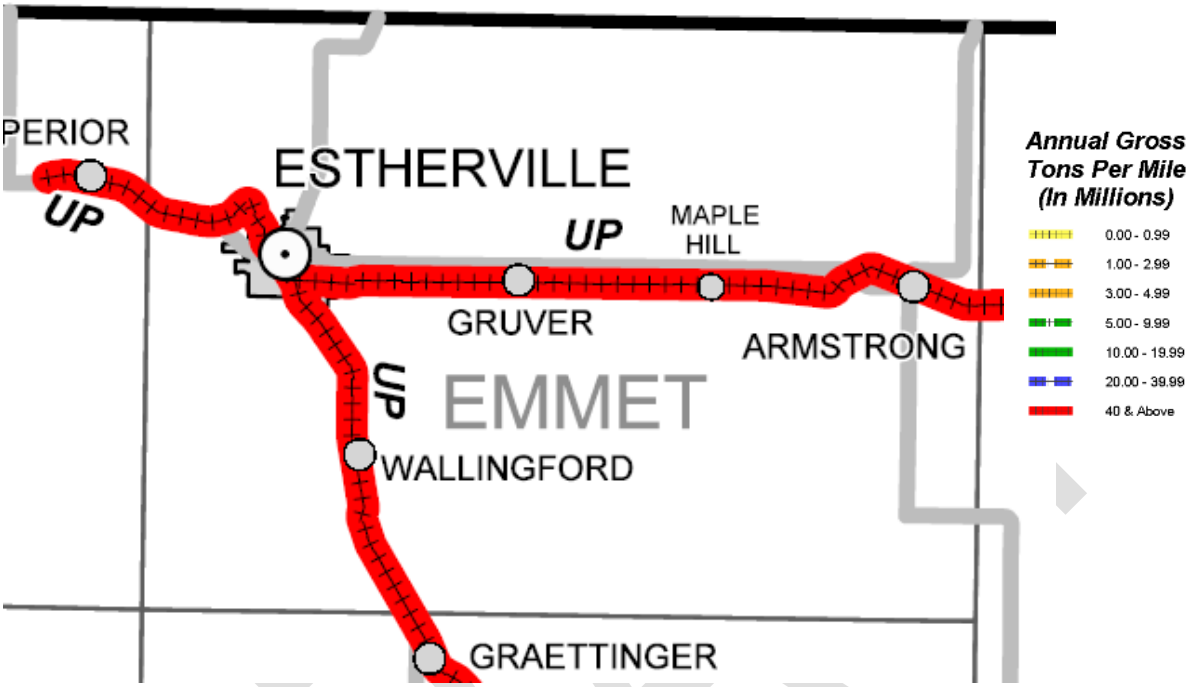
Figure 3-22 in the Infrastructure Failure Incident section shows the major highways in Emmet County.

According to the Iowa Department of Transportation, the total daily traffic in Emmet County is 32,565, and the total daily truck traffic is 3,432. (Source: http://iowadot.maps.arcgis.com/apps/MapSeries/index.html?appid=db6cb43313354a4f85505089ab317e7a)

*Rail Transport*

Union Pacific Railroad, Ltd. (UP) operates in Emmet County with a line running east-west from Estherville, through Gruver, Maple Hill, and Armstrong. A line also runs northwest-southeast through Estherville and Wallingford. Figure 3-49 shows the railroads that operate in Emmet County.

**Figure 3-49 Railroad lines in Emmet County**




Source: Iowa Department of Transportation, http://www.iowadot.gov/iowarail/railroads/maps/maphome.htm

*Air Transport*

The Mason City Municipal Airport in Gordo County is the primary commercial airport that services Emmet County. Within Emmet County, the Estherville Municipal Airport, located approximately 4 miles west of the Estherville central business district is owned by the City of Estherville. Local access to the Perry airport is provided via Iowa Highway 9.

The Iowa Aviation System Plan identifies the Estherville Municipal Airport as a General Service airport. General Service airports have runways 4,000 feet or greater in length with facilities and services customized to support most general aviation activity, including small to mid-size business jets.

**Figure 3-50 Estherville Municipal Airport**


Source: Iowa Department of Transportation, http://www.iowadot.gov/aviation/airports/municipal.aspx

### *Previous Occurrences*

*Rail Transportation Incidents*

Table 3-76 provides details of 8 train-vehicle accidents in Emmet County since 1975 from the Des Moines Register News Data Central.

**Table 3-76 Train-Vehicle Accidents in Emmet County since 1975**

| Railroad | Year | City | Highway | Fatalities | Injuries |
|---|---|---|---|---|---|
| RI | 1975 | Estherville | Central Ave | 0 | 1 |
| RI | 1975 | Graettinger | Main Street | 0 | 1 |
| CNW | 1975 | Estherville | 6th Ave South | 0 | 1 |
| CNW | 1984 | Estherville | W 14th Ave N | 0 | 0 |
| CNW | 1992 | Armstrong | Highway 15-6th St | 0 | 0 |
| UP | 1998 | Armstrong | 3rd Street | 0 | 0 |
| UP | 2000 | Gruver | 450th Avenue | 0 | 1 |
| UP | 2011 | Wallingford | St. James Street | 0 | 0 |

Source: Des Moines Register, http://db.desmoinesregister.com/dangerous-crossings

### *Air Transportation Incidents*

Table 3-77 provides details of 7 air transportation incidents in (or near) Emmet County from 1967 to 2016 (50 years) from the National Transportation Safety Board (NTSB).

**Table 3-77 Emmet County Aircraft Incidents/Accidents (1967-2016)**

| Event Date | Location | Injury Severity | Aircraft Damage | Make | Broad Phase of Flight |
|---|---|---|---|---|---|
| 02/11/2003 | Estherville, IA | Non-Fatal | Substantial | Cessna | Taxi |
| 11/11/1995 | Estherville, IA | Non-Fatal | Substantial | Forney | Landing |
| 04/29/1982 | Estherville, IA | Non-Fatal | Substantial | Piper | Landing |
| 01/16/1975 | Estherville, IA | Non-Fatal | | Piper | |
| 08/02/1971 | Estherville, IA | Non-Fatal | | Piper | |
| 01/10/1969 | Estherville, IA | Non-Fatal | | Piper | |
| 12/06/1968 | Estherville, IA | Non-Fatal | | Cessna | |

Source: http://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx.

### *Highway Transportation Incidents*

The Iowa Department of Transportation's Office of Traffic and Safety maintains traffic crash statistics and location maps by county and cities in Iowa. Table 3-78 and Table 3-79 show the crash history in Emmet County from 2007-2016 for urban and rural crashes, respectively.

**Table 3-78 Emmet County Urban Crashes, 2007-2016**

| | Crash Counts/Classification | | | | | | Injury/Fatality Counts/Classification | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Crashes | Fatal | Major | Minor | Poss / Unk | Property Damage Only | Injuries | Fatalities | Major | Minor | Possible | Unknown |
| 2007 | 124 | 0 | 2 | 5 | 11 | 106 | 24 | 0 | 3 | 7 | 11 | 3 |
| 2008 | 125 | 0 | 1 | 13 | 18 | 93 | 42 | 0 | 1 | 14 | 23 | 4 |
| 2009 | 139 | 0 | 0 | 8 | 10 | 121 | 23 | 0 | 0 | 10 | 13 | 0 |
| 2010 | 111 | 0 | 1 | 11 | 14 | 85 | 3- | - | 1 | 13 | 15 | 1 |
| 2011 | 90 | 0 | 1 | 3 | 8 | 78 | 16 | 0 | 1 | 4 | 11 | 0 |
| 2012 | 117 | 0 | 4 | 11 | 14 | 88 | 39 | 0 | 4 | 19 | 15 | 1 |
| 2013 | 109 | 1 | 3 | 10 | 8 | 87 | 32 | 1 | 3 | 11 | 17 | 0 |
| 2014 | 87 | 0 | 2 | 5 | 8 | 72 | 16 | 0 | 2 | 5 | 7 | 2 |
| 2015 | 93 | 0 | 2 | 9 | 12 | 70 | 28 | 0 | 2 | 9 | 15 | 2 |
| 2016 | 86 | 0 | 1 | 6 | 8 | 71 | 19 | 0 | 1 | 6 | 11 | 1 |
| **Total** | **1,081** | **1** | **17** | **81** | **111** | **871** | **269** | **1** | **18** | **98** | | **152** |

Source: Iowa Department of Transportation's Office of Traffic and Safety

**Table 3-79 Emmet County Rural Crashes, 2007- 2016**

| | Crash Counts/Classification | | | | | | Injury/Fatality Counts/Classification | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Crashes | Fatal | Major | Minor | Poss / Unk | Property Damage Only | Injuries | Fatalities | Major | Minor | Possible | Unknown |
| 2007 | 106 | 0 | 1 | 7 | 14 | 84 | 22 | 0 | 1 | 7 | 14 | 0 |
| 2008 | 66 | 0 | 3 | 5 | 13 | 45 | 24 | 0 | 3 | 5 | 17 | 0 |
| 2009 | 94 | 1 | 5 | 9 | 17 | 62 | 42 | 1 | 5 | 13 | 22 | 1 |
| 2010 | 96 | 0 | 2 | 18 | 9 | 67 | 39 | 0 | 2 | 22 | 12 | 3 |
| 2011 | 83 | 3 | 4 | 10 | 11 | 55 | 38 | 3 | 8 | 11 | 16 | 0 |
| 2012 | 92 | 3 | 4 | 17 | 3 | 65 | 40 | 3 | 4 | 25 | 7 | 1 |
| 2013 | 80 | 1 | 3 | 8 | 11 | 57 | 39 | 1 | 4 | 16 | 18 | 0 |
| 2014 | 97 | 1 | 4 | 15 | 5 | 72 | 29 | 1 | 5 | 18 | 5 | 0 |
| 2015 | 70 | 1 | 1 | 8 | 6 | 54 | 19 | 1 | 1 | 9 | 8 | 0 |
| 2016 | 85 | 0 | 1 | 13 | 5 | 66 | 24 | 0 | 1 | 17 | 6 | 0 |
| **Total** | **869** | **10** | **28** | **110** | **94** | **627** | **317** | **10** | **34** | **143** | | **130** |

Source: Iowa Department of Transportation's Office of Traffic and Safety

### *Probability of Future Occurrence*

A major transportation incident can occur at any time. Even though traffic engineering, inspection of traffic facilities and land use management of areas adjacent to roads and highways has increased, incidents continue to occur. The combination of cars and trucks, farm equipment, wildlife, unpredictable weather conditions, potential mechanical problems and human error always leaves the potential for a transportation accident.

Based on the available information, the probability of air transportation or highway incident that directly threatens life and which results in property damage and/or death(s)/injury(s) and/or adversely impact a community's capabilities to provide emergency services is "Highly Likely" with greater than 33 percent likelihood to occur in any given year.

**Probability Score:** 4 - Highly Likely

## Vulnerability

### *Overview*

Transportation incidents can almost always be expected to occur in specific areas, on or near airports, roadways or other transportation infrastructure. The exception is air transportation incidents, which can occur anywhere. However, it is difficult to predict the magnitude of any specific event because these types of events are accidental and the circumstances surrounding these events will impact the extent of damage or injuries that occur. The number of urban and rural highway/roadway transportation accidents from 2007 to 2016 was a total of 1,950 crashes during this 10-year time period (average 195 per year). 11 fatalities occurred during this time period (averaging 1 per year). Transportation incident has resulted in the most deaths historically in the county compared to other hazards.

Due to the potential for fatalities to occur, this hazard received a magnitude rating of "Catastrophic".

**Magnitude Score:** 4 - Catastrophic

### *Potential Losses to Existing Development*

The U.S. Department of Transportation Federal Highway Administration issued a technical advisory in 1994 providing suggested estimates of the cost of traffic crashes to be used for planning purposes. These

figures were converted from 1994 dollars to 2016 dollars using an annual inflation rate of 2.85 percent. The costs are listed below in Table 3-80.

**Table 3-80 Costs of a Traffic Crash**

| Severity | Cost per injury (in 2016 dollars $) |
|---|---|
| Fatal | $4,412,996 |
| Evident Injury | $61,101 |
| Possible Injury | $32,250 |
| Property Damage Only | $3,395 |

Source: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2016 dollars.

Using the traffic crash costs per type of severity from Table 3-80 and combining major and minor injuries as "evident injury" and possible and unknown as "possible injury" the total costs of traffic crashes is figured in Table 3-81 for Emmet County based on previous events.

**Table 3-81 Costs of Traffic Crashes in Emmet County, 2007-2016**

| Urban/Rural | Fatalities | Evident Injury | Possible Injury | Property Damage | Total |
|---|---|---|---|---|---|
| Urban | 1 | 116 | 152 | 871 | |
| Rural | 10 | 177 | 130 | 627 | |
| Total | 11 | 293 | 282 | 1,498 | |
| Estimated Cost | $48,542,956 | $17,902,593 | $9,094,500 | $5,085,710 | $80,625,759 |

Sources: U.S. Department of Transportation Federal Highway Administration Technical Advisory T 7570.2, 1994. Adjusted to 2014 dollars and Iowa Department of Transportation's Office of Traffic and Safety, http://www.iowadot.gov/crashanalysis/index.htm?

Based on the 10 years of data, the annual average cost of transportation accidents in Emmet County is $8,062,575. Estimated losses as a result of rail and air transportation are not available for this analysis.

### *Future Development*

Overall population in Emmet County has been decreasing, with growth focused on smaller cities. Current development trends do not suggest that this hazard will increase significantly in the near future.

### *Climate Change Impact*

If projections regarding milder winters come to fruition, climate change impacts may reduce the number of transportation incidents associated with some severe weather. However, if ice occurs, rather than snow, this could result in higher incidents of weather-related accidents.

### *Transportation Hazard Summary by Jurisdiction*

All jurisdictions within the planning area are at risk to some kind of transportation incident.

| Jurisdiction | Probability | Magnitude | Warning Time | Duration | Score | Level |
|---|---|---|---|---|---|---|
| Emmet County, Iowa | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Armstrong | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Dolliver | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Estherville | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Gruver | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Ringsted | 4 | 4 | 4 | 1 | 3.70 | High |
| City of Wallingford | 4 | 4 | 4 | 1 | 3.70 | High |
| North Union Public Schools | 4 | 4 | 4 | 1 | 3.70 | High |
| Estherville-Lincoln Schools | 4 | 4 | 4 | 1 | 3.70 | High |
| Iowa Lakes Community College | 4 | 4 | 4 | 1 | 3.70 | High |

## 3.6 Hazard Analysis Summary

This table below provides a tabular summary of the hazard ranking for each jurisdiction in the planning area.

**Table 3-82 Hazard Ranking Summary by Jurisdiction**

| Jurisdiction | Animal/Plant/Crop Disease | Dam/Levee Failure | Drought | Earthquake | Expansive Soils | Extreme Heat | Flash Flood | Grass/Wildland Fire | Hazardous Materials | Human Disease | Infrastructure Failure | Landslide | Radiological Incident | River Flood | Severe Winter Storm | Sinkholes | Terrorism | Thunderstorm/Lightning/Hail | Tornado/Windstorm | Transportation Incident |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unincorporated Emmet County | M | N/A | M | L | L | M | M | H | L | M | H | L | L | L | H | L | M | M | H | H |
| City of Armstrong | M | N/A | M | L | L | M | M | M | M | M | H | L | L | M | H | L | M | M | H | H |
| City of Dolliver | M | N/A | M | L | L | M | M | M | L | M | H | L | L | N/A | H | L | M | M | H | H |
| City of Estherville | M | N/A | M | L | L | M | M | H | M | M | H | L | L | H | H | L | M | M | H | H |
| City of Gruver | M | N/A | M | L | L | M | M | M | L | M | H | L | L | N/A | H | L | M | M | H | H |
| City of Ringsted | M | N/A | M | L | L | M | M | M | M | M | H | L | L | L | H | L | M | M | H | H |
| City of Wallingford | M | N/A | M | L | L | M | M | M | L | M | H | L | L | H | H | L | M | M | H | H |
| North Union Public School District | L | N/A | M | L | L | M | M | M | L | M | H | L | L | L | H | L | M | M | H | H |
| Estherville-Lincoln Public School District | L | N/A | M | L | L | M | M | M | L | M | H | L | L | H | H | L | M | M | H | H |
| Iowa Lakes Community College | L | N/A | M | L | L | M | M | M | L | M | H | L | L | L | H | L | M | M | H | H |

# 4 MITIGATION STRATEGY



***44 CFR Requirement §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.***

This section presents the mitigation strategy updated by the Hazard Mitigation Planning Committee (HMPC) based on the updated risk assessment. The mitigation strategy was developed through a collaborative group process and consists of updated general goal statements to guide the jurisdictions in efforts to lessen disaster impacts, as well as specific mitigation actions that can be put in place to directly reduce vulnerability to hazards and losses. The following definitions are based upon those found in the March 2013 Local Mitigation Planning Handbook:

- Goals are general guidelines that explain what the community wants to achieve with the plan. They are usually broad policy-type statements that are long-term, and they represent visions for reducing or avoiding losses from the identified hazards.
- Mitigation Actions are specific actions that help achieve goals.

## 4.1 Goals

***44 CFR Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.***

This planning effort is an update to an existing hazard mitigation plan. Therefore, the goals from the 2013 Emmet County Hazard Mitigation Plan were reviewed to determine if they are still valid. The HMPC participated in a facilitated discussion during their second meeting to review and update the plan goals. To ensure that the goals are comprehensive and support State goals, the 2013 State Hazard Mitigation Plan goals were reviewed as well. The HMPC also reviewed common categories of mitigation goals from other plans.

The planning committee determined that all three goals from the previous plan remain valid. However, changes were made to Goal 2 to emphasize the importance of jurisdiction's capabilities in supplementing County operations. The validated plan goals for the Emmet County Hazard Mitigation Plan are below:

- Goal 1: Natural hazards that cause injuries, illness, deaths, property loss, utility service disruption and economic loss will be reduced and mitigated against by planning for the protection of property and life.
- Goal 2: Protect critical facilities, infrastructure, and jurisdictional operations from disruptions due to hazard impacts.
- Goal 3: Educate the public on natural hazards and what necessary information is needed to protect themselves and their property.

## 4.2 Identification and Analysis of Mitigation Actions

***44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.***

During the second meeting of the HMPC, sample results of the risk assessment update were provided to the HMPC members. To lay the framework for the impacts to be addressed by the updated mitigation strategy, the full draft of the Risk Assessment Chapter was also provided for review by the HMPC members. Also, at Meeting #2, each jurisdiction was provided with a handout listing the actions they included in the previous hazard mitigation plan. The mitigation strategy of the previous plan consisted of 220 individual jurisdictional actions. Only 210 previous actions are reported on in the following summary because Dolliver did not participate in this plan update, so the status of their 10 previous actions is unknown.

Jurisdictional representatives were instructed to work with others in their jurisdiction to update the status of each of the previous actions. The status updates were provided between Meeting #2 and Meeting #3. Of the 210 previous actions, 36 have been completed, 58 are continuing (38 Continue In-process and 20 Continue Not Started), and 116 were deleted (see Table 4-1). The list of the completed and deleted actions is provided in Appendix C with comments providing additional details, as available.

**Table 4-1 Status of Previous Actions**

| Jurisdiction | Completed | Delete | Continue In-Progress | Continue Not Started | Grand Total |
|---|---|---|---|---|---|
| Emmet County | 5 | 24 | 8 | 1 | 38 |
| Armstrong | 7 | 18 | 7 | 5 | 37 |
| Estherville | 3 | 27 | 6 | 0 | 36 |
| Gruver | 5 | 17 | 4 | 3 | 29 |
| Ringsted | 13 | 10 | 3 | 2 | 28 |
| Wallingford | 3 | 20 | 8 | 7 | 38 |
| Iowa Lakes Community College | 0 | 0 | 2 | 2 | 4 |
| **Grand Total** | **36** | **116** | **38** | **20** | **210** |

For a comprehensive range of mitigation actions to consider, the jurisdictions were provided relevant information and sources to be used in development of new mitigation actions including:

- Validated Plan Goals
- Previous Actions from 2013 Plan
- Key Issues from Risk Assessment
- FEMA's Mitigation Ideas booklet
- State Priorities for Hazard Mitigation Assistance Grants
- Public Opinion from Surveys

To facilitate discussion and ideas on new actions that jurisdictions may want to submit to the plan update, the planning committee reviewed the plan goals that were updated at Meeting #2. Key issues/problem statements for sample hazards in the risk assessment were also discussed, as well as the actions from the

2013 plan that were identified relative to each hazard. The discussion was geared toward identifying any gaps that may exist between the problems identified and actions already developed to address the problems to develop new actions. To provide consideration of a comprehensive range of alternatives, FEMA's Mitigation Ideas Booklet was also reviewed for additional ideas/alternatives for new actions. After the committee meeting, jurisdictions reviewed the materials to determine final mitigation actions to submit to the plan update.

The jurisdictions were encouraged to be comprehensive and include all appropriate actions to work toward becoming more disaster resistant. They were encouraged to maintain a realistic approach and were reminded that the hazard mitigation plan is a "living document". As capabilities, vulnerabilities, or the nature of hazards that threaten each jurisdiction change, the mitigation actions can and should be updated to reflect those changes, including addition or deletion of actions, as appropriate.

As part of the meeting discussion, jurisdictions were instructed to consider the potential cost of each project in relation to the anticipated future cost savings. This type of discussion allowed the committee as a whole to understand the broad priorities and enable discussion of the types of projects most beneficial to all jurisdictions within Emmet County.

## 4.3 Implementation of Mitigation Actions

***44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.***

Jurisdictional representatives worked with others in their community to finalize the actions to be submitted to the updated mitigation strategy. Throughout the discussion of the types of projects that the committee would include in the mitigation plan, emphasis was placed on the importance of a benefit-cost analysis in determining project priority. The Disaster Mitigation Act regulations state that benefit-cost review is the primary method by which mitigation projects should be prioritized. Recognizing the federal regulatory requirement to prioritize by benefit-cost, and the need for any publicly funded project to be cost-effective, the HMPC decided to pursue implementation according to when and where damage occurs, available funding, political will, jurisdictional priority, and priorities identified in the Iowa State Hazard Mitigation Plan. Due to many variables that must be examined during project development, the benefit/cost review at the planning stage primarily consisted of a qualitative analysis. For each action, the jurisdictions included a narrative describing the types of benefits that could be realized with implementation of the action. Where possible, the cost was estimated as closely as possible with further refinement to occur as project development occurs. Cost-effectiveness will be considered in additional detail if/when seeking FEMA Hazard Mitigation Assistance grant funding or other grant funding for eligible projects identified in this plan. At that time, additional information will be researched to provide for a quantitative benefit-cost analysis.

To provide a mechanism for jurisdictions to prioritize actions, a modified STAPLEE worksheet was completed by the jurisdictions for each new and continued action submitted for the updated mitigation strategy. The modified STAPLEE worksheet includes elements to consider protection of life and reduction of damages. Although a similar STAPLEE method was a component of the prioritization method utilized for the 2013 plan, the scoring elements were slightly different. For the plan update, the modified STAPLEE worksheet was chosen to re-evaluate all continuing and new actions, as this was deemed a more simplified approach and ensured a consistent methodology for all continuing and new actions.

The STAPLEE prioritization method in general is a tool used to assess the costs, benefits, and overall feasibility of mitigation actions. STAPLEE stands for the following:

- **S**ocial: Will the action be acceptable to the community? Could it have an unfair effect on a particular segment of the population?
- **T**echnical: Is the action technically feasible? Are there secondary impacts? Does it offer a long-term solution?
- **A**dministrative: Are there adequate staffing, funding, and maintenance capabilities to implement the project?
- **P**olitical: Will there be adequate political and public support for the project?
- **L**egal: Does your jurisdiction have the legal authority to implement the action?
- **E**conomic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- **E**nvironmental: Will there be negative environmental consequences from the action? Does it comply with environmental regulations? Is it consistent with community environmental goals?

Additional questions were added to the modified STAPLEE worksheet to include elements to consider mitigation effectiveness related to protection of life and reduction of damages as well as reduction in the need for response actions, and the potential for benefits to exceed the cost.

Figure 4.1 is a sample of the Action Plan worksheet. The Prioritization Section is at the bottom of the worksheet. There is a total possible prioritization score of 19. Those actions that scored 13 or higher were given a priority rating of "High". Those actions that scored 7-12 were given a priority rating of "Medium". And those actions that scored less than 7 were given a rating of "Low".

**Figure 4-1 Action Plan Worksheet**

**Emmet County Multi-Jurisdictional Hazard Mitigation Plan**
**Mitigation Action Plan Worksheet**

| | | |
|---|---|---|
| **Jurisdiction:** | **2018 Action Status**<br>☐ Continue Not Started<br>☐ Continue In-Progress<br>☐ New | **Action ID:**<br>Refer to handout for continuing actions<br>For new actions number with next sequential number after last action #. |
| **Hazards Addressed:** | Check all that apply | |
| ☐ Animal/Plant/Crop Disease<br>☐ Dam /Levee Failure<br>☐ Drought<br>☐ Earthquake<br>☐ Extreme Heat<br>☐ Flash Flood | ☐ Grass/Wildland Fire<br>☐ Hazardous Materials Incident<br>☐ Human Disease<br>☐ Infrastructure Failure<br>☐ Radiological Incident<br>☐ River Flooding | ☐ Severe Winter Storm<br>☐ Sinkholes<br>☐ Terrorism<br>☐ Thunderstorm/Lightning/Hail<br>☐ Tornado/Windstorm<br>☐ Transportation Incident |
| **Action Title/ Description:** | | |
| **Applicable Goal Statement:** Check one | ☐ Goal 1 ☐ Goal 2 ☐ Goal 3 | |
| **Issue/Background:** Why is this action needed? What is the problem? | | |
| **Obstacles to Implementing?** | | |
| **Responsible Office:** Which department in Jurisdiction would implement/track? | | |
| **Partners:** Who would help? | | |
| **Potential Funding Source:** (Grants-specific if known, local funds, combination, etc.) Check all that may apply | ☐ FEMA Hazard Mitigation Assistance Grant (HMGP, PDM, or FMA)<br>☐ Local funds, ☐ In-Kind (donated),<br>☐ Private Non-Profit, ☐ Other (specify) | |
| **Cost Estimate:** | ☐ Little or no cost ☐ Less than $10,000 ☐ $10,000 to $50,000<br>☐ $50,000 to $100,000 ☐ $100,000 to $500,000 ☐ $500,000 to $1,000,000<br>☐ Over $1,000,000 | |
| **Benefits:** (Describe Losses Avoided) | | |
| **Timeline:** How many years to complete? | ☐ 1 yr<br>☐ 2-3 yrs<br>☐ 3-5 yrs<br>☐ More than 5 yrs.<br>☐ Other | Completed by: (name/title/phone #) |
| **Prioritization:** Rate the questions from 0-3 0-unlikely, 1-maybe, 2-probably, or 3-definitely | If implemented, will the action result in lives saved? ☐ 0, ☐ 1, ☐ 2, ☐ 3<br>If implemented, will the action result in reduced property damages? ☐ 0, ☐ 1, ☐ 2, ☐ 3<br>If implemented, will the action reduce the need for response actions? ☐ 0, ☐ 1, ☐ 2, ☐ 3<br>If implemented, will the benefits exceed the cost? ☐ 0, ☐ 1, ☐ 2, ☐ 3 | |
| **STAPLEE Rating:** Give the action a rating for each element as follows:<br><br>Positive (+)<br>Neutral (0)<br>Negative (-) | Socially Acceptable<br>Technically Feasible<br>Administrative Capability<br>Politically Desirable<br>Legal Authority Exists<br>Economically Beneficial<br>Environmentally Beneficial | ☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ -<br>☐ +, ☐ 0, ☐ - |

The mitigation action summary table presenting the summary of continuing and new mitigation actions for each jurisdiction is provided in Table 4-2. In addition to the 58 actions that were continued from the previous plan, 17 new actions were identified, for a combined total of 75 actions in this updated mitigation strategy.

The Action ID for each action has been carried over from the 2013 plan for continuing actions. As a result of completed and deleted actions, the Action ID does not follow a sequential order. New actions were assigned the next sequential Action ID for each jurisdiction. Following the action summary table, additional details are provided for each continuing and new action in Table 4-3. The detailed table serves as the action plan describing how each action will be implemented and administered by the local jurisdiction. The final table, Table 4-4, provides the results from the action prioritization.

**Table 4-2 Mitigation Action Summary—Continuing and New Actions**

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Emmet County - 2 | Backup Power Generator (buy) | Continue In-Progress | HS has one, staged in Emmet Co.; yearly inspection | Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 17 | H |
| Emmet County - 4 | NOAA Weather Radios (buy/distribute) | Continue In-Progress | Have given some away, would do more with funding. Need to make sure public agencies have these. | Extreme Heat, Flash Flood, Hailstorm, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Grass or Wildland Fire | 1, 3 | 15 | H |
| Emmet County - 5 | Designating Community Shelter. Review existing list of community shelters, adding shelters as appropriate and removing designated sites that are no longer applicable | Continue Not Started | Have old(?) list for most(?) communities | Extreme Heat, Flash Flood, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 3 | 19 | H |
| Emmet County - 18 | Maintain Outdoor Warning Sirens | Continue In-Progress | Need New | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1, 3 | 19 | H |
| Emmet County - 29 | Backup of City/County Records - convert paper records to electronic | Continue In-Progress | Digital copies of existing records and off-site storage of back-up | Flash Flood, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 15 | H |
| Emmet County - 30 | Create Dry Hydrant | Continue In-Progress | Determine the cost of dry hydrant installation | Grass or Wildland Fire | 1 | 18 | H |
| Emmet County – 35* | Remain Compliant with NFIP | Continue In-Progress | Ongoing | Flash Flood, River Flood | 1 | 14 | H |
| Emmet County - 40 | Enforce Floodplain ordinance | Continue In-Progress | | Flash Flood, River Flood | 1, 2 | 11 | M |
| Emmet County - 52 | Stream gauge monitoring system | Continue In-Progress | Ongoing | Flash Flooding, River Flooding | 1, 2 | 15 | H |
| Emmet County - 57 | Extreme Heat | New | | Drought, Extreme Heat | 1, 3 | 19 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Emmet County - 58 | Animal/Crop/Plant Disease | New | | Animal/Plant/Crop Disease, Terrorism | 1 | 16 | H |
| Emmet County - 59 | Hazardous Materials | New | | Animal/Plant/Crop Disease, Flash Flood, Infrastructure Failure, River Flooding, Terrorism, Tornado/Windstorm, Transportation Incident | 1 | 19 | H |
| Emmet County - 60 | Human Disease | New | | Animal Plant/Crop Disease, River Flooding, Terrorism, Human Disease | 1 | 19 | H |
| Emmet County - 61 | Infrastructure Failure | New | | Extreme Heat, Infrastructure Failure, River Flooding, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident | 1 | 19 | H |
| Emmet County - 62 | Terrorism | New | | Terrorism | 1 | 19 | H |
| Emmet County - 63 | Transportation Incident | New | | Transportation Incident | 1 | 19 | H |
| Emmet County - 64 | Human Disease- We have a process to screen all patients for immunization status, travel history, and contact with certain disease processes. We provide education to the public, patients, and staff as indicated. We provide immunizations as indicated. | New | | Human Disease | 2 | 15 | H |
| Emmet County - 65 | Hazardous Materials Response- Permanent Decon facilities will be built at Avera | New | | Hazardous Materials Incident | 1, 2 | 15 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| | Holy Family Hospital in Estherville, IA. | | | | | | |
| Armstrong - 1 | Enforce Tree Trimming | Continue In-Progress | Follow up | Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 15 | H |
| Armstrong - 2 | Backup Power Generator (buy) | Continue In-Progress | HS has one, staged in Emmet Co.; yearly inspection | Extreme Heat, Flash Flood, Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 15 | H |
| Armstrong - 3 | Bury Utility Lines | Continue In-Progress | | Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Grass or Wildland Fire | 1, 2 | 14 | H |
| Armstrong - 4 | NOAA Weather Radios (buy/distribute) | Continue In-Progress | Have given some away, would do more with funding | Extreme Heat, Flash Flood, Hailstorm, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Grass or Wildland Fire | 1, 3 | 17 | H |
| Armstrong - 5 | Designating Community Shelter | Continue Not Started | Have old(?) list for most(?) communities | Extreme Heat, Flash Flood, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 3 | 16 | H |
| Armstrong - 8 | Tornado Safe Room (build) | Continue In-Progress | 1 completed at Tuttle Lane | Thunderstorm and Lightning, Tornado, Windstorm | 1 | 17 | H |
| Armstrong - 20 | Clean/Enlarge Sewage Lagoons | Continue Not Started | | Flash Flood, Levee Failure | 1, 2 | 17 | H |
| Armstrong - 21 | Construct Sewer Lift Station | Continue Not Started | | Flash Flood | 1, 2 | 17 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Armstrong - 25 | Purchase Portable Pumps | Continue Not Started | | Flash Flood, River Flood | 1, 2 | 15 | H |
| Armstrong - 28 | Shelter rations (cots, blankets, water, etc.) | Continue Not Started | | Thunderstorm and Lightning, Tornado, Windstorm | 1, 3 | 15 | H |
| Armstrong - 43 | Maintain & expand debris removal site | Continue In-Progress | Ongoing | Flash Flood, Hailstorm, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 15 | H |
| Armstrong - 54 | Improve water quality/quantity | Continue In-Progress | | Drought | 1 | 17 | H |
| Armstrong - 55 | Purchase generator for water plant | New | | Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1 | 11 | M |
| Estherville - 3 | Bury Utility Lines | Continue In-Progress | | Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Grass or Wildland Fire | 1 | 16 | H |
| Estherville - 18 | Maintain Outdoor Warning Sirens | Continue In-Progress | | Hailstorm, Thunderstorm and Lightning, Tornado, Windstorm | 3 | 14 | H |
| Estherville - 22 | Replace Sewer Lines | Continue In-Progress | | Flash Flood, River Flood | 1, 2 | 16 | H |
| Estherville - 35 | Remain Compliant with NFIP | Continue In-Progress | Ongoing | Flash Flood, River Flood | 1 | 14 | H |
| Estherville - 40 | Enforce Floodplain ordinance | Continue In-Progress | | Flash Flood, River Flood | 1, 2 | 14 | H |
| Estherville - 41 | Test Warning sirens monthly | Continue In-Progress | ongoing monthly | Hailstorm, Thunderstorm and Lightning, Tornado, Windstorm | 3 | 14 | H |
| Estherville - 46 | Storm Sewer Rerouting Project | New | | Flash Flood | 2 | 16 | H |
| Gruver - 9 | Outdoor Warning Sirens (build or update) | Continue In-Progress | None | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1, 3 | 13 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Gruver - 17 | Public Education/Awareness | Continue In-Progress | Ongoing | Drought, Extreme Heat, Flash Flood, Grass/Wildland Fire, Hazardous Materials Incident, Human Disease, Infrastructure Failure, River Flood, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm, Transportation Incident | 3 | 6 | L |
| Gruver - 22 | Replace Sewer Lines, Move sewer lift station to different location | Continue Not Started | | Flash Flood, River Flood | 1, 2 | 11 | M |
| Gruver - 27 | List of residents who may need more help in an emergency | Continue In-Progress | | Extreme Heat, Flash Flood, Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 3 | 10 | M |
| Gruver - 30 | Create Dry Hydrant | Continue Not Started | | Grass or Wildland Fire | 1 | 13 | H |
| Gruver - 34 | Determine which areas are most prone to flood | Continue In-Progress | Ongoing | Flash Flood, River Flood | 1 | 11 | M |
| Gruver - 49 | Alternate Water Supply Plan | Continue Not Started | | Drought, Extreme Heat, Grass/Wildland Fire | 1 | 11 | M |
| Ringsted - 2 | Backup Power Generator (buy) | Continue Not Started | HS has one, staged in Emmet Co.; yearly inspection | Extreme Heat, Flash Flood, Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 14 | H |
| Ringsted - 18 | Maintain Outdoor Warning Sirens | Continue In-Progress | Need New | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1, 3 | 17 | H |
| Ringsted - 24 | Look into NFIP Participation | Continue In-Progress | | Flash Flood, River Flood | 1, 3 | 13 | H |
| Ringsted - 25 | Purchase Portable Pumps | Continue Not Started | Ringsted has one pump | Flash Flood, River Flood | 1, 2 | 16 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Ringsted - 48 | Storm Water System Improvements | New | | Flash Flood | 1 | 12 | M |
| Wallingford - 3 | Bury Utility Lines | Continue In-Progress | | Hailstorm, Severe Winter Storm, Thunderstorm/ Lightning/Hail, Tornado, Windstorm, Grass or Wildland Fire | 1, 2 | 12 | M |
| Wallingford - 4 | NOAA Weather Radios (buy/distribute) | Continue In-Progress | Have given some away, would do more with funding | Extreme Heat, Flash Flood, Hailstorm, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Grass or Wildland Fire | 1, 3 | 12 | M |
| Wallingford - 8 | Tornado Safe Room (build) | Continue In-Progress | 1 completed at Tuttle Lane | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1, 2 | 13 | H |
| Wallingford - 9 | Outdoor Warning Sirens (build or update) | Continue Not Started | None | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1, 3 | 17 | H |
| Wallingford - 10 | Watershed study & Implement | Continue Not Started | | Flash Flood, River Flood | 1 | 17 | H |
| Wallingford - 11 | Promote Landscaping Practices | Continue Not Started | | Landslide, River Flood | 1 | 11 | M |
| Wallingford - 17 | Public Education/Awareness | Continue In-Progress | Ongoing | Drought, Extreme Heat, Flash Flood, Hailstorm, Landslide, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm, Dam Failure, Levee Failure, Grass or Wildland Fire | 3 | 15 | H |
| Wallingford - 20 | Clean/Enlarge Sewage Lagoons | Continue In-Progress | | Flash Flood, Levee Failure | 1, 2 | 16 | H |
| Wallingford - 21 | Construct Sewer Lift Station | Continue Not Started | | Flash Flood | 1, 2 | 15 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| Wallingford - 22 | Replace Sewer Lines | Continue Not Started | | Flash Flood, River Flood | 1, 2 | 15 | H |
| Wallingford - 25 | Purchase Portable Pumps | Continue Not Started | | Flash Flood, River Flood | 1, 2 | 17 | H |
| Wallingford - 27 | List of those of elderly, disabled or medically distressed | Continue Not Started | | Extreme Heat, Flash Flood, Hailstorm, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 3 | 15 | H |
| Wallingford - 29 | Backup of City/County Records | Continue In-Progress | | Flash Flood, River Flood, Severe Winter Storm, Thunderstorm and Lightning, Tornado, Windstorm | 1, 2 | 10 | M |
| Wallingford - 30 | Create Dry Hydrant | Continue In-Progress | | Grass or Wildland Fire | 1 | 17 | H |
| Wallingford – 35* | Remain Compliant with NFIP | Continue In-Progress | Ongoing | Flash Flood, River Flood | 1 | 14 | H |
| Wallingford - 63 | Add new tornado siren for the City of Wallingford | New | N/A | Tornado/Windstorm | 1 | 14 | H |
| Wallingford - 64 | Storm Water Sewer Service | New | | Flash Flood, Severe Winter Storm, Thunderstorm/Lightning/Hail | 2 | 15 | H |
| Wallingford - 65 | Cleaning and Maintaining Drainage Ditch | New | | Flash Flood, River Flooding | 2 | 16 | H |
| Iowa Lakes Community College - 2 | Backup Power Generator (buy) | Continue In-Progress | purchased generator for IT backbone, not for entire campus | Extreme Heat, Infrastructure Failure, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm | 2 | 15 | H |
| Iowa Lakes Community College - 8 | Tornado Safe Room (build) | Continue Not Started | Not done due to cost | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1 | 15 | H |
| Iowa Lakes Community College - 17 | Public Education/Awareness | Continue In-Progress | Ongoing | Dam/Levee Failure, Drought, Extreme Heat, Flash Flood, Grass/Wildland Fire, | 3 | 16 | H |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment | Hazards Addressed | Applicable Goal | Score | Priority |
|---|---|---|---|---|---|---|---|
| | | | | Hazardous Materials Incident, River Flooding, Severe Winter Storm, Thunderstorm/Lightning/Hail, Tornado/Windstorm | | | |
| Iowa Lakes Community College - 9 | Outdoor Warning Sirens (build or update) | Continue Not Started | Installed 2; Estherville/Emmetsburg each have 1 siren | Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1 | 15 | H |
| North Union - 1 | Create a safe room/tornado shelter | New | | Flash Flood, Infrastructure Failure, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1 | 14 | H |
| North Union - 2 | Install Backup Generators | New | | Flash Flood, Infrastructure Failure, Severe Winter Storm, Terrorism, Thunderstorm/Lightning/Hail, Tornado/Windstorm | 1 | 13 | H |

*Denotes Actions related to continued compliance with the NFIP; H=High, M=Medium, L=Low

**Table 4-3 Mitigation Action Implementation Strategy—Continuing and New Actions**

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Emmet County - 2 | To maintain Critical infrastructure by providing back up generators to remote communication tower sites. | Purchase stand-by and automatic transfer generators for each site (3) | Funding: Making sure each critical asset is set up to receive generator power | EMA | City/County Government Utilities/FEMA/HS | Grants, Local Governme nt. FEMA | $100,000-$500,000 | Continued Power to infrastructure | More than 5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Emmet County - 4 | Notify the at-risk population of weather issues | Countywide plan EOP | Funding | EMA | Public Health/ Law enforcement Elderly/waiver homes Senior Centers | Grants | Less then $10,000 | For warn to prevent loss of life | 2-3 years |
| Emmet County - 5 | To protect loss of human life | Educate our residents how to mitigate the effects of extreme heat on themselves and homes. Provide cooling centers. Educate the public on signs and symptoms of heat illness. | Appropriate selection of cooling centers and establishing MOUs with those centers | EMA | Local Townships, County | FEMA Grant, Local funds, Private/Non-Profit | Little or no cost | Saving human life | 2-3 years |
| Emmet County - 18 | Outdoor warning systems needed County parks and campgrounds | Install outdoor warning systems | Funding | County, EMA | County, County Conservation | County, FEMA | $10,000 to 50,000 | Prevent loss of life and property | 3-5 years |
| Emmet County - 29 | Loss of vital records | Source vendors to provide the service. | Funding | Government entities | Local Government | Local Government funding | $10,000 to 50,000 | Preservation of vital records | 1 year |
| Emmet County - 30 | To get water in an emergency to the city of Dolliver. | Install dry hydrant | Obtaining easement from land owners, sourcing water supply. | Fire | Fire Departments, EMA | Local Govt. funding, Insurance company grants | $10,000 to 50,000 | Prevent loss of life and property | 3-5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Emmet County - 35 | Annual flooding | Codes in place, NFIP, etc. | Time | EMA | NFIP | County Dollars | | | 1 year |
| Emmet County - 40 | Annual flooding | Develop mitigation strategies | Time | EMA | DNR, Geological Survey, County Engineer | County Funds, | Little or no cost | | 2-3 years |
| Emmet County - 52 | Redundant ability to measure the river height | Visual gauges by Central Ave bridge and East Fork of Des Moines river west of Armstrong. GIS maps developed for river heights. | Funding | EMA | DNR, United States Geological Survey, Jacov Westergard, Land owners | County Funds, Volunteers | Little or no cost | EMA will have visual confirmation on river levels | 1 year |
| Emmet County - 57 | To protect livestock health and crop commodity production. Extreme heat is dangerous to livestock/crop production | Educate our residents how to mitigate the effects of extreme heat on themselves, homes, and livestock. Educate producers on the selection of heat tolerant livestock and crops. | | EMA | Livestock/ Crop entities | FEMA Grant, Local funds, Private/Non-Profit | Little or no cost | Building resiliency for farm production income by eliminating risk/loss | 2-3 years |
| Emmet County - 58 | Loss of animal and crop production would result in property and economic loss for citizens | Encourage purchase of crop insurance. Provide guidance for biosecurity measures for livestock producers. | Lack of buy in and organization of producers. Lack of funding due to poor | Emmet County EMA | Farm Service Agency; IDOL; Multi-State Partnership for Agriculture | FEMA Grant, Local funds, Other - Emmet County Foundation Grant | Little or no cost | Building resilience into a producer's income by eliminating risk/loss | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | | Encourage crop diversification. | commodity prices preventing producers being able to purchase insurance. | | | | | | |
| Emmet County - 59 | There are 26 Tier II facilities in Emmet County (12 in Estherville, 9 in Armstrong); 11 facilities classified as having extremely Hazardous Substances, Main transportation corridors (state highways and railroad lines) multiple gas transmission pipelines present. To protect the citizens and property of the effects of hazardous materials released into the environment. | Identify storage facilities of hazardous materials and see that hazardous material placards are in place and conduct feasibility studies for the construction of protection and containment structures for the identified hazardous materials. Provide education of the public and responders on the identification of hazardous materials. Ensure that all response entities have updated Emergency | Sourcing a qualified person to conduct the feasibility studies. Funding of protection and containment structures. | EMA | Fire Service, Mason City Hazmat Response Team, Chemtrec, Avera Holy Family Hospital | FEMA Grant, Local funds, Private Non-Profit | $100,000 to $500,000 | Minimize the environmental impact of hazardous materials spills, protect water supplies, protect the population | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | | Response Guidebooks. | | | | | | | |
| Emmet County - 60 | To protect the population from spread of disease. Enhanced disease risk in more densely populated areas and in some other countries, but with our mobile society, a risk to all populations. Influenza and pneumonia were the 8th leading cause of death in Iowa in 2016. Continued concern of bioterrorism. | Education of public on disease prevention and o; encourage immunizations; surveillance of disease trends; disease control/mitigation. | Buy in for the importance of immunizations. | Emmet County Public Health | Hospitals/clinics, EMA | FEMA Grant, Local funds, Other - Federal and State funds | Less than $10,000 | Minimizing loss of life, saved hospitalization costs | 2-3 years |
| Emmet County - 61 | Maintain the necessary roadway system and utilities for economic growth and safety. Aging roadway system and the need for enhancement of the electrical distribution system. | Complete a study and prioritize replacement and improvement of roadway system and utilities. Identify vulnerabilities of both. Continue the practice of overhead electrical lines to underground. | Funding | EMA | Emmet County Engineer; Iowa DOT; USGS; Utility Companies; MISO (Midcontinent Independent Systems Operator), Iowa Pipeline Safety | FEMA Grant, Local funds, Private Non-Profit | $500,000 to $1,000,000 | More dependable and safer delivery of utilities. Enhanced protection from terrorist activities. Safer and more efficient driving conditions for motorists. | More than 5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Emmet County - 62 | To protect the citizens, food & water supplies, essential Government function/services from terroristic actions. | Educate the public to create an awareness of potential target/issues/vulnerabilities. See something – say something. Evaluate targets of terrorism and make recommendations for security improvements. Conduct cyber threat training to Governmental entities. Education to agriculture producers about agro-terrorism. | Funding, buy-in | EMA | Law Enforcement, IT, Iowa State Extension, FSA, Iowa Dept. of Land Stewardship, Multi-State Partnership for Agriculture | FEMA Grant, Local funds, Private Non-Profit | Little or No Cost | Minimization of life and economic loss, end environmental impact | 2-3 years |
| Emmet County - 63 | Minimize loss of life and impact to the environment. The increased potential of transportation incidents due to 3 state highways, as well as a railroad line that transports alcohol from a local ethanol plant. | Education of motorists by social media, public safety announcements, and public presentations. Identification of problem areas and improvement of them. Enhanced enforcement of traffic laws. | Buy in by the public | Law Enforcement | EMA, Iowa State Patrol, Emmet County Engineer, Iowa DOT, Governor's Traffic Safety Board | Local funds, Private Non-Profit | Little or No Cost | Minimize loss of life and enhanced efficiencies of transportation system | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Emmet County - 64 | We want to keep patients, staff, and the public up to date on information related to Human Disease outbreaks | | Staff time, training, and hardwiring of processes | Avera Holy Family Hospital | Emmet County Public Health | Local funds, Private Non-Profit | Little or No Cost | Helps provide education to the public during disease outbreaks, help screen people to prevent future outbreaks, and provide immunization s as indicated. | 1 year |
| Emmet County - 65 | At Avera Holy Family Hospital, we currently have a portable decontamination unit. It is in an area that is difficult to access and takes time to set up the equipment. | | Funding has been in an issue as to why permanent decon facilities have not been installed. | Avera Holy Family Hospital | Emmet County EMA, Emmet County Public Health, Area Fire Departments, Regional HazMat team | Local funds, Private Non-Profit | $50,000 to $100,000 | Provide permanent decon facilities at Avera Holy Family Hospital will benefit the staff and the community. It allows us to be better prepared for response to a HazMat event. | 1 year |
| Armstrong - 1 | When storms hit the city is responsible for clean up | Countywide plan EOP | none | City of Armstrong | Armstrong | | Little or no cost | ensure power during storms | 2-3 years |
| Armstrong - 2 | During sever storms and power goes out | Countywide plan EOP | funding | City of Armstrong | Armstrong | Budgets, grants FEMA | 10000 - 50,000. | ensure power during storms | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Armstrong - 3 | During sever storms and power goes out | Countywide plan EOP | funding | Alliant | Alliant/city of Armstrong | Budget/FEMA | ????? | power would stay on during storms | 2-3 years |
| Armstrong - 4 | Alert people in their homes of severe weather | Countywide plan EOP | funding | EMA | Armstrong | Budget | Less than $10,000 | Loss of life avoided | 2-3 years |
| Armstrong - 5 | county needs a list of all shelters | EMA will take care of this | | EMA | Armstrong | none | Little or no cost | educate the community | 2-3 years |
| Armstrong - 8 | City needs a safe area for the residents without basements | Strategic Plan, Capital improvements plan | Funding | City of Armstrong | EMA, FEMA | Grants budgets | $500,000 | | 3-5 years |
| Armstrong - 20 | 30 yr old lagoon only 3 ft deep needs to be 9 ft deep | Engineer drew up preliminary plans | funding | Armstrong | SRF funding, | same | 2.3 Million | Property damage | 3-5 years |
| Armstrong - 21 | needs updated | as money allows | funding | Armstrong | SRF funding, | same | ?? | property damage | More than 5 years |
| Armstrong - 25 | prone to flooding | city will purchase a large pump | funding | Armstrong | | budget | $1,500.00 | property | 2-3 years |
| Armstrong - 28 | Need supplies in case of Emergency | Purchase emergency supplies for the City | | City of Armstrong | EMA, County | Budgets, FEMA | $10,000-$50,000 | Supplies to Residents | 2-3 years |
| Armstrong - 43 | Need more room in case of emergency | Expanding or buying property | Funding | City of Armstrong | EMA, County | Budgets, FEMA | $10,000-$50,000 | Supplies to Residents | 2-3 years |
| Armstrong - 54 | | Build water plant and storage area | Funding | City of Armstrong | EMA, County | Grants, Budgets, FEMA | Over $1,000,000 | Water to the city | More than 5 years |
| Armstrong - 55 | If there is no electricity there is no water to the city | | Funding | City of Armstrong | FEMA, City funds, Alliant | FEMA Grant, Local funds (water, | $50,000 to $100,000 | Water, sanitation, fire protection | More than 5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Energy, Fundraising | sanitation, fire protection) | | | |
| Estherville - 3 | To lessen impact of weather on electric transmission lines | A section of line will be buried each summer | None identified | City Administrator / Elect Dist. Supt. | N/A | Other - Elect. Dist. Budget | $50,000 to $100,000 | Fewer electric outages | Other |
| Estherville - 18 | To insure sirens work when needed | Has been implemented - requires ongoing attention | None identified | Emergency Management - City Electrical Distribution | Same | Local funds | Little or no cost | Ability to warn public about dangerous conditions | Other |
| Estherville - 22 | Fix infiltration of storm water and River water into sewer system | | | City of Estherville | City of Estherville, EMA | Local Funds, FEMA, Grants | Over $1,000,000 | Waist water plant will not take on the added water | More than 5 years |
| Estherville - 35 | Need to remain compliant with the NFIP to ensure flood insurance is available to residents | Codes in place, NFIP, etc. | None identified | Community Development Director | None identified | Local funds | Little or no cost | Ensures flood insurance is available; protects property | Other |
| Estherville - 40 | Floodplain ordinance must be regularly reviewed and enforced | Has been implemented - requires continual review | None identified | Community Development Director | None identified | Local funds | Little or no cost | Protects properties from flood damage | Other |
| Estherville - 41 | To insure sirens work when needed | Has been implemented - requires ongoing attention | None identified | Emergency Management - City Electrical Distribution | Same | Local funds | Little or no cost | Ability to warn public about dangerous conditions | Other |
| Estherville - 46 | Street flooding occurs during heavy rain at intersection of S. | | None identified | City Administrator | Successful bidder | Local funds | $50,000 to $100,000 | End street flooding hazard | 1 year |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | 9th Street (Hwy 4) and 1st Ave S. | | | | | | | | |
| Gruver - 9 | To warn people within the City of a tornado or bad storm | None | None | City of Gruver | | FEMA Grant, Local funds | Less than $10,000 | Potential for lives saved | Other |
| Gruver - 17 | | Multi-Hazard Plan, Continue in Schools, Nursing Homes, Hospitals, etc. | | City of Gruver, Emmet County First Responders | | FEMA Grant, Local funds, In-Kind | Less than $10,000 | Residents could stay up to date on education | Other |
| Gruver - 22 | The current lift station is sitting in a very low area that is prone to flooding with heavy rain | | Cost of moving | Iowa Lakes Regional Water | EMA, City of Gruver | FEMA Grant | $50,000 to $100,000 | Would not have much time in labor when we get heavy rains, the pumps would last longer in the lift station | 2-3 years |
| Gruver - 27 | | | | City of Gruver Fire Dept. | Public Health, EMA | | Little or no cost | Could respond quicker with the correct equipment to help them | 2-3 years |
| Gruver - 30 | When fires out in the rural area, the need for water is huge. We have one installed already at Tuttle Lake | | | Fire Dept. | Other fire agencies in the County | Local funds, In-Kind | Less than $10,000 | Have more access to water | 3-5 years |
| Gruver - 34 | In process of fixing tile issues within the City of Gruver | | Old tile systems | City of Gruver, County Engineer | Emmet County, | FEMA Grant, Local funds | $10,000 to $50,000 | Get better drainage in the town | Other |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | to keep water away from homes | | | | EMA, Engineer | | | | |
| Gruver - 49 | If we have a major water issues that takes long to fix, we may need to look for a different source | | | City of Gruver, EMA | Iowa Lakes Rural Water | FEMA Grant, local funds | $10,000 to $50,000 | Town would not go without water | 3-5 years |
| Ringsted - 2 | When electrical grid goes down, Main infrastructure lose power. | Countywide plan EOP | Funding | City of Ringsted EMA | Ringsted, FEMA EMA | Budget, Grants | $50,000 - $100,000 | Power and information | 2-3 years |
| Ringsted - 18 | Need to replace with one that is activated by PSAP | Multi-Hazard Plan | Funding | Cities, EMA | Ringsted, FEMA EMA | Budget, Grants | $10,000 - $50,000 | Warning Community of Damaging storm, without placing people in harms way. | 2-3 years |
| Ringsted - 24 | Need to look into | Need to look into this with the county | Unknown at this time | Ringsted, EMA | County | Budget, Grants | Unknown | Help the City | 2-3 years |
| Ringsted - 25 | Flooding during major events | Budget or Grants | Funding | Ringsted, EMA | Ringsted, FEMA EMA | Budget, Grants | $10,000-$50,000 | Help with flooding | More than 5 years |
| Ringsted - 48 | The City has hired a firm the summer of 2018 to locate infiltration of storm water into the sewer system. The Storm system is taking too long to take up the rain | | None identified | City Superintendent | None identified | Local funds | $50,000 to $100,000 | Storm water will reside faster to help with less flooding and also help with backups in residents' basements | 3-5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | water on streets, causing more water to build up on property due to some areas are hooked to the sewer system and this also causes more backups in basements due to excess storm water going into the sewer system. | | | | | | | | |
| Wallingford - 3 | Power outage during strong storms and winter weather | Countywide plan EOP | Funding | Alliant | | FEMA, Alliant, City of Wallingford and grants | | | 2-3 years |
| Wallingford - 4 | Community has no warning siren at this time | Countywide plan EOP | Funding | EMA | City of Wallingford | Budget | Less Than $10,000 | Property loss and live safety | 2-3 years |
| Wallingford - 8 | Residents need a place to take shelter | None | | EMA | | FEMA, Budgets | $50,000 to $100,000 | Life safety | 3-5 years |
| Wallingford - 9 | City needs a way to inform residents of approaching hazards | None | | Cities, BOS, EMA | | | $10,000 to $50,000 | Life safety and property | 3-5 years |
| Wallingford - 10 | The City wishes to better understand and manage flood issues on a watershed level | None | | BOS | | City of Wallingford | $50,000 to $100,000 | Property Damage | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Wallingford - 11 | Drains need to be kept clear of debris to ensure the stormwater system can operate to it's full capacity. | None | | BOS | | City of Wallingford | Little or no cost | | 2-3 years |
| Wallingford - 17 | Regular messaging should be maintained to ensure the public is aware of potential hazards and knows how to prepare to keep themselves and their families safe | Multi-Hazard Plan, Continue in Schools, Nursing Homes, Hospitals, etc. | | EMA, First Responders | | | Little or no cost | Life safety and property | 2-3 years |
| Wallingford - 20 | The sewage lagoons need to be regularly maintained to prevent overflow | | Funding | City of Wallingford | | City of Wallingford | Less than $10,000 | Property | More than 5 years |
| Wallingford - 21 | Sewer lift station will ensure continued operation during a flood event | | Funding | City of Wallingford EMA | | City of Wallingford | $100,000-$500,000 | Property | More than 5 years |
| Wallingford - 22 | Sewer lines are aging. Preventative maintenance is needed. | | Funding | City of Wallingford | | City of Wallingford | $500,000 to 1,000,000 | Property | More than 5 years |
| Wallingford - 25 | Flooding issues in the town | Purchase water pumps for the city | Funding | City of Wallingford | | City of Wallingford | $50,000 to $100,000 | Property | More than 5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Wallingford - 27 | Vulnerable populations may require special response during emergencies | Get list from city | | Public Health | | City of Wallingford | Little to no cost | Life safety | 2-3 years |
| Wallingford - 29 | Power outage or equipment failure and we could lose records. All paper files could be lost in firer. | unknown | | Wallingford | | City of Wallingford | Less Than $10,000 | Information loss | 1 year |
| Wallingford - 30 | Have trouble getting water to lake homes out in the county | Put one in already would like more | | Fire | | City of Wallingford and Emmet County | $10,000 to $50,000 | Loss of property | More than 5 years |
| Wallingford - 35 | NFIP compliance reduces flood risks and ensures residents can maintain flood insurance which protects property. | Codes in place, NFIP, etc. | | EMA | | | | | 1 year |
| Wallingford - 63 | Currently Wallingford does not have a tornado siren | Community currently does not have a siren; citizens rely on radio or TV stations; purchase new tornado siren and ensure plans and procedures are in place for its operation and maintenance | Budget constraints; available funding | City of Wallingford | Emergency Management, Fire Service | FEMA Hazard Mitigation Assistance Grants; local funds | Less than $10,000 | Life safety | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Wallingford - 64 | When it rains water has nowhere to go. Citizens have to use sump pumps to get rid of water | | N/A | City of Wallingford | Contractors | FEMA | Over $1,000,000 | Citizens don't have to rely on sump-pumps, avoid flood water damages | Other |
| Wallingford - 65 | When it rains and floods water can go towards houses and other buildings when it reaches or goes over the banks, creating damage | | N/A | City of Wallingford | local excavation services | FEMA Grant, Local funds | Less than $10,000 | No water damage to houses and other properties | Other |
| Iowa Lakes Community College - 2 | The county has identified specific critical sites that are vulnerable to power loss. The sites provide critical functions. | Countywide plan EOP | Funding, making sure each critical asset is set up to receive generator power | EMA | County engineer, County critical asset holders, Community critical asset holders | FEMA Grant, Local funds, in-Kind | $50,000 to $100,000 | The project will ensure continuation of critical functions during a power loss | 3-5 years |
| Iowa Lakes Community College - 8 | The college is used as a tornado shelter for the nearby community trailer park, college students and employees and other community members attending outdoor activates on or near campus. | None | Funding | EMA, ILCC | County engineer, County critical asset holders, Community critical asset holders | FEMA Grant, Local funds, in-Kind | $50,000 to $100,000 | A tornado safe room will ensure the safety of community members that do not have viable options. | 3-5 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| Iowa Lakes Community College - 17 | The community needs continued awareness training on all hazards and Iowa Lakes Community College is a willing host. | Provide education to students, staff. Provide free rooms for educating public. | No obstacles. County EMA and other community members provide the training expertise and are hosted by Iowa Lakes Community College | EMA, ILCC | County engineer | In-Kind | Little or No Cost | Educating the community on awareness, concerns, dangers and opportunities for mitigation of natural hazards. | Other |
| Iowa Lakes Community College - 9 | The college would install or update outdoor warning system/sirens that ties into the county/city system to alert community members of potential severe weather activity. Nearby community trailer park, college students and employees and other community members attending outdoor activates on or near campus. (softball, soccer, | None | Funding | EMA, ILCC | County engineer | FEMA Grant, Local funds, in-Kind | $10,000 to $50,000 | The additional severe weather outdoor warning sirens would improve coverage on the college campus and surrounding area | 2-3 years |

| Action ID | Issue/Background | Ideas for Implementation | Obstacles | Responsible Office | Partners | Potential Funding Source(s) | Cost Estimate | Benefits | Timeline |
|---|---|---|---|---|---|---|---|---|---|
| | football practice field. | | | | | | | | |
| North Union - 1 | Armstrong has no tornado shelter or safe room. Currently the school uses hallways with no windows. The school building does not have anything shelter wise that meets FEMA guidelines. | Build a safe room that can be used by students and community. | Funding | School District, City of Armstrong, EMA | City of Armstrong | FEMA Grant, Local funds | Over $1,000,000 | Saving lives | More than 5 years |
| North Union - 2 | At this time the school district has no generator to keep the school going if it lost power. The school building does not have anything shelter wise that meets FEMA guidelines. | Get a building generator that can be used by students and community. | Funding | School District, City of Armstrong, EMA | City of Armstrong | FEMA Grant, Local funds | $50,000 to $100,000 | Saving lives | 3-5 years |

**Table 4-4 Action Prioritization**

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Emmet County - 2 | Backup Power Generator (buy) | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Emmet County - 4 | NOAA Weather Radios (buy/distribute) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Emmet County - 5 | Designating Community Shelter. Review existing list of community shelters, adding shelters as appropriate and removing designated sites that are no longer applicable | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 18 | Maintain Outdoor Warning Sirens | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 29 | Backup of City/County Records - convert paper records to electronic | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Emmet County - 30 | Create Dry Hydrant | 3 | 3 | 3 | 3 | 1 | | 1 | 1 | 1 | 1 | 1 | 18 | H |
| Emmet County - 35 | Remain Compliant with NFIP | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Emmet County - 40 | Enforce Floodplain ordinance | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 | M |
| Emmet County - 52 | Stream gauge monitoring system | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Emmet County - 57 | Extreme Heat | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Emmet County - 58 | Animal/Crop/Plant Disease | 0 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |
| Emmet County - 59 | Hazardous Materials | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 60 | Human Disease | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 61 | Infrastructure Failure | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 62 | Terrorism | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 63 | Transportation Incident | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 19 | H |
| Emmet County - 64 | Human Disease- We have a process to screen all patients for immunization status, travel history, and contact with certain disease processes. We provide education to the public, patients, and staff as indicated. We provide immunizations as indicated. | 3 | 2 | 3 | 3 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 15 | H |
| Emmet County - 65 | Hazardous Materials Response- Permanent Decon facilities will be built at Avera Holy Family Hospital in Estherville, IA. | 2 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 15 | H |

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Armstrong - 1 | Enforce Tree Trimming | 2 | 3 | 3 | 3 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 15 | H |
| Armstrong - 2 | Backup Power Generator (buy) | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Armstrong - 3 | Bury Utility Lines | 2 | 2 | 3 | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 14 | H |
| Armstrong - 4 | NOAA Weather Radios (buy/distribute) | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 17 | H |
| Armstrong - 5 | Designating Community Shelter | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 16 | H |
| Armstrong - 8 | Tornado Safe Room (build) | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 17 | H |
| Armstrong - 20 | Clean/Enlarge Sewage Lagoons | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Armstrong - 21 | Construct Sewer Lift Station | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Armstrong - 25 | Purchase Portable Pumps | 1 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Armstrong - 28 | Shelter rations (cots, blankets, water, etc.) | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Armstrong - 43 | Maintain & expand debris removal site | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Armstrong - 54 | Improve water quality/quantity | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Armstrong - 55 | Purchase generator for water plant | 1 | 2 | 3 | 2 | 1 | 1 | -1 | -1 | 1 | 1 | 1 | 11 | M |
| Estherville - 3 | Bury Utility Lines | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |
| Estherville - 18 | Maintain Outdoor Warning Sirens | 3 | 1 | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Estherville - 22 | Replace Sewer Lines | 1 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Estherville - 35 | Remain Compliant with NFIP | 2 | 2 | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Estherville - 40 | Enforce Floodplain ordinance | 2 | 2 | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Estherville - 41 | Test Warning sirens monthly | 3 | 1 | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Estherville - 46 | Storm Sewer Rerouting Project | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |
| Gruver - 9 | Outdoor Warning Sirens (build or update) | 3 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 13 | H |
| Gruver - 17 | Public Education/Awareness | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 6 | L |
| Gruver - 22 | Replace Sewer Lines, Move sewer lift station to different location | 0 | 3 | 0 | 3 | 1 | 1 | 1 | 1 | -1 | 1 | 1 | 11 | M |
| Gruver - 27 | List of residents who may need more help in an emergency | 2 | 0 | 2 | 3 | 1 | 1 | 1 | 1 | -1 | 0 | 0 | 10 | M |
| Gruver - 30 | Create Dry Hydrant | 0 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 13 | H |
| Gruver - 34 | Determine which areas are most prone to flood | 0 | 3 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 11 | M |
| Gruver - 49 | Alternate Water Supply Plan | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 11 | M |
| Ringsted - 2 | Backup Power Generator (buy) | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 14 | H |
| Ringsted - 18 | Maintain Outdoor Warning Sirens | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 17 | H |
| Ringsted - 24 | Look into NFIP participation | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 13 | H |

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Ringsted - 25 | Purchase Portable Pumps | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 16 | H |
| Ringsted - 48 | Storm Water System Improvements | 0 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 12 | M |
| Wallingford - 3 | Bury Utility Lines | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 12 | M |
| Wallingford - 4 | NOAA Weather Radios (buy/distribute) | 3 | 2 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | M |
| Wallingford - 8 | Tornado Safe Room (build) | 3 | 1 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 13 | H |
| Wallingford - 9 | Outdoor Warning Sirens (build or update) | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 17 | H |
| Wallingford - 10 | Watershed study & Implement | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Wallingford - 11 | Promote Landscaping Practices | 0 | 2 | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 | M |
| Wallingford - 17 | Public Education/Awareness | 1 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Wallingford - 20 | Clean/Enlarge Sewage Lagoons | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |
| Wallingford - 21 | Construct Sewer Lift Station | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 15 | H |
| Wallingford - 22 | Replace Sewer Lines | 1 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 15 | H |
| Wallingford - 25 | Purchase Portable Pumps | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 17 | H |
| Wallingford - 27 | List of those of elderly, disabled or medically distressed | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Wallingford - 29 | Backup of City/County Records | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 | M |

| Action ID | Mitigation Action Title / Description | Lives Saved? | Reduced Property Damages? | Reduce need for response actions? | Will benefits exceed cost? | Social | Technical | Administrative | Political | Legal | Economic | Environment | Score | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-unlikely, 1-maybe, 2-probably, or 3-definitely | | | | Positive (1) Neutral (0) Negative (-1) | | | | | | | | |
| Wallingford - 30 | Create Dry Hydrant | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 17 | H |
| Wallingford - 35 | Remain Compliant with NFIP | 1 | 3 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 14 | H |
| Wallingford - 63 | Add new tornado siren for the City of Wallingford | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 14 | H |
| Wallingford - 64 | Storm Water Sewer Service | 0 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 | H |
| Wallingford - 65 | Cleaning and Maintaining Drainage Ditch | 1 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 16 | H |
| Iowa Lakes Community College - 2 | Backup Power Generator (buy) | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Iowa Lakes Community College - 8 | Tornado Safe Room (build) | 3 | 0 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| Iowa Lakes Community College - 17 | Public Education/Awareness | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 16 | H |
| Iowa Lakes Community College - 9 | Outdoor Warning Sirens (build or update) | 3 | 0 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 15 | H |
| North Union - 1 | Create a safe room/tornado shelter | 3 | 1 | 2 | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 14 | H |
| North Union - 2 | Install Backup Generators | 2 | 1 | 2 | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 13 | H |

# 5 PLAN MAINTENANCE PROCESS



This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

## 5.1 Monitoring, Evaluating, and Updating the Plan

***44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.***

### 5.1.1 Hazard Mitigation Planning Committee (HMPC)

With adoption of this plan, the HMPC will continue to be tasked with plan monitoring, evaluation and maintenance. The participating jurisdictions and agencies, led by the Emmet County Emergency Management Coordinator, agree to:

- Meet annually to review the Hazard Mitigation Plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Report on plan progress and recommended changes to the Emmet County Board of Supervisors and governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The HMPC is an advisory body and can only make recommendations to county, city, town, or district elected officials. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about

hazard mitigation, passing concerns on to appropriate entities, and posting relevant information in areas accessible to the public.

### 5.1.2 Plan Maintenance Schedule

The HMPC agrees to meet annually to monitor progress, discuss recent hazard events and changes in development that impact vulnerability, and update the mitigation strategy. The Emmet County Emergency Management Coordinator will be responsible for initiating the plan reviews.

In coordination with the other participating jurisdictions, a written update of the plan will be submitted to the Iowa Homeland Security and Emergency Management Department and FEMA Region VII for approval within the required five-year cycle per Requirement §201.6(c)(4)(i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

### 5.1.3 Plan Maintenance Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or
- Increased vulnerability as a result of new development (and/or annexation).

The annual reviews and updates to this plan will:

- Consider changes in vulnerability due to action implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards that may arise or were previously overlooked,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Incorporate growth and development-related changes to inventories, and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate the mitigation strategy during plan review and update, the participating jurisdictions will follow the following process:

- A representative from the responsible office identified in each mitigation action will be responsible for tracking and reporting the action status on an annual basis to the jurisdictional HMPC member and providing input on any completion details or whether the action still meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the action does not meet identified objectives, the jurisdictional HMPC member will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.
- As part of the annual review process, the Emmet County Emergency Management Coordinator will provide the updated Mitigation Strategy with the current status of each mitigation action to the County Board of Supervisors and County Department Heads as well as all Mayors, City Clerks, School

District Superintendent, and governing board members requesting that the mitigation strategy be incorporated, where appropriate in other planning mechanisms.

Changes will be made to the plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as the Emmet County HMPC deems appropriate and necessary, and as approved by the Emmet County Board of Supervisors and the governing boards of the other participating jurisdictions.

## 5.2 Incorporation into Existing Planning Mechanisms

***44 CFR Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.***

Many of the small jurisdictions in Emmet County do not have standing formal planning mechanisms such as a Comprehensive Plan or Capital Improvements Plan through which formal integration of mitigation actions can be documented. As a result, activities that occur in these small communities are developed through annual budget planning, regular City Council Meetings and other community forums rather than a formal planning process. Planning mechanisms that do exist to some degree within the participating jurisdictions include:

- Comprehensive Plans;
- Various ordinances of participating jurisdictions, including floodplain management ordinances in NFIP-participating communities;
- Capital Improvement Plans

For a detailed summary of planning mechanisms and other mitigation-related capabilities, see Chapter 2.

### 5.2.1 Incorporation of Updated Hazard Mitigation Plan into existing Planning Mechanisms

Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. After the annual review of the Hazard Mitigation Plan, the Emmet County Emergency Management Coordinator will provide the updated Mitigation Strategy with the current status of each mitigation action to the County Board of Supervisors and County Department Heads as well as all Mayors, City Clerks, School District Superintendent, and governing boards requesting that the mitigation strategy be incorporated, where appropriate in other planning mechanisms.

Table 5-1 Provides additional details on each jurisdiction regarding how the 2013 Hazard Mitigation Plan was integrated into existing planning mechanisms as well as the strategy going forward to integrate this plan update into existing planning mechanisms.

**Table 5-1 Integration of Previous Plan and Strategies to Integrate Plan Update**

| Jurisdiction | Incorporation of 2013 Plan into Existing Planning Mechanisms | Integration Process for Plan Update |
|---|---|---|
| Emmet County | Referenced mitigation plan for County and community preparedness | Review against County Comprehensive Plan and tie to infrastructure plans |
| Armstrong | | |
| Dolliver | | |
| Estherville | The plan has been considered when planning future capital improvements and infrastructure projects. | The City will continue to consult the plan when planning capital improvements and infrastructure projects. Information in the plan will also be integrated into any changes to the comprehensive plan. |
| Gruver | The plan was not incorporated much in the last 5 years. | The plan will help the City to prioritize planned projects and identify problem areas. Information from the plan will be incorporated into comprehensive planning, capital improvement planning, and infrastructure plans. |
| Ringsted | No incorporation occurred. | The plan will be integrated with existing stormwater management and will be incorporated into any new efforts of comprehensive planning, capital improvement planning, and infrastructure planning. |
| Wallingford | Little incorporation over the past five years. | The plan will help the City to prioritize the projects that need to be implemented and identify problem areas so that this information can be integrated with capital improvement planning, comprehensive planning, and infrastructure plans. |
| Estherville-Lincoln PSD | N/A | |
| North Union PSD | N/A | |
| Iowa Lakes Community College | Mitigation plan is part of the College's master plan. | Plan will continue to be incorporated into the master plan and the risk assessment as well as the infrastructure plan |

## 5.3 Continued Public Involvement

***44 CFR Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.***

The public will be involved in the plan maintenance process by publication of a Press Release after each annual review indicating the committee has met with a summary of mitigation action status updates and highlights of specific completed mitigation actions, as applicable. The public will be invited to provide comments on HMPC meeting outcomes and/or attend HMPC meetings. Public notice will be posted through available website postings, community message boards, and social media outlets.

The update process also provides an opportunity to publicize success stories from the plan's implementation and seek additional public comment. When the HMPC reconvenes for the update, it will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan.

# APPENDIX A: REFERENCES

- Coalition to Support Iowa's Farmers
- Des Moines Register News Data Central
- Emmet County Assessor's Office
- Emmet County Conservation Board
- Emmet County, Iowa Multi-Jurisdictional Hazard Mitigation Plan, 2013
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- Environmental Protection Agency, Surf Your Watershed
- Federal Emergency Management Agency, BCA Reference Guide, 2009
- Federal Emergency Management Agency, Community Status Book
- Federal Emergency Management Agency, National Flood Hazard Layer
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- Federal Emergency Management Agency, Taking Shelter from the Storm, 3rd Edition
- Federal Emergency Management Agency, Emmet County Flood Insurance Study (2018-Preliminary)
- Flood Insurance Administration, Policy and Loss Statistics
- Hazards US MH 2.2 (HAZUS)
- Hazards US MH 4.0 (HAZUS)
- Hazards Vulnerability Research Institute, Social Vulnerability Index
- High Plains Regional Climate Center
- Iowa Communications Network
- Iowa Department of Agriculture and Land Stewardship, Division of Soil Conservation
- Iowa Department of Agriculture and Land Stewardship, Pesticide Bureau - Sensitive Crop Registry
- Iowa Department of Agriculture, Agricultural Statistics bulletin
- Iowa Department of Education, Bureau of Planning, Research and Evaluation
- Iowa Department of Natural Resources, Animal Feeding Operations
- Iowa Department of Natural Resources, Dam Safety Program
- Iowa Department of Natural Resources, NPDES
- Iowa Department of Natural Resources, NRGIS Library
- Iowa Department of Public Health Center for Acute Disease Epidemiology
- Iowa Department of Transportation’s Office of Traffic and Safety
- Iowa Homeland Security and Emergency Management Department
- Iowa State Hazard Mitigation Plan, 2013
- Iowa State University, College of Agriculture and Life Sciences
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- Karl, T.R., J.M. Melillo, and T.C. Peterson (eds). 2009. Global Climate ChangeImpacts in the United States. U.S. Global
- Midwestern Regional Climate Center
- National Drought Mitigation Center, U.S. Drought Monitor & Drought Impact Reporter
- National Inventory of Dams
- National Oceanic and Atmospheric Administration, Storm Prediction Center
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- National Park Service, National Register of Historic Places
- National Severe Storms Laboratory
- National Transportation Safety Board
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- New York Times.com, Water Supply Systems
- Pipeline and Hazardous Materials Safety Administration
- Southwestern Community College website
- Stanford University, National Performance of Dams Program
- Tornado and Storm Research Organization (TORRO), Department of Geography, Oxford Brooks University
- TornadoChaser.net
- TornadoHistoryProject.com
- U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory
- U.S. Army Corps of Engineers, National Inventory of Dams
- U.S. Army Corps of Engineers, National Levee Database
- U.S. Census Bureau, American Community Survey, 5-Year Estimates, 2016
- U.S. Census Bureau, Building Permit Data
- U.S. Census Bureau, Decennial Census, 2000, 2010
- U.S. Census Bureau, Population Estimates, 2016
- U.S. Department of Agriculture Cropland Data Layer (CropScape)
- U.S. Department of Agriculture National Agricultural Statistics Service, 2012 Census of Agriculture
- U.S. Department of Agriculture, Emerald Ash Borer County Detection Map
- U.S. Department of Agriculture, Risk Management Agency Crop Insurance Statistics
- U.S. Department of Agriculture, Secretarial Disaster Declarations
- U.S. Department of Transportation

- U.S. Fish and Wildlife Service, Threatened and Endangered Species
- U.S. Geological Survey
- University of Nebraska, National Drought Mitigation Center
- University of Wisconsin-Madison, Department of Forest Ecology and Management, SILVIS Lab

# APPENDIX B: PLANNING PROCESS

The following materials are provided to document the planning process:

## B.1 Emmet County Hazard Mitigation Planning Committee (HMPC) Members

**Jurisdictional and Stakeholder Representatives that Attended Meetings**

| Name | Title | Department | Jurisdiction/Organization |
|---|---|---|---|
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**Stakeholder Representatives Invited to Provide Comments**

| First Name | Last Name | Title | Agency | Type |
|---|---|---|---|---|
| | | | | |

## B.2 Kick-Off Meeting Invitation

## B.3 Kick-Off Meeting Agenda

Emmet County
Multi-Jurisdictional Hazard Mitigation Plan Update
Kickoff Meeting
December 11, 2017
4:00 to 5:00 pm CST

# Agenda

- Hazard Mitigation Planning Purpose
- Grant Programs Linked to Approved Plan
- Multi-jurisdictional Approach
- Planning/Participation Requirements
- Public Involvement
- Data Collection Guides
- Discussion/Prioritization of Hazards
- Critical Facilities
- Next Steps in the Planning Process

amec
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wheeler

## B.4 Kick-Off Meeting Minutes

| | |
|---|---|
| To | **Emmet County Hazard Mitigation Planning Committee** |
| Through | **Terry Reekers, Emergency Management Coordinator** |
| From | **Kyle Karsjen, Amec Foster Wheeler** |
| Date | **12/13/2017** |
| Subject | **Minutes from Emmet County Hazard Mitigation Planning Kickoff Meeting held on 12/11/2017** |

This document is a record of attendance and a summary of the issues discussed during the above meeting. The presentation began with an introduction to the purpose of hazard mitigation planning, grant programs linked to an approved plan, and the benefits of a multi-jurisdictional approach. The hazard mitigation planning process was reviewed to include requirements for participation and public involvement and the use of data collection guides. The presentation continued with a discussion of the hazards that have the potential to impact Emmet County, including preliminary research conducted by Amec Foster Wheeler on each hazard. The hazard ranking method adopted by the Iowa Homeland Security and Emergency Management Department for the 2013 State Hazard Mitigation Plan was introduced and coordination occurring to update the GIS layer of critical facilities was discussed. The meeting concluded with a discussion of the next steps in the planning process.

The meeting was held remotely via Skype Webinar/Conference Call from 4:00 pm to 5:00pm CST.

**Note: Copies of all meeting materials are available through the project's box.com account located at** https://amec.app.box.com/v/Emmet-CO-IA

### Attendees

| Name | Jurisdiction |
|---|---|
| Dan Jorgenson | Ringsted |
| Delaine Hiney | Iowa Lakes Community College |
| Terry Reekers | Emmet County |
| Barb Mack | Estherville |
| Kathy Preston | Emmet County |
| Madi Pluss | Amec Foster Wheeler |
| Kyle Karsjen | Amec Foster Wheeler |

Page 1

## Introductions

The meeting began with a welcome from Terry Reekers, Emmet County Emergency Management Coordinator and a short discussion of items on the agenda for the LEPC Meeting. Kyle Karsjen, Amec Foster Wheeler Mitigation Planner facilitated the remainder of the planning meeting to discuss the Hazard Mitigation Plan Update.

## Hazard Mitigation Planning Purpose

Mr. Karsjen presented information on the purpose of Hazard Mitigation Planning and the Disaster Mitigation Act of 2000. The attendees were reminded this is an update of the Emmet County Hazard Mitigation Plan, previously approved in November 2013. A summary of the Presidential Disaster Declarations including Emmet County since 1965 was presented. The June 14, 2014 Presidential Disaster Declaration (DR-4184) for Severe Storms, Tornadoes, Straight-line Winds, and Flooding was the only declaration including Emmet County that has occurred since the previous hazard mitigation plan was approved.

## Grant Programs Linked to Approved Plan

Mr. Karsjen briefly discussed the FEMA Hazard Mitigation Assistance grants that require participation in an approved Hazard Mitigation Plan for jurisdictions to be eligible to apply. These include: Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program. All programs are available for jurisdictions covered under an approved Hazard Mitigation Plan.

## Multi-Jurisdictional Approach

An overview of the 9 Planning Tasks that will be followed during the planning process was given and Mr. Karsjen addressed the benefits for jurisdictions participating in this mitigation plan update including improved coordination and communication among local jurisdictions. Impacts of hazards do not stop at jurisdictional boundaries. This multi-jurisdictional approach allows for a more comprehensive risk assessment and resulting mitigation strategy for the entire planning area. The following jurisdictions have been invited to participate as "official participants" in the Emmet County Multi-Jurisdictional Hazard Mitigation Plan Update:

- Emmet County
- City of Armstrong
- City of Dolliver
- City of Estherville
- City of Gruver
- City of Halfa
- City of Ringsted
- City of Wallingford
- North Union Public School District
- Estherville-Lincoln Public School District
- Iowa Lakes Community College

Mr. Karsjen also described the role of the HMPC. Each jurisdiction participating in development of the plan must meet the following minimum requirements:

- Designate a representative to serve on the Emmet County HMPC, which will meet **three** times during the planning process,
- Provide data for and assist in the development of the updated risk assessment that describes how various hazards impact your jurisdiction,
- Provide data to describe current capabilities,
- Develop/update mitigation actions (at least one) specific to your jurisdiction,
- Provide comments on plan drafts as requested,
- Inform the public, local officials, and other interested parties about the planning process and provide opportunities for them to comment on the plan, and
- Formally adopt the mitigation plan.

Jurisdictions that choose not to participate in development of a FEMA-approved mitigation plan **will not** be eligible applicants for FEMA Hazard Mitigation Assistance Grants.

## Planning for Public Involvement

The local hazard mitigation plan requirements state that the public needs to have the opportunity to comment on the plan. The public will be given two opportunities to comment on the plan; once during the drafting stage and another when the plan is complete in the final draft stage.

A survey has been created to both provide information about the plan update under development as well as gain input from the public on the hazards they are most concerned about and mitigation strategies that they think will be most effective. This was shared with the attendees in hard copy and via email.

Terry Reekers, Emergency Management Coordinator, will be coordinating a press release announcing the availability of the survey. The press release will provide the SurveyMonkey.com link at https://www.surveymonkey.com/r/Emmet-CO-IA and will also state that hard copies will be available at local post office locations. The survey will also be distributed to other locations such as city halls and the courthouse where public access is available. The survey will remain open until **February 9, 2018**.

## Data Collection Process

Amec Foster Wheeler provided electronic files of the Data Collection Guides prior to the meeting via email. (these documents are also available through the box.com link at https://amec.app.box.com/v/Emmet-CO-IA). The guides are specific for local units of government and schools. To assist with completion of the Data Collection Guide, the previous plan can also be accessed through the box.com account.

The Data Collection Guide is designed to collect information on existing capabilities within each jurisdiction to implement mitigation initiatives as well as collect information on previous hazard events. For the hazards that were included in the existing 2013 plan, information is especially needed for the events that have occurred from 2013 to the present. For hazards not included in the 2013 plan, all known previous events are needed.

**Deadline for submittal of the Data Collection Guides to Amec Foster Wheeler is January 5, 2017.**

## Discussion/Prioritization of Hazards

Mr. Karsjen discussed information about the hazard profiles in the plan and introduced the HMPC to the elements of probability, magnitude, warning time, and duration to rank the hazards. The table below provides additional information on the elements and rating levels.

Page 3

| Element/Level | Characteristics |
|---|---|
| **Probability** | |
| 4 - Highly Likely | Event is probable within the calendar year.<br>Event has up to 1 in 1 year chance of occurring (1/1=100%)<br>History of events is greater than 33% likely per year.<br>Event is "Highly Likely" to occur |
| 3 – Likely | Event is probable within the next three years.<br>Event has up to 1 in 3 years chance of occurring (1/3=33%)<br>History of events is greater than 20% but less than or equal to 33% likely per year<br>Event is "Likely" to occur |
| 2 – Occasional | Event is probable within the next five years.<br>Event has up to 1 in 5 years chance of occurring (1/5=20%)<br>History of events is greater than 10% but less than or equal to 20% likely per year<br>Event could "Possibly" occur |
| 1 – Unlikely | Event is possible within the next 10 years<br>Event has up to 1 in 10 years chance of occurring (1/10=10%)<br>History of events is less than or equal to 10% likely per year<br>Event is "Unlikely" but is possible of occurring |
| **Magnitude / Severity**** | |
| 4 - Catastrophic | Multiple deaths<br>Complete shutdown of facilities for 30 or more days<br>More than 50 percent of property is severely damaged |
| 3 – Critical | Injuries and/or illnesses result in permanent disability<br>Complete shutdown of critical facilities for at least two weeks<br>25–50 percent of property is severely damaged |
| 2 – Limited | Injuries and/or illnesses do not result in permanent disability<br>Complete shutdown of critical facilities for more than one week<br>10–25 percent of property is severely damaged |
| 1 – Negligible | Injuries and/or illnesses are treatable with first aid<br>Minor quality of life lost<br>Shutdown of critical facilities and services for 24 hours or less<br>Less than 10 percent of property is severely damaged |
| **Warning Time** | |
| 4 | Less Than 6 Hours |
| 3 | 6-12 Hours |
| 2 | 12-24 Hours |
| 1 | 24+ Hours |
| **Duration** | |
| 4 | More Than 1 Week |
| 3 | Less Than 1 Week |
| 2 | Less Than 1 Day |
| 1 | Less Than 6 Hours |

These elements are used in the 2013 Iowa State Hazard Mitigation Plan to determine a final Hazard Assessment Score for each hazard. The score provides a hazard ranking mechanism as well as a planning significance rating, to focus planning efforts on those hazards with the highest scores. Using the ranking described in the table above, the formula used to determine each hazard's score, which includes weighting factors defined by the State of Iowa's Hazard Mitigation Plan is:

**(Probability x .45) + (Magnitude/Severity x .30) + (Warning Time x .15) + (Duration x .10) = Weighted Score**

The scores for each element may be revised throughout the course of the risk assessment update based on additional information. Additionally, individual hazard ranking scores will be developed for each participating jurisdiction to demonstrate how hazards vary among jurisdictions. The revised planning area hazard ranking results and results for each participating jurisdiction will be available for

Page 4

comment in the draft risk assessment which will be provided to the planning committee prior to the 2nd planning meeting.

Mr. Karsjen presented initial research information on the 20 hazards included in the 2013 State Hazard Mitigation Plan that have the potential to impact Emmet County; she also identified which hazards were profiled in the previous county plan. Details of the information provided are in the PowerPoint presentation which can be obtained at https://amec.app.box.com/v/Emmet-CO-IA.

If the decision to exclude any of the 20 hazards form further review in the plan due to lack of risk/non-occurrence in the county, the HMPC will be notified and the plan update will provide justification for exclusion.

## Critical Facilities

Mr. Karsjen explained that the Risk Assessment will include information on critical facilities for each jurisdiction. The GIS inventory of critical facilities is being compiled from available layers and will be compared against hazard with geographic data, such as riverine flood to determine critical facilities at risk.

## Next Steps

Attendees were asked to complete their jurisdiction's Data Collection Guide by **January 5th, 2018**. **The 2nd meeting of the Hazard Mitigation Planning Committee for this plan update will be held on January 23rd, 2018. Additional details will be provided closer to date.** The meeting will involve a review of the risk assessment results and update of the plan's goals and previous mitigation actions. **The 3rd and final planning meeting will be targeted for late February 2018**. This meeting will focus on development of any new mitigation actions as well as development of Action Implementation Plans for all continuing and new actions. Decisions to ensure review and maintenance of the Hazard Mitigation Plan will also be discussed at this final meeting.

- Data Collection Guides
  - **Due Jan. 5, 2017** to Amec Foster Wheeler
- 2nd Planning Meeting targeted for **Jan 23, 2018 – details TBD**
  - Risk Assessment Update Results
  - Review/Update Mitigation Goals
  - Begin Status Updates for Previous Mitigation Actions
- 3rd/Final Planning Meeting targeted for **Feb 2018** – details TBD
  - Status Update Summary of Previous Mitigation Actions
  - Brainstorm / Discuss Potential New Mitigation Actions
  - Mitigation Action Implementation Plans for Continuing and New Actions
  - Discuss Plan Maintenance

Page 5

## B.5 Kick-Off Meeting Sign-In Sheets

## B.6 Meeting #2 Agenda

Emmet County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting #2
January 23, 2018
5:30-7:30 pm

# Agenda

Welcome/Introductions

Brief Review

Public Survey Update

Participation Requirements/Status

Plan Update Format

Sample Results of Countywide Risk Assessment Update

Update Mitigation Goals

Discuss Mitigation Action Updates

Next Steps

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## B.7 Meeting #2 Minutes

| | |
|---|---|
| To | **Emmet County Hazard Mitigation Planning Team** |
| From | **Kyle Karsjen, Amec Foster Wheeler Mitigation Planner** |
| Tel / E-mail | **303-820-4661 / kyle.karsjen@amecfw.com** |
| Date | **2/7/2018** |
| Subject | **Minutes from Emmet County Hazard Mitigation Planning Meeting #2 held on 1/23/2018** |

This document is a record of attendance and a summary of the issues discussed during the above meeting, including: a brief review of the purpose of a Hazard Mitigation Plan, an update on the public survey for the plan update, discussion of participation requirements and the status of each jurisdiction, presentation of the plan update format, sample results of the risk assessment update, a discussion to update the plan's mitigation goals, discussion of status updates of previous mitigation actions, and the next steps in this process.

### Attendees

| First Name | Last Name | Title | Jurisdiction/Organization |
|---|---|---|---|
| Brent | Shatto | Chief | Estherville PD |
| Mary | Moorman | Office Manager | Emmet Public Health/City of Wallingford |
| Ben | Krambeer | Engineer | Iowa Lakes Electric Cooperative |
| Terry | Reekers | Emmet County Emergency Management Coordinator | Emmet County EMA |
| Cathy | Wikert | City Clerk | City of Ringsted |
| Christy | Muntah | Quality Improvement | Avera Holy Family Hospital—Estherville |
| Delaine | Hinery | Executive Director Facilities | Iowa Lakes Community College |
| Barb | Mack | Community Development Director | City of Estherville |
| Penny | Clayton | City Administrator | City of Estherville |
| Richard | Beaver | Fire Chief | Estherville |

### Introductions

Terry Reekers, Emergency Management Coordinator with Emmet County Emergency Management began the meeting by welcoming and thanking the attendees. Kyle Karsjen, with Amec Foster Wheeler Environment & Infrastructure, Inc., the firm contracted to assist in the development of the Emmet County multi-jurisdictional hazard mitigation plan update, facilitated the remainder of the presentation.

### Purpose/Public Survey/Participation Status

Kyle provided a brief summary of the purpose of the Hazard Mitigation Plan and the Disaster Mitigation Act of 2000 that codified the requirement of local governments to adopt a hazard mitigation plan to maintain eligibility for FEMA Hazard Mitigation Assistance Grants. The nine-task planning process was summarized and participants were informed that at the conclusion of the meeting, the planning team will have completed at least portions of Tasks 1-6. Kyle also provided a status update and summary of responses to date for the Public Survey that has been disseminated via survey monkey at: https://www.surveymonkey.com/r/Emmet-CO-IA. Planning

1

team representatives were encouraged to continue to publicize the availability of the surveys and to notify Amec Foster Wheeler of these efforts so that they can be described in the planning process section of the plan. To date, over 131 surveys have been collected.

A review of the requirements for jurisdictions to officially participate in the Multi-Jurisdictional Hazard Mitigation Plan was provided as well as a table summarizing each jurisdiction's participation to date.

## Plan Format/Sample Results of Countywide Risk Assessment

Kyle provided the overall format of the plan update document as follows:

- Executive Summary
- Chapter 1—Planning Process
- Chapter 2—Jurisdiction Profiles
- Chapter 3—Risk Assessment
- Chapter 4—Mitigation Strategy
- Chapter 5—Plan Maintenance
- Appendices

A PDF file of the Chapter 3 draft risk assessment has been uploaded to the Box.com account provided on page 1 of these minutes. Kyle asked that the planning committee, along with other representatives from their jurisdiction, review the risk assessment and provide comments and additional data by February 9, 2018. Jurisdictions were specifically requested to review the hazard ranking tables at the end of each hazard section to review/validate the ranking of each hazard for their jurisdiction. There are several areas in the draft risk assessment that are highlighted in blue, indicating information is needed from jurisdictions. Green highlighting in the risk assessment indicates further analysis or research to be completed by Amec Foster Wheeler.

Kyle provided a summary of the hazard ranking for the overall planning area and requested that the planning committee provide any comments on these rankings along with other comments on the risk assessment. The overview presentation provided just some of the details that are included in the full Draft Risk Assessment. All hazards identified for Emmet County are included in the Draft Risk Assessment chapter that is available for review.
The group discussed several hazard incidents that have occurred in the county. Highlights of the discussion are noted by hazard in the table below.

| Hazard or Topic | Meeting Discussion |
|---|---|
| **Animal/Plant/Crop Disease** | • No Avian Flu impacts<br>• The county experienced an Asian Beetle problem, but they sprayed |
| **Dam Failure** | • Total dam failure wiped out a county road in 1993<br>• Low head dams—Michaelson Park, West Fork DSM River |
| **Extreme Heat** | • Hospital is a designated cooling center<br>• Heat spells may last a week<br>• County has experienced heat indexes over 100 |
| **Flash Flood** | • Many small incidents have occurred; some of these areas have been identified<br>• Emmet County has issues with basement flooding |

2

| | |
|---|---|
| | • Wastewater treatment can be taxed have experienced jumps from handling 2 million gallons to 6-8 millions due to rain before |
| **Wildfire** | • HMPC identified high fuel areas along river and at Fort Defiance<br>• Greatest areas of concern are grass fires, ditch fires and crop fires<br>• Emmet County has experienced many crop fires, leading to an application for wildland fire equipment<br>• The HMPC identified a significant fire that occurred in Wallingford 3 years ago. High winds blew flames over roadways |
| **Hazardous Materials Incident** | • The HMPC identified an incident involving a truckload of batteries that shut down Highway 4 for 8 hours<br>• Train derailments sometimes occur around County<br>• Ethanol mostly on trains<br>• Two 110 car trains traveling through the County per week |
| **Human Health** | • The HMPC had concerns with the data for West Nile, Lyme Disease and E. Coli – numbers are low |
| **Infrastructure Failure** | • Estherville lost a sewer line in summer 2017 |
| **Flooding** | • Emmet County participated in a buyout program involving 12 homes in Estherville, 1 in Armstrong, and 1 in Half Mile Hill<br>• Flood maps were last updated in 1988; new mapping exists but has not yet been distributed |
| **Winter Storm** | • The HMPC identified one declaration for an ice storm prior to 2007.<br>• Storms have caused pole damage<br>• The HMPC questioned what kind of crop damage occurs in the winter; the data does not drill down into specifics |
| **Sinkholes** | • The HMPC stated that sinkholes in the county are man-made, not natural<br>• No history of previous occurrences in the County |
| **Terrorism** | • The HMPC noted bomb threats made on schools; people have been charged for making terroristic threats |
| **Thunderstorm/Lightning/Hail** | • Kyle noted that recorded hail damages are always low because it is insured loss; the HMPC agreed that real damages throughout the county from hail are much higher<br>• Many have had to replace roofs<br>• Communications center was struck by lightning multiple times, leading to equipment damage |
| **Tornado** | • HMPC noted that an estimated F3 tornado occurred in April 1936; this event resulted in 7-8 fatalities and millions of dollars in damages in Estherville.<br>• Tornadoes also cause a significant amount of agricultural damages. |
| **Transportation Failure** | • The HMPC noted 130-180 crash reports each year |

## Mitigation Goals

Following the discussion of the risk assessment, Kyle facilitated a discussion of the mitigation goals. Common categories of mitigation goals were presented, as well as the 2013 State Hazard Mitigation Plan goals.

This planning effort is an update to an existing hazard mitigation plan. As a result, the goals from the *2013 Emmet County Multi-Jurisdictional Hazard Mitigation Plan* were reviewed. The planning committee determined that all three previous goals remain valid. The committee

3

discussed adding some additional verbiage to Goal 2 around continued jurisdictional operations. Note that Goal 2 below has been revised to reflect this change.

- Goal 1: Natural hazards that cause injuries, illness, deaths, property loss, utility service disruption and economic loss will be reduced and mitigated against by planning for the protection of property and life.
- **Goal 2: Protect critical facilities, infrastructure, and jurisdictional operations from disruptions due to hazard impacts.**
- Goal 3: Educate the public on natural hazards and what necessary information is needed to protect themselves and their property.

## Mitigation Action Status Updates

The planning team members were provided handouts of the actions that were included in the previous plan and were instructed to provide status updates and comments; **the deadline to return the information has been extended to February 23, 2018**. The table below provides a summary of the previous actions for each jurisdiction.

| Jurisdiction | # of Previous Actions |
|---|---|
| Emmet County | 33 |
| Armstrong | 38 |
| Dolliver | 10 |
| Estherville | 37 |
| Gruver | 29 |
| Ringsted | 29 |
| Wallingford | 39 |
| ILCC | 6 |

Instruction was provided on how to provide feedback on each jurisdiction's mitigation measures; communities are asked to explain whether a mitigation measure meets one of four categories:

1. Completed – the project has been implemented. Provide date completed and funding amount if applicable
2. Delete – the project should not be rolled over into the new plan, and should be deleted; jurisdictions are asked to provide an explanation
3. Continue in-progress – the project has been started, but is not complete and should be included in the new plan
4. Continue not started – the project has not been started, but should be rolled over into the plan update

The third and final meeting planned for early to mid-March will focus on development of any new mitigation actions. Planning team members were asked to consider what actions could reduce/eliminate damages as they review the Draft Risk Assessment as well as discuss mitigation alternatives with other representatives from their jurisdiction.

## B.8 Meeting #2 Sign-In Sheet

**EMMET COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE**
**MEETING #2—SIGN-IN SHEET**

| | | | |
|---|---|---|---|
| **Project:** | Emmet County, Iowa Multi-Jurisdictional Hazard Mitigation Plan Update | **Meeting Date/Time:** | January 23, 2018<br>5:30-7:30 pm |
| **Facilitator:** | Kyle Karsjen, Amec Foster Wheeler | **Place/Room:** | Room 74 at ILCC, 300 South 18th Street, Entrance 1, Estherville, IA, 51334 |

| Name | Title | Department/Agency | Email | Phone # | Signature |
|---|---|---|---|---|---|
| Brent Shatto | Chief | Estherville P.D. | epdshatto@gmail.com | 712-209-0556 | |
| Mary Moorman | Office Mgr. | Emmet Co. Public Health<br>City of Wallingford | mmoorman@emmetcountyia.com | 712-209-0041 | |
| Ben Krambeer | Engineer | Iowa Lakes Electric Cooperative | benk@ilec.coop | 712-362-6747 | |
| Terry Reekers | Emmet Co Coordinator EMA/E911 | EmmetCO EMA 911 | emae emmetcounty.com | 712-362-5762 | |
| Cathy Wikert | City Clerk | City of Ringsted | Cityhall eringtelco.com | 712-866-0877 | |
| Christy Mintah | Quality Improvement | Avera Holy Family Hospital Estherville | christy.mintah eavor.org | 712-362-6405 | |
| Delaine Hiney | Ex. Director Facilities | Iowa Lakes Comm. College | dhiney@iowalakes.edu | 712-362-0428 | |
| Barb Mack | Comm. Dev. Director | City of Estherville | estherville@mchsi.com | 712-362-7771 | |
| Penny Clayton | City Administrator | City of Estherville | p.clayton@cityofestherville.org | 712-362-7771 | |
| Richard Beaver | FIRE CHIEF | Estherville Fire Dept | beauspick@mchsi.com | 712-260-0052 | |

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## B.9 Meeting #3 Agenda

Emmet County
Multi-Jurisdictional Hazard Mitigation Plan Update
Planning Meeting #3

Tuesday, April 24, 2018
5:30 - 7:30 pm

# Agenda

- Introductions/Remarks
- Review Purpose/Requirements
- Public Survey Results
- Updating the Mitigation Strategy
  - Review Updated Plan Goals
  - Status of Previous Actions
  - Development of New Actions
  - Prioritization of Mitigation Actions
- Hazard Mitigation Assistance Grants
- Plan Maintenance
- Next Steps

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## B.10 Meeting #3 Minutes

| | |
|---|---|
| To | **Emmet County Hazard Mitigation Planning Committee** |
| From | **Kyle Karsjen, Amec Foster Wheeler Mitigation Planner** |
| Tel / E-mail | **303-820-4661/kyle.karsjen@woodplc.com** |
| Date | **5/4/2018** |
| Subject | **Minutes from Emmet County Hazard Mitigation Planning Meeting #3 held on 4/24/2018** |

This document is a record of attendance and a summary of the issues discussed during the above meeting, including: a brief review of the purpose of a Hazard Mitigation Plan, the public survey results, updating the mitigation strategy, Hazard Mitigation Assistance grants, plan maintenance and the next steps in this process.

### Attendees

| Name | | Title | Department | Jurisdiction Name |
|---|---|---|---|---|
| Bev | Juhl | Supervisor | Board of Supervisors | Emmet County |
| Kathy | Preston | Nurse Administrator | Emmet County Public Health | Emmet County |
| Mike | Martens | Sheriff | Emmet County Sheriff's Office | Emmet County |
| Brett | Grems | | City Council<br>Gruver Fire | Gruver |
| Cathy | Wibert | City Clerk | City of Ringsted | Ringsted |
| Elizabeth | Burton | City Clerk/Finance Director | City of Estherville | Estherville |
| Christy | Mintah | Emergency Preparedness Coordinator | Avera Holy Family Hospital | Estherville |
| Gregory | Buum | Mayor | City of Armstrong | Armstrong |
| Jarrod | Fischer | Mayor/Fire Chief | City of Wallingford | Wallingford |
| Laura | Haburn | Facilities Specialist | Iowa Lakes Community College | ILCC |
| Delaine | Hiney | Executive Director | Iowa Lakes Community College | ILCC |
| Kyle | Karsjen | Project Manager | Wood PLC | Wood PLC |

Kyle Karsjen, with Wood PLC (formerly Amec Foster Wheeler), the firm contracted to assist in the development of the Emmet County multi-jurisdictional hazard mitigation plan update, facilitated the meeting.

**Note: The PowerPoint presentation utilized during the meeting is available, along with other planning materials at the following location:** https://drive.google.com/open?id=1zAWF_jSGK1syYW9c6i6veGT3HbI2pgeM

### Review Purpose/Participation Status

Kyle provided a brief recap of the purpose of the Hazard Mitigation Plan and the Disaster Mitigation Act of 2000 that codified the requirement of local governments to adopt a hazard mitigation plan to maintain eligibility for FEMA Hazard Mitigation Assistance Grants. The nine-task planning process was summarized and participants were informed that at the conclusion of the meeting, the planning committee will have completed at least portions of Tasks 1-6.

A review of the requirements for jurisdictions to officially participate in the Multi-jurisdictional Hazard Mitigation Plan was provided. Kyle presented a summary of participation requirements met by each jurisdiction. Communities are asked to return info as soon as possible. Kyle will follow up with participation requirements and needs separately.

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## Public Survey Results

Kyle presented a summary of the public survey results; 150 surveys were completed. Survey responses showed that of the hazards evaluated, the top three in terms of probability of occurrence were Thunderstorm/Lightning/Hail, Severe Winter Storm and Tornado/ Windstorm. The top three hazards in terms of potential magnitude were Tornado/Windstorm, Severe Winter Storm, and Thunderstorm/Lightning/Hail.

## Mitigation Strategy

Kyle reviewed the following information related to update of the mitigation strategy:

- Plan Goals
- Previous Actions from Previous Plan
- Key Issues from Risk Assessment (identified hazards)
- FEMA's Mitigation Ideas booklet
- State Priorities for Hazard Mitigation Assistance Grants
- Public Opinion from Surveys

## Goals

To facilitate discussion and ideas on new actions that jurisdictions may want to submit to the plan update, Kyle reminded the planning of the plan goals that were updated at meeting #2; note that Goal 1 has been edited.

- **Goal 1: Reduce and mitigate natural hazards that cause injuries, illness, deaths, property loss, utility service disruption and economic loss**
- Goal 2: Protect critical facilities, infrastructure and jurisdictional operations from disruptions due to hazard impacts
- Goal 3: Educate the public on natural hazards and what necessary information is needed to protect themselves and their property

## Previous Actions

The group reviewed mitigation actions present in the previous Emmet County Mitigation Plan. Kyle discussed status updates for previous actions. Previous actions that are considered "continue in-progress" or "continue not started" will be included as mitigation actions in the new plan.

The group discussed necessary information for mitigation actions included in the new plan. Kyle will develop a first draft of the county mitigation strategy based on strategy feedback received, which will be shared with the HMPC members. Each community is asked to provide a mitigation action worksheet for any new or continuing action in the plan.

## Key Issues

Key issues/problem statements for selected hazards in the risk assessment were discussed, and a handout was provided. The discussion was geared toward identifying any gaps that may exist between the problems identified and actions already developed to address the problems. The planning committee was encouraged to develop new actions to fill any gaps. Planning

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committee members will work with others in their jurisdiction to determine any additional new mitigation actions that are necessary for the hazards in the plan.

## FEMA Requirements - Actions

Kyle reminded the group of FEMA's requirements for mitigation actions in the new mitigation plan:

- Each jurisdiction must have AT LEAST ONE new or continuing mitigation action
- There must be AT LEAST ONE new or continuing mitigation action for each hazard identified in the plan

## FEMA Mitigation Ideas Booklet

A link to FEMA's Mitigation Ideas Booklet at http://www.fema.gov/hazard-mitigation-planning-resources was provided to the HMPC; the document can be accessed directly at https://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf. The PDF document of this Mitigation Ideas Booklet was shown to the planning committee and action ideas were reviewed for several of the hazards. Jurisdictions were encouraged to review this document with others in their jurisdiction to determine final mitigation actions to submit to the plan update.

## State Priorities

Kyle also discussed the priorities set by the Iowa Homeland Security and Emergency Management Division for use of Hazard Mitigation Assistance Grants, as well as the results of the public survey related to mitigation actions that the public considers important and effective. Per Iowa Homeland Security and Emergency Management, the two biggest current state priorities are property acquisition and structure demolition and relocation, though shovel-ready projects are also a priority.

## Public Opinion

The survey results for the question asking the public about the mitigation actions that they felt should be considered resulted in the following percent of public support for each action type presented:

| | |
|---|---|
| Electrical Utilities Infrastructure Retrofit (i.e. strengthening lines/connections to withstand ice/wind damages, burying power lines) | 80.14% |
| Minor Localized Flood Reduction Projects (stormwater management or other localized flood control projects) | 62.33% |
| New Tornado Safe Room Construction | 58.90% |
| Structural Retrofitting of Existing Buildings to Add a Tornado Saferoom | 54.11% |
| Soil Erosion Stabilization | 45.21% |
| Flood-prone Property Acquisition & Structure Demolition/Relocation | 42.47% |
| Retrofitting of Existing Buildings and Facilities to Prevent Wind Damage | 38.36% |
| Flood-prone Structure Elevation | 33.56% |
| Wildfire Mitigation | 33.56% |
| Floodproofing of Historical and/or Non-residential Structures | 26.03% |
| Other (please specify) | N/A |

amec foster wheeler Page 3

## Action Plans

Kyle discussed the excel spreadsheet that has been created capturing each jurisdiction's previous actions and the updated status. The spreadsheet has been emailed to the planning committee members and is uploaded to the Google Drive account with these minutes. The spreadsheet reflects all updates from the action plan discussion at the meeting, as well as any new additional mitigation actions discussed during the meeting. The spreadsheet can be sorted by community; if you need any assistance or the information in a different format, please let Kyle know.

Jurisdictions must provide a completed Action Plan Worksheet for all continuing and all new actions; jurisdictions can also just fill this data in on the spreadsheet instead if they choose.

Communities participating in the National Flood Insurance Program were informed that they must have at least one action addressing continued compliance with the National Flood Insurance Program; these actions have been added to the updated action list. NFIP jurisdictions are:

- Unincorporated Emmet County
- Estherville
- Wallingford

**The due date for completion and return of Action Plan worksheets for ALL continuing and ALL new actions is May 25, 2018.**

In discussing the action plans, the concept of cost-effectiveness of actions was discussed. For planning purposes, benefits will be recorded for each action in qualitative terms. For example, an action to construct a community safe room will provide life-safety benefits. Kyle explained that for actions that will be submitted as Hazard Mitigation Assistance grant applications, a quantitative benefit-cost analysis must be completed to demonstrate that the benefits that will be realized after implementation outweigh the cost of completing the project. FEMA has benefit-cost analysis modules available for this purpose.

## Hazard Mitigation Assistance Grants

The Hazard Mitigation Plan is a requirement for jurisdictions to be eligible to apply for FEMA's Hazard Mitigation Assistance Grants. Jurisdictions were informed that Iowa's Homeland Security and Emergency Management Department is the State agency responsible for administration of these grants. Kyle also presented a list of agencies and grant programs of other state and federal grants that fund mitigation activities.

## Plan Implementation

The communities discussed how the previous plan had been implemented in conjunction with previous planning efforts over the last five years, and how the new plan will be implemented in conjunction with planning efforts through 2023. Attendees at the meeting filled out Integration in Existing Planning Mechanisms questionnaires for their communities; communities that did not attend the meeting will need to return this questionnaire as part of their required documentation.

amec foster wheeler Page 4

## Plan Maintenance

Kyle discussed the requirements for the plan to provide a formal plan maintenance process to ensure that the mitigation plan remains an active and relevant document. After discussion, the following plan maintenance process is proposed:

- The HMPC will meet annually to review the Hazard Mitigation Plan;
- The Emmet County Emergency Management Coordinator will organize the meetings;
- After the annual review, the Emergency Management Coordinator will forward the updated Mitigation Strategy with status updates to mayors, city clerks, and school superintendents for consideration in other planning mechanisms/discussions;
- The Emmet County Emergency Management Coordinator will coordinate the formal plan update/re-submittal to IA HSEMD and FEMA every 5 years;
- The public will be involved in the plan maintenance process by publication of a Press Release indicating the team has met with a summary of mitigation action status updates and highlights of specific completed mitigation actions, as applicable.

## Next Steps

The meeting concluded with a discussion of the remaining steps to complete the planning process as follows:

- **ASAP** — **Data Collection Guides/Missing Action Statuses**
- May 25, 2018 — Project Worksheets for all new and all continuing actions due
- June 2018 — Final draft for committee review
- August 2018 — Final public comment period/State review
- October 2018 — Submit Plan to FEMA
- November 2018 — Anticipate FEMA's "Approval (Pending Adoption)"
- December 2018 — Jurisdictions adopt plan

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## B.11 Meeting #3 Sign-In Sheets

**EMMET COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE**
**MEETING #3—SIGN-IN SHEET**

| | | | |
|---|---|---|---|
| **Project:** | Emmet County, Iowa Multi-jurisdictional Hazard Mitigation Plan Update | **Meeting Date/Time:** | March 27, 2018<br>5:30-7:30 pm |
| **Facilitator:** | Kyle Karsjen, Amec Foster Wheeler | **Place/Room:** | Iowa Lakes Community College, Room 29<br>300 South 18th Street, Estherville IA |

| Name | Title | Department/Agency | Email | Phone # | Signature |
|---|---|---|---|---|---|
| Ben Juhl | Supervisor | Emmet Co. | bdjuhl@hotmail.com | 712-209-1140 | Ben Juhl |
| Kathy Preston | Nurse Administrator | Emmet County Public Health | kpreston@emmetcountyia.com | 712-362-2490 | Kathy Preston |
| Mike Martens | Emmet Co Sheriff | Emmet County Sheriffs office | mmartens@emmetcountyia.com | 712-362-2639 | |
| Brett grems | gruver | gruver Fire City council | brettgrems@dgmail.com | 712-380-2815 | Brett Grems |
| Cathy Wibert | City Clerk | City of Ringsted | cityhall@ringsted.com | 712-866-0807 | Cathy Wibert |
| Elizabeth Burton | City Clerk/ Finance Dir | City of Estherville | b.burton@cityofestherville.org | 712-362-9771 | Elizabeth Burton |
| Christy Mintah | Emergency Preparedness Coordinator | Avera Holy Family Hospital Estherville | christy.mintah@avera.org | 712-362-6405 | Christy Mintah |
| Gregory W. Byum | MAYOR | City of Armstrong | cityofarmstrong@gmail.com | 712-260-9309 | Gregory W. Byum |
| Jason Fischer | Mayor Fire Chief | City of Wallingford | wcfd@rvtc.net | 7123305859 | |
| Laura Haburn | Facilities Specialist | Iowa Lakes Comm. College | lhaburn@iowalakes.edu | 712.362.0420 | |

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## EMMET COUNTY MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN UPDATE
## MEETING #3—SIGN-IN SHEET

| | | | |
|---|---|---|---|
| **Project:** | Emmet County, Iowa Multi-jurisdictional Hazard Mitigation Plan Update | **Meeting Date/Time:** | March 27, 2018<br>5:30-7:30 pm |
| **Facilitator:** | Kyle Karsjen, Amec Foster Wheeler | **Place/Room:** | Iowa Lakes Community College, Room 29<br>300 South 18th Street, Estherville IA |

| Name | Title | Department/Agency | Email | Phone # | Signature |
|---|---|---|---|---|---|
| Delaine Hiney | Ex Director Facilities Management | Iowa Lakes Community College | dhiney@iowalakes.edu | 712-362-0428 | Delaine Hiney |
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## B.12 Public Notice During Drafting Stage

## B.13 Plan Summary/Questionnaire for Public Comment during Drafting Stage

Online Survey was available at SurveyMonkey.com and hard copies were available at post office locations throughout the County.

### Public Survey: Emmet County Multi-jurisdictional Hazard Mitigation Plan

The federal government requires all states and local governments to have hazard mitigation plans approved by FEMA that are consistent with the Disaster Mitigation Act of 2000. This is required to maintain eligibility for certain types of federal Hazard Mitigation Assistance Grants. Mitigation planning is the process of identifying hazards to which jurisdictions are at risk as well as development of actions that will reduce or prevent damages from those hazards.

A planning committee comprised of representatives from Emmet County, the incorporated cities, public school districts, and other stakeholders including private businesses, private non-profits, and others is currently developing an update to the comprehensive Emmet County Multi-Jurisdictional Hazard Mitigation Plan with a strategy to reduce the vulnerability of people and property in the planning area to the impacts of hazards and to remain eligible for mitigation funding programs from FEMA.

One of the key components of a hazard mitigation plan is public input during the planning process. The planning committee will be evaluating information on the hazards that impact each jurisdiction within Emmet County. The committee is seeking your input on the hazards that will be evaluated as well as your opinions on the types of activities that should be considered to reduce future impacts. Your comments will be considered by your community's representatives on the planning committee as the plan is developed. Please take a few moments to answer the following questions. Thank you for your participation.

1. Please select your jurisdiction from the list. You may only select one jurisdiction for each survey completed. If you belong to more than one jurisdiction in this list, please complete multiple surveys.

- ☐ Unincorporated Emmet County
- ☐ City of Armstrong
- ☐ City of Dolliver
- ☐ City of Estherville
- ☐ City of Gruver
- ☐ City of Halfa
- ☐ City of Ringsted
- ☐ City of Wallingford
- ☐ Other _____
- ☐ North Union Public School District
- ☐ Estherville-Lincoln Public School District

2. The hazards addressed in the Multi-Jurisdictional Hazard Mitigation Plan Update are listed below. Please indicate your opinion on the likelihood for each hazard to impact YOUR JURISDICTION (identified above).
**Please rate EACH hazard 1 through 4 as follows:**
**1=Unlikely, 2=Occasional, 3=Likely, 4=Highly Likely**

- ☐ Animal/Plant/Crop Disease
- ☐ Dam/Levee Failure
- ☐ Drought
- ☐ Earthquake
- ☐ Expansive Soils
- ☐ Extreme Heat
- ☐ Flash Flood
- ☐ Grass or Wildland Fire
- ☐ Hazardous Materials Incident
- ☐ Human Disease
- ☐ Infrastructure Failure
- ☐ Landslide
- ☐ Radiological Incident
- ☐ River Flooding
- ☐ Severe Winter Storm
- ☐ Sinkholes
- ☐ Terrorism
- ☐ Thunderstorm/Lightning/Hail
- ☐ Tornado/Windstorm
- ☐ Transportation Incident

Optional Online Survey: https://www.surveymonkey.com/r/Emmet-CO-IA

# Public Survey: Emmet County Multi-jurisdictional Hazard Mitigation Plan

3. Please indicate your opinion on the potential magnitude of each hazard's impact on YOUR JURISDICTION (identified above). **Please rate EACH hazard 1 through 4 as follows: 1=Negligible, 2=Limited, 3=Critical, 4=Catastrophic**

- ☐ Animal/Plant/Crop Disease
- ☐ Dam/Levee Failure
- ☐ Drought
- ☐ Earthquake
- ☐ Expansive Soils
- ☐ Extreme Heat
- ☐ Flash Flood
- ☐ Grass or Wildland Fire
- ☐ Hazardous Materials Incident
- ☐ Human Disease
- ☐ Infrastructure Failure
- ☐ Landslide
- ☐ Radiological Incident
- ☐ River Flooding
- ☐ Severe Winter Storm
- ☐ Sinkholes
- ☐ Terrorism
- ☐ Thunderstorm/Lightning/Hail
- ☐ Tornado/Windstorm
- ☐ Transportation Incident

4. FEMA Hazard Mitigation Assistance Grants can fund projects identified in the Hazard Mitigation Plan. These grants are administered by the Iowa Homeland Security & Emergency Management Department. Listed below are some types of projects considered.
**Please check all those that could benefit your jurisdiction, in your opinion:**

- ☐ Flood-prone Property Acquisition & Structure Demolition /Relocation
- ☐ Flood-Prone Structure Elevation
- ☐ Dry Floodproofing of Historical Residential Structures and/or Non-residential Structures
- ☐ Minor Localized Flood Reduction Projects (storm water management or localized flood control projects)
- ☐ Structural Retrofitting of Existing Buildings to Add a Tornado Safe Room
- ☐ Non-structural Retrofitting of Existing Buildings, and Facilities from Wind Damage.
- ☐ New Tornado Safe Room Construction
- ☐ Electrical Utilities Infrastructure Retrofit
- ☐ Soil Erosion Stabilization
- ☐ Wildfire Mitigation
- ☐ Other (please specify)

_____

5. Please comment on any other issues that the Emmet County Hazard Mitigation Planning Committee should consider in developing a strategy to reduce future losses caused by hazard events.

**Return / Contact Information:** Terry Reekers, Coordinator, Emmet County Emergency Mgmt. ema@emmetcountyia.com, 712-362-5702, 114 North 6th St., Suite 3, Estherville, IA 51334

Optional Online Survey: https://www.surveymonkey.com/r/Emmet-CO-IA

## B.14 Announcement for Final Public Comment Period

# APPENDIX C: COMPLETED/DELETED MITIGATION ACTIONS

The table below provides the disposition of actions from the previous Emmet County Hazard Mitigation Plan that the jurisdictions did not continue forward in the mitigation strategy of this plan update. This includes actions with the following statuses:

- Completed
- Delete

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment |
|---|---|---|---|
| Armstrong - 6 | Purchase Snow Plow/Truck | Delete | Lack of funds |
| Armstrong - 7 | Good Neighbor Program | Delete | |
| Armstrong - 9 | Outdoor Warning Sirens (build or update) | Completed | None |
| Armstrong - 12 | Building/Zoning Codes | Delete | State Codes |
| Armstrong - 13 | Continue HAZMAT Training (Mason City) | Delete | Courses every year |
| Armstrong - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Armstrong - 15 | Snow Removal Policy | Completed | |
| Armstrong - 17 | Public Education/Awareness | Delete | Ongoing |
| Armstrong - 18 | Maintain Outdoor Warning Sirens | Completed | |
| Armstrong - 19 | Update/Create Local Emergency Plan | Delete | Estherville completed prototype and sent to others; ongoing, ESF review and updated annually |
| Armstrong - 22 | Replace Sewer Lines | Delete | |
| Armstrong - 24 | Look into NFIP Participation | Delete | |
| Armstrong - 26 | Fire Gear PPE | Delete | |
| Armstrong - 27 | List of those of elderly, disabled or medically distressed | Delete | |
| Armstrong - 29 | Backup of City/County Records | Completed | Computer Zone |
| Armstrong - 30 | Create Dry Hydrant | Completed | County completed this action |
| Armstrong - 31 | Enforce Burn Bans | Delete | Ongoing |
| Armstrong - 33 | Sand bags | Delete | Ongoing, 70,000 on hand |
| Armstrong - 36 | Better Connection with DNR | Completed | |
| Armstrong - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Armstrong - 38 | Paramedic equipment | Delete | |
| Armstrong - 39 | Maintain sand bagging plan | Delete | |
| Armstrong - 41 | Test Warning sirens monthly | Completed | ongoing monthly |
| Armstrong - 44 | Monitor Levees and dams | Delete | |
| Armstrong - 45 | Review/update Local operations Plan | Delete | |
| Emmet County - 1 | Enforce Tree Trimming | Delete | Follow up |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment |
|---|---|---|---|
| Emmet County - 3 | Bury Utility Lines | Delete | Determain, bural plans time_ line project. |
| Emmet County - 9 | Outdoor Warning Sirens (build or update) | Delete | None |
| Emmet County - 10 | Watershed study & Implement | Delete | |
| Emmet County - 12 | Building/Zoning Codes | Delete | |
| Emmet County - 13 | Continue HAZMAT Training (Mason City) | Delete | Courses every year |
| Emmet County - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Emmet County - 15 | Snow Removal Policy | Delete | |
| Emmet County - 16 | List Storm Shelters | Completed | Needs to be reviewed |
| Emmet County - 17 | Public Education/Awareness ( Fire Prevention, Hazmat, CPR) | Completed | Ongoing |
| Emmet County - 19 | Update/Create Local Emergency Plan | Delete | Estherville completed prototype and sent to others; ongoing, ESF review and updated annually |
| Emmet County - 22 | Replace Sewer Lines | Delete | Delete |
| Emmet County - 25 | Purchase Portable Pumps | Delete | |
| Emmet County - 26 | Fire Gear PPE | Delete | In Progress as grants and funds allow |
| Emmet County - 28 | Shelter rations (cots, blankets, water, etc.) | Delete | |
| Emmet County - 31 | Enforce Burn Bans | Completed | Ongoing |
| Emmet County - 32 | Affirm Rural Water Connection | Delete | |
| Emmet County - 33 | Stock pile Sand bags | Completed | Ongoing, maintain 70,000 on hand |
| Emmet County - 34 | Determine which areas are most prone to flood | Delete | Ongoing |
| Emmet County - 36 | Better Connection with DNR | Delete | |
| Emmet County - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Emmet County - 41 | Test Warning sirens monthly | Completed | ongoing monthly |
| Emmet County - 42 | Update Transmission Structures | Delete | |
| Emmet County - 43 | Maintain & expand debris removal site | Delete | Ongoing |
| Emmet County - 44 | Monitor Levees and dams | Delete | Ongoing |
| Emmet County - 53 | Energy Conservation Program | Delete | |
| Emmet County - 54 | Improve water quality/quantity | Delete | |
| Emmet County - 55 | Land Stewardship | Delete | |
| Emmet County - 56 | Sustainable Food Production | Delete | |
| Estherville - 1 | Enforce Tree Trimming | Delete | Follow up |
| Estherville - 2 | Backup Power Generator (buy) | Delete | HS has one, staged in Emmet Co.; yearly inspection |
| Estherville - 4 | NOAA Weather Radios (buy/distribute) | Delete | Have given some away, would do more with funding |
| Estherville - 5 | Designating Community Shelter | Delete | Have old(?) list for most(?) communities |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment |
|---|---|---|---|
| Estherville - 6 | Purchase Snow Plow/Truck | Delete | Lack of funds |
| Estherville - 7 | Good Neighbor Program | Delete | |
| Estherville - 8 | Tornado Safe Room (build) | Delete | 1 completed at Tuttle Lane |
| Estherville - 9 | Outdoor Warning Sirens (build or update) | Completed | None |
| Estherville - 11 | Promote Landscaping Practices | Delete | |
| Estherville - 12 | Building/Zoning Codes | Completed | Completed 2017 |
| Estherville - 13 | Continue HAZMAT Training (Mason City) | Delete | Courses every year |
| Estherville - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Estherville - 15 | Snow Removal Policy | Delete | |
| Estherville - 16 | List Storm Shelters | Delete | Needs to be reviewed |
| Estherville - 17 | Public Education/Awareness | Delete | Ongoing |
| Estherville - 19 | Update/Create Local Emergency Plan | Delete | Estherville completed prototype and sent to others; ongoing, ESF review and updated annually |
| Estherville - 25 | Purchase Portable Pumps | Delete | |
| Estherville - 26 | Fire Gear PPE | Delete | In Progress as grants and funds allow |
| Estherville - 27 | List of those of elderly, disabled or medically distressed | Delete | |
| Estherville - 28 | Shelter rations (cots, blankets, water, etc.) | Delete | |
| Estherville - 29 | Backup of City/County Records | Completed | |
| Estherville - 31 | Enforce Burn Bans | Delete | Ongoing |
| Estherville - 32 | Affirm Rural Water Connection | Delete | |
| Estherville - 33 | Sand bags | Delete | Ongoing, 70,000 on hand |
| Estherville - 34 | Determine which areas are most prone to flood | Delete | Ongoing |
| Estherville - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Estherville - 39 | Maintain sand bagging plan | Delete | |
| Estherville - 43 | Maintain & expand debris removal site | Delete | |
| Estherville - 44 | Monitor Levees and dams | Delete | |
| Estherville - 45 | Review/update Local operations Plan | Delete | |
| Gruver - 2 | Backup Power Generator (buy) | Completed | HS has one, staged in Emmet Co.; yearly inspection |
| Gruver - 3 | Bury Utility Lines | Delete | |
| Gruver - 5 | Designating Community Shelter | Completed | Have old(?) list for most(?) communities |
| Gruver - 6 | Purchase Snow Plow/Truck | Delete | Lack of funds |
| Gruver - 7 | Good Neighbor Program | Delete | unknown |
| Gruver - 12 | Building/Zoning Codes | Delete | |
| Gruver - 13 | Continue HAZMAT Training (Mason City) | Delete | Courses every year |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment |
|---|---|---|---|
| Gruver - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Gruver - 15 | Snow Removal Policy | Delete | |
| Gruver - 16 | List Storm Shelters | Delete | Needs to be reviewed |
| Gruver - 18 | Maintain Outdoor Warning Sirens | Completed | Need New |
| Gruver - 20 | Clean/Enlarge Sewage Lagoons | Delete | |
| Gruver - 24 | Look into NFIP Participation | Delete | |
| Gruver - 26 | Fire Gear PPE | Delete | In Progress as grants and funds allow |
| Gruver - 32 | Affirm Rural Water Connection | Delete | |
| Gruver - 33 | Sand bags | Completed | Ongoing, 70,000 on hand |
| Gruver - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Gruver - 38 | Paramedic equipment | Delete | |
| Gruver - 41 | Test Warning sirens monthly | Completed | ongoing monthly |
| Gruver - 48 | Maintain Rescue Equipment | Delete | |
| Gruver - 50 | Clean up equipment list | Delete | |
| Gruver - 51 | Fuel tanks for emergencies | Delete | |
| Ringsted - 1 | Enforce Tree Trimming | Completed | Follow up |
| Ringsted - 3 | Bury Utility Lines | Delete | |
| Ringsted - 4 | NOAA Weather Radios (buy/distribute) | Delete | Given away at the County level |
| Ringsted - 5 | Designating Community Shelter | Completed | Have old(?) list for most(?) communities |
| Ringsted - 6 | Purchase Snow Plow/Truck | Completed | |
| Ringsted - 7 | Good Neighbor Program | Delete | |
| Ringsted - 9 | Outdoor Warning Sirens (build or update) | Completed | |
| Ringsted - 13 | Continue HAZMAT Training (Mason City) | Completed | |
| Ringsted - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Ringsted - 15 | Snow Removal Policy | Completed | Community snow ordinance is in place |
| Ringsted - 17 | Public Education/Awareness | Completed | Ongoing |
| Ringsted - 19 | Update/Create Local Emergency Plan | Delete | Estherville completed prototype and sent to others; ongoing, ESF review and updated annually |
| Ringsted - 20 | Clean/Enlarge Sewage Lagoons | Completed | |
| Ringsted - 22 | Replace Sewer Lines | Completed | |
| Ringsted - 26 | Fire Gear PPE | Completed | |
| Ringsted - 27 | List of those of elderly, disabled or medically distressed | Delete | Handled by County |
| Ringsted - 29 | Backup of City/County Records | Completed | |
| Ringsted - 31 | Enforce Burn Bans | Completed | Ongoing |

| Action ID | Action Title | 2018 Action Status | 2018 Action Status Comment |
|---|---|---|---|
| Ringsted - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Ringsted - 41 | Test Warning sirens monthly | Delete | This is already done annually in Ringsted |
| Ringsted - 43 | Maintain & expand debris removal site | Delete | No site identified for debris in Ringsted |
| Ringsted - 44 | Monitor Levees and dams | Delete | |
| Ringsted - 46 | Deeper well | Completed | |
| Ringsted - 47 | Water Restriction Plan | Delete | |
| Wallingford - 1 | Enforce Tree Trimming | Completed | In Zoning |
| Wallingford - 2 | Backup Power Generator (buy) | Completed | HS has one, staged in Emmet Co.; yearly inspection; Installed at Fire Station |
| Wallingford - 5 | Designating Community Shelter | Delete | Have old(?) list for most(?) communities |
| Wallingford - 6 | Purchase Snow Plow/Truck | Completed | Contracted Out |
| Wallingford - 7 | Good Neighbor Program | Delete | |
| Wallingford - 12 | Building/Zoning Codes | Delete | Go by state codes |
| Wallingford - 13 | Continue HAZMAT Training (Mason City) | Delete | Courses every year |
| Wallingford - 14 | Continue Fire Dept. Training | Delete | Training every year |
| Wallingford - 15 | Snow Removal Policy | Delete | |
| Wallingford - 16 | List Storm Shelters | Delete | County to complete |
| Wallingford - 18 | Maintain Outdoor Warning Sirens | Delete | City doesn't have a siren |
| Wallingford - 19 | Update/Create Local Emergency Plan | Delete | Estherville completed prototype and sent to others; ongoing, ESF review and updated annually |
| Wallingford - 23 | Install Riprap | Delete | County project |
| Wallingford - 26 | Fire Gear PPE | Delete | In Progress as grants and funds allow |
| Wallingford - 31 | Enforce Burn Bans | Delete | |
| Wallingford - 32 | Affirm Rural Water Connection | Delete | |
| Wallingford - 33 | Sand bags | Delete | 70,000 on hand; County manages |
| Wallingford - 34 | Determine which areas are most prone to flood | Delete | |
| Wallingford - 37 | Reaffirm Mutual AID | Delete | Verbal agreements affirmed; ongoing |
| Wallingford - 38 | Paramedic equipment | Delete | |
| Wallingford - 41 | Test Warning sirens monthly | Delete | City doesn't have a siren |
| Wallingford - 43 | Maintain & expand debris removal site | Delete | Ongoing |
| Wallingford - 44 | Monitor Levees and dams | Delete | Ongoing |

# APPENDIX D: ADOPTION RESOLUTIONS

<Placeholder for resolutions after FEMA provides approval pending adoption letter>