State of South Dakota Enhanced Hazard Mitigation Plan

APRIL 2024

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1 INTRODUCTION

1.1. Mission Statement and Purpose

The South Dakota State Hazard Mitigation Team (SHMT) reviewed and validated the following mission statement for the state's overall mitigation planning efforts at the June 16, 2021 project kickoff meeting.

To reduce the impacts to life and property from hazards through a long term sustainable statewide mitigation strategy while maintaining economic vitality.

The purpose of the State of South Dakota Enhanced Hazard Mitigation Plan is:

- To guide South Dakota's mitigation program to reduce the impact of or eliminate destructive effects of significant hazards to the state e.g., threats to life and property.
- To serve as a public and private sector reference document and management tool for mitigation activities throughout South Dakota.
- To meet the state planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and other federal and state requirements as detailed in Section 1.1.

1.2. Background

Hazard mitigation as defined by the Federal Emergency Management Agency (FEMA) as any action taken "to reduce loss of life and property by lessening the impact of disasters." These actions are long-term solutions that protect life and property from hazard events by reducing or eliminating long-term risks.

South Dakota's first recorded hazard mitigation efforts took place in the late 1800s. After the 1881 flood of the Vermillion and Missouri Rivers that destroyed the town of Vermillion, the town was relocated on the bluffs behind the former town to prevent another recurrence. This marks the first recorded hazard mitigation effort by a government entity in South Dakota. During the 1950s, the U.S. Army Corp of Engineers placed levees along the Belle Fourche River in Belle Fourche and also placed flash flood containment systems in Fall River County to protect the community of Hot Springs from flash flooding. Following the 1972 Black Hills/Rapid City flood, development was prohibited from the floodway.

Hazard mitigation efforts were also conducted after the Deadwood Fire in 1959. Homestake Mining Company implemented a large Wildfire Urban Interface tree thinning project on private lands around Lead, South Dakota to protect the community from another large forest fire.

South Dakota mitigation efforts have also involved mitigation of landslides. Since 1969, the South Dakota Department of Transportation (SDDOT) has created and implemented engineering and construction methods and procedures for the mitigation of landslides. Over time, these measures were copied by other states and are still in use today. South Dakota has received national recognition for their mitigation leadership.

Currently, the South Dakota Office of Emergency Management (OEM) oversees hazard mitigation grant funding available through FEMA's Hazard Mitigation Assistance programs and supports local implementation of various mitigation projects. Across the State of South Dakota mitigation progress has included multiple outreach and public education campaigns, acquisition and relocation projects to reduce flood damage, drainage improvement projects, road elevation projects, vegetation management to prevent wildfires, power line burials, and much more.

The first State of South Dakota Hazard Mitigation Plan was completed and approved in June 2004, and formally adopted by the State on February 28, 2005. The Plan was updated in 2008, 2011, 2014, and 2019; additionally, the hazard identification and risk assessment (HIRA section) was updated in 2016, 2018 and

2022. This current 2024 revision updates the Plan with new information and analyses, and also brings the Plan into compliance with the requirements for an Enhanced State Hazard Mitigation Plan, as set out in 44CFR§201. South Dakota remains committed to updating this plan every five years, or as new information requires it. The Plan will also be reviewed and evaluated regularly to monitor progress and assess the effectiveness of mitigation activities.

1.3. Plan Organization

This plan demonstrates the state's current and future mitigation actions in an organized fashion consistent with the guidance materials provided by FEMA. The reviewer will note that the section headings and subheadings follow the organization of the Standard and Enhanced State Hazard Mitigation Plan Review Tool. Several appendices accompany this plan. They contain technical data, meeting minutes, and other relevant information that complements the content of this plan.

Section 1 demonstrates the legal authority of this plan through the Governor's adoption and compliance with federal and state laws and regulations. Section 2 documents the planning process for developing this plan, including coordination with local mitigation planning efforts. Section 3 outlines the identified hazards South Dakota is vulnerable to and assesses the risk for each hazard on a per county basis. Section 4 details the statewide capability assessment, to include assessment of local capabilities, and demonstrates coordination/integration with other agencies and programs. Section 5 describes the State's mitigation strategy, along with how the state prioritizes and funds mitigation activities while ensuring funds are used effectively. Section 6 outlines the plan implementation and maintenance process. Each section includes details on how this 2024 plan was updated from the previous 2019 plan.

1.4. Executive Summary

Section 1 – Introduction

This plan is an update of the 2019 State Hazard Mitigation Plan pursuant to the Disaster Mitigation Act of 2000 as amended. This Plan is written in compliance with FEMA's most recent State Mitigation Plan Review Guide dated April 2022. This plan demonstrates the State's current and future mitigation actions in an organized fashion similar to the guidance materials provided by FEMA.

The South Dakota Hazard Mitigation Team (SHMT), led by the director of the South Dakota Office of Emergency Management and charged by the governor with the responsibility of implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended), recommended that this 2024 revised and updated Enhanced Hazard Mitigation Plan be adopted by the governor. Governor Kristi Noem adopted the revised Plan on DATE.

Section 2 – Planning Process

The 2024 Plan update process was conducted in full accordance with DMA2000 requirements and other FEMA guidance. As with previous SHMP updates, the SHMT served as the primary planning team during the 2024 update, with technical assistance from the consulting team of WSP USA Environment & Infrastructure, Inc. The core leadership of the State Hazard Mitigation Team consists of one representative from each state and regional department or agency with mitigation responsibilities. The South Dakota Silver Jackets again functioned as a core coordination element for involving relevant federal stakeholders and conducted meetings jointly with the SHMT. Three face-to-face meetings were supplemented by numerous phone calls and email exchanges. A draft version of the plan was made available to the entire SHMT and Silver Jackets for comment and was also made available for public comment.

Section 3 – Hazard Identification and Risk Assessment

The state HIRA was completely revised in 2022 to add new hazard events and information. Past disaster history was reviewed, future trends were analyzed, and hazards were evaluated based on probability of occurrence, primary & secondary impacts, and the area affected. Input from local hazard mitigation plans as well as the results of a Rural Electric Cooperative survey were also incorporated. The following hazards were determined to be the greatest concern statewide and are profiled in detail in this plan.

Table 1-1 Hazard Ranking and Planning Consideration

Hazard Type and Ranking		Planning Significance Based on Hazard Level
1	Flooding (flash, long-rain, snowmelt, and dam or levee failure)	High
2	Winter Storms	High
3	Wildfires	High
4	Drought	High
5	Tornadoes	Medium
6	Summer Storms	Medium
7	Windstorm	Medium
8	Agricultural Pests and Diseases	Medium
9	Hazardous Materials	Medium
10	Geological Hazards (Landslide, Mudflow, Expansive Soils, Earthquake)	Low

The hazard rankings are based on the geographic extent, probability of occurrence, and potential magnitude/severity of each hazard. Overall significance is given for the state as a whole, although significance can vary greatly in different parts of the state. Section 3.1 further details the process for developing the planning significance rating.

The vulnerability of each county and tribe was also evaluated based on population, growth and development patterns, social vulnerability, past disaster declarations, and building exposure. The vulnerability of state facilities was also assessed separately.

Section 4 – State Capability Assessment

The state has established a comprehensive, multi-directional state hazard mitigation program. State mitigation initiatives are integrated with FEMA programs and are designed to focus federal and state programs in support of local planning efforts. State mitigation planning is integrated with other state emergency management efforts as well as other state and regional planning initiatives.

True success in reducing the statewide risk of all hazards requires strong collaboration among state agencies, federal agencies, and local and tribal governments. Thus, the Enhanced State Hazard Mitigation Plan (ESHMP) is closely linked to a number of statewide and local planning initiatives. Throughout the 2024 Plan update process, other plans, programs, and initiatives were reviewed to ensure they were integrated into the Plan. Section 4 outlines the capabilities and activities of state agencies that support hazard mitigation, and how those programs are integrated with the ESHMP. The integration of the State Hazard Mitigation Plan with other state planning initiatives primarily occurs through, the assessment of state capabilities, data-sharing between different plans, through participation on planning committees, and policy commissions.

Supporting local mitigation efforts is a top priority for the state. In order to prioritize these needs, an assessment of local capabilities is included in Section 4.6. That section also summarizes local risk reduction capabilities, as well as completed and identified mitigation actions noted within the LHMPs.

Section 5 – Mitigation Strategies

Since the development of the first State Hazard Mitigation Plan in 2004, South Dakota has achieved significant progress in reducing risks to natural hazards. Section 5.1 lists six goals of the state mitigation program, as revised during the 2024 update process:

Goals:

1 **Reduce injuries and loss of life from natural hazards.**
2 **Reduce damage to existing and future structures within hazard areas.**
3 **Reduce the losses to critical facilities, utilities, and infrastructure from hazards.**
4 **Reduce impacts to the economy, the environment, and cultural resources from hazards.**
5 **Support and assist local mitigation capabilities and efforts.**
6 **Increase partnerships with tribal nations.**

The goals are purposefully applicable to all of the identified hazards and intended to encompass all mitigation needs identified by the state as well as local communities. One or more objectives were identified for each goal to provide more detailed direction.

Many of the mitigation actions identified in the 2019 Plan remain ongoing. Section 5.2 presents the current ongoing and new mitigation actions as confirmed by the SHMT during the 2024 update process. Progress made since the 2019 Plan update is noted for each action.

Funding sources used for mitigation projects are described in Section 5.3, along with other potential funding sources identified by the SHMT. Section 5.4 discusses the effective use of mitigation funding, to include determining loss avoidance, measuring effectiveness, and integrating mitigation into post-disaster recovery operations.

Section 6 – Plan Maintenance Procedures

The SHMT meet regularly throughout the year and as needed following disaster events. They will review this Plan at least annually, to include a review of mitigation goals and objectives to ensure they remain relevant. The status of ongoing mitigation actions will also be reviewed, and implementation notes and/or progress notes added as available. The SHMT will also meet following every declared disaster to determine if any mitigation projects were impacted by the disaster, and whether or not it is possible to evaluate the effectiveness of those projects in reducing losses or damage. The state will participate in an annual consultation with FEMA that will include a review of the enhanced plan criteria to remain in good standing.

The South Dakota Office of Emergency Management (OEM) will continue to review applications for submittal for FEMA Hazard Mitigation Assistance (HMA) grants. OEM may also maintain a list of proposed or contemplated actions that could quickly be turned into applications for new projects when other grant funds become available.

The state will submit an updated Enhanced Hazard Mitigation Plan to FEMA for review and approval every five years, as required by DMA 2000.

1.5. Compliance with Federal and State Laws and Regulations

44 CFR Part 201.4 Requirement:
The plan must: Include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR parts 200 and 3002. The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes).

This plan is prepared to comply with the requirements of:

- The Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 as amended by Public Law 106-390, October 30, 2000 United States Code Title 42. Public Health and Welfare Chapter 68. Disaster Relief [As amended by Pub. L. 103-181, Pub. L. 103-337, and Pub. L. 106-390] (Pub. L. 106-390, October 30, 2000, 114 Stat. 15521575) hereafter referred to as the Disaster Mitigation Act of 2000 (DMA 2000);
- All pertinent presidential directives associated with the U.S. Department of Homeland Security and FEMA;
- All aspects of 44 CFR pertaining to hazard mitigation planning and grants pertaining to the mitigation of adverse effects of disasters (natural, manufactured, and other);
- All interim and final rules pertaining to hazard mitigation planning and grants, as described above;
- All planning criteria issued by FEMA, to include the most recent State Mitigation Plan Review Guide dated April 2022; and
- All Office of Management and Budget circulars and other federal government documents, guidelines, and rules.

In accordance with Federal regulation, 44 CFR § 201.4(a), states must have an approved state mitigation plan meeting the requirements in 44 CFR § 201.4 as a condition of receiving certain non-emergency Stafford Act assistance and FEMA mitigation grants, including the Hazard Mitigation Grant Program (HMGP), the Building Resilient Infrastructure and Communities (BRIC) program, which replaced the Pre-Disaster Mitigation (PDM) program, and the Flood Mitigation Assistance (FMA) Program, all of which are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. State mitigation plans must be submitted to FEMA for approval every five years in order to maintain eligibility. Additional information about how the plan will be reviewed and updated is in Section 6.

The state complies with all administrative requirements outlined in 2 CFR parts 200 and 3002 in their entirety and to monitor all Sub-recipients supported activities to ensure compliance with 2 CFR parts 200 and 3002 in their entirety. The state also requires all sub-recipients receiving $750,000 or more in federal assistance to have an audit conducted in accordance with the Single Audit Act under 44 CFR 14, Administration of Grants: Audits of State and Local Governments. Such reports by an independent certified public accountant will be maintained by OEM. All general audit requirements in 44 CFR 14 will be adhered to by OEM as well as sub-recipients receiving FEMA hazard mitigation grant awards.

This plan also complies with and implements all relevant State of South Dakota laws, regulations, and policies as detailed in Section 4.2.2.

1.6. Adoption by the State

44 CFR Part 201.4 Requirement:
The plan must: Be formally adopted by the State prior to submittal to [FEMA] for final review and approval.

Governor M. Michael Rounds adopted the original State of South Dakota Hazard Mitigation Plan by letter dated February 28, 2005. Subsequent plan adoptions were completed in 2007, 2011, 2014, and 2019. These letters are included on the following pages to demonstrate the legacy of the State of South Dakota's commitment to hazard mitigation.

The State Hazard Mitigation Team, led by the director of the South Dakota Office of Emergency Management and charged by the Governor with the responsibility of implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (P.L. 93-288, as amended), directed this most recent Plan update, and on ______ presented it to the Governor and recommended it for adoption. Governor Noem adopted the 2024 Plan on ______.

The state will continue to comply with all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with § 13.11 (c). As reflected in Section 6 Plan Implementation and Maintenance, the state will amend its plan when necessary to reflect changes in state or federal laws and statutes as required in §13.11 (d), or in the event of significant changes to the state's hazards or capabilities.

This page to be replaced with signed adoption letter for 2019.

2 PLANNING PROCESS

44 CFR Part 201.4 Requirement:
[The plan must include a] description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated. *The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.*

This section details the planning process conducted during 2023-2024 to revise and update the State of South Dakota Hazard Mitigation Plan (previously adopted on April 8, 2019).

2.1. 2024 Plan Update Process

The planning process for this update formally began in December 2022 and continued through 2024 until the adoption of the plan in April of 2024, prior to the expiration of the former mitigation plan. This process has provided and continues to provide all relevant stakeholders the opportunity to actively participate in the update of this plan. The 2023-2024 planning process was conducted through several virtual and in-person meetings. These meetings are described further in Section 2.3. Related planning efforts with direct linkages to the 2024 process are noted below, which include activities that date back to 2014, 2016, and 2019.

2.1.1. 2022 Hazard Identification and Risk Assessment (HIRA) Update

SD OEM updated the Hazard Identification and Risk Assessment (HIRA) section of the SHMP in 2022. Conducting a full HIRA update in 2022 allowed the 2023-2024 update process to focus more on the mitigation strategy and other sections of the Plan. During the 2023-2024 update, the HIRA was only revised to include hazard events that had occurred since 2022 or other areas where additional data was available and significant; new maps were created only when necessary to reflect significant changes since 2022. The planning process used during the 2022 HIRA update is described further in Section 2.3.

2.1.2. South Dakota Drought Mitigation Plan

The South Dakota Drought Mitigation Plan was created in 2014-2015 to better analyze the hazards, vulnerabilities, and mitigation activities associated with drought. The Drought Plan was meant to serve as a hazard-specific supplement to the SHMP and was included as an attachment in the 2019 Plan. For the 2024 Plan, the Drought Plan has been fully integrated into the SHMP.

2.1.3. Enhanced Plan Process

For the 2019 update, the State of South Dakota pursued and was approved as an Enhanced State Hazard Mitigation Plan in accordance with 44CFR§201.5 and FEMA guidance. An enhanced state mitigation plan documents sustained, proven commitment to hazard mitigation. The enhanced status acknowledges the coordinated effort a state currently is taking to reduce losses, protect life and property, and create safer communities. Approval of an enhanced state mitigation plan by FEMA results in eligibility for increased Hazard Mitigation Grant Program (HMGP) funding.

The 2024 update continues to meet enhanced plan requirements. Additional information and material to meet the requirements of an enhanced plan are incorporated throughout the Plan. The locations of specific enhanced plan elements are summarized in the attached Plan Review Tool.

2.2. Stakeholder Involvement

The State of South Dakota's mitigation planning process has included all relevant stakeholders at the state, regional, local, tribal, and federal levels, as well as private sector entities and the public. The engagement of stakeholders is an ongoing and key aspect of the State's comprehensive mitigation strategy that goes beyond the update of this SHMP. Thus, additional details of the State's integrated hazard mitigation planning program are detailed in Section 4.2 Integrated Hazard Mitigation Planning. Integration with other Federal/National Mitigation Programs and Initiatives is covered in Section 4.5. The following section describes the coordination specific to the update of the 2024 SHMP.

2.2.1. State Hazard Mitigation Team

The South Dakota Hazard Mitigation Team (SHMT) is the principal body responsible for coordinating the state's comprehensive hazard mitigation program. The membership and responsibilities of the SHMT are established via a series of Executive Orders, the most recent being EO 2019-29 dated December 10, 2019. The SHMT consists of one representative from each of the departments and offices listed in the executive order. More details on the SHMT, including membership and designated responsibilities, can be found in Section 4.2.1.

Participation of SHMT Members in the 2023-2024 planning process meetings is captured in Table 2-1 below. The role of the SHMT was revisited at the December 2022 kickoff meeting. The role and participation expectations included:

- Attending planning meetings
- Assisting with data collection
- Reporting on agency mitigation capabilities
- Leveraging funding/programs to maximize benefits
- Providing input to mitigation strategy/actions
- Reviewing the draft of the updated SHMP

2.2.2. Coordination with State and Regional Agencies

As noted above, the SHMT was the primary vehicle for coordinating the plan update with relevant state agencies throughout the planning process. South Dakota's SHMT comprises a broad group of state agency partners and natural hazard SMEs as a part of the USACE Silver Jackets team, encompassing a whole-community approach. These agency partners, summarized in Table 2-1, contribute to South Dakota's mitigation program and the E-SHMP's integrated planning process. These contributions came through various means, including defining capabilities, identifying mitigation funding, providing data and information for the risk assessment, participating in the planning process, contributing to the updated mitigation strategy, and through ongoing review and comment on plan drafts throughout the update. The State Hazard Mitigation Officer (SHMO) communicated regularly via e-mail and follow-up phone calls with members of the SHMT and other stakeholders. The SHMO ensured that everyone on the SHMT was given multiple opportunities to provide input during the planning process.

The 2024 SHMT roster was initially based on involvement in the 2019 E-SHMP update and was continually updated and expanded throughout the planning process. Additional members were added based on SHMT member suggestions and interactions throughout the plan update. Invitations to participate as part of the SHMT and become involved in the 2024 E-SHMP update process originated from SHMO by email and direct conversations.

As was done for the 2019 plan update, the SHMT identified a list of stakeholders from state, regional, local, tribal, and federal agencies to solicit input. Regional stakeholders included Rural Electric

Cooperatives, Regional Planning Districts, and related associations. The involvement of local governments and the public is discussed in Section 2.4. To illustrate how the planning team encompassed all relevant hazards and areas of responsibilities, participating state and regional agencies were cross-walked against the list of identified hazards, and against different impacted sectors (see Section 4.2.4, Tables 4-3 and 4-4).

Table 2-1 shows agency and stakeholder attendance during the planning process, including their participation in the three in-person planning meetings. A complete list of attendees is on file with the SHMO.

Table 2-1 Agency and Stakeholder Participation in the 2023 Planning Process

Stakeholder Organization	Liaison Position	SHMT Member	12/15/22 Meeting	4/6/23 Meeting	6/15/23 Meeting
South Dakota Office of Emergency Management	State Hazard Mitigation Officer	Y	Y	Y	Y
South Dakota Office of Emergency Management	Director		Y		Y
South Dakota Office of Emergency Management	Deputy Director		Y	Y	Y
South Dakota Office of Emergency Management	Hazard Mitigation Specialist		Y	Y	Y
South Dakota Office of Emergency Management	Hazard Mitigation Specialist		Y	Y	Y
South Dakota Office of Emergency Management	Logistics and Admin Branch Team Leader		Y	Y	
South Dakota Office of Emergency Management	State NFIP Coordinator		Y	Y	Y
South Dakota Office of Emergency Management	Recovery and Mitigation Manager		Y	Y	Y
South Dakota Office of Emergency Management	State Planner HMEP Grant Administrator				Y
South Dakota Department of Agriculture & Natural Resources	Natural Resources Engineer III	Y	Y	Y	Y
South Dakota Department of Agriculture & Natural Resources	Natural Resources Engineer III		Y	Y	Y
South Dakota Department of Tribal Relations	Tribal Relations	Y		Y	
South Dakota Department of Agriculture & Natural Resources	Special Projects Coordinator	Y			Y
South Dakota Game, Fish, and Parks	Grants Coordinator				Y
South Dakota Game, Fish, and Parks	Fisheries Program Administrator	Y		Y	Y
South Dakota Office of Risk Management	State Risk Manager	Y		Y	Y
South Dakota Department of Transportation	Operations Maintenance Engineer	Y			Y
South Dakota Governor's Office of Economic Development	Program Accountant	Y		Y	Y
South Dakota State Historic Preservation Office	Review and Compliance Coordinator	Y		Y	Y
South Dakota State University	State Climatologist	Y	Y	Y	Y
Central Electric	Manager of Finance and Administration		Y	Y	

Stakeholder Organization	Liaison Position	SHMT Member	12/15/22 Meeting	4/6/23 Meeting	6/15/23 Meeting
Federal Emergency Management Administration	Senior Community Planner			Y	
Federal Highway Administration	Special Projects & ROW Engineer			Y	
Federal Highway Administration	Division Bridge Engineer		Y		
National Weather Service	Sr. Service Hydrologist			Y	
National Weather Service	Warning Coordinator Meteorologist				Y
United States Army Corps of Engineers	Engineer		Y		
United States Army Corps of Engineers	Engineer		Y		
United States Army Corps of Engineers	Engineer			Y	Y
United States Army Corps of Engineers	Engineer			Y	
United States Geological Survey	Hydrologist		Y		
West Central Electric	Staff Engineer		Y		Y
West River Electric Association	CFO/Manager of Finance		Y	Y	Y

In November 2023, the SHMT reviewed a complete draft of this plan update. All SHMT members reviewed the draft plan, and their comments were incorporated into the final Plan as appropriate.

Additionally, other state agencies were provided a draft of the plan in March 2024 and asked to review and provide feedback. These agencies include those that regulate building codes, housing (including Food, Water, Shelter community lifelines) and those with programs, policies, and assistance that support underserved communities, and other representatives serving these communities. The specific agencies and their input in the ESHMP are noted below:

- South Dakota State Fire Marshal's Office – Provided additional review and input on building codes and capabilities around those.
- South Dakota Housing Development Authority – Provided additional review and input regarding vulnerability of unhoused populations, resulting in expanding this discussion in the hazard sections of Section 3 HIRA.
- South Dakota Bureau of Administration Office of the State Engineer – Provided clarification on role as agency responsible for vertical construction for state owned property.

2.2.3. Tribal Agencies

During the update process outreach was done to all nine federally recognized Tribes in South Dakota. The first outreach occurred in May 2023 through a survey to the Tribal Emergency Managers. The survey solicited input to better understand the vulnerabilities within South Dakota and solicit input on the need to mitigate or reduce the impacts of hazards before they occur. No comments were received. The list of tribes is below:

- Cheyenne River Sioux Tribe

- Crow Creek Sioux Tribe
- Flandreau Santee Sioux Tribe
- Lower Brule Sioux Tribe
- Pine Ridge Reservation
- Rosebud Sioux Tribe
- Sisseton Wahpeton Oyate
- Standing Rock Sioux Tribe
- Yankton Sioux Tribe

The second opportunity was a request for review and input on the draft plan by SDOEM to 19 members of the Tribal Emergency Manager listserv before the plan was finalized in March of 2024. No specific comments were received from this outreach outside of one from the Sisseton Wahpeton Oyate that expressed thanks for including in them in the update process.

2.2.4. Non-profit Organizations

South Dakota Volunteers Active in Disasters (VOAD) also were solicited to review the draft plan prior to finalization in March of 2024. This solicitation came from SDOEM and this group was specifically asked to focus on Section 3: Hazard Identification and Risk Assessment with consideration of how the identified hazards may affect the state's vulnerable populations. Organizations included on the VOAD include:

- Catholic Social Services
- Feeding South Dakota
- Lutheran Social Services
- Red Cross
- Partnership with Native Americans
- Salvation Army

One comment was received that acknowledged the amount of planning that went into putting the ESHMP together.

2.2.5. Private Organizations

In parallel to the update of this plan SDOEM joined forces with the SD Retailers Association to encourage business owners to develop a Continuity of Operations (COOP) plan. These plans serve as a shield against adversity, ensuring businesses are well-prepared for any disaster that may come their way. SDOEM designed a beacon of resilience template for business owners to adopt. This invaluable resource was generously shared with all members of the SD Retailers Association via email and prominently featured in their SD Retailers magazine. Together, we are attempting to build a strong community through unity and foresight, ready to weather any storm. This organization will be tapped into further in future updates of the SHMP.

2.2.6. Coordination with Federal Agencies

As with the 2019 update process, the South Dakota Silver Jackets was the primary mechanism for coordinating the Plan update with relevant federal stakeholders. The Silver Jackets program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce risks associated with flooding and other natural hazards. In South Dakota, the Silver Jackets team consists of the US Army Corp of Engineers, FEMA Region VIII, USGS, National Oceanic and Atmospheric Administration (NOAA)/National Weather Service (NWS), US Department of the Interior Bureau of Reclamation, US Geological Survey (USGS), South Dakota OEM, South Dakota Department of Agriculture and Natural Resources, South Dakota Department of Transportation, and South Dakota Bureau of

Information and Telecommunications. All SHMT meetings were conducted jointly with Silver Jacket meetings to maximize participation while minimizing redundant meetings. See Section 4.5.2 for more information about the Silver Jackets.

The primary federal agencies involved in the planning process are listed in Table 2-1 above and are described in more detail in Section 4.5. Section 4.5.1 discusses the Annual Mitigation Consultation Meetings conducted with FEMA Region VIII since 2019. The summaries of these meetings are included in Appendix F.

2.3. Documentation of the Planning Process

South Dakota OEM oversaw and directed the planning process required to update and revise the Plan for adoption in 2024. The staffing and organization of the OEM Hazard Mitigation Section is described in Section 4.3. OEM contracted with the consulting firm WSP USA Environment & Infrastructure, Inc. (WSP) for technical assistance throughout the process including meeting facilitation, risk assessment expertise, and plan updating and alignment with FEMA Enhanced Plan requirements.

2.3.1. Timeline of the Plan Update Process

The 2023 planning process involved four meetings of the SHMT, Silver Jackets, and consulting team, in addition to meetings with an advisory committee that updated the HIRA on April 27, 2022. These meetings were supplemented by many calls among team members and the contracted consulting staff, as well as general communication via e-mail and digital data sharing to facilitate draft reviews and collection of comments. An overview of those meetings and collaboration results is presented in Table 2-2, and elaborated on in the following sections.

Table 2-2 Overview of 2024 Update Planning Process

Timeframe	Activity
2021-2022	HIRA update
June 16, 2021	HIRA update project kickoff meeting
September 23, 2021	HIRA update meeting
December 16, 2021	HIRA update results overview meeting
2022-2023	ESHMP update
September 21, 2022	Initial coordination meeting
December 15, 2022	ESHMP update project kick-off meeting
March 21, 2023	SD Planning Districts Meeting
April 6, 2023	Mitigation capability assessment update meeting
June 15, 2023	Mitigation strategy workshop meeting
September 21, 2023	Plan update and Drought Plan integration meeting
November 2023	SHMT review of draft plan
December 2023	Public/Stakeholder review period
February 2024	Submittal to FEMA for review and approval
March 2024	Adoption by the State of South Dakota

Meeting invitations, agendas, sign-in sheets, presentations, meeting summaries, and handouts used throughout the planning process are on file with the SHMO.

2.3.2. Planning Meetings

2021-2022 HIRA Update

As discussed above in Section 2.1.1, the South Dakota State Hazard Mitigation Plan update process began in 2021 with the HIRA update. Three meetings were held as part of the 2022 HIRA Update process, as described below. These meetings were supplemented by calls among team members and the contracted consulting staff, as well as general communication via e-mail and digital data sharing to facilitate draft reviews and collection of comments.

The 2022 HIRA update included significant new or updated geographic information systems (GIS) data for analysis of hazards such as flooding, summer and winter storms, wildfire, hazardous materials, and the inclusion of climate change considerations. More specific information on the HIRA update process can be found in Section 3.

HIRA Update Kickoff Meeting, June 16, 2021

This two-hour kickoff meeting was held virtually with the SHMT and other key stakeholders. The meeting agenda was as follows:

- Introductions
- Discussion of objectives and schedule for the HIRA update
- Approach and Tasks
- HIRA update requirements
- New items: Emergency Management Accreditation Program (EMAP) consequence analysis and climate change
- Review and discussion of Identified Hazards
- Data collection needs
- Next steps
- Questions and answers

HIRA Update Meeting, September 23, 2021

Highlights of the updated HIRA were presented to the SHMT during a two-hour virtual meeting. The meeting agenda was as follows:

- Introductions
- Review of Objectives, Requirements, and Schedule for the HIRA Update
- Hazard Identification Update - Significant Disasters/Hazard Impacts in past 5 years
- Critical Facilities and State Assets Update
- FEMA National Risk Index
- Flood Vulnerability Update Approach
- Rural Electric Cooperatives Hazard Vulnerability Survey
- Data Needs and Next Steps
- Questions and Answers

The primary purpose of this meeting was to review the highlights of the updated HIRA and obtain input from the planning team and stakeholders.

HIRA Update Results Overview Meeting, December 16, 2021

The updated HIRA was presented to the SHMT during a final two-hour virtual meeting. The meeting agenda was as follows:

- Introductions
- Summary of Local Hazard Mitigation Plan Hazard/Risk Roll Up
- Rural Electric Cooperatives Hazard Vulnerability Survey
- Application of FEMA National Risk Index Update
- State Assets Analysis Update
- Schedule and Next steps

- Questions and Answers

The primary purpose of this meeting was to review the updated HIRA prior to submission to FEMA.

2023-2024 ESHMP Update

Once the HIRA update was completed, the State began a separate planning process to update the full SHMP, to include integrating the updated HIRA. Four meetings were held as part of this process, as described below. These meetings were supplemented by calls among team members and the contracted consulting staff, as well as general communication via e-mail and digital data sharing to facilitate draft reviews and collection of comments.

Project Kick-Off (Meeting #1), December 15, 2022

The kickoff meeting was held to orient the SHMP and Silver Jackets to the 2023-24 plan update process. Kickoff meeting participants are shown in Table 2-1. The meeting agenda was as follows:

- Hazard Mitigation Planning Process and Requirements
- Role of the SHMT
- Overview of the 2019 Hazard Mitigation Plan and 2021 HIRA Update
- Coordination with Other Agencies, Related Planning Efforts, & Recent Studies
- Planning for Public & Stakeholder Involvement
- Initial Information Needs
- Next Steps
- Questions and Answers

Mitigation Capability Assessment Update (Meeting #2), April 6, 2023

Meeting participants are shown in Table 2-1. This meeting focused on updating the State's mitigation capability assessment, using the following agenda:

- Introduction
- Planning Process Update
- Review of Local Plan Rollup
- Enhanced Plan Considerations
- Review of Hazard Mitigation Goals & Objectives
- Status of Mitigation Actions In 2019 SHMP
- Next Steps

Mitigation Strategy Workshop (Meeting #3), June 15, 2023

The third meeting of the SHMT focused on updating the State's mitigation strategy, including progress on existing mitigation actions as well as the development of new actions. The meeting followed this agenda:

- Introductions
- Hazard Mitigation Planning Process Update
- Social Vulnerability/Equity Discussion
- Types of Mitigation Actions
- Progress on Mitigation Actions From 2019 HMP
- Development of New Mitigation Actions
- Plan Implementation & Maintenance
- Next Steps

Plan Update and Drought Plan Integration (Meeting #4), September 21, 2023

The fourth and final SHMT meeting focused on integrating the 2015 Drought Plan into the ESHMP. The SHMT reviewed elements of the Drought Plan, updated data for 2023, and discussed how much material should be incorporated into the HIRA vs. how much should be moved to an Appendix.

2.3.3. Additional Coordination Between Planning Team & Stakeholders

As discussed in Section 2.2.3 above, SHMT meetings were conducted jointly with the South Dakota Silver Jackets to maximize stakeholder participation. In addition to the specific joint meetings listed above, the Silver Jackets met quarterly throughout the update cycle to discuss risk reduction strategies and activities pertaining to floods and other hazards.

The WSP consultant team met with SD OEM bi-weekly throughout 2023 to ensure the project stayed on track. Frequent email communications between SHMT members and other stakeholders kept the planning process moving between in-person meetings.

2.4. Public Participation

The SHMO or a representative attended the local kick-off meetings for counties and tribes that were awarded grant funds to develop or update LHMPs when it is feasible to do so. The SHMO discussed the SHMP update, the availability of Hazard Mitigation Assistance (HMA funding), and the opportunity to develop mitigation projects to reduce or eliminate the hazards identified in their plans. The SHMO also discussed the SHMP update at quarterly board meetings for the Planning and Development Districts (see Section 4.4.12), and various meetings with the South Dakota Rural Electric Association (see Section 4.4.11).

From December 22, 2023, to January 8, 2024, OEM made the draft plan available for review by the public, local emergency management programs, and other key stakeholders. The plan was made available through a variety of sources:

- The plan was posted on OEM's website.
- A press release was issued announcing the availability of the plan for review:
- Announcements regarding the public review draft were made on Facebook and Twitter by OEM and the South Dakota Department of Agriculture and Natural Resources.
- A flyer was disseminated at the South Dakota Emergency Management Association's conference, as well as the County Commissioners' conference.
- Five public comments were received by the end of the comment period. These comments were reviewed by the SHMT and resulted in several minor edits throughout the document.

2.4.1. Ongoing Public Outreach Since Last Update

OEM continued and expanded on outreach activities used in prior updates. This served to coordinate and integrate mitigation planning throughout the state. Since the last mitigation plan update, OEM created a story map webpage (https://storymaps.arcgis.com/collections/e5e937c388b14fbaa0f2e84beb9888d9) to engage communities in mitigation planning. For the 2024 update process, OEM has continued to use a mitigation brochure (created with assistance from FEMA) in outreach efforts to advertise the idea of mitigation planning and encourage organizations of all types to partner with OEM in mitigating natural hazards.

Beginning in 2016, OEM wrote and distributed a series of four *Tommy the Turtle* children's books, created to educate children on the importance of being prepared for disasters. Each book focuses on one of the state's four top hazards as identified in the HIRA: flooding, severe winter storms, tornadoes, and fires. Copies have been distributed to all 2nd-grade classrooms in the state, along with all dental offices, doctor's offices, and public libraries. The Fire Marshall's office is also distributing the fire books to kids visited by fire departments throughout the state. Tommy the Turtle, in real-life costume character form, has since become an office mascot and spokesperson of sorts for OEM. Tommy regularly visits schools, preparedness events, and local fairs to educate attendees on preparedness activities. Since the last mitigation plan update, Tommy has even starred in hazard-preparedness videos posted on YouTube. (e.g., https://www.youtube.com/watch?v=KDbAPWK3DfE).

In addition, OEM has continued to partner with the Department of Health on their "bReady" campaign to educate the public on preparedness measures. A guidebook, brochures, and information available to the public as part of this campaign can be found at http://www.bready.sd.gov/. The Department of Health advertises this website and publicizes the campaign to schools, daycares, nursing homes, and at every meeting and exercise they operate (e.g., training exercises for the pandemic flu).

Since the 2014 Plan update, OEM has continued to use outreach materials along with several additional outreach campaigns. Current and ongoing campaigns and efforts to improve public outreach include:

- South Dakota Disaster Kits
- Extension Disaster eNetwork (EDEN)
- Community Wildfire Protection Plans
- Rangeland Insurance (cropland insurance is strong)
- Winter weather and severe weather preparedness guides
- Twitter announcements for severe weather
- School safety sessions, including Tommy the Turtle as described above
- Safety classes through South Dakota State University (SDSU) Extension
- Partnership with the Public Utility Commission One Call system
- Information on local warning sirens
- NFIP flood insurance promotion through meetings and ad campaigns. NFIP Coordinator provides information to communities that do not participate in the NFIP. For those who do participate, the NFIP Coordinator assists with the development of mitigation plans
- Encourages floodplain ordinances / policies for local governments
- Public briefings at the beginning of every mitigation grant award.

Other state agencies also conduct preparedness exercises and mitigation outreach. These agencies and some of their relevant public outreach campaigns are listed below.

- Department of Transportation: Buckle Up, Save it For Later, Give 'em a Brake, Don't Crowd the Plow, temperature warnings, highways construction, and hazard notification press releases, safetravelusa.com, 511 Travel Information
- Department of Agriculture and Natural Resources: Drought education, wildfire prevention
- Department of Public Health: Flu campaign
- National Weather Service: Flood safety
- Rural Electric Cooperatives: Electrical safety literature, outreach materials, and public service announcements
- State Historic Preservation Office: Public Education on historic property mitigation
- Drought Task Force: provides a forum for community members affected by drought in which they can ask questions and obtain information.

In addition, OEM continues to provide mitigation materials at their State Fair booth annually. A severe weather preparedness week is funded through the Emergency Management Performance Grant (EMPG). This includes a package of information that goes to schools, local emergency managers, daycares, assisted living centers, and nursing homes. Safe room information is also disseminated from the hazard mitigation office to local emergency managers and floodplain administrators.

3 HAZARD IDENTIFICATION AND RISK ASSESSMENT

44 CFR Part 201 Requirement:
[The State plan must include] Risk assessments that provide the factual basis for activities proposed in the strategy portion of the mitigation Plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments.

The Hazard Identification and Risk Assessment (HIRA) lays the foundation for the South Dakota Multi-Hazard Mitigation Plan. It sets the stage for identifying mitigation goals and activities to help the State become disaster resilient and keep South Dakota residents safe. The major components of this HIRA include a hazard identification/analysis and a vulnerability analysis that answer the following questions: What are the hazards that could affect South Dakota? What can happen as a result of those hazards? How likely is each of the possible outcomes? When the possible outcomes occur, what are the likely consequences and losses, and how does this vary across the state? This section attempts to answer these questions on a hazard-by-hazard basis, based on best available data.

The Federal Emergency Management Agency (FEMA) defines risk assessment terminology as follows:

- **Hazard** - A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Vulnerability** - Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Exposure** - Exposure describes the people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Risk** - Risk depends on hazards, vulnerability, and exposure. It is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. It refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.
- **Risk Assessment** - Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

3.1. Identifying Hazards

44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview of the type…of all natural hazards that can affect the State…

The hazards evaluated in the HIRA include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future. The following resources were used to identify hazards that may affect the State of South Dakota:

- Federal disaster/emergency declarations (see Table 3-3)
- State South Dakota Hazard Mitigation Team (SHMT) and South Dakota Silver Jackets members
- Local hazard mitigation plans covering all 66 counties and six tribal governments
- National Risk Index Data
- Survey of Rural Electric Cooperatives (2021)
- Public input via an online survey (2013)

Based on past disaster history and population and property potentially at risk (numbers and dollars), the following hazards have emerged as the greatest concern statewide and are profiled in detail in this plan:

- Agricultural Pests and Diseases
- Drought
- Floods (flash, long-rain, snowmelt, and dam failure or levee failure floods)
- Geological Hazards (Landslides, Mudflows, Expansive Soils, Subsidence, and Earthquakes)
- Summer Storm (Hail and Lighting)
- Tornadoes
- Wildfire
- Windstorm
- Winter Storm
- Hazardous Materials

The South Dakota Hazard Mitigation Plan has matured over several update cycles, and each time the SHMT has reexamined the hazards that threaten the State. Since 2016 OEM has followed a sequenced update process to its State Plan, with a comprehensive update of the HIRA in 2021 in anticipation of the next overall Plan update in 2024. The SHMT met three times at Silver Jackets quarterly meetings between June and December 2021 to discuss the HIRA update. Wood Environment & Infrastructure Solutions, Inc. was the consultant utilized to prepare the update (now WSP USA Environment & Infrastructure Inc). During the 2021 update, all hazard profiles were updated with recent hazard events occurring since the last time the HIRA was updated during 2016-2018.

During the 2021 HIRA update the overall significance of the hazards were assessed using the methodology summarized in the table below. A hazard ranking survey was conducted with the SHMT during a meeting to assess any significant changes in perceived hazard significance since the 2016 HIRA update. The hazards of greatest significance were identified to be flooding, winter storms, wildfires, and drought.

Table 3-1 South Dakota Hazard Significance Summary Table

Hazard	Geographic Extent	Potential Magnitude / Severity	Probability of Future Occurrence	Overall Significance
Agricultural Pests and Diseases	Limited	Limited	Likely	Medium
Drought	Extensive	Critical	Likely	High
Floods	Significant	Critical	Highly Likely	High
Geological Hazards	Negligible	Negligible	Occasional	Low
Tornadoes	Extensive	Limited	Highly Likely	Medium
Summer Storms	Extensive	Limited	Highly Likely	Medium
Wildfire	Limited	Critical	Highly Likely	High
Windstorm	Extensive	Limited	Highly Likely	Medium
Winter Storm	Extensive	Critical	Highly Likely	High
Hazardous Materials	Negligible	Limited	Highly Likely	Medium

Geographic Extent
Negligible: Less than 10 percent of planning area or isolated single-point occurrences
Limited: 10 to 25 percent of the planning area or limited single-point occurrences
Significant: 25 to 75 percent of planning area or frequent single-point occurrences
Extensive: 75 to 100 percent of planning area or consistent single-point occurrences

Potential Magnitude/Severity
Negligible: Less than 10 percent of property is severely damaged, facilities and services are unavailable for less than 24 hours, injuries and illnesses are treatable with first aid or within the response capability of the jurisdiction.
Limited: 10 to 25 percent of property is severely damaged, facilities and services are unavailable between 1 and 7 days, injuries and illnesses require sophisticated medical support that does not strain the response capability of the jurisdiction, or results in very few permanent disabilities.
Critical: 25 to 50 percent of property is severely damaged, facilities and services are unavailable or severely hindered for 1 to 2 weeks, injuries and illnesses overwhelm medical support for a brief period of time or result in many permanent disabilities and a few deaths.
Catastrophic: More than 50 percent of property is severely damaged, facilities and services are unavailable or hindered for more than 2 weeks, the medical response system is overwhelmed for an extended period of time, or many deaths occur.

Probability of Future Occurrences
Unlikely: Less than 1 percent probability of occurrence in the next year or has a recurrence interval of greater than every 100 years.
Occasional: Between a 1 and 10 percent probability of occurrence in the next year or has a recurrence interval of 11 to 100 years.
Likely: Between 10 and 90 percent probability of occurrence in the next year, or has a recurrence interval of 1 to 10 years
Highly Likely: Between 90 and 100 percent probability of occurrence in the next year or has a recurrence interval of less than 1 year.

Overall Significance
Low: Two or more of the criteria fall in the lower classifications or the event has a minimal impact on the planning area. This rating is also sometimes used for hazards with a minimal or unknown record of occurrences/impacts or for hazards with minimal mitigation potential.
Medium: The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is also sometimes utilized for hazards with a high impact rating but an extremely low occurrence rating.
High: The criteria consistently fall along the high ranges of the classification and the event exerts significant and frequent impacts on the planning area. This rating is also sometimes utilized for hazards with a high psychological impact or for hazards that the jurisdiction identifies as particularly relevant.

3.1.1. Hazards Considered But Not Included

The following natural hazards were not included in this analysis because they do not threaten South Dakota: avalanches, coastal erosion, coastal storms, hurricanes, tsunamis, and volcanoes. Other hazards considered during the 2021 HIRA update included human disease/pandemic due to the COVID-19 pandemic affecting the world from late 2019 and continuing into 2022 as of the time of this HIRA update. It was ultimately determined that other public health planning mechanisms address pandemics, and to keep the focus of the HIRA on natural hazards more commonly addressed with mitigation efforts, and funding, by OEM and other agencies.

3.1.2. Local Hazard Mitigation Plan Roll-Up

As part of the plan update process for this HIRA, the hazard mitigation plans for each county and tribe in the State were reviewed for their content and analysis of hazard significance. A total of 58 local plans have undergone updates since the last state HIRA update in 2016, providing new risk assessment information at the local level to be incorporated into this update. The majority of the local plans in South Dakota identified and prioritized hazards in a largely consistent manner with those prioritized by the State HMP. Amongst the local plans flood was the most commonly profiled hazard, with all 70 county or tribal plans profiling the hazard. This aligns with the State Plan's identification of flood as the highest significance hazard. The next most commonly profiled hazards were wildfire, drought, tornado, and winter storms, each of which are also profiled in this plan.

Many of the local plans also identified hazards individually which are contained under the wider umbrella of a specific hazard profile that is included in this plan. For example, 24 counties profiled earthquake and 14 profiled landslides separately while both of these are included in the geological hazards profile. Similarly, many counties profiled individual hazards such as ice storms, heavy snow, and extreme cold which are all addressed under winter storm in this plan. Several additional hazards were identified by the local plans, but not profiled by the State Plan. While these are not explicitly profiled in this plan, the SHMT and the State Hazard Mitigation Officer (SHMO) will use this information to continue working with the local communities to understand the concerns these hazards pose, how they are in part already addressed by the State Plan, and ways they can be mitigated.

A summary of all hazards profiled by each local plan is included in Table 3-2 below, showing how many plans ranked each hazard and the priority the hazards were given. Appendix H has additional details of the plan roll-up.

Table 3-2 Summary of Local Hazard Mitigation Plan Roll-Up

Hazard	Ranked High	Ranked Medium	Ranked Low	Profiled, but not Ranked	Total
Floods	20	19	7	24	70
Wildfires	9	21	14	23	67
Drought	20	21	3	20	64
Tornadoes	9	26	2	20	57
Severe Winter Storms	21	7	0	25	53
Windstorm	20	9	1	20	50
Hail	9	14	5	16	44
Ice Storm or Freezing Rain/Sleet	12	7	0	10	29
Severe Thunderstorms	7	6	3	13	29
Summer Storm (Hail, Lightning, High Winds, Tornadoes)	6	9	2	11	28

Hazard	Ranked High	Ranked Medium	Ranked Low	Profiled, but not Ranked	Total
Heavy Snow	10	8	1	8	27
Lightning Strikes	4	9	6	8	27
Urban Fire	2	7	7	10	26
Hazardous Materials Incidents	1	5	4	16	26
Earthquake	0	2	17	5	24
Extreme Heat	8	8	4	2	22
Extreme Cold	12	6	2	0	20
Heavy Rain	7	11	1	0	19
Dam Failure	0	3	10	4	17
Ice Jam	0	7	10	0	17
Terrorism	0	0	3	12	15
Landslide and Mudflow	0	4	8	2	14
Spring Snow Melt	5	8	1	0	14
Transportation Incidents	0	4	0	7	11
Utility Interruption	5	2	3	1	11
Geologic Hazards	0	1	6	3	10
Infectious Diseases/ Epidemic	0	2	0	5	7
Civil Disturbances	0	2	1	4	7
Agriculture Contamination/ Illness in Livestock	1	4	1	0	6
Wildland/Interface Fire	0	0	1	4	5
Nuclear Incident	0	0	2	3	5
Epidemic	0	1	2	0	3
Aviation Incident	0	1	1	1	3
Communication Failure	2	1	0	0	3
Active Shooter	0	2	1	0	3
National Security Emergency	0	0	0	3	3
Subsidence	0	0	2	0	2
Motor Vehicle Transportation Incidents	0	0	0	2	2
Mass Casualty Incident	0	0	1	1	2
Avalanche	0	0	1	0	1
Volcano	0	0	1	0	1
Manmade Hazards	0	0	0	1	1
Railway Incident	0	0	0	1	1
Structural Fires	0	0	0	1	1
Bioterrorism	0	0	0	1	1
Shortage of Critical Materials	0	0	0	1	1

3.1.3. Non-Natural Hazards

Beyond hazardous materials, the SHMT determined not to include human-caused and technological hazards in this plan. Certain human-caused hazards are addressed in the State's Threat and Hazard Identification and Risk Analysis (THIRA), originally developed in 2012 and updated periodically. The THIRA analyzes the State's capabilities toward addressing certain natural, human-caused, and technological hazards that are anticipated to have significant impacts. The THIRA was developed in compliance with the U.S. Department of Homeland Security Comprehensive Preparedness Guide 201 by a committee led by the State's Office of Homeland Security. The THIRA was scheduled for an update in 2022.

3.1.4. Disaster Declaration History

Table 3-3 summarizes presidential disaster declarations, fire management assistance declarations, and emergency declarations for South Dakota since 1954 through the end of 2023. Ninety-one presidential declarations in this 69-year period indicate that a disaster is declared in the State on average at least once a year. However, the frequency of disasters has increased in recent decades; since the early 1990s the State has had a presidential declaration on an annual basis, with many years seeing multiple declarations. These declared disasters have resulted in a total federal funding obligation of $822,853,460 to the State, which results in an average annual loss of $11,925,412.

Table 3-3 Federal Declaration History in South Dakota

Declaration Number	Declaration Date	No. of Counties/ Reservations	Disaster Type	FEMA Disaster Relief Costs[1] (Federal Share)
FEMA-4718-DR	7/6/2023	10 (1 reservation)	Flooding	$1,548,522*
FEMA-4689-DR	2/27/2023	17	Severe Winter Storms and Snowstorm	$2,209,129*
FEMA-4688-DR	2/20/2023	1 reservation	Severe Winter Storms and Snowstorm	$277,569*
FEMA-4687-DR	2/20/2023	1 reservation	Severe Winter Storms and Snowstorm	$798,173*
FEMA-4664-DR	8/2/2022	6	Severe Storm, Straight-Line Winds, Tornadoes, and Flooding	$1,657,410*
FEMA-4656-DR	6/29/2022	20 (2 reservations)	Severe Storm, Straight-line Winds, Tornadoes, and Flooding	$11,103,966*
FEMA-5418-FM	10/4/2021	1	Auburn Fire	none reported
FEMA-5384-FM	3/29/2021	1	Schroeder Fire	none reported
FEMA-4527-DR	4/5/2020	Statewide	Covid-19 Pandemic	$30,105,545
FEMA-3536-EM	3/13/2020	1 reservation	Covid-19 Pandemic	n/a
FEMA-3526-EM	3/13/2020	1 reservation	Covid-19 Pandemic	$1,232,767*
FEMA-3513-EM	3/13/2020	1 reservation	Covid-19 Pandemic	n/a
FEMA-3475-EM	3/13/2020	Statewide	Covid-19 Pandemic	n/a
FEMA-4469-DR	11/18/2019	23	Severe Storms, Tornadoes, and Flooding	$24,358,888
FEMA-4467-DR	10/7/2019	6	Severe Storms, Tornadoes, and Flooding	$2,459,331
FEMA-4463-DR	9/23/2019	25	Severe Storms and Flooding	$7,949,600
FEMA-4448-DR	6/20/2019	1	Severe Winter Storm, Snowstorm, and Flooding	$1,179,421*
FEMA-4440-DR	6/7/2019	58	Severe Winter Storm, Snowstorm, and Flooding	$58,681,798
FEMA-5272-FM	8/11/2018	1	Vineyard Fire	$665,425*
FEMA-5229-FM	12/12/2017	1	Legion Lake Fire	$3,055,336
FEMA-4298-DR	2/1/2017	24	Severe Winter Storm	$11,339,993
FEMA-4237-DR	8/7/2015	1 reservation	Severe Storms, Straight-line Winds, and Flooding	$439,284
FEMA-4233-DR	7/30/2015	11	Severe Storms, Tornadoes, Straight-line Winds, & Flooding	$3,071,933*

Declaration Number	Declaration Date	No. of Counties/ Reservations	Disaster Type	FEMA Disaster Relief Costs[1] (Federal Share)
FEMA-4186-DR	7/28/2014	11	Severe Storms, Tornadoes, and Flooding	$11,144,676*
FEMA-4155-DR	11/8/2013	11	Severe Winter Storm, Snowstorm, and Flooding	$43,113,023*
FEMA-4137-DR	8/2/2013	8	Severe Storms, Tornado, and Flooding	$1,159,221*
FEMA-4125-DR	6/28/2013	4	Severe Storms, Tornado, and Flooding	$1,215,685*
FEMA-4115-DR	5/10/2013	7	Severe Winter Storm and Snowstorm	$8,231,035*
FEMA-5010-FM	9/1/2012	1	Wellnitz Fire	$6,664*
FEMA-2996-FM	7/20/2012	1	Myrtle Fire	$622,321*
FEMA-1984-DR	5/13/2011	28	Severe Storms and Flooding	$56,890,071
FEMA-1947-DR	11/2/2010	4 (1 reservation)	Severe Storms and Flooding	$1,079,973*
FEMA-1938-DR	9/23/2010	12	Severe Storms and Flooding	$4,429,890*
FEMA-1929-DR	7/29/2010	3 (1 reservation)	Severe Storms, Tornadoes, and Flooding	$666,649*
FEMA-1915-DR	5/13/2010	31	Flooding	$21,498,620*
FEMA-1914-DR	5/13/2010	3	Severe Winter Storm	$1,862,943*
FEMA-1887-DR	3/10/2010	29 (3 Reservations)	Severe Winter Storm	$49,059,868*
FEMA-1886-DR	3/9/2010	12 (2 Reservations)	Severe Winter Storm and Snowstorm	$874,503*
FEMA-1844-DR	6/16/2009	14 (2 Reservations)	Severe Storms and Flooding	$5,301,081*
FEMA-1811-DR	12/12/2008	13 (4 Reservations)	Severe winter storm and record and near record snow	$5,825,275*
FEMA-1774-DR	7/2/2008	26 (3 Reservations)	Severe storms and flooding	$4,716,310*
FEMA-1759-DR	5/22/2008	6	Severe winter storm and record and near record snow	$7,826,996*
FEMA-2716-FSA	7/21/2007	1	Boxelder Fire	$387,967*
FEMA-2710-FSA	7/8/2007	1	Alabaugh Canyon Fire	$1,953,897*
FEMA-1702-DR	5/22/2007	24 (3 Reservations)	Severe Storms, Tornadoes, and Flooding	$13,159,478
FEMA-2658-FSA	7/27/2006	1	East Ridge Fire	$1,543,489*
FEMA-1647-DR	6/5/2006	6	Severe Winter Storm	$3,177,446*
FEMA-1620-DR	12/20/2005	26	Severe Winter Storm	$24,647,040*
FEMA-3234-EM	9/10/2005	Statewide	Hurricane Katrina Evacuation	$219,506*
FEMA-1596-DR	7/22/2005	7	Severe Storm (wind)	$677,995*
FEMA-2569-FSA	7/16/2005	1	Skyline #2 Fire	$14,231*
FEMA-2565-FSA	7/10/2005	1	Ricco Fire	$428,064*
FEMA-2557-FSA	4/19/2005	1	Camp Five Fire	n/a
FEMA-1531-DR	7/20/2004	10 (1 Reservation)	Severe Storms and Flooding	$1,058,537*
FEMA-2513-FSA	11/20/2003	1	Mill Road Fire	$45,685*
FEMA- 2458-FSA	8/18/2002	1	Battle Creek Fire	$1,313,879*
FEMA-2434-FSA	6/29/2002	1	Grizzly Gulch Fire	$759,650*
FEMA-2369-FSA	7/31/2001	1	Elk Mountain Fire	$293,179*
FEMA-1375-DR	5/17/2001	24	Severe Storms (flooding)	$5,097,819*

Declaration Number	Declaration Date	No. of Counties/ Reservations	Disaster Type	FEMA Disaster Relief Costs[1] (Federal Share)
FEMA-2324-FSA	8/25/2000	1	Jasper Fire	$2,496,379*
FEMA-2319-FSA	8/13/2000	1	Flagpole Fire	$1,050,618*
FEMA-1330-DR	5/19/2000	7	Winter Storm	$1,779,886*
FEMA-1280-DR	6/9/1999	2	Severe Storms, Flooding, and Tornadoes	$801,100*
FEMA-1218-DR	6/1/1998	9	Flooding, Severe Storms, and Tornadoes	$15,953,312
FEMA-1173-DR	4/7/1997	66	Severe Storms, Flooding (high winds)	$82,490,180
FEMA-1161-DR	2/28/1997	10	Severe Winter Storms	$2,526,209
FEMA-1156-DR	1/10/1997	Statewide	Severe Winter Storms/Blizzards	$18,431,301
FEMA-1075-DR	1/5/1996	26	Ice Storms	$12,431,366
FEMA-1052-DR	5/26/1995	52	Severe Storms, Flooding	$33,866,882
FEMA-1045-DR	3/14/1995	21	Severe Winter Storms	$3,627,131
FEMA-2109-FSA	8/16/1994	1	Stagebarn Canyon Fire	$49,833*
FEMA-1031-DR	6/21/1994	21	Severe Storm, Flooding	$7,789,915
FEMA-999-DR	7/19/1993	39	Flooding, Severe Storms, Tornadoes	$50,202,256
FEMA-948-DR	7/2/1992	9	Flooding, Severe Storms, Tornadoes (high winds)	$1,669,825
FEMA-2076-FSA	9/14/1990	1	Swedlund Fire	$715,276*
FEMA-2068-FSA	7/26/1988	1	West Berry Trail Fire	n/a
FEMA-2061-FSA	7/22/1987	1	Battle Mountain Fire	n/a
FEMA-764-DR	5/3/1986	25	Severe Storms, Flooding	$4,893,611
FEMA-2057-FSA	7/15/1985	1	Flint Hill Fire	n/a
FEMA-2056-FSA	7/15/1985	1	Seven Sisters Fire	n/a
FEMA-717-DR	7/19/1984	9	Severe Storms, Flooding	$4,216,001
FEMA-511-DR	6/25/1976	4	Flash Flooding, Mudslides	$4,439,769
FEMA-3015-EM	6/17/1976	61	Drought	n/a
FEMA-2017-FSA	7/29/1975	1	Custer State Park	n/a
FEMA-2016-FSA	7/8/1974	1	Argle & Booms Canyon	n/a
FEMA-336-DR	6/10/1972	4	Heavy Rains, Flooding	$111,907,010
FEMA-257-DR	4/18/1969	26	Flooding	$4,369,737
FEMA-197-DR	5/26/1965	4	Flooding	$3,771,780
FEMA-132-DR	7/27/1962	23	Floods, Tornadoes	$3,652,937
FEMA-99-DR	4/8/1960	16	Floods	$933,934
FEMA-20-DR	7/31/1954	2	Floods	$252,255

Sources: FEMA, South Dakota Office of Emergency Management, Public Entity Risk Institute
1Costs include Public Assistance, Individual Assistance, and mitigation and are in constant 2006 dollars (with the exception disasters post-2006, which are year of event dollars). Fire costs are from the State, represent total outlays, and are not adjusted for inflation (with the exception of FEMA-2710-FSA, which is from InciWeb).
*Includes Public Assistance only

Another way to assess the significance of South Dakota's hazards is to review the patterns of past disaster declarations and the costs incurred by them. FEMA's Public Assistance Program provides supplemental grants to State, tribal, territorial, and local governments to enable communities to quickly respond to and recover from major disasters. Under the program, facilities which can be funded by public assistance must be a building, public works, system, equipment, or natural feature and work must be required as a result of the declared incident, located within the designated disaster area, and be the legal responsibility of the applicant. The federal share of assistance provided is not less than 75 percent of the eligible cost, with a 25 percent local match.

Different hazards have historically impacted South Dakota to differing levels and can reasonably be expected to continue to do so in a similar pattern. Table 3-4 The table below summarizes the public assistance funding provided to South Dakota since 1999, detailing the number of projects which received funding, the federal amount obligated, and the amount required by the State agency, as well as the incident type which triggered the federal disaster declaration. There have been 419 projects funded by public assistance since 1999, at a cost to the federal government of $36 million and state government $12 million. By far the greatest number of projects and the highest costs have been incurred by flooding, followed by severe storms. Given this trend coupled with the State's past history of disaster declarations and the future probability for these two hazards to continue as the most pressing hazards, it can be expected that they will cause the most risk to jurisdictions and state assets in the future. While disaster losses continue, the maps in Figure 3-1 and Figure 3-2 below illustrates the location of various mitigation projects in South Dakota funded with FEMA HMA. Nearly every county has at least one project that will mitigate losses from future events.

Table 3-4 Public Assistance by Hazard, 1999-2020

Incident Type	Number of Projects	Federal Amount Obligated	State Obligation
Biological	1	$811,668	$270,556
Coastal Storm	6	$208,997	$69,666
Flood	242	$27,262,234	$9,087,411
Severe Storm	156	$7,642,965	$2,547,655
Snow	9	$243,856	$81,285
Tornado	5	$191,783	$63,928
Total	**419**	**$36,361,503**	**$12,120,501**

Source: OpenFEMA Data

Figure 3-1 Hazard Mitigation Projects Funded by FEMA

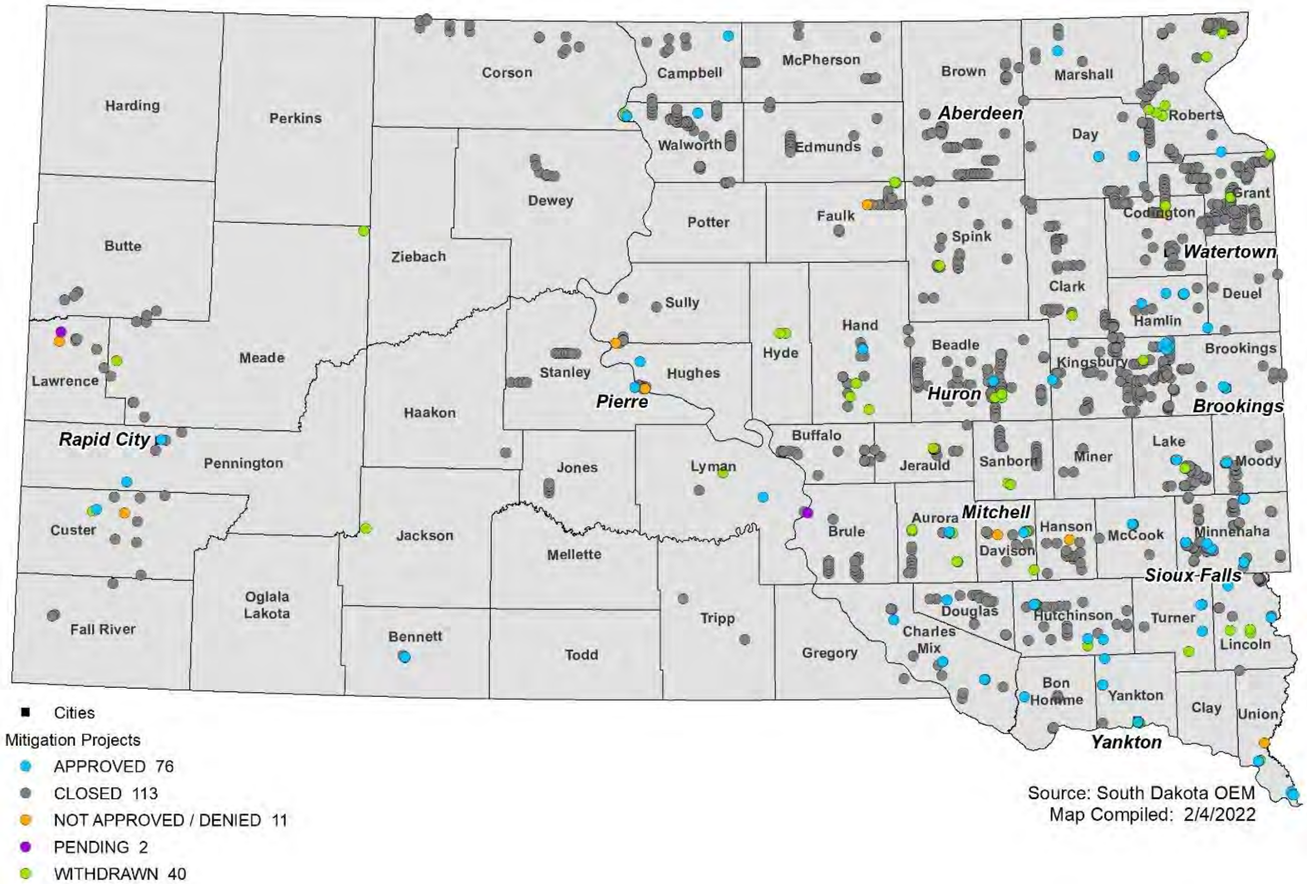
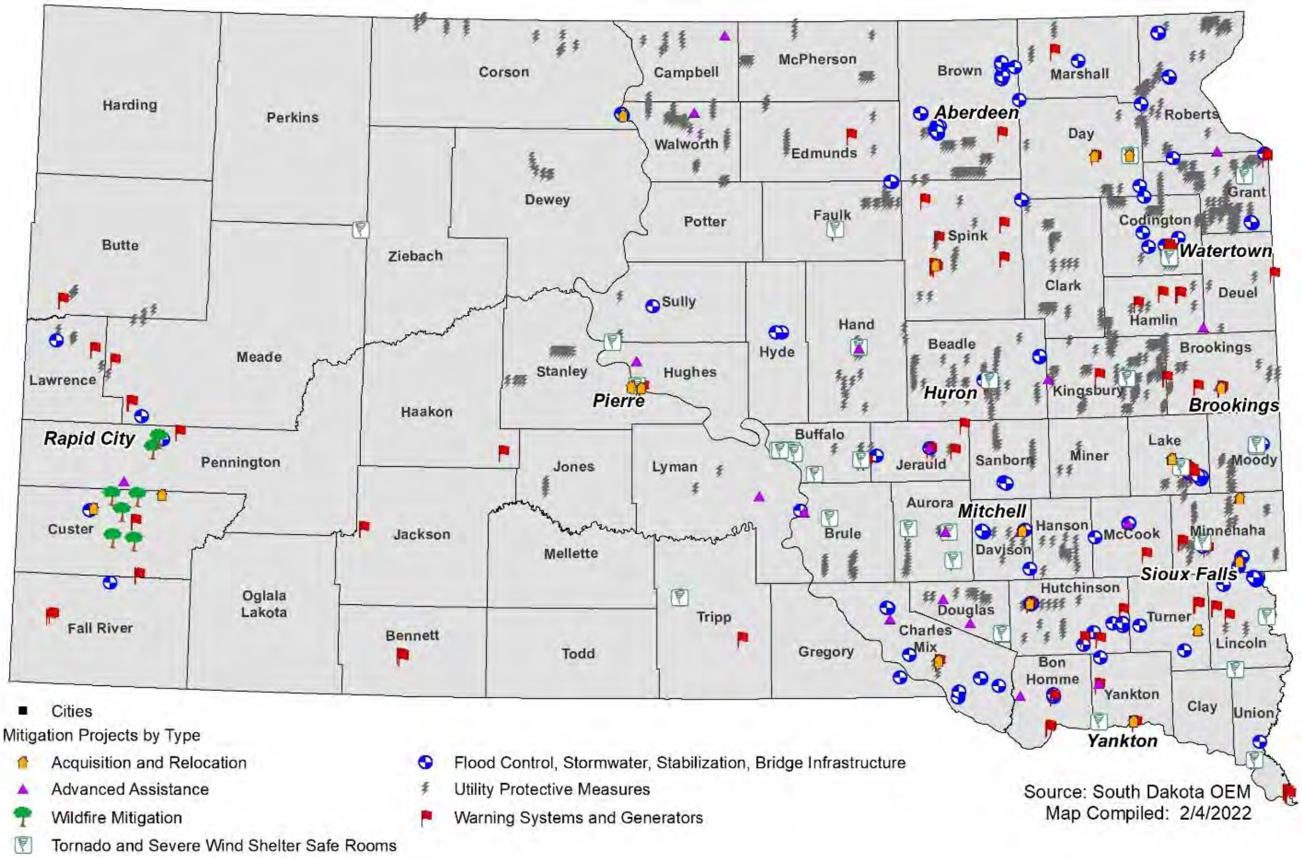


Figure 3-2 Hazard Mitigation Projects Funded by FEMA by Project Type



3.1.5. Overview of Hazard Identification and Risk Assessment

The HIRA was re-organized during the 2021 update to consolidate information by hazard that had previously been split into profiles and vulnerability sections. State Assets have been consolidated into the next section in the document to discuss the overall exposure of state property, critical facilities, and infrastructure. The Hazard Profiles section of the HIRA includes detailed information for the identified hazards. Each hazard profile includes the following subsections:

Hazard Description —This section gives a description of the hazard and associated issues

Location – This section gives a spatial description of the potential location or areas of South Dakota where the hazard expected to impact.

Magnitude/Severity (Extent) – This section gives a description of the potential strength or magnitude of the hazard.

Past Events —This section contains information on historical incidents, including impacts where known.

Probability of Future Occurrence—The frequency of past events is used in this section to gauge the likelihood of future occurrences.

Climate Change Considerations - This describes the potential for climate change to affect the frequency and intensity of the hazard in the future.

Vulnerability - Following the hazard profiles is a vulnerability assessment for each identified hazard. The assessment was conducted through the study of potential impacts to the following specific sectors:

- People
- Property
- State Assets, Critical Facilities, and Infrastructure
- Economy
- Environment and Cultural Resources
- Development Trends and Consequence Summary

Following the hazard profiles is a section on Rural Electric Cooperative Considerations, which summarizes vulnerability specifics to the electric providers in the State. At the end of the HIRA is a Risk Summary that captures the key issues/problems identified for each hazard, as an easy reference and for basing the update or development of mitigation strategies.

Information Sources

Data used to support the HIRA and updates to have included the following:

- South Dakota Agencies and Departments
- FEMA
    - National Risk Index
    - FEMA Region VIII
    - Hazus-MH

- Public Entity Risk Institute
- University of South Carolina Hazards and Vulnerability Research Institute
    - Spatial Hazard Events and Losses Database for the United States (SHELDUS)
    - Social Vulnerability Index for the United States

- National Oceanic and Atmospheric Administration
    - National Centers for Environmental Information
    - National Weather Service

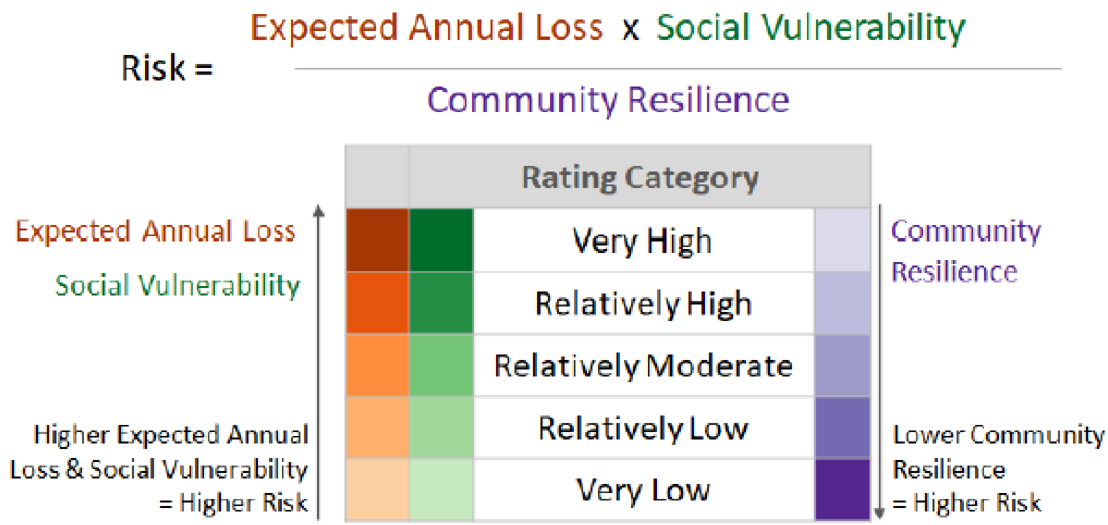
- U.S. Department of Agriculture Risk Management Agency
- Federal Wildland Fire Occurrence Database
- U.S. Army Corps of Engineers
- U.S. Geological Survey
- Input given at stakeholder meetings during the 2021 update process
- Literature and written and oral communications from state and national hazard experts

3.1.6. National Risk Index Overview

During the 2021 HIRA update a new online risk assessment tool became available from FEMA. The National Risk Index (NRI) is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. It was designed and built by FEMA in close collaboration with various stakeholders and partners in academia; local, state and federal government; and private industry. The Risk Index leverages available source data for natural hazard and community risk factors to develop a baseline relative risk measurement for each United States county and census tract. The NRI's interactive mapping and data-based interface enables users to visually explore individual datasets to better understand what is driving a community's natural hazard risk. Users may also create reports to capture risk details on a community or conduct community-based risk comparisons, as well as export data for analysis using other software. Intended users of the NRI include planners and emergency managers at the local, regional, state, and federal levels, as well as other decision makers and interested members of the general public.

The NRI provides relative Risk Index scores and ratings based on data for Expected Annual Loss (EAL) due to natural hazards, social vulnerability, and community resilience. Separate scores and ratings are also provided for each component: Expected Annual Loss, Social Vulnerability, and Community Resilience.

Figure 3-3 Generalized National Risk Index Risk Equation and Components



Source: FEMA NRI Technical documentation 2021

For the Risk Index and EAL, scores and ratings can be viewed as a composite score for all hazards or individually for each of the 18 hazard types.

NATIONAL RISK INDEX HAZARD TYPES

1.	Avalanche	6.	Hail	11.	Lightning	16.	Volcanic Activity
2.	Coastal Flooding	7.	Heat Wave	12.	Riverine Flooding	17.	Wildfire
3.	Cold Wave	8.	Hurricane	13.	Strong Wind	18.	Winter Weather
4.	Drought	9.	Ice Storm	14.	Tornado		
5.	Earthquake	10.	Landslide	15.	Tsunami		

The NRI was evaluated by the SHMT and OEM's planning consultant to determine its applicability to South Dakota's HIRA update. Prior to 2021, the planning consultant had used similar methods to generate composite vulnerability indices for each county in South Dakota for wind, winter storm, and tornado hazards based on available census data and National Centers for Environmental Information (NCEI) incident data. Comparing these to the NRI, the SHMT and consultant found similar trends in risk rankings. An added benefit of leveraging NRI data for the update included standardized methods for assess risk on a county-by-county scale for all of the hazards in the HIRA, with the exception of agricultural pest and disease. This included composite risk indicators for hazards previously lacking necessary data, including lightning, hail, landslides, and subsets of winter storms including cold wave and ice storms. The other benefit is that moving forward, FEMA will be periodically updating and improving the NRI, which should provide a valuable and standardized resource for future HIRA updates.

The hazard profiles in the HRIA contains the following aggregate risk products where applicable, mapped by WSP using NRI products:

- Annualized Frequency
- Composite Risk Index Rating
- Expected Annual Loss

Sources of hazards and exposure data within the NRI includes SHELDUS, NOAA, USGS, National Weather Service (NWS), United States Department of Agriculture (USDA). Consequences of hazard occurrences are categorized into three different types: buildings, population, and agriculture. Additional details can be referenced in the FEMA NRI Technical documentation 2021, available at https://hazards.fema.gov/nri/.

3.2. Assets At Risk

44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview and analysis of the State's vulnerability to the hazards described in paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. …State owned or operated critical facilities located in the identified hazard areas shall also be addressed…. *The State shall update the overview and analysis of vulnerable State owned or operated buildings, critical facilities, and infrastructure, based on available data. The update should reflect acquisition or development of new properties and infrastructure.*
44 CFR Part 201 Requirement:
[The State risk assessment shall include an] overview and analysis of potential losses to identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State shall estimate the potential dollar losses to state-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *A comprehensive, multi-year plan to mitigate the risks posed to existing buildings that have been identified as necessary for post-disaster response and recovery operations.*

Assets evaluated for the purpose of determining vulnerability can include many categories, such as people, structures, critical facilities, and natural, historic, or cultural resources. The following is a discussion of the assets that can potentially be affected by hazard in South Dakota.

Section 3.2.1 specifically addresses assets owned or leased by the State of South Dakota. Sections 3.2.2 through 3.2.5 look more broadly at assets throughout the state regardless of ownership.

3.2.1. State Owned or Leased Property

In order to help assess the overall exposure of the State's assets, the State of South Dakota provided information pertaining to the number and value of buildings owned by various state agencies. Table 3-5 The table below summarizes the number of buildings, total square footage, insured building value, content value, and total value of facilities owned and maintained by the state. This information helps to provide an overall picture of the exposure of state assets to hazards in South Dakota. Discussions on how vulnerability to state assets differs by hazard can be found in the State Assets, Critical Facilities, and Infrastructure subsection of each hazard profile, with more specific analysis aided by GIS where data is available.

Table 3-5 Summary of Insured State-Owned Buildings by State Agency

State Agency	Building Count	Total Square Footage	Building Value (Insured)	Content Value	Total Value
Office of the Attorney General	1	1200	$264,000	$47,054	$311,054
SD Board of Regents BHSU	28	872,809	$250,097,989	$13,590,804	$263,688,793
Board of Administration	20	799,219	$88,670,641	$29,633,047	$118,303,688
Dakota State University	23	693,755	$193,267,859	$18,926,332	$212,194,191
Northern State University	27	1,002,954	283,512,137	$23,067,591	$306,579,728
SD School for the Deaf	1	43,021	$5,469,898	$104,565	$5,574,463
SD Board of Regents SD School for the Visually Handicapped	1	44,956	$13,740,808	$1,025,150	$14,765,958
SD Board of Regents SD School of Mines & Technology	22	886,204	$268,142,734	$35,148,513	$303,291,247

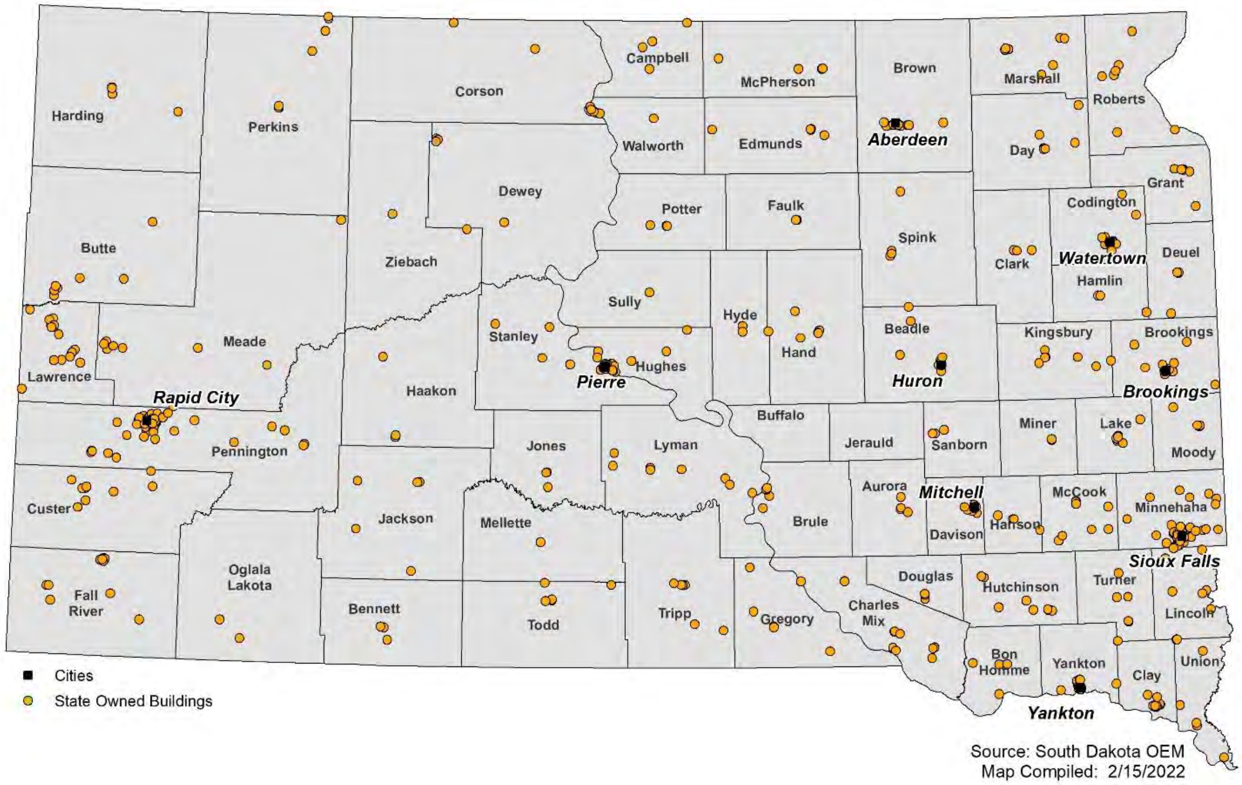
State Agency	Building Count	Total Square Footage	Building Value (Insured)	Content Value	Total Value
SDSU	183	4,923,890	$1,369,988,933	$145,460,023	$1,515,448,956
University of South Dakota	51	2,824,034	$794,314,610	$61,085,626	$855,400,236
South Dakota Department of Corrections	49	1,263,311	$348,627,585	$10,541,548	$359,169,133
South Dakota Department of Game, Fish, & Parks	88	466,002	$121,134,217	$19,111,205	$140,245,422
South Dakota Department of Human Services	21	356,231	$96,577,847	$8,903,883	$105,481,730
South Dakota Department of Military Affairs (State share in parentheses)	57	909,123	$234,689,475 ($112,083759)	$13,079,561 ($6,594,705)	$247,769,036 ($118,678,464)
South Dakota Department of Social Services	12	355,845	$106,267,968	$7,317,797	$113,585,765
South Dakota Department of Transportation	240	1,602,581	$277,800,640	$43,588,395	$321,389,035
South Dakota Department of Agriculture/Natural Resources	70	618,730	$61,793,718	$5,159,116	$66,952,834
South Dakota Department of Public Safety/Highway Patrol	20	53,362	$10,034,122	$2,659,193	$12,693,315
South Dakota Federal Surplus Property	5	41,280	$3,637,239	$238,977	$3,876,216
South Dakota Governor's Mansion	1	14,550	$6,804,000	$526,665	$7,330,665
South Dakota Veteran's Home	18	214,458	$56,693,033	$7,713,851	$64,406,884
South Dakota Public Broadcasting	10	11,112	$4,598,983	$7,424,138	$12,023,121
South Dakota Department of Education	1	900	$256,597	$39,755	$296,352
Grand Total	**949**	**17,999,527**	**$4,596,385,033**	**$454,392,789**	**$5,050,777,822**

Source: Compiled by WSP from data provided by SD Office of Risk Management Feb 2022

The method used to determine vulnerability to state facilities was to overlay facilities data on digital hazard maps, where available, and identify those facilities potentially at risk. This method was used to determine vulnerability to floods and wildfire. For severe weather hazards including winter weather, tornadoes, and wind it is generally accepted that these hazards could strike anywhere in the State at various levels of severity. Instead, an exposure analysis was used for these hazards. Exposure analyses are different from loss estimates in that they present facilities likely to be exposed to these hazards, but do not attempt to estimate the amount of damages incurred during an event. The vulnerability of state assets to each hazard is covered in the Vulnerability Assessment section of that hazard's profile.

Some state properties were made available in a GIS database as depicted in the figure below. Building valuations are not included in the State's GIS-based facility data, thus an estimate of potential losses to state facilities is difficult to quantify. The State's facility data was used for location information to overlay the facilities with the hazard maps, where applicable.

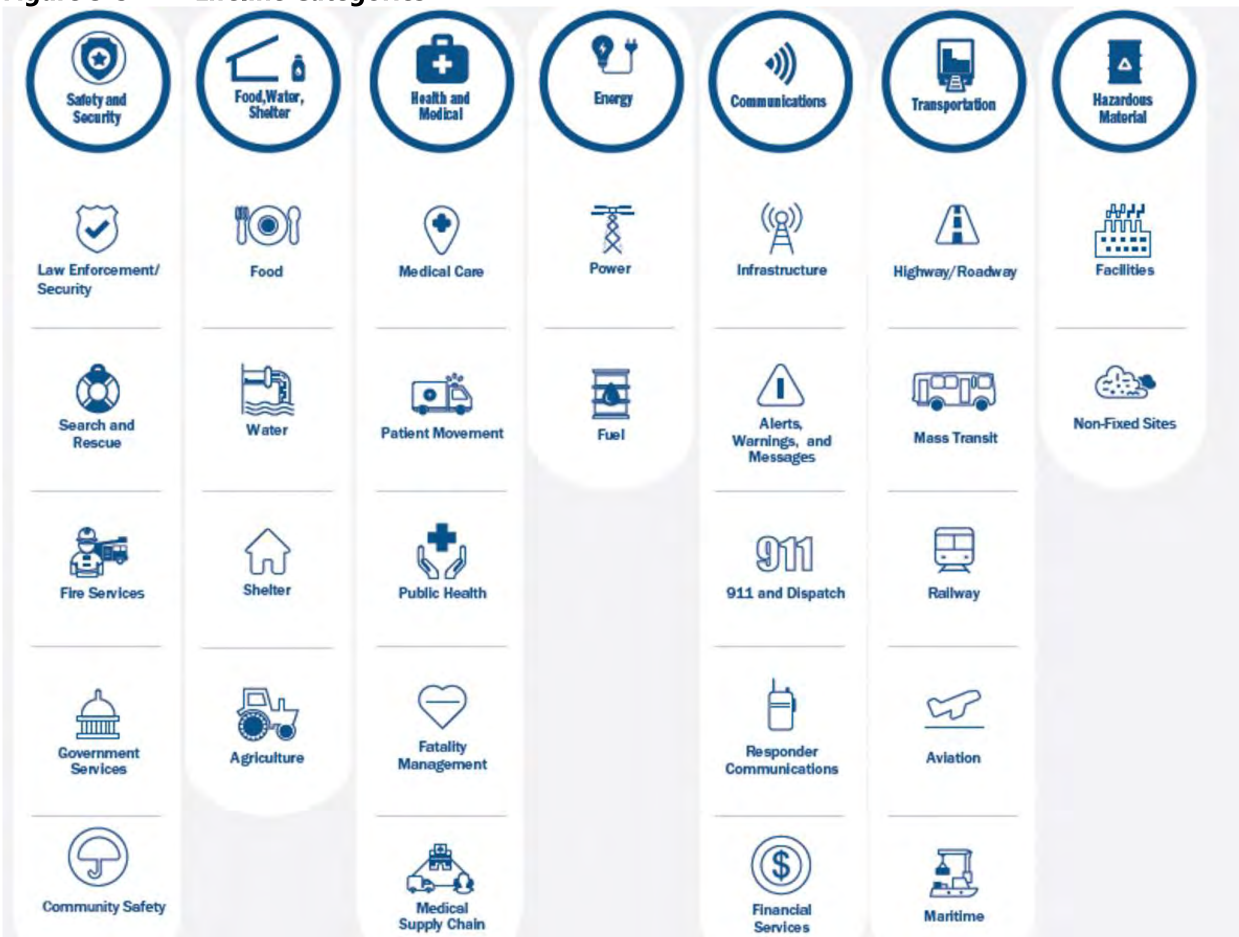
Figure 3-4 State Owned Buildings



3.2.2. Lifelines (Critical Facilities and Infrastructure)

A significant aspect of the 2021 HIRA update was the update of critical facilities and an alignment/classification with the FEMA Lifelines framework. For the purposes of this plan, a critical facility is defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. FEMA sorts critical facilities into seven lifeline categories as shown in the figure below. (Note that FEMA has revised the Lifeline categories since the completion of the 2022 HIRA update; to eliminate confusion, the previous categories are maintained throughout this document.)

Figure 3-5 Lifeline Categories



These lifeline categories standardize the classification of critical facilities and infrastructure that provide indispensable service, operation, or function to a community, and ultimately the State. A lifeline is defined as providing indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security. These categorizations are particularly useful as they:

- Enable effort consolidations between government and other organizations (e.g., infrastructure owners and operators).
- Enable integration of preparedness efforts among plans, easier identification of unmet critical facility needs.
- Refine sources and products to enhance awareness, capability gaps, and progress towards stabilization.
- Enhance communication amongst critical entities, while enabling complex interdependencies between government assets.
- Highlight lifeline related priority areas regarding general operations as well as response efforts.

During the 2021 HIRA update, the Homeland Infrastructure Foundation Level Database (HIFLD) was used to identify critical facilities and infrastructure across South Dakota. This generally aligns the data with layers associated with FEMA's Resilience Analysis and Planning Tool (RAPT). The categories of facilities and infrastructure include:

- Public Schools (state source)
- Private Schools
- Colleges/Universities
- Courthouses
- EMS
- Fire stations
- Electric power plants
- Hospitals
- Hazardous Materials: Risk Management Plan and Toxic Resource Inventory facilities
- Local Law Enforcement
- Local Emergency Operations Center
- Prisons
- Wastewater Treatment Facilities
- Water Facilities (source SD OEM)
- Weather Radar Stations

Table 3-6 Summary of Critical Facilities by FEMA Lifeline

FEMA Lifeline	Critical Facility	Count
Energy	Power Plant	56
	Total	**56**
Food, Water, Shelter	Wastewater Facility	341
	Water Facility	7
	Total	**348**
Hazardous Material	Risk Management Plans (RMP) Facility	162
	Toxics Release Inventory (TRI) Facility	259
	EMS Station	262
	Hospital	76
	Total	**759**
Safety and Security	College/University	30
	Courthouse	65
	Fire Station	383
	Local EOC	86
	Local Law Enforcement	169
	Prison	55
	Private School	66
	Public School	649
	State EOC	1
	Weather Radar Station	3
	Total	**1,507**
Transportation	Aviation	183
	Bridge	5,640
	Bridge Scour	248
	Total	**6,071**
Grand Total		**8,741**

Source: State of South Dakota OEM, HIFLD, South Dakota OpenData, WSP GIS analysis

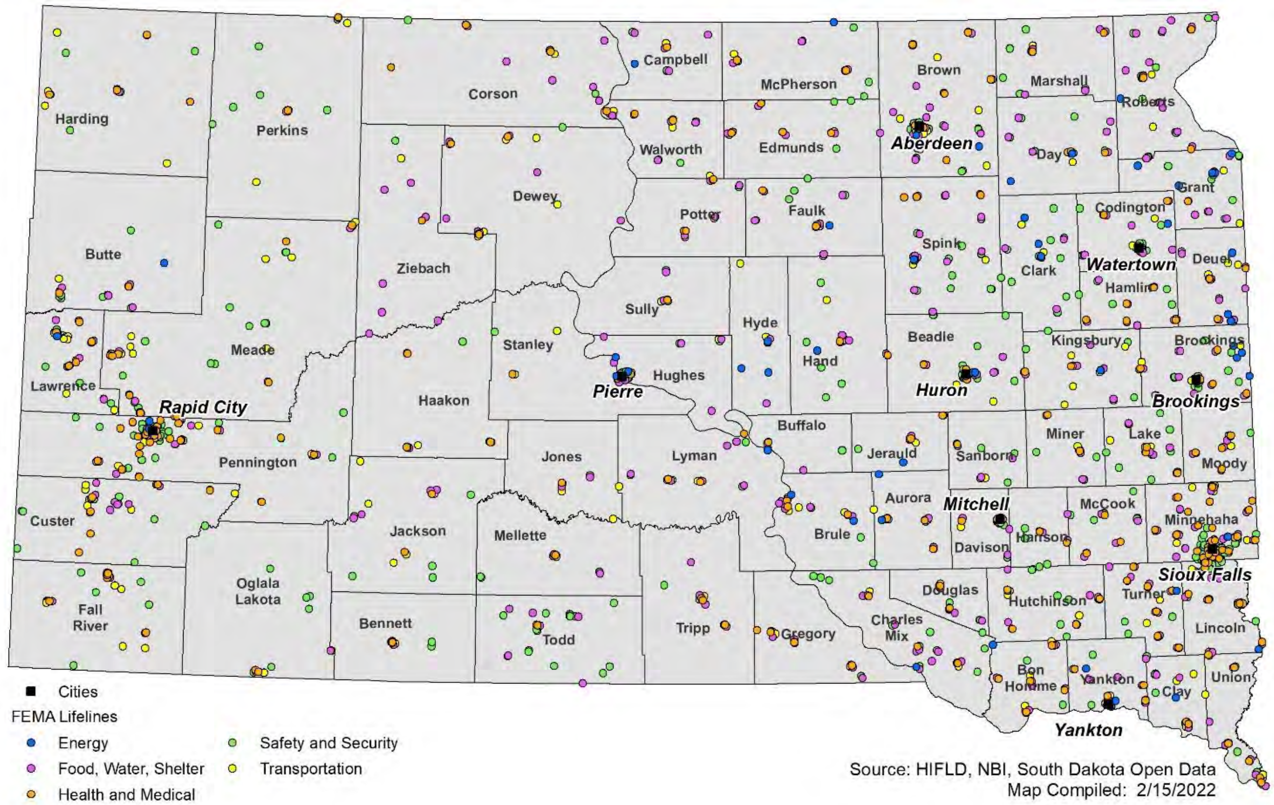
Other linear infrastructure that is considered a lifeline is the State's transportation network including highways and bridges. Impacts to these assets are noted by hazard where applicable, e.g. flood, and winter storm in particular. The majority of the State's electric power infrastructure is owned by rural electric cooperatives. While these assets are not included here with state-owned assets, the SHMT recognizes they are critical resources. See the section on Rural Electric Cooperative Considerations for a detailed discussion of rural electric infrastructure, including the vulnerability of those assets and potential mitigation activities.

Linear and Transportation networks

- Highways
- National Bridge Inventory
- Aviation Facilities
- Transmission lines

A map of the lifelines and infrastructure are shown in Figure 3-6.

Figure 3-6 Critical Facilities / Lifelines



Critical Facility and Lifeline Exposure Summary

Hazus-MH version 5.1 inventory data was used as the basis for overall exposure of buildings and lifelines. The Essential Facilities inventory for the State includes schools, police departments, fire departments and emergency operations centers. Hazus-based total count and value of buildings in these categories include 1,586 buildings and $6.2 billion in exposure. Essential facilities in Hazus include 857 schools representing $3.9 billion in value, 86 hospitals with 3,281 beds representing $697 million, 169 police stations representing $405 million, 387 fire stations representing $929 million, and 87 emergency operations facilities representing $208 million in value respectively. In Hazus-MH there are utility and infrastructure data sets that are considered 'lifeline' inventory. There are seven transportation systems that include highways, railways, light rail, bus, ports, ferry, and airports. There are six utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The total value of the lifeline inventory is over $196 billion. This inventory includes over 7,417 miles of highways, 5,815 bridges, and 293,608 miles of pipes.

3.2.3. Population

The U.S. Census Bureau's 2020 Census lists South Dakota's 2020 population at 886,667. This reflects an increase of 8.9% between 2010 and 2020, which places South Dakota ahead of the national average for state population growth. South Dakota ranked 45th among the 50 states in population in 2020, 17th in rate of growth from 2010 to 2020, and 16th in land area. A primarily rural state, South Dakota is the 5th least densely populated state; Minnehaha County is the only South Dakota County with a population density higher than the national average (216.3 people per square mile vs 96 people per square mile nationally). Decennial census data in Table 3-7 from the last several decades illustrate South Dakota's growth.

Table 3-7 South Dakota Decennial Census 1970-2020

Year	Population	% Change
1970	665,507	-2.2
1980	690,768	+3.8
1990	696,004	+.8
2000	754,844	+8.5
2010	814,180	+7.9
2020	886,667	+8.9

Source: U.S. Census Bureau

Between 2014 and 2020, 31 South Dakota counties gained population. Lincoln County was the 9th fastest growing county in the United States (of counties with 10,000 or more in population) between 2010 and 2020, with a 45.4% increase in population since a 2010 and an 85.8% increase in population during the previous decade from 2000 to 2010. No counties in South Dakota were ranked among the top 100 largest (by population) in the U.S. The three largest counties in the State (Minnehaha, Pennington, and Lincoln) were in the Top 10 Counties that experienced the largest population growth by number and by percent gained.

Table 3-8 Ten Largest Counties Ranked by Population

County	2020 Population
Minnehaha	197,214
Pennington	109,222
Lincoln	65,161
Brown	38,301
Brookings	34,375
Meade	29,852
Codington	28,325
Lawrence	25,768
Yankton	23,310

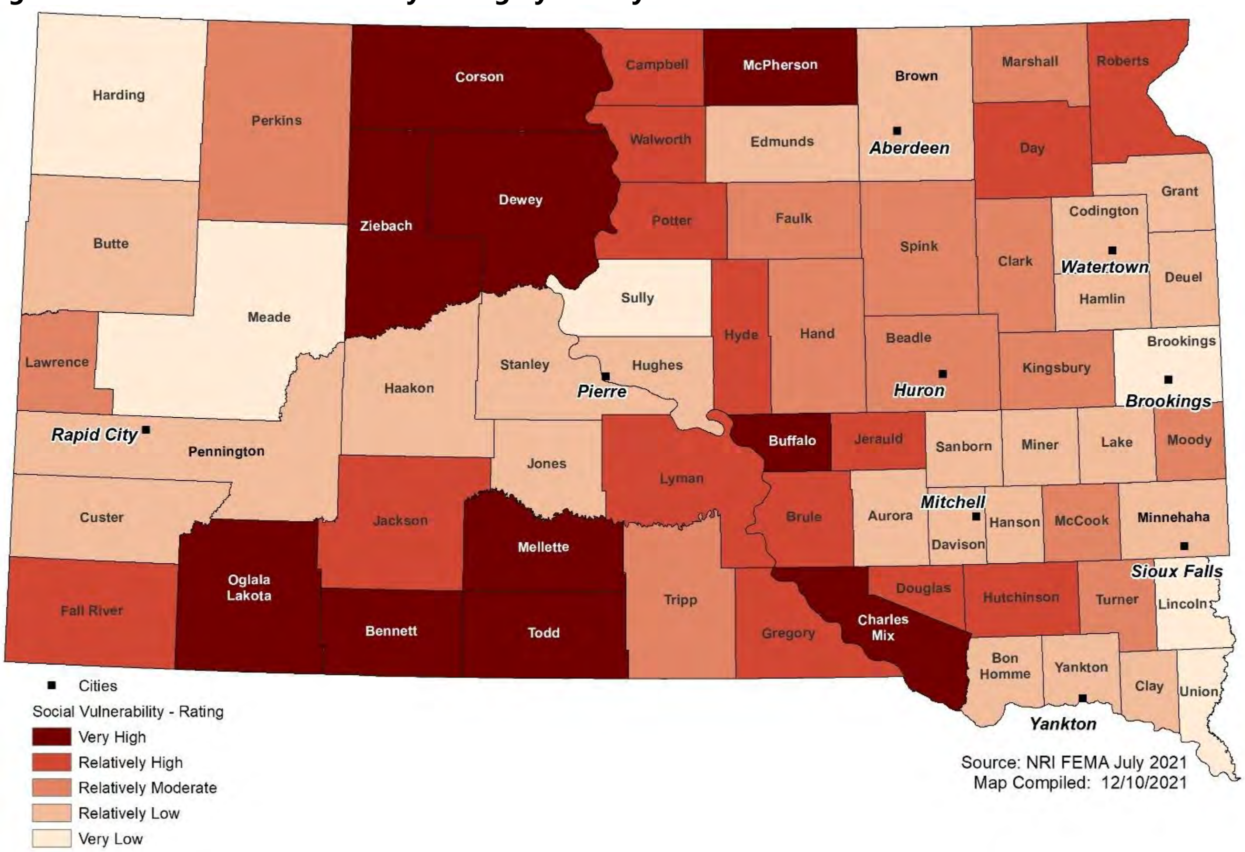
Source: U.S. Census Bureau

Social Vulnerability and Community Resilience

Social vulnerability is broadly defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social Vulnerability considers the social, economic, demographic, and housing characteristics of a community that influence its ability to prepare for, respond to, cope with, recover from, and adapt to environmental hazards.

The NRI has incorporated a social vulnerability index (SoVI) rating as a "consequence enhancing risk component" using the SoVI compiled by the Hazards and Vulnerability Research Institute in the Department of Geography at the University of South Carolina. This SoVI is a location-specific assessment and measures the social vulnerability of U.S. counties to environmental hazards utilizing 29 socioeconomic variables which have been deemed to influence a community's vulnerability. The comparison of SoVI values between counties within the State allows for a more detailed depiction of variances in risk and vulnerability. Figure 3-7 below shows this social vulnerability rating by county in South Dakota, with those counties shaded in darker red having the highest levels of social vulnerability.

Figure 3-7 Social Vulnerability Rating by County in South Dakota



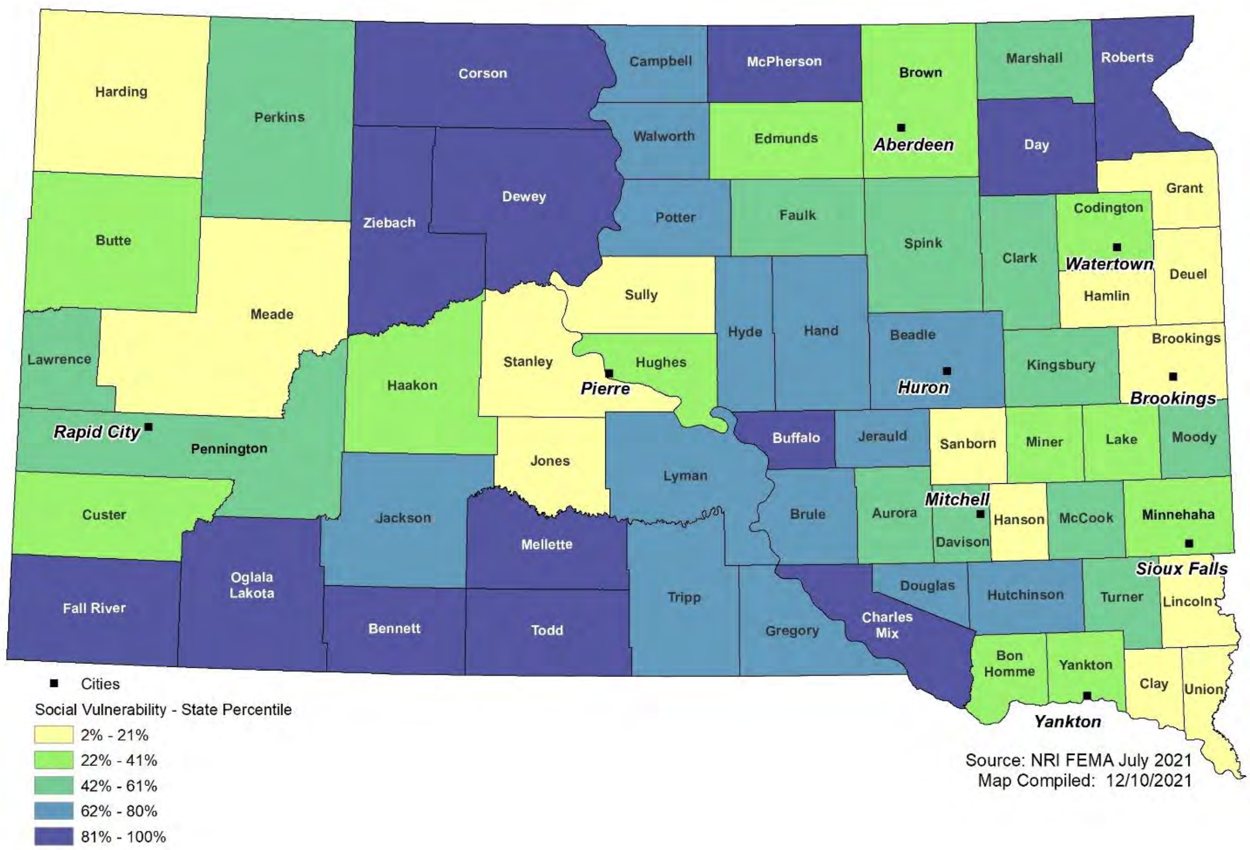
The index can be used by the State to help determine where social vulnerability and exposure to hazards overlaps and how and where mitigation resources might best be used. The SoVI provides a score between 0.01 and 100, with higher scores indicative of higher levels of social vulnerability. According to the index, the following, listed in order, are South Dakota's ten most socially vulnerable counties:

1. Oglala Lakota County (Score 99.11)
2. Buffalo County (Score 98.63)
3. Todd County (Score 96.28)
4. Ziebach County (Score 91.06)
5. Bennett County (Score 87.43)
6. Mellette County (Score 84.63)

7. Dewey County (Score 82.24)
8. Lyman County (Score 77.08)
9. Corson County (Score 75.75)
10. Charles Mix County (Score 72.88)

Each of the above counties are also in the top 20 percent in the nation in terms of social vulnerability. The average national social vulnerability score is 38.35 and the average for South Dakota is 41.26. Todd County for instance has a higher social vulnerability score than 99.8% of U.S. counties. In addition to the ten counties listed above, Day, Roberts, and Fall River also rank in the top 20% most socially vulnerable counties nationwide. Figure 3-8 below shows the percentile of each county's social vulnerability ranking on a national scale.

Figure 3-8 Social Vulnerability State Percentile

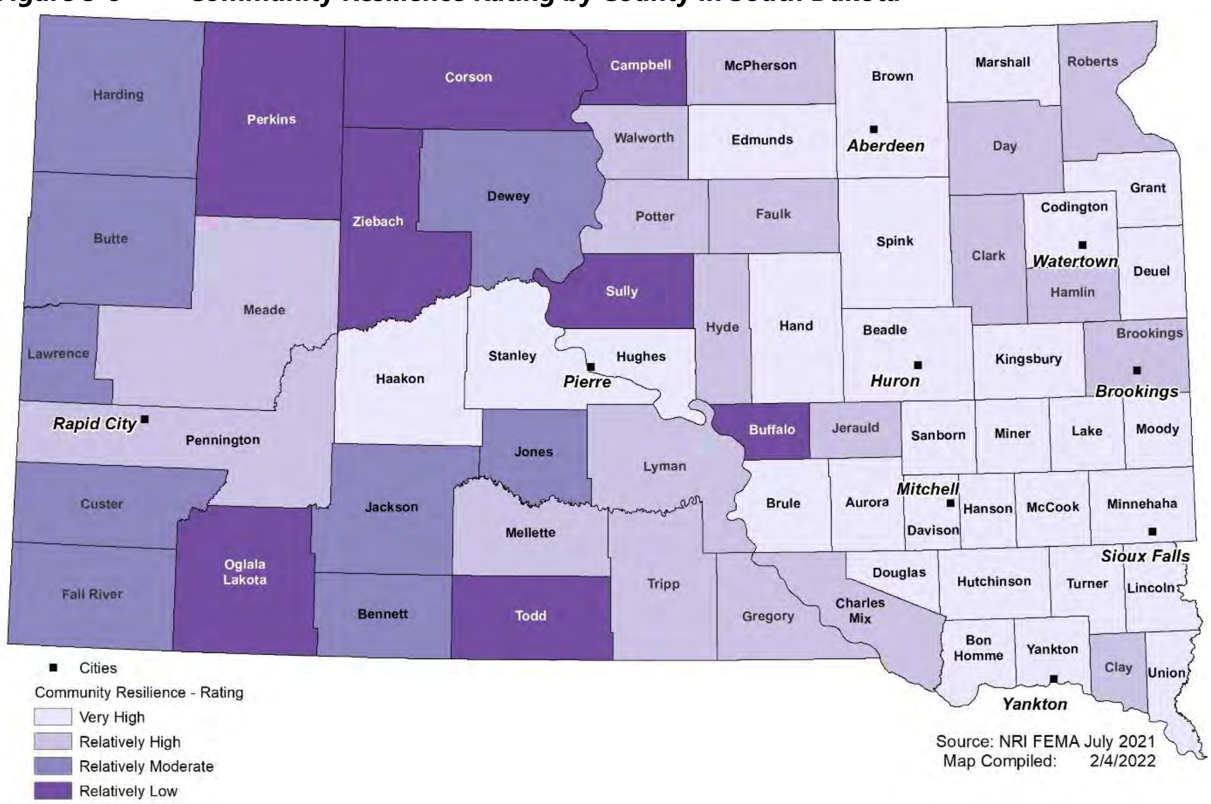


Related to social vulnerability, the NRI utilizes community resilience as a "consequence reduction component". Community Resilience can essentially be thought of as an inverse to social vulnerability. The NRI defines community resilience as the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. There are multiple, well-established ways to define community resilience at the local level, and key drivers of resilience vary between locations. Because there are no nationally available, bottom-up community resilience indices available, the Social Vulnerability and Community Resilience Working Group chose to utilize a top-down approach. The NRI relies on using broad factors to define resilience at a national level and create a comparative metric to use as a risk factor.

The Community Resilience score is a consequence reduction risk factor and represents the relative level of community resilience in comparison to all other communities at the same level. A higher Community Resilience score results in a lower Risk Index score. Because Community Resilience is unique to a geographic location—specifically, a county—it is a geographic risk factor. Community resilience data are supported by the University of South Carolina's Hazards and Vulnerability Research Institute (HVRI) Baseline Resilience Indicators for Communities (BRIC). HVRI BRIC provides a sound methodology for quantifying community resilience by identifying the ability of a community to prepare and plan for, absorb, recover from, and more successfully adapt to the impacts of natural hazards. The HVRI BRIC dataset includes a set of 49 indicators that represent six types of resilience: social, economic, community capital, institutional capacity, housing/infrastructure, and environmental. It uses a local scale within a nationwide scope, and the national dataset serves as a baseline for measuring relative resilience. The data can be used to compare one place to another and determine specific drivers of resilience, and a higher HVRI BRIC score indicates a stronger and more resilient community.

Figure 3-9 below shows the community resilience rating for each county in South Dakota.

Figure 3-9 Community Resilience Rating by County in South Dakota



The community resilience rating can be useful in determining counties which have higher levels of ability to cope with hazards and identify success stories for building resilience. According to the index, the following, listed in order, are South Dakota's ten most resilient counties:

1. Turner County (61.56)
2. McCook County (61.47)

3. Hanson County (61.42)
4. Hutchinson County (61.12)
5. Lincoln County (61.03)
6. Brule County (60.62)
7. Lake County (60.51)
8. Aurora County (60.28)
9. Haakon County (60.16)
10. Kingsbury County (60.11)

Each of the above counties are also in the top 20 percent in the nation in terms of community resilience. The average community resilience score for the State of South Dakota is 57.10, which is higher than the national average score of 54.59. Only 0.4% of counties in the country have a higher level of community resilience than South Dakota's highest rated county, Turner County. In addition to the ten counties listed above, Davison, Hughes, and Douglas County each are identified as having very high levels of community resilience and also rank in the top 20% of resilient counties nationwide. Figure 3-10 below shows the percentile of each county's community resilience ranking on a national scale.

Figure 3-10 Community Resilience State Percentile

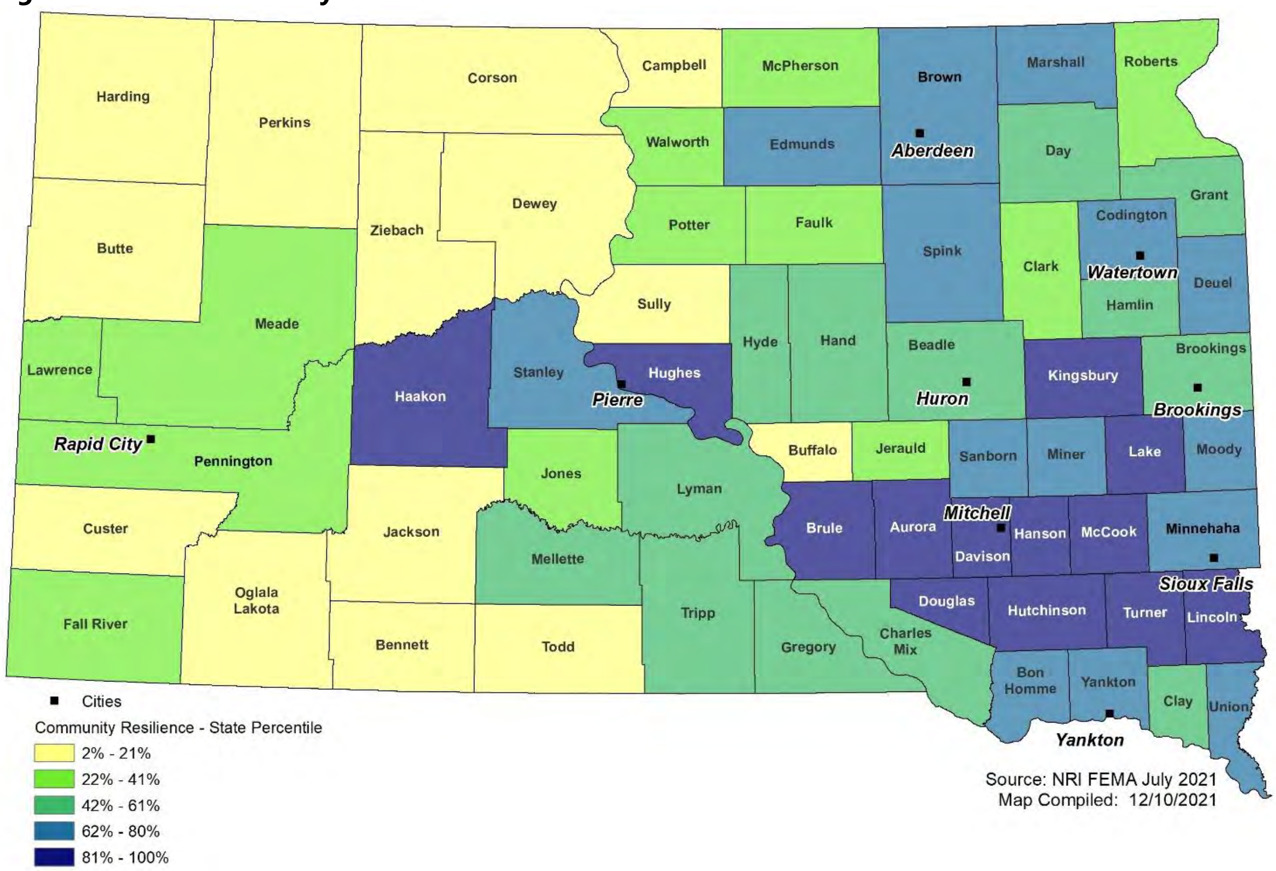


Table 3-9 below lists the percentages of the population of South Dakota that fall into key metrics of social vulnerability, and compares them to the national average. South Dakota is above the national average for households without broadband internet access, people without health insurance, and both the percentage of the population under 18 and over 65.

The State ranks well below the national average for people with limited English proficiency, households without access to a car, people without a high school diploma, and several key poverty metrics. However, it is crucial to remember that just the State ranks low in a given area does eliminate the need to identify, engage, and assist the members of that group. For example, 5% of South Dakota households do not have a car, and therefore may need more assistance to evacuate during an emergency. While only 2.1% of the population does not speak English well, plans for emergency public information and warning still need to plan to reach and inform those people.

Table 3-9 Socially Vulnerable Demographics, South Dakota vs. U.S.

Characteristic	South Dakota	US	% Difference
No broadband internet access	16.8%	14.8%	13.5%
No health insurance	9.6%	8.7%	10.3%
Population under 18	24.5%	22.4%	9.4%
Population over 65	16.7%	16.0%	4.4%
People living in poverty	12.8%	12.8%	0.0%
People with a disability	11.7%	12.7%	-7.9%
People on food stamps/SNAP	8.7%	11.4%	-23.7%
Households with rent above 35% of income	30.3%	40.0%	-24.3%
People unemployed	2.4%	3.4%	-29.4%
Did not graduate from high school	7.8%	11.5%	-32.2%
Households with no vehicle	5.0%	8.5%	-41.2%
People with limited English proficiency	2.1%	8.2%	-74.4%

Source: U.S. Census Bureau, 2022 American Community Survey

3.2.4. Building Exposure

Ideally, the risk assessments in this plan for building assets would be based on information and data presented in LHMPs. However, each LHMP is a product developed by the local planning team for each plan. Local plans inherently reflect the unique characteristics of the area it covers. This prevents a fair comparison of local-jurisdiction vulnerability. Fortunately, the NRI provides a vulnerability assessment using a consistent methodology across jurisdictions. Therefore, in this HMP update a list of key issues and problems are discussed for each hazard and NRI data are used to provide vulnerability information and data and to provide a solid basis for the vulnerability assessment. In cases where NRI data are unavailable, suitable substitutes are identified and used.

For future SHMP updates, the South Dakota of Emergency Management (SDOEM) will integrate the plan update assessment into the grant award briefing during the plan's initiation. This assessment will emphasize recommendations for improvement based on lessons learned from previous plans and address the changes outlined in the new Local Mitigation Planning Policy Guide.

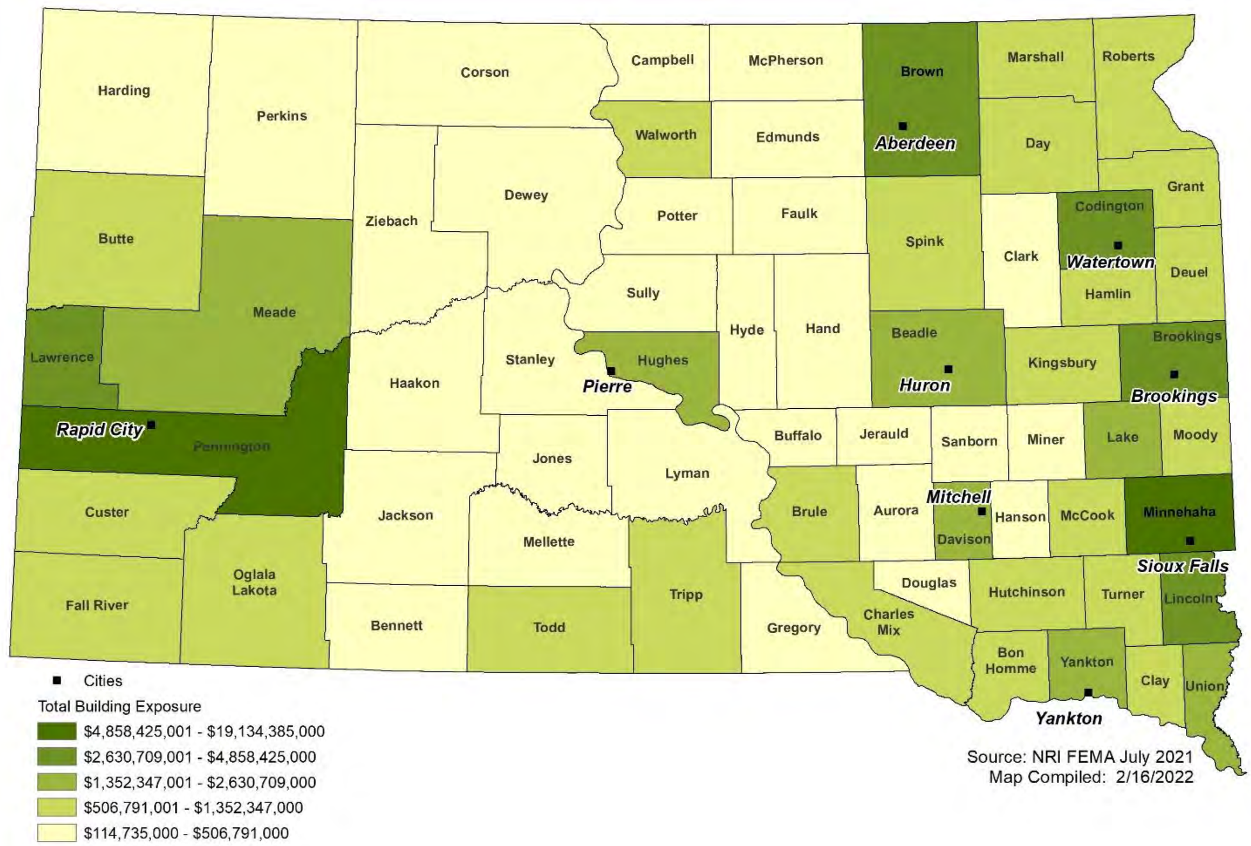
In 2023, SDOEM took a proactive step by creating a comprehensive story map. This resource provides valuable State guidance, application development tips, and insights into potential pitfalls. Additionally, SDOEM will continue collaborating with FEMA Region VIII to establish LHMP best practices. These practices will guide local jurisdictions in effectively meeting the LHMP requirements and ensure consistency in presenting this critical information. The resulting best practices will be incorporated into the SDOEM Mitigation story map, which will be accessible to all jurisdictions for their planning efforts.

While OEM can be celebrated for the success of their grant administration through grant award briefings, it is essential to note that approximately 40% of local plans are currently undergoing updates. Generating appropriate information and data in LHMP updates will demand additional effort from local planning teams and authors to meet the LHMP requirements.

Exposure is a term borrowed from the insurance industry as a measure of property "exposed" to a particular hazard. The 2020 Census estimates that there are 393,375 total buildings across South Dakota. FEMA NRI-based building values were used to estimate the total replacement value (excluding contents) of these buildings at $89,645,685,000. Figure 3-11 shows a thematic map at how building exposure varies by county across the State.

An event that would destroy or damage the entire inventory in a given county is unlikely, but it is possible that a tornado or wind-driven wildfire impacting the heart of a rural community could result in considerable building losses.

Figure 3-11 Building Exposure 2021



3.2.5. Land Use, Growth, and Development Trends

Land use and development trends exert a significant impact on the vulnerability assessments for South Dakota relative to specific hazards. In some cases, a dominant land use may increase the vulnerability to a specific hazard, such as agricultural diseases or wildfire. Land use trends may also indicate areas where vulnerability and risk may be more sustained than in other areas of the State and help identify areas where vulnerability and risk levels vary. This is particularly important to examine in a statewide hazard mitigation plan, to ensure the document reflects accurate variability of these elements.

One characteristic of local land use in South Dakota that must be considered in both state and local hazard mitigation planning is how the land use patterns are changing at the community level. Identifying both the type and rate of change from existing land uses to future land uses, whether they are planned or unplanned, can help to identify the local jurisdictions most subject to development pressures and consequently help to focus the mitigation planning to minimize the vulnerability to future disasters of the newly constructed neighborhoods, facilities, and infrastructure. Data from local plans can be used to identify the jurisdictions where planned land uses are significantly different from existing land uses.

The consequences of development trends for vulnerability of state assets and for jurisdictions is explicitly addressed for each hazard in hazard-specific sections on the HIRA.

As part of the plan update process, the State looked at changes in growth and development at the county level and examined these changes in the context of the State's hazard-prone areas and how the changes in growth and development affect loss estimates and vulnerability. Increases in population growth and development can result in greater exposure to hazards, particularly atmospheric hazards such as tornadoes, windstorms, and winter storms.

Table 3-10 and Table 3-11 summarize some trends in population growth in South Dakota since 2010. The decreases and increases in population by county are depicted on the map below.

Table 3-10 Top Ten Counties with Numerical Population Increase, 2010-2020

County	2010 Population	2020 Population	Numerical Change
Minnehaha County	169,468	197,214	27,746
Lincoln County	44,828	65,161	20,333
Pennington County	100,948	109,222	8,274
Meade County	25,434	29,852	4,418
Union County	14,399	16,811	2,412
Brookings County	31,965	34,375	2,410
Brown County	36,531	38,301	1,770
Beadle County	17,398	19,149	1,751
Lawrence County	24,097	25,768	1,671
Clay County	13,864	14,967	1,103

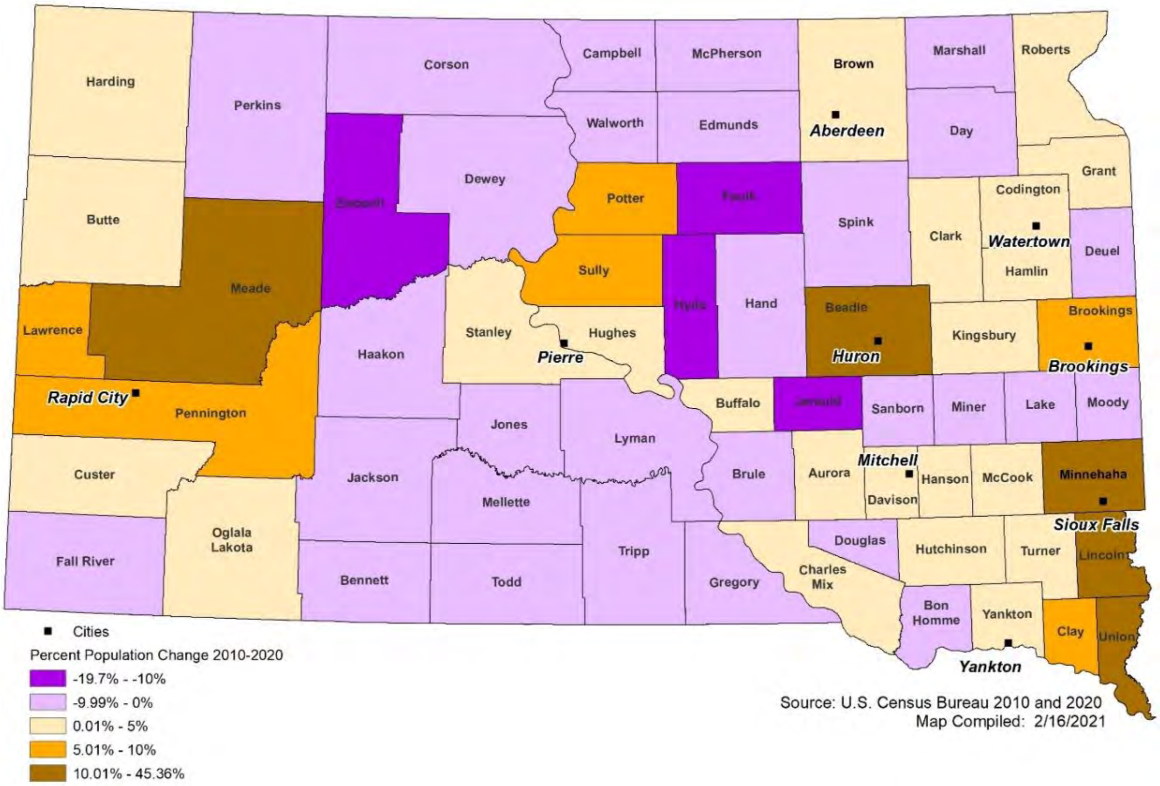
Source: U.S. Census Bureau, 2010 and 2020 Census Results

Table 3-11 Top Ten Counties by Percent Growth, 2010-2020

County	Percent Change
Lincoln County	45.36%
Meade County	17.37%
Union County	16.75%
Minnehaha County	16.37%
Beadle County	10.06%
Pennington County	8.20%
Clay County	7.96%
Brookings County	7.54%
Lawrence County	6.93%
Potter County	6.14%

Source: U.S. Census Bureau, 2010 and 2020 Census Results

Figure 3-12 Population Change 2010-2020



Between 2010 and 2020, 33 South Dakota counties lost population. Of the counties with the greatest losses in population, five (Mellette, Jones, Faulk, Hyde, and Jerauld) also rank among South Dakota's 10 least populous counties. This trend of population loss amongst half of all counties in South Dakota, coupled with the fact that the State as a whole saw an 8.9% population increase over the same period, outpacing the national average growth rate, indicates that South Dakota's future growth is urbanizing. More and more of the population growth is directed towards the existing urban centers in the State.

Table 3-12 and Table 3-13 summarizes these trends in development growth in South Dakota, in terms of housing unit development, since 2010. The counties with the greatest increases in housing units have an increased building and population exposure hazards compared to counties that have experienced a decrease in units.

Table 3-12 Top Ten Counties with Percentage Increase in Housing Units, 2010-2020

County	2010 Units	2020 Units	Change (+/-)	Percent change
Lincoln County	17,875	26,227	8,352	47%
Minnehaha County	71,557	83,717	12,160	17%
Union County	6,280	7,215	935	15%
Brookings County	13,137	14,849	1,712	13%
Meade County	11,000	12,357	1,357	12%
Lawrence County	12,756	14,163	1,407	11%
Clay County	5,639	6,180	541	10%
Pennington County	44,949	49,153	4,204	9%

Hanson County	1,177	1,279	102	9%
Yankton County	9,652	10,372	720	7%

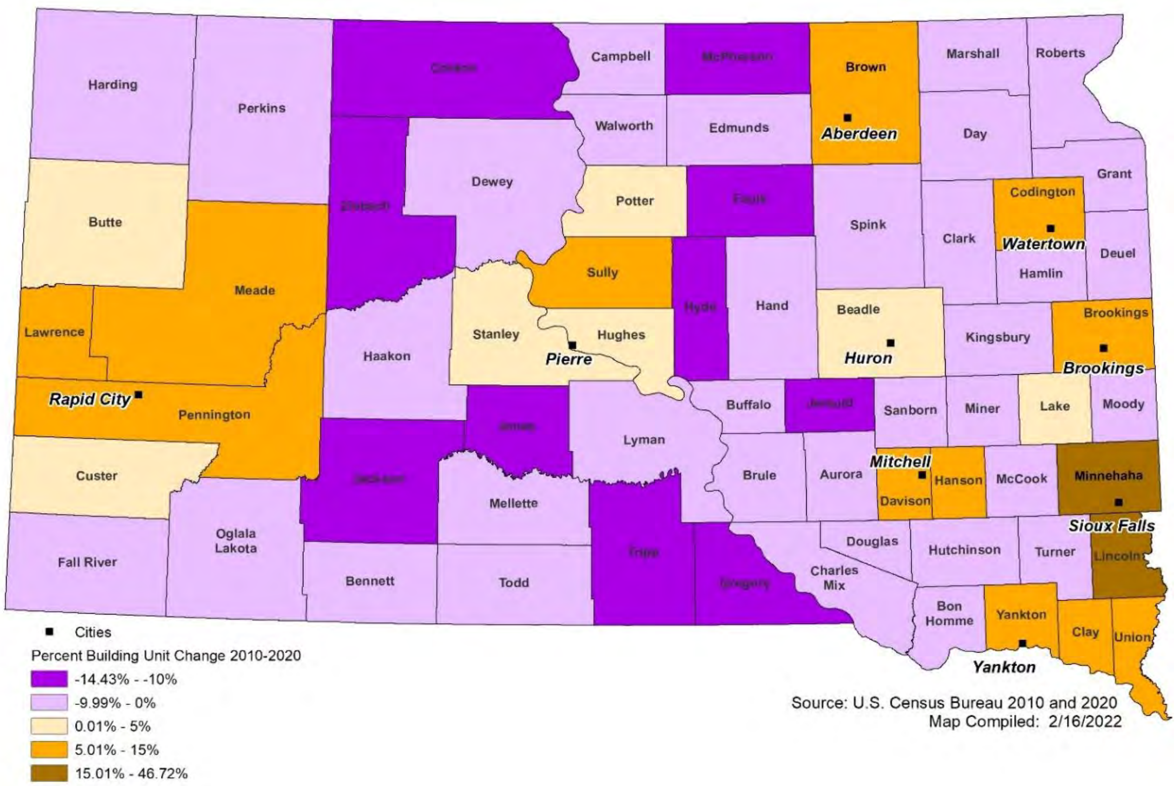
Source: U.S. Census Bureau, 2010 and 2020 Census Results

Table 3-13 Top Ten Counties with Percentage Decrease in Housing Units, 2010-2020

County	2010 Units	2020 Units	Change (+/-)	Percent change
Jones County	589	504	-85	-14%
Gregory County	2,503	2,186	-317	-13%
Hyde County	708	626	-82	-12%
Corson County	1,540	1,362	-178	-12%
McPherson County	1,418	1,258	-160	-11%
Jerauld County	1,070	952	-118	-11%
Jackson County	1,193	1,064	-129	-11%
Ziebach County	987	882	-105	-11%
Tripp County	3,072	2,762	-310	-10%
Faulk County	1,136	1,022	-114	-10%

Source: U.S. Census Bureau, 2010 and 2020 Census Results

Figure 3-13 Housing Unit Change 2010-2020



In general, counties with growing populations and increased housing units have an increased exposure to hazards not defined by specific geographic areas. These hazards may include winter storms, summer storms, tornadoes, wind, drought, wildfire, and earthquake. The counties experiencing the most development pressures all participate in the National Flood Insurance Program.

Rapid City, in Pennington County, is in the Community Rating System at Class 7. This suggests that flood risk should not be increasing, assuming that county floodplain ordinances are being effectively implemented and wise use of floodplains encouraged. New data suggests that repetitive losses are increasing in the State. Union County is one of the fastest growing counties and has potential for high flood losses as described in the flood vulnerability section. New homes being built in Meade and other counties increase the exposure to damage from tornadoes.

Additional information on growth and development trends came from the review of local and tribal hazard mitigation plans that have been updated since 2017, as summarized in Table 3-14.

Table 3-14 Growth and Development Trends Extracted from Local Plans Updated Since 2017

Jurisdiction	Growth and Development Trend
Aurora County	Aurora County has seen limited population growth from 2011 to 2021, with projections indicating a potential decrease. Nevertheless, climate change might introduce a new dimension to local vulnerability, potentially influencing the occurrence and intensity of hazards like winter storms, flooding, and drought.
Beadle County	Beadle County has witnessed a general increase in population and development, heightening the vulnerability to natural hazards. While rural jurisdictions are experiencing a decline in population, growth is evident in Huron, Cavour, Hitchcock, Virgil, Wessington, Wolsey, and Yale. These expanding communities have identified existing gaps in emergency preparedness, posing additional risks to their growing development. For example, Wessington grapples with the potential for flooding due to the Rose Hill Dam failure and is susceptible to various hazards prevalent in Beadle County, with past storms causing significant damages. Similarly, Wolsey faces infrastructure concerns, such as the collapse of the sewer system in heavy rain events.
Bon Homme County	Bon Homme County faces sustained population decline and limited development. While there's no expectation of increased infrastructure and population exposed to hazards, poor land management poses risks for flooding, drought, and wildfires. Ongoing conversion of wetlands to agriculture, especially in Tyndall's southern edge, heightens flooding vulnerability by reducing the land's ability to absorb excess water. Continued land use trends also elevate drought vulnerability. Along the Missouri River, abundant brushy vegetation and cedar trees increase wildfire risk, emphasizing the need for careful land use management to mitigate hazards.
Brown County	While some communities within the Brown County are experiencing a decline in population, the majority are experiencing growth including Groton, Claremont, Columbia, Hecla, and Warner. Housing development is occurring on the outskirts of Aberdeen, near Richmond Lake and Tacoma Park. Most commercial and industrial development is happening in incorporated municipalities, not in rural areas. With new development came the elevated effort of flood mitigation with regulations to retain runoff with open natural drainage systems and encourage infill development.
Brule County	Brule County is sparsely populated with limited growth and development. While there's no expectation of increased infrastructure and population exposed to hazards, poor land management poses risks for flooding, drought, and wildfires. Ongoing conversion of wetlands to agriculture heightens flooding vulnerability, diminishing the land's natural capacity to absorb excess water. Continued land use trends also increase drought vulnerability. Flood risk from Big Bend Dam failure adds to concerns due to mismanagement of dam releases. Brushy vegetation and cedar trees along the Missouri River's hilly terrain increase wildfire risk, highlighting the need for careful land use management to mitigate potential hazards.
Buffalo/Crow Creek Reservation	The county’s population has declined slightly from its peak in 2000 but is projected to increase with almost all the growth expected to occur on the Crow Creek Reservation. Growth that occurs in the housing areas located some distance from Fort Thompson is expected to have increase vulnerability to winter and summer storms, as many of the residents would lack access to a storm shelter. Vulnerability to wildfire is expected to increase if growth occurs in the areas of Fort Thompson identified as being at high risk of fire. Another factor that could increase wildfire

Jurisdiction	Growth and Development Trend
	vulnerability is the continued spread of cedar trees in Buffalo County and the Crow Creek Reservation.
Cheyenne River Sioux Tribe	The city of Eagle Butte sees significant growth, especially with the upcoming Badger Creek housing project. No growth is expected in hazard-prone areas. Limited growth is anticipated in Dewey and Ziebach counties. Despite declining population and housing units, the area remains vulnerable to hazards like winter storms, tornadoes, floods, high winds, and wildfires.
Codington County	Since 1930, the County has seen continuous population growth, driven by the expansion of Watertown. Municipalities have wastewater systems, while rural areas use septic tanks. The environmental concern lies in the density of septic systems and potential water contamination. While significant residential growth isn't anticipated, careful planning and development guidelines are crucial for controlling new developments.
Custer County	Custer County is currently experiencing a population influx, with around 69% residing in unincorporated areas. Over the decade from 2010 to 2020, the county saw a 1% population increase, and projections suggest an anticipated 8.1% rise by 2026. Custer City and Hermosa are witnessing population expansion in rural Wildland Urban-Interface (WUI) areas, increasing the risk of wildfire damage. Approximately 79% of populated areas in Custer County face a direct threat of wildfires, while 21% face an indirect risk. Implementing Firewise practices is crucial to mitigate structural ignitability and reduce the risk of fire spread.
Davison County	The County's population is set to increase, with growth concentrated near Lake Mitchell and south of the City of Mitchell. The plan notes concern for heightened demand for water and energy, impacting development and stressing natural resources. Municipalities have wastewater systems, while rural areas rely on septic tanks. Urban expansion around Mitchell necessitates additional sewer lines, requiring careful planning for the city's sewage treatment capacity. Flood vulnerability is exacerbated by converting wetlands to agriculture. Continued trends may increase drought vulnerability. Changing conditions will require new agricultural practices.
Deuel County	Deuel County and its communities, including Clear Lake, Gary, and Toronto, are growing with adopted Comprehensive Land Use Plans. Agriculture dominates the county's economy, with larger but fewer farm units. In 2010, 10.1% of the population was below the poverty line, and a slight increase is expected due to the Covid-19 Pandemic. Residential growth in the county is not anticipated to be significant.
Douglas County	The plan notes that increased water and energy demand will limit development, stress resources, and raise competition. Douglas County has a sparse population, declining by almost 47% since 1950, with expectations of further decrease. The spread-out nature poses vulnerability. Rural areas may be more susceptible to winter storms due to challenges in electricity transmission and accessibility for residents during prolonged snow blockages.
Edmunds County	Mina Lake and Ipswich see housing development on larger plots, while Roscoe experiences additional commercial growth with four new houses built in the past year. The remaining areas of Edmunds County are focused on maintaining current population levels, resulting in static development trends. While most structures in the county and local jurisdictions are outside flood plains, they remain susceptible to wildfires, winter storms, and summer storms.
Flandreau Santee Sioux Tribe	Flandreau projected potential lot numbers within flood hazard areas based on land use density. The city adheres to the latest National Flood Insurance Program and approved ordinances for floodplain regulation, with no amendments in the last five years. Anticipated changes to planned areas within the floodplain are expected with the adoption of updated boundaries from the RiskMap project.
Haakon County	Haakon County has seen a continued expansion of agricultural on marginal land. The demand for more water from farming can heighten the County’s risk of drought. Additionally, the urban and rural development can strain underground water sources, especially for wells and septic systems. New rural developments could face increase wildfire risk due to distance from emergency services. Aging citizens and declining young population in Philip raise concerns about natural hazard impacts on vital services.

Jurisdiction	Growth and Development Trend
Hanson County	Hanson County is sparsely populated with the projection of modest population growth. Though future growth isn't significant, there is concern for expanding development near flood-prone areas in the northeast corner of Alexandria. The ongoing conversion of wetlands to agriculture raises the risk of flooding. Potential vulnerability to drought may rise if current land use trends persist. Modest population growth suggests wildfire vulnerability remains stable, but the construction of Cargill's large grain storage facility in Emery and the spread of cedar trees increase local fire risk.
Hughes County/ Stanley	From 1960 to 2020, Hughes County experienced a 39% population increase, driven by its status as the state capital and the Oahe Dam construction. In contrast, Stanley County's population decreased by 27%. The area around Pierre and Fort Pierre is expected to continue growing, with rural subdivisions becoming popular. Future growth in both counties is projected without hazard area development. Flood ordinances restrict building in flood-prone regions. However, New development in dam inundation areas is at risk unless elevated. Windstorm susceptibility is equal throughout, but developments along the bluffs by the Missouri River may face more severe events. Landslide risks rise due to growing populations along the Missouri River, with Pierre implementing additional engineering requirements and regulations to mitigate future risks.
Hyde County	Over the past fifty years, both Hyde County and the City of Highmore have experienced a steady decrease in population, particularly in rural areas due to fewer farms, increased mechanized farming, and ongoing outmigration. However, there is a growing popularity of rural homesteads, which leaves the residents vulnerable to wildfires due to the distance from emergency services. Drought vulnerability may also increase with current land use trends, as more marginal land is brought into agricultural production with mechanized methods demanding additional water. The lack of flood maps complicates future development planning around flood zones, posing challenges for risk assessment.
Jones County	Jones County have witnessed a continuous migration trend from rural to urban and suburban areas, driven by reduced farms and increased mechanized farming which are larger in acres and have higher water demand. The rural population decline is linked to fewer farms, while there are non-farmers moving to rural areas who are often classified as an older population. The concentration in rural residents increases vulnerability to wildfires due to the distance from emergency services.
Lake County	Lake County has seen a slight decrease in population from 2010. However, the County has maintained a steady population since the 1920s. While the number of farms and ranches has declined, the remaining agricultural production has significantly increased in size. It's uncertain what the future development trends are and their potential overlap with hazards.
Lincoln County	Lincoln, South Dakota's fastest-growing county, is undergoing urbanization, especially with Sioux Falls' southward expansion. Residential development is expected to continue in both Lincoln and Minnehaha County, necessitating controlled growth through planning and guidelines to avoid hazard-prone areas like floodways or wetlands. Development-related land use changes could impact flooding, increasing runoff and altering stream channels, affecting peak discharge, volume, and flood frequency.
Mellette County	Mellette County's communities are facing declining populations in recent decades. The primary goal is to maintain and support the current population. While population growth isn't anticipated to increase vulnerability to hazards, climate change may influence vulnerability in the future.
Perkins County	Perkins County has experienced a population decline of 9.6% from the 2010 census and an overall change of -14.8% from 2000.
Todd/Rosebud Sioux Tribe	Despite a sparse population, Todd County has been steadily growing over the past few decades and is projected to continue this trend. If current land use trends persist, future development will potentially raise vulnerability to wildfires, particularly in Wildfire Interface or Wildfire Intermix zones, areas such as pastures, grasslands, dried out wetlands, and wildlife production areas. The ongoing spread of juniper trees, also known as cedar, could further amplify the risk of wildfires.
Sanborn County	Sanborn County's population has been declining for decades, with no significant development since the current plan was established. The ongoing conversion of wetlands and marginal land to

Jurisdiction	Growth and Development Trend
	agriculture is likely to increase the county's vulnerability to flooding. Farming these areas raises the probability and severity of flooding as the land's natural capacity to absorb excess water diminishes. Additionally, vulnerability to drought may rise if current land use trends persist and more marginal land is brought into agricultural production.
Standing Rock Sioux Tribe	Standing Rock Sioux Tribe anticipates population growth in Fort Yates and Long Soldier District. The primary vulnerabilities for new development include drought and wildfire risks. The reliance on underground water sources poses a threat, particularly with increased population and economic activity. Wells and septic systems in rural areas currently go unregulated which is where growth is projected. These remote residents are also vulnerable to wildfire risks due to their distant from fire departments.
Sully County	Sully County projects gradual population growth, with vulnerability to hazards linked to rural land use practices. The risk of drought may rise if current trends bring more marginal land into agricultural production. The ongoing conversion of wetlands and marginal land to agriculture poses a potential increase in vulnerability to flooding, diminishing the land's natural water absorption capacity. Vulnerability to wildfires may grow due to the Cow Creek Development and increased rural homesteads.
War Hawk District	Communities experience growth and/or development at this time include Mobridge, Selby, Herreid, and some rural areas of Walworth and Campbell Counties. Both counties are anticipating wind energy development. Prior to this plan the counties within the district didn't adhere to zoning practices which put exist development at risk. With projected growth, mitigation practices are being adopted.
Yankton County	The County's population has risen by 17% since 1990 and is expected to continue growing moderately. However, this growth brings challenges, such as increased demand for water and energy, constraining development and stressing natural resources. Growth could impact vulnerability to flooding, especially with continued development along Lewis and Clark Lake and the Missouri River. Factors like the conversion of wetlands to agriculture contribute to flooding vulnerability. Additionally, Yankton County faces a potential increase in vulnerability to wildfires, particularly in growing residential developments west of Yankton, exacerbated by the continued spread of cedar trees. There is also a high risk of wildfire impact for ongoing residential development in Wildfire Interface zones, areas such as pastures, grasslands, dried out wetlands, and wildlife production areas.

Source: local and tribal hazard mitigation plans

There is still room for improvement when it comes to promoting community resilience through planning. A 2022 Survey of State Planning Laws by the American Planning Association ranked South Dakota medium for its emphasis on hazard mitigation planning, but low on the overall strength of the state's role in land use planning and climate action planning. This could be an area the state could explore further to potentially strengthen the linkage between land use and hazard mitigation planning. Another area of focus could be a review of state-level laws that enable local planning for updates needed in response to the growing threats posed by a changing climate, increasingly frequent and severe natural hazards, as well as the growth and development trends being experienced in the State. However, it must be recognized that the political will to increase state control over local and private land use decisions may not exist.

3.3. Hazard Profiles

44 CFR Part 201 Requirement:
[The State risk assessment shall include an overview of the] location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate…

South Dakota identified the 10 hazards for analysis in the HIRA which are discussed in the following order:

1. Agricultural Pests and Diseases
2. Flood (including Dam and Levee Failure)
3. Summer Storm (including Lightning and Hail)
4. Winter Storm
5. Wildfire
6. Drought (including Extreme Heat)
7. Tornado
8. Windstorm
9. Hazardous Materials
10. Geologic Hazards (Landslides, Mudflows, Expansive Soils, Subsidence, and Earthquakes)

3.3.1. Agricultural Pests and Diseases

Hazard Description

Agricultural hazards are divided into two categories: pests and diseases. For this plan, such events are defined as the naturally occurring infection of crops or livestock with insects, vermin, or diseases that render the crops or livestock unfit for consumption, sale, or other use. South Dakota has a substantial agricultural industry and a significant infrastructure composed of related facilities and locations, so the potential for infestation of crops or livestock poses a significant risk to the economy of the State. In order to profile each element adequately, this hazard profile focuses on events that primarily affect livestock (primarily disease) and crops (disease and pests). In some cases, pests may also serve as the vector of disease for livestock.

Agriculture is a vital industry in South Dakota. According to the most recent (2017) Census of Agriculture conducted by the USDA, the State had 29,968 farms, with over 43,243,742 acres of farmland, for an average farm size of 1,443 acres. The agriculture industry nets over $2.4 billion per year in farm income. A 2021 study released by the SD Department of Agriculture and Natural resources found the total value-added agricultural output of South Dakota was $11.7 billion in 2021.[1] The same study found agriculture and associated economic activity accounted for 1 in 5 jobs in South Dakota and produced a rich analysis of county-level data with a handy interactive mapping tool for communicating a geographic context and meaning for the study findings.[2] The State boasts 48,813 producers, ninety-five percent of which operate family-owned farms. South Dakota's agricultural history dates back to the nineteenth century, when homesteaders used a mule and moldboard plow to break the thick prairie sod. Currently, in the twenty-first century, crop production has increased as farmers embrace new technologies, better hybrids, and more efficient land use practices, which has resulted in a 6% decrease in the total number of farms since the 2012 (USDA) Census of Agriculture. More than 19.8 million acres of the State is cropland and approximately 22 million acres are devoted to pastureland. Table 3-15 below shows where South Dakota

1 South Dakota Department of Agriculture and Natural Resources et al., 2021, 2021 Economic Contribution Study of South Dakota Agriculture, Ethanol and Forestry, prepared by Decision Innovation Solutions, study webpage: https://danr.sd.gov/AboutDANR/EconomicStudy.aspx.

2 The visualization tool is available at https://danr.sd.gov/AboutDANR/EconomicStudy.aspx or https://tinyurl.com/2021-SD-AFECS.

ranks amongst other states in the production of various crops, including the amount produced and what percentage of the total U.S. production comes from South Dakota.

Table 3-15 South Dakota Rank in U.S. by Commodity

U.S. Rank	Commodity and Date	Number	Unit	Percent of U.S. Total
1	**Bison,** inventory, Census of Agriculture, 2017	30,035	head	16.3
1	**Oats,** production, 2020	10,780,000	bushels	16.5
2	**Honey,** production, 2020	14,945,000	pounds	10.1
2	**Sunflower, All,** production, 2020	1,167,020,000	pounds	39.1
2	**Sunflower, Oil,** production, 2020	1,064,000,000	pounds	40.7
2	**Sunflower, Non-oil,** production, 2020	103,020,000	pounds	28.2
3	**Millet, Proso,** production, 2020	1,715,000	bushels	18.6
3	**Sorghum for Silage,** production, 2020	350,000	tons	11.2
4	**Sorghum for Grain,** production, 2020	11,360,000	bushels	3.0
5	**Beef Cows, All,** inventory, January 1, 2021	1,799,000	head	5.8
5	**Calf Crop,** January-December, 2020	1,780,000	head	5.1
5	**Hay, Alfalfa,** production, 2020	3,240,000	tons	6.1
5	**Lamb Crop,** inventory, 2020	200,000	head	6.2
5	**Land in Farms,** 2020	43,200,000	acres	4.8
5	**Safflower,** production, 2020	16,875,000	pounds	11.4
5	**Wheat, Spring,** production, 2020	35,720,000	bushels	6.1
5	**Wool,** production, 2020	1,650,000	pounds	7.1
6	**Peas, Dry Edible,** production, 2020	448,000	cwt	2.1
6	**Sheep and Lambs, All,** inventory, January 1, 2021	245,000	head	4.7
6	**Sheep and Lambs, Market,** inventory, January 1, 2021	56,000	head	4.0
7	**Cattle and Calves, All,** inventory, January 1, 2021	4,000,000	head	4.3
7	**Cattle on Feed,** inventory, January 1, 2021	460,000	head	3.1
7	**Corn for Grain,** production, 2020	729,000,000	bushels	5.1
7	**Corn for Silage,** production, 2020	6,480,000	tons	4.7
7	**Grain Storage Capacity, On Farm,** December 1, 2020	730,000,000	bushels	5.4
7	**Hay, All,** production, 2020	5,365,000	tons	4.2
7	**Principal Crops Harvested,** 2020	15,189,000	acres	5.2
8	**Cropland,** total, acres, Census of Agriculture, 2017	19,813,517	acres	5.0
8	**Pig Crop,** December 2019-November 2020	6,857,000	head	4.9
8	**Principal Crops Planted,** 2020	15,581,000	acres	5.0
8	**Soybeans,** production, 2020	223,860,000	bushels	5.4
8	**Wheat, All,** production, 2020	70,520,000	bushels	3.9
10	**Grain Storage Capacity, Off Farm,** December 1, 2020	440,000,000	bushels	3.7
10	**Wheat, Winter,** production, 2020	34,800,000	bushels	3.0
11	**Hay, Other,** production, 2020	2,125,000	tons	2.9
11	**Hogs and Pigs, All,** inventory, December 1, 2020	2,020,000	head	2.6
13	**Cash Receipts from Farm Marketings,** 2019	8,894,483,000	dollars	2.4
13	**Red Meat Production, Commercial,** 2020	1,473,800,000	pounds	2.6
16	**Barley,** production, 2020	616,000	bushels	0.4

Source: USDA National Agricultural Statistics Service

Small losses caused by agricultural pests and diseases are normal for South Dakota farmers and ranchers. Concerns arise when the level of an infestation escalates suddenly and overwhelms normal control efforts, a new type of infestation occurs, diseases decimate animal populations, or when diseases pose a risk to humans. The levels and types of such events vary based on many factors, including cycles of heavy rains and drought, feeding practices, cross contamination or exposure, or inadequate infection control measures.

While zoonotic diseases (those transmissible to humans from animals or via an animal vector) are a concern, those events are best addressed in a pandemic or contagious disease plan, in order to address the variability and magnitude those events entail. The control of insects and rodents partially addresses the mitigation of zoonotic disease, but for the purposes of this plan, that is an extra factor, rather than a primary focus. This hazard profile focuses on the diseases which impact the population of domesticated livestock or crops, which in turn damages the economic return on these valuable assets.

The following evaluation of crop hazards is reproduced from the South Dakota State University website:

Farmers endure a number of problems during the growing season which can curtail yield. Some of these problems occur because best management practices are not applied. The lack of a good stand, crop-nutrient deficiencies, insect infestations, weed population increases, poor field drainage, and salinity problems can to some degree be managed. However, there are some weather-related natural events that are beyond the farmer's control. High humidity and strong southerly breezes can carry windborne pathogens from Mexico and the southern states to infect crops. Violent storms from May to August can bring hail can reduce crop yield potential or damage crops beyond recovery. Lack of timely precipitation can wither crops and reduce yields. Late frost in the spring can kill crops and early frost in the fall can curtail the grain filling period of fall harvested crops.

Weeds that infest fields may cause problems during harvest. The weeds may clog small to medium size combines, so alternative harvesting techniques are required. The cut-and-swathing technique is not preferable as it may encourage grain loss and requires a greater investment of time and/or manpower.

Rodent infestations, such as mice, rabbits, and other pests, also threaten to damage crops in all stages of the production process. Young plants are vulnerable to the rodents who feed on them. Harvested and stored crops may be contaminated by rodents burrowing into storage units, either to feed on the materials or create nests during winter months or become contaminated by fecal matter. The nature of such infestations makes tracking statistical data nearly impossible. Variables include the geographic distribution of the rodents and the crops, the number of rodents in the area, the presence and proliferation of natural predators, and the reproduction rates relative to the amount of natural food resources available. As such, while this is an acknowledged element of the agricultural hazards, it is not a primary focus in this profile.

Insect plagues also cause significant damage to crops in South Dakota. The last major grasshopper infestation in the United States occurred in the 1930s. Following this disaster, it was decided that local control of grasshopper outbreaks was insufficient, and that regional coordination was required. The 1934 Congress charged the U.S. Department of Agriculture (USDA) with controlling grasshoppers on federal rangeland. In 1987, the Animal and Plant Health Inspection Service (APHIS), which is part of the USDA, created the Grasshopper Integrated Pest Management (GHIPM) Project to develop new technologies for managing grasshopper populations. Grasshopper infestations in the 1950s, 1980s, and 2000s further underscore the importance of mitigating this insect-driven hazard.

Similar insect hazards include locusts, aphids, and bark beetle plagues. In 2012, Campbell, Corson, Harding, and Perkins counties all received USDA disaster designations involving insects and disease (S3467). In early March 2010, USDA designated Ziebach County as a primary natural disaster area due to weather and grasshopper problems in 2009.

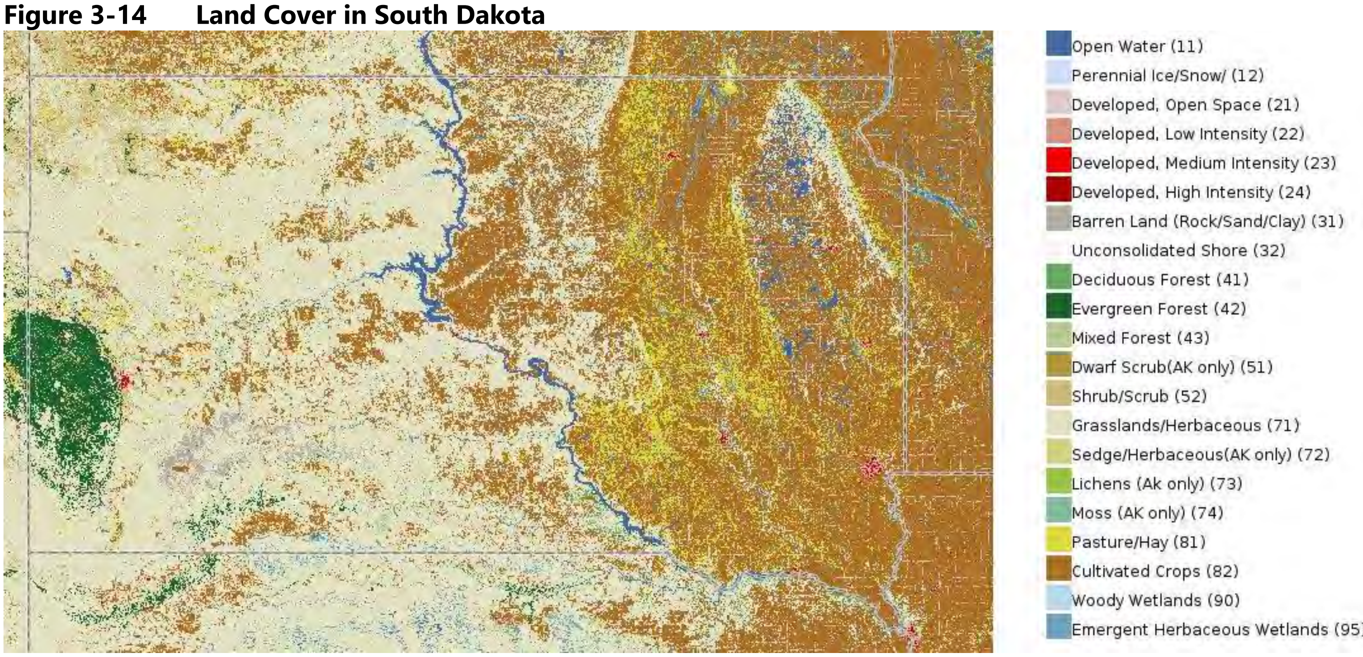
Location

Figure 3-14 shows land cover data from the USGS National Map. Land cover in South Dakota is predominantly cropland and rangeland. The significant forested areas in the State are concentrated in the Black Hills Region, located in the southwest corner of the State. Large bands of cultivated cropland and pastureland or haymaking areas run from north to south across eastern South Dakota. Areas in the western half of the State are marked with cropland and pastureland and pockets of barren land but are primarily characterized by grasslands. Highly concentrated areas of development, including residential and commercial/industrial/transportation classifications of land, are limited geographically and centralized around the major population centers of Rapid City, Pierre, and Sioux Falls. Other areas of concentrated urbanization include Aberdeen, Watertown, and Huron, which is consistent with data presented in Section 3.2.3, *Population*, above.

Livestock diseases are possible anywhere that livestock are present. In addition, humans who come into contact with contaminated livestock or byproducts may also be exposed to livestock diseases. 21,997,620 acres in South Dakota are devoted to pastureland, which accounts for 44.6% of the total land area of the State. Pastureland is primarily located in bands that stretch from north to south in the eastern half of the State, and in the grasslands that dominate the western area of the State. In Figure 3-15, pastureland areas are indicated in yellow, while grasslands are indicated in beige and cultivated crops are indicated with darker brown.

Similarly, crop diseases are possible in any cultivated cropland environment. 19,813,517 acres in South Dakota are designated as cropland, which accounts for 40.1% of the total land area of the State. Cultivated crops are more prevalent in the eastern half of the State, though significant areas of cropland interspersed with grasslands also exist in the west.

Figure 3-14 Land Cover in South Dakota



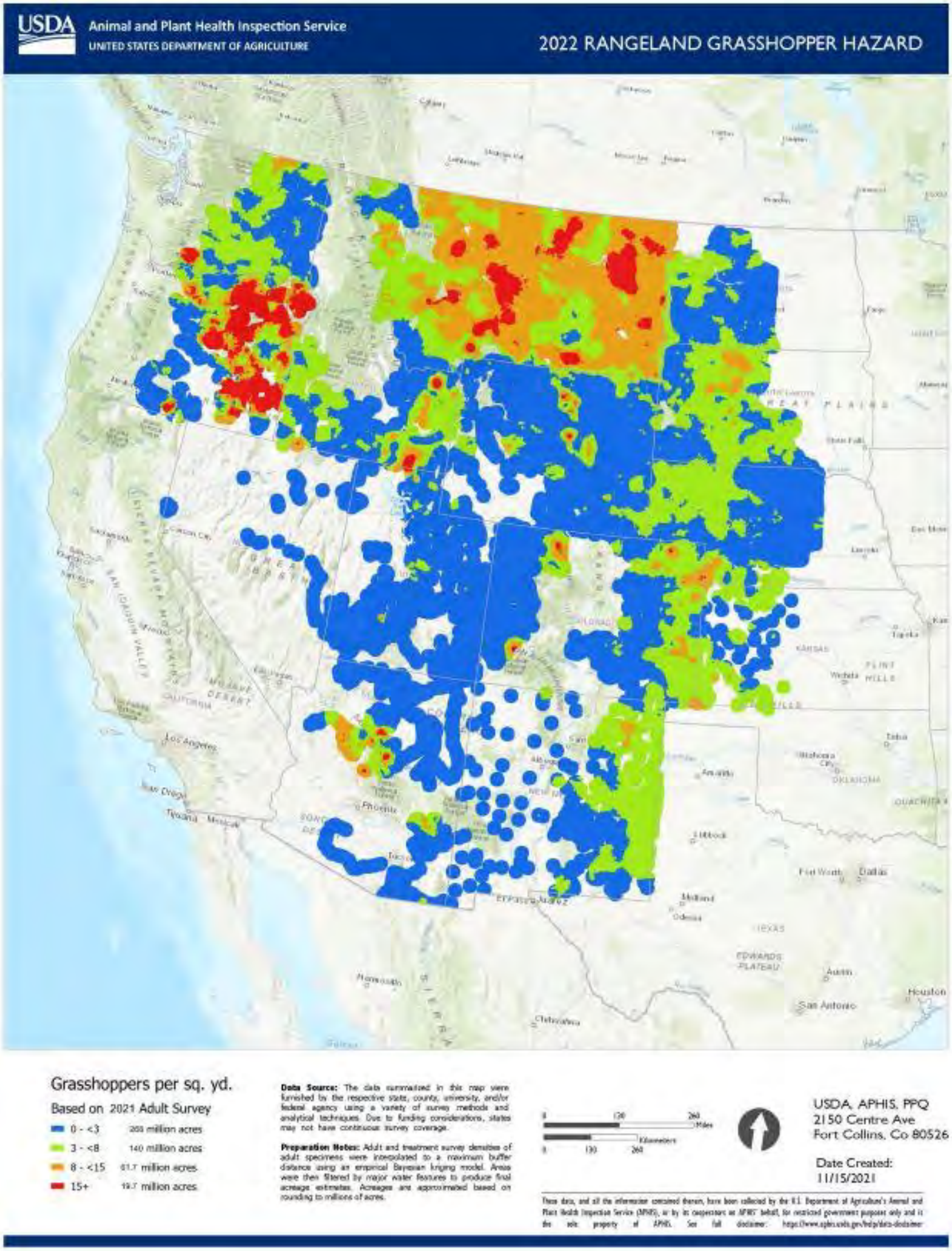
Source: The National Map Seamless Server hosted by the USGS, using NLCD 2016 Land Cover data.

Rodents such as mice, rats, and rabbits, are found across the entire planning region, as are insects. The presence of the rodents and insects is a consistent feature, with normal population density flows following the seasonal patterns. However, when density of these populations exceeds the capacity of the ecosystem, agricultural industries such as crops, and the health of livestock are threatened. As discussed above, the ability to model these trends is difficult and inconsistent.

Grasshoppers are a historical insect hazard impacting agricultural production of crops. Figure 3-15 below shows the projected grasshopper density in the Western U.S. for 2021. While the map indicates that the majority of the density ratings are in western South Dakota, outside of the majority of cultivated cropland, this is due to the fact that the USDA does not survey in the eastern part of the State.

The future location of agricultural pests and disease concerns will be impacted by both climate change and development. Climate change will alter the ecology of pests and disease and is discussed further in the subsection below titled *Climate Change Considerations.* Development will alter the exposure of agriculture to pests and disease. In a simple example, taking cropland out of production for municipal development will reduce the exposure of crops to pests and disease. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Figure 3-15 South Dakota Grasshopper Hazard



Past Events

Past events are detailed differently in this section compared to other hazard profiles. While previous occurrences are listed, where applicable, it is also important to recognize the potential devastating diseases or pests for which the State constantly monitors. The use of vaccines in livestock and fungicides, pesticides or resistant seeds have mitigated some previously severe hazards. Other potentially devastating hazards have not yet appeared in South Dakota and appropriate preventative measures are in place to help inhibit their introduction. As such, monitored diseases or infestations are as equally important as known events.

Table 3-16 provides a summary of the information presented on the South Dakota Animal Industry Board Disease Control Website with additional information provided from the USDA and other resources. Only diseases for cattle, pigs, poultry, and wildlife are profiled here due to their importance to South Dakota's economy. However, additional information on sheep and horses is also available on the website. In addition, diseases with minimal impact on humans and a low incidence rating in animals are not included in this profile.

Table 3-17 and Table 3-18 also summarize some of the many common crop diseases that impact the production, yield, and overall quality of harvests. Some crops are sold as a commodity, while others are used to support the livestock industry. As with livestock disease, tracking every occurrence is unwieldy because, to some level, crop disease is omnipresent. This section shows the occurrence rate of common crop hazards for the top commodities groups grown in South Dakota - that is, small grains, oilseeds, dry beans and dry peas (ranked 9th in the nation for value of sales), corn for grain (ranked 7th in the nation for production in 2020), soybeans (ranked 8th in the nation for production in 2020), sunflowers (ranked 2nd in the nation for production in 2020), and forage (ranked 3rd in the nation for production). Note that commodities are grouped by disease vulnerability, rather than by commodities group. The information is drawn from an issue of "Extension Extra" published by the College of Agricultural and Biological Sciences at the South Dakota State University, which discusses the recognition and management of common crop diseases in South Dakota. Additional information was obtained from news sources and the USDA for events post-2009.

The 2021 HIRA update did not identify significant events post-2012. Some highlights of past events listed below, or events of particular significance, include:

- Campbell, Corson, Harding, and Perkins counties received USDA disaster designations for losses related to insects and disease (S3467) in 2012. In that same year, 30 counties received a total of $702,633 in indemnities for crop loss related to insects. 22 counties received $184,810 in insect-related indemnities in 2011, and 27 counties received $927,938 in insect-related indemnities in 2010. The crop losses in all three years included forage used to feed livestock.
- In 2013, the majority of counties in the State were declared by the USDA for drought (S3591; S3620; S3505; S3522; S3549); secondary impacts of this drought included insect infestation and disease spread.
- Several counties also received indemnities for crop losses related to plant disease between 2010 and 2012. 12 counties received $62,183 in 2012, 38 counties received $3,303,117 in 2011, and 16 counties received $572,831 in 2010. Impacted crops included wheat, corn, soybeans, oats, dry peas, sunflowers, forage, and "other" not specified. The specific plant diseases that caused these losses were not identified in the Risk Management Agency data.
- The USDA produced a "Cattle Death Loss" report in 2011 which detailed the number of cattle and calves lost to various causes (predator and non-predator) in each State in 2010. A total of 68,000 head of cattle and 90,000 calves died in South Dakota in 2010. 12.6% (8,568 head) of cattle losses were attributed to digestive problems, 31.1% (21,148 head) to respiratory problems, and 5.2%

(3,536 head) to other unspecified diseases. 12.8% (11,520 head) of calf losses were related to digestive problems, 29.2% (26,280 head) to respiratory problems, and 0.9% (810) to other unspecified diseases. Additional details were not available on the specific nature of the digestive and respiratory problems. At a value of $1,133 per head for cattle and $381 per head for calves, South Dakota's cattle industry losses in 2010 totaled $52,384,926 due to respiratory, digestive, and other diseases. (Weather-related cattle and calf losses are discussed in the Winter Storm hazard profile.)

- The USDA "Cattle Death Loss" report comes out approximately every five years, but previous reports for 2005 and 2000 organized data by region rather than state. The 1995 and 1991 reports are organized by state and can be compared to the 2011 report. The 1995 report indicates that a total of 59,600 cattle and 162,600 calves were lost in 1995. Of the 59,600 total cattle deaths, 6,800 were lost to digestive problems and 14,300 to respiratory problems. Of the 162,600 total calf deaths, 37,000 died from digestive problems and 30,000 were lost to respiratory problems. In 1991, cattle and calf losses totaled 55,000 head and 110,000 head respectively. Digestive problems killed 8,100 cattle and 33,400 calves. Respiratory problems killed 16,500 cattle and 31,300 calves. "Other diseases" was not listed as a category in 1995 or 1991. Total dollar value per head was not provided in the 1995 and 1991 reports.
- In January 2011, the USDA designated Jackson and Todd Counties as natural disaster areas due to the ongoing grasshopper infestation that began in June 2010. Designated contiguous counties included Bennett, Jones, Pennington, Tripp, Haakon, Mellette, and Oglala Lakota (previously Shannon County).
- In April 2010, the State was approved for pasture grazing loss assistance under the Emergency Livestock Assistance Program (ELAP) due to the 2009 grasshopper infestation.
- In 2009, the State experienced combined effects of severe storms with hail, high wind, flooding, and grasshopper infestation in 35 counties. This led to the release of USDA Secretarial Disaster S2916.
- In 2005, the State experienced an unusually high outbreak of anthrax, with 56 positively confirmed cases in 18 counties.
- Trichomoniasis (trich) cases have been steadily increasing in recent years. The highest number of cases also occurred in FY 2005, with 45 positive cases in 11 counties.
- Asian soybean rust is still not documented and confirmed in the State, but extensive scouting efforts are underway, particularly in the southeast counties.
- Palmer amaranth, a vigorous weed that has developed herbicide resistance in other states, was confirmed in central South Dakota in 2014. It has since been found in other locations in the State and in North Dakota, but it is not widespread and is currently being monitored.

Table 3-16 South Dakota Livestock Diseases

Disease Name	Incidents, History, and Other Reporting Measures	Human Vulnerability
Cattle		
Brucellosis, also known as Bangs Disease or Bangs	U.S. states are free from brucellosis in domestic cattle herds due to extensive vaccination and testing requirements. Buffalo and Elk in the Greater Yellowstone Area remain natural carriers of the disease and present the largest risk to domestic cattle herds. Documented cases include far reaching impacts and tremendous costs for movement restrictions, testing requirements, indemnities, and epidemiology.	Yes, if ingested or directly exposed to the bacteria. Human-to-human transmission is possible, but rare.
Tuberculosis, also known as TB	South Dakota has maintained a “TB Free” status by the USDA since 1982; however, all intact dairy cattle imported to the State must reflect a ‘negative’ result in official TB testing within 60 days prior to entering South Dakota. The bovine strain of bacteria is distinct from the most common forms that impact humans. However, the strain may be passed between cattle, from humans to cattle, and from cattle to humans. In both human and cattle patients, TB may be fatal if untreated or neglected.	Yes, if ingested (particularly from untreated milk). Sustained animal-to-human transmission is possible but rare.
Bovine Spongiform Encephalopathy (BSE), also called ‘Mad Cow Disease’	First surfacing in Great Britain in 1986, BSE is a chronic degenerative disease of the central nervous system. There is no method for testing for the disease in live cattle, so suspected cases pose an extreme cost impact on ranchers. There have been sporadic cases in Canada and the United States. Strict regulations prohibit the feeding of ruminant derived proteins to ruminants. The disease is not passed between cows except via consumption. According to the Center for Disease Control, the first confirmed domestic case of BSE disease was reported in Washington State in 2003. Two subsequent diagnoses were confirmed for a 2004 case in Texas (confirmed in 2005) and in 2006 in Alabama. Luckily, these cases have resulted in minimal impact on domestic cattle herds, but monitoring remains a key component.	Strong epidemiologic, laboratory, and circumstantial evidence exists to link consuming BSE-infected food with contracting Variant Creutzfeldt-Jakob disease (vCJD) in humans.
Anthrax	Anthrax is a spore-forming bacterium that causes acute infections. In 2005, South Dakota experienced a serious anthrax outbreak, with 55 herds with confirmed losses to the disease in the space of four months. Mitigation and response measures helped contain the outbreak, with efforts to vaccinate over 1 million cattle during the summer months. The State Veterinarian reported that the effects of drought contributed to the severity of the 2005 outbreak. Since South Dakota is located in the ‘anthrax belt’, potential losses and vulnerability remain high and vigilance remains critical. Previous cases include 1 infected herd in 2009, 3 in 2008, 2 in 2007, and 2 in 2006.	Yes, if spores are inhaled, ingested, or infected materials are improperly handled. The disease is not known to be peer-to-peer transmissible.
Johne’s Disease (pronounced Yo-nees), also called Paratuberculosis	Johne’s disease is a chronic infection that causes diarrhea and wasting, which primarily impacts cattle over the age of 2 years and is also found in other ruminant animals such as goats and sheep. The disease is closely related to tuberculosis but grows very slowly. The disease causes wasting of the inflicted animals and may be spread via fecal matter, nursing from infected dams or contamination of the udder with manure, or en vitro. The disease may cause early death or culling losses, decreased milk production, decreased slaughter weights, loss of show, sale and breeding animals, and incurred veterinary costs. There is no effective	None known.

Disease Name	Incidents, History, and Other Reporting Measures	Human Vulnerability
	vaccine. Johne's disease cases are reported at a rate of approximately 4.4% and appear to be increasing. Dairy cows seem to demonstrate a higher occurrence rate than beef cows.	
Foot and Mouth Disease (FMD)	FMD is a fast-spreading virus which impacts all cloven-footed animals and causes blisters on feet, in mouths, and on mammary glands, resulting in lameness, the inability to eat or drink, and mastitis in dairy animals. In all cases, animals rapidly lose weight and may die. Transmission rates are nearly 100% of exposure, and young animals may die. FMD poses huge economic risks to livestock owners and consumers. In February 2001, the UK was forced to destroy over 9% of the national food animal production industry, and over 11 months to eradicate the disease.	None known.
Vesicular Stomatitis (VS)	VS is a virus that causes similar symptoms as FMD and is highly contagious, though it demonstrates a lower mortality rate. The disease may lead to serious restrictions on the movement, marketing, and exportation of animals from affected areas, which has a significant economic impact on livestock-driven economies. While no cases have been diagnosed recently in South Dakota, cases in nearby states underscore the need for vigilance and close reporting requirements.	Humans may contract the disease from sand flies or improper handling of infected animals and animal byproducts. Symptoms are flulike.
Trichomoniasis, also called 'trich'	Trich is a venereal disease that causes infertility and occasional abortions in cows. Bulls, once infected, carry the disease for life but cows seem to spontaneously recover after a period of infection, in some cases. During the FY 2005 breeding season, South Dakota experienced an unexpected resurgence of the disease in 45 confirmed cases, all west of the Missouri River. The known endemic qualities of the disease and the presence of the disease in states west and south of South Dakota, increased cases and magnified losses. Regulations for controlling and reporting Trichomoniasis were affected on June 1, 2005. Additional cases include 13 in FY 2009, 7 in FY 2008, 10 in FY 2007, and nine in FY 2006.	The disease may be contracted from livestock through improper hygiene when handling infected animals. It can subsequently be spread between humans.

Disease Name	Incidents, History, and Other Reporting Measures	Human Vulnerability
Swine		
Pseudorabies (PRV), also known as Aujesky's Disease or mad itch in cattle	PRV is a viral disease that causes abortion, high mortality of piglets, and may cause other symptoms in adult pigs. In addition, cattle, dogs, bears, cats, sheep, rabbits, and raccoons may contract the disease, which often proves fatal in these secondary hosts. The disease is spread via nasal secretions and saliva. On April 16, 2003, South Dakota was granted Stage V-Free status. Though domestic swine herds have been PRV-free since 2003, the disease remains in feral herds, which pose the greatest risk to domesticated animals. Positive animals must be destroyed to limit the spread, and, in some cases, the entire herd must be destroyed. The disease is considered one of the most economically devastating diseases of swine herds and the potential for a reintroduction of the virus from feral pig exposures remains a concern.	None known.
Porcine Reproductive and Respiratory Syndrome (PRRS)	PRRS is a virus that attacks the respiratory system and leads to an overall weakened immune system. The disease is highly contagious and spreads rapidly but seems to impact different herds with varying degrees of severity for unknown reasons. First identified in the U.S. in North Carolina in the 1980s, the disease spread rapidly across the continent. All breeds and ages of pigs are susceptible, though there is some indication that some breeds demonstrate less vulnerability than others. The impacts of this disease are still under evaluation, but losses to pig herds have economic ramifications for sale for slaughter and breeding.	None known. Without proper infection control practices humans may serve as mechanical vectors of the disease and cause its spread between animals.
Poultry		
Avian Influenza	While Avian Influenza is not currently documented in the State, the concern remains that exposure could result in the infection of domestic avian flocks, including turkeys, geese, chicken, and other fowls, that may contribute to the crossover between birds and people. A detailed response and containment plan has been developed and is a factor in mitigation should quarantine and/or subsequent destruction of flocks be required. A surveillance project went into effect in FY 2007.	Humans may contract the disease through extensive exposure to avian carriers. The concern is that the influenza serotype could genetically alter to sustain transmission between humans.
West Nile Virus	The first identified domesticated cases of WNV occurred in FY 2006, identified in geese at a production site in northeastern South Dakota.	West Nile Disease is spread from animals, especially birds, to humans by the bite of an infected mosquito.

Disease Name	Incidents, History, and Other Reporting Measures	Human Vulnerability
Wildlife		
Chronic Wasting Disease	The first case of CWD in farmed elk or deer in the U.S. was identified in a private South Dakota herd in late 1997. On February 5, 1998, a mandatory Cervid Chronic Wasting Disease Surveillance Identification (CCWDSI) Program was enacted. This monitoring program has become the model program for numerous other state CWD monitoring programs as well as the federal interim CWD monitoring plan.	No known human transmissions at this time. However, the disease is closely related to mad cow disease (BSE, see above), which is transmissible to humans. As a result, extensive precautions are taken to avoid human exposure to CWD-infected animals.
Rabies	Rabies in the wildlife population remains at a high level. Skunks are the reservoir of the disease and they represent the largest number of positive diagnoses at the laboratory. Bats have also been recognized as a significant reservoir of rabies. For FY 2009, thirty-two (32) animals were reported infected with rabies, compared to twenty-nine (29) in FY 2008, twenty-five (25) in FY 2007; fifty-three (53) in FY 2006; eighty (80) in FY 2005; one hundred five (105) in FY 2004.	Yes, if exposed through bites or handling of infected animals.

Sources: South Dakota Animal Industry Board Disease Control Website, Centers for Disease Control, U.S. APHIS

Table 3-17 Small Grains

Disease	Winter Wheat	Spring Wheat	Barley	Oats	Rye	Occurrence
Barley Yellow Dwarf (Red Leaf of Oats)	X	X	X	X		Common
Common Root Rot	X	X	X	X	X	Widespread
Covered Smut & Common Bunt	X	X	X	X	X	Fairly Common
Dryland Root & Crown Rot	X	X	X	X	X	Widespread, most serious on winter wheat
Leaf Rust	X	X	X	X		Widespread
Loose Smut	X	X	X	X		Common (>2% In Given Field)
Scab (Fusarium Head Blight)	X	X	X	X	X	East River Counties: Common West River Counties: Rare
Stem Rust	X	X	X	X	X	Rare
Stripe Rust	X	X				Frequent, Severity Varies by Year
Take All	X					Rare
Tan Spot, Septoria Leaf Blotch & Other Leaf Spot Diseases	X	X	X	X		Widespread
Vomitoxin	X	X	X	X	X	Fairly Common
Wheat Streak Mosaic	X	X				Frequent

Table 3-18 Sunflowers, Oilseeds, Dry Beans, Dry Peas and Soybeans, Corn, Alfalfa and Flax

Disease	Sunflowers	Canola	Safflower	Field Pea	Chick-pea	Lentil	Dry Bean	Soybeans	Corn	Alfalfa	Flax	Occurrence
Alternaria Leaf &Stem Spot, Leaf Blight	X		X*									Annually in late summer *common
Anthracnose						X	X		X*	X	X*	Rare *Occasional
Apical Chlorosis	X											Infrequent
Ascochyta Blight					X	X						Common
Asian Soybean Rust								X				Not yet reported in the State
Aster Yellows		X									X	Infrequent, no control
Bacterial Blight & Wilt[$]				X			X*	X		X[$]		Widespread, *Occasional [$]Rare
Bean Pod Mottle								X				Widespread
Black Leg		X										Common
Blackspot		X										Common, no control
Brown Spot								X				Widespread
Brown Stem Rot (BSR)								X				Occasional
Charcoal Rot								X				Occasional, extreme southeast counties
Common Leaf Spot										X		Common
Damping Off			X						X	X		Common
Downy Mildew	X							X				Common
Eyespot									X			Occasional
Frogeye Leaf Spot								X				Rare in state, observed in extreme southeast counties
Fusarium Root Rot and Wilt[$]				X	X	X	X	X		X[$*]	X[$*]	Occasional *Common
Goss's Bacterial Wilt & Blight									X			Rare
Gray Leaf Spot									X			Fairly common
Holcus Spot									X			Annual in early summer
Maize Dwarf Mosaic									X			Common, typically low incidence
Northern Stem Canker								X				Frequent

Disease	Sunflowers	Canola	Safflower	Field Pea	Chick-pea	Lentil	Dry Bean	Soybeans	Corn	Alfalfa	Flax	Occurrence
Northern Corn Leaf Blight									X			Occasional
Pasmo											X	Occasional
Phoma Black Stem	X											Annually in late summer
Phomopsis Stem Canker	X											Annually in late summer
Pod & Stem Blight								X				Widespread
Pythium Damping Off & Seed Decay				X	X	X	X	X		X		Widespread
Phytophthora Root & Stem Rot								X		X*		Widespread *Fairly Common
Rhizoctonia Seedling Blight[$] & Root Rot								X			X[$*]	Widespread *Common
Root & Crown Rot Complex										X		Common
Sclerotinia Wilt, Stalk Rot & Head Rot	X											Annually in late summer
Soybean Cyst Nematode								X				Widespread in southeastern counties, scattered in other areas
Soybean Mosaic								X				Rare
Spring Black Stem & Leaf Spot										X		Widespread
Stalk Rot Complex									X			Annual in fall
Stem Nematode										X		Rare, restricted to western counties
Sudden Death Syndrome (SDS)								X				Rare: only in Clay County
Summer Black Stem & Leaf Spot										X		Common
Verticillium Wilt										X		Common
White Mold		X	X	X	X	X	X					Common

Probability of Future Occurrence

To some extent, disease outbreaks and pest infestations are guaranteed to occur somewhere in the state, in some form. The determination of probability becomes most valuable when areas of particular occurrence rates, or when events of unusual severity, are recorded. Many times, extreme events are documented concurrently with other hazard event occurrences, such as the outbreak of high anthrax levels in 2005, which was attributed to drought; the grasshopper plagues of the 1930s, also attributed to drought; or the recurrence of certain crop molds, which correspond to unusually wet growing periods.

Overall, the agricultural disease hazard is constant and a disease outbreak of some sort occurs somewhere in South Dakota virtually every year. The focus on agricultural pests in this SHMP is one reflection of the degree to which the state proactively manages this threat. Thanks in large part to the ongoing focus on mitigating agricultural pests, it is possible to make some statements about probabilities of outbreaks in specific regions or counties.

In general, the western portion of the State (counties lying to the west of the Missouri River) have a higher documented occurrence rate of trich and stem nematode afflictions of alfalfa crops. Counties along the river basins bore the brunt of the anthrax outbreaks in 2005. Eastern counties have higher documented rates of the soybean cyst nematode, frogeye leaf spot, scab, and West Nile Virus in domestic fowl flocks. Areas with a primarily cultivated crop land use are more susceptible to crop diseases, and thus have a predicted higher probability rating than areas devoted to rangeland. Areas where wildlife interaction is more common among livestock have higher exposure probabilities to diseases like rabies and brucellosis.

A South Dakota State University Extension entomologist said that "based on the high grasshopper count late last summer (2009), there is potential for another year of grasshopper infestation in counties in western South Dakota". This prediction was accurate; grasshopper infestations continued to plague South Dakota in 2010. Drought or periods of higher-than-average temperatures, particularly in the winter, increase the severity of grasshopper population numbers, because more eggs survive to hatch. Based on historical data, South Dakota has experienced four grasshopper plagues in the 123-year time period from 1887 to 2010, resulting in an annual chance of 3.2%. Smaller infestations, which still exert significant economic impact, may be predicted in roughly ten-year cycles, or a 10% annual chance.

One approach to planning for agricultural pests and disease is to take past occurrence and trends in frequency and intensity into account and mitigate for the range of scenarios of what seems possible. In one sense, there is already a financial, if not existential, incentive for farmers and ranchers to employ this approach. Constant development and improvement of preparing for hazards has likely been a fixture of agriculture since it began.

However, there is a clear role for the state to facilitate research aimed at improving our predictions of future hazard conditions. At the least, research would be welcome that articulates how recent advances in climate science and demographic projections are relevant to agriculture and especially to mitigation planning for agricultural pests and disease. This is a clear gap that limits the analysis presented in this SHMP.

Magnitude/Severity (Extent)

Many agricultural pests exist can impact different crops in different ways. For example, coyotes may present problems in ranching settings while grasshoppers and various blights are troublesome for crops. Invasive plants can be a problem by themselves, by competing with crops for resources or changing the quality of forage for grazing. Invasive plants can also stress desirable vegetation and amplify the impact of other pests such as insects, plant diseases. It is certain that in every year some pests will impact agriculture be a problem, though the most important pests change from year to year and the magnitude of impact fluctuates. Based on the USDA's Risk Management Agency (RMA) Crop Indemnity Reports, between 2007 and 2020, there were 269,937 acres lost due to plant disease, mycotoxins, and insects and $22,878,707 in indemnity payments were made. Statewide there was approximately $5.7 million in crop indemnity payments issued in the time period since the last plan update, from 2016-2020, for damages caused by mycotoxins, insects, or plant diseases.

As mentioned above in the Location section, the impacts of grasshoppers on cattle production have also been significant, with several past events causing significant impact. Campbell, Corson, Harding, and Perkins counties received USDA disaster designations for losses related to insects and disease (S3467) in 2012. In that same year, 30 counties received a total of $702,633 in indemnities for crop loss related to insects. 22 counties received $184,810 in insect-related indemnities in 2011, and 27 counties received $927,938 in insect-related indemnities in 2010. The crop losses in all three years included forage used to feed livestock. The prediction for 2009, based on the grasshopper density ratings mentioned above, indicated that food supplies for cattle in the western portion of the State would be severely impacted by the grasshoppers. This proved accurate in August of 2009, when the Associated Press reported that grasshopper infestations forced ranchers to sell livestock because food supplies were unavailable. South Dakota, specifically Ziebach County, was named in USDA Secretarial Disaster Declaration S2916 for damages done by grasshoppers.

Climate Change Considerations

Climate change has the potential to have a significant, direct impact on South Dakota’s agricultural sector and therefore on the state economy. Climate change can alter the physical conditions that led to the success of native species and historically-successful crops and livestock. Weed species are commonly able to compete more successfully with native species as conditions change from what has existed in the past. For example, as the climate becomes warmer, weed species can compete more effectively and become established further north. The relevant effects of climate change vary by region and crop type, so it is important to understand the different environmental factors and the underlying physiological mechanisms’ responses. If the invasion of new species can be detected in advance, efforts can be made to control the growth.

Crop diseases can be animal, fungal, bacterial, or viral. An increase in severe weather events such as tornadoes, high wind, or storms may increase crop damage, crop losses and/or catalyze the spread of crop disease such as soybean rust. Drought and especially wet weather also have the potential to facilitate plant and crop disease.

Various frost-sensitive insects have been shown to increase in population with the rise of milder winters. Warmer winters may foster an environment that allow for pests and invasive weeds to survive through the cold season. Increasing annual average temperatures also aid in the growth and reproduction in certain insects. Studies on aphids and moths have shown that increasing temperatures can allow insects to reach their minimum flight temperature sooner, aiding in increased dispersal capabilities. Multiple studies have shown the northward expansion or shift of insect ranges, such as Edith's checkerspot butterfly or the mountain pine beetle, to be correlated with increasing temperatures.

According to the Fourth National Climate Assessment, the Northern Great Plains region is projected to become warmer and generally wetter through the middle of the 21st century, along with elevated levels of atmospheric CO_2. The assessment includes a detailed overview of agriculture in the Northern Great Plains states and the impacts that a changing climate may have on the economy and food security in the U.S., including how these changes may influence the prevalence and impact of agricultural pests and diseases. For example, an increase in the abundance and competitive ability of weeds and invasive species, an increase in the range and fecundity of crop pests, and overall warmer conditions which may make more favorable conditions for certain pests and diseases to establish.

The rising minimum (overnight) temperatures and relative humidity, particularly in the summer season, also have impacts on livestock health. Warm, humid nights can prevent proper body cooling and reduce cattle comfort and performance.

Vulnerability Assessment

The impacts of agricultural pests and diseases on the agricultural industry in South Dakota will vary from year-to-year and county-to-county, but it is anticipated that the agricultural industry will continue to suffer losses from the various pests and diseases. Economically, much is exposed to the agricultural pests and disease hazard. For context, agriculture and associated activities account for nearly $12 billion annually in total value added to the South Dakota economy.[3] One in five jobs in South Dakota depend on agriculture. Vast areas of South Dakota have economic value because the agriculture industry is able to mitigate the impacts of pests and diseases. Non-economically, agricultural pests and diseases have the potential to affect human health as well.

In terms of vulnerability, South Dakota agriculture has developed resistance to agricultural pests and disease. Only a portion of what is exposed is likely to be lost each year. Vulnerability is difficult to measure, but can be thought of as what is likely to be lost, rather than what is exposed. Vulnerability is affected by natural factors such as pest ecology, disease epidemiology, as well as mitigation measures such as pesticide use, vaccination programs, and monitoring and response to outbreaks.

For planning purposes, however, it is possible to gain a sense of the vulnerability of agriculture in some key ways. For example, evaluating recent crop loss, conveniently quantified as insured loss, is useful. This approach assumes the location, intensity, frequency and duration of the hazard in the near future will be similar to the recent past. To the extent these assumptions are met, evaluating losses in the recent past provides some insight to likely losses in the near future. Projections of loss can be adjusted upward to account for new exposures, such as a growing reliance on a particularly vulnerable crop or anticipation of a novel disease. Projections can be adjusted downward to account for new mitigation measures, such as expanding livestock vaccination programs against a damaging disease.

Impacts of agricultural pests and disease to people can be understood by evaluating the impacts to the agricultural industry statewide, but measured at a local scale. This approach can identify trends or provide insight to why some areas are more heavily impacted than others and help planners customize mitigation measures to specific situations. In addition, focusing on vulnerabilities relevant to specific lifelines can help prioritize mitigation measures. The remainder of the vulnerability assessment employs these tactics to develop a better understanding of the vulnerability of South Dakota to agricultural pests and diseases.

Climate change, discussed in the previous section, presents an ominous challenge to estimating the vulnerability of South Dakota to agricultural pests and disease. Quite simply, the climate over next 50 years promises to be considerably different than the past 50 years. This will likely change the exposure of agriculture to this hazard in ways we have not seen. Predicting how climate change will impact agricultural pests and disease in South Dakota in coming decades is a challenge and an information gap that may be addressed through synthesis of existing and emerging research.

People

The NRI does not specify risk to agricultural pests and diseases. However, it is notable that vulnerable populations experience an elevated risk of impact from this hazard. Additionally, the most vulnerable population depends on the scenario of agricultural pest or disease considered. For example, counties and populations dependent on hunting-based tourism are most vulnerable to an outbreak of chronic wasting

3 South Dakota Department of Agriculture and Natural Resources et al., 2021, 2021 Economic Contribution Study of South Dakota Agriculture, Ethanol and Forestry, prepared by Decision Innovation Solutions, study webpage: https://danr.sd.gov/AboutDANR/EconomicStudy.aspx.

disease in deer herds, whereas counties and populations dependent on poultry production are most sensitive to an outbreak of bird flu.

Vulnerable populations in South Dakota include those that depend on the agricultural industry, especially those with low incomes and reduced access to the social safety net, such as migrant workers. Vulnerability is compounded for the elderly and very young, people who do not speak English well, and those with developmental, physical, or sensory disabilities. The impacts of agricultural pests and disease on vulnerable populations is more severe than for other groups. Vulnerable persons and families may have fewer financial resources to prepare for or recover from these hazards.

Table 3-14 above specifies human vulnerability to several livestock diseases which could occur in South Dakota. West Nile Disease is the livestock disease most commonly spread to humans. The incidence of West Nile Disease per capita in South Dakota is among the highest rates in the U.S. From 1999 to 2022, 2,751 cases have been reported, with 71 cases reported in 2022, the most recent year data are available. Transmission of other livestock diseases to humans is fortunately rare.

The threat of transmission of livestock disease to humans should not be underestimated. In an extreme example, health experts have warned for many years that influenza A virus from birds and swine could possibly mutate in a way that would trigger a global pandemic.[4] The situation is serious enough that the South Dakota Department of Health produced a 67-page Pandemic Influenza Plan.[5]

Perhaps a more tangible example exists in the case of an outbreak of mad cow disease (BSE, Table 3-16) in the United Kingdom in the 1980s and 1990s. Near-certain transmission of BSE to humans caused nearly 200 deaths, caused a major health scare, and triggered bans on exporting British beef to many parts of the world. To bring the outbreak under control, over four million head of cattle were destroyed. Were a similar outbreak to occur in South Dakota, or perhaps elsewhere in the United States, the consequences could be ruinous for the beef industry.

A more local example is that of Chronic Wasting Disease. This disorder has not been confirmed to infect any human and recent research finds cattle are unlikely to become infected, even after intentional exposure to the prion causing the disease.[6] Nevertheless, the threat of a mad-cow-like disease spreading to humans has led to extensive precautions that have been particularly costly to the hunting industry.

Agricultural pests and diseases also can have secondary impacts on people. For example, there are reports of branches of ash trees, weakened by emerald ash borer pests, falling and causing harm to people.

Much is known about the impacts of agricultural pests and diseases on people. However, knowledge in the South Dakota setting is limited. Studies and analysis are typically limited to specific issues, such as chronic wasting disease, and limited in extent, such as lacking quantitative information on impacts or future projections. Studies that describe impacts on

4 See guidance provided by various public health agencies.
CDC: https://www.cdc.gov/flu/avianflu/virus-transmission.htm
WHO: https://www.who.int/news-room/fact-sheets/detail/influenza-(avian-and-other-zoonotic)
UN Food & Agriculture Organization: https://www.fao.org/3/i0808e/i0808e.pdf
5 The 2006 South Dakota Department of Health Pandemic Influenza Plan:
https://doh.sd.gov/media/x5bblw4u/panfluplan06.pdf
6 Williams, E.S., et al. 2018. Cattle (*Bos taurus*) resist chronic wasting disease following oral inoculation challenge or ten years' natural exposure in contaminated environments. *Journal of wildlife diseases* 54, no. 3: 460-470. PDF at:
http://tinyurl.com/ms5nfncj

vulnerable populations are especially needed. These information gaps reduce the effectiveness of hazard mitigation planning.

Property

An infestation of agriculture pests could impact crop yields, potentially destroying a crop in whole fields. Between 2007 and 2020, insects and crop disease damaged 269,937 acres of field crops, causing the RMA to provide $22,878,707 in indemnities to farmers. For context, this is 0.2% of the total value-added agricultural output of South Dakota, estimated at $11.7 billion in 2021.[7] While 0.2% may seem like a small number, some additional loss exists as non-insured loss. Far more significantly, this loss likely speaks to the effectiveness of mitigation measures that have been developed to minimize the impacts of agricultural pests and disease.

State Assets, Critical Facilities, and Infrastructure

Critical facilities assessed in this plan would not be directly impacted by agricultural pests or diseases. Simply stated, the state does not produce crops or livestock or have assets that would be directly impacted by agricultural disease and pests. Direct impact to state assets by agricultural pests and disease is likely $0 in all parts of the state. However, *indirect losses* to the state include reduced tax revenue from lost economic activity and likely increased costs to deploy the social safety net to those people and businesses most affected and/or to repair disruption to community lifelines. Considered from this perspective, despite having no direct exposure of state assets to agricultural pests and disease, the state still has a strong financial incentive to mitigate impacts from this hazard.

Economy

According the 2017 census of agriculture hogs and pork represented $577,034,000 of the livestock sold in in South Dakota, and cattle and calves represented $3,191,493,000 in sales. As of December 31, 2017, there were 1,560,522 hogs and pigs and 3,988,183 cattle and calves in the State. A serious illness affecting pig herds could have a devasting impact on the State economy as well as employment of those in the agricultural industry. The same would be true for a disease affecting cattle, such as Mad Cow Disease or FMD. The potential economic losses from a major epidemic among the State's livestock populations could be massive.

Nationally, it is estimated that invasive species cost the USA $138 billion per year. As noted above, pests and crop disease in South Dakota have caused $22,878,707 indemnity payments made. Statewide there was approximately $5.7 million in crop indemnity payments issued since the last HIRA update. The average annualized losses due to crop and plant disease is estimated to be $1,759,900. Economic impacts also include both prevention, response, and recovery costs.

Environment and Cultural Resources

Invasive species typically harm native species through predation, habitat degradation, and competition for shared resources; they can muscle native species out of natural habitats and are a leading cause of population decline and extinction in animals. As discussed above in the Climate Change Considerations section, the conditions which could help invasive species and

7 South Dakota Department of Agriculture and Natural Resources et al., 2021, 2021 Economic Contribution Study of South Dakota Agriculture, Ethanol and Forestry, prepared by Decision Innovation Solutions, study webpage: https://danr.sd.gov/AboutDANR/EconomicStudy.aspx.

diseases spread and establish may be on the rise in coming years. This presents a great deal of vulnerability, which is likely increasing, not only for agriculture but also for environmental and natural systems in South Dakota.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to agricultural pests and disease hazard vulnerability, especially at a statewide level. It is conceivable that local HMPs, other government documents, and academic studies on how development affects vulnerability to agricultural pests and disease could be synthesized to help set the stage for a statewide basis. However, as of this SHMP update, no analysis exists to evaluate how recent or future development has or will affect vulnerability to agricultural pests and disease hazards at a state level. As of this SHMP update, this is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to agricultural pests and disease. It would be especially useful if future research considers trends in agriculture management practices, pest and disease ecology, and climate change. Evaluations of current and future demographics in South Dakota to identify and describe populations most vulnerable would be useful to planning for mitigating agricultural pests and disease. Analysis that adds climate change scenarios to a development study would be especially valuable.

Despite gaps in the present state of knowledge, it is apparent that agriculture pest or disease events can have large impacts on both the State's economy as well as the livelihood and mental health of individuals in the industry. With an annual probability of occurrence of 100% that an agriculture pest or disease event of some sort will occur somewhere in South Dakota in any given year, the State's vulnerability to this type of hazard event is not expected to decrease in the future. Counties with a higher presence of agricultural activities and economic value, such as Brown and Spink Counties, will remain more vulnerable to the impacts of agricultural pests and diseases. As noted within the Climate Change Consideration subsection, climate change is expected to increase winter and spring precipitation which may lead to disruptions in planting seasons. While summer season precipitation is projected to decrease, this may lead to an increase in drought events which in turn will continue to leave the State vulnerable to agricultural pests and diseases.

Table 3-19 Risk Summary and Overall Significance

Category	Narrative
Impact on the Public	Potential for animal-to-human transfer of disease; potential for loss of livelihoods; potential for mental health issues due to severe economic hardship
Impact on the Economic Condition of the State	Potentially devastating depending on the pest or disease and its impacts; disease can wipe out whole herds; pests or disease can wipe out crops; incident may disrupt business operations of farms statewide; impacts could come from an incident in the State, or an incident in a nearby state; agriculture economy can be affected by something as simple as an unchecked rumor; significant implications for the potential expansion of the ranges of various pests and invasive species driven by climate change
Impact on the Environment	Zoonotic animal diseases may spread between livestock and wildlife; crop diseases or pests may spread between crops and surrounding flora; potential for widespread impacts depending on parameters of incident

Category	Narrative
Impact on Property, Facilities, and Infrastructure	No physical impacts to property; infected crops or livestock may be barred from slaughterhouses, co-ops, markets, and other agriculture sites
Impact on the Public Confidence in Government	Ability to respond and recover may be questioned and challenged if planning, response, and recovery is not timely and effective.
Impact on Responders	Isolation or quarantine can stress first responders needed to close roads or provide security
Impact on Continuity of Operations and Continued Delivery of Services	Need for personnel may stress limited resources
Cascading Hazards	N/A

3.3.2. Flood

Hazard Description

Throughout the United States, flooding is recognized as the most prominent disaster-producing phenomenon, generating annual losses in the billions of dollars. Floods are among the most serious, devastating, and costly natural hazards that affect South Dakota. The greatest impact of these phenomena has been to the eastern half of the state, principally, the Big Sioux, Vermillion, and James River basins, which have recurring problems and are unregulated (no dams) within South Dakota.

The following is extracted from "Flooding in South Dakota," a fact sheet written by Stan F. Pence from the South Dakota Department of Environment and Natural Resources.

What Is a Flood?

A flood occurs when water rises to flow over land that is normally dry. Floods happen in low-lying areas, such as valley bottoms, lake basins, and coastal areas. In South Dakota, flooding occurs mainly in valley bottoms, deep canyons, and lake basins when the amount of water moving through a river, or entering a lake, is so great that the natural or artificial banks can no longer contain all of the water. Therefore, the water overflows the banks of the river or lake and spreads out onto low-lying areas that are not normally covered with water.

What Causes a Flood?

In South Dakota, there are two main climatological causes of flooding: runoff from rainfall and runoff from melting snow. The water from rainfall or melting snow flows overland until it reaches a nearby river or lake. If the river or lake cannot hold all the water that is entering it, some of the water will begin to overflow the banks of the river or lake, causing flooding. The size of the flood is commonly influenced by such factors as the intensity of the rainfall, length of the rainfall, melting rate of the snow, and the infiltration rate of the water into the ground.

In addition to climatological reasons for flooding in South Dakota, floods can also result from the failure of dams. Dam failure can result from defective construction, poor maintenance or a poor foundation. Many small dams in South Dakota fail because their spillway is not big enough. Often, failure occurs as a result of extremely heavy rainfall that causes a large increase in the amount of water held by the dam. This increase in water behind the dam could place more stress (pressure) on the dam than it was designed to handle, causing the dam to fail.

What Types of Floods Occur in South Dakota?

Four types of floods can occur in South Dakota. The first type is commonly called a flash flood. A flash flood is the result of several inches or more of rain falling in a very short period of time, often tens of minutes. This high intensity rainfall is commonly caused by powerful thunderstorms that cover a small geographic area. Because so much water is falling onto the ground very rapidly, there is little time for the water to soak in, and most of the water runs off into nearby rivers or lakes. The flood that occurs as a result of this runoff happens very rapidly, hence the term "flash." This type of flood is generally very destructive, affecting a fairly small, localized area, commonly several tens of square miles or less. The flash flood often ends almost as quickly as it started. Probably the best-known flash flood in South Dakota occurred when Rapid Creek left its banks on June 9, 1972, in Rapid City. Fifteen inches of rain that fell in less than 6 hours caused the flooding. This flood was devastating both in terms of loss of human life and property damage. Two hundred thirty-eight people lost their lives in this flood and about $150 million (in 1972 dollars) of property damage occurred.

The second type of flooding is sometimes termed the long-rain flood and is the most common cause of major flooding. This type of flood results after several days or even weeks of fairly low-intensity rainfall over a widespread area, often hundreds of square miles. As a result, the ground becomes "waterlogged," and the water can no longer infiltrate into the ground; therefore, the water begins to flow toward rivers or lakes. The flooding that can result is often widespread, covering hundreds of square miles, and can last for several days or many weeks. Much of the flooding that occurred in eastern South Dakota during the summer of 1993 was this type of flooding.

The third type of flood in South Dakota is the result of melting snow in the spring. This type has characteristics that are almost a combination of the flash flood and long-rain flood. The area covered by this type of flood is generally not as large as that covered by the long-rain flood but is typically larger than that covered by the flash flood. Generally, the flood lasts for several days, occurring when large amounts of snow melt rapidly due to warm temperatures. The flooding can be made worse if the ground remains frozen while the snow is melting; this causes all of the melted water to run off to nearby rivers and lakes rather than infiltrate into the ground.

Some of the largest floods that have occurred in South Dakota were the result of melting snow and ice. These large floods have occurred along the entire length of the Missouri River. The Great Flood of 1881 is probably the most well-known of all the floods to take place in South Dakota. Ice jams on the river caused the flooding to become extremely devastating, destroying large amounts of property and causing many lives to be lost. Towns such as Yankton, Vermillion, Burbank, Meckling, and Pierre were all severely damaged by the flooding.

The fourth type of flood results from the failure of dams or levees. The four largest dams in South Dakota - Oahe at Pierre, Big Bend at Fort Thompson, Fort Randall at Pickstown, and Gavins Point at Yankton - are all located on the Missouri River. Large dams in the Black Hills are the Deerfield, Pactola, Sheridan, Angostura and Orman dams. If any of these large dams were to fail, flood damage could be very great. Fortunately, all of these dams are considered to be properly constructed and have been designed to hold back very large amounts of water; therefore, they are considered to be very safe, and the likelihood of failure is extremely small. Except for these Missouri and Black Hills dams, the majority of the dams in South Dakota are very small, and if they were to fail, flooding would likely be minimal. Levees protect many areas in South Dakota from floods; however, when levees fail or are overtopped significant damages can result.

Further information regarding dam and levee failure and other flooding risk in South Dakota follows.

Dam Failure

South Dakota has approximately 2,573 dams in the National Inventory of Dams (see Figure 3-21 in Location section below). The State defines a dam as follows: “a structure is a dam if the height to the dam crest is greater than or equal to 25 feet and the storage at the dam crest (not at the spillway elevation) is greater than 15-acre feet or if the height to the dam crest is greater than 6 feet and the storage at the dam crest (not at the spillway elevation) is greater than or equal to 50 acre feet. The height of the dam is the difference in elevation between the natural bed of the watercourse or the lowest point on the toe of the dam, whichever is lower, and the crest elevation of the dam.”

In Federal Guidelines for Dam Safety: Hazard Potential Classification Systems for Dams (FEMA 2004), dams are classified as follows:

- **Low Hazard Potential** - Dams assigned the low hazard potential classification are those where failure or mis-operation result in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.
- **Significant Hazard Potential** - Dams assigned the significant hazard potential classification are those dams where failure or mis-operation result in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other

concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

- **High Hazard Potential** - Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life as well as economic, environmental, and lifeline losses.

Table 3-20 breaks down South Dakota's dam by hazard potential and ownership.

Table 3-20 Dams in South Dakota by Hazard Potential and Ownership

Owner	High Hazard	Significant Hazard	Low Hazard	Total
Federal	42	7	88	137
Local Government	8	13	58	79
Private	14	107	2,044	2,165
Public Utility	0	1	0	1
State	22	23	123	168
Tribal Government	0	4	19	23
Total	86	155	2,332	2,573

Source: National Inventory of Dams

Of the State's 2,573 dams, 2,332 (91%) have low hazard potential; 2,044 (88&) of the low hazard dams are privately owned. South Dakota has 86 are high hazard dams, almost half of which are federally owned. All high hazard dams are required to have Emergency Action Plan (EAPs); 97% of the State's high hazard dams have EAPs on file. This represents a consistent improvement from 24# in 2007, to 83% in 2012, until reaching 97% in 2023.

Levee Failure

In addition to these dams, South Dakota also has levees that pose flood risks. Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, designed for urban areas where there is insufficient room for earthen levees. When levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in loss of life and injuries as well as damages to property, the environment, and the economy. In South Dakota, there are numerous levees ranging from small agricultural levees that protect farmland from high-frequency flooding to large urban levees that protect people and property from larger less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach of a levee as defined in the U.S. Army Corp of Engineers' Publication - So *You Live Behind a Levee!* (https://www.spl.usace.army.mil/Portals/17/SoYouLiveBehindLevee.pdf).

- **Overtopping** occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.
- **Breaching** - A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Location

According to the NWS, flash floods are the deadliest natural disaster in South Dakota. They are caused by stationary or slow-moving thunderstorms that produce heavy rain over a small area. The Black Hills are especially vulnerable to flash floods, where steep terrain and narrow canyons can funnel heavy rain into small creeks and dry ravines, turning them into raging walls of water. Even on the prairie, normally dry draws and low spots can fill with rushing water during very heavy rain. The following map illustrates where FEMA regulated floodplains have been mapped in the State of South Dakota, based on Digital Flood Insurance Rate Maps integrated into the National Flood Hazard Layer (NFHL).

The future location of flood hazards will be impacted by both climate change and development. Climate change will alter precipitation patterns, soil conditions, and evaporation and is discussed further in the subsection below titled *Climate Change Considerations*. Development is interesting as it will alter the exposure of people and assets. Hydrologically speaking, development generally impacts the abundance of impervious surfaces and increases runoff. However, development can also improve stormwater infrastructure and reduce flooding potential. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

The anticipated extent of flooding in South Dakota is shown in Figure 3-17. This map describes the extent of flooding anticipated once in 100 years, or with a 1% chance of occurring in any one given year.

South Dakota is divided into 14 river drainage basins (See Figure 3-18). These basins extend beyond the political boundary of the State. Although not discussed or included in this plan, an interstate understanding of water policy is required to fully analyze and comprehend South Dakota water systems.

Figure 3-16 South Dakota FEMA Digital Floodplains Status

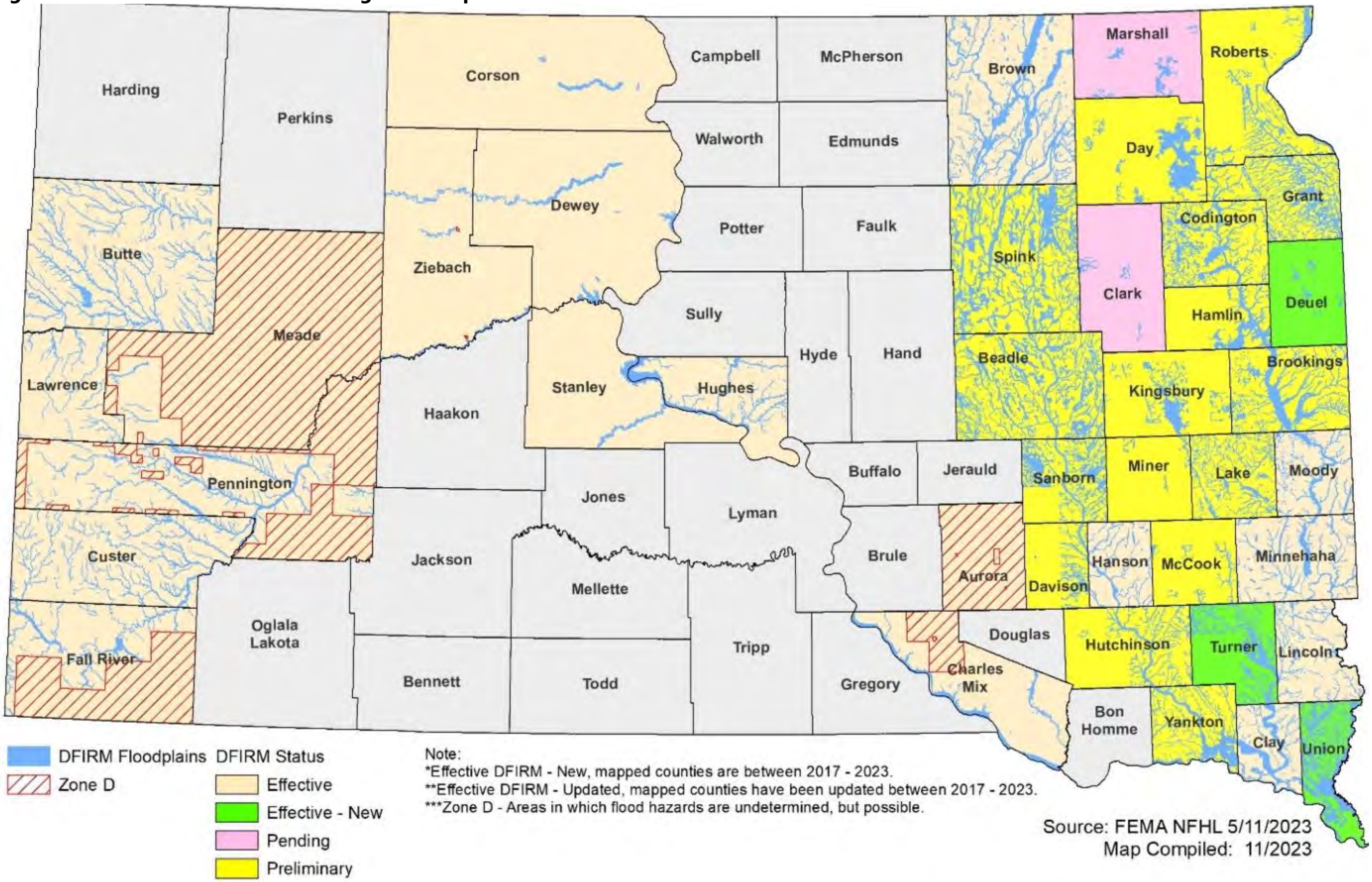


Figure 3-17 South Dakota, 100-year Flood Zones Based on Hazus

Figure 3-18 Drainage Basins of South Dakota

Source: USDA Natural Conservation Resources Service South Dakota

Missouri River Basin

The following description of the Missouri River Basin is from Microsoft Encarta Online Encyclopedia:

Considered as a separate river, the Missouri is the longest in the United States. In combination with the Mississippi River into which it flows at St. Louis, it is the longest river system in the United States. The river begins where the Gallatin River, Jefferson River, and Madison River come together in the foothills of the Rockies in Montana. It flows through Montana, North Dakota, and South Dakota before forming the boundary between Iowa and Nebraska. It forms the extreme northeast border of Kansas before turning almost due east through the State of Missouri.

South Dakota is drained almost entirely by the Missouri River and its tributaries. The only sections that are not lie in the extreme northeast and northwest. The Missouri flows southward and then southeastward across the State, in a deep, wide channel. It forms part of the South Dakota–Nebraska state line. Much of the South Dakota section of the river is now made up of a chain of four reservoirs impounded by large dams. These dams include Fort Randall, Gavins Point, Big Bend, and Oahe dams which were built for flood control and to provide water for irrigation and the generation of hydroelectricity. Lake Oahe is formed by Oahe Dam at Pierre. The James River, the Vermillion River, and the Big Sioux River, all in the eastern half of the State, flow southward in roughly parallel courses to join the Missouri. In the western part of the State the Grand, Moreau, Cheyenne, Bad, and White rivers flow generally eastward to join the Missouri.

South Dakota cities on the river include Pierre, Mobridge, Oacoma, Chamberlain, Pickstown, Fort Thompson, Ft. Pierre, Springfield, Yankton, and Lower Brule. The interstate effects of water policy are evident in the capital city of Pierre, where national policy objectives produce an ever-rising Missouri River to offset flooding in downriver states.

The largest natural lake in South Dakota is Lake Thompson in the east central part of the State. Other natural lakes of significant size in South Dakota are lakes Traverse and Big Stone, both in the northeastern corner of the State. Lake Traverse is a reservoir created by damming up the Boise Des Sioux Rivers near Rosholt. Big Stone Lake is a reservoir created by damming the Little Minnesota River near Big Stone City. In addition, there is the Waubay Lakes Chain and adjoining closed basins (discussed further in this section) located in the northeastern part of the State, which have continuous ongoing flooding issues. Numerous small lakes and sloughs dot the landscape of northeastern South Dakota, as well. The largest lakes are the reservoirs behind dams on the Missouri River, all of which were constructed as part of the Missouri River Basin Project.

Big Sioux River Basin

The Big Sioux River Basin is the eastern most major river pattern in South Dakota. It is formed within a topographic feature known as the Coteau de Prairie Highlands. This glacial formed feature rises about 800 feet above the bordering Red River lowlands of Minnesota. It is also bordered on the west by the James River Lowland. The Coteau has what is known as a flatiron shape lying in a general northwest to southeast direction. It is about 200 miles long and 80 miles wide at the widest point. It has a variation in elevation from 2,050 feet at the highest point to 1,090 feet at the lowest point.

The northern part of the Coteau has geologically developed features of potholes, sloughs, and lakes. During periods of low precipitation, these features tend to hold backwater and do not contribute to the drainage of the Big Sioux River. Conversely, during wet years, this area can accumulate enough moisture to greatly increase the water supply to the drainage basin. There are about 1,970 square miles of land within the basin that is designated as noncontributing to the drainage system. The portion of the basin that does contribute to the Big Sioux River is about 7,280 square miles, 4,280 square miles of which is in South Dakota.

The headwaters for the Big Sioux River are found in the Coteau Lake Region of Roberts and Day Counties. The river flows in a southerly direction to its junction with the Missouri River near Sioux City, Iowa. The variation in elevation from the headwaters to the mouth greatly influences the movement of water through the basin. The elevation decreases from 1,826 feet near Waubay to 1,281 at Sioux Falls. The Granite Falls formation of Sioux Falls has a 100-foot drop in elevation. Below the falls, the elevation varies from 1,281 feet to 1,098 feet at the river's mouth near Sioux City, Iowa.

Associated with the elevation is the slope profile of the river. The slope varies from 1.83 feet per mile near Watertown, 1.50 feet per mile at Sioux Falls, and 0.5 feet per mile at the junction with the Missouri River. The Big Sioux River has a steeper gradient than the James or Vermillion rivers. This steep slope causes water to move quickly down the drainage system and thus shortens the time of peak flooding in any given portion of the basin.

James River Basin

The James River Basin is the largest of the East River Basin Systems. It is bordered on the east by highlands of the Coteau de Prairie and on the west by the high ground of the Coteau de Missouri. The valley is a nearly flat stretch of land about 216 miles long and averaging 60 miles wide. It is only in the southern portion that the topography becomes steeper. There is little variance in the elevation of the basin. At Columbia, where the river basin forms in South Dakota, the elevation is 1,290 feet. At the southern terminus of the basin near Yankton, the elevation is 1,162 feet.

The James River drainage area encompasses all or part of 23 counties. It drains 12,609 square miles or over eight million acres of land in South Dakota. This represents 16.3 percent of the total land in the State. The river valley is about 400 miles long, 25 to 75 feet deep, and varies in width from a few hundred feet to three miles. The slope of the valley is 0.493 feet per mile and the average slope of the river is 0.280 feet per mile.

There are seventeen contributing streams within the James River Valley. These streams drain 10,606 square miles. The majority of the basin lacks good drainage features. This is due to the slight variance in elevation and limited slope of the river. Much of its drainage is noncontributing and remains in small swales and basins.

Vermillion River Basin

The Vermillion River Basin is the smallest of the East River systems. It has its headwaters in the lake country of Kingsbury County. The river flows through McCook, Turner, and Clay Counties to join with the Missouri River near Burbank, South Dakota. The west branch originates in Miner County and connects with the main stem near Parker in Turner County.

The Vermillion River Basin is formed in the Dakota Valley or what is more commonly called the James River Lowland. This area is more than 200 miles long and about 60 miles wide and occupies a portion of the lower half of the basin. The gradient of this river system is approximately 400 feet throughout the length of the river. The east branch elevation is 1,518 feet and the elevation near Vermillion is 1,119 feet. The slope profile is approximately four feet per mile.

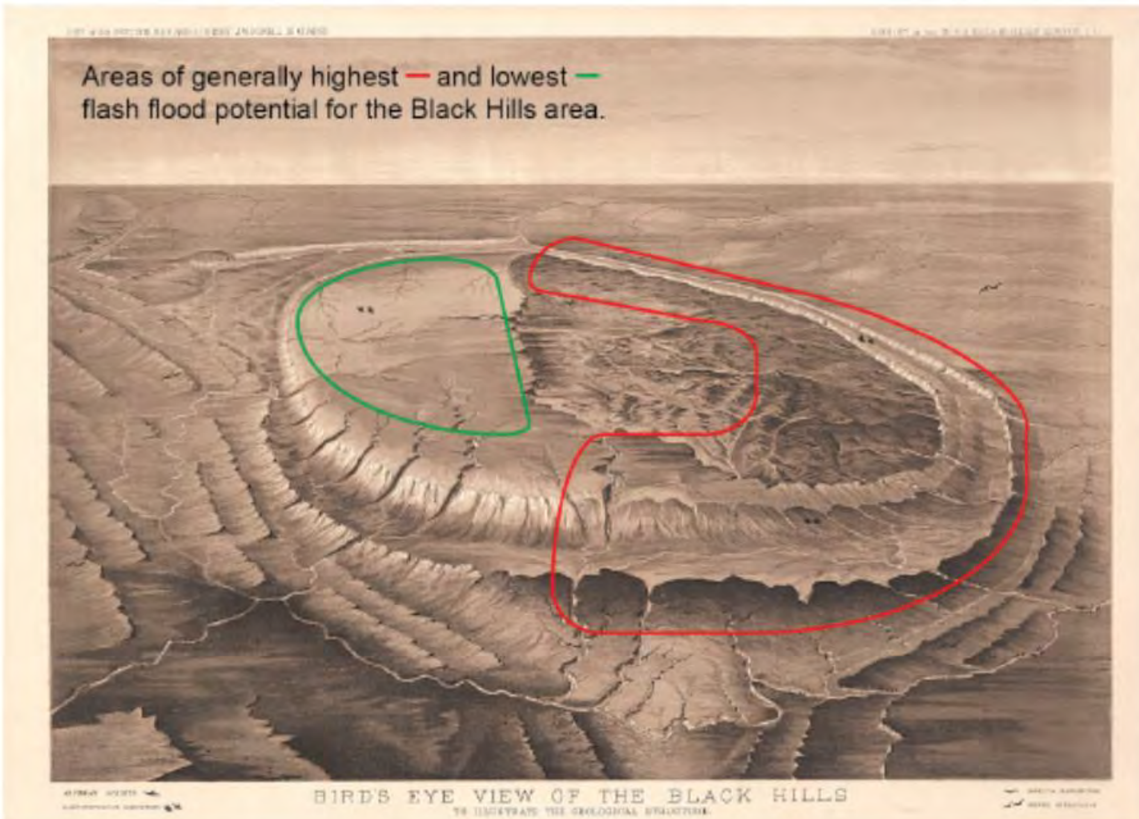
The drainage system is supplied with water from both the east and west portion of the basin. The major tributaries are the Little Vermillion River, Turkey Ridge Creek, and Saddle Creek. There are also a number of very small tributaries contributing to its drainage pattern.

Black Hills Region

The western most drainage system is found in the Black Hills Region. The Black Hills lie within the states of Wyoming and South Dakota with the majority in western South Dakota. The region is 125 miles long and 60 miles wide. The general shape of the Black Hills is elliptical. This formation presents a startling contrast to the surrounding topography. Its eastern side rises from the prairie to a height from 2,600 to 3,500 feet. The western part of the Black Hills varies in elevation from 3,500 to 7,200 feet at Black Elk Peak.

The major drainage creeks of Alkali, Battle, Bear Butte, Beaver, Box Elder, Elk, French, Rapid, Spearfish, Spring, and Whitewood are all capable of causing heavy flooding and flood-related damage. These eleven creeks drain about 7,500 square miles of land. Figure 3-19 below is a diagram of the Black Hills Region's susceptibility to flash flooding.

Figure 3-19 Generalized Potential for Flash Flooding in the Black Hills Area



Source: Driscoll, Huft, and O'Connor, Extreme Floods in the Black Hills Area: New Insights from Recent Research, 2012

Waubay Lakes Chain and Adjoining Closed Basins

The Waubay Lakes Chain is part of a 409 square mile closed basin area in the Big Sioux River Basin in northeastern South Dakota (mostly in Day County). The 10 major lakes in this chain are glacial in origin and include Bitter Lake, Blue Dog Lake, Enemy Swim Lake, Hillebrands Lake, Minnewasta Lake, Pickerel Lake, Rush Lake, Spring Lake, Swan Pond, and Waubay Lake. In closed basins, under most circumstances, water does not have a direct drainage path to a river outside the closed basin and the water would have to evaporate into the atmosphere for lake levels to recede. The northeastern area of South Dakota is much like a giant bathtub. Water fills the basin until it overflows the sides. Because the area is atop a flat area of high ground, the sides of the tub are higher than the normal drainage routes (e.g., the Big Sioux and the James Rivers), leaving the accumulated runoff without a natural outlet.

Rising waters have inundated portions of Day County and the surrounding areas in the past, in particular during the 1990s. Significant increases in lake levels within the Waubay Lakes Chain have occurred mainly due to greater-than-normal precipitation along with less-than-normal evaporation. In September 1998, FEMA issued a mission assignment to the U.S. Geological Survey to provide oversight, coordination, and hydrologic expertise for a study of the Waubay Lakes Chain and the adjoining closed basins. This study, including pertinent maps, is on file with the OEM and FEMA Region VIII. The U.S. Army Corps of Engineers also provided technical expertise and analysis for the study as well as possible structural mitigation solutions. The Natural Resource Conservation Service provided soils data. This study found that from 1991 until the report was published in 1999, the Waubay Lakes Chain experienced a wet climatic period that can be expected to occur less than once every 100 years, on average. Due to periods of above normal precipitation and below normal evaporation, significant increases in lake levels and inundation areas within closed basins in northeastern South Dakota have been observed.

Based on the study of the Waubay Lakes Chain the lake levels for Bitter, Hillebrands, Minnewasta, Rush, Spring, and Waubay lakes and Swan Pond have significantly increased. The total surface area of the ten major lakes increased by 74 percent between 1991 and 1998. The water levels for Bitter, Hillebrands, Spring, and Waubay lakes and Swan Pond increased between 15 and 18 feet from 1991 to 1998. Blue Dog, Enemy Swim, and Pickerel lakes have concrete weir outlet structures and experienced lake level increases of 2.7, 1.8, and 0.1 feet respectively between fall 1991 and fall 1998. Minnewasta and Rush lakes experienced lake level increases of 9.2 feet and 3.9 feet respectively.

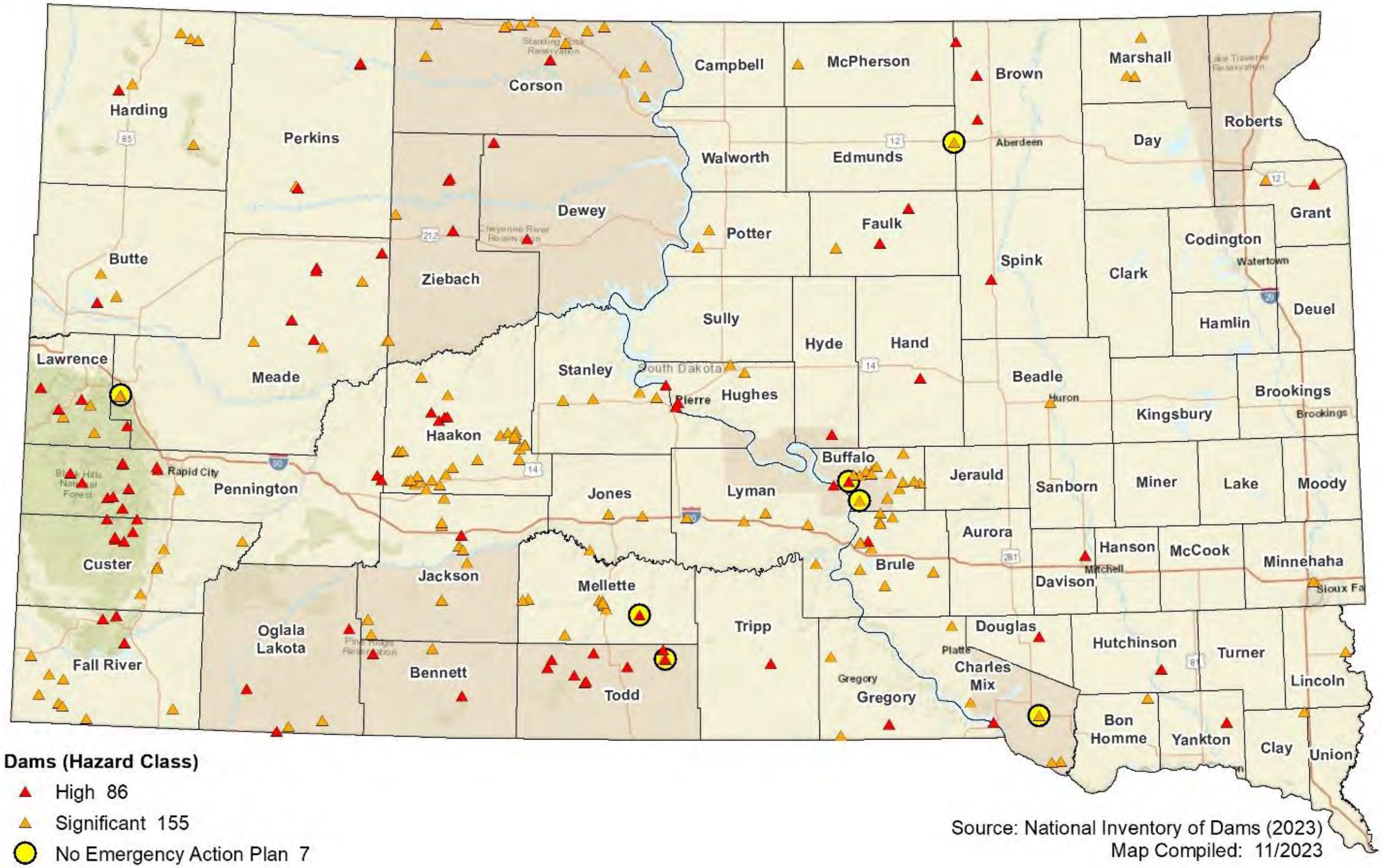
At the time the study was published, the U.S. Army Corps of Engineers' hydrologic model simulation suggested that flooding problems would persist in the region for the next few years, regardless of whether the climate was wet or dry. It would take at least a decade of drought similar to that experienced in the 1930s to return the lakes to pre-1992 conditions. If relatively wet climate conditions persist, the lakes would continue to climb until Bitter, Blue Dog, Rush, and Waubay lakes form a single lake that will inundate over 60,000 acres and the natural drainage divide south of Bitter Lake could overflow and spill to the Big Sioux River. This scenario, however, would require nearly 15 years of wet conditions.

Rising water levels in the Waubay Lakes Chain have resulted in substantial damage to public and private properties in the basin. Several presidential declarations in the 1990s allowed for funding to be used to address the immediate problems of inundated roads and structures for emergency access purposes. Numerous public roads and highways have been damaged or closed because of high water, and some have been raised at great cost. Many parks and recreational facilities have been adversely affected as well. The available data show that the greatest impacts from flooding have been to agriculture and transportation. The federal government had spent over $71 million in northeastern South Dakota for response and recovery efforts and emergency measures during the 1990s. However, because a major storm event or flash flood did not cause the damage (it was caused by an accumulation of annual runoff and a lack of evaporation), established FEMA disaster programs could not adequately address the situation. Since that time 29 homes have been acquired in Waubay with FEMA HMA funding in 2012, which should mitigate some of the losses to residential structures in this area in the future.

South Dakota Dams

Figure 3-20 shows the locations of the high and significant hazard dams in South Dakota. Most of the High Hazard dams are located along the Missouri River and in the Black Hills; others are scattered across the mostly west-river counties of the state.

Figure 3-20 South Dakota High and Significant Hazard Dams



The four largest dams in South Dakota in terms of normal storage capacity are Oahe at Pierre, Big Bend at Fort Thompson, Fort Randall at Pickstown, and Gavins Point at Yankton. These are U.S. Army Corps of Engineers Dams on the Missouri River. Large dams in the Black Hills are the U.S. Department of the Interior Bureau of Reclamation's (BOR) Deerfield, Pactola, and Angostura dams, the U.S. Forest Service's Sheridan Lake dam and the Orman dam which is associated with the Belle Fourche Irrigation District. Shadehill Reservoir, while not in the Black Hills, is a significant BOR dam which stores water for irrigation (6,700 acres) and flood control purposes. More specifics on the High Hazard dams, including county, ownership and National Inventory of Dams identifier are located in Appendix I.

Historically, the absence of dam-failure inundation mapping information has been a key limitation for hazard planning. Dam inundation areas often have not been delineated or, in the case of any Federally operated dam, have not been readily available. Planners are often left to infer where high hazard areas exist. Where inundation areas have been delineated, the impacts have not. This is a knowledge gap that clearly limits hazard planning.

Fortunately, times appear to be changing with regard to dam-failure inundation mapping. Recently, inundation mapping for USACE dams has become available through the NID (https://nid.sec.usace.army.mil/viewer/index.html?version=3.48.1). This development occurred too late for inclusion in this ESHMP update, but will be available moving forward. U.S. Bureau of Reclamation and U.S. Forest Service dam inundation mapping remains classified and is a substantial limitation for hazard planning.

Among significant hazard dams, 143 are not required to have an EAP under state rule. Of those that are required to have an EAP, only three do not as of December 2023.

South Dakota Levees

As mentioned previously, South Dakota contains numerous levees ranging from small agricultural levees that protect farmland from high-frequency flooding to urban levees protecting large urban populations and property from larger less-frequent flooding events such as 100-year and 500-year floods. According to the U.S. Army Corps of Engineers National Levee Database, there are 105 levee systems in South Dakota containing 118 miles of levees. Sixteen (16) of these systems, containing a total of 41 miles of levees, are USACE constructed systems.

Table 3-21 shows the location of the U.S. Army Corp of Engineers Levees, as well as detail about each levee. These are also graphically depicted on Figure 3-20. The following table is not a comprehensive inventory of levees in the State. The SHMT noted that there are several levees along the James River in Spink and Brown Counties that are not certified and frequently overtopped. Although these are not represented in the FEMA database of levees, the James River Water Development District (JRWDD) commissioned a LiDAR survey of the floodplain and now maintains GIS data of all of the levee locations along the James River. This information is being used by the JRWDD to identify specific mitigation actions within the watershed. JRWDD and Brown County are exploring opportunities to commission LiDAR for the entire county.

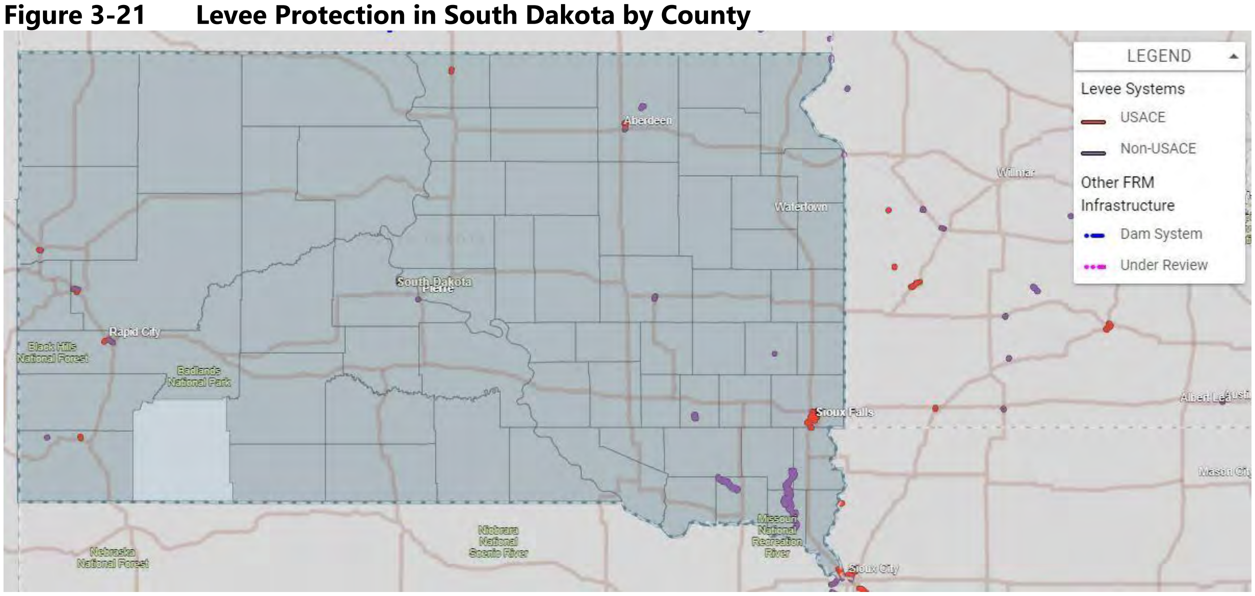
Table 3-21 U.S. Army Corps of Engineers Owned Levees by County in South Dakota

County	City	System Name	Construction Completion Date	What's Behind the Levee?		
				Population	Buildings	Property Value (Millions)
Brown	City of Aberdeen	Aberdeen – Moccasin Creek RB	-	5,453	2,126	$591
Butte	City of Belle Fourche	Belle Fourche RB	6/1/1938	435	166	$54.2
Campbell	Town of Herreid	Herreid - Spring Creek RB	10/19/1953	382	251	$39.2
Fall River	City of Hot Springs	Hot Springs - Fall River Channel West System	7/25/1949	41	28	$17.3

County	City	System Name	Construction Completion Date	What's Behind the Levee?		
				Population	Buildings	Property Value (Millions)
Fall River	City of Hot Springs	Hot Springs - Fall River Channel East System	7/25/1949	125	39	$17.2
Lincoln, Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB and Skunk Creek RB	1/1/1961	8,492	249	$513
Meade	City of Sturgis	Sturgis - Deadman Gulch RB	6/26/1980	82	31	$14.7
Minnehaha	City of Sioux Falls	Sioux Falls - Diversion Channel LB - South	1/1/1961	1	4	$3.9
Minnehaha	City of Sioux Falls	Sioux Falls - Diversion Channel LB - North	1/1/1961	7,026	176	$429
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB and Skunk Creek LB	1/1/1961	1,695	458	$249
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux RB	1/1/1961	326	75	$54.9
Minnehaha	City of Sioux Falls	Sioux Falls - Big Sioux LB North and Diversion Channel RB	1/1/1961	8,120	1,798	$1,100
Minnehaha	City of Sioux Falls	Sioux Falls – Big Sioux LB Downtown		154	6	$9.72
Minnehaha	City of Sioux Falls	Sioux Falls – Big Sioux River LB South		3,830	418	$252
Pennington	City of Rapid City	Rapid City - Rapid Creek RB	11/26/1978	304	119	$56.4
Union	City of North Sioux City	North Sioux City - Union County - Big Sioux River RB	10/20/1981	1,093	450	$188

Source: U.S. Army Corps of Engineers

Figure 3-21 Levee Protection in South Dakota by County



Source: USACE National Levee Database

Past Events

According to the NCEI Storm Events Database, there were 2,801 floods or flash floods reported in South Dakota between January 1993 and August 2021. The actual number of floods is somewhat lower, as some of these NCEI events include individual floods which may have impacted more than one county or city and been reported multiple times. However, the monetary damages and casualties are not double-counted and are correct. Total property and crop damage for these events over the nearly 29-year record is $1.13 billion.

One calendar year, 2019, accounts for 90% of the financial damages reported over the entire NCEI 1993-2021 record. In September of that year, a flood event caused three dams to fail and several to sustain damage/incidents without failure.[8] Furthermore, 90% of the damages incurred in 2019 were to crops, with only 10% of monetary damages occurring to property. The crop-heavy damage ratio is a dramatic departure from all other years, which have experienced roughly 25% and 75% of damage to crops and property, respectively.

There were seven deaths and five injuries during the 29-year period, January 1993 to August 2021. Three of the fatalities occurred in 2019. Table 3-22 describes some of the floods that have occurred in South Dakota, specifically those that have led to a federal disaster declaration.

South Dakota is remarkable in that as early as the late 1800s, flood mitigation efforts were pursued and implemented. The first effort was after the 1886 flood of the Vermillion and Missouri rivers that wiped out the town of Vermillion. The town was relocated on the bluffs behind the former town to prevent another recurrence. This was the first recorded hazard mitigation effort by a government entity in South Dakota and possibly in the nation.

The second effort followed the 1972 Black Hills/Rapid City flood. This flood stands out in South Dakota history as the deadliest and most expensive in terms of damage. Following the flood, Rapid City refused to allow rebuilding in the floodway, effectively launching federal government efforts to create a hazard mitigation program.

While there have been failures of low hazard dams in recent years, no deaths or injuries were reported, and property damage was minimal. The only significant failures of high hazard dams are the breach of Canyon Lake Dam in 1972 (Rapid City flood) and the failure of Menno Dam in 1984 (see event descriptions below). Rose Hill Dam in Hand County failed in 2010 due to heavy rains. Two people were stranded, hanging from a tree as floodwaters rushed past, until first responders were able to rescue them. Over the course of the 2019 floods, the Hidden Timber, Okobojo, and Quinn Dams each failed over the course of the spring months and resulted in washed out roads downstream, but none of these incidents resulted in property damage or injuries.

Table 3-22 Significant South Dakota Flood Events

Date	Comments
September 12, 2019	Severe Storms, Tornadoes, and Flooding (FEMA-4469-DR) Heavy rainfall from September 10-12 totaling 7 to 8 inches near Mitchell led to widespread areal flooding. Travel was significantly hampered across most of the county, including the closure of Interstate 90. Smaller creeks and ponding resulted in the closure of most township and county roads. Five miles south of Mitchell, a bridge over Enemy Creek was washed out, requiring a swift water rescue of one person who was overwhelmed by the current. Three residents located one-half mile east of this bridge were also evacuated from waist deep waters. This bridge was one of nine

8 - Platte Dam, Old Stickney Dam, and New Stickney Dam all failed in the Sept 2019 flood event. Lake Corsica Dam, a high hazard dam in Douglas County, the secondary spillway operated resulting in a couple of feet of water in the downstream campground. The secondary spillway also operated at East Vermillion Dam, a low hazard dam in McCook County, and erosion washed out the access road to the boat launch and a campground.

Date	Comments
	damaged across the county. A no-wake order was placed on Lake Mitchell due to extremely high water. Significant street flooding occurred around Mitchell for the better part of three days. Property damages totaled $22.2 million. Flooding also resulted in the loss of crops, with an estimated $2.4 million in losses provided by the USDA.
June 30-July 21, 2019	Severe Storms, Tornadoes, and Flooding (FEMA-4467-DR) A continuation of flooding from June, relentless rainfall during July 2019 brought basin averages from 6 to 10 inches north of Interstate 90 and 4 to 6 inches south of Interstate 90. As a result, flooding along the Big Sioux River either continued, or was renewed, during the month.
May 26, 2019	Severe Storms and Flooding (FEMA-4463-DR) After major to record flooding due to widespread heavy precipitation during the previous week, conditions were primed for additional flooding when rain began May 26. As much as four inches of rain was observed near Faith, while one to two inches of rain fell over portions of the White River basin. Approximately $2.35 million in property damages were reported to the NCEI.
March 14, 2019	Severe Storms and Flooding (FEMA-4440-DR/FEMA-4448-DR) This event occurred during the wettest period on record in the U.S., from January to May of 2019. Beginning in mid-March with rainfall of one to three inches on frozen ground and into a snowpack with between 2 and 5 inches of liquid water equivalent resulted in considerable overland flooding. One of the hardest hit areas was around Yankton, where a No Travel Advisory was issued for the city on March 13-14. Businesses along north Highway 81 toward Yankton Mall had considerable ponding of water. Water rescues were necessary as cars stalled in high water in low spots around Yankton. Two people were also rescued from their inundated vehicle on Jim River Road east of Yankton. Water also got into power substations and caused spotty power outages and necessitated temporary evacuation of residents. State government offices across the area were closed on March 14 due to the flooding and a Federal Disaster was declared on June 7, 2019. The Federal Disaster Designation ultimately included all but eight counties in the State. Flooding occurred all throughout the State along the Missouri River and its tributaries, continuing into Nebraska, Iowa, and Missouri. High water levels persisted across the State through April and into May, with flood stage conditions persisting in many rivers throughout the Midwest for almost the entirety of 2019. Ultimately three deaths and upwards of $58.9 million in damages was reported statewide in this event. Almost $1 billion in crop losses statewide can also be attributed to the conditions created by this event, as it resulted in the loss of or inability to plant crops.
June 24, 2015	Severe Storms, Tornadoes, Straight-line Winds, and Flooding (FEMA-4233-DR) Strong thunderstorms over western and central Pennington County dumped three to four inches of rain during the evening and overnight hours of June 23-24. Runoff from the heavy rain caused areas of flooding along streams. Runoff from heavy rain caused flooding in Rapid Valley. Green Valley Drive was flooded for a quarter of a mile and Anderson Road was impassable. Flooding was also observed at two gauging stations along Rapid Creek. The river gauge near Rapid Valley crested 2.1 feet over flood stage and the river gauge at Farmingdale crested 0.9 feet over flood stage. Total property damage in those counties is estimated to be more than $20,000.
May 19, 2015	Severe Storms, Straight-line Winds, and Flooding (FEMA-4237-DR) Record flooding occurred along the White River from the Nebraska state line to Badlands National Park. The White River was over 200 yards wide and at least two feet deep on BIA Highway 41 north of Oglala, where a vehicle was swept off the highway and the passengers had to be rescued. BIA Highway 32 near Slim Butte was washed out and a culvert on BIA Highway 27 washed out and the road was damaged north of Rockyford. Total property damage in those counties is estimated to be more than $20,000.
June 14-18, 2014	Severe Storms, Tornadoes, and Flooding (FEMA-4186-DR)

Date	Comments
	Repeating heavy rain caused record flooding of the lower Big Sioux River from June 15th through June 26th. Considerable flooding of farmland and other lowlands included numerous roads, with some roads damaged and a few washed out. A few farm homes and other buildings were damaged by floodwaters. There was considerable damage to counties including Union, Minnehaha, Lincoln, Turner, Jackson, Lake, Yankton, Clay, Hutchinson, McCook, Moody, Butte, Harding, Meade, Perkins, and Ziebach. Repeated heavy rains caused record flooding of the Big Sioux River. Farmland and other lowlands including numerous roads were flooded. Some roads were damaged, and some secondary roads were washed out. A few farm homes, other farm buildings, and some fences were damaged by floodwaters. The river crested at a record 12.92 feet above flood stage at Hawarden, Iowa on June 17th. Interstate 29 was temporarily closed along a 22 mile stretch to facilitate levee building to divert some Big Sioux River water to McCook Lake, but the interstate was reopened when the river crested at a lower level than was feared. A levee breach across the river from Akron, Iowa, briefly aggravated lowland flooding before it was repaired. Total property damage in those counties is estimated to be more than $1 million.
October 11, 2013	Severe Winter Storm, Snowstorm, and Flooding (FEMA-4155-DR) Heavy rain falling on snow remaining from the October 3-5 blizzard caused flooding over portions of western South Dakota. One to three inches of rain fell on October 10 and 11. The runoff and melted snow caused flash flooding in Keystone and flooding along creeks and streams on the plains of western South Dakota. Water covered Elk Creek Road and Antelope Creek Road north of Box Elder, Curlew Road and Pioneer Road north of New Underwood, and Coyote Lane and Golden Valley Drive north of Rapid City. Some fields and pastures in southern Meade County also flooded. The river gauge on Elk Creek at Elk Vale Road north of Rapid City reached a height of 12.6 feet, which is 3.6 feet over flood stage. Total property damage is estimated to be more than $50,000.
June 1, 2013	Severe Storms, Tornadoes, and Flooding (FEMA-4137-DR) A large upper level low-pressure system pushed across the Northern Plains, bringing heavy rain to the northern Black Hills. Embedded thunderstorms produced additional heavy rain, with four to six inches of rain falling over a 24-hour period. Runoff caused minor flooding along the Belle Fourche River and its tributaries. Several county roads were closed or washed out and culverts were damaged. Redwater River, Crow Creek, and several small creeks and streams experienced flooding. Water reached the edge of a house along the Redwater River and some low water crossings were flooded. Total property damage in those counties is estimated to be more than $200,000.
May 29, 2013	Severe Storms, Tornado, and Flooding (FEMA-4125-DR) Thunderstorms developed along the eastern slopes of the Black Hills and adjacent plains from Nisland to Sturgis to the Rapid City area. As these storms moved toward the northwest, they redeveloped and became stationary over the eastern foothills. As much as six inches of rain fell in a few hours. Flash flooding was reported in Rapid City; Sturgis; and rural areas of Butte, Meade, and Pennington Counties. Runoff from the rainfall quickly inundated city streets, overflowed small creeks, and breached a few private stock dams. After heavy during the early evening caused flash flooding in south central Butte County, additional rain overnight exacerbated the flooding. High water from several tributaries caused minor flooding along the Belle Fourche River, which was two feet deep over the Bismarck Bridge east of Vale. Total property damage is estimated to be more than $25,000.
March 11 – July 22, 2011	Severe Storms and Flooding (FEMA-1984-DR) A deep and expansive snowpack across the area began to melt bringing many areas of flooding to central and northeast South Dakota beginning in mid-March and continuing into early April. Many roads along with countless acres of crop and pastureland remained flooded. Roads, culverts, and

Date	Comments
	bridges were damaged across the region. Several roads were washed out with many closed. Many homes were threatened with some surrounded by water. Rising lake levels in northeast South Dakota also threatened and flooded many homes. Many people had to use four-wheelers to get to their homes. A Presidential Disaster was declared for all of the counties due to the flooding damage. The total damage estimates, including March, were from 4.5 to 5 million dollars for the area. High water and groundwater levels resulting from record precipitation in the previous year contributed to the slowness of any improvement in the flooding situation until the spring. The flooding diminished across much of the area into May. Flash flooding events began in May and continued through July. Heavy rains and thunderstorms produced flash floods around the State. Storms dropped several inches of rain over the already saturated soils in a matter of hours.
September 22-23, 2010	Severe Storms and Flooding (FEMA-1947-DR) Persistent thunderstorms developed in the late morning over southeast South Dakota and continued through the afternoon and evening. All of the storms through early afternoon produced large hail, with one report of damaging wind gusts. Large hail, heavy rain, and flash flooding were noted during the evening. Some of the flash flooding continued through the night and next day as flooding.
July 21-30, 2010	Flooding (FEMA-1938-DR) A powerful storm dumped heavy rain causing flash flooding in South Dakota. As much as nine inches of rain fell in the southeastern part of the State, flooding homes and neighborhoods. The heavy rain also forced Sioux Falls officials to discharge untreated wastewater into the Big Sioux River. The storms in late-July affected counties where soils already were saturated, and roads, bridges and culverts had been damaged from the earlier flooding and storms. Rain gauge readings ranged from 3.69 inches to 4.15 inches. The NWS says the previous July 21 record at Mitchell was 2.32 inches in 1907. Total damage to public infrastructure in those counties is estimated to be more than $4 million from heavy rains and severe storms during the period between July 21 and July 30, 2010.
March 10, 2010	Flooding (FEMA-1915-DR) Floodwaters closed roads, filled basements, and soaked agricultural fields in southeastern South Dakota in late March 2010. A combination of snowmelt, ice jams, and heavy rains drove the Vermillion, Big Sioux, and James Rivers over their banks. Some residents described the flooding as the worst in living memory, according to the Associated Press. This event also resulted in a presidential disaster declaration.
March 20, 2009	Severe Storms and Flooding (FEMA-1844-DR) Rapid snowmelt and ice jamming caused the Elm River near Westport to rise above flood stage on March 20th. The Elm River reached an all-time record level of 22.69 feet on March 25th almost 9 feet above flood stage. The previous record was 22.11 feet set on April 10, 1969. The flood stage for the Elm River at Westport is 14 feet. The city of Westport was evacuated with the flood waters causing damage to many homes and roads in and around Westport. Also, many other roads and agricultural and pastureland along the river were flooded. The Elm River slowly receded and fell below flood stage on March 30th. The flood waters from the Elm River flowed south and into the northern portion of Moccasin Creek. Subsequently, the Moccasin Creek rose as the water flowed south into the city of Aberdeen. Flooding became a concern for Aberdeen and for areas along the creek north of Aberdeen. The governor signed an emergency declaration which allowed the State to help with flood response efforts, including sending 50,000 sandbags to the area. Also, the National Guard was activated to move a variety of heavy equipment. Some sandbagging and a falling Elm River kept the Moccasin Creek from causing any significant flooding in and north of Aberdeen. Although, some township and county roads were flooded from the creek.
June 1 – June 6, 2008	Severe Storms and Flooding (FEMA-1774-DR)

Date	Comments
	A series of intense storms impacted more than twenty counties across the State over a period of five days, incurring several million dollars' worth of damage and causing flash flooding, hail and wind damages to livestock, wildlife, property and cropland, and resulting in a presidential disaster declaration. Periodic flash flooding continued for another four days, incurring several hundred thousand dollars more of damage.
May–June 2007	Severe Storms, Tornadoes, and Flooding (FEMA-1702-DR) Flooding brought on by record-setting rainfall on May 4 and 5 caused widespread damage to homes, businesses, farmland, infrastructure, and utilities across eastern South Dakota. Houses were destroyed; with basement walls collapsing, and critical utilities were nonfunctional. Thousands of acres of farmland were flooded that could not be planted, resulting in financial impacts to the individual operations as well as businesses dependent on the farming community. State and local governments also sustained damage to infrastructure. Flooding along the James River in Yankton County exposed URD cable. The Bon Homme Yankton Electric Association was forced to relocate the cable. Additionally, the flooding shut down one irrigation system for the entire summer. The Association's emergency repair and restoration costs were estimated at $20,023.
May–June 2004	Severe Storms and Flooding (FEMA-1531-DR) Thunderstorms developed from northern Turner County to western Yankton County on May 29. These storms produced large hail and strong winds across the area and saw very little movement over an eight-hour period. As a result, three to six inches of rain fell in portions of Yankton, Turner, and Minnehaha Counties, including Sioux Falls and the towns of Parker, Hartford, Crooks, and Marion. Urban flooding resulted with rapid runoff from streets across Sioux Falls. Willow Creek in Crooks and Skunk Creek in Hartford rose several feet in only a couple of hours. In western Sioux Falls, Skunk Creek reached its highest level in 20 years. River flooding continued the following two days. On June 16, strong thunderstorms developed in western Sioux Falls and moved east. As the storms moved east, new storms developed just west of Sioux Falls, resulting in repeated episodes of heavy rain in the Sioux Falls metropolitan area. Rainfall amounts were similar to May 29, but the rate of rainfall was much higher. Over two inches of rain fell in one hour at the Sioux Falls airport, and multiple locations around the city received more than three inches of rain in two hours. The highest amount of rainfall reported in Sioux Falls was 7.79 inches. There were numerous reports of three to six inches across the city. The large amount of rainfall in a short period of time produced excessive runoff across the city and Skunk Creek and the Big Sioux River rose rapidly as a result. At the time, the 31 days up to and including June 16 marked the wettest 31-day period on record for Sioux Falls (12.74 inches at Joe Foss Field). Source: NWS Sioux Falls
April 2001	Severe Storms (Flooding) (FEMA-1375-DR) This presidentially declared disaster was precipitated by an onset of flooding that began during a spring thaw in early March 2001. On April 6, a series of rainstorms that dropped from two to six inches of rain resulted in flooding of the James, Vermillion, and Big Sioux rivers. According to the NWS, the James River, at Huron, reached its highest crest of 18.1 feet (flood stage of 11 feet) on April 10, the second highest crest on record. On April 11, a second similar weather system produced more heavy rains in the Aberdeen, Huron, Watertown, and Brookings areas. Flooding of the James River occurred in and around Huron and Mitchell. The west fork of the Vermillion River caused flooding around Parker and Centerville. The Big Sioux River flooded in and around Watertown, Dells Falls, and Sioux Falls. At Mitchell, the James River reached its highest crest of 21 feet (flood stage of 14 feet) on April 11, the second highest crest on record according to the NWS. Peak crests on the Vermillion and West Vermillion rivers were two to four feet above flood stage. The Big Sioux River in Sioux Falls crested at 22 feet (flood stage of 16 feet) on April 24.

Date	Comments
	A third major system passed through South Dakota on April 21-22. The Black Hills, in the western part of the State, received up to 22 inches of heavy wet snow and the eastern portion of the State received 4-8 inches. Beadle, Brookings, Brown, Buffalo, Clark, Codington, Day, Deuel, Edmunds, Grant, Gregory, Hamlin, Hanson, Jerauld, Kingsbury, Marshall, Mellette, Moody, Roberts, Sanborn, Spink, Todd, Turner, and Tripp Counties were included in the disaster declaration. The major impact was to public infrastructure. Due to ice and wind damage to utility poles and lines, electrical services to some areas were interrupted. Numerous bridges and roads were impacted as well. There was damage to county and township roads in the eastern and northeastern portion of the State that had previously not been affected by floodwater. Some of the damaged roads included school bus, mail, and farm-to-market routes. Travel on these roadways involved significant risk. Several roads were temporarily impassable, requiring residents to travel greater distances because of detours. Many farmers were unable to access their fields to begin spring planting. In Mellette County, ice jam fluctuations substantially damaged a bridge, which caused the county to close the bridge to through traffic, resulting in a 40-mile detour for residents needing to cross the White River. This disaster also heavily impacted South Dakota's agricultural and livestock community.
April-June, 1998	Flooding, Severe Storms, and Tornadoes (FEMA-1218-DR) Heavy rain of 2 to 4 inches with some amounts nearing 5 inches fell across a large part of the six-county area mainly on the evening of the 11th. This round of heavy rain only exacerbated the already extensive flooding occurring from many years of above normal precipitation. Day county was most affected by this round of heavy rain where area lakes were already at new record levels. Blue Dog, Waubay, Rush, and Bitter Lake in Day County were just a few of the lakes hard hit again. In fact, extensive sandbagging was done around Blue Dog Lake to save many homes. Some residents of Blue Dog Lake said they had never seen the lake so high in over 35 years of living there.
February–May 1997	Severe Storms/Flooding (FEMA-1173-DR) This disaster had its roots in past flooding events. Beginning in 1992, the State had a series of weather-related events of sufficient magnitude and impact to warrant eight presidential disaster declarations prior to this event; five for flooding, four for ice/snow; and one for just snow. These events kept the water table saturated, which prevented much of the winter snow melt and the spring/summer rains from soaking into the ground, thus contributing to flooding. The first significant winter storm of 1996 hit the eastern part of the State in mid-November, dumping up to 10 inches of snow across the northeast and producing a major ice storm with widespread damage across the southeast (see Winter Storms). In 1997, major winter storms were fairly frequent throughout January with several blizzards, mostly in the northeast part of the State (see Winter Storms). From mid-November to mid-February, the general weather across the eastern part of the State was cold and wet with below normal temperatures (in excess of 30°F below zero) and record-setting above normal snowfall. The persistent cold greatly limited snowmelt between storms, allowing up to 48 inches of snow to accumulate across much of the northeastern part of the State. Mid-February snow depths elsewhere across eastern South Dakota ranged from 10 to 24 inches. The NWS snow water equivalent measurements of February 12 ranged from approximately two inches near the Missouri River to over six inches in Marshall County. Snow water equivalent values from 4 to 5 ½ inches were common over the central and northern portions of the James and Big Sioux River basins. Seasonably cool and relatively dry weather prevailed across the eastern part of the State from mid-February to early April. An early April blizzard added to the remaining snowpack, which gradually melted south to north by the end of April. Heavy rain and snowstorms in April, compounded by severe winter blizzards and existing saturated soil conditions, resulted in persistent flooding throughout the State. Many people were evacuated from their homes and farms, while others had limited or no access or

Date	Comments
	escape. Heavy snowmelt and pounding rains turned prairie potholes into lakes, pushed people from their homes, and prevented farmers from planting thousands of acres of land. The JRWDD estimated that five years of flooding destroyed or severely damaged approximately 75 percent of the forested areas in the James River Valley. Riverine flooding destroyed or damaged many homes and businesses, impacted water and sewage treatment plants, and damaged or destroyed many roads and bridges. All counties were included in the presidential disaster declaration. This flood caused approximately $82.5 million in damage (2006 dollars) and two deaths.
March–May 1995	Severe Storms, Flooding (FEMA-1052-DR) The entire State had above normal precipitation between January and May, ranging from about one to two inches above normal in the southwest to five to nine inches above normal in the east. This is up to 200 percent of normal. Many official reporting stations, including Huron, Mitchell, and Sioux Falls, experienced their all-time wettest springs on record. Most damage to public facilities was caused by ground saturation and flooding due to very high residual groundwater tables from 1994, heavy winter snow and spring rain, and rapid snowmelt. Many roads were under water or unusable due to high groundwater saturation of the subgrade, causing interruption of emergency services. Damage to power transmission and distribution facilities owned by rural electric cooperatives was also reported. Preliminary damage surveys identified over 3,000 homes with some type of damage. The vast majority of damage was from one to three inches of groundwater seepage into basements. In many areas, the water table rose to near land surface levels, saturating septic drain fields and preventing proper treatment of residential sewage. Preliminary damage surveys estimated $9.3 million in damage to infrastructure of public facilities. Roads and Bridges and Utilities incurred the most damage with almost $5.7 million and $2.6 million in estimated damages, respectively. Federal aid system roads received $7.1 million in damage.
March–July 1994	Severe Storm/Flooding (FEMA-1031-DR) Flooding in northeastern South Dakota began in mid-February 1994, as a result of very high residual groundwater tables from 1993's extremely high levels of precipitation (snow and rain) and rapid melting of the snowpack. Flooding continued into late March 1994 and then subsided. Rain continued throughout the spring and summer months, but the remainder of the snowmelt was gradual and did not significantly contribute to flooding. On July 6, a significant storm system passed through central and northeastern South Dakota. Severe winds caused damage in the Pierre area, and the town of Milbank in Grant County received approximately six inches of rain in two to three hours. The thunderstorm in Milbank caused the town's storm and sanitary sewer systems to overload and water backed into basements of several homes. Damage was estimated at approximately $4 million. The vast majority of damage was to county and township roads (which had significantly deteriorated because of saturation from near ground-level water tables), culverts, and bridges. Many roads remain under water, as once small (or dry) glacial lakes with no drainage outlets, grow in size and encroach upon nearby roadways. In 1995, total damages were estimated to be $36.5 million.
March–September 1993	Flooding, Severe Storms, Tornadoes (FEMA-999-DR) Early and rapid snowmelt resulted in localized flooding along portions of the three eastern river basins. Major problems began in May when severe weather spawned tornadoes and floods in five eastern counties, injuring 12 and killing one. Heavy rains continued throughout May, June, and July, which included a 6.5-inch deluge in Sioux Falls on May 23 that backed up sewage into 190 basements and damaged city streets. By the end of June, the Big Sioux River was over a mile wide in places, flooding many communities along its banks. During early July, the swollen Vermillion and James Rivers inundated thousands of acres of farmland and surrounding communities. Heavy July rains developed flash flood torrents on small drainages in Madison and Yankton, while rising lake levels flooded numerous communities on lake shores. Overall, the disaster heavily impacted 39 counties in South Dakota, over half the State, and contributed to four deaths, approximately $2 million damage to business, $12 million damage to public facilities, $10 million to private residences, and $204 million to agriculture. Federal aid system roads received $3 million.

Date	Comments
June 1992	Flooding, Severe Storm, Tornadoes (FEMA-948-DR) On June 13 and 14, a major spring storm resulted in severe weather in Harding County. Golf ball size hail and 10 ½ inches of rain occurred in a three-hour time span. Crops were destroyed and over 500 sheep were killed. On the afternoon and evening of the June 16, several violent thunderstorms (super cells) produced large amounts of rain and several large, damaging tornadoes. Heavy rain was experienced in the Davison, Miner, Kingsbury, Lyman, Buffalo, Moody, Brookings, Deuel, Minnehaha, and Hamlin Counties. The heavy rains occurred in an area already saturated by previous rains. Over a two to three-day period, 15 to 20 inches of rain fell in the Clear Lake/Watertown area resulting in widespread flooding of the Big Sioux River. The rains subsided late in the week. Some flooding was experienced by South Dakotans as far south as Sioux Falls.
May 1986	Severe Storms, Flooding (FEMA-764-DR) The above average fall rains and heavy winter storms during 1985-86 created a condition of supersaturated ground and record water levels in the lakes and Big Sioux River Basin in the northeast part of the State. The snowmelt runoff into the numerous lakes forced the already full lakes to overflow and seriously impact residences, cottages, resort business, and agribusiness. A severe winter storm covered the entire State the week of April 14, adding one to three inches of precipitation to the area. Flood damage was estimated at approximately $25.9 million, $20.6 million of which was to agriculture.
Spring 1984	Severe Storms, Flooding (FEMA-717-DR) The winter of 1983-84 was the third snowiest on record (75 inches of snow at Sioux Falls). The heaviest snows occurred in November 1983 and in March 1984. Severe snowmelt flooding began March 20 and after the fourth wettest April on record, caused near record flooding on the Big Sioux, Vermillion, and lower James Rivers in April. These rivers did not go below flood stage until the end of April. Numerous reports of water damage were recorded in the communities of Mt. Vernon, Parkston, Tabor, and Volin. June was the wettest June on record in southeast South Dakota and was the sixth wettest month on record at Sioux Falls. Between June 4 and June 22, many large storms crossed the region and dumped approximately 30 inches of rain, which caused repeated flash floods. Numerous roads and bridges were heavily damaged. Many areas had severe urban flooding, because sewers and storm drains were unable to handle the load. As a result, many basement walls collapsed. The Lake Menno Dam (Hutchinson County) collapsed on June 12, killing 450 hogs, destroying one car and damaging two, moving a farmhouse 75 feet off its foundation, scattering and destroying farm machinery, and completely sweeping away grain bins. On June 16, three feet of water was flowing through downtown Davis (Turner County). Vermillion Lake Dam (McCook County) and many smaller dams sustained severe erosion. The Fulton Lake Dam (Hanson County) was severely weakened and in imminent danger of failing but held. On June 18, a train was derailed at Parker (Turner County) due to washed out tracks. On June 20, Lake Dimock Dam (Hutchinson County) gave way, destroying the dam and causing flooding in Milltown. A 400-yard sandbag dike saved the Lake Carthage Dam (Miner County) from destruction. Widespread flash flooding caused severe erosion; washed out or weakened many roads, bridges, and culverts; and washed away crops in low-lying areas. Many small stock dams collapsed, washing out roads, bridges, and culverts beneath them. In Mt. Vernon (Davison County), there was three to four feet of water in homes. Twenty homes were evacuated along Dry Run Creek in Mitchell (Davison County). Sewage was five to six feet deep in parts of Mitchell. Estimates by the U.S. Geological Survey place the flooding on the Big Sioux River drainage at about a 10 to 30 year recurrence interval, the Vermillion River at about a 100–500 year recurrence interval, and the lower James River at about a 100–300 year recurrence interval. By June 22, over one million acres of cropland in the region were under water. Total damage was estimated at $289 million.

Date	Comments
June 1976	Flash Flooding, Mudslides (FEMA-511-DR) In a 24-hour period on June 13-14, 3 to 10 inches of rain fell in the northern Black Hills. And additional two to three inches of rain plus heavy snow was recorded over this area on the June 15 and 16. The runoff from this precipitation did considerable damage in the counties of Lawrence, Meade, Butte, and Harding. Physical structures, streets, roads, sewers, and water systems sustained about $1.5 million in damage. Deadwood, Spearfish, Belle Fourche, Sturgis, and Galena received most of this damage. Throughout the region, a number of bridges and culverts were washed out and many of the roads suffered water erosion. Debris damage was not as great as in 1972, however, there was considerable movement of rocks and gravel. There was also a problem with mudslides and landslides. One death resulted from this flood.
June 1972	Heavy Rains, Flooding (FEMA-336-DR) On June 9-10, 1972, extremely heavy rains over the eastern Black Hills of South Dakota produced record floods on Rapid Creek and other streams in the area. Scattered showers had occurred throughout the Black Hills area on several days prior to the heavy rains that began on June 9. Near Pactola Dam, these earlier showers left the soil saturated, which increased the amount of runoff for the flood of June 9-10. Rainfall began in the Black Hills area on the afternoon of June 9, when a group of almost-stationary thunderstorms formed over the eastern Black Hills. Precipitation totals for June 9-10 ranged from 4 inches to more than 12 inches in the Rapid Creek watershed between Pactola Dam and Rapid City. In the Boxelder Creek watershed, 15 inches of rain during a six-hour period was measured at Nemo. The heaviest rainfall averaged about four times the six-hour amounts that are to be expected once every 100 years in the area. The resulting runoff produced record floods (highest peak flows recorded) along Battle, Spring, Rapid, and Boxelder creeks. Smaller floods also occurred along Elk Creek and Bear Butte Creek. The floods struck quickly and forcefully, but they did not last long, nor did they make much impact farther downstream in the basins. Nonetheless, the Black Hills Region sustained millions of dollars of damage to roads, streets, and bridges (very few bridges were left standing). Rapid City - Evacuation of residents along Rapid Creek was ordered by 10:15 p.m. Flood and debris-laden water flowed into Canyon Lake and clogged the dam’s chute spillway. This caused a 300-foot breach in the dam and sent a wall of water and debris pouring down on residents below the dam. The effect of this dam failure on the subsequent flood wave into urban Rapid City has been difficult to assess because the amount of water coming down Rapid Creek and several tributaries (accounting for 86 percent of the peak flow) far overshadowed the amount of water in the small lake. The peak flow was carried through Rapid City via Rapid Creek at about midnight on June 9, while many people were asleep and unaware of the impending flood. The stage of Rapid Creek (measured above Canyon Lake) rose more than 13 feet in five hours during the flood. The toll of the flood-produced carnage was staggering. At least 238 people died (including five listed as missing and presumed dead). Thousands of people barely escaped death and hundreds of people were forced to climb, stand, or cling to objects which saved them from being swept away. Property damage exceeded $79 million. 436 houses were destroyed, and 930 houses damaged. 710 mobile homes were either damaged or destroyed. 36 businesses were wiped out and 236 more sustained damage. About 5,000 cars were reported lost to the flood. Keystone - Motels, shops, bars, and restaurants, which cater to tourists were either damaged or destroyed. Many campgrounds located along the creeks were washed away. At least 10 campers died. Total damage was set at $1.4 million. Black Hawk and Box Elder - These cities incurred $2 million in damage as the flood destroyed or damaged 75 homes and 180 mobile homes along Box Elder Creek. Sturgis - Sturgis sustained over half a million dollars in damage; 275 houses and 25 businesses were affected.
Spring 1969	Flooding (FEMA-257-DR)

Date	Comments
	Big Sioux River - This flood surpassed the flood of 1881 in magnitude with water discharge rates more than twice those of 1962. It resulted from a large buildup of snow. Snow fell in December (1968) in normal amounts, but the accumulations for January and February set a record. The temperatures during March were below the seasonal average, so little runoff occurred. The entire basin was ice free by April 6. The upper part of the basin received an inch of rain on April 7 and compounded the flood. One-eighth of Watertown was under water. Dempster, Estelline, and Castlewood had flood damage as did the lower portion of Dell Rapids. Fifty families were evacuated from Moody County, and fifty people had to be removed from Renner. Sioux Falls was more fortunate as they had developed a flood control system, which was credited with preventing more than $12 million in flood damage. Vermillion River - This flood was greater than the 1962 flood. The town of Centerville was surrounded by water. Within the town, the sewers backed up and the disposal plant was flooded. In the surrounding country, the damage was about the same as in the previous floods. Three bridges were washed out and numerous roads damaged. 450 feet of one highway was completely washed away. The dike system did not contain the water and the lowlands flooded. The U.S. Geological Survey placed the damage to the basin at $1 million. James River - The river was in flood during all of April. The creeks in the lower portion of the basin started flooding early in the month. Their discharge of water started breaking up ice on the main stem of the James. The massive flow of the smaller tributaries caused a backing up of water along the James and increased the problem of flooding. Huron recorded a flood crest of 16.7 feet, almost one foot higher than registered in the previous 30 years. In that area, damage was estimated at $750,000. In the northern part of the State, Moccasin Creek flooded from water coming out of Richmond Lake. This caused some flooding in Aberdeen, as well as extensive flooding in the surrounding countryside. Total damage to the basin was over $16 million. Most of the damage was incurred by farmland, bridges, and roads.
May 18, 1965	Flooding (FEMA-197-DR) Black Hills - Flash flooding brought widespread damage to Deadwood, Spearfish, and Sturgis. Heavy snows in excess of 30 inches and 7 inches of rain triggered an avalanche of water shooting down the creeks and gullies. Some houses were swept away in the Spearfish-Sturgis area while others sustained major damage. One resident whose home was near a creek lost everything. He reportedly had a 70-ton concrete retaining wall between the house and the creek - this was completely washed away. Flood damage to the Black Hills area was estimated at over $2 million.
Summer 1962	Flooding, Tornadoes (FEMA-132-DR) Black Hills - A summer storm dumped more than three inches of rain on Rapid City. The resulting damage: 120 mobile homes, two motels, and over 400 homes had water damage. Bridges, roads, sewer systems, streets, and recreation areas along Rapid Creek were also damaged. Total damage to Rapid City alone was over $800,000. Sturgis, Deadwood, and Whitewood received extensive damage to roads and bridges. Road equipment lost during this flood was estimated at $200,000.
April 1960	Floods (FEMA-99-DR) Vermillion River - Between 10 and 15 thousand acres were flooded when the dikes were unable to retain the rapid runoff. Many fences were destroyed due to ice and debris pile up. Also, county road systems were damaged due to erosion. The town of Davis received about one foot of water.

Source: If not otherwise sourced in the table, the NCEI and FEMA Disaster Declarations page are the information source.

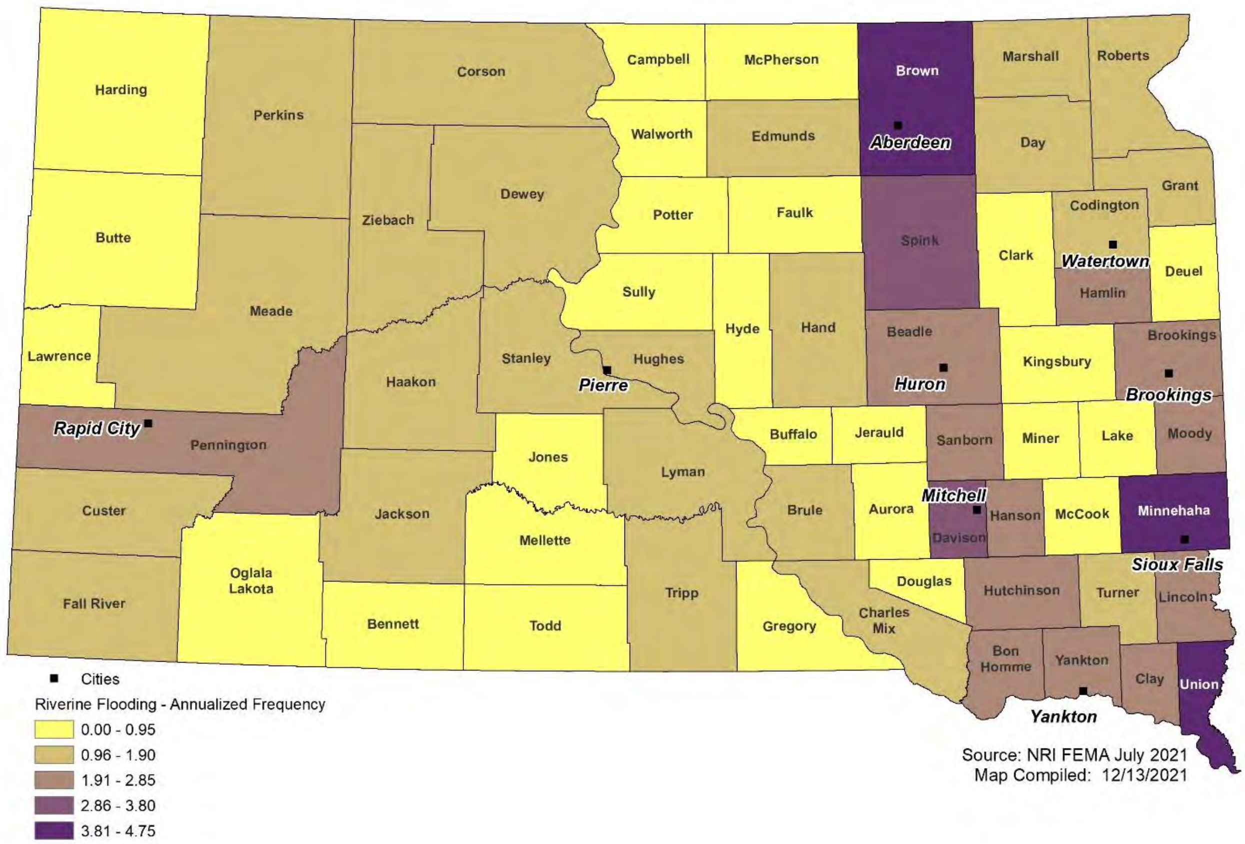
Probability of Future Occurrence

FEMA flood studies provide mapping and detailed flood information for floodplains where the water body has a one percent chance of occurrence in any given year in identified special flood hazard areas. Smaller and more frequent damaging events occur in the State on an annual basis. Floods result in $403.9 million per year in average annualized losses to the State. Based on the frequency of past occurrences in South Dakota, a flood event can be expected somewhere in the State annually.

USGS, South Dakota Department of Transportation, and other state and federal agencies published a study in June 2012 titled “Extreme Floods in the Black Hills Area: New Insights from Recent Research.” One of the most significant findings of the study is that massive floods as large as or larger than the 1972 flood have occurred multiple times over the past millennium in many drainage basins of the eastern Black Hills. According to the study, geologic evidence indicates that 12 floods exceeding 66,000 cfs occurred in the past 2,000 years, with the largest one occurring 440 years ago. The study found that “the steep terrain and narrow canyons along the eastern periphery of the Black Hills are most susceptible to flash flooding. Here the thin, rocky soils absorb little rainfall, and the steep slopes cause rapid runoff into the stream channels. The steep and narrow canyons further amplify ferociously fast and deep floods.” Figure 3-23 depicts the areas of the Black Hills with the highest and lowest potential for flash flooding based on the USGS/South Dakota Department of Transportation (SDDOT) study.

The NRI developed by FEMA includes a comparison of the annualized frequency of several hazards by county. This is depicted in Figure 3-22 below. The annualized frequency provides an estimate of the likelihood for future flood occurrences in South Dakota by taking the average number of recorded riverine flood events per year over the 24-year period of record from the NRI. This gives the estimated number of events per year by county, as shown in the map legend. Based on the NRI analysis, counties in the eastern half of the State and those along the Missouri River generally have a higher probability for flooding compared to the rest of the State.

Figure 3-22 Annualized Frequency of Riverine Flooding by County



Magnitude/Severity (Extent)

Magnitude and severity can be described or evaluated in terms of a combination of the different levels of impact that a community sustains from a hazard event. Specific examples of negative impacts from flooding in the State of South Dakota span a comprehensive range and are summarized as follows:

- Floods cause damage to private property that often creates financial hardship for individuals and families
- Floods cause damage to public infrastructure resulting in increased public expenditures and demand for tax dollars
- Floods cause loss of personal income for agricultural producers that experience flood damages
- Floods cause loss of income to businesses relying on recreational uses of regional waterways
- Floods cause emotional distress on individuals and families
- Floods can cause injury and death

Flood recurrence intervals describe the statistical expectation of inundation frequency. Typical recurrence intervals include the list below, all of which can be experienced in South Dakota:

- 10 years (10% probability of occurring in any given year)
- 25 years (4% probability of occurring in any given year)
- 50 years (2% probability of occurring in any given year)
- 100 years (1% probability of occurring in any given year)
- 500 years (0.2% probability of occurring in any given year)

Floods present a risk to life and property, including buildings, their contents, and their use. Floods can affect crops and livestock. Floods can also affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies. The impact of a flood event can vary based on geographic location to waterways, soil content and ground cover, and construction. The extent of the damage of flooding ranges from very narrow to widespread based on the type of flooding and other circumstances such as previous rainfall, rate of precipitation accumulation, and the time of year.

The magnitude and severity of the flood hazard is usually determined by not only the extent of impact it has on the overall geographic area, but also by identifying the most catastrophic event in the previous flood history. Sometimes it is referred to as the "event of record." The flood of record is almost always correlated to a peak discharge at a gauge, but that event may not have caused the worst historic flood impact in terms of property damage, loss of life, etc. The flood of record in South Dakota is considered to be the series of floods which impacted the entire State throughout the year 2019. During this prolonged flood event the James River in South Dakota remained at flood stage for 17 consecutive months. Overall, this series of related floods resulted in five different federal disaster declarations and approximately $94.6 million in federal assistance, as detailed in Table 3-3.

Related to dam failure, certain dams pose a hazard to people and property downstream. Dams are classified using a three-tier hazard rating system that indicates the magnitude of the potential impact of an incident, as previously described in the Hazard Description subsection. With 86 high hazard rated dams, considerable potential exists for a dam failure event that could result in loss of life and significant property damage.

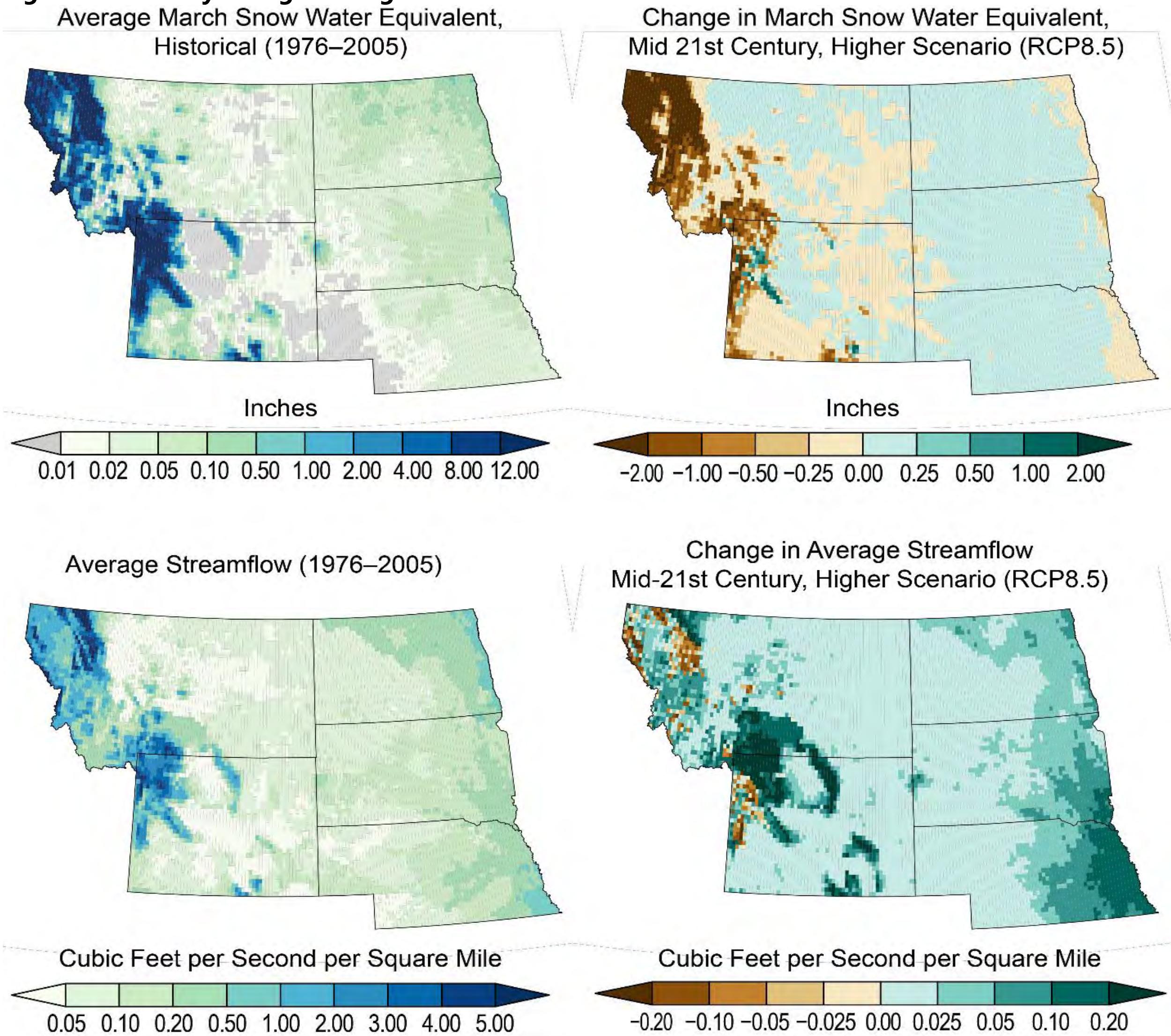
Climate Change Considerations

For better or for worse, climate change will, or already is, affecting flood hazards. In many cases, climate change is responsible for increasing drought. The decrease in precipitation due to drought intuitively reduces flood potential. In addition, the drying of soils during drought increases the capacity of soils to absorb rainfall when it does occur. However, climate change is also likely to, or already has increased the intensity of heavy rainfalls, which strongly increases runoff and enhances the potential for flooding.

To compound uncertainty regarding future flood conditions, a sometimes-overlooked aspect of flooding is that more heavy rainfall does not automatically translate to more flooding. Other factors exist. Construction and maintenance of stormwater infrastructure or dams profoundly affects flood hazards. Use of so-called green infrastructure such as vegetative swales also reduces flooding, as does increasing tree canopy and enhancing riparian areas. What is certain, however, is that future flood hazards will be different from past flood hazards.

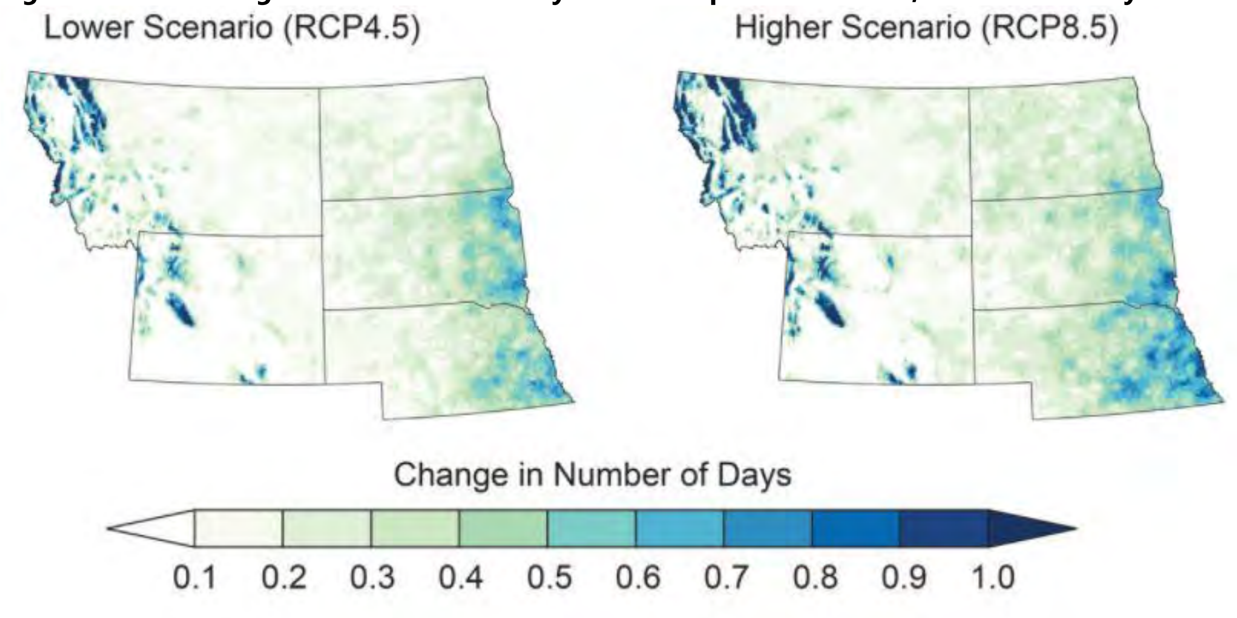
According to the Fourth National Climate Assessment, the Upper Missouri River Basin is very sensitive to climatic fluctuations. Trends over the past 50 years indicate an increase in runoff in the eastern portion of the Northern Great Plains, where South Dakota is located. Figure 3-23 illustrates projected mid-21st century hydrologic changes in the Northern Great Plains compared to the historical average from 1976-2005. The top two maps show average values for March to provide historical and future end-of-season estimates of snow water equivalent, which is the amount of liquid water contained within snowpack and therefore the amount of water that will be released when the snowpack melts. This illustrates projected warming and potential snow loss. Similarly, annual streamflow's are expected to increase across much of the eastern part of the region. Figure 3-24 below illustrates the projected changes in the number of days with precipitation exceeding 1 inch by mid-21st century, indicating that significant portions of South Dakota are projected to see increasing frequency of high precipitation events. These projected changes coupled together could result in increased frequencies of events such as the 2019 floods, where runoff, high precipitation, and waterlogged or frozen soils lead to water flow rates which overwhelm the capacity of stream channels.

Figure 3-23 Hydrologic Changes Across the Northern Great Plains



Source: Fourth National Climate Assessment

Figure 3-24 Change in the Number of Days with Precipitation Over 1", Mid-21st Century

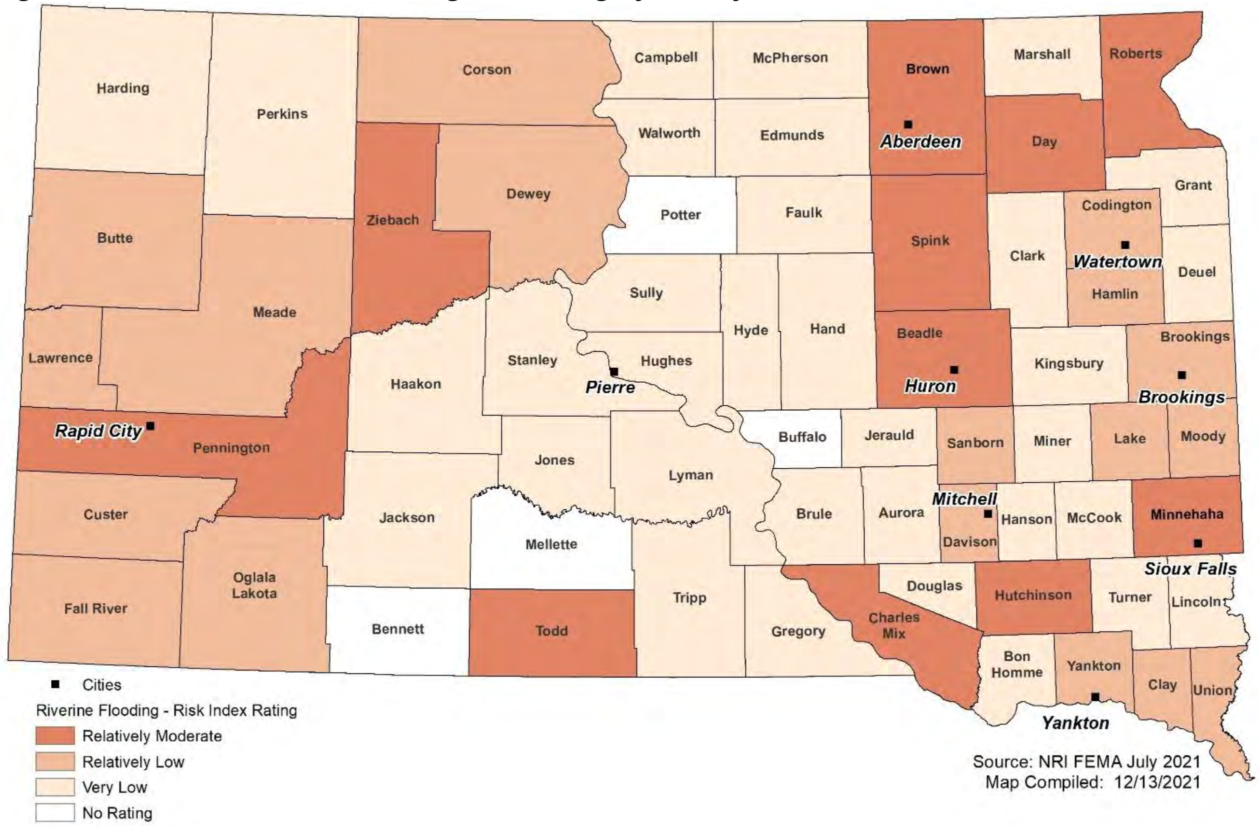


Source: Fourth National Climate Assessment

Vulnerability Assessment

While there are some benefits associated with flooding, such as the replenishment of sediments and nutrients to agricultural lands, it is considered a hazard to development in floodplains. Severe flooding has the potential to inflict significant damage to people and property South Dakota. Mitigating flood damage requires that the State remain diligent and notify local officials of potential flood (and flash flood) prone areas near infrastructure such as roads, bridges, and buildings. In order to analyze the State's vulnerability to flood, the NRI was used as a primary tool during the 2021 HIRA update. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the expected annual loss and social vulnerability in a given community in relation to that community's resilience. This composite risk rating is illustrated in Figure 3-25 below, showing the risk to riverine flooding by county in South Dakota.

Figure 3-25 NRI Riverine Flooding Risk Rating by County in South Dakota



People

Vulnerable populations in South Dakota include those that live within known floodplains or near areas vulnerable to flash floods as well as people traveling through or recreating in areas prone to flash flooding. Certain populations within these areas are particularly vulnerable. This includes the homeless, the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, prisons, low-income housing areas, or temporary shelters, people who do not speak English well, tourists and visitors, and those with developmental, physical, or sensory disabilities. The impacts of flooding on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from a flood, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

Development further complicates the issue of mitigating hazards for vulnerable populations. Projecting how demographic changes will occur throughout the state, and further putting that information into the context of flood hazard mitigation, remains an information gap. Resolving this gap will provide local and state planners a basis for customizing mitigation actions to protect vulnerable populations from flood hazards

This problem of identifying and describing vulnerable populations in high hazard flood areas has additional complexity when considering dam failure hazards.. As a practical matter, inundation zones for dams in South Dakota are often not available. In addition, many factors affect who is potentially exposed. Conceivably, anyone who lives, works, recreates, or travels through an inundation zone is potentially exposed. With regard to impacts, additional factors are relevant. The severity and timing of inundation are important, as are mitigation measures such as the effectiveness of early warning systems. The sudden and often deep and rapidly flowing water associated with dam failures can prove deadly if awareness and warning time is limited. Levee failure can pose a similar risk if warning time is limited. Social vulnerability is a valuable indicator of vulnerability. While social vulnerability has been mapped by census tract throughout the United States, the lack of dam failure inundation maps makes assessing dam failure on vulnerable populations somewhat speculative.

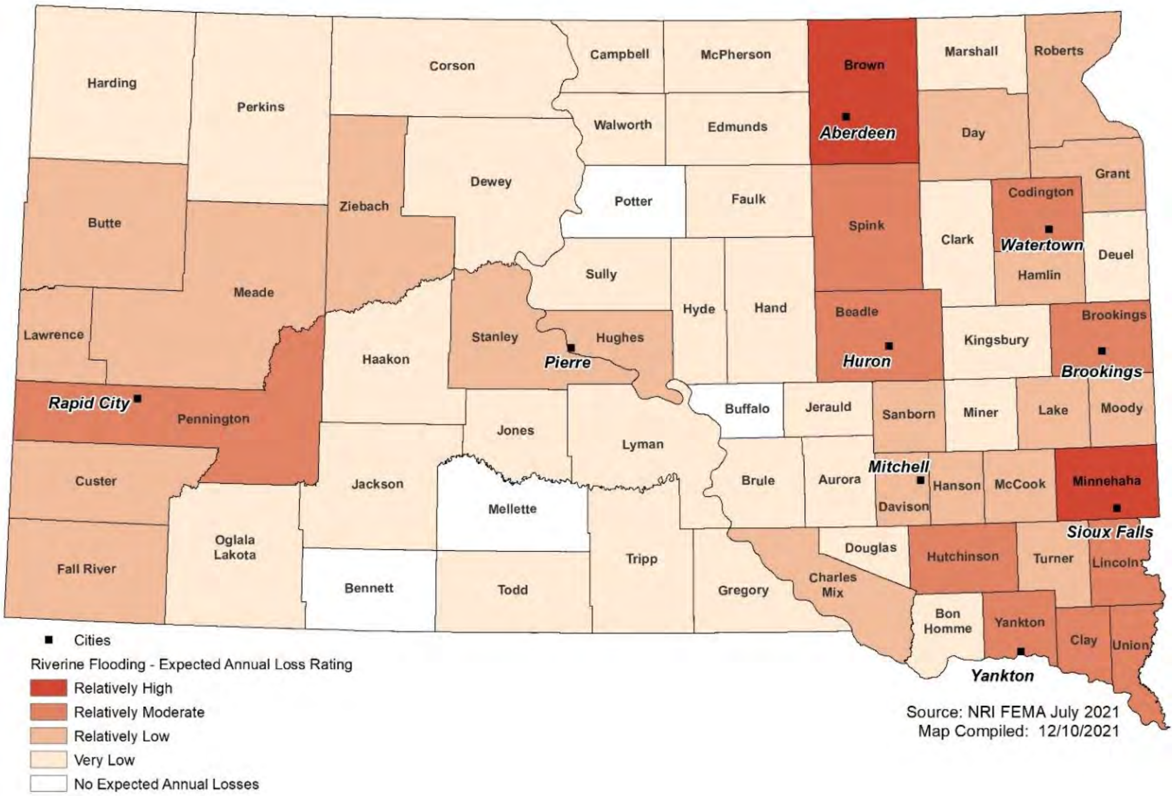
Typically, addressing the information gaps described in this section is considered fine-scale hazard analysis and is therefore left to local hazard mitigation plans. The role of the SHMP is to provide a summary of those plans and the gaps they contain. Nevertheless, future research that provides statewide analyses to help resolve these data gaps would be a welcome development that would help jurisdictions across the state develop better hazard mitigation plans.

Property

Buildings in the floodplain throughout South Dakota are susceptible to damages by rising waters; damages could also require costly and time-consuming cleanup during the recovery process. Flood recovery can take years for affected communities to be rebuilt, depending on the severity of the flood.

The NRI also utilizes EAL as an indicator of risk. EAL represents the average economic loss in dollars resulting from natural hazards each year. It is calculated for each hazard type and quantifies loss for relevant consequence types: buildings, people, and agriculture. EAL is calculated using a multiplicative equation that includes exposure, annualized frequency, and historic loss ratio risk factors for 18 natural hazards, including riverine flooding. Figure 3-26 below illustrates the EAL for each county in South Dakota. As the map shows, the highest expected annualized losses are for Brown and Minnehaha Counties. Both Brown and Minnehaha Counties are among the fastest growing in South Dakota, ranking #7 and #1 by numerical population increase 2010-2020, respectively, and the most populous counties, ranking #4 and #1, respectively. Counties located in the Big Sioux and James River basins have generally higher EAL ratings.

Figure 3-26 Riverine Flooding Expected Annual Loss Rating in South Dakota



Relative to riverine and even flash flooding, most dam failures cause higher flow velocities, volume, depth, and a more extensive inundation area. These features of the dam failure hazard creates a greater potential for destruction. Inundation zones for dam failure are not available in digital format for South Dakota. This makes it difficult or impossible to reliably estimate what property is potentially exposed to dam failure hazards. Emergency managers are left to infer the hazard, vulnerability, and risk, or refer to hardcopy maps in Emergency Action Plans. Some local HMPs may have qualitative or quantitative data useful for planning at the state level.

Specific to levee failure there is over 6,000 buildings behind USACE levees, based on a summary of information presented in Table 3-18. This represents $3.5 billion in property exposure. The majority of these levees exist in Minnehaha County in the southeastern portion of the state. Minnehaha County is also the most populated county in South Dakota and the fastest growing, in terms of numerical population increase, 2010-2020 (Table 3-10).

National Flood Insurance Program (NFIP) Claims Analysis

The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. The State has analyzed NFIP flood-loss data to determine areas of South Dakota with the greatest flood risk. South Dakota flood-loss information was obtained from FEMA's "NFIP Policy and Claims Report" for South Dakota, which documents losses from 1978. This section was updated based on information obtained from FEMA through OEM current as of late 2021.

There are several limitations to analyzing flood risk entirely on this data, including:

- Only losses to participating NFIP communities are represented,

- Communities joined the NFIP at various times since 1978,
- The number of flood insurance policies in effect may not include all structures at risk to flooding,
- Some of the historical loss areas have been mitigated with property buyouts.

Despite these limitations, the data depict a pattern of historical flood losses in the State. The greatest losses have changed to be in Lake, Lincoln, and Codington Counties. Lincoln County is notable as the fastest growing county in South Dakota by percent growth (Table 3-11). Table 3-23 shows the details of the ten South Dakota counties with the greatest historical dollar losses. Union County was not within the top ten list in the 2010 plan update but is now number four behind Lake, Lincoln and Codington counties. Lake has replaced Codington as the leader in terms of overall dollars paid. Codington's polices, however, decreased from 524 in 2016 to 367 in 2021. Since 2016, Lake County has increased dollars paid over $6.5 million, and increased its number of current policies from 169 to 235 as of 2021. Other notable changes include Minnehaha Country rising from number ten to nine in dollars paid out. Spink County was also supplanted by Yankton County in the top ten for dollars paid out. South Dakota's State NFIP coordinator explained the policy count decrease as partly related to the historic Missouri River flood of 2011, which caused a spike in policies. Union County has continued the trend of lower flood policies from 403 to 317 since 2016. A notable decrease occurred in 2018 in the City of Sioux Falls, which had their levee system certified by the Corps of Engineers resulting in 1,600 structures no longer being required to have flood insurance. NFIP policy summary statistics from FEMA for Region VIII continues to show a decline in NFIP policies within the designated states including South Dakota.

Table 3-23 Top Ten Counties for Flood Insurance Dollars Paid, 1978 - 2021

County	Dollars Paid ($ Historical)	Flood Claims	Current Policies	Coverage ($)
Lake	$7,970,816	303	235	$43,015,200
Lincoln	$6,676,182	227	359	$117,493,900
Codington	$6,411,610	463	367	$75,010,500
Union	$5,282,237	430	317	$105,319,900
Hamlin	$5,159,410	431	72	$17,705,400
Day	$4,152,879	261	14	$2,062,800
Brown	$3,283,855	486	187	$41,978,700
Stanley	$2,555,208	118	133	$38,186,600
Minnehaha	$2,319,203	192	118	$25,036,700
Yankton	$1,603,545	64	87	$19,435,800

Source: FEMA, NFIP Insurance Report, 2021

Information about flood insurance losses and policies for all South Dakota counties is in Appendix E. Based on this data the average annual insured losses are about $1 million.

Repetitive Loss Analysis

A high priority in South Dakota and nationwide is the reduction of losses to repetitive loss structures. These structures strain the National Flood Insurance Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, with at least two of the claims being more than 10-days apart.

Table 3-24 lists the number of South Dakota's 336 repetitive loss properties by county, to include historical numbers from 2016, 2018 and 2021. Overall, the number of repetitive loss properties in the State have increased considerably. Hamlin and Codington Counties have the most repetitive loss properties, followed by Minnehaha, Lake and Brown Counties. Minnehaha and Brown Counties are among the ten fastest growing counties by numerical population increase, 2010-2020 (Table 3-10). Five new counties were added to this list since 2021: Hand, Kingsbury, Lyman, McPherson and Stanley counties. This shows that repetitive losses to flood damages are increasing throughout South Dakota. This also shows that focusing mitigation activities on repetitive losses could help alleviate a significant number of losses and repeated hardship. Also shown below are 27 severe repetitive loss structures, of which nine are in Codington County. These properties should be applicable to utilize NFIP programs such as the Increased Cost of Compliance (ICC) and or Flood-proofing, Relocation, Elevation or Demolition (FRED) mitigation activities. This could aid reducing NFIP payouts in places like Codington County which is in the top three in flood insurance payouts historically.

Table 3-24 Repetitive Loss Properties by County

County*	Rep Loss 2016	Rep Loss 2018	Rep Loss 2021	Difference 2018-2021	Severe Repetitive Loss 2021
Beadle	1	2	2	0	1
Brookings	4	4	9	+5	0
Brown	13	14	24	+10	0
Butte	1	1	2	+1	0
Charles Mix	1	1	2	+1	0
Clark	2	2	2	0	1
Clay	1	1	1	0	0
Codington	32	38	53	+15	9
Davison	1	1	3	+2	0
Day	19	20	23	+3	3
Grant	4	4	7	+3	1
Hamlin	38	39	56	+17	1
Hand	0	0	1	+1	0
Hanson	1	1	2	+1	0
Hughes	4	4	4	0	1
Kingsbury	0	0	2	+2	0
Lake	2	3	30	+27	2
Lincoln	6	6	1	-5	0
Lyman	0	0	2	+2	0
Marshall	2	2	2	0	0
McCook	1	1	5	+4	0
McPherson	0	0	1	+1	0
Meade	2	2	2	0	0
Minnehaha	17	19	53	+34	4
Moody	7	7	9	+2	3
Pennington	1	3	6	+3	1
Roberts	5	5	4	-1	0
Spink	8	8	8	0	0
Stanley	0	0	1	+1	0
Turner	1	1	3	+2	0
Union	1	2	11	+9	0
Yankton	2	2	5	+3	0
Total	177	193	336	+143	27

Source: South Dakota Emergency Management, FEMA's "NFIP Insurance Report," 2016
* County includes policy and loss information for both incorporated and unincorporated areas
** Includes insured and uninsured properties

Table 3-25 shows repetitive loss claims by county. Lincoln, Codington, and Day Counties are the top three by repetitive loss dollars paid. Lincoln County also happens to be the fastest growing county in South

Dakota, by percent growth 2010-2020 (Table 3-11) and second fastest growing by numerical population increase (Table 3-10). Repetitive loss claims have increased through the State since 2018, mainly due to the significant 2019 flooding.

Table 3-25 Repetitive Loss Claims by County

County*	2018	2021	Difference 2018-2021	2018	2021	Difference 2018-2021
Beadle	6	6	0	$116,289	$368,084	+$251,795
Brookings	9	15	+6	$103,500	$966,934	+$863,434
Brown	29	52	+23	$206,324	$3,283,855	+$3,077,531
Butte	2	2	0	$6,593	$11,833	+$5,240
Charles Mix	3	2	-1	$227,915	$504,260	+$276,345
Clark	5	5	0	$117,455	$189,919	+$72,464
Clay	2	2	0	$4,880	$50,954	+$46,074
Codington	97	162	+67	$1,971,014	$6,411,610	+$4,440,596
Davison	2	4	+2	$17,207	$840,402	+$823,195
Day	43	53	+10	$1,186,524	$4,152,879	+$2,966,355
Grant	10	17	+7	$107,408	$242,103	+$134,695
Hamlin	88	155	+67	$1,498,552	$5,159,410	+$3,660,858
Hand	0	4	+4	$0	$77,210	+$77,210
Hanson	2	7	+5	$5,770	$166,928	+$161,158
Hughes	8	9	+1	$75,263	$693,582	+$618,319
Kingsbury	2	2	0	$382,290	$382,290	+$0
Lake	6	62	+56	$81,511	$7,970,816	+$7,889,305
Lawrence	0	1	+1	$279,219	$279,219	+$0
Lincoln	13	46	+33	$2,690,957	$6,676,182	+$3,985,225
Lyman	0	4	+4	$383,909	$383,909	+$0
Marshall	6	6	0	$23,766	$144,193	+$120,427
McCook	2	11	+9	$4,431	$447,310	+$442,879
Meade	5	5	0	$28,627	$52,781	+$24,154
Minnehaha	46	103	+57	$422,858	$2,319,203	+$1,896,345
Moody	19	30	+11	$180,728	$840,422	+$659,694
Pennington	6	14	+8	$48,068	$490,194	+$442,126
Roberts	10	12	+2	$142,522	$645,757	+$503,235
Spink	19	25	+6	$446,931	$1,016,507	+$569,576
Stanley	3	3	0	$2,555,208	$2,555,208	+$0
Turner	2	6	+4	$28,259	$341,115	+$312,856
Union	4	24	+20	$126,216	$5,282,237	+$5,156,021
Yankton	4	11	+7	$15,052	$1,603,545	+$1,588,493
Total	**448**	**860**	**409**	**$9,884,620**	**$54,550,851**	**$41,065,605**

Source: South Dakota Emergency Management, FEMA's "NFIP Insurance Report," 2018
* County includes policy and loss information for both incorporated and unincorporated areas

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss, severe repetitive loss, and defined it 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 amount 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." In South Dakota, as of January 2022, there are 27 properties that potentially meet this definition according to FEMA data provided by SD OEM.

As noted in the table below, in the State of South Dakota more properties outside the Special Flood Hazard Area have sustained repetitive loss damages than the properties located in the SFHA. In the data noted there were 283 repetitive loss properties located in Zone X, B or C zones, meaning low risk zones. This is twelve more properties than the 271 buildings located in the designated SFHA or areas known to have at least a 1% chance of an annual flood event. This is not an unusual trend. Based on nationwide statistics, according to the NFIP Between 2015 and 2019 more than 40% of the National Flood Insurance claims came from properties outside the high-risk food areas.

The data underscores the importance of flood insurance, even if a property is located in an area that is considered “low risk”. Other reasons for this trend could be a lack of extensive or adequate flood hazard maps, or areas that historically have not flooded are beginning to due to climate change and/or land development, or high groundwater ponding in areas outside of floodplains.

Table 3-26 State Repetitive Loss Summary

Repetitive Loss Type	AE, A1-30, AO, AH, A	B, C, X	Total
RL Buildings	271	283	556
RL Buildings (Insured)	39	33	72
RL Losses (Total)	424	437	863
RL Losses (Insured)	76	52	128
RL Payments (Total)	$7,234,533.51	$10,352,485.32	$17,605,647.21
Building	$6,645,455.57	$8,497,380.74	$15,161,464.69
Contents	$589,077.94	$1,855,104.58	$2,444,182.52
RL Payments (Insured)	$1,999,258.60	$1,539,807.10	$3,539,065.70
Building	$1,879,684.05	$1,389,402.35	$3,269,086.40
Contents	$199,574.55	$150,404.75	$269,979.30

Source: FEMA NFIP Policy and Claims Report for South Dakota, January 2022

As summarized in Table 3-27 below. There are five Post-FIRM Repetitive Loss buildings in South Dakota at the time of this assessment. There also are a total of four properties with flood insurance with four or more repetitive losses. Throughout the State there are also 38 properties with 2-3 loss greater than the total value of the property itself. There is also a total of 42 targeted repetitive loss buildings within the State. These properties should be applicable to utilize NFIP programs such as the ICC and or FRED mitigation activities.

Table 3-27 Target Repetitive Loss Properties Summary

Repetitive Loss Buildings	Total Number of Buildings
Post – FIRM RL Buildings	5
Insured Bldgs. With four or more Losses	4
Insured Buildings with 2-3 Losses > Building Value:	38
Total Target RL Buildings	42

State Assets, Critical Facilities, and Infrastructure

Key support facilities and structures most necessary to withstand the impacts of, and respond to, natural disasters are referred to as critical facilities. Examples of these critical facility types include utilities, transportation infrastructure, and emergency response and services facilities, given failures of components along major lifelines or even closures or inaccessibility to key emergency facilities could limit if not completely cut off transmission of commodities, essential services, and other potentially catastrophic repercussions.

Vulnerable critical assets include at risk population facilities, essential services, hazmat facilities and vital services. Major flooding could have devastating consequences on any of these facilities, including life safety issues, structural damage, access issues, and temporary or permanent disruption of the delivery of services, which in turn can impede the ability of the State or local municipalities to respond to and recover from a major flood event.

A GIS overlay analysis was performed to determine vulnerability of state facilities to flooding. The latest available NFHL (1% and 0.2% annual chance flood zones) and Hazus-MH modeled base flood extents (in areas where NFHL was not available) were used. Areas protected by levee were extracted from NFHL data and also analyzed to provide an overview of state-owned building exposure by county in each flood hazard zone. The Department of Transportation has the highest number of buildings potentially at risk; additional details can be referenced in Appendix D. Flood consequences to DOT buildings may compromise the transportation lifeline in certain areas of the state; site specific studies would need to be conducted to assess actual risk and need for mitigation.

A deficiency exists in state asset databases. The State does not currently have consistent data on the location, type, and replacement values of most state assets. Table 3-5 "Summary of Insured State-Owned Buildings by State Agency" which includes estimated values was created from one database, which does not contain geocoding information. A different database was used to identify assets in hazard areas, such as for Table 3-28 "State Buildings at Risk to Flood Hazards" but that database does not include property values. Deconflicting and merging these databases and verifying them with the owning agency is a lengthy process that was not able to be done for this plan update. This has been identified as a need, see mitigation action 2-2.

The vulnerability of state buildings to flood is likely an indicator of vulnerability to dam failure. It is probable that many structures vulnerable to riverine flooding are also vulnerable to dam failure flooding, but a lack of digital inundation mapping statewide makes it difficult to pinpoint vulnerability further.

Table 3-28 State Buildings at Risk to Flood Hazards

County	1% Annual Chance Count	0.2% Annual Chance NFHL Count	Area Protected by Levee	1% Annual Chance
Brown County	4	-	-	-
Codington County	1	1	-	-
Fall River County	7	-	-	-
Hughes County	-	1	-	-
Lawrence County	6	3	-	-
McCook County	1	-	-	-
Meade County	-	1	-	-
Minnehaha County	4	1	10	-
Moody County	-	1	-	-
Pennington County	3	-	-	-
Turner County	-	-	-	2
Walworth County	-	-	-	7
Yankton County	1	-	-	-
Total	**27**	**8**	**10**	**9**

Source: State of South Dakota, FEMA NFHL

Table 3-29 State Buildings at Risk to Flood Hazards by State Agency

Agency	1% Annual Chance Count	0.2% Annual Chance NFHL Count	Area Protected by Levee	1% Annual Chance
Department of Transportation	13	0	0	9
Dept Of Human Services	1	0	2	0
Dept of Revenue	3	1	1	0
Dept of Health	1	1	3	0
Dept of Game, Fish & Parks	3	0	1	0
Unified Judicial System	1	1	0	0
Dept of Social Services	1	1	0	0
Dept of Labor & Regulations	2	0	0	0
Bureau of Administration	1	0	0	0
Dept of Public Safety	1	0	1	0
Office of the Attorney General	0	1	0	0
Bureau of Information and Telecommunications	0	1	1	0
Dept of Military	0	2	1	0
Total	**27**	**8**	**10**	**9**

Source: State of South Dakota, FEMA NFHL

A similar GIS overlay analysis was performed to identify trends in vulnerabilities to critical facilities/lifelines. The results are captured in the table below. Trends indicate a high number of wastewater facilities, schools, hazardous materials facilities, and fire stations. Consequences to these lifeline facilities could be serious as previously noted, including transportation disruptions due to bridge impacts, potential loss of critical services such as fire and EMS, vulnerable population impacts (school aged children), power loss, and hazardous material spills.

Table 3-30 Critical Facilities/Lifelines at Risk to Flood Hazards

Critical Facility	1% Chance Hazus	1% Chance NFHL	0.2% Chance NFHL	Levee NFHL	Total
Aviation	-	2	2	1	**5**
Bridge	77	2,362	75	22	**2,536**
Bridge Scour	3	118	8	-	**129**
College/University	-	-	-	1	**1**
Courthouse	-	-	1	-	**1**
EMS Station	-	6	6	6	**18**
Fire Station	-	11	7	3	**21**
Hospital	-	-	2	-	**2**
Local EOC	-	-	1	1	**2**
Local Law Enforcement	-	1	3	-	**4**
Power Plant	-	2	-	-	**2**
Prison	-	-	2	3	**5**
Private School	-	1	2	8	**11**
Public School	-	13	11	3	**27**
RMP Facility	-	-	1	4	**5**
State EOC	-	-	-	-	**-**
TRI Facility	-	9	10	24	**43**
Wastewater Facility	3	46	9	-	**58**
Water Facility	-	1	1	-	**2**

Critical Facility	1% Chance Hazus	1% Chance NFHL	0.2% Chance NFHL	Levee NFHL	Total
Weather Radar Station	-	-	-	1	**1**
Total	**83**	**2,572**	**141**	**77**	**2,873**

Source: State of South Dakota OEM, HIFLD, NBI, South Dakota OpenData, FEMA NFHL, WSP GIS analysis

The National Bridge Inventory (NBI), which was developed by the Federal Highway Administration, includes a "scour index" that is used to quantify the vulnerability of bridges to scour during a flood. Bridges with a scour index between one and three are considered "scour critical," or a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition. Based on the NBI information submitted to the Federal Highway Administration as of January 26, 2022, there are 126 state-owned bridges identified as scour critical and nine local government bridges. Additionally, there are 1,697 state-owned bridges in the inventory with unknown foundations. These bridges are shown in Figure 3-27 below, with their conditions of good, fair, or poor shown in Figure 3-28 below.

Figure 3-27 State Owned Bridges

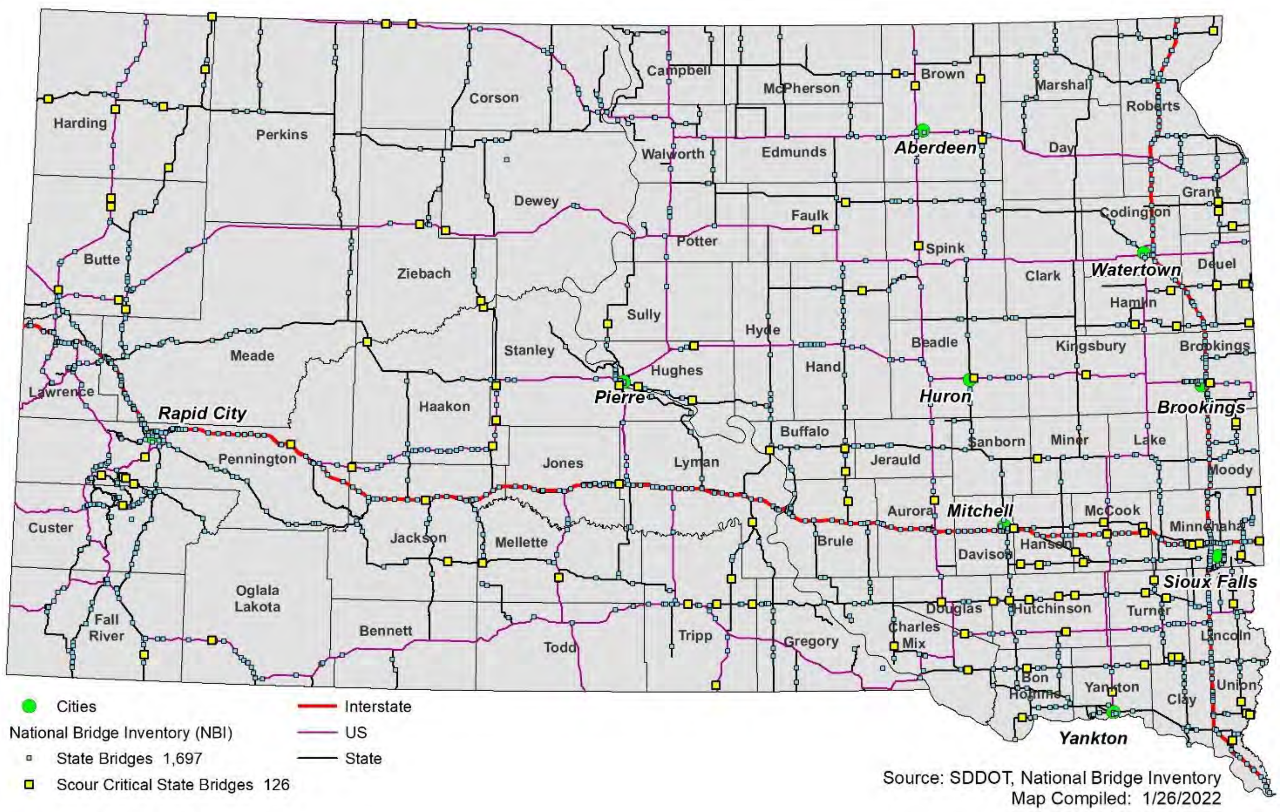
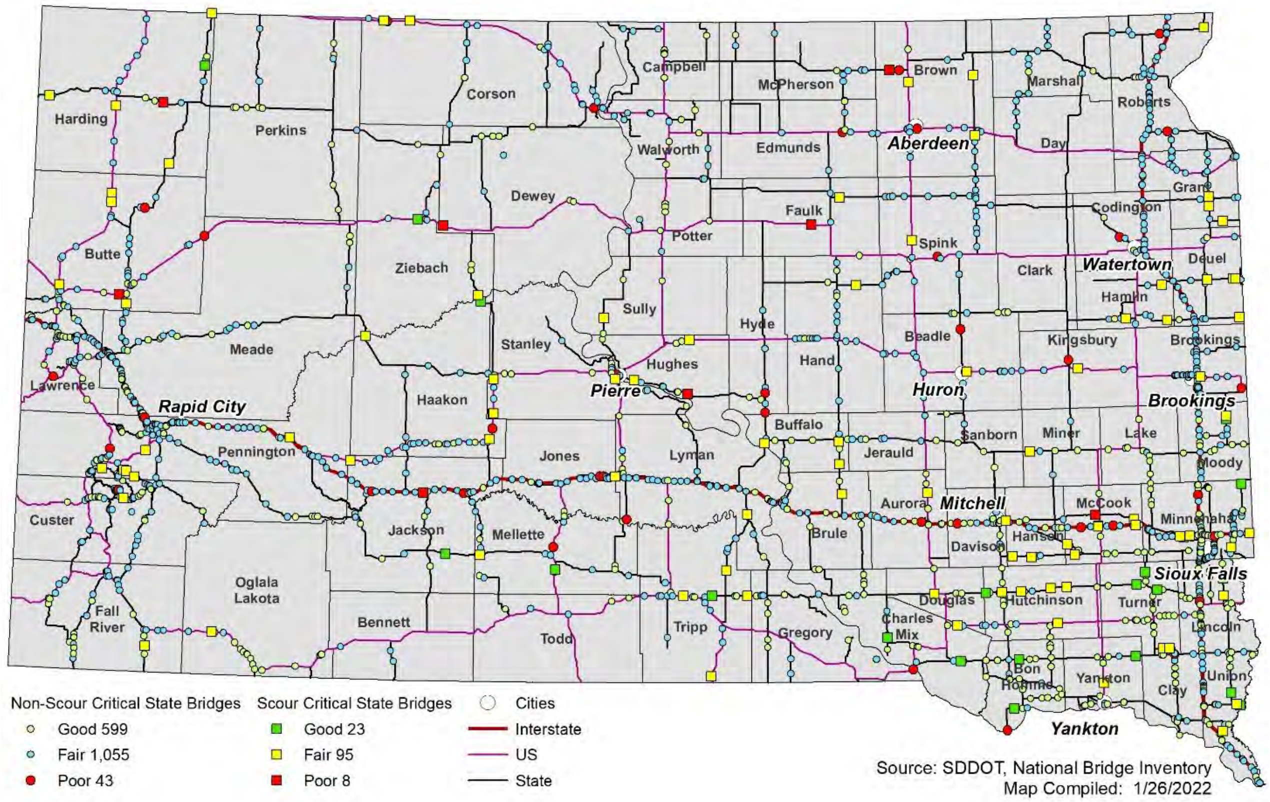


Figure 3-28 Condition of State-Owned Bridges



Railroads are vital to the rural farming economy in South Dakota, and past floods have impacted railroad bridges, delaying rail shipments of agricultural supplies for days or weeks. The NBI bridge database does not contain railroad bridges so further analysis of vulnerability could not be determined. Also noted during the planning process were the number of repeated culvert washouts and replacements on gravel roads from multiple flood disasters; some of the losses associated with this damage is reflected in the FEMA Public Assistance program expenditures noted in the disaster declaration summaries in the introduction section of the HIRA.

Dams are another example of critical infrastructure that could be at risk from floods. Based on a GIS overlay of dams and flood inundation zones there are 15 high hazard potential dams at risk from 1% annual chance flood hazards (identified in Appendix D). Pennington County and Custer County are notable for having four and five of these dams, respectively. Pennington County is also the third fastest growing county in South Dakota, in terms of numerical population growth (Table 3-10) and sixth fastest by percent population growth 2010-2020 (Table 3-11). While dams are typically designed with spillways to bypass excess inflows and prevent overtopping sometimes extreme flood events can put additional stress on dams. This makes them more prone to having high release flows which can exacerbate flooding downstream, but this is done in order to relieve stress on the dam or limit uncontrolled flow associated with spillways.

Fortifying state assets that are particularly vulnerable to flood hazards has historically been done on a case-by-case basis or is implicitly included in facility management. There has been no state-wide analysis of which state assets are most vulnerable to flood hazards, among all state assets that are located in high flood hazard zones. The present arrangement of identifying which assets are *exposed* limits the degree to which these hazards can be prioritized for mitigation and is considered a knowledge gap.

In addition, no state-level evaluation exists of the vulnerability of specific state assets to flood hazards in a future affected by climate change. Nor has a state-wide assessment been done to describe how demographic projections will affect the consequence of essential infrastructure failures in the future. Filling these research gaps would help local jurisdictions understand what they should plan for and help state-level analysis of shifting needs for hazard mitigation.

Estimating the potential dollar loss to state assets from flood hazards is another knowledge gap in this SHMP update. This is due to the aforementioned limitation of state asset GIS databases that lack identification of their value. This deficiency is addressed in Mitigation Action 2-2.

Economy

Flooding can have major negative impacts on the local and regional economy, including indirect losses such as business interruption, lost wages, reduced tourism and visitation, and other downtime costs. Flood events can cut off customer access to a business as well as close a business for repairs or permanently. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures. Additionally, flooding can impact the economy through the direct damages and losses to property and costs to recover, as summarized in the property section above.

Environment and Cultural Resources

Natural resources are generally resistant to flooding and floodplains provide many natural and beneficial functions. Nonetheless, with human development factored in or in areas after periods of previous disasters such as drought and fire, flooding can impact the environment in negative ways. Wetlands, for example, exist because of natural flooding incidents. Areas that are no longer wetlands may suffer from oversaturation of water, as will areas that are particularly impacted by drought. Areas recently suffering from wildfire damage may erode because of flooding, which can permanently alter an ecological system. Migrating fish can wash into roads or over dikes into flooded fields, with no possibility of escape. Pollution from roads, such as oil, and hazardous materials can wash into rivers and streams. During floods, these can settle onto normally dry soils, polluting them for agricultural uses. Human development such as bridge abutments can increase stream bank erosion, causing rivers and streams to migrate into non-natural courses.

Tourism and outdoor recreation are an important part of the State's economy. If part of the planning area were damaged or rendered inaccessible by flooding for an extended period of time, tourism and outdoor recreation could potentially suffer.

A dam failure has potential for much greater and more permanent consequences to cultural resources and to the environment than riverine flooding. A dam failure that empties a reservoir will immediately curtail outdoor recreation opportunity, the reservoir will be gone, and likely impact tourism. Lake habitat will be lost. Downstream riverine habitat will be disrupted, likely impaired, and possibly altered permanently. The absence of the dam may create new potential for species migration.

Interestingly, dam structures themselves are often historic properties, which must be considered within the Section 106 process. In many cases, historic properties are damaged or destroyed by flooding. Unlike certain natural resources, cultural resources are non-renewable.

Development Trends and Consequence Summary

The counties experiencing the most development pressures in the State all participate in the NFIP and many communities have also taken steps to also participate in the CRS. Despite the pressures from population growth and increased development being felt in some counties, the overall flood risk should not be increasing assuming county floodplain regulations and standards are being effectively implemented and local mitigation measures are taking place. However, as the flood insurance loss analysis demonstrates, significant flood losses are occurring outside of mapped flood hazard areas. More extensive and improved flood hazard mapping should improve flood risk determinations to existing and future development over time, though the areas experience the most growth are mapped. The risk of flooding may be increasing over time, given long-term climate trends including the potential for more extreme precipitation events that could exceed mapped flood hazard areas.

Development trends may also affect dam failure consequences. Typically, this occurs when areas beneath a dam are developed, making the dam a high hazard-rated dam, a phenomenon sometimes referred to as hazard creep. No studies have explicitly evaluated this issue in South Dakota and no program exists to review dam hazard classification in relation to downstream development. Therefore, the stable number of high hazard dams in South Dakota should not be taken as an indication that the consequence of dam failure is also stable. In fact, the official status of dams may provide a false sense of stability in terms of development-driven hazard creep.

Improving the state of knowledge regarding development in South Dakota as it relates to flood hazards would help improve future SHMP updates. In particular, research that incorporates climate change into projections of flood hazards and explicitly identifies and describes vulnerable populations would be useful.

Table 3-31 Flood, Including Dam and Levee Failure, Consequence Table

Category	Narrative
Impact on the Public	Impacts on people will change with characteristics of event (e.g., flash flood in a canyon, river flood on the plains, etc.); residents/ property owners without flood insurance may be impacted greater than those with coverage; residents may be displaced due to evacuation, damage, or inaccessibility to homes; persons within flood areas have the potential for direct contact with hazardous materials; potential for drowning or personal injury; increased potential for exposure to disease. **Dam/Levee Failure:** Similar consequences as flood, but higher potential for loss of life and displacements due to evacuation if a High Hazard dam is involved or a levee that protects residential and commercial properties. Damage to homes and businesses and their contents. Subsequent road closures, traffic congestion, and possible loss of services such as water supply and wastewater. Loss of recreation opportunity.
Impact on the Economic Condition of the State	Local economy and finances may be adversely affected, possibly for an extended period of time depending on damage and length of investigation; potential for businesses to permanently close; localized disruption of roads, facilities, and utilities caused by incident may postpone delivery of services. **Dam/Levee Failure:** Similar to flood. Potentially high damage repair costs, including replacing or rebuilding the dam structure and removal of debris. Indirect costs include loss of electrical generation, tourism, and employment.
Impact on the Environment	Localized impact expected to be severe for incident areas and moderate to light for other areas affected by flood; wetland impacts due to flooding can result in water quality impacts and wildlife habitat impacts; potential for hazardous materials impacts if a release occurs. **Dam/Levee Failure:** Similar to flood. Potentially severe sediment removal/scouring and sediment deposition. Loss of reservoir habitat, disruption and damage to riverine habitat, new potential for species migration.

Category	Narrative
Impact on Property, Facilities, and Infrastructure	Vulnerabilities to critical infrastructure, facilities and property in floodplain areas; High potential for flooded basements; foundation damage; transportation corridor (road, bridge, rail line) washouts; culvert damage. **Dam/Levee Failure:** Similar to flood. Higher flow velocity and energy of floodwaters increases potential for damage to structures and vegetation, sediment transport and deposition. Loss of hydropower generation at dam.
Impact on the Public Confidence in Government	Ability to respond and recover may be questioned and challenged if planning, response, and recovery are not timely and effective. **Dam/Levee Failure:** Similar to flood. Additional scrutiny of dam and levee safety programs, planning, and preparedness; possible, panic and chaos during and following event.
Impact on Responders	Need for evacuation support such as door-to-door notification and traffic management may increase responder risk; widespread flooding could stretch first responder personnel thin some areas; potential impacts to transportation corridors and communications lines may affect ability to effectively respond; possibility of responder injury or death; higher risk to responders in flash flood. **Dam/Levee Failure:** Similar to flood. Potentially very sudden onset, unprecedented inundation, energy, and destruction.
Impact on Continuity of Operations and Continued Delivery of Services	Damage to facilities/personnel in incident area may require temporary or permanent relocation of some operations. **Dam/Levee Failure:** Similar to flood, potentially more severe.
Cascading Hazards	Hazardous Materials Incidents. **Dam/Levee Failure:** Similar to flood. Sequential dam and levee failures.

3.3.3. Summer Storm

Hazard Description

Summer storms are not limited to one area of the State, and historically occur from early spring to early fall. Summer storms can include high winds, heavy rains and flooding, lightning, and hail; they can also spur the development of funnel clouds and tornadoes. They can vary in intensity from mild to severe, and can cause injury or death, destroy property, and kill livestock. Winds, flooding, and tornadoes are discussed further in other sections. This section covers two types of hazards caused by summer storms: hail and lightning.

Hail

Damaging hail events occur sporadically throughout South Dakota, usually associated with severe summer storms and wind events. Hail is formed when water droplets freeze and thaw as they are circulated high into the upper atmosphere by the violent internal forces of thunderstorms. Recent studies suggest that super-cooled water may accumulate on frozen particles near the backside of a storm as they are pushed forward across and above the updraft by the prevailing winds near the top of the storm. Eventually, the hailstones encounter downdraft air or become too heavy to remain suspended and fall to the ground.

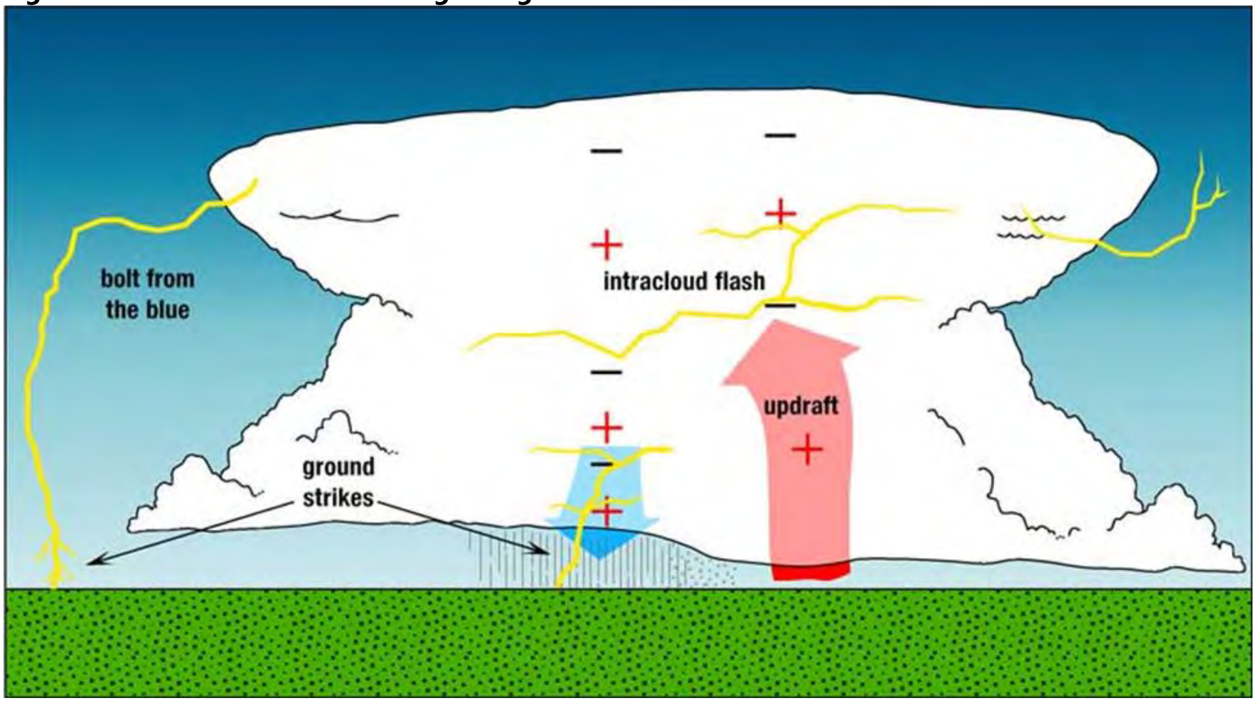
Nationally hail causes more than $1 billion of property damage each year. Hail is often associated with severe storms within South Dakota. Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). The largest hailstone ever recorded fell in Vivian, South Dakota on July 23, 2010, and measured approximately 8 inches in diameter. Hail diameter is usually referenced in comparison to everyday objects; a hail size comparison chart is presented below under the Magnitude/Severity (Extent) section.

Lightning

Lightning is defined as any and all of the various forms of visible electrical discharge caused by thunderstorms. Cloud to ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction of the object or structure. Damage may also be indirect, when the current passes through or near an object, which generally results in less damage. Refer to 3.3.5 Wildfire for more information related to the risk associated with lighting in igniting wildland fires in the Blacks Hills and prairie ecosystems.

Cloud to ground lightning is the most damaging and dangerous type of lightning. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. Additionally, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

Figure 3-29 Cloud to Ground Lightning



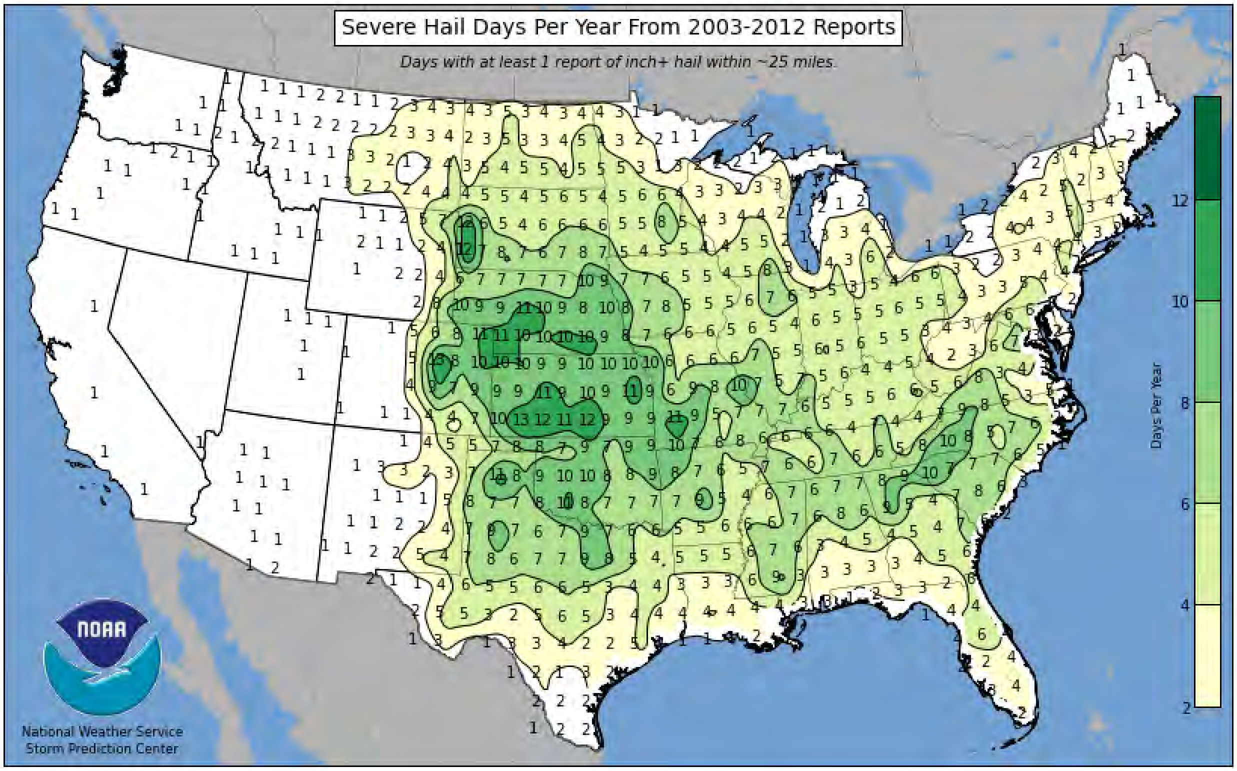
Source: NWS

Location

Summer storms can occur anywhere across the State, though the higher elevations of the Black Hills have more potential for large hail and also for lightning to some degree. Figure 3-30 below shows the average number of days with severe hail per year across the U.S. Figure 3-31 illustrates the average annual lightning strike density nationwide from 2015-2019. This shows that the frequency of these events varies across the State. Hail occurs much more often in the Black Hills and southwest areas of South Dakota. Lightning also follows a gradient, higher in the southwest, lower in the northeast. The multiple shades of purple in the map in Figure 3-31 are somewhat misleading, lightning is three to eight times more frequent in the southwest part of the state than the northeast part of the state. More location information is in the following sections on Past Events and Vulnerability Assessment.

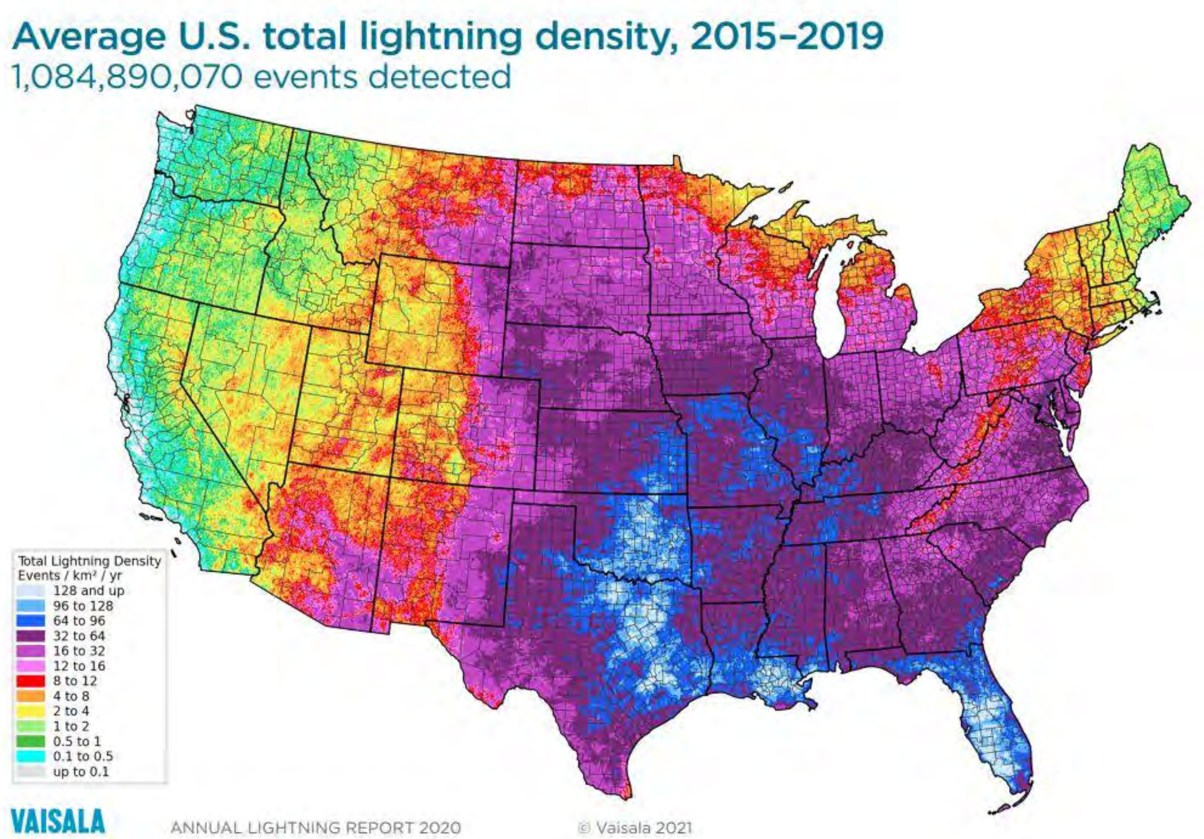
The future location of summer storm hazards will be impacted climate change and the vulnerability to these storms is further affected by development. Climate change will alter weather and is discussed further in the subsection below titled *Climate Change Considerations*. Development will alter the exposure of people and assets. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Figure 3-30 Severe Hail Days per Year (2003-2012)



Source: NOAA

Figure 3-31 Average Annual Lightning Density, 2015-2019



Source: Vaisala Lightning Detection Network

Past Events

According to the NCEI South Dakota has experienced 11,613 separate hail incidents between 1996 and 2020. It is important to note that these incidents may be separate impact areas caused by the same storm; it is also important to note that while NCEI is the best available free source for data on hazard impacts, the data can sometimes be imperfect.

NCEI data shows that the hail caused $162,706,750 in property damage and $44,869,000 in crop damage over this time period. Data on crop indemnity payments due to hail was also obtained from the USDA RMA. This data showed that, from 2007 to 2020, over 3,942,000 acres of crop land were damaged by hail and $455,119,168 in indemnity payments were made to farmers in South Dakota.

The NCEI records include 41 injuries and no fatalities caused by hail over this same timeframe. Amongst recent hail events since the last update of the HIRA, there was one event of significance taking place in Lawrence County and amounted to $2 million in property damages. The following table analyzes the percentage of these incidents that caused recorded impacts.

Table 3-32 Impacts by Incident-Hail

Impact	Total	Number of Incidents with Impacts	% of Incidents with Recorded Impacts
Property Damage	$162,706,750	513	4.4%
Crop Damage	$44,869,000	96	0.83%
Injuries	41	14	0.12%

Impact	Total	Number of Incidents with Impacts	% of Incidents with Recorded Impacts
Fatalities	0	N/A	N/A

Source: NCEI

Figure 3-32 shows past hail occurrences in South Dakota, from 1955-2019, by the magnitude of the hail.

Figure 3-32 South Dakota Hail Occurrences, 1955-2019

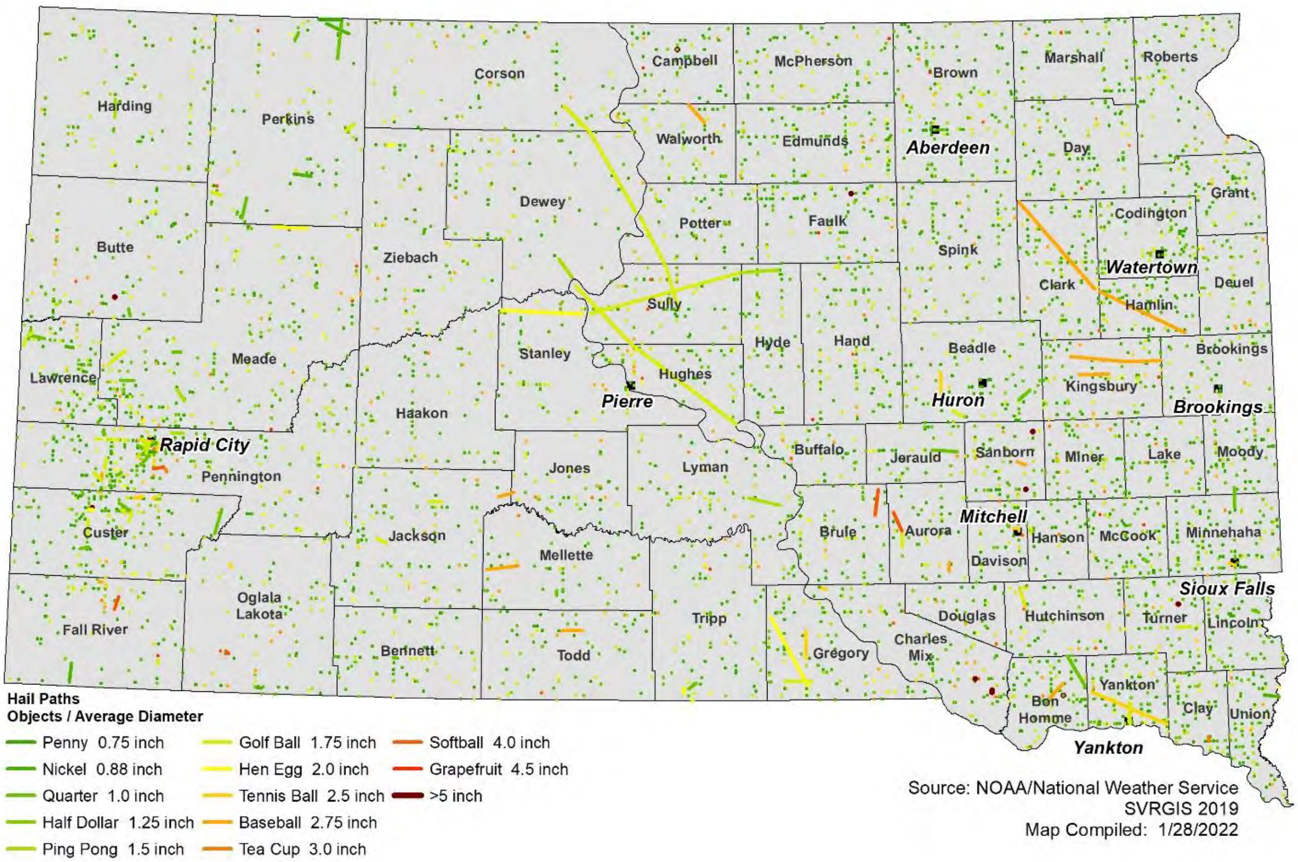


Table 3-33 lists recorded hail incidents by county between 1996 and 2020. The top five counties for recorded hail incidents are Pennington (888), Meade (567), Custer (460), Lawrence (355), all in the southwest part of the state, and Minnehaha (315) in the southeast part of the state. Pennington County has also experienced the highest reported cumulative losses, with an estimated $67.6 million in damages reported to the NCEI over this time period.

In terms of development, Pennington County ranks #3 in the state by numerical population growth (Table 3-10), and #6 by percent population growth 2010-2020 (Table 3-11). Meade County ranks #4 by numerical population growth and #2 by percent growth.

Table 3-33 Number of Hail Incidents by County (1996-2020)

County	Total Listed Events	Total Cumulative Damage
Aurora	124	$475,000
Beadle	185	$134,000
Bennett	163	$2,087,000
Bon Homme	159	$455,000
Brookings	118	$9,548,000

County	Total Listed Events	Total Cumulative Damage
Brown	257	$0
Brule	135	$7,312,000
Buffalo	67	$0
Butte	200	$4,532,000
Campbell	107	$0
Charles Mix	205	$4,962,000
Clark	164	$0
Clay	124	$282,000
Codington	153	$0
Corson	240	$0
Custer	460	$4,556,000
Davison	135	$5,350,000
Day	140	$0
Deuel	67	$0
Dewey	171	$0
Douglas	64	$1,286,000
Edmunds	210	$0
Fall River	242	$2,720,250
Faulk	130	$0
Grant	93	$0
Gregory	188	$5,035,000
Haakon	162	$160,500
Hamlin	137	$0
Hand	247	$0
Hanson	82	$67,000
Harding	258	$250,500
Hughes	127	$0
Hutchinson	120	$7,422,000
Hyde	104	$0
Jackson	221	$1,127,500
Jerauld	87	$2,285,000
Jones	92	$0
Kingsbury	126	$3,506,000
Lake	114	$1,560,000
Lawrence	355	$7,763,000
Lincoln	134	$4,200,000
Lyman	168	$0
Marshall	125	$0
McCook	127	$135,000
McPherson	149	$0
Meade	567	$3,677,500
Mellette	117	$170,500
Miner	85	$110,000
Minnehaha	315	$28,361,000
Moody	96	$1,812,000
Oglala Lakota	247	$616,000
Pennington	888	$67,584,000
Perkins	238	$2,051,000
Potter	91	$0

County	Total Listed Events	Total Cumulative Damage
Roberts	88	$0
Sanborn	90	$2,747,000
Spink	166	$0
Stanley	135	$0
Sully	118	$0
Todd	193	$573,000
Tripp	200	$741,000
Turner	142	$2,551,000
Union	116	$586,000
Walworth	125	$0
Yankton	187	$18,034,000
Ziebach	173	$751,000
Grand Total	**11,613**	**$207,575,750**

Source: NCEI

Table 3-34 shows selected hail incidents by hail size. It is noteworthy that the hailstone from Vivian on July 23, 2010, currently holds the record as the largest hailstone by diameter, circumference, and weight in the United States. It measured 8 inches in diameter, 18.75 inches circumference, and 1.938 pounds.

Table 3-34 Selected South Dakota Hail Events

County	Area	Date	Hail Size in Inches	Deaths	Injuries	Property Damage	Crop Damage
Lyman	Vivian	7/23/2010	8	0	5	$0	$0
Charles Mix	Dante	8/21/2007	6.88	0	0	$0	$0
Charles Mix	Wagner	8/21/2007	6.13	0	0	$0	$0
Butte	Nisland	6/19/2015	6	0	0	$25000	$0
Butte	Newell	6/29/2018	4.5	0	0	$0	$0
Pennington	Pactola Reservoir	8/8/2020	4.5	0	1	$0	$0
Mellette	Norris	8/26/2020	4.5	0	0	$0	$0
Minnehaha	Hartford	7/13/1997	4.5	0	0	$20,00,000	$2,000,000
Meade	Piedmont	6/1/2015	4.5	0	0	$500,000	$0
Kingsbury	Lake Preston	7/28/2002	4.5	0	0	$100,000	$0
Lawrence	St. Onge	6/19/2015	4.5	0	0	$10,000	$0
Meade	Howes	6/26/1998	4.5	0	1	$0	$0
Faulk	Faulkton	8/4/2000	4.5	0	0	$0	$0
Fall River	Oelrichs	6/12/2001	4.5	0	0	$0	$0
Brown	Barnard	6/23/2002	4.5	0	0	$0	$0
McPherson	Leola	7/9/2002	4.5	0	0	$0	$0
Meade	Elm Springs	8/26/2002	4.5	0	0	$0	$0
Lyman	Presho	6/11/2003	4.5	0	0	$0	$0
Butte	Newell	6/19/2015	4.5	0	0	$0	$0
Pennington	Rapid City	8/3/2007	4.25	0	0	$500,000	$0
Pennington	Johnson Siding	8/30/2013	4.25	0	0	$500,000	$0
Todd	Rosebud	7/13/2009	4.25	0	0	$200,000	$0
Todd	St Francis	3/18/2012	4.25	0	0	$100,000	$0
Fall River	Edgemont	6/22/2012	4.25	0	0	$100,000	$0
Oglala Lakota	Oglala	8/17/2014	4.25	0	0	$100,000	$0
Fall River	Angostura Reservoir	5/24/2010	4.25	0	0	$40,000	$0
Custer	Fairburn	6/21/2013	4.25	0	0	$25,000	$0

County	Area	Date	Hail Size in Inches	Deaths	Injuries	Property Damage	Crop Damage
Todd	Lakeview	7/20/2005	4.25	0	0	$20,000	$0
Harding	Camp Crook	7/22/2011	4.25	0	0	$10,000	$0
Meade	Faith	6/7/2005	4.25	0	0	$5,000	$0
Sully	Agar	8/24/2006	4.25	0	0	$0	$0
Douglas	Delmont	9/16/2006	4.25	0	0	$0	$0
Aurora	White Lake	6/21/2007	4.25	0	0	$0	$0
Aurora	White Lake	6/21/2007	4.25	0	0	$0	$0
Sully	Clifton	6/21/2007	4.25	0	0	$0	$0
Sully	Clifton	6/21/2007	4.25	0	0	$0	$0
Turner	Center Pt	5/1/2008	4.25	0	0	$0	$0
Custer	Hermosa	6/1/2008	4.25	0	0	$0	$0
Brown	Westport	7/17/2010	4.25	0	0	$0	$0
Lyman	Vivian	7/23/2010	4.25	0	0	$0	$0
Hughes	Blunt	8/26/2018	4	0	0	$0	$0
Bennett	Swett	7/10/2020	4	0	0	$0	$0
Pennington	Pactola Reservoir	8/8/2020	4	0	0	$0	$0
Brown	Winship	8/23/2020	4	0	0	$0	$0
Butte	Belle Fourche	7/5/1998	4	0	3	$3,000,000	$0
Lake	Countywide	7/11/2000	4	0	0	$500,000	$1,000,000
Custer	Buffalo Gap	5/24/2010	4	0	0	$75,000	$0
Meade	Piedmont	6/14/1997	4	0	0	$0	$0
Hughes	Pierre	6/30/1997	4	0	0	$0	$0
Roberts	Wilmot	7/19/1997	4	0	0	$0	$0
Pennington	Wall	8/2/1997	4	0	0	$0	$0
Oglala Lakota	Oglala	6/4/1999	4	0	0	$0	$0
Butte	Belle Fourche	6/25/2007	4	0	0	$0	$0
Bon Homme	Avon	8/8/2009	4	0	0	$0	$0
Davison	Betts	8/8/2009	4	0	0	$0	$0
Spink	Spink Colony	6/21/2013	4	0	0	$0	$0
Totals				**0**	**10**	**$5,810,000**	**$3,000,000**

Source: NCEI

While not as prominent as hail, NCEI records include 124 lightning incidents between 1996 and 2020 (note that NCEI only counts lightning strikes that were significant enough in some way to be reported; the actual number of lightning strikes is undoubtedly far higher). The recorded lightning strikes caused $4,892,200 in property damage and $5,000 in crop damage; five fatalities and 19 injuries were attributed to these events. The following table presents lightning incidents in the State that caused damages, injuries, or fatalities.

Table 3-35 South Dakota Damaging Lightning Events 1996-2020

County	Area	Date	Deaths	Injuries	Property Damage	Crop Damage
Lake	Chester	5/7/1996	0	0	$1,000	$0
Kingsbury	Lake Preston	5/18/1996	0	0	$2,000	$0
Douglas	Armour	7/6/1996	0	0	$10,000	$0
Bon Homme	Springfield	8/6/1996	0	0	$10,000	$0
Lincoln	Sioux Falls	10/16/1996	0	0	$20,000	$0
Davison	Mitchell	7/16/1997	0	0	$1,000	$0
Fall River	Edgemont	7/23/1997	0	0	$5,000	$0
Davison	Mitchell	7/24/1997	0	0	$4,000	$0

County	Area	Date	Deaths	Injuries	Property Damage	Crop Damage
Clay	Vermillion	7/27/1997	0	0	$20,000	$0
Minnehaha	Brandon	9/8/1997	0	0	$20,000	$0
Lincoln	Beresford	5/15/1998	0	0	$40,000	$0
Bon Homme	Running Water	6/17/1998	0	0	$20,000	$0
Pennington	Rochford	7/8/1998	0	1	$0	$0
Beadle	Huron	7/18/1998	0	0	$10,000	$0
Moody	Flandreau	7/18/1998	0	0	$5,000	$0
Brookings	Volga	7/20/1998	0	0	$5,000	$0
Hutchinson	Parkston	8/5/1998	0	1	$0	$0
McCook	Bridgewater	8/23/1998	0	0	$10,000	$0
Kingsbury	De Smet	6/4/1999	0	0	$2,000	$0
Todd	Parmelee	8/11/1999	0	1	$0	$0
Marshall	Langford	8/12/1999	0	0	$50,000	$0
Lake	Madison	5/17/2000	0	0	$1,000	$0
Moody	Colman	6/3/2000	0	0	$70,000	$0
Minnehaha	Sioux Falls	6/25/2000	0	0	$100,000	$0
Brookings	Bruce	7/9/2000	0	0	$5,000	$0
Lawrence	Lead	7/27/2000	0	0	$5,000	$0
Brookings	Elkton	4/22/2001	0	0	$80,000	$0
Minnehaha	Sioux Falls	4/22/2001	0	0	$20,000	$0
Minnehaha	Sioux Falls	4/22/2001	0	1	$5,000	$0
Oglala Lakota	Pine Ridge	6/9/2001	1	1	$1,000	$0
Pennington	Sheridan Lake	6/24/2001	1	2	$0	$0
Yankton	Yankton	7/7/2001	0	0	$10,000	$0
Charles Mix	Lake Andes	7/7/2001	0	0	$1,000	$0
Brookings	Brookings	7/22/2001	0	0	$3,000	$0
Brookings	Brookings	7/22/2001	0	0	$3,000	$0
Bon Homme	Avon	7/30/2001	0	0	$5,000	$0
Aurora	Plankinton	7/30/2001	0	0	$1,000	$0
Custer	Custer	8/1/2001	0	0	$500,000	$0
Brookings	Brookings	5/7/2002	0	0	$5,000	$0
Moody	Flandreau	6/10/2002	0	0	$5,000	$0
Kingsbury	De Smet	7/28/2002	0	0	$10,000	$0
Brule	Kimball	8/8/2002	0	0	$20,000	$0
Kingsbury	Arlington	8/12/2002	0	0	$2,000	$0
Minnehaha	Sioux Falls	9/19/2002	0	0	$20,000	$0
Beadle	Huron	5/29/2003	0	0	$5,000	$0
Beadle	Huron	5/29/2003	0	0	$5,000	$0
Lincoln	Hudson	7/3/2003	0	0	$5,000	$0
Pennington	Rapid City	7/8/2003	0	1	$0	$0
Yankton	Midway	7/20/2003	1	1	$0	$0
Union	Elk Pt	4/21/2004	0	1	$2,000	$0
Miner	Howard	5/21/2004	0	0	$20,000	$0
Todd	Okreek	6/8/2004	0	0	$500,000	$0
Beadle	Hitchcock	8/1/2004	0	0	$5,000	$0
Hanson	Alexandria	8/3/2004	0	0	$50,000	$0
Yankton	Yankton	8/22/2004	0	0	$2,000	$0
Brule	Bijou Hills	8/23/2004	0	0	$20,000	$0
Davison	Mitchell	8/31/2004	0	0	$10,000	$0

County	Area	Date	Deaths	Injuries	Property Damage	Crop Damage
Davison	Mitchell	9/4/2004	0	0	$2,000	$0
Kingsbury	De Smet	5/7/2005	0	0	$200,000	$0
Lake	Madison	6/29/2005	0	0	$200	$0
Minnehaha	Sioux Falls	7/7/2005	0	0	$10,000	$0
Grant	Milbank	8/10/2007	0	0	$2,000	$0
Hughes	Pierre	6/5/2008	0	0	$50,000	$0
Minnehaha	East Sioux Falls	7/31/2008	0	2	$0	$0
Meade	Sturgis	8/5/2008	0	3	$0	$0
Brookings	Brookings	5/4/2009	0	0	$5,000	$0
Lincoln	Tea	6/23/2009	0	0	$30,000	$0
Moody	Colman	9/30/2009	0	0	$1,000	$0
Yankton	Yankton	7/11/2010	0	0	$5,000	$0
Moody	Flandreau	5/10/2011	0	0	$20,000	$0
Pennington	Rapid City	6/24/2011	0	0	$6,000	$0
Pennington	Wasta	8/3/2011	1	0	$0	$0
Custer	Buffalo Gap	5/27/2014	0	1	$0	$0
Brown	Aberdeen	6/5/2014	0	0	$2,000	$0
Pennington	Rockerville	6/4/2015	0	0	$2,000	$0
Pennington	Rapid City	6/20/2015	0	0	$50,000	$0
Lawrence	Spearfish	7/12/2015	1	1	$0	$0
Lincoln	South Sioux Falls	8/27/2015	0	0	$5,000	$0
Lincoln	Tea	8/27/2015	0	0	$5,000	$0
McCook	Salem	5/25/2016	0	0	$45,000	$0
Pennington	Rapid City	6/13/2016	0	0	$20,000	$0
Pennington	Rapid City	8/8/2016	0	2	$0	$0
Pennington	Rockerville	8/14/2016	0	0	$50,000	$0
Grant	Milbank	8/18/2017	0	0	$10,000	$0
Davison	Mitchell	4/5/2019	0	0	$50,000	$0
Hutchinson	Freeman	7/17/2019	0	0	$90,000	$0
Charles Mix	Geddes	8/6/2019	0	0	$0	$5,000
Union	McCook Lake	8/10/2020	0	0	$2,500,000	$0
McPherson	Eureka	8/12/2020	0	0	$1,000	$0
Grand Total			5	19	$4,892,200	$5,000

Source: NCEI

Table 3-36 analyzes the percentage of lightning incidents that caused impacts.

Table 3-36 Impacts by Incident-Lightning

Impact	Total	Number of Incidents w/ Impact	Percentage of Incidents with Impact
Property Damage	$2,171,200	69	61%
Crop Damage	0	N/A	N/A
Injuries	17	13	11%
Fatalities	5	5	4.3%

Source: NCEI

Probability of Future Occurrence

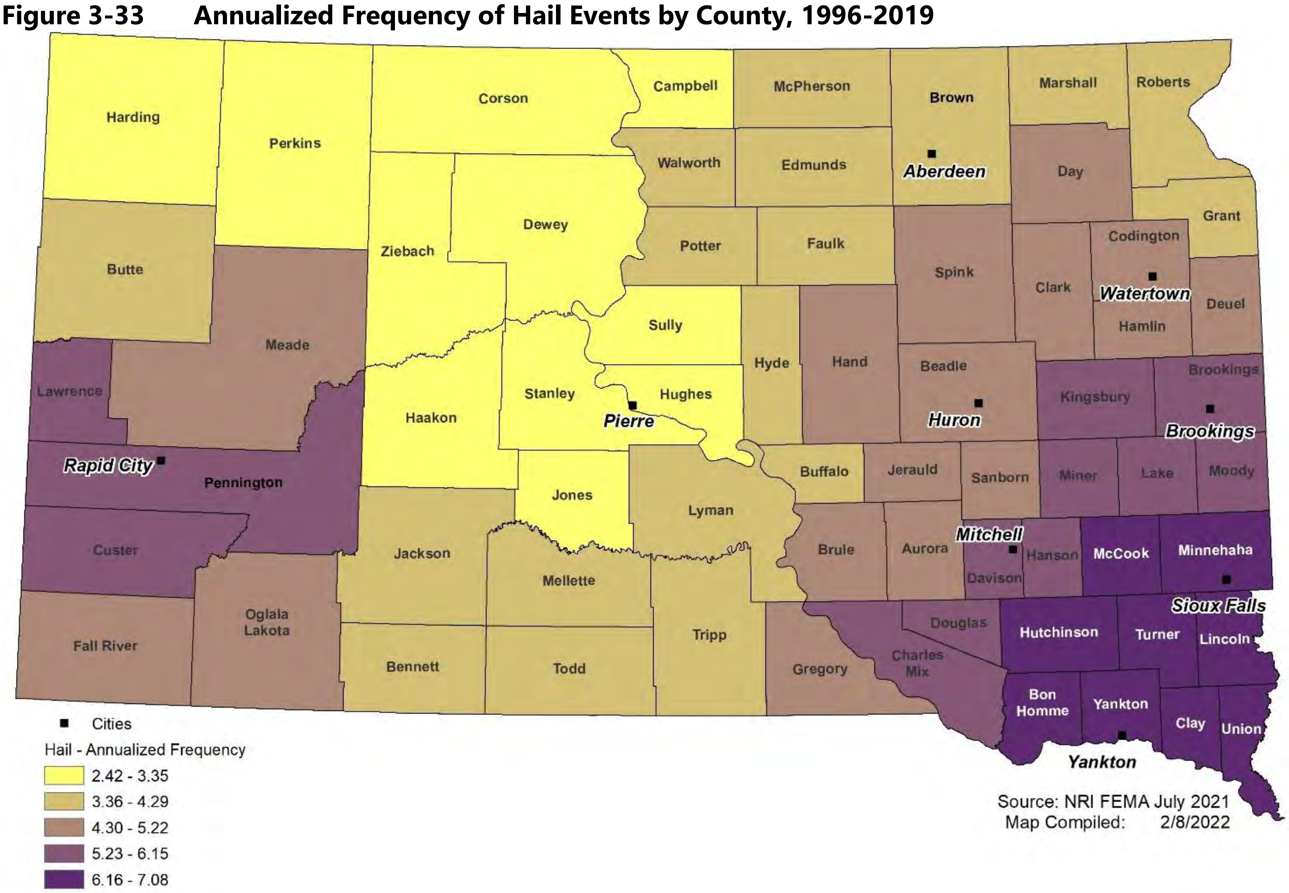
No study has explicitly forecast the future occurrence of lightning in South Dakota and no forecasts of this hazard have been incorporated into this SHMP update. This is a gap in knowledge. It is unclear whether this gap affects the ability to plan for this hazard. Evaluating past occurrence of lightning can allow at least a somewhat enlightened, and perhaps adequate, approach to envisioning the future of this hazard.

The future frequency and extent of damaging hail is similarly little studied. During this SHMP update, no studies or forecasts of the future occurrence of damaging hail were identified. Given the degree of property damage done by large hail, the lack of a forecast is a clear gap in knowledge that limits the ability to plan for this hazard. However, evaluating past occurrence of damaging hail can allow at least a somewhat enlightened approach to envisioning the future of this hazard.

According to the NCEI, there were 11,613 hail incidents in South Dakota between 1996 and 2020. The average hail stone size for these incidents was approximately 1.25 inches in diameter, though hail up to eight inches in diameter has been recorded in Vivian in Lyman County in July 2010. This suggests that South Dakota averages 484 separate hail incidents annually. Zero deaths and 41 injuries were attributed to these events. Based on past history, South Dakota can expect few if any deaths, and almost 1-2 injuries each year caused by hail. Based on this information, the probability that multiple hailstorms will occur in South Dakota in any given year is 100 percent.

Figure 3-33 depicts the annualized frequency of hail events by county between 1996 and 2019 based on the FEMA NRI. The data indicates a higher frequency of events in the southeastern and western parts of the State.

Figure 3-33 Annualized Frequency of Hail Events by County, 1996-2019

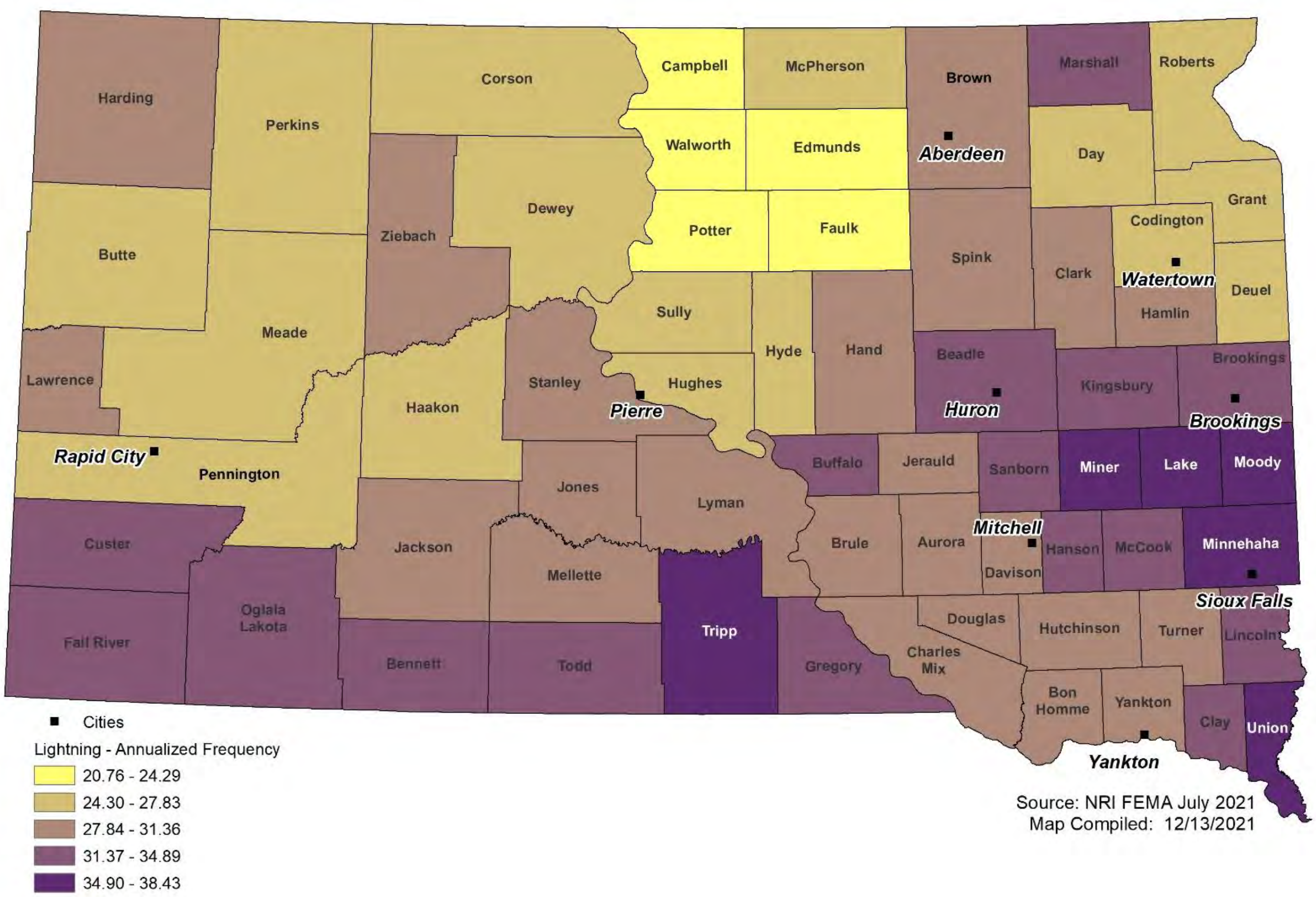


Lightning is a common event that occurs in every thunderstorm in the state. Most lightning bounces from cloud to cloud is harmless to those on the ground. However, when lightning does strike a target on the ground, it can do tremendous damage to people and property.

The data used to quantify cloud-to-ground lightning frequency in this SHMP update are nuanced. NCEI maintains a database of lightning strikes that occur during a designated weather watch/warning/advisory or when a report of lightning is received. In essence, NCEI data are a record of damaging or 'significant' lightning strikes, rather than a record of the frequency of all lightning strikes. Between May 1996 and 2020, NCEI reported 124 separate lightning strikes, perhaps better thought of as 124 harmful or 'significant' lightning strikes. This is approximately 5 per year. Cumulatively, lightning strikes during this time caused five deaths and nineteen injuries. Assuming the lightning hazard will be relatively stable in the near future, the State of South Dakota can expect damaging lightning strikes regularly, at least annually; based on NCEI-recorded data, these strikes will cause one recorded injury every other year, and a lightning-caused fatality every four years.

Figure 3-34 depicts annualized frequency of lightning events by county between 1996 and 2019 reported by the FEMA NRI, using NCEI data. The data presented by the NRI are provided in map form, by county. This makes it possible to identify parts of southern and southeastern South Dakota experiencing more frequent damaging or 'significant' lightning strikes.

Figure 3-34 Annualized of Frequency of Lightning Event by County, 1996-2019



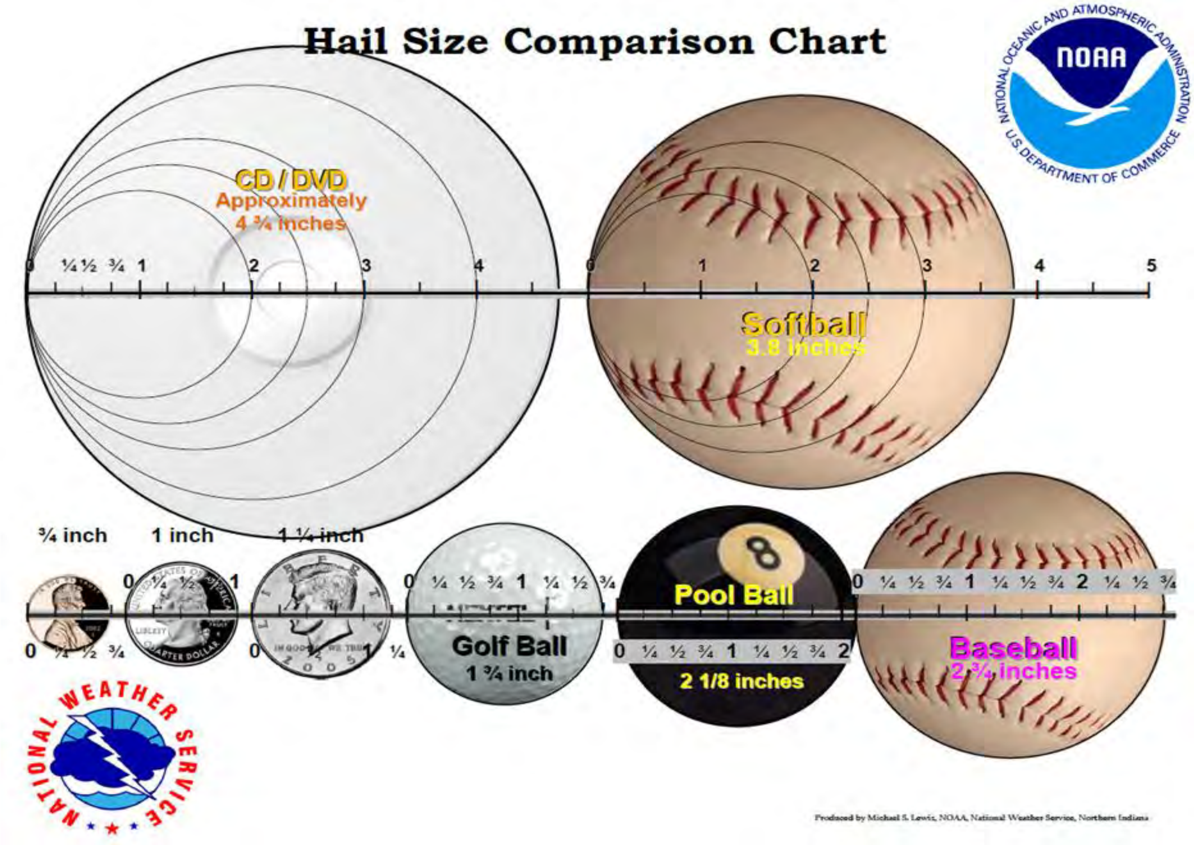
Magnitude/Severity (Extent)

Lightning in South Dakota is very severe, even causing death, but is limited to isolated cases of injury or property damage. The frequency of damaging lightning strikes, including injuries recorded in recent history, is discussed above in the subsection titled *Probability of Future Occurrence*.

The NWS classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Figure 3-35 below shows the hailstone measurements utilized by the NWS.

There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms probably produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short so there is not much time for growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, golf ball sized hail or larger is associated with supercells, but non-supercell storms are also capable of producing golf ball size hail.

Figure 3-35 NOAA Hail Size Comparison Chart



Source: NWS

Table 3-37 National Weather Service Hail Severity

Severity	Description	Hail Diameter Size (in inches)
Non-Severe Hail Does not typically cause damage and does not warrant severe thunderstorm warning from NWS.	Pea	1/4"
	Marble/mothball	1/2"
	Penny	3/4"
	Nickel	7/8"
Severe Hail Research has shown that damage occurs after hail reaches around 1" in diameter and larger. Hail of this	Quarter	1" (severe)
	Half Dollar	1 1/4"
	Walnut/Ping Pong Ball	1 1/2"
	Golf Ball	1 3/4"

Severity	Description	Hail Diameter Size (in inches)
size will trigger a severe thunderstorm warning from NWS.	Hen Egg/Lime	2"
	Tennis Ball	2 1/2"
	Baseball	2 3/4"
	Teacup/Large Apple	3"
	Softball	4"
	Grapefruit	4 1/2"

Source: NWS

Common problems associated with lightning include the loss of utilities and related impacts. Loss of life is uncommon but can occur during severe storms. Loss of utilities, specifically power lines can occur due to strikes or downed trees from lighting.

Lightning is measured by the Lightning Activity Level (LAL) scale, created by the NWS to define lightning activity into a specific categorical scale. The LAL is a common parameter that is part of fire weather forecasts nationwide. Various areas of the State are at risk to experience lightning in any of these categories. The LAL is reproduced in Table 3-38.

Table 3-38 Lightning Activity Level Scale

Lightning Activity Level	
LAL 1	No thunderstorms
LAL 2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five-minute period
LAL 3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a five-minute period
LAL 4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent, 11 to 15 cloud to ground strikes in a five-minute period
LAL 5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period
LAL 6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag warning

Source: NWS

Climate Change Considerations

Increased heat in the atmosphere due to climate change provides more energy for severe storms. The frequency of severe weather events has increased steadily over the last century. The number of weather-related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate. The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. All of these impacts could have significant economic consequences in terms of direct damages as well as potential lost income due to agricultural impacts, for example.

The Climate Science Special Report (2017) states that damages from convective weather hazards (such as severe thunderstorms and tornadoes) have undergone the largest increase in damages, relative to other extreme weather, since 1980. Some studies have considered the number of days that will be favorable for severe thunderstorms as well. There is projected to be an increase in potential days for severe thunderstorms in the mid- to late 21st century. The largest increases, however, are in neighboring regions of the Midwest and Southern Plains. Also, storm intensity is projected to increase. There is some uncertainty in these projections, but severe thunderstorms and tornadoes will remain a hazard in South

Dakota every year. The Fourth National Climate Assessment projects an increase in both the number of days above 90 degrees and the number of days with precipitation exceeding 1 inch by the mid-21st century for the Northern Great Plains region. Both of these shifts create conditions favorable to or characteristic of severe thunderstorms. According to studies referenced by the National Lightning Safety Institute, it could be possible globally to see an increase of 10-20% in the incidence of lightning with each degree Celsius of global temperature increase. This could potentially lead to higher frequency of thunderstorm occurrence in South Dakota.

Vulnerability Assessment

All counties in South Dakota are vulnerable to summer storms. In order to analyze the State's vulnerability to summer storms, the NRI was used as a primary tool. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. This composite risk rating is illustrated in Figure 3-36 for hail and Figure 3-37 for lightning below, showing the risk to these aspects of summer storms by county in South Dakota. Because hail can occur anywhere, the hail risk within the NRI is based on the entire building, population, and agricultural value of each county when considering exposure. The NRI considers the same for exposure to lightning.

Figure 3-36 Hail Risk Rating by County in South Dakota

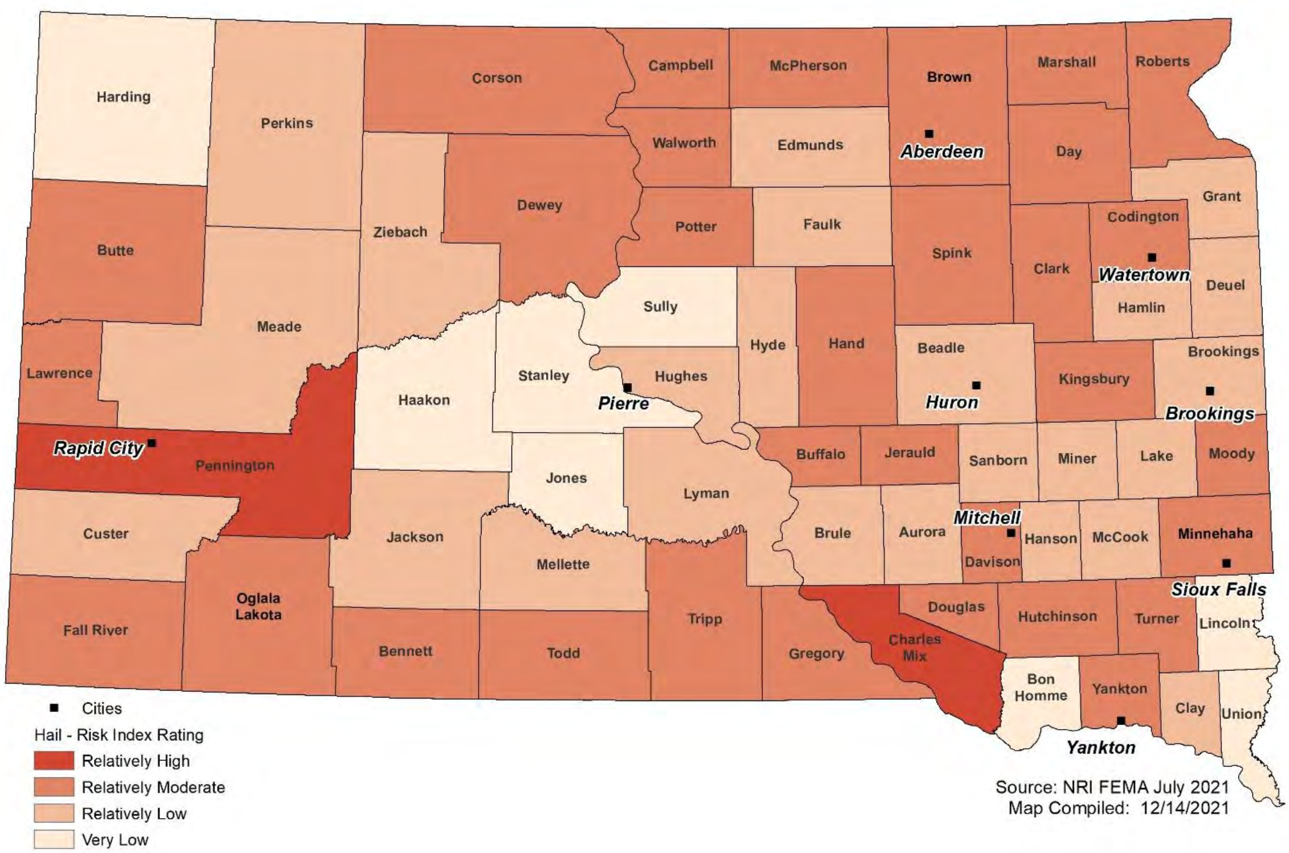
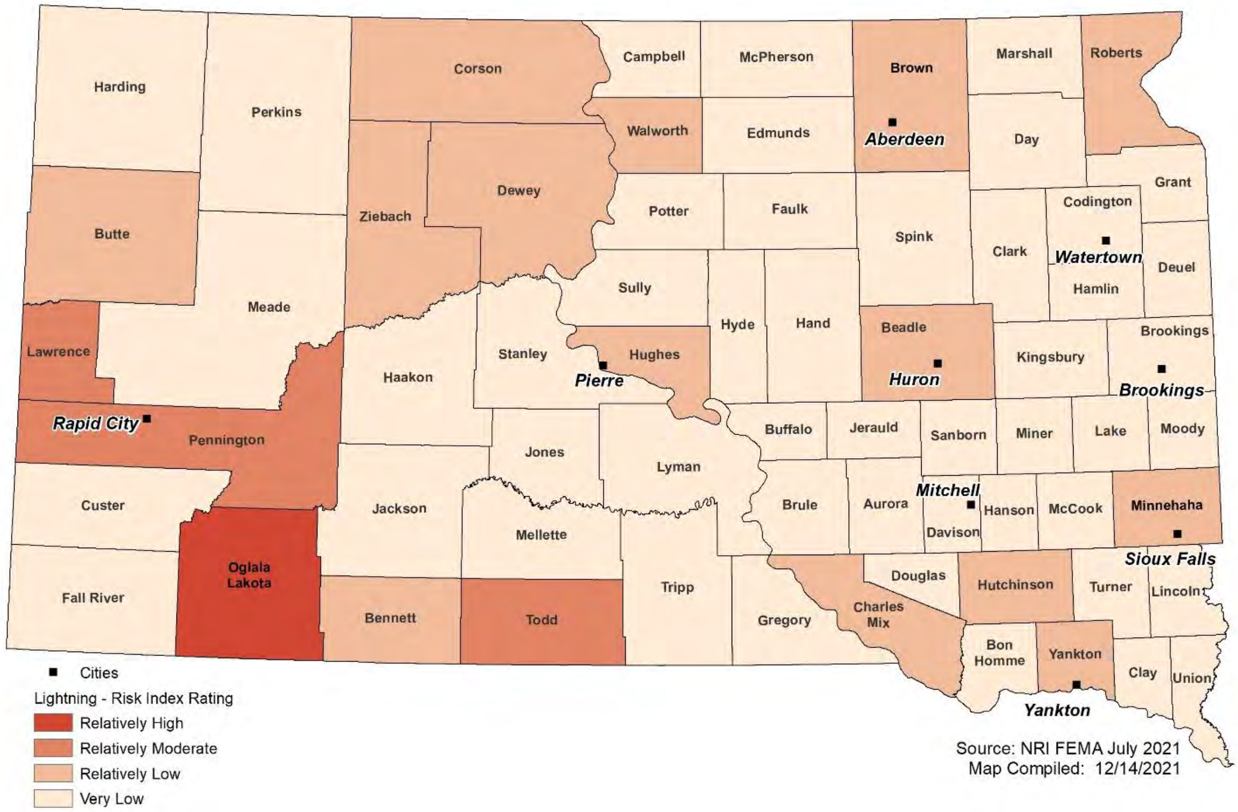


Figure 3-37 Lightning Risk Rating by County in South Dakota



People

Exposure to large hail is a formidable danger to people who are outdoors and are unable to take refuge. Some populations are particularly vulnerable include the homeless, the elderly and very young, tourists and visitors, and those with developmental, physical, or sensory disabilities. The impacts of summer storm on vulnerable populations can be especially severe. Individuals and families may have fewer financial resources to prepare for or recover from a summer storm, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to take cover, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods. Large hail has the potential to cause significant bruising, concussions, broken bones, and even death. Large hail also has the potential to cause extensive damage to dwellings and possessions such as vehicles.

The financial impact of hail on vulnerable populations is worthy of special consideration. Low-income populations are more likely to be uninsured or underinsured for hail damage, causing them to experience more severe financial hardships caused by hail. Individuals with disabilities may need more assistance after a major event, especially if transportation or utility services are disrupted.

Lightning affects people somewhat differently than hail. In South Dakota, outdoor enthusiasts are primarily affected, rather than disadvantaged populations. Lightning caused five fatalities and nineteen recorded injuries between 1996 and 2020; these injuries were to people caught unprotected during a lightning storm.

Indirectly, populations that rely on a constant, uninterrupted electrical supply can be vulnerable to power disruptions caused by lightning. Residents of nursing homes or other special needs housing populations often fall into this group. In addition, an estimated 9,922 Medicare beneficiaries in South Dakota rely on electricity to live independently in their homes. Isolation of these populations is a significant concern, particularly if they do not have a back-up power source.

Prolonged power outages can be dangerous in other settings. For example, many people in rural areas, and many agricultural operations rely on electricity for heating, cooling, and water supplies. Loss of these services can cause substantial problems.

Identifying where these and other vulnerable populations exist is important to hazard mitigation planners. Equally important to knowing *where* these populations exist is knowing *why* each is vulnerable. These pieces of information are vital to designing effective mitigation actions for specific situations. Social vulnerability data exist that describe both the location and characteristics of vulnerable populations. However, analysis of these traits in local mitigation plans is uncommon and no statewide assessments exist. This is an information gap.

An additional gap exists with regard to how climate change and development will affect, or continue affecting, vulnerable populations in South Dakota. For example, how climate change will affect large hail hazards in South Dakota has not been described, particularly with regard to how it will affect vulnerable populations. Likewise, demographic projections have not been analyzed for how they affect vulnerability to summer storm hazards.

Property

Hail can strike anywhere in South Dakota, and all structures are vulnerable. Hail can damage roofs, shingles, windows, siding, unsheltered vehicles, and any other property unprotected from the storm. Hail causes more than a billion dollars of property damage nationally each year. Most of this damage is to crops, but hail can also decimate structures, shatter windows, peel paint, and severely damage automobiles and equipment not protected or stored inside.

As mentioned in the past events section above, lightning has caused approximately $4.9 million in property damages since 1996 in South Dakota. This is equivalent to an expected annualized loss of approximately $204,167.

State Assets, Critical Facilities, and Infrastructure

Hail can lead to the temporary incapacitation of roads when small hail stones build up so deep, they block roads. Hail has also been observed to block storm drains and prevent proper runoff, potentially resulting in flooding as a secondary hazard. Most structures, including the State's critical facilities, should be able to provide adequate protection from hail to their occupants but the structures themselves could suffer broken windows and dented exteriors. Those facilities with back-up generators are better equipped to handle a severe weather situation should the power go out.

Lightning impacts some essential infrastructures and facilities. Emergency responders, hospitals, government services, schools, and other important community assets have a similar vulnerability to lightning as what exists for non-state assets (e.g. property) and the population. Some aspects of infrastructure that affect vulnerability are construction, especially with regard to electrical systems, and/or location in places prone to lightning exposure. Sometimes, communications and infrastructure are interrupted by lightning strikes. Damage or loss to communications and infrastructure due to lightning has impacts such as delaying response times, hindering interagency communication efforts, or endangering or damaging communication networks.

Fortifying state assets that are particularly vulnerable to summer storm hazards related to hail and lightning has historically been done on a case-by-case basis or is implicitly included in maintenance and facility management. There has been no state-wide analysis of which state assets are most vulnerable to summer storm hazards. The present arrangement of identifying which assets are *exposed* limits the degree to which these hazards can be mitigated and is considered a knowledge gap.

Putting a specific dollar value on vulnerable state assets is possible, in the sense that large hail and lightning can affect any part of the state, which makes all state assets exposed and potentially vulnerable. Section 3.2.1 and especially Table 3-5 provide the value of state assets. In addition, it is possible to characterize the types of assets most likely to be damaged. Simply stated, building exteriors and vehicles are especially likely to sustain damage from large hail and inadequately designed and constructed electronics are especially likely to sustain damage from lightning. Unfortunately, this is where a limitation exists in our knowledge.

While all parts of the state are vulnerable, in the sense they are exposed to summer storm hazards, there is variability in that exposure. This is described at length in the section above titled, *Location*.

Not all assets are equally likely to be damaged if exposed to summer storm hazards. However, there has been no successful attempt to identify which specific state assets are most likely to sustain damage from large hail and lightning, or how this is statistically plays out in an average year. This type of analysis would make this vulnerability assessment more useful for mitigating hazards in future plan updates.

Similarly, we can say with some confidence that climate change will increase the severity of convective storms and therefore can be expected to increase exposure of state assets to hail and lightning across the state. In one sense, 100% of state assets are potentially exposed and vulnerable to hail and lightning now, amplifying these hazards can’t increase the vulnerability of state assets any further. However, increasing these hazards certainly can increase the damage sustained when assets are exposed. Expressing the impact of climate change on the statistical dollar value of damage experienced in a typical year depends on addressing the knowledge gaps described above, and then projecting increases.

Present and future development also affects damage from large hail and lightning. It is possible to characterize the likely loss of state assets from hail and lightning as dependent on the value of state assets in areas likely to experience these hazards. In one sense, 100% of state assets are vulnerable to these hazards, therefore the impact of development on vulnerability is equivalent to the effect of development on the value of state assets. However, putting a dollar value on how development will affect the expected loss of state assets in a typical year runs into the same problems described above for valuing state assets likely to be damaged in a typical year.

All of this is to say with confidence that all state assets are vulnerable to loss from large hail and lightning (see Section 3.2.1 and especially Table 3-5). However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to hail and lightning will be possible in future hazard mitigation plans.

Economy

The economic impact from hail can be severe on impacted areas, and potentially long lasting. As mentioned throughout this section, hail is the one of the costliest hazards experienced in South Dakota. While most damages due to hail are typically covered by private insurance, direct damages have totaled $207,575,750 over the last 24 years and severe indirect economic impacts can also be felt through businesses which may be forced to close for repairs. A review of the USDA RMA records shows between 2007 and 2020 over 3,942,000 acres of crop land were damaged by hail and $455,119,168 in indemnity payments were made to farmers in South Dakota. The estimated average annualized losses due to hail is $8,648,990.

Economic impacts of a severe thunderstorm are typically short-term. Lightning events can cause power outages and fires. Generally, long-term economic impacts arise more from hazards that cascade from a severe thunderstorm, including wildfires ignited by lightning. Similarly with the previous section, lightning can cause structural damage or damage to electrical systems to private buildings as well as critical infrastructure.

Environment and Cultural Resources

While summer storms are a natural environmental process, they can cause significant environmental damage through their many impacts and cascading hazards. As discussed throughout this section hail and lightning are both capable of inflicting significant physical damage to the built environment, as well as the natural environment, breaking tree limbs, damaging trees and other plants in bloom, sparking fires, and destroying crops. Some cultural and historic properties may also be at risk of damage from hail and fire caused by lightning strikes.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to summer storm hazard vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to summer storm hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to summer storm hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to summer storm hazards.

Despite the present state of knowledge, it is apparent that many counties in South Dakota have seen a decrease in population growth and development pressures. However, a few specific counties have seen concentrated growth since the last census. Lincoln County experienced the greatest percentage of population gain of all the counties in South Dakota from 2010 to 2020, while Minnehaha saw the greatest absolute change in population over the same time period. Lincoln, Meade, Union, Minnehaha, and Beadle Counties have increased their population by more than 10% since 2010. Climate change is predicted to increase both the occurrence and intensity of summer storms. As these counties continue to grow, these increases in population and residential development exposed to these summer storm events will increase their vulnerability to the hazard. The agricultural industry, which is one of the State's primary industries will continue to be vulnerable to hail events. Counties that are particularly dependent economically on crops or livestock will have high vulnerability to this type of hazard event. (See agricultural pests and diseases vulnerability discussion).

Table 3-39 Summer Storms Consequence Table

Category	Narrative
Impact on the Public	Exposure risks to motorists, outdoor workers, homeless persons, general public; risk to persons with energy dependent medical needs and pre-existing medical conditions
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure function or accessibility and uninsured
Impact on the Environment	Tree and vegetation damage, crop damage; animal impacts
Impact on Property, Facilities, and Infrastructure	Buildings, equipment, and utility infrastructure are exposed to heavy hail, sometimes complicated by strong winds; transportation system impacts; possibility of roof damage; potential power loss and strain on energy systems

Category	Narrative
Impact on the Public Confidence in Government	High expectations of government capabilities for reducing impact of hail events related to transportation
Impact on Responders	Exposure risks; adverse working conditions. Potential impacts to communications systems
Impact on Continuity of Operations and Continued Delivery of Services	Potential loss of facilities or infrastructure function; potential loss of ability or accessibility to provide services; possible power interruption; transportation system impacts
Cascading Hazards	Floods, Tornadoes, High Wind

3.3.4. Winter Storm

Hazard Description

Winter storms are not limited to one area of the State and historically occur from late fall to the middle of spring. They vary in intensity from mild to severe. Winter storms regularly destroy property and kill livestock. They can immobilize a region, blocking roads and railways and closing airports, which can disrupt emergency and medical services, hamper the flow of supplies, and isolate homes and farms, possibly for days. Heavy snow can collapse roofs and knock down trees and power lines. Unprotected livestock may be lost. Economic impacts include cost of snow removal, damage repair, and business losses.

The NWS describes different types of snow 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 3 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.
- **Snow Flurries** - Light snow falling for short durations with little or no accumulation.

Also associated with winter storms are ice, freezing rain, and sleet. Freezing rain coats objects with ice, coating on the sidewalks, roads, etc., creates dangerous conditions. Sleet does not generally cling to objects like freezing rain, but it does make the ground very slippery. Heavy accumulations of ice can bring down trees and topple utility poles and communication towers. Ice can disrupt communications and power for days while utility companies repair extensive damage; even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

Winter storms can also generate flooding, usually as a result of ice jams or snowmelt, which can cause significant damage and loss of life. Ice jams form when long cold spells cause rivers and lakes to freeze and a rise in water level or a thaw breaks the ice into large chunks that become jammed at obstructions (e.g., a bridge). Water backs up at the jam, which is acting as a dam, and flooding results. The snowmelt hazard is defined as a sudden thaw of a heavy snowpack that often leads to flooding. Both snowmelt and ice jam floods are common in South Dakota.

Extreme cold often accompanies a winter storm or is left in its wake. It is most likely to occur in the winter months of December, January, and February. Prolonged exposure to the cold can cause frostbite or hypothermia and can become life threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Extreme cold can disrupt or impair communications facilities.

Location

Winter storm hazards can occur anywhere in the South Dakota, but some clear spatial patterns exist. Cold-wave events are far more likely to occur in the relatively low-elevation, northeastern part of the state. Ice storms are many times more likely to occur in the southeast part of the state than in the southwest. Winter storms are most common in the Black Hills and the northeast corner of the state.

Patterns of winter storms are discussed at greater length below, in the section titled *Probability of Future Occurrence*. That section presents a more complete description of winter storms, NCEI data and NRI maps, as an indicator of winter storm conditions likely to occur in the near future.

The future location of winter storm hazards will be impacted by both climate change and development. Climate change will alter weather and is discussed further in the subsection below titled *Climate Change Considerations*. Development will alter the exposure of people and assets. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Past Events

According to the NCEI, there were 2,136 winter storms (snow and ice events) recorded in South Dakota between January 1993 and December 2021, and 499 extreme cold events from January 1994 to December 2021. Winter storm events have resulted in 20 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1.4 deaths and five injuries each year. Total property damage for these events is estimated at $105 million dollars. This suggests that South Dakota averages 76 winter storms and $3.7 million in winter storm losses annually, as well as 18 extreme cold events each year.

The event of record took place on December 25, 2016. The blizzard event resulted in a presidential declaration for 24 counties. The table below provides more details on the event.

Table 3-40 South Dakota Winter Storm Events

Date	Comments
December 12-25, 2022	South Dakota Severe Winter Storms and Snowstorm (FEMA DR-4689-SD) A potent and long-lasting low pressure system brought widespread snow and blizzard conditions to much of the northern Plains from late Monday, December 12, 2022 through Friday, December 16. Conditions gradually improved late Friday, December 16. Precipitation changed from freezing drizzle to snow by December 13. Snow continued through December 14 and 15 before finally ending on Friday. Strong northwesterly winds, gusting to 60 mph or higher, led to blowing and drifting snow throughout the event, and contributed to upslope-enhanced snowfall over the northern Black Hills and foothills. Those locations received the highest amounts of snow, with around 3 feet reported in the Spearfish and Sturgis areas and around 4 feet reported in the Cheyenne Crossing and Lead/Deadwood areas. From Pine Ridge eastward into central SD, 2 to 3 feet of snow were reported. Many locations received a foot or two of snow. Due to the effects of downsloping winds, the southern Black Hills and foothills were spared from the worst of the snow and strong winds; only a couple inches of snow were reported in those areas. The strong winds lasted through Friday, so even after the snow ended, blizzard conditions continued for much of the South Dakota plains. Source: National Weather Service, www.weather.gov/unr/2022-12-12_16
April 10-11, 2019	A historic late-season, multi-day winter storm developed rapidly across the central Plains on Wednesday, April 10. This system spiraled several periods of wintry precipitation through the region. The leading precipitation on April 10 was a mix of rain, freezing rain and sleet from far eastern South Dakota through the Interstate 90 areas of southwest Minnesota and northwest Iowa, changing to snow to the north and west. Heavy snowfall developed from the early morning of April 11 and continued into the early morning of April 12 across much of southeast South Dakota into northern portions of southwest Minnesota, which accumulated to 1 to 2 feet during the storm. The most persistent snowfall occurred for areas west to north of Sioux Falls, but even there, a brief period of freezing rain or sleet occurred at some point ahead of the main upper trough passage. Ice accumulation and near blizzard conditions led to a shutdown of government offices and schools, and travel was not recommended due to the extremely hazardous conditions. A period of freezing rain, sleet and snow resulted in ice accumulations starting the afternoon of April 10 through early April 11 of one-third to one-half inch. As winds increased and gusted as high as 59 mph at Sioux Falls, widespread power outages resulted as power poles snapped and transmission lines were downed. Several communities were without power at times between the evening of April 10 and April 12, including Marion, Parker, Dolton and Viborg. At the peak,

Date	Comments
	electric companies and cooperatives estimated as many as 25,000 customers were without power. Many areas were without power for a day or two due to the intensity of the storm.
January 1, 2017	A couple became stranded northeast of Eagle Butte on Jan 1st in snow and low visibility when their vehicle went into the ditch. It was very cold when the couple decided to walk to safety with both of them freezing to death. A command center was set up with a large search and rescue operation occurring. Multiple search parties along with a helicopter were dispatched. The woman was located within 48 hours while the man was not located until nearly a month later.
December 25, 2016	Severe Winter Storm and Snowstorm (FEMA-4298-DR) An intense storm system moved across the Northern Plains, producing snow and strong winds across much of western South Dakota. Areas of freezing rain, freezing drizzle, sleet, and snow developed over the area in the morning, before changing to snow. Snowfall was heaviest during the late afternoon and nighttime hours. Four to eight inches of snow were reported across much of western South Dakota, with local amounts as much as a foot. Embedded thunder was also noted with the precipitation. Strong winds developed late in the day and continued into the next morning, with blizzard conditions across much of the western South Dakota Plains. Interstate 90 was closed for a prolonged period from the Wyoming border to Chamberlain. Rural electric systems sustained significant damage to poles and wires due the snow, ice, and wind. A man died as he tried to walk home after his pickup truck went into a ditch. This storm resulted in a major disaster declaration for 24 counties. The NCEI records identifies $13,311,000 in combined property damage. FEMA Public Assistance totaled $9,632,647 for the event (federal share).
October 3-5, 2013; declared Nov 8, 2013	Severe Winter Storm, Snowstorm, and Flooding (FEMA-4155-DR) A multi-day blizzard in October 3-5 caused damage to public utilities, primarily in the western portion of the state.
April 8-10, 2013	Severe Winter Storm and Snowstorm (FEMA-4115-DR) A large spring snowstorm dumped heavy snow over most of western South Dakota April 8-10, 2013. The final NWS storm report showed that Deadwood received 30 inches of snow during the storm and Rapid City received 28.2 inches for some of the highest snowfalls in the State. April 2013 ended up being the snowiest month on record for South Dakota with 39.5 inches total, beating the previous record of 38.5 inches set in April 1927. This storm resulted in a major disaster declaration for seven counties.
January 17, 2011	Northwest winds caused blowing and drifting snow over an area which extended from Brookings County into southwest Minnesota. Cold temperatures and wind chills approaching 20 degrees below zero developed during the event and continued through the night as the winds and blowing snow slowly decreased. There was a fatality from exposure in Brookings County during the event. A 65-year-old woman died of exposure after she left her vehicle which had become stuck in drifts on a township road near Elkton.
January 9, 2011	Snow produced heavy accumulations of 8 to 10 inches in an area near the Missouri River in southeast South Dakota during a 24-hour period beginning in the late afternoon of January 9th. Lesser accumulations of 4 to 8 inches were reported further north and west in southeast South Dakota. An exposure fatality was reported in Sioux Falls during the snowfall. A 70-year-old woman died after wandering away from her assisted living facility at night. Wind chills at the time varied from zero to 5 above.
December 23, 2010	An upper level disturbance passed over the region during the night and early morning, bringing milder air over cold air at the surface. Light freezing rain developed over western South Dakota, mixing with snow and sleet at times. The heaviest freezing rain fell across southwestern South Dakota, including the Black Hills, where as much as a quarter inch of ice accumulated. Roads became ice covered and caused many accidents during the morning. A total of $475,000 in damages (2010$) resulted from this event. NCEI did not record any injuries or fatalities.
December 10, 2010	Snowfall ranging from 2 to 8 inches was accompanied by sustained northwest winds which reached 40 mph at times, with gusts as high as 55 mph. The snowfall, strong winds, and existing snow cover resulted in widespread blizzard conditions. Travel was made impossible in much of

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	the area. There were several accidents and vehicles going into ditches, attributed to slick roads and low visibilities. Several motorists were stranded. Businesses were forced to close, and several school and other weekend activities were cancelled or postponed.
April 2, 2010	Severe Winter Storm (FEMA-1914-DR) The April 2, 2010, blizzard caused an estimated $1.6 million in damage in the three-county area. A band of heavy snow set up across Corson and Dewey Counties during the early morning hours of April 2nd. Along with heavy wet snow, northwest winds gusting up to 40 mph developed. By the time the snow ended in the late morning hours, 6 to 8 inches of snow had fallen. The heavy snow, combined with the strong winds, downed many power poles across the region along with making travel treacherous. Some snowfall amounts included: 4 inches at Eagle Butte; 6 inches at Timber Lake, McLaughlin, and 14 miles north of Isabel; 7 inches at Isabel and 6 miles southeast of McIntosh; 8 inches southwest of Keldron. Heavy snow and strong winds knocked down power lines and poles, cutting off electricity to more than 1,500 rural electric customers. More than 400 poles were lost to the heavy snow leaving approximately 800 people without power. Eighty linemen worked through the Easter weekend in the snow and mud. McLaughlin and Keldron were the hardest hit. Several hundred people were still without power on April 5th. Corson, Perkins, and Ziebach Counties were also among those struck by a late-January ice storm that qualified them for an earlier presidential disaster declaration. Some of the power lines damaged by the April storm had just been repaired from damage caused by the January ice storm.
January 20-26, 2010	Severe Winter Storm (FEMA-1887-DR) A powerful storm struck the northeast half of the State. The storm began with rain, turning to sleet, followed by heavy snow. Winds of up to 60 mph accompanied the storm. Power lines burdened by ice after several days of heavy fog began snapping and falling. FEM Electric lost over 4,300 utility poles in Edmunds, Faulk, McPherson, and Potter Counties. Customers of 1,600 meters were without power for 13 days. One customer was poisoned from inhaling generator exhaust. FEM Electric's business and economic impacts were estimated at $40,000,000, while emergency repair and restoration costs were estimated at $10,000,000. High winds and blizzard conditions across the eastern and north central regions of the State stalled traffic and further complicated relief efforts. Interstate 90 was closed from Chamberlain to the Minnesota border. Interstate 29 was closed from Sioux Falls to the North Dakota border. An estimated 7,600 customers across South Dakota were without power. Some phone systems also experienced outages. At least 31 emergency shelters were open across the hard-hit regions. Indian reservations were hit especially hard. The Cheyenne River Sioux Tribe had a breakdown at the water treatment plant as a result of the storm that left many residents without potable water.
December 23-27, 2009	Severe Winter Storm (FEMA-1886-DR) A powerful winter storm blanketed the entire State. The entire interstate highway systems were shut down for an extended period across South Dakota. Winds gusted as high as 76 mph in western South Dakota Preliminary storm totals from the State Climatologist across the State from the Christmas blizzard indicated that the large majority of the State received over 10" of snow in the storm with 20" or greater amounts in the southeast (Marion-Vermillion-Yankton), northeast (Sisseton and Clear Lake), central (Kennebec and Murdo) and northwest (Perkins County). The northern Black Hills recorded 40-50". The statewide average was 15.4". This would place it as one of the top few storms for snowfall totals statewide.
March 23-34, 2009	A powerful spring storm brought rain, snow, and very strong winds to western South Dakota. Precipitation started as rain, then changed to snow, and blizzard conditions developed. The heaviest snow fell over the northern Black Hills, where 18 to 48 inches of snow was measured. Ten to 20 inches of snow fell across far northwestern South Dakota, with drifts as high as ten feet. Most other locations received at least six inches of snow. Sustained winds of 30 to 55 mph, with gusts over 80 mph, were reported. Interstate 90 and other highways were closed for more than 24 hours. Some power outages were reported, mainly across the northern Black Hills and

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	northwestern South Dakota. Tens of thousands of livestock perished. Damage estimates were slated in the millions.
November 5-7, 2008	An intense fall storm brought heavy snow and gusty winds to much of the Black Hills. The heaviest snow fell across the northern Black Hills as upslope-enhanced snow fell for many hours. Snowfall amounts ranged from only a few inches across the southeastern slopes of the Black Hills to near five feet from Cheyenne Crossing to Lead and Deadwood in the northern Black Hills. The next day, a strong area of low pressure moving across South Dakota and into Minnesota brought widespread rain, freezing rain, and snow to central, north central, and northeast South Dakota. Much of the freezing rain fell across central and north central South Dakota west of the Missouri River. As the freezing rain changed over to snow and the winds increased, the ice and snow buildup on the power lines and poles caused hundreds of power poles to break across Jones, Stanley, Dewey, and Corson Counties. East of the Missouri River, the colder air and stronger winds moved in changing the rain over to snow. Strong winds of 30 to 45 mph with gusts near 60 mph brought widespread blizzard conditions to all the area. Ice buildup from the freezing rain ranged from a tenth to as much as an inch for counties west of the Missouri River. Snowfall amounts across the entire area generally ranged from 2 to 8 inches with a 15-inch amount recorded in southwest Corson County. Some of the snowfall amounts included: 3 inches at Eagle Butte, Blunt, Kennebec, Mission Ridge, and Onida; 4 inches at Pollock, Gettysburg, and Bowdle; 5 inches south of Harrold, Iona, and near McIntosh; 6 inches at Mobridge; 7 inches at Murdo; 8 inches at McLaughlin, and 15 inches southwest of Keldron. All 4,600 customers of the Moreau-Grand Electric company lost power due to the storm. The last time this occurred was during the winter of 1967-68. The monetary loss to this cooperative and other electric cooperatives for Jones, Stanley, Corson, and Dewey Counties was in the hundreds of thousands of dollars. There were over 100 line workers working countless hours with crews coming from as far away as Nebraska and Iowa to assist in the power recovery. Over 1,000 customers were without power for an extended period of time. Cell phone coverage was also knocked out for parts of the West River area due to downed towers. The blizzard resulted in numerous schools, business, and road closures along with flight cancellations. Interstate-90 was shut down from Mitchell, South Dakota to the Wyoming border from Thursday the 6th until Friday evening of the 7th. Many semi-trucks and cars were stranded along the interstate with many people being rescued. Many travelers took shelter in Murdo, Chamberlain, and Pierre until the interstate reopened Friday evening. There were also several accidents across the area with a serious accident in Walworth county on Highway 83 near the Potter county line. In the early afternoon hours of Friday, the 7th, slippery roads, high winds, and low visibilities contributed to the rollover of a passenger van carrying seven students. The passenger van rolled several times causing serious injuries to three of the students. Also, a semi-truck rolled over on an icy and snowy Highway 45 south of Miller in the late afternoon hours of the 6th. The driver received minor injuries. The governor declared a state of emergency on the 7th, and President Bush declared South Dakota a disaster area.
April 25-26, 2008	A strong low-pressure area brought widespread heavy snow of 6 to 20 inches to most of northeast South Dakota for much of the 25th and into the early morning hours of the 26th. The precipitation began as light freezing rain in the early morning across parts of the area before changing to all snow by mid-morning. As the low-pressure area intensified, snowfall rates and the north winds also increased. The heavy snow combined with the strong winds created widespread visibility problems along with large snowdrifts. Snowfall amounts included, 6 inches at Andover, Britton, Gann Valley, and 15 miles south of Miller, 8 inches at Roy Lake, 9 inches at Clark, Big Stone City, Hillside Colony, and Sisseton, 10 inches 7 miles south of Bristol, and 11 inches at Hayti. Locations with a foot or more of snowfall, included 12 inches at Wilmot, Webster, and Waubay, 13 inches at Milbank, 15 inches at Castlewood, 16 inches near Victor, and near Summit, 17 inches at Clear Lake, 19 inches at Watertown, and 20 inches at Bryant. There were a number of automobiles that went into the ditch along with many other automobiles

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	damaged in accidents. Many stranded motorists had to abandon their vehicles in the hardest hit areas. Travel was not advised across the entire area. A school bus slid into a ditch east of Castlewood with no injuries occurring. Interstate-29 was closed from 3 pm the 25th until 3 pm on the 26th from Brookings north to the North Dakota border. In addition, South Dakota State Highway 12 was closed from Webster to the Minnesota line from the afternoon of the 25th until the late morning of the 26th. Most counties affected by the storm opened emergency shelters when Interstate 29 was closed to house stranded motorists. Also, many schools were closed across the area. The very heavy snow set several records across the area. The 19 inches at Watertown broke its all-time 24-hour snowfall record of 16 inches. Both Victor and Clear Lake had their second highest snowfall ever recorded in a 24-hour period. Watertown, along with several other locations in northeast South Dakota, received near record or record snowfall for the month of April. In fact, Watertown's 29.5 inches of snow for the month of April was almost their seasonal normal snowfall. This event was also declared a disaster by the President.
March 1, 2007	In southeast South Dakota, four to eight inches of snow was accompanied by sustained winds of over 30 mph at times with gusts over 40 mph. The combination of new snow, wind, and existing fresh snow cover resulted in a blizzard with widespread near zero visibilities. Drifting snow made travel extremely difficult to impossible. As a result, some who did attempt to travel became stuck or slid off roads. Schools and school activities were cancelled, and numerous businesses closed.
April 18-20, 2006	Severe Winter Storm (FEMA-1647-DR) The strongest storm of the 2005-2006 winter brought heavy, wet snow to northwestern South Dakota and the Black Hills and heavy rain across southwestern and south-central South Dakota. Reported snow totals included 10 to 24 inches in northwestern South Dakota, 16 to 30 inches in the Bear Lodge Mountains, 40 to 70 inches in the northern Black Hills, 74 inches in Lead, and 55 inches in Deadwood. Fifteen-foot drifts were reported on the plains of northwestern South Dakota. Source: NWS Rapid City
November 27-29, 2005	Severe Winter Storm (FEMA-1620-DR) This storm brought snow and ice to the State. It was one of the worst ice storms in the State's history. Snowfall accumulations in central South Dakota ranged from 2 to 20 inches. Strong northwest winds of 30 to 50 mph with gusts to 70 mph caused widespread blizzard conditions. Visibilities were reduced to zero across the area with snowdrifts of 5 to 10 feet high in some places. Freezing rain occurred before the snow in some areas coating objects with up to three inches of ice and causing power outages. Some power lines were also brought down by snow and ice accumulation and high winds. Tens of thousands of households and businesses lost power from one day to up to two to three weeks in some rural areas. One electric cooperative said it was the worst damage they had in their 65 years of existence. Bon Homme Yankton Electric Association had 455 broken poles, 82 cross arms, and numerous line breaks. 509 customers were affected. The last line was turned on 8 days after the start of the storm. Consumers experienced roughly 118.1 hours or 4.9 days without power. Emergency repair and restoration costs were estimated at $352,323 with $282,538 in federal and state disaster relief funding. Many roads, including Interstates 90 and 29 were closed due to the treacherous travel conditions. Several accidents occurred during the storm, killing two and injuring others. Many motorists were stranded. Several people had to be rescued. Air traffic was also brought to a halt across much of the area. Schools, businesses, government offices, and many other organizations were closed. Minor damage was caused to homes and vehicles by the strong winds and by windblown debris, mainly from trees. A 79-year old man died from exposure in Douglas County. Source: NCEI and SHMT
April 2000	Winter Storm (FEMA-1330-DR) From April 19-20, a severe spring storm consisting of rain, heavy snow, and very high winds struck seven western counties of South Dakota. The storm’s greatest impact was on the

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	electrical power system. One to three feet of heavy, wet snow coupled with ice and high winds caused significant damage to three rural electric cooperatives, resulting in widespread power outages to homes and businesses. The power providers reported that over 1,500 power poles were damaged or destroyed. Eligible damage to public infrastructure was estimated at approximately $2,500,000.
April 1997	An ice storm that affected Edmunds and McPherson Counties damaged 400 utility poles and caused 1,500 wire breaks. FEM Electric customers on 600 meters were without power for seven days. Business and economic impacts of this storm were estimated at $3,000,000 and emergency repair and restoration costs were estimated at $1,000,000.
January 1997	Severe Winter Storms/Blizzards (FEMA-1156-DR) All counties were declared disaster areas. Twice in a seven-day period in early January, cold Arctic air swept down and “froze” the State. The governor closed the interstates for public safety. More than 36,000 head of cattle perished. Roads were blocked or covered by 20-foot drifts of snow. Fifteen days after the storm ended, some roads were still blocked by snow. The Day County highway superintendent reported 20- and 40-foot vertical drifts blocking the highway. Livestock losses, damaged buildings, and feed shortages occurred in an area called the “red zone.” This is an area of 4,722 cattle operations, 1,200 sheep operations, 1,000 hog farms, and 515 dairies along the northern third of the State west to east. The storm caused more than $30 million in damage/cleanup efforts. Three people died while trapped in vehicles along the highways. The snowmelt from this record-breaking storm was a major contributor to the flood disaster a few months later.
December, 1996	Extreme cold struck portions of South Dakota. A Summit man died from exposure to the extreme cold after his vehicle became stuck in the snow. The man attempted to walk for help and was found about one mile from his car in the driveway of a home about a mile and a half west and one mile south of Summit.
November 13-26, 1996	A slow-moving winter storm with severe snow and freezing rain entrenched itself over much of the State. The effects of the storm were felt primarily in the Black Hills and southeastern portions of the State. The storm was a result of a strong system of cold air, hovering close to the ground, with a system of warm air above. This combination made for rain, fog, and snow that quickly turned to damaging ice. The snow and ice formed and amassed on roadways, trees, electric transmission lines, and power poles. Some power lines were swollen by ice to five inches in diameter. The excessive weight and severe wind conditions snapped lines and flattened poles. Thousands of pole braces, crossarms, and anchors cracked under the heavy stress. Six rural electric cooperatives, affecting approximately 10,700 customers, experienced serious outages due to the loss of poles, braces, lines, crossarms, anchors, and substation failures. Customers were without power in subfreezing temperatures for several hours to several days. The force of the storm caused major delays on Interstates 90 and 29. Portions of state and county highways and roads were closed for an extended period of time due to heavy ice and snow accumulation and extremely poor visibility.
October 22-24, 1995	Ice Storms (FEMA-1075-DR-SD) Between October 22 and 24, 1995, a severe autumn snow and ice storm caused widespread damage in South Dakota. Effects of this storm were felt first in the Black Hills. Portions of the hills received up to 22 inches of snow. As the storm moved across South Dakota, ice and 5 to 15 inches of wet snow covered trees and electric lines and poles. Winds associated with the storm caused lines to slap together and poles to fail, producing widespread power outages to large portions of rural South Dakota. Tree damage also led to significant damage to electrical utilities. Thirteen rural electric cooperatives reported damage from this storm. The cooperatives lost nearly 9,500 poles and 170 transmission lines. Damage was estimated at $10 to $10.3 million to rural electric infrastructure only. Approximately 30,290 households were affected by the power outages. Crews from electric cooperatives in South and North Dakota, Minnesota, Iowa, and Nebraska assisted local cooperatives with line repairs.

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	The power outages also caused several rural water system pumping stations to go off-line, causing a loss of water utilities to members of rural water systems. The National Guard provided generators to power these pumping stations to restore water service. This storm also forced major transportation delays as portions of Interstates 90 and 29 had to be closed because of the snow accumulation on the roadway and poor visibility. One of these interstate closings led Davison and Codington counties to initiate their sheltering plans for travelers who could not find rooms at local motels. The storm also caused numerous cancellations and delays in school openings because of travel conditions or the lack of power. Interstate traffic was restored by early October 24. Twenty-eight counties were included in the disaster declaration: Aurora, Beadle, Bon Homme, Brookings, Brule, Buffalo, Charles Mix, Clark, Codington, Davison, Day, Deuel, Douglas, Grant, Gregory, Hamlin, Hanson, Hutchinson, Jerauld, Kingsbury, Lake, McCook, Marshall, Miner, Roberts, Sanborn, Spink, and Tripp Counties.
January–February 1995	Severe Winter Storms (FEMA-1045-DR) Damage to electric power lines in 21 counties was caused by an unusually foggy January weather. Continuous fog in many areas resulted in a heavy crust of ice forming on many of the power lines in central South Dakota. The fog-crust was reported to be three to five inches in diameter. The addition of high winds caused power poles to snap. Deep drifts of snow made it difficult for power company linemen to gain access to the damaged power lines, and in many areas, county snow removal equipment was required to provide access. According to reports, 13,435 households were without power for varying periods of time. The maximum time without power was 12 days. Early damage was estimated at more than $3.2 million. More than 1,700 power poles had to be replaced.
November–December 1983	Weeks of subzero temperatures preceded the actual blizzard and set the stage for the deadly combination of cold, blizzard conditions, and loss of electrical power. A series of winter storms struck South Dakota in late November and throughout December. The impact was felt statewide, but it was particularly heavy on the Rosebud and Pine Ridge reservations. Cheyenne River, Lower Brule, and Crow Creek reservations were also affected, but to a lesser degree. Many of the Rosebud and Pine Ridge communities had propane fueled/heated homes. At the height of the storms, reservation roads were drifted closed and became impassible. A fuel shortage occurred when the weeks of subzero temperatures drained propane tanks faster than normal. Tribal governments opened community shelters for those who could make it to the shelters. As conditions worsened, fuel contractors could not start their delivery vehicles and roads were increasingly impassible. County and tribal government snowplows were overwhelmed by the enormity of the task. One death resulted from these storms.
October 9, 1981	The entire Black Hills area was virtually paralyzed by three to six feet of heavy snow and 40 to 70 mph winds. Roads were totally blocked, trees and power lines broken, and some homes sustained heavy damage. Not only were the northern hills residents isolated, but some were also without water and power for at least three days, causing food spoilage.
March 29, 1981	A winter storm front created a tornado near Martin, which destroyed a mobile home and injured one occupant. By 3:00 a.m. on March 30, the storm was generating 50 to 80 mph winds and dumping up to 10 inches of heavy, wet snow in the northwest. Power lines and at least 1,500 poles in the northwest were snapped after being coated with one to six inches of ice. Strong winds also snapped power lines and poles in south central South Dakota. These winds overturned trucks and cars along Interstate 29. The winds also overturned a railroad tank car, spilling phosphoric acid. This accident forced the evacuation of part of Garretson.
January 1981	A series of storms blocked the majority of roads in eastern South Dakota, overturned vehicles, and stranded hundreds of motorists. The severity of these storms caused four deaths in vehicles stalled in the deep snow.
1977	February, March, and November were especially active months for winter storms. Many rural roads were blocked with snow drifts six to eight feet high. Interstate 90 was often blocked and up to 100 cars were stranded. Six people died as a result of these storms. In addition to power

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	outages reported in various part of the State, the March storm dropped over an inch of rain in the eastern part of the State and generated walnut size hail in Grant County. In November, a winter storm toppled a 1,400-foot television tower and derailed six freight cars.
January 1975	Of the two blizzards in 1975, the one on January 11 and 12 was the worst. High winds exceeding 60 mph, subzero temperatures, and heavy snow combined to produce killer conditions. Several people died, and thousands of head of livestock perished in eastern South Dakota.
March 1969	Heavy snowfall and high winds knocked out power in the Aberdeen area. Rural residents were hard hit as blocked roads prevented early power line repair. The Belle Fourche area also sustained loss of power and phone service as hundreds of poles were knocked down.
March 1966	This storm moved into eastern South Dakota and remained stationary for 12 hours. Winds of 60 to 70 mph were common. Gettysburg had gusts up to 100 mph. The driving wet snow clung to the mouths of livestock and they suffocated. Cattle and sheep loss approached 100,000 animals with a value of nearly $20 million. Many towns suffered physical damage from the storm. A total of 380 people in Pierre had to be evacuated as the result of a power failure. Many towns lost phone service, and some communities had windows shattered by high winds, allowing snow to drift into buildings. A 121-car train was completely stopped by snow drifts. This storm killed 10 people.
December 1965	An ice storm destroyed an estimated 3,500 telephone poles in the Aberdeen area. Damage was nearly $650,000. Total damage to light and power systems approached $1 million. At the time, this was the worst ice storm experienced in 40 years.
January 1952	The temperature dropped from 40°F to -8°F in a short period of time. The wet, driving snow clung to everything. Cattle were blinded and suffocated as snow covered their mouths and noses. Young country school children lost their way home and died of hypothermia. A few ranchers died when they tried to gather their livestock. Snow piled up to a point that people could walk along tops of power lines. In some isolated areas, people were snowed in for four months off and on throughout the winter. Planes were used to deliver mail, groceries, fuel, and feed for livestock. Snow track vehicles were used to transport doctors to isolated farm areas.
January 1949	A blizzard affected the entire State. Blizzard conditions existed for weeks rather than days. The general weather conditions were low temperatures (-2°F to -8°F), heavy snows (24 inches for the month), and winds from 40 to 73 mph. Towns and rural areas were completely isolated as the snow blocked up everything. Roads, railroad tracks, and buildings were buried under tons of snow. People were lost in the storm and many cattle were frozen. Airplanes were used to deliver food, fuel, and medicine to stranded people. Snow was very deep in western South Dakota. Pictures of the area showed drifts 35 feet high and several thousand feet long.
1943	A blizzard killed a large number of cattle.
1927	A blizzard killed a large number of cattle.
May 1905	A blizzard hit western South Dakota counties in May. Cattle wandering around in the blizzard walked off the bluffs in the Badlands area and fell to their death. Estimated cattle loss exceeded 16,000.
January 12, 1888	A blizzard was preceded by 10 days of cold, snowy weather, 8 to 10 inches of new snow, and a low temperature of -28°F. The weather warmed on January 11 and 12; it was foggy and about 32°F. The temperature dropped on the afternoon of January 12 to -20°F in five minutes. The wind blew so strongly that it knocked people off their feet. Many children, sent home from school, did not make it home. The blizzard was so withering that people lost their sense of direction and wandered about until they died of hypothermia (exposure). Thousands of head of livestock and wild animals perished. Many buildings were covered with snow or destroyed, and all transportation stopped. Although the storm lasted less than one day, an estimated 400 people died throughout the Dakotas, 174 of which were in South Dakota.

Source: NCEI unless noted otherwise

Probability of Future Occurrence

According to the NCEI Storm Events Database, there were 2,136 winter storms (snow and ice events) recorded in South Dakota between January 1993 and December 2021, and 499 extreme cold events from January 1994 to December 2021. On average, South Dakota experiences 76 winter storms and 18 extreme cold events each year. During the same time period, 20 deaths and 127 injuries were attributed to these events. This suggests that South Dakota can expect approximately 1.4 deaths and five injuries each year. Based on this information, the probability that at least one winter storm will occur in South Dakota in any given year is 100 percent.

The following figures compare the annualized frequency, or the estimate likelihood of future cold wave, ice storm and winter storm events by county between 1996 and 2019. The figures are based on data from the NRI developed by FEMA and the number of recorded cold wave and winter storm occurrences per year over the 23-year period of record from the NRI. Because cold wave and winter storm events can occur over several days or in a single day the event-basis was used to estimate annualized frequency. Ice storm used a similar method but used an estimated number of occurrences in event-days each year for a specified area over the period of record of 23 years. In the map legend of each figure below the estimated annualized frequency by county is described.

Based on the NRI analysis, in terms of cold wave Figure 3-38, counties in the northeastern portion of state have a higher probability of an event occurring compared the rest of the state. Counites with the highest probability include Edmunds, Brown, Marshall, Day, Roberts, and Grant. Of these, only Brown County ranks among the top 10 counties in numerical population increase 2010-2020 (#7, Table 3-10). In terms of ice storms Figure 3-39) the southeastern portion of the State has a higher probability of an ice event. The counties with the highest probability of an ice event include Minnehaha, Turner, Lincoln, and Union. In this case, Minnehaha County ranks #1, Lincoln County #2, and Union County #5 in numerical population increase. Minnehaha, Lincoln, and Union Counties are also the #4, #1, and #3 fastest growing counties by percent growth (Table 3-11).The frequency of winter storm events Figure 3-40 is more distributed across the State compared to cold wave and ice storm events, although Lawrence County, located in the Black Hills Region and the 9th fastest growing in terms of both numerical population increase and percent increase, stands out as having the highest frequency of winter storm event in the State.

This distribution of winter storm hazards corresponds to the areas of highest elevation (the Black Hills Region) and the areas with the greatest moisture content (the southeast corner of the State, where terrain is peppered with lakes and streams). Cold wave trends affect the northern and northeast counties more often.

Figure 3-38 Annualized Frequency of Cold Wave Events by County 1996-2019

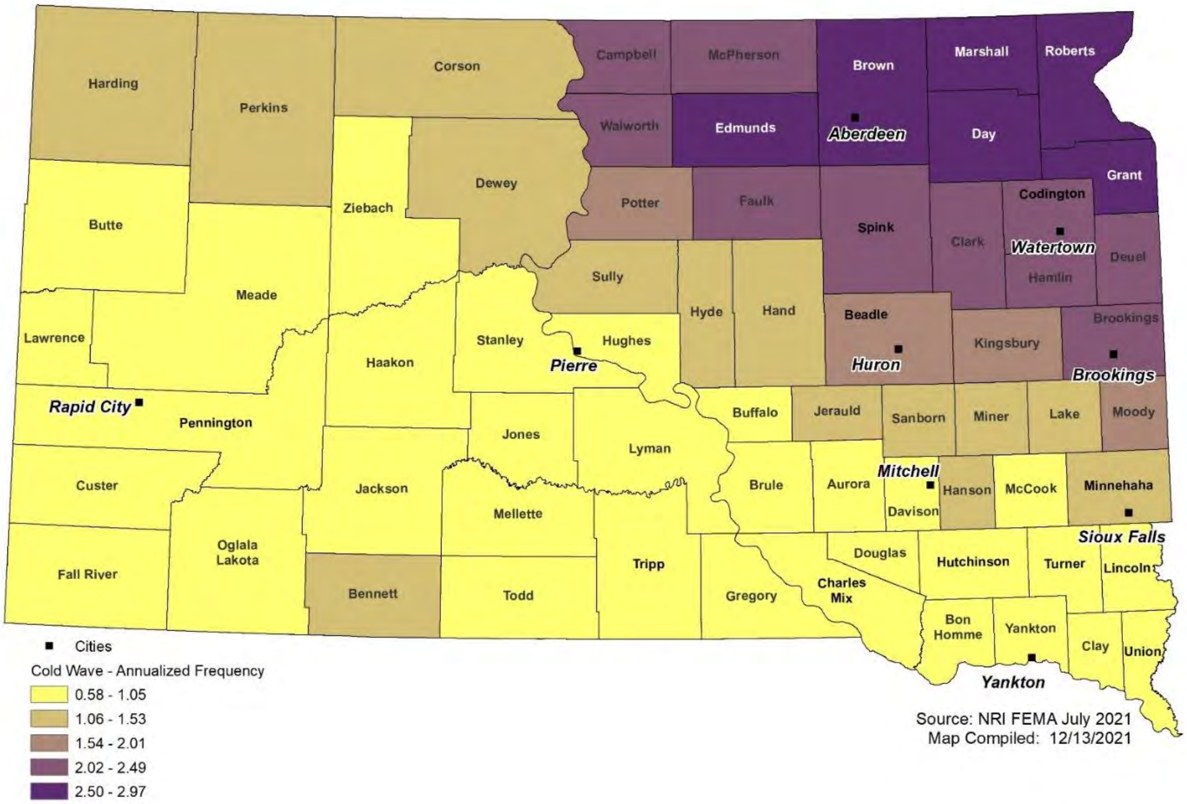


Figure 3-39 Annualized Frequency of Ice Storm Events by County 1996-2019

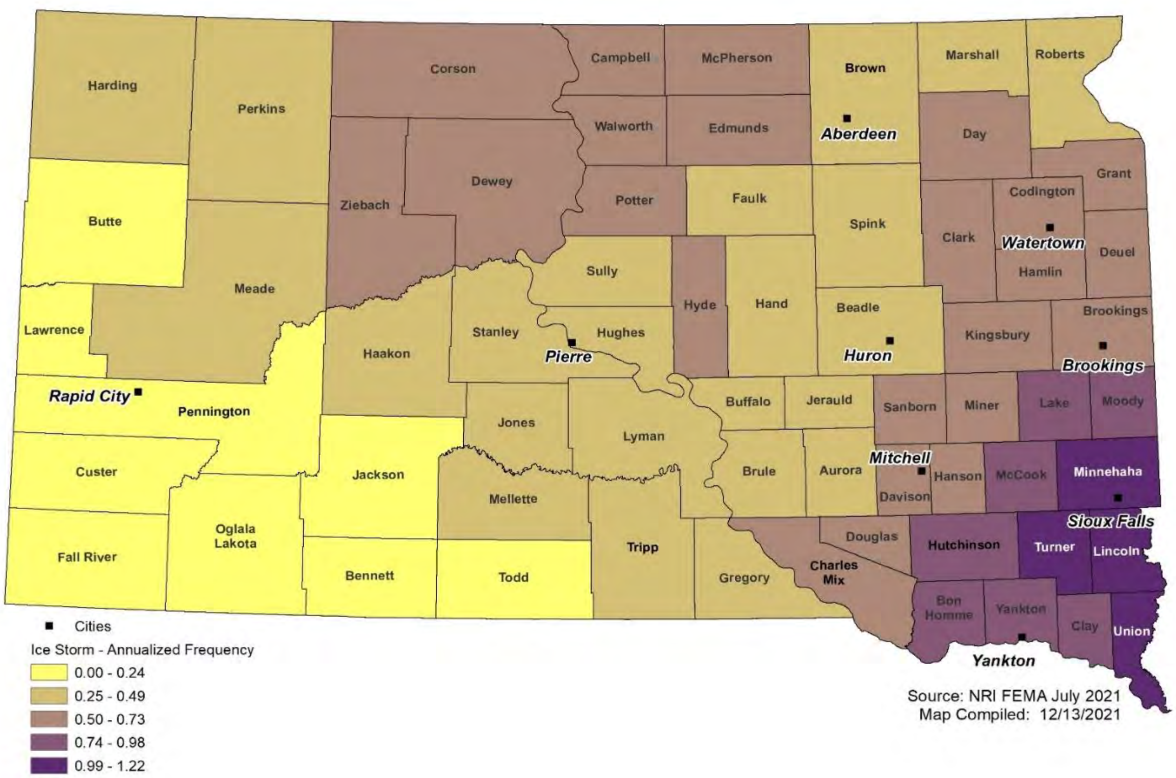
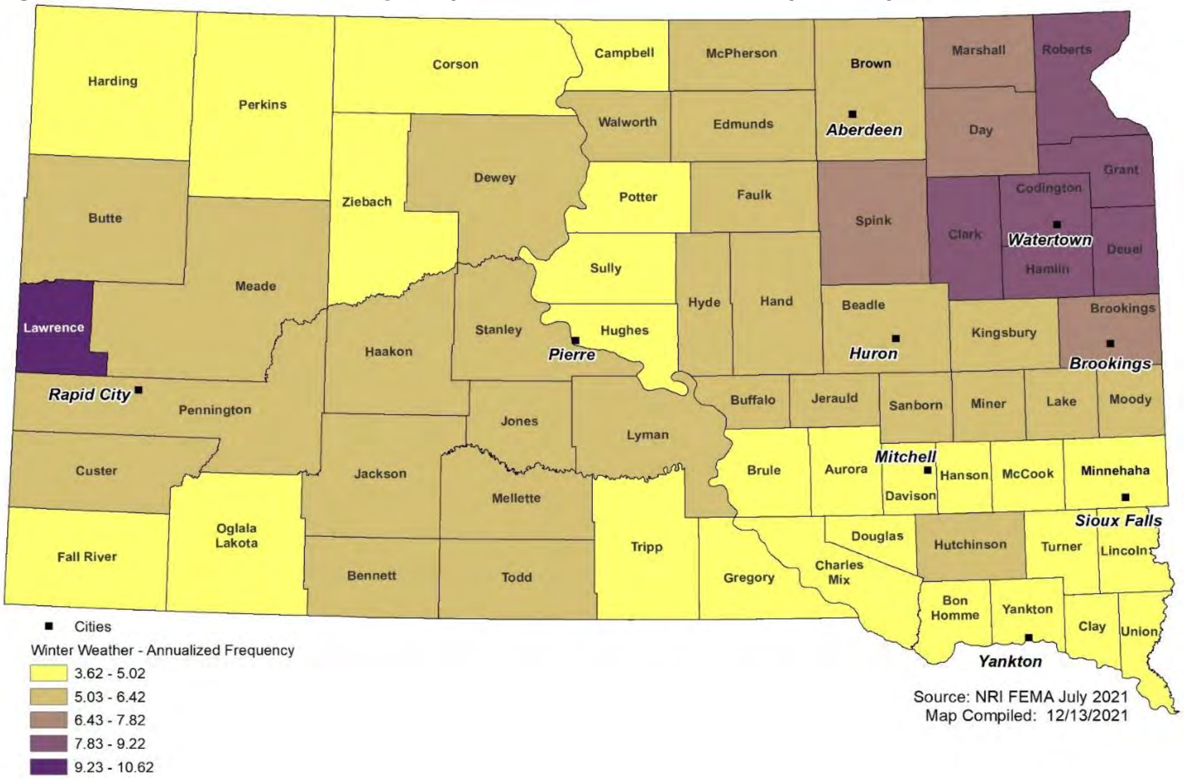


Figure 3-40 Annualized Frequency of Winter Storm Events by County 1996-2019



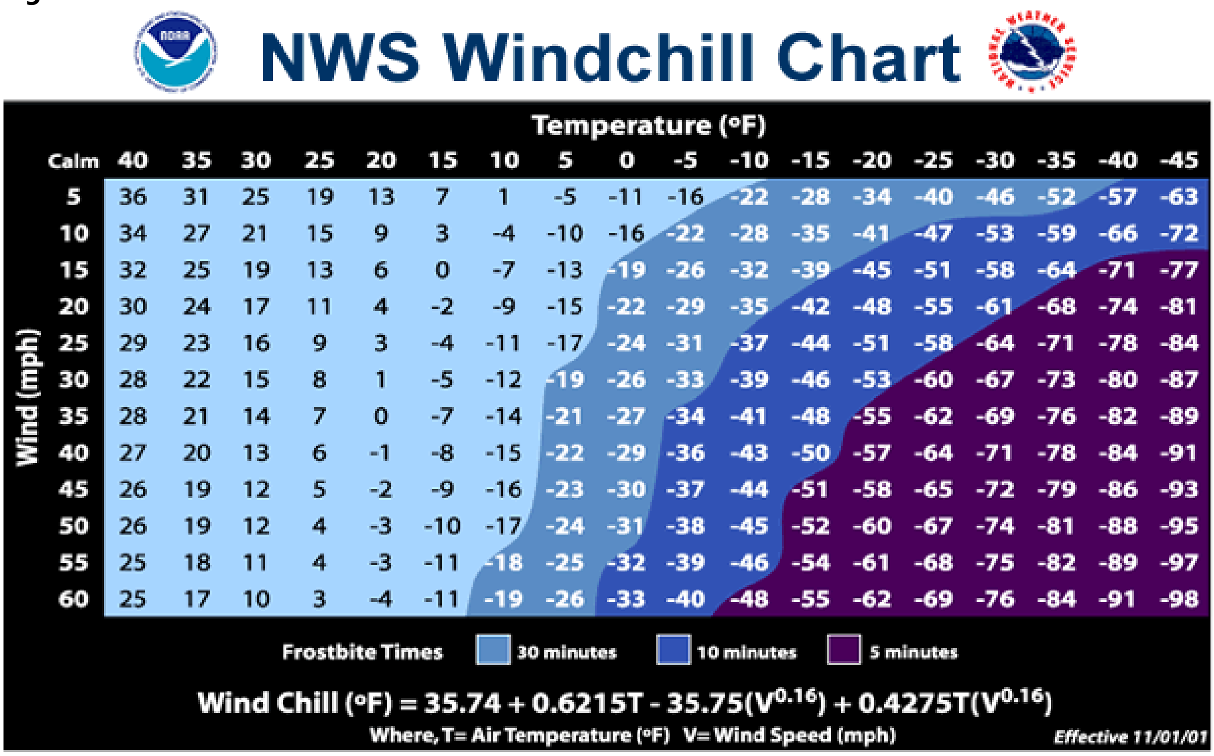
Magnitude/Severity (Extent)

The extent rating of winter storms that cause issues in South Dakota includes storms forecasted to be Winter Storm Warnings or Blizzard Warnings. The NWS issues a Winter Storm Warning when conditions that can quickly become life threatening and are more serious than an inconvenience are imminent or already occurring. Heavy snows, or a combination of snow, freezing rain or extreme wind chill due to strong wind, may bring widespread or lengthy road closures and hazardous travel conditions, plus threaten temporary loss of community services such as power and water. Deep snow and additional strong wind chill or frostbite may be a threat to even the appropriately dressed individual or to even the strongest person exposed to the frigid weather for only a short period.

The most dangerous of all winter storms is the blizzard. A blizzard warning is issued when winds of 35 miles an hour will occur in combination with considerable falling and/or blowing snow for at least 3 hours. Visibilities will frequently be reduced to less than 1/4 mile and temperatures are usually 20 degrees Fahrenheit or lower. The blizzard marks the upper extent of severe winter storms that could be experienced in South Dakota.

In 2001, the NWS implemented an updated Wind Chill Temperature index (see Figure 3-41). This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 3-41 National Weather Service Wind Chill Chart



Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Source: NWS

NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes (see table below). The RSI is a regional index; a separate index is produced for each of the six NCEI climate regions in the eastern two-thirds of the nation. South Dakota is included in the Northern Rockies and Plains Region, along with Nebraska, North Dakota, Wyoming, and Montana.[9] RSI ratings from 1 to 5 are possible in South Dakota.

Table 3-41 Regional Snowfall Index (RSI) ratings for significant snowstorms

Category	Description
1	Notable
2	Significant
3	Major
4	Crippling
5	Extreme

9 The RSI is assigned according to methods outlined in:
Squires et al. (2014) The regional snowfall index. Bulletin of the American Meteorological Society, 95(12), 1835-1848.
For more information see https://www.ncei.noaa.gov/access/monitoring/rsi/.

Winter storms and blizzards can result in multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours. This can include property damage, local and regional power and phone outages, and closures of streets, highways, schools, businesses, and nonessential government operations. People can also become isolated from essential services in their homes and vehicles. A winter storm can escalate, creating life threatening situations when emergency response is limited by severe winter conditions. Other issues associated with severe winter weather include hypothermia and the threat of physical overexertion that may lead to heart attacks or strokes. Snow removal costs can impact budgets significantly. Heavy snowfall during winter can also lead to flooding or landslides during the spring if the area snowpack melts too quickly and contribute to high ground water tables and seepage into foundations. High snow loads also cause damage to buildings and roofs.

Climate Change Considerations

The winter season is warming at a faster rate than any other season in the Northern Plains Region, and this is also true for South Dakota. Winter storms and blizzards, however, will continue to be a severe weather hazard in the State. Warmer winter temperatures could mean more ice and freezing rain events, which often impact electrical utilities and communication systems, but can also affect agricultural livestock and roads and transportation. A warmer winter climate could reduce energy consumption for heating in the long run, but there will still be some periods of exceptional cold temperatures.

The northern U.S. has experienced an increase in the frequency of large snowfall events, where other places in the country have been decreasing. Some analyses have shown an increase in winter storm frequency and intensity, with storm tracks moving northward since 1950. There remains some uncertainty in projections for the coming decades, but the rising trend of extreme precipitation events in general (including winter season) will continue to be a hazard. According to the Fourth National Climate Assessment, rising temperatures in the Northern Great Plains have resulted in shorter snow seasons and rapid melting of winter snowpack. Changes in climate conditions will also make other atmospheric conditions to become less predictable. The polar vortex is the large areas of low pressure and cold air that is constrained by a strong polar just keeping it near North Pole. The increasing in temperature difference between the mid-latitude and polar regions, weakens and destabilizes the polar jet stream allowing it to dip into lower latitudes brining extreme polar cold into the continental United States. South Dakota experienced a polar vortex event in February 2021.

Vulnerability Assessment

While all counties in South Dakota are vulnerable to winter storms, the more developed areas, represented by greater building values and higher population densities, will generally have greater costs for snow removal and functional downtime as a result of loss of utility services. The counties with greater developed areas may have the capacity to absorb those costs more than the rural areas.

In order to analyze the State's vulnerability to winter storms, the NRI was used as a tool. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. This composite risk rating for cold wave, ice storms and winter storm is illustrated in Figure 3-42 through Figure 3-44 below

Figure 3-42 NRI Cold Wave Risk Rating by County in South Dakota

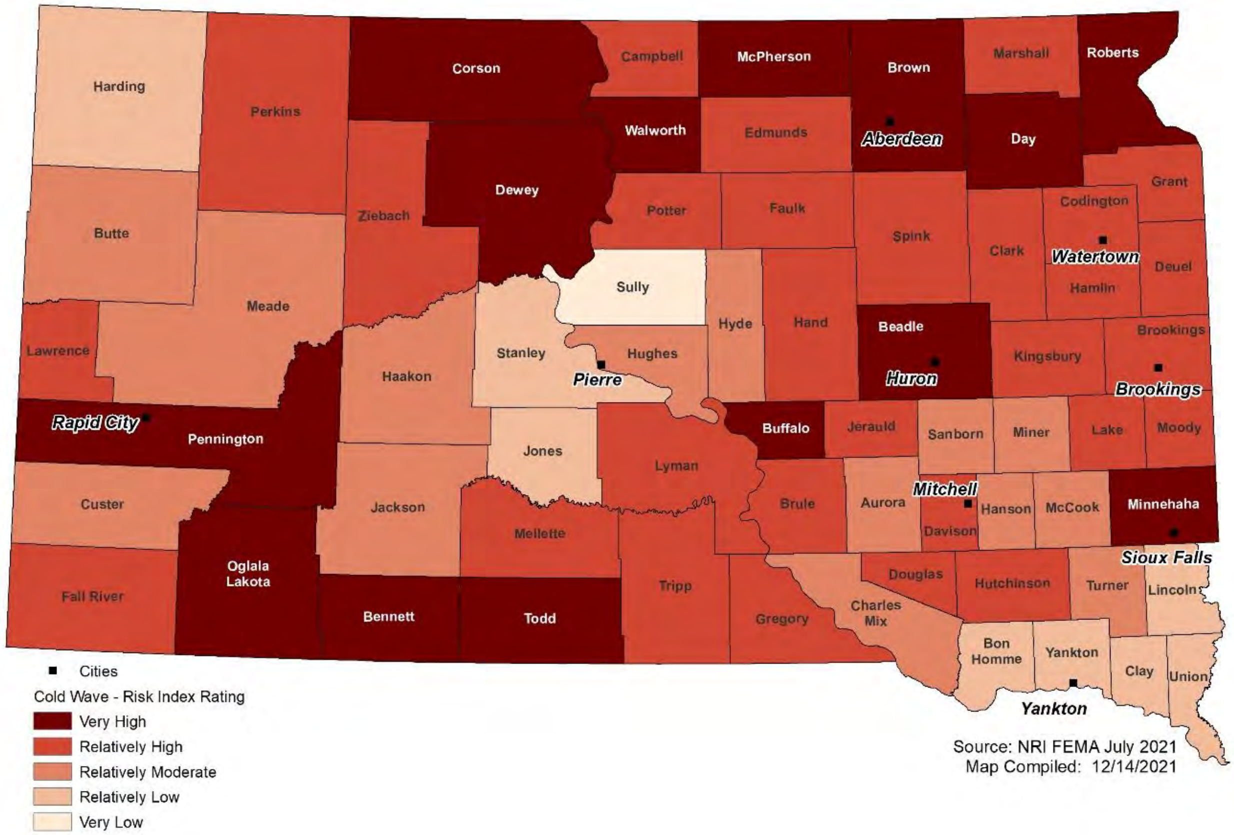


Figure 3-43 NRI Ice Storm Risk Rating by County in South Dakota

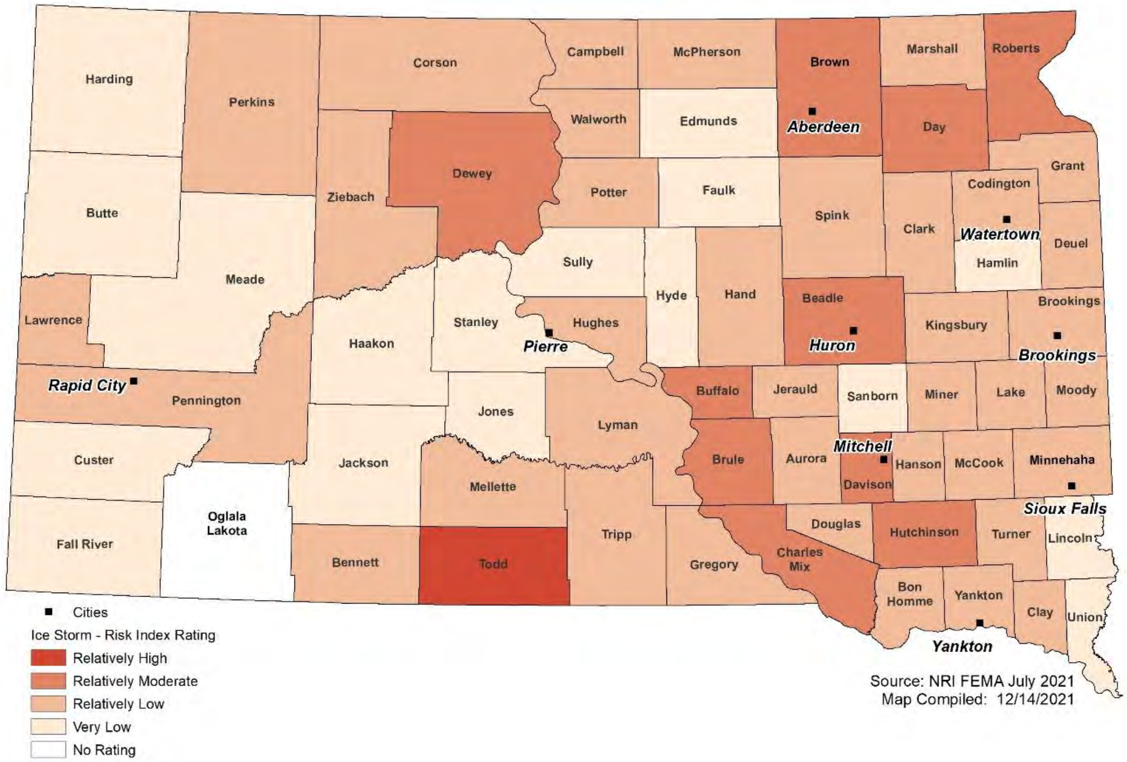
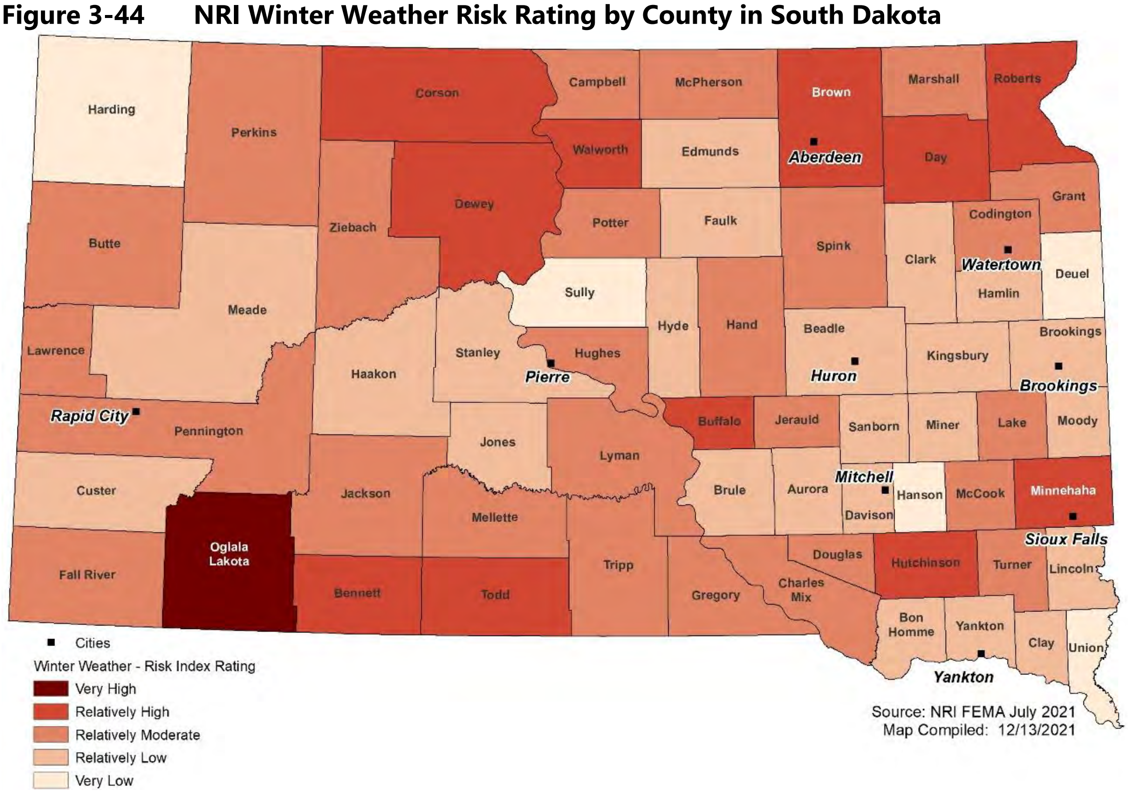


Figure 3-44 NRI Winter Weather Risk Rating by County in South Dakota



People

Some segments of the population are more vulnerable to winter storm hazards. This is especially true if indirect impacts of severe winter storms are considered, particularly the loss of electrical power. As a group, the homeless are particularly vulnerable. The elderly or disabled are also more vulnerable, especially those with home health care services that rely heavily on an uninterrupted source of electricity. Resident populations in nursing homes or other special needs housing may also be vulnerable if electrical outages are prolonged. As noted under Section 3.3.3 Summer Storm, statewide an estimated 9,922 Medicare Beneficiaries or 5% of total Beneficiaries (183,640) rely on electricity to live independently in their homes. Rural residents and agricultural operations are often vulnerable to prolonged power outages that impact heating and especially the operation of pumps to recover water from wells.

Severe winter weather also increases the vulnerability of the commuting population. While there is no way to quantify which of these accidents occur during severe winter storms versus regular winter storms, the numbers indicate that winter driving conditions raise the vulnerability of the commuting population.

According to the NCEI Storm Events Database South Dakota experiences an average of 76 winter storm events and 18 extreme cold events annually. Each year South Dakota can expect approximately 1.4 deaths and 127 injuries due to winter storm and extreme cold events.

Analyses that evaluate where vulnerable populations exist, and why they are vulnerable, are limited in local HMPs. Likewise, there is room to improve the understanding of how climate change and development will affect vulnerability to winter storms. The role of the SHMP update is to evaluate local HMPs and identify gaps such as these.

Property

Property vulnerabilities to severe winter weather include damage caused by high winds, ice, or snowpack and subsequently melting snow. Vehicles may be damaged by the same factors, or temporarily un-useable due to the driving conditions created by severe winter weather. Contents of homes, storage units, warehouses and storefronts may be damaged if the structures are compromised or fail due to the weather, or during potential flooding caused by melting snow. Very wet snowpack is very heavy. This may create strains on structures, causing partial or entire collapses of walls, roofs, or windows and cause tree limbs to damage buildings and overhead utilities. This is a factor of both by architecture and construction material and should be assessed on a building-by-building basis. These records are probably tracked via insurance or other private vendors.

Agricultural operations including crops and livestock are also highly vulnerable to severe winter storms.

To estimate potential losses to winter storms, historic loss data was analyzed. The NCEI data did not lend itself to county-by-county loss summaries, only a statewide summary, due to data tracking by forecast zones. According to the NCEI, there were 2,136 winter storms (snow and ice events) in South Dakota between January 1993 and December 2021, and 499 extreme cold events from January 1994 to December 2021. Total property damage for these events is estimated at $105 million dollars. This suggests that South Dakota averages 76 winter storms and $3.7 million in winter storm losses annually,

Figure 3-45 through Figure 3-47 shows the EAL rating due to cold wave ice storm and winter storm events for all South Dakota counties. Using data from the NRI tool, the EAL ratings are calculated using the annualized frequency and historic loss ratio for each county. With the exception of Charles Mix, Bon Homme, Yankton, Clay and Union Counties, the remaining counties in the State ranked within the relatively moderate to very high rating for expected annual losses in terms of cold wave events. Expected annual losses due to ice storms rates is relatively low to relatively moderate statewide. Brown and Minnehaha are the only counties that rate as very high expected annual losses due to winter storms, likely due to the larger populations in these areas and more development compared to the rural areas of the State. Brown and Minnehaha Counties also happen to be the #7 and #1 fastest growing counties in South Dakota by numerical population increase (Table 3-10).

Figure 3-45 Expected Annual Losses due to Cold Wave Events by County

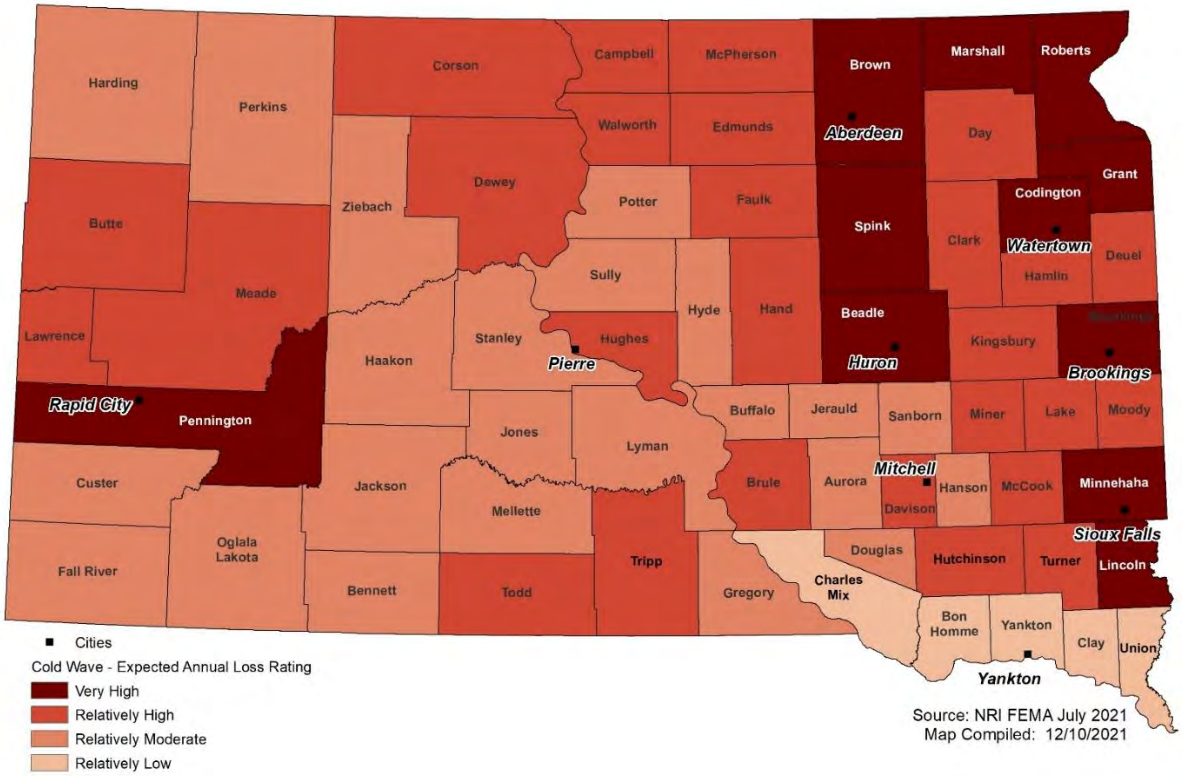


Figure 3-46 Expected Annual Losses due to Ice Storm Events by County

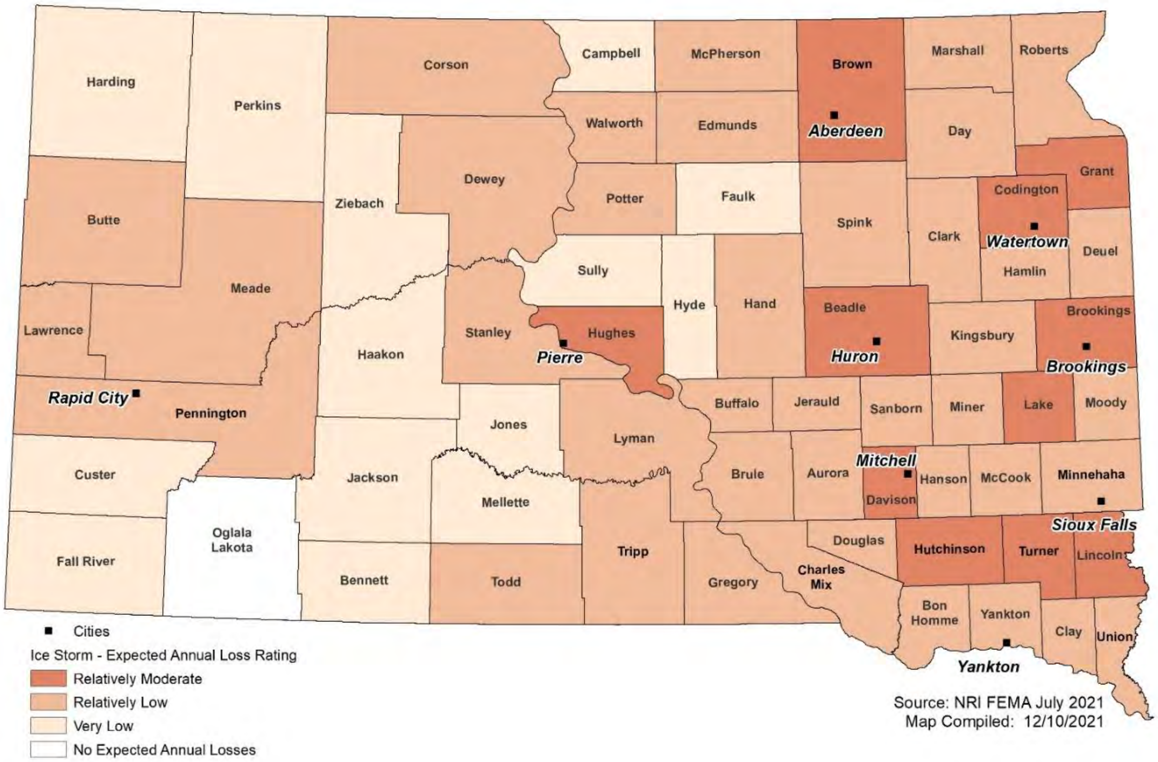
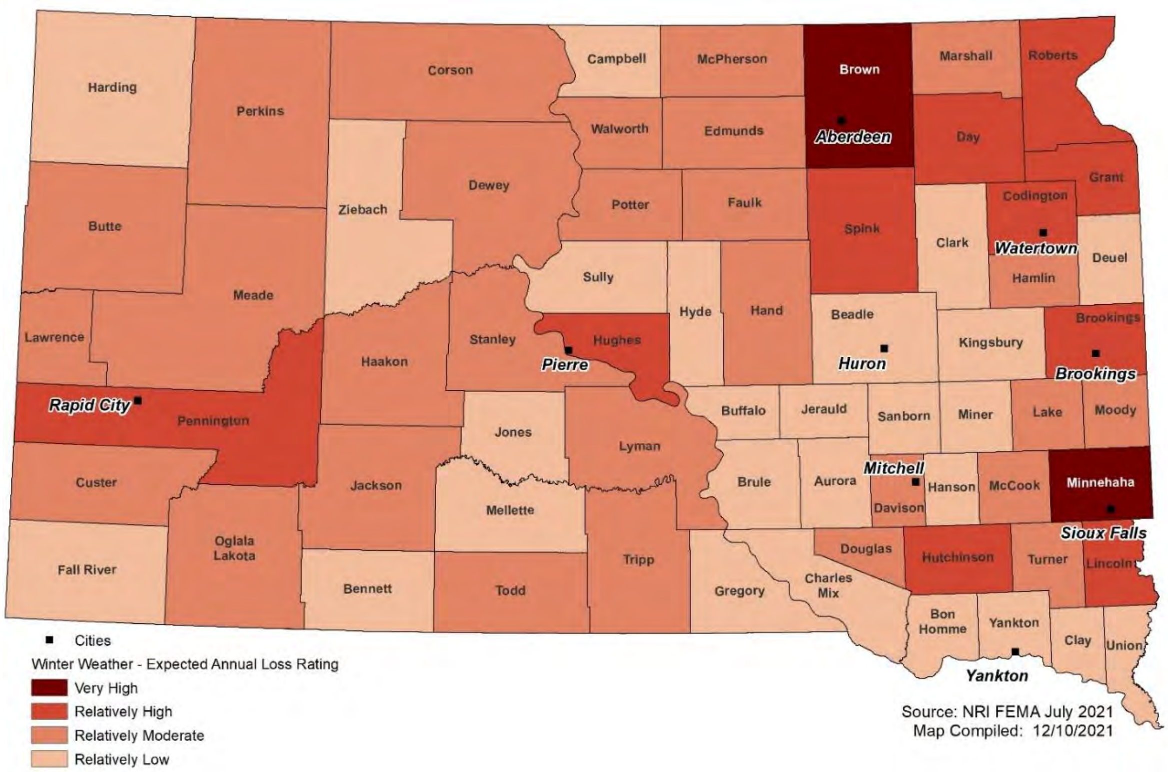


Figure 3-47 Expected Annual Losses due to Winter Storm Events by County



State Assets, Critical Facilities, and Infrastructure

The *Property* subsection, above, provides some insight to the hazards that affect state assets and essential infrastructure. Most significantly, severe winter weather may disrupt the services provided by essential infrastructure, including utility delivery (gas, electric and water), telephone service, emergency response personnel capabilities, road plowing, and childcare availability. Ice storms or high winds in winter storms can cause extensive loss of overhead utility lines due to build up either on the lines or on adjacent trees that either collapse due to the weight or blow down onto the utility lines. Undergrounding of electric utility lines to increase power grid resiliency has been a priority of many rural electric cooperatives in South Dakota (see Rural Electric Cooperative section). Severe winter storms may even halt the operation of an area for periods of time, making the vulnerability of the counties even higher. As mentioned previously, ice or heavy accumulations of snow, particularly when blowing and drifting, can temporarily impact the State and local roadway system.

During the 2013 October blizzard, record amounts of snow developed on the SD Game Fish and Parks McNenny Fish Hatchery west of Spearfish. The excessive amounts caused the roof to fail and collapse. FEMA Public Assistance funding was used for the repairs. Fortifying state assets that are particularly vulnerable to winter storm hazards has historically been done on a case-by-case basis or is implicitly included in maintenance and facility management.

Putting a specific dollar value on vulnerable state assets is possible, in the sense that winter storms can affect any part of the state, which makes all state assets vulnerable. Section 3.2.1 and especially Table 3-5 provide the total value of state assets. While all parts of the state are vulnerable, in the sense they are exposed to winter storm hazards, there is variability in that exposure. This is described at length in the section above titled, *Location*.

Not all assets are equally likely to be damaged if exposed to winter storm hazards. However, it is possible to characterize the types of assets most likely to be damaged. As described above, power distribution infrastructure such as overhead powerlines are especially likely to sustain damage from winter storms. Unfortunately, this is where a limitation exists in our knowledge.

While all parts of the state are vulnerable, in the sense they are exposed to winter storm hazards, there is variability in that exposure. This is described at length in the section above titled, *Location*.

Not all assets are equally likely to be damaged if exposed to winter storm hazards. The assets more likely to be damaged are characterized above, but there has been no successful attempt to identify which specific state assets are most likely to sustain damage from winter storms, or how this is statistically plays out in an average year. For example, it is apparent that repairing downed powerlines is relatively expensive, but quantifying even this cost is deceptively complex and has not been successfully done for the State of South Dakota.

As discussed above in the subsection titled, *Climate Change Considerations*, we can say with some confidence that climate change is increasing winter storm hazards and therefore can be expected to increase exposure of state assets. In one sense, 100% of state assets are already potentially vulnerable to winter storm hazards, amplifying these hazards can’t increase the vulnerability of state assets any further. However, increasing these hazards certainly can increase the damage sustained when assets are exposed. Expressing the impact of climate change on the statistical dollar value of damage experienced in a typical year depends on addressing the knowledge gaps described above, and then projecting increases.

Present and future development also affects damage from winter storms. It is possible to characterize the likely loss of state assets from winter storms as dependent on the value of state assets in areas likely to experience these hazards. In one sense, 100% of state assets are vulnerable to these hazards, therefore the impact of development on vulnerability is equivalent to the effect of development on the value of state assets. However, putting a dollar value on how development will affect the expected loss of state assets in a typical year runs into the same problems described above for valuing state assets likely to be damaged in a typical year.

All of this is to say with confidence that all state assets are vulnerable to loss from winter storms (see Section 3.2.1 and especially Table 3-5). However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to winter storms will be possible in future hazard mitigation plans.

Economy

South Dakota's agricultural industry is also very susceptible to losses from winter weather and extreme cold. Data was obtained from the USDA RMA's indemnity reports for 2007 through 2021. The RMA identifies several causes of loss related to extreme cold and winter weather, including cold winter, freeze, and frost. South Dakota received $152,447,135 in indemnities and lost 1,596,749 acres from freeze, frost and cold winter related events between 2007 and 2021. This averages out to $10,889,081 in winter weather-related indemnities each year.

Environment and Cultural Resources

Natural resources may be damaged by the severe winter weather, including broken limbs and trees. Unseasonable storms may damage or kill plant and wildlife, which may impact natural food chains until the next growing season. Historic structures may be more vulnerable to severe winter storms due to pre-code construction and age of structures. Cultural resources generally experience the same vulnerabilities outlined in Property, in addition to lost revenue impacts due to transportation impacts. The overall vulnerability of these resources is medium.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to winter storm hazard vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to winter storm hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to winter storm hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to winter storm hazards.

Despite gaps in the present state of knowledge, it is apparent that every county in the State is at moderate to high risk of winter storms. Despite this risk and high probability of future occurrences of a winter storm, the vulnerability to future winter storms is not likely to increase. The agricultural industry will also continue to be vulnerable to winter storms. Counties that are particularly dependent economically on crops or livestock will have a higher vulnerability to the effects of a winter storm event. Utility outages result in loss of service and direct damages and can increase risk of cold weather injuries.

All future development has the potential to be affected by severe winter storms. The vulnerability of community assets to severe winter storms is increasing through time as more people enter the certain areas of the State. Development pressures has been greatest in the southwest portion of the State which has experienced the greatest increase in housing unit development since 2010. The ability to withstand impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. The adoption of the International Building Code which is equipped to deal with the impacts of severe weather events is one tools that can help counties deal with future growth and the associated impacts of severe weather.

Table 3-42 Winter Storms Consequence Summary

Category	Narrative
Impact on the Public	Exposure risks to motorists, outdoor workers, homeless persons, general public; risk to persons with energy dependent medical needs and pre-existing medical conditions
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure function or accessibility and uninsured; impact to transportation sector and movement of goods, even if closures are not in the State itself; lost revenue to decreased business patronage or inability of workers to reach employment locations
Impact on the Environment	Tree and vegetation damage, crop damage; animal impacts
Impact on Property, Facilities, and Infrastructure	Buildings, equipment, and utility infrastructure are exposed to heavy snow and ice, sometimes complicated by strong winds; transportation system impacts; possibility of roof collapse; potential power loss and strain on energy systems; frozen pipes; limited access to or ability to maintain operations of public transportation or access to transportation hubs
Impact on the Public Confidence in Government	High expectations of government capabilities for reducing impact of snow and ice events related to transportation (roads, bridges, airports, rail); expectations for rapid power restoration
Impact on Responders	Exposure risks; adverse working conditions; buried fire hydrants
Impact on Continuity of Operations and Continued Delivery of Services	Potential loss of facilities or infrastructure function; potential loss of ability or accessibility to provide services; possible power interruption; transportation system impacts
Cascading Hazards	Wind, Floods

3.3.5. Wildfire

Hazard Description

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Wildfires can start from natural causes, such as lightning, but most are caused by humans, either accidentally or intentionally, including escaped prescribed burns. Prescribed fires, also known as prescribed burns, refer to the controlled application of fire by a team of fire experts under specified weather conditions to restore health to ecosystems that depend on fire. Wildfires can damage natural resources, destroy homes, and threaten human lives and safety.

Wildfire may be ignited by natural causes, such as lightning, or by human acts. Lightning remains a fixed element of the ecosystem, and human-caused fire risks continue to increase as more and more people move to and recreate in fire-prone wildland areas.

South Dakota has a history of damaging wildfires. The State's susceptibility to wildfire was recognized nationally in 1897 when, prompted by a series of large forest fires in 1893, President Grover Cleveland established the Black Hills Forest Reserve to protect the forests from fires (as well as wasteful lumbering practices).

Prior to 2010, years of drought along with extremely low percentages of normal snowpack in the Black Hills created the potential for catastrophic wildfires in South Dakota. 2015 was a dry year, thus wildfire risk returned. Compounding this situation is the impact of the mountain pine beetle on pine trees in South Dakota. The most common host is the Ponderosa Pine. This tree occurs on more than 1 million acres of forestland in South Dakota. When the beetle population is very low, only stressed or weakened trees, such as those struck by lightning or stressed by drought, are colonized. However, approximately every ten years the beetle population increases, and the beetles begin colonizing healthy as well as stressed trees. The South Dakota Department of Agriculture (SDDA) reported in 2012 that the mountain pine beetle population had reached epidemic proportions. SDDA published a Black Hills Regional Mountain Pine Beetle Strategy (2012) which proposed mitigation strategies for reducing the population to endemic levels over the course of several years. Between mountain pine beetles and dry conditions, there is great concern for wildfires in the wildland urban interface and also for agricultural and rural wildfires. Fires involving grass, prairie, or timber can cause mass destruction of property and vegetation.

South Dakota's semi-arid climate, highly flammable native vegetation, rugged terrain, and populated wildland urban interface up its wildfire make hazard.

Topography - The Black Hills are an outcropping of the Rocky Mountains, lying in an ellipse 100 miles long and 50 miles wide along the State's western edge. In the Black Hills, terrain varies from broad, open valleys; rolling topography; mountainous terrain up to 7,242 feet in elevation; and steep, narrow canyons.

Fuels - Fuels are generally conducive to high rates of spread, represented by National Fire Danger Rating System fuel models "G", "L," "K," and "C." Grass predominates in the broad valley bottoms. Ponderosa Pine grows on all aspects, and extensive pure forests of Ponderosa grow in the Black Hills. Mixed grass and timber stands occur in many areas depending on aspect. Fuel loading is lightest in the southern Black Hills and heaviest in the northern Black Hills.

Weather - During the summer months, temperatures are often in the 90s and low 100s with relative humidity in the teens. The average annual precipitation is approximately 17.5 inches. Some of this precipitation comes in association with thunderstorms that bring lightning during the fire season.

Lightning fires tend to burn more acreage than human-caused fires, in part, because 1) multiple lightning fire ignitions often occur at the same time; 2) lightning fires can occur throughout the protection area, while most human-caused fires occur in accessible areas; 3) people often detect and report human-caused fires quickly due to their proximity to inhabited areas; and 4) lightning producing thunderstorms typically occur during the hottest portion of the fire season, while many human-caused fires start during spring or fall.

Conditions - The Black Hills ecosystem is fire adapted, having evolved with fire and fire dependent plant species. The forests of the Black Hills are very different from pre-settlement times when frequent, low-intensity fires maintained a healthy forest structure. Ponderosa Pine is adapted to benefit from frequent, low-intensity fires started in summer by lightning. Historically, these fires killed smaller plants that competed with the pines for moisture and released nutrients from litter on the forest floor. These fires also prevented accumulation of fuels that feed severe fires, which can destroy the thick-bark defense of the trees.

Today, the forest contains many more trees per acre and much more undergrowth, needle litter and deadwood than it did historically. Under these circumstances, when wildfires occur under dry, warm, and windy conditions, they will frequently develop into uncontrollable crown fires that destroy the forest and any homes within it.

Mountain pine beetle attacks in Ponderosa Pine often coincide with abundant weak trees resulting from drought and overgrown conditions. These circumstances have been common throughout the Black Hills and have allowed a mountain pine beetle infestation to become epidemic. The Custer State Park area around Harney Peak, and the Norbeck Wildlife Preserve adjacent to Mount Rushmore has extremely high fuel loading due to mountain pine beetle outbreaks.

Wildland Urban Interface - Wildfires destroy hundreds of structures throughout the western United States every year. These fires can and will occur anywhere that humans and their development meet or intermix with wildland fuels. This wildland urban interface fire problem exists in every state, including South Dakota, and worsens each year. People continue to develop residential properties in fire-prone environments, increasingly exposing themselves and their personal property to the risks of wildfire. Fire and resource management professionals know that wildland urban interface development can draw the efforts of firefighters away from protecting the natural resources, whose stewardship they are charged with.

In this plan, the wildland urban interface is assumed to include both forested and grassland wildlands adjacent to urban areas.

Location

Early writings by explorers, trappers, and settlers often describe South Dakota as a sea of waving grass. The descriptions would not be valid today for the eastern half of the State. The more fertile and climatically desirable prairie of the eastern portion is now used for crop production. But the wild prairie still exists in the western part of the State. South Dakota’s portion of the Great Plains now exists from the foothills of the Black Hills to the western boundary of the Missouri River. This amounts to nearly 35,000 square miles of land, which is used primarily for livestock grazing and some wheat and small grain cultivation. For most of the year, this area, which is predominantly grassland, is at risk to wildfires because of the nature of the ground cover and the limited precipitation.

Although wildfires occur throughout the State, the grass and forestland areas west of the Missouri River represent the area most prone to large wildfires. This area remains vulnerable due to the large areas of continuous fuels and the extreme burning conditions that occur in the area. The area of the State known as the Black Hills has the highest potential for loss of lives and personal property from wildfire. After years of fire suppression, the landscape of the Black Hills has become a dense forest. High fuel loads, years of drought, and mountain pine beetle infestation have combined to make the area particularly susceptible to wildfire. Between 2000 and 2002, 10 percent of the Black Hills National Forest burned (see Past Events)

(U.S. Forest Service, Spearfish, South Dakota, and the Northern Black Hills: Steps to Improve Community Preparedness for Wildfire).

The Black Hills National Forest encompasses 1,534,471 acres of land in South Dakota and Wyoming. Over one million acres of the forest are exclusively in South Dakota (Custer, Fall River, Lawrence, Meade, and Pennington Counties). Of the one million acres, about 80 percent is federally controlled. The remaining 20 percent is controlled by the State and private citizens.

The land ownership pattern in the Black Hills includes a mix of private, Black Hills National Forest, State of South Dakota, Bureau of Land Management, and National Park Service lands. A "checkerboard" ownership pattern in the Black Hills National Forest produces a condition where private, residential structures are scattered throughout much of the National Forest. The U.S. Forest Service has reduced, through land exchanges, the number of individual property inholdings and the land area they cover within the Black Hills National Forest. However, the number of occupied developments on the remaining inholdings increases constantly. This rural residential growth continually and dramatically increases private property exposure within U.S. Forest Service's fire jurisdiction.

The State primarily maintains fire protection responsibility on private and state lands but protects a relatively large amount of federal land as well. The State of South Dakota Department of Public Safety Wildland Fire Division (SDWF) is the protecting agency (under contract) for all BLM lands in SD, approximately 250,000 acres. In addition, we provide mutual aid assistance to our federal wildland firefighting agencies throughout the State. Since a large portion of the State's fire protection area is private land, single family dwellings exist throughout the State's protection area. However, there are existing pockets with no dwellings due to the roughness of the terrain in some areas.

The greatest concentration of structures is located in and around the towns and cities in the Black Hills, including subdivisions within a few miles of the town and city limits. Rapid City and bedroom communities within a five-mile radius of the city represent the greatest concentration of structures located in the forested areas of the Black Hills. The population of new residents is growing, especially in Pennington, and Meade Counties (Table 3-10 and Table 3-11), and there are far more individual property owners to deal with than in the past.

Many new residents are unfamiliar with the realities and responsibilities of living in a fire dependent ecosystem such as the Black Hills, are unaware of the natural role of fire, the concept of defensible space, and the capabilities of local government services. Many homeowners seem to value aesthetics more than safety and resist the concept of defensible space, believing that they will spoil the environment for which they came.

In addition to the Black Hills National Forest, there are fire-prone smaller forested areas on the Custer National Forest in Harding County, and BIA Trust and tribal lands on the Pine Ridge Reservation of Oglala Lakota County (unorganized), and the Rosebud reservation of Todd County (also unorganized). These three counties are in western South Dakota.

The USDA Wildfire Hazard Potential (WHP) map pictured below is an index that quantifies the relative potential for wildfire that may be difficult to control, used as a measure to help prioritize where fuel treatments may be needed. The 2020 version of the WHP is shown in the map below, using vegetation and landscape conditions from the LANDFIRE 2014 data set. As such, the data presented here reflect landscape conditions as of the end of 2014. This dataset represents best available data statewide, using data from a nationwide fire risk study (www.wildfirerisk.org) and a noted improvement over SILVIS datasets used in previous versions of this HIRA. The mapping reflects the higher risk areas in western and southwestern South Dakota (Pennington, Custer, Lawrence, Fall River, Oglala Lakota Counties). Also notable are pockets of very high potential in central South Dakota in Hyde, Hand, and Buffalo Counties. As noted in Figure 3-48 below.

Figure 3-48 South Dakota Wildfire Potential

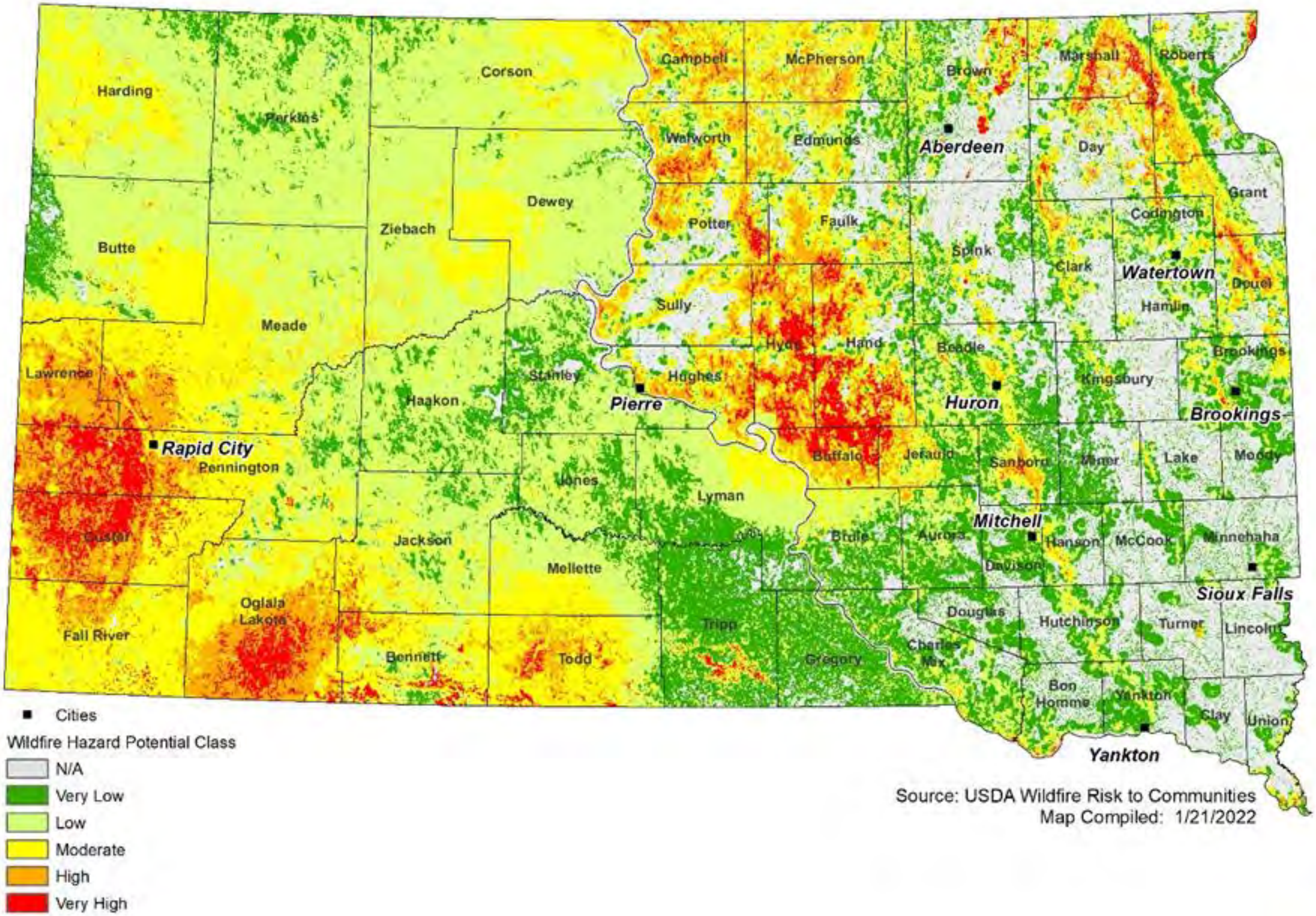


Figure 3-49 South Dakota Wildfire History 1800-2021

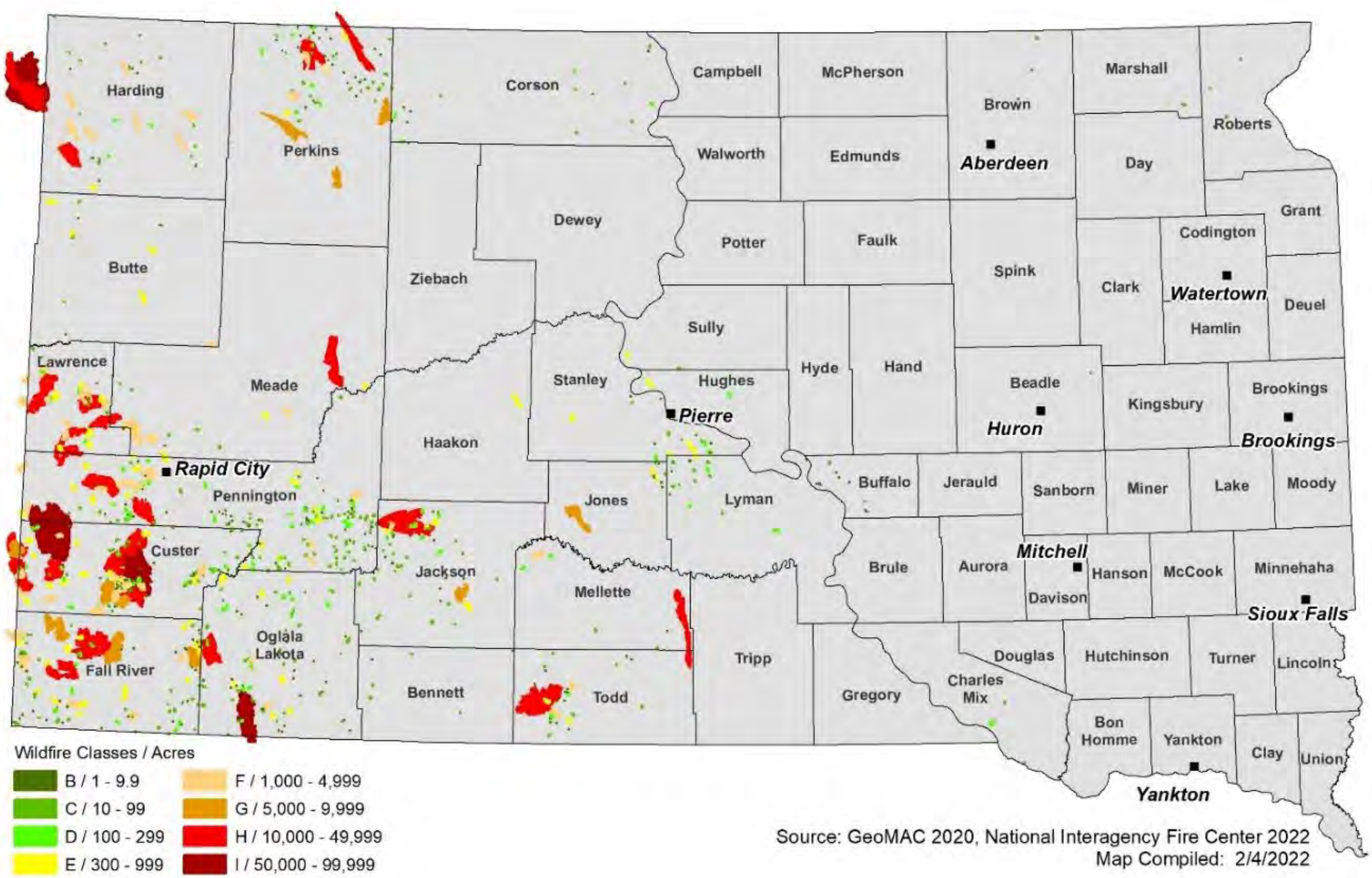


Figure 3-49 describes the history of wildfire in South Dakota, relative to USDA Forest Service wildfire class. Wildfire classes include the following, all of which have been experienced in South Dakota:

- <1 acres Wildfire Class A
- 1-9.9 acres Wildfire Class B
- 10-99 acres Wildfire Class C
- 100-299 acres Wildfire Class D
- 300-999 acres Wildfire Class E
- 1,000-4,999 acres Wildfire Class F
- 5,000-9,999 acres Wildfire Class G
- 10,000-49,999 acres Wildfire Class H
- 50,000-99,999 acres Wildfire Class I

A notable pattern of fire in grassland vs. forested areas can be inferred by comparing land cover in South Dakota (Figure 3-14) with Figure 3-48 and Figure 3-49. The forest conditions described above have led to high fire danger and a history of relatively large fires in the forested parts of the state. In the eastern part of the state, development, in the form of farming, has helped to suppress wildfire danger and past occurrences. In the central part of the state has a notable area of elevated wildfire danger. This area is less cultivated and is largely grassland. However, the wildfire history is muted in this area, which likely shows that while grasslands in South Dakota are wildlands and can burn, they typically don't, especially when compared to wildfire in forested areas of South Dakota. In other words, the "prairie-urban interface" or "grassland-urban interface" is a significant concern for wildfire hazards, but much less so than the "forest-urban interface".

The future location of wildfire hazards will be impacted by both climate change and development. Climate change will alter weather, including precipitation and drought, which affects the potential for wildfire, and is discussed further in the subsection below titled *Climate Change Considerations*. Development will alter the exposure of people and assets, particularly at the wildland-urban interface (WUI). Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Past Events

Past wildfire events have traditionally affected the western and southwestern portion of State. Wildfire burn footprints from 1800-2021 are depicted in Figure 3-49. Data for fires burning less than 1 acre (NWCG Data Standard Fire Size Class Code A) are unavailable and no fires larger than NWCG Data Standard Fire Size Class Code I have occurred in South Dakota.

The National Interagency Fire Center information indicates that lightning represents the single largest ignition source in its jurisdiction, causing 35 percent of fires and burning 41 percent of the acreage lost between 1996 and 2000. While debris burning caused slightly more fires, these fires burned only about one-third of the acreage lost to lightning-caused fires.

The table below contains information about wildfires in South Dakota between dating back to 1871. Most of the fire occurrence and corresponding acres burned in the Black Hills occur in Custer and Fall River Counties. Since 2012, the State of South Dakota has received six fire management assistance declarations. These events are summarized in Table 3-39.

One of the largest wildfires in South Dakota history is the Jasper Fire complex in August 2000, which is profiled in Table 3-42. Of these fires between 0.1 and 84,782 acres, 88% were human caused, 10% resulted from natural causes, and the causes of the remaining 2% were unknown. Between 1980 and 2015 191 fires burned 1,000 acres or more. Collectively these 191 fires burned a total of 1,058,056 acres. 121 (63%) of these fires occurred due to human causes, and the remaining 70 (37%) occurred due to natural causes.

The location and cause distribution of the 191 events are depicted in the figures below. Most of the instances regarding wildfire events and hazards have occurred in the southwestern portion of South Dakota. With the largest events having taken place in Custer, Fall River, and Meade Counties.

Table 3-43 South Dakota Wildfire Events

Date	Comments
October 4, 2021	The Auburn Fire (FEMA-5418-FM) The fire began on October 4, 2021 and lasted until October 10, 2021. The Auburn Wildfire burned an estimated 500 to 750 acres north of Rapid City. It started in Pennington County and spread north into Meade County. There have been no reports of any structures destroyed at the current moment.
March 29, 2021	**The Schroeder Fire (FEMA-5384-FM)** The South Dakota Schroeder Fire began on March 29, 2021 and ended April 4, 2021. It burned 4 miles west of Rapid City, South Dakota, causing several neighborhoods in the Rapid City community to be evacuated. The Schroeder Fire burned a total of 2,195 acres, with no structural or loss of life reported.
August 11, 2018	**The Vineyard Fire (FEMA-5272-FM)** The fire began on August 11, 2018 east of the City of Hot Springs. The fire is estimated to have burned over 550 acres and came in close proximity to dense residential areas in Hot Springs. No injuries or structural damage had been recorded at the time of this plan update. The cause of the fire is still under investigation while the State Plan was being updated.
December 12, 2017	**The Legion Lake Fire (FEMA-5229-FM)** The Legion Lake Fire began on December 12, 2017 in Custer State Park and was fully contained by December 19, 2018. The fire was caused by a tree falling on a power line that caused sparks which ignited dormant vegetation that had been left from previous logging operations. The fire eventually moved out of the State Park, into Wind Cave National Park and onto private property burning 10,000 acres of private ranches. The Legion Lake Fire is the third-largest wildfire in the region's history burning 54,000 acres.
2015	**Sheep Draw Fire** The Sheep Draw Fire in northwest South Dakota was estimated at 13,949 acres. One non-commercial structure was burned. No injuries reported.
2013	**Pautre Fire** Planned to be a prescribed fire up to 210 acres on the Dakota Prairie National Grasslands, strong winds pushed the fire across a mowed fire line into tall grass and ultimately burned 10,679 acres.
2012	**Crookston Fire** Driven by strong winds, the blaze started northeast of Kilgore and burned its way down to Crookston, Nebraska. The smoke was so thick firefighters closed the highway west of Valentine, Nebraska.
August 29, 2012	**Wellnitz Fire (FEMA-5010-FM)** The Wellnitz Fire began on August 29th due to lightning. The fire burned 77,159 acres across Oglala Lakota County (previously Shannon County), South Dakota and into Nebraska. Burned acreage in South Dakota alone was estimated at 28,478. The fire was 100% contained by September 7, 2012.
August 16, 2012	A wildfire burned grassland in and near the Karl E. Mundt National Wildfire Refuge in southeastern Gregory County South Dakota on August 16th. No structures were burned. The fire burned 146 acres, including 112 acres on the refuge and 34 acres of private land.
July 19, 2012	**Myrtle Fire (FEMA-2996-FM)**

Date	Comments
	South Dakota received two fire management assistance declarations in 2012. The Myrtle Fire began on July 19th, 2012 in Custer County due to human causes. The fire burned 10,080 acres and was 100% contained by July 24th, 2012.
January 9, 2012	Unseasonably warm and dry weather, along with dry and dormant vegetation, provided a setting in which several fires that were started to burn trash and vegetation went out of control in Moody County. The largest was several miles northeast of Flandreau, where the burning of a tree pile spread to grassland. This fire burned about 120 acres, reaching to the eastern border of the county and State. Another fire just northwest of Flandreau, started to burn garbage, burned 4 acres of grassland. No indications of damage amounts were received, but no structures were reported to have burned.
October 4, 2011	Several wildfires broke out in Gregory and Charles Mix Counties during the four-day period. Warm and dry weather, strong winds, and dry vegetation due to extended dry weather preceding this time contributed to the fires starting and spreading. The fires affected grassland and cropland, including baled hay.
2011	740 fires burned 38,684.62 acres
2010	609 fires burned 13,448.181 acres
August 27, 2010	**Flynn Creek Fire** - Human-caused fire that burned 65 acres of U.S. Forest Service Southeast of Custer, SD
2009	495 fires burned 11,372.499 acres
July 24, 2009	**Duck Creek Fire** - Railroad caused fire that burned 342.95 acres on U.S. Forest Service Southwest of Hot Springs, SD
2008	476 fires burned 7,088.953 acres
May 18, 2008	**Freeland Well Fire** - Human-caused fire that burned 168 acres on U.S. Forest Service South of Custer, SD
2007	808 fires burned 160,851.23 acres
July 2007	**Boxelder Fire (FEMA-2716-FSA)** At the time of the State's request, the fire had burned approximately 700 acres and had resulted in the evacuation of 100 residents from the town of Nemo in Lawrence County.
July 2007	**Alabaugh Fire (FEMA-2710-FSA)** This fire near Hot Springs in Fall River County was started by lightning on July 7 and was contained on July 12. It burned 10,324 acres. The fire killed one man and destroyed 33 homes. It also forced the evacuation of about 600 residents in about 300 homes. Fire suppression costs were estimated at $2.7 million. A state official said the blaze was the most intense wildfire ever recorded in the Black Hills. Sources: InciWeb, Rapid City Journal, National Public Radio
2006	1,388 fires burned 371,226.31 acres Source: Steve Hasenohrl, South Dakota Chief Fire Management Officer
July 2006	**East Ridge Fire (FEMA-2658-FSA)** 3,204 acres burned, $1,973,107 total outlay
2005	781 fires burned 45,323.641 acres
July 2005	**Skyline #2 Fire (FEMA-2569-FSA)** 42 acres burned, total outlay: $18,975 (FEMA share: $14,231)
July 2005	**Ricco Fire (FEMA-2565-FSA)** 3,939 acres burned in Meade County, started by lightning, total outlay: $573,581 (FEMA share: $428,064)

Date	Comments
April 2005	**Camp Five Fire (FEMA-2557-FSA)** 775 acres burned. Request for assistance withdrawn because event did not meet fire cost thresholds.
2004	437 fires burned 15,517.87 acres
2003	710 fires burned 111,999.37 acres
November 2003	**Mill Road Fire (FEMA-2513-FSA)** Total outlay: $62,852 (FEMA share: $45,685)
2002	846 fires burned 179,287.9 acres
August 2002	**Battle Creek Fire (FEMA-2458-FSA)** On August 16, 2002, the Battle Creek Fire ignited on private land near Keystone. High temperatures, low relative humidity, and strong winds created conditions that led to intense fire behavior with long-range spotting. The fire burned actively for four days and burned 12,450 acres (9,120 acres of national forest system lands, 3,330 acres of private lands) before it was fully contained on August 25. Over 600 structures and the town of Keystone were threatened, but thanks to firefighters, losses were limited to three residences near Hayward. Source: U.S. Forest Service (www.fs.fed.us/r2/blackhills/fire/history/battlecreek/index.shtml) Total outlay: $1.8 million
June–July 2002	**Grizzly Gulch Fire (FEMA-2434-FSA)** This fire near Deadwood and Lead burned 10,801 acres and destroyed 7 homes and 20 other structures. Source: Jerome Harvey, "Historic Wildfire in the Black Hills" (www.nfpa.org/assets/files/PDF/blackhills.pdf)
2001	611 fires burned 124,401.74 acres
July–August 2001	**Elk Mountain #2 Fire (FEMA-2369-FSA)** This fire burned mostly in Wyoming but was complexed with the Roger's Shack fire which burned 11,896 acres in South Dakota in western Custer County. Two single family residential homes were lost. Total outlay: $293,000
August–September 2000	**Flagpole Fire Complex (FEMA-2319-FSA) and Jasper Fire (FEMA-2324-FSA)** The Flagpole fire complex started on August 11, 2000, in Fall River County in southwestern South Dakota. The wildfire was actually three different starts, the Flagpole Mountain, Green Canyon, and Chilson II fires in the southern hills area. The fires were attributed to lightning. The Flagpole Mountain fire burned in Ponderosa Pine; the Green Canyon fire burned in grass, scrub, and juniper. The terrain was extremely rocky and steep, making access and firefighting difficult. Pushed by shifting winds, the Flagpole fire immediately threatened structures, including two homes, and destroyed one outbuilding. The Flagpole and Chilson II fires burned more than 6,000 acres by the evening of August 12. The Flagpole fire threatened 30 homes on the north, south, and east sides of the fire and prompted officials to call for voluntary evacuations in the Shep's Canyon area, where there was only one access road. One residence was lost on the north side of the fire. The fires eventually burned 7,386 acres. The Jasper Fire was located in Custer County in the Southwest Black Hills. It was the largest fire to occur in the Black Hills in at least a century. The fire started at about 2:30 p.m. on August 24, 2000 and was contained on September 8, 2000. The cause of the fire was arson. The weather was very hot and dry, vegetation moisture was at record low levels, and atmospheric conditions were very unstable. The conditions caused extreme fire behavior and the fire spread rapidly, doubling in size every hour on the day it started. Almost immediately after ignition, the fire spread into the tops of the trees and blowing embers began causing

Date	Comments
	spot fires ahead of the main fire. The fire created its own weather pattern as it burned. Lightning from the storm created by the fire was a big concern. The fire completely blackened some areas, leaving scorched, dead trees and ash-covered ground in its wake. Other areas experienced only a light ground burn. Large areas within the fire perimeter remained green, either lightly burned or completely undamaged. Firefighting efforts continued for a month, and firefighters declared the fire controlled on the evening of September 25, 2000. The Jasper Fire burned 83,500 acres and was the largest fire in Black Hills history. It destroyed one summer cabin and three outbuildings, burned acreage at the Jewel Cave National Monument, and threatened more than 100 other structures and the communities of Custer and Hill City. Fire losses included approximately 244 million board feet of timber, 150 miles of range fence, 65 livestock water tanks, 20 miles of range water lines, 17 wildlife water developments, 59 wooden power line structures, and 2,738 feet of above ground telephone line. Total outlay for both fires: $4.25 million
2000	1,348 fires burned 354,357.13 acres
1999	879 fires burned 161,972.42 acres
1998	208 fires burned 6,843.96 acres
1997	69 fires burned 1,353.65 acres.
March 28, 1997	**Burdock Fire** - burned 350 acres on Private
1996	69 fires burned 3,484.57 acres
February 10, 1996	**East Gate Fire** - Powerline fire that burned 996 acres on Private
1995	56 fires burned 1,588.97 acres
September 5, 1995	**Indian Canyon Fire** - Lightning-caused fire on Private burned 1,504 acres
1994	201 fires burned 2,663 acres [includes Stagebarn Canyon].
August 15, 1994	**Stagebarn Canyon Fire (FEMA-2109-FSA)** Stagebarn Canyon near Indian Hills subdivision northwest of Rapid City. Fire started by lightning. 112 acres burned; cost in excess of $159,000.
1993	44 fires burned 678 acres.
1992	958 fires burned 20,367 acres.
1991	815 fires burned 43,782 acres.
September 1990	**Swedlund Fire (Cicero Peak fire) (FEMA-2076-FSA)** Burned 14,518 acres, approximately 5,000 acres in Custer State Park. Caused by logging equipment.
1990	860 fires burned 11,725 acres.
1989	911 fires burned 14,779 acres.
1988	1,171 fires burned 69,512 acres.
July 5, 1988	**Galena Fire** – 16,788 acres burned in Custer State Park. Started by lightning and required the evacuation of the City of Keystone during the height of tourist season.
Jul 25, 1988	**Westberry Trail Fire (FEMA-2068-FSA)** Suspected arson fire and was located in a subdivision on the western edge of Rapid City. Burned 14 homes and 3,980 acres.
June 20, 1988	The **Short Pines Fire** in Harding County started by lightning burned over 5,274 acres of School and Public state land and one 105-acre fire started by a powerline in Rapid City on Skyline Drive destroyed one single family residence.

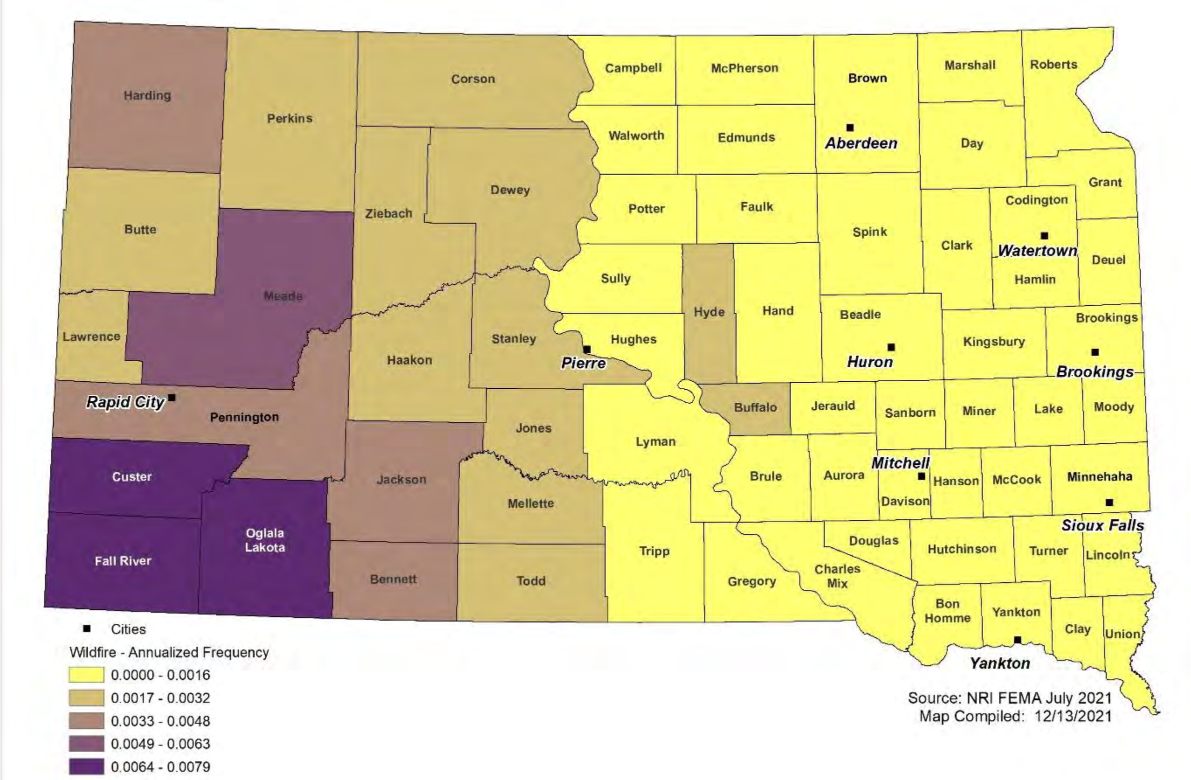
Date	Comments
Jul 20, 1987	**Battle Mountain Fire (FEMA-2061-FSA)** Started by lightning in the game production area, two miles from Hot Springs. Burned 2,200 acres.
1987	1,638 fires burned 52,277 acres.
1986	478 fires burned 3,572 acres.
July 12, 1985	**Flint Hill Fire (FEMA-2057-FSA)** Lightning-caused fire that burned 23,000 acres west of Edgemont.
July 12, 1985	**Seven Sisters Fire (FEMA-2056-FSA)** Lightning cause fire that burned 9,300 acres south of Hot Springs.
1985	1,229 fires burned 110,669 acres.
1984	651 fires burned 28,230 acres.
1983	950 fires burned 18,613 acres.
1982	403 fires burned 6,886 acres.
1981	1,556 fires burned 24,537 acres.
1980	1,349 fires burned 42,077 acres.
1979	485 fires burned 14,214 acres.
1978	479 fires burned 48,290 acres.
1977	535 fires burned 6,952 acres.
1976	582 fires burned 9,130 acres.
July 1975	Custer State Park (FEMA-2017-FSA)
1975	851 fires burned 30,671 acres
July 1974	**Argle & Booms Canyon (FEMA-2016-FSA)** Lightning-caused fire that burned 4,356 acres north of Hot Springs.
1974	1,022 fires burned 38,864 acres.
1973	704 fires burned 36,252 acres.
1972	452 fires burned 13,638 acres.
1971	815 fires burned 20,890 acres.
1970	477 fires burned 6196 acres.
1969	211 fires burned 3254 acres.
November 21, 1962	Burned an area that stretched from Harrold to Highmore (20 miles long) and consumed 30,000 acres of hay and cropland. No loss of life.
August 30, 1960	Two simultaneous lightning strikes south of Hot Springs started the Green Canyon fire (6,389 acres) and the Wildcat fire (10, 454 acres).
September 8, 1959	This human-caused fire nearly destroyed the town of Deadwood. The fire burned 4,500 acres (1,971 federal, 2,560 private) around the town and did more than $1 million (1959 dollars) in damage. More than 60 structures (businesses, residences, utilities, etc.) were destroyed and damage to infrastructure was severe. Nearly 4,000 people were evacuated from the town in less than 30 minutes. Source: Jerome Harvey, "Historic Wildfire in the Black Hills" (www.nfpa.org/assets/files/PDF/blackhills.pdf)
August 23, 1949	Human-caused forest fire started by Nemo. Burned out to the hogback area by Tilford. Burned 6,630 acres and required both the SDNG and Rapid City Air Base to provide over 1000

Date	Comments
	personnel to the Black Hills NF to suppress the fire. (Source: Big Elk fire file, SDWF agency historical archives)
September 5, 1947	Three human-caused fires burned into one conflagration that burned an estimated 320,000 acres in Hyde, Sully, Potter, Faulk and Hughes Counties in one day. Estimated $2,000,000 damage to improvements (1947 dollars). Considerable damage to range and farmland, (Source: SDWF agency historical archives and *"75 Years of Sully County History*" published by the *Onida Watchman)*.
July 10, 1939	**McVey Fire by Hill City South Dakota** - Cause is still unclear. Burned 21, 857 acres. Almost burned over the town of Hill City. One firefighter was killed by a lightning strike during mop-up. 45 miles of fire line was constructed by over 1775 men at the height of the blaze. (Source*: Sawmills of the Black Hills*, by M. Linde and SDWF agency archives).
1931	**Rochford Burn** - Arson set forest fire. Burned approximately 20,900 acres in western Pennington County in the high elevation limestone country of the Black Hills National Forest, 12 structures were lost. (Source: SDWF Agency historical archives)
1899	**The Iron Creek fire** - Burned for most of August south of Spearfish. By the time winter snows arrived, it had burned 38,400 acres of timber on the Black Hills National Forest and numerous mining claims
March 1879	This fire burned for at least one week in an area from Brookings County to Union County. The path was over 100 miles long and 20 miles wide
October 1871	During the week of the Great Chicago fire, a large wildland fire occurred along the Missouri River burning from Springfield to Yankton, burning many structures and farms.

Probability of Future Occurrence

The western and southwestern portions of South Dakota are more vulnerable to wildfires, but some counties have a higher risk than others. In addition, the vulnerability can vary slightly based on the seriousness of wildfires. As referenced in Figure 3-50 below**,** Pennington, Custer and Oglala Lakota Counties have a higher probability of occurrence, based on the best available NRI data. Pennington County is notable for its fast growth, ranking #6 in the state by percent growth 2010-2020, while Ogalala Lakota County has the highest social vulnerability rating in the state (Figure 3-7).

Figure 3-50 South Dakota Wildfire Annual Frequency



Magnitude/Severity (Extent)

The magnitude of wildfires is typically measured by how many acres they burn, the intensity of the burn, and the potential for property losses. The spatial extent of historical fires in South Dakota and description of the USDA Forest Service wildfire classification system are provided in Figure 3-49 and the text in the subsection titled, *Location*. Typically, wildfires in the wildland urban interface result in a complete loss of the structure and contents. Wildfires often result in massive evacuations can also cause multiple deaths and injuries. The counties with the greatest vulnerability to wildfire hazards are those in the Black Hills Region.

Climate Change Considerations

Wildfire conditions across South Dakota and the western United States in general are likely to worsen in the future due to climate change. This is due to increasing temperatures, an increase in annual precipitation, and drought as a regular occurrence. The increase in temperatures can dry out fuels more rapidly. The increase in moisture can provide favorable conditions for fuel (vegetation) growth. The trend towards larger precipitation events with drought as a common occurrence provides multiple windows of opportunity for the fuels to dry out and burn, particularly fine fuels like grasses. South Dakota has already had large fires in every month of the year, and so it is possible that the State will have a true 12-month fire season. As a case in point the Legion Lake Fire on December 12, 2019 was the third-largest wildfire in the Black Hills Region's history, burning 54,000 acres.

The U.S. Forest Service released a study titled "Wildland Fire and Climate Change" detailing the effect climate change will likely have on atmospheric patterns that affect fire weather. These changes could result in fire patterns that will in turn impact carbon cycling, forest structure, and species composition. The study explains that with a doubled CO_2 environment, there is potential for an increase in lightning activity, a higher frequency of surface pressure and associated circulation patterns conducive to surface drying, and fire weather conditions in general. These findings suggest that these factors and higher summer temperatures will likely increase the annual window of high fire risk by 10-30%. Predictions past 2040 are largely speculative given the current rate of increase in fossil fuel emissions, but there will certainly be in increase in the potential for drought and the number of days in a year with flammable fuels. The above variables will extend fire seasons and area burned in ecoregions where fire extent is linked to fuel conditions. More intense wildfires can produce highly erodible soils that can lead to increased sediment loading in reservoirs and streams, damaging water infrastructure and degrading water quality. This can also result in increased flood and debris flow risk in affected watersheds for many years following a destructive fire.

Vulnerability Assessment

The southwestern portion of South Dakota has the highest risk index rating according to FEMA's NRI data listed below in. To assist with the evaluation of past events, the NRI has developed the Risk Index Rating as a method of identifying and quantifying risk. As noted below, two counties in South Dakota have a relatively high risk of a wildfire occurring.

These counties are Oglala Lakota and Todd counties. With counties such as Fall River, Custer, Pennington, and Bennett being in the same portion of the State and having a moderate chance of a wildfire occurring. This can be attributed to environmental factors such as climate change and drought.

Figure 3-51 South Dakota Wildfire Expected Annual Loss Rating

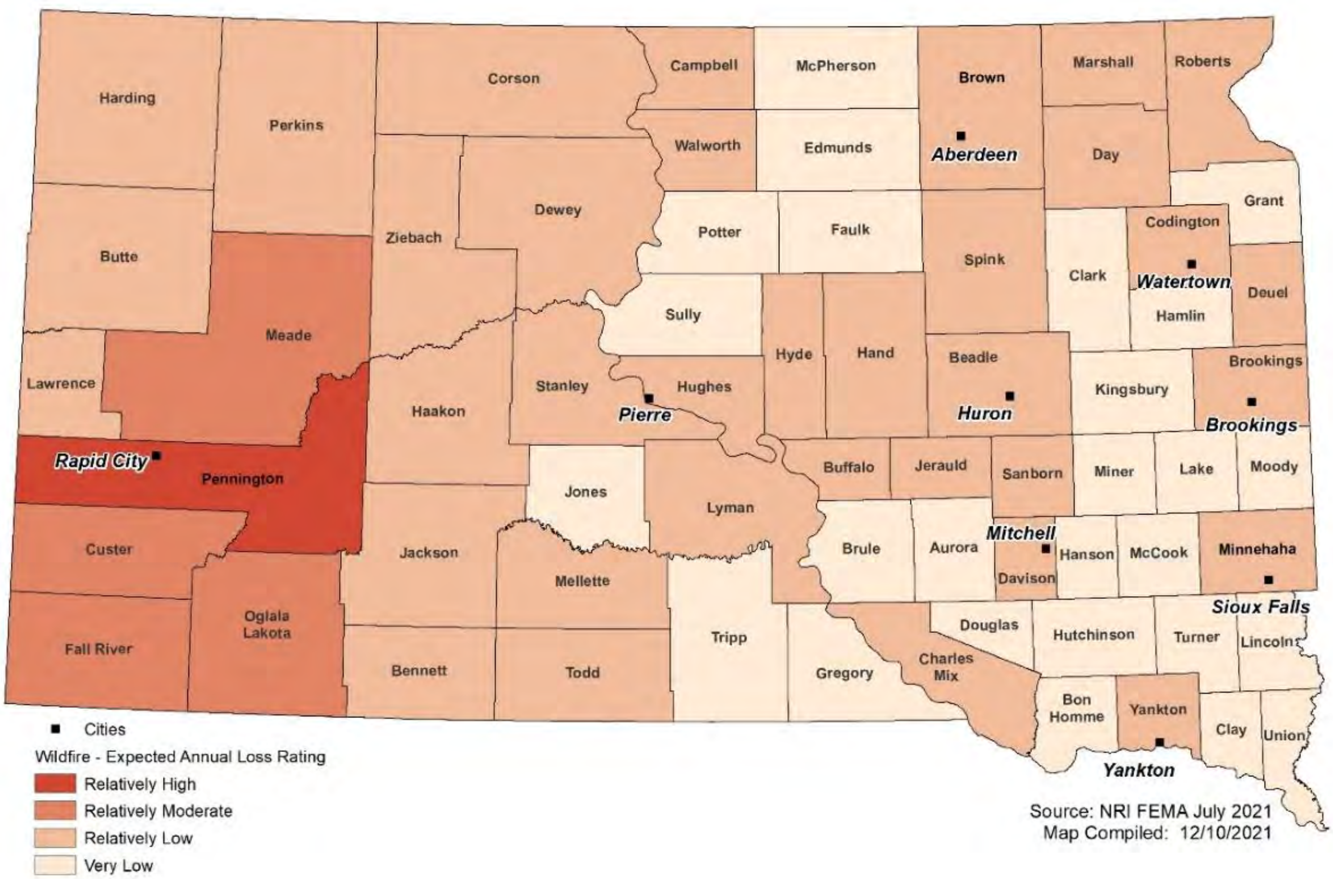


Table 3-44 South Dakota State Building Wildfire Risk by State Agency

State Agency	Very High	High
Bureau of Information and Telecommunications	1	10
Dept of Ag & Natural Resources	0	1
Dept of Corrections	0	4
Dept of Game, Fish & Parks	4	13
Dept of Health	0	3
Dept of Labor	0	1
Dept of Military	0	35
Dept of Public Safety	4	3
Dept of Transportation	4	31
Unified Judicial System	1	0
Total	**14**	**101**

Source: WSP Analysis based on USDA WHP data, State of South Dakota

Drought can create conditions for more numerous and intense fires that quickly overwhelm local and state capacities for fire suppression. Generally, large wildfires make up a small portion of total fire occurrences in any given year but account for the greatest portion of suppression costs. Expenses can also be driven up by atypically large numbers of moderate or small fires that drain resources. Table 3-44 summarizes South Dakota's fire suppression costs from 1994 to 2018. State fire suppression costs totaled $54,956,928 in that 24-year timespan. This averages as $2,289,872 annually per year and does not include losses to structures, forests, utilities, etc. Note that the amount of financial support was not known for every event. Within that 24-year time period, the highest suppression costs occurred in 2002, 2006, 2007, and 2012; each of these years coincided with a drought. The fire suppression costs for these years was orders of magnitude greater than that of wet years, such as 2010. In addition, in response to the drought year 2006, the South Dakota Legislature passed a law that was enacted to allow the use of the State Fire Suppression Fund to pay for responding and managing large wildfire activity in the prairie regions of the State. This can drive up fire fund expenditures in future years. (Source, SDCL 41-20A-8.)

Table 3-45 State Fire Suppression Costs by Year, 1994-2018

Year	State Fire Suppression Costs		Year	State Fire Suppression Costs
2018	$943,237		2005	$2,127,925
2017	$3,055,336		2004	$1,009,829
2016	$3,004,592		2003	$1,599,697
2015	$1,196,440		2002*	$9,444,193
2014	$454,641		2001	$2,025,028
2013	$893,262		2000	$1,510,648
2012*	$8,493,171		1999	$191,441
2011	$1,789,511		1998	$135,301
2010	$801,405		1997	$149,239
2009	$525,343		1996	$307,694
2008	$938,134		1995	$258,766
2007*	$7,686,640		1994	$389,033
2006*	$6,026,422		**Total**	**$54,956,928**

Source: SDWF, 2018; *Drought year

People

Populations most exposed to fire hazards live in wildland urban interface (WUI) zones, where residential properties are directly intruding into traditional wildland areas. The exposure of the population in these zones increases with the exposure of the corresponding general property, examined in the subsection below titled *Property*. To date, populations in these zones have been engaged by authorities regarding fire hazards as possible.

Vulnerable populations wildfire hazards include those that live within WUI zones. Vulnerability is compounded for people with respiratory ailments, the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, prisons, low-income housing areas, or temporary shelters, people who do not speak English well, are homeless, as well as tourists and visitors, and those with developmental, physical, or sensory disabilities. The impacts of wildfire on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from wildfire, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

Indirect impacts from wildfires on people are potentially severe and very widespread. As discussed above, dense smoke from wildfires within the region regularly blankets wide areas that extend far from the WUI and impacts health and wellbeing. Wildfires in the past three years have decreased the air quality throughout the western United States. Dense smoke poses a risk to both people with compromised health as well as those considered healthy. A study from the University of California San Diego found that wildfire smoke is more harmful to respiratory health in humans than pollution from cars (NPR 2021). Studies have also shown an increase in ambulance calls, hospital visits and an increase of people experiencing respiratory or cardiac emergencies (NPR 2020).

Three types of study, specific to South Dakota, would facilitate more effective management of wildfire hazards. First, a formal analysis of the populations within WUI zones would benefit future wildfire mitigation plans, especially if it identifies populations with elevated social vulnerability and what it is about those populations that makes them vulnerable.

Second, an analysis that identifies vulnerable populations within South Dakota exposed to wildfire smoke would be useful. Fortunately, much is known about which populations are vulnerable to air pollution in general that can be applied to the wildfire smoke issue. Explicitly doing so will help hazard mitigation managers draw from broader and better established public health knowledge.

Third, it is becoming increasingly clear that the wildfire risk of the last 30 years does not look the same as the wildfire risk of the next 30 years. Both climate change and ecological factors are accelerating wildfire frequency and severity throughout the western U.S. Relatively coarse forecasts of physical hazards exist, but applying those to social vulnerabilities in South Dakota will help hazard mitigation managers conceptualize what future scenarios to plan for.

Ultimately, synthesizing all these studies would help create a holistic picture of wildfire risk in South Dakota. These three types of study will help make that synthesis possible.

In the immediate term, it is apparent that some parts of South Dakota have either a very high exposed population to wildfire hazards and/or have particularly high social vulnerability. Pennington County is the second most populous county in South Dakota, third fastest growing by numerical increase (Table 3-10) and also has areas of WUI zones. Due to this Pennington has one of the highest wildfire risks in the State. When factoring in social vulnerability, Oglala Lakota County may have a harder time recovering from extensive wildfires due to low income levels.

Property

The potential impacts of wildfire on property include crop loss, injury and death of livestock and pets, and damage to infrastructure, homes and other buildings located throughout the wildfire risk area, with greatest potential impact on property, buildings and infrastructure located within high and very high hazard zones including the WUI, and buildings and infrastructure located within forested lands, to include national forests and parks. Pennington County where Rapid City is located along with the surrounding counties of Meade, Custer, Fall River and Oglala Lakota all have the highest annual loss rating.

As of this SHMP update no statewide analysis is available regarding present or future of development in the WUI. South Dakota has a slow growth rate relative to other western states. Nevertheless, future SHMP updates may benefit from an explicit analysis of present and future development in WUI areas. In particular, analysis of vulnerable populations moving into high hazard zones would be useful. As described in the section titled *People*, above, adding climate change scenarios to a development study would be welcome.

State Assets, Critical Facilities, and Infrastructure

Wildfire impacts to critical facilities can include structural damage or destruction and risk to persons located within facilities. Disruption of transportation, shipping, and evacuation operations, and interruption of facility operations and critical functions.

Pennington County has the highest amount of state buildings susceptible to wildfire damages. With 101 total buildings being subject to wildfire hazards. Four of which are considered to have a very high vulnerability as noted in Table 3-45 below. Custer County also has ten buildings in what is a very high wildfire hazard area based on analysis using USDA GIS data.

Table 3-46 South Dakota State Building Wildfire Risk

State Buildings by County	State Buildings Wildfire Hazard Area	Very High	High	Moderate
Pennington	101	4	51	46
Fall River	49	0	1	48
Hughes	33	0	4	29
Lawrence	21	0	8	13
Custer	29	10	16	3

USDA, Wildfire Information, January 2022

A similar GIS overlay analysis was performed to identify trends in vulnerabilities to critical facilities/lifelines. The results are captured in the table below. Trends indicate a high number of public school and fire station facilities potentially at risk to wildfires. Consequences of wildfires impacting these facilities include loss of buildings and contents, loss of essential services, and impacts to potentially vulnerable populations (school-aged children).

Table 3-47 Critical Facilities/Lifelines at Risk to Wildfire Hazards by Hazard Ranking

Critical Facility	Very High	High	Moderate	Low	Very Low	Total
Aviation	1	22	30	51	43	**147**
Bridge	167	443	841	1,235	1,433	**4,119**
Bridge Scour	8	20	40	51	51	**170**
College/University	-	3	4	1	8	**16**
Courthouse	1	2	8	19	19	**49**
EMS Station	3	21	38	56	55	**173**
Fire Station	5	33	72	82	80	**272**
Hospital	-	6	12	16	15	**49**

Critical Facility	Very High	High	Moderate	Low	Very Low	Total
Local EOC	1	4	12	22	26	**65**
Local Law Enforcement	1	7	28	40	41	**117**
Power Plant	3	7	7	13	16	**46**
Prison	2	1	10	10	14	**37**
Private School	3	6	9	7	9	**34**
Public School	2	41	84	141	131	**399**
RMP Facility	-	4	12	26	47	**89**
State EOC	-	-	1	-	-	**1**
TRI Facility	1	8	27	38	85	**159**
Wastewater Facility	7	23	36	41	54	**161**
Water Facility	-	-	1	2	2	**5**
Weather Radar Station	-	-	-	1	1	**2**
Total	**205**	**651**	**1,272**	**1,852**	**2,130**	**6,110**

Source: State of South Dakota OEM, HIFLD, South Dakota OpenData, USDA Wildfire Risk to Communities, WSP GIS analysis

Fire suppression may also require increased cost to local and state government for water acquisition and delivery, especially during periods of drought when water resources are scarce. Drought can create conditions for more numerous and intense fires that quickly overwhelm local and state capacities for fire suppression. Generally, large wildfires make up a small portion of total fire occurrences in any given year but account for the greatest portion of suppression costs. Expenses can also be driven up by atypically large numbers of moderate or small fires that drain resources. Table 3-41 summarizes South Dakota's fire suppression costs from 1994 to 2018. State fire suppression costs have totaled $54,956,928 in the past 24 years. This averages as $2,289,872 annually per year and does not include losses to structures, forests, utilities, etc. Note that the amount of financial support was not known for every event. Within that 24-year period, the highest suppression costs occurred in 2002, 2006, 2007, and 2012; each of these years coincided with a drought. The fire suppression costs for these years were orders of magnitude greater than that of wet years, such as 2010. In addition, in response to the drought year 2006, the South Dakota Legislature passed a law that was enacted to allow the use of the State Fire Suppression Fund to pay for responding and managing large wildfire activity in the prairie regions of the State. This can drive up fire fund expenditures in future years. (Source, SDCL 41-20A-8.)

Fortifying state assets that are particularly vulnerable to wildfire hazards has historically been done on a case-by-case basis or is implicitly included in maintenance and facility management.

Putting a specific dollar value on vulnerable state assets is difficult beyond not yet possible, in the sense that wildfire can affect any part of the state, which makes all state assets vulnerable. Section 3.2.1 and especially Table 3-5 provide the value of state assets.

The analysis provided above is an important step toward developing a more nuanced understanding of the vulnerability of state assets to wildfire. Unlike some atmospheric hazards, the spatial distribution of wildfire hazards is better understood. Accordingly, the vulnerability of state-owned buildings in the five most vulnerable counties is provided in Table 3-46 and the number of critical facilities in each county, arranged according to the magnitude of wildfire hazard is provided in Table 3-47. While this analysis does not yet include dollar values, it is exactly the type of analysis that may be valuable to developing mitigation actions.

In addition, it is possible to characterize the types of assets most likely to be damaged. Simply stated, buildings in the wildland urban interface are especially likely to sustain damage from wildfire. Unfortunately, this is where a limitation exists in our knowledge. There has been no successful attempt to identify which specific state assets are most likely to sustain damage from wildfire, or how this is statistically plays out in an average year. For example, our present analysis is limited to evaluating assets in *counties* that are the most affected. Specifying assets in the wildland-urban interface area would be more useful for identifying which assets are most likely to sustain damage from wildfire.

Similarly, we can say with some confidence that climate change will increase the severity of wildfire hazards and therefore can be expected to increase exposure of state assets. This is true across the state, not just in areas identified as having the highest vulnerability. In one sense, 100% of state assets are already potentially vulnerable to wildfire, amplifying these hazards can't increase the vulnerability of state assets any further. However, increasing wildfire hazards certainly can increase the damage sustained when assets are exposed. Expressing the impact of climate change on the statistical dollar value of damage experienced in a typical year depends on addressing the knowledge gaps described above, and then projecting increases.

Present and future development also affects damage from wildfire. It is possible to characterize the likely loss of state assets from wildfire as dependent on the value of state assets in areas likely to experience these hazards. In one sense, 100% of state assets are vulnerable to these hazards, therefore the impact of development on vulnerability is equivalent to the effect of development on the value of state assets. However, putting a dollar value on how development will affect the expected loss of state assets in a typical year runs into the same problems described above for valuing state assets likely to be damaged in a typical year.

All of this is to say with confidence that all state assets are vulnerable to loss from large hail and lightning (see Section 3.2.1 and especially Table 3-5). However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to hail and lightning will be possible in future hazard mitigation plans.

Economy

The economic impacts of wildfire include loss of property, direct agricultural sector job loss, secondary economic losses to businesses in or near wildland resources like parks and national forests, and loss of public access to recreational resources. Tourism in South Dakota plays a major economic role, with the presence of State and National Park's and other outdoor recreational opportunities. Damage to these assets or disruption of access to them can have far reaching negative impacts to the local economy. Mt. Rushmore is in Pennington County. Pennington has the highest annual loss rating in the entire state and happens to be the #6 fastest growing county in South Dakota by percent growth (Table 3-11). The mountain carving for another national monument is being constructed in Custer County, which also has a relatively moderate loss rating.

Counties in the Black Hills Region that are at a higher risk of wildfire exposure than counties east of the Missouri River have felt these development pressures. Pennington, Custer, and Meade Counties have seen an increase in the development of subdivisions and residential properties within the WUI in their jurisdictional boundaries as well as surrounding communities. In addition to the increased growth in the WUI, climate change is expected to increase the fire risk for the State by 10-30%, because of increased temperatures, increased likelihood of drought events, as well as the increased risk to beetle and insect infestations. Due to these factors, future vulnerability to wildfire events is likely to increase. The implementation of mitigation projects such as educating homeowners on how to protect their property, or the implementation of development standards and regulations related to wildfire mitigation, will help the State's population and infrastructure be better protected when a wildfire event does occur.

Environment and Cultural Resources

The wildfire hazard in South Dakota is likely to increase in the coming years, due largely to increasing temperatures, drought severity, and extreme heat, all of which are amplified by climate change. South

Dakota has some notable vulnerabilities to wildfire. The tourism and outdoor industries are particularly susceptible to wildfires. In addition, historic and cultural resources are at risk. Certain areas of the state, such as the Black Hills, have high concentrations of historic properties with wooden features and a high risk to wildfires. High intensity wildfires can deflate soils, which is damaging to archaeological resources. Even low intensity wildfires can denude soils and contribute to increased erosion, which increases risk of damage to archaeological resources from erosion and flooding.

The wildfire hazard in South Dakota can be mitigated by using management tools such as prescribed fires. Prescribed fires apply science to plan each fire in advance and account for the type and scale of fire desired, management objectives, different type of fuels and the environmental conditions. Utilizing prescribed fires can help foster diverse ecological environments for plants, animals and the endangered within species in South Dakota and lower the risk from uncontrolled wildfire.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. Any analyses that may exist to evaluate how recent or future development has or will affect vulnerability to wildfire hazards have not been resolved at a statewide basis or remain in need of synthesis to aid planning. This is a clear knowledge gap. The local plan roll-up (Section 3.1.2) showed clear acknowledgement of issues that were conceivably related to development. For example, land cover dominated by juniper trees was a widespread concern for spreading fires. As was the loss of wetlands that have value as a fire break. Many local hazard mitigation plans expressed concerns related to the WUI and wildfire hazards. However, these issues were generally acknowledged without explicit analysis on development issues. It remains somewhat speculative to draw from local plans to describe the statewide situation of development as it relates to wildfire vulnerability. It is conceivable that information from local plans, government reports, and academic literature on wildfire hazards could be synthesized to provide a statewide analysis of vulnerability. However, as of this SHMP update, no analysis exists to evaluate how recent or future development has or will affect vulnerability to wildfire hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to wildfire hazards, likely focusing on the WUI. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to wildfire hazards.

Despite gaps in the present state of knowledge, it is apparent that some counties have experienced an increase in population and resulting development pressures. In the Black Hills Region Pennington, Custer, and Meade Counties have seen an increase in the development of subdivisions and residential properties within the WUI in their jurisdictional boundaries as well as surrounding communities. In addition to the increased growth in the WUI, climate change is expected to increase the fire risk for the State by 10-30%, because of increased temperatures, increased likelihood of drought events, as well as the increased risk to beetle and insect infestations. Due to these factors, future vulnerability to wildfire events is likely to increase. The implementation of mitigation projects such as educating homeowners on how to protect their property, or the implementation of development standards and regulations related to wildfire mitigation, will help the State's population and infrastructure be better protected when a wildfire event does occur.

Table 3-48 Wildfire Consequence Table

Category	Narrative
Impact on the Public	Staff, recreationists, campers, property owners in remote areas or the WUI areas, and persons with breathing difficulties may at risk to injury or death; secondary impacts may negatively affect water quality and downstream water users

Category	Narrative
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure; potential impact to tourism and land development activities depending on severity of the fire season and location of fire events. Depending on nature of area where fire occurs, many home-based businesses will be impacted due to evacuation, lack of utility service, or through destruction of property. State fire suppression and management costs average $2M annually
Impact on the Environment	Significant impact related to loss of forest or grasslands, impacts to water quality; erosion and sedimentation may affect critical infrastructure and natural waterways. Loss of ground vegetation may encourage landslides, mudslides, or other geologic movement of land. Dead or damaged trees are at risk of falling
Impact on Property, Facilities, and Infrastructure	Vulnerabilities in WUI areas include critical infrastructure, facilities, properties, equipment, vehicles, and communications and utility infrastructure
Impact on the Public Confidence in Government	Ability to respond and recover may be questioned and challenged if planning, response, and recovery is not timely and effective. Coordinated warning and evacuation is essential
Impact on Responders	Exposure exists to response personnel performing routine duties when event occurs; fire event - related duties may cause significant danger to response personnel including evacuation, suppression, law enforcement, and damage assessment. Local, state and federal fire management personnel involved in firefighting at risk to injury and death
Impact on Continuity of Operations and Continued Delivery of Services	Potential loss of facilities or infrastructure function or accessibility or ability to provide services. Power interruption is likely if not adequately equipped with back-up generation
Cascading Hazards	Landslides, Floods

3.3.6. Drought

Hazard Description

According to the NWS, "Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage causing adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in all climate zones, from very wet to very dry. Human factors, such as water demand and water management, can exacerbate the impact that drought has on a region." Five common types of drought are defined below.

- **Meteorological** drought describes a physical lack of moisture. It is characterized by divergence of precipitation from the long-term average precipitation over a given length of time. Evaporation also plays a role in meteorological drought, but is relatively difficult and expensive to measure and is commonly not considered in meteorological drought indices such as the Standardized Precipitation Index (SPI).
- **Hydrological** drought describes how a meteorological drought affects the physical availability of water in streams, lakes, reservoirs, soils, snowpack, and groundwater. Hydrologic drought conditions are also expressed as the deviation from normal or long-term averages. This approach provides a more nuanced definition of drought and is arguably more useful for water managers in regions such as Utah that depend on winter snowpack and reservoir storage.
- **Agricultural** drought describes how meteorological drought and hydrologic drought affect the agricultural sector. Soil water deficiency, which stresses crops and plants, is a key factor that determines agricultural drought. Dry farms can be especially vulnerable to agricultural drought, while impacts to irrigated farms can hopefully be limited to increased irrigation costs.
- **Socioeconomic** drought occurs when a shortfall in water supply causes a shortage of an economic good. For example, if precipitation is low enough, reservoir levels may decline to a point where generation of hydropower is not possible. Snowpack being insufficient to support a good ski season is another example of a socioeconomic drought.
- **Flash** drought refers to relatively short period of warm surface temperature and anomalously low and rapid decreasing soil moisture. It is related to the rate of rapid drought intensification rather than duration of drought conditions.

Drought and Heat

In this Plan, extreme heat is considered together with drought. Heat is not a necessary element of drought, but the two often exist together and compound negative effects. This is true in South Dakota, where drought is often accompanied by periods of extreme heat. FEMA considers extreme heat as a condition where air temperature hovers at least 10°F above the average high temperature for the region and lasts for several weeks.

Heat, often associated with drought, is deadly. In the United States, about 175 people succumb to summer heat annually. According to the NWS, among natural hazards, only the cold of winter - not lightning, hurricanes, tornadoes, floods, or earthquakes - takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat kills by taxing organisms beyond their ability to cope. Heat stress can overwhelm an animal's ability to shed heat through circulatory changes and sweating. In some cases, excessive sweating can cause a dangerous chemical (salt) imbalance. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. Elderly persons, small children, those with chronic illnesses, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails. Table 3-48 illustrates the relationship between temperature, humidity, and danger to health.

Table 3-49 NWS Heat Index and Heat Disorders

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	118	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	126	130					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Source: NWS
Note: Heat Index (HI) values were devised for shady, light wind conditions. Exposure to full sunshine can increase HI values by up to 15°F. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

The NWS has a system of issuing advisories or warnings when the Heat Index (HI) 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 the issuance of excessive heat alerts is when the maximum daytime high is expected to equal or exceed 105°F and a nighttime minimum high of 80°F or above is expected for two or more consecutive days. Heat alerts are issued by a county when any locations within the county is expected to reach these criteria.

Location

No portion of the State of South Dakota is immune to drought conditions. Statistically, drought is a deviation from 'normal' hydrologic conditions based on weather records dating to the late 1800s. Assumptions made in drought metrics include:

- the true frequency of drought across South Dakota is captured in the past 100+ years of weather records,
- the climate is not changing, and our drought measurement methods are not biased, and
- all areas will experience a similar amount of severe drought over a sufficiently long period of time.

If each of these assumptions hold true, all areas will deviate from 'normal' hydrologic conditions and experience a similar amount of drought. However, recent history of drought monitoring does reveal spatial pattern. Figure 3-52 shows the average annual number of days in D3 or D4 drought status, according to the US Drought Monitor, 2000-2022. The technical meaning of D3 and D4 drought status is described in the following section, titled *Magnitude/Severity*. Over the past two decades, drought frequency has been greatest in the western part of the state, least common in the northeastern part of the state. It is unclear whether this trend will continue in the future.

Figure 3-52 Average Days/Year in D3 or D4 Drought Status

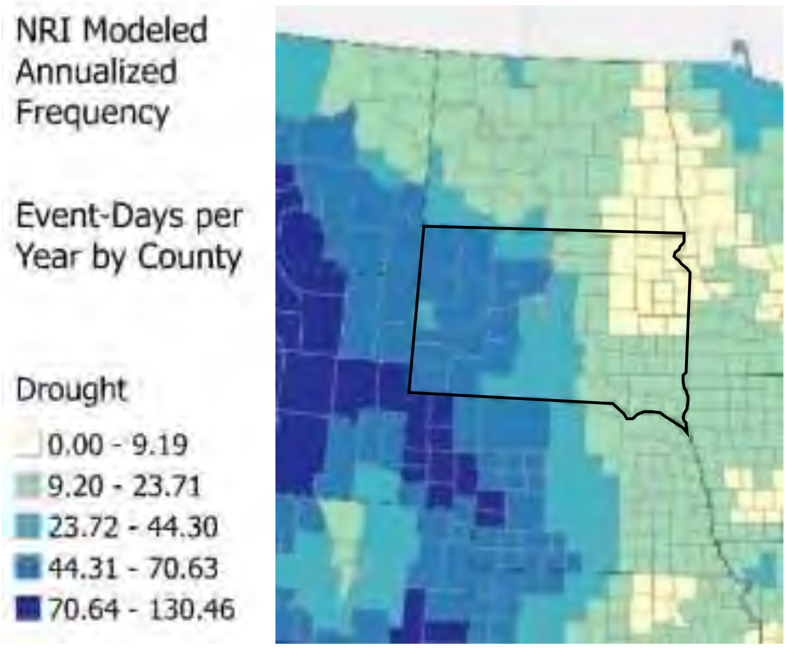


Image source: National Risk Index Technical Documentation, March 2023, Figure 39.

The future location of drought hazards will be impacted by climate change. Climate change affects weather, including precipitation and evaporation conditions. It is possible that areas observed to have higher drought frequency, measured as a deviation from long-term weather records, are simply being affected by climate change. Climate change is discussed further in the subsection below titled *Climate Change Considerations.* As of this SHMP update, application of climate change projections in the South Dakota hazard mitigation plan is limited.

Development will alter the exposure of people and assets to drought. Development affects demand for water, and the consequences if water becomes unavailable. Perhaps most significant, development in the form or urbanization, can create so-called heat islands and greatly increase hazards cause by summertime heat. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

As of this SHMP update analysis of future development in South Dakota is limited. No analysis exists to evaluate how future development will affect vulnerability to drought or extreme heat. Nevertheless, future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to drought and extreme heat. Evaluations of current and future demographics in South Dakota as they relate to populations that are vulnerable to drought and extreme heat would be useful to drought mitigation planning. Analysis that adds climate change scenarios to a development study would be especially valuable.

Magnitude/Severity

The impacts drought can have on modern society are often underrated. Drought impacts in the planning area can be wide-reaching: economic, environmental, and societal. Droughts cause obvious and severe impacts on agricultural areas by destroying existing crops and prolonging unsuitable growing conditions which hinders efforts to recover agricultural losses. This causes secondary financial impacts first on the farmers, who have no crops to sell, and then on the consumers, who must pay higher prices for scarce produce. Increased demand for a decreased water supply raises water costs, which also drives up the overall costs to both farm producers and consumers. The State may see an increase in dry fuels and associated wildfires, and some loss of tourism/recreation revenue. Water supply issues for municipal, industrial, and domestic needs will be a concern. Lawn and tree impacts in urban areas could result from water restrictions. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. It also increases the wildfire hazard and even landslide hazard.

Urban areas are also impacted by rising water costs, which may impact personal property and personal water usage bills. Recreational uses which are water-dependent may increase significantly in price or decrease in availability, particularly those which are based in reservoirs or lakes, as the water levels may be too low to sustain safe recreation. Finally, the increased risk of wildfires impacts the State. While the hazard of fire itself is profiled separately, drought conditions increase the likelihood that wildfires will occur, either naturally or due to human causes.

The United States Drought Monitor measures drought in five categories, from D0 (Abnormally Dry) to D4 (exceptional drought). These ratings are intended to flexibly combine a wide range of information on drought and measure aspects of drought most relevant to people. Each condition is defined in Table 3-49. The State of South Dakota experiences all levels of drought.

Table 3-50 U.S. Drought Monitor Drought Severity Classifications

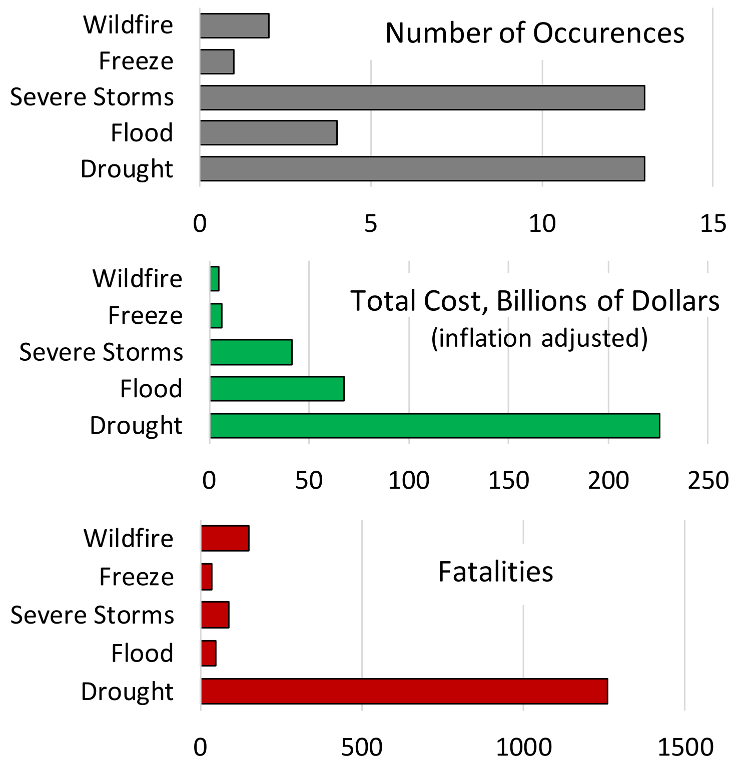
			Ranges				
Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: • short-term dryness slowing planting, growth of crops or pastures Coming out of drought: • some lingering water deficits • pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	• Major crop/pasture losses • Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: U.S. Drought Monitor

NOAA's National Centers for Environmental Information (NCEI) maintains a database of hazard events that cause at least $1 billion damage since 1980. The methods NCEI uses to define $1 billion events are relatively coarse in some respects. For example, if a given hazard affects parts of four states and has a total cost of $1 billion, that hazard event is credited as a $1 billion event for each of the four states. Also, the accounting of cost itself is complex. However, the NCEI $1 billion event data are arguably the best barometer available to make general observations about the relative harm and regional importance of different hazards.

Figure 3-53 summarizes CPI-adjusted NCEI data for $1 billion hazard events affecting at least part of South Dakota 1980-2023 and provides a strong indicator of the relative harm caused by drought relative to other hazards. By a wide margin, drought causes the most monetary damage of any hazard in South Dakota. In fact, from 1980-2023 the damage from $1 billion drought events is nearly double the damage caused by $1 billion events from all other hazards combined. Moreover, NCEI only considers agricultural losses in their data. It is arguable the real financial cost of drought is higher. When considering heat alongside drought, as NCEI does, $1 billion drought/heat events caused *nearly four times more* fatalities than all other $1 billion hazard events.

Figure 3-53 $1 Billion Hazard Events Affecting South Dakota, 1980-2023



Based on CPI-adjusted data downloaded 11-1-2023 from:
NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023). https://www.ncei.noaa.gov/access/billions/

Insured crop loss to farmers is another useful metric and indicator of the impact of drought on the agricultural sector. The 2017 USDA Census of Agriculture for South Dakota estimates the market value of sold agricultural products to be nearly $10 billion annually. Annual insured crop losses due to drought have averaged $505 million over the past 15 years and topped $1 billion three times in that span (Table 3-50). These values are a nearly three-fold increase from similar 15-year statistics cited in the 2015 Drought Plan.

Table 3-51 Insured Losses Caused by Drought, 2008-2022, Adjusted for Inflation

Year	Losses		Year	Losses
2008	$401,185,541		2016	$164,003,976

Year	Losses	Year	Losses
2009	$221,737,100	2017	$352,044,329
2010	$489,487,970	2018	$271,427,144
2011	$477,789,116	2019	$1,094,887,392
2012	$1,113,051,537	2020	$497,845,742
2013	$411,045,671	2021	$705,337,156
2014	$180,045,367	2022	$1,018,179,675
2015	$187,961,980	**Average**	**$505,735,313**

Source: USDA NASS

As of 2023, the National Risk Index (NRI, https://hazards.fema.gov/nri/) provides a divergent view on the severity of drought in South Dakota. Upon investigation of county-level NRI statistics, it was discovered that expected annual losses from drought were at least an order of magnitude lower than past insured loss payouts and typically two orders of magnitude lower than reported in both the 2015 Drought Plan and NCEI's database of $1 billion hazard events. The discrepancy apparently extends across much of the Western United States and it was decided to not consider NRI data that uses expected annual loss in the drought analysis.

Past Events

Drought is remarkably common in South Dakota (Figure 3-54). The U.S. Drought Monitor maintains weekly records of drought. From January 2000 through October 2023, the U.S. Drought Monitor reported all or portions of South Dakota were in some level of drought status more than 88% of this time (142 of 1,243 weeks). All or portions of the state were in Extreme Drought (D3) or Exceptional Drought (D4) 31% of the time (383 of 1,243 weeks). The 2006-07 and 2012-13 drought events were particularly widespread and severe, causing extreme drought over 60% of the State, but fortunately not especially prolonged. In contrast, drought events in 2002-2005 and 2020-2023 were somewhat less severe and widespread but much longer in duration.

Figure 3-54 Historical Drought Conditions, South Dakota 2000-2023

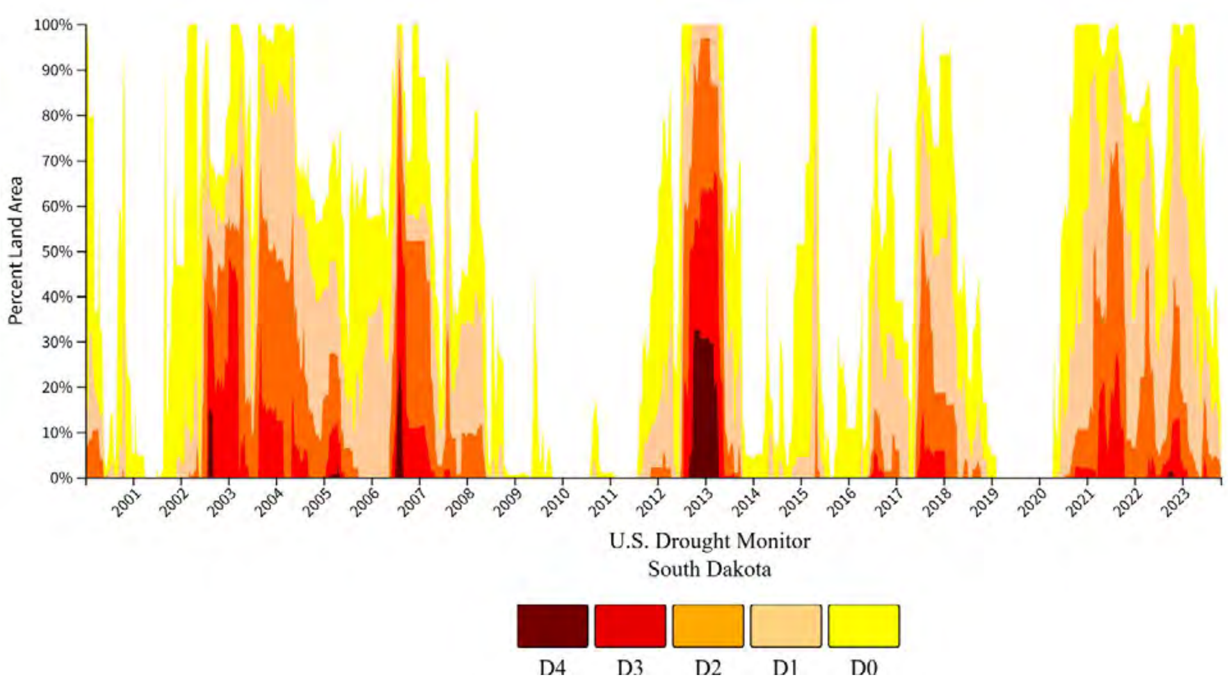


Image source: US Drought Monitor, https://www.drought.gov/states/south-dakota

Academic studies of tree rings provide a longer-term perspective on drought in South Dakota. Bunkers et al. (1999) provide data describing drought conditions dating to the 1300s CE (Table 3-51). To put the historical range of drought into perspective, the drought that led to the Dust Bowl in the 1930s, highlighted in bold text, was only half as long as the longest-lasting drought found in the study. In other words, as severe as drought has been in the last 100 years, it can get much worse.

Table 3-52 Duration & Magnitude Estimates of 15 Dry and 15 Wet Spells in South Dakota

	Dry Periods			Wet Periods		
Rank	Years	No. Years	% Of Max	Years	No. Years	% Of Max
1	1531-1551*	21	100.0	1429-1448*	20	100.0
2	1325-1344*	20	90.8	1284-1297*	14	80.3
3	1859-1873	15	82.5	1559-1574*	16	66.0
4	1397-1411*	15	73.0	1609-1617	9	53.6
5	1710-1725	16	65.8	1762-1769	8	35.7
6	1780-1791	12	51.3	1882-1892	11	31.5
7	1933-1942	10	50.0	1683-1695	12	30.0
8	1753-1761	9	43.5	1792-1806	15	28.1
9	1660-1668	9	44.7	1903-1910	8	27.2
10	1580-1598*	9	32.2	1962-1969	8	26.1
11	1852-1857	6	29.7	1773-1779	7	24.4
12	1956-1961	6	29.6	1832-1842	11	21.1
13	1467-1472*	6	27.0	1726-1733	8	21.0
14	1377-1388*	12	26.3	1943-1947	5	20.6
15	1637-1640	4	24.8	1641-1645	5	19.5

Source: Bunkers, M.J., L.R. Johnson, J.R. Miller, and C.H. Sieg. 1999. Old Black Hills Ponderosa Pines Tell a Story. *Proceedings of the South Dakota Academy of Science*, Vol. 78.
Note: *Sample size <5 trees and is likely not adequate to reliably infer precipitation patterns.

Another source of data on previous drought occurrences is the National Drought Mitigation Center (NDMC), available through their Drought Impact Reporter[10]. These data describe drought impacts based on reports from media, observers, impact records, and other sources. Drought Impact Reporter data are an indicator of the timing, magnitude, and severity of past drought events.

Drought Impact Reporter data contains 400 reports of drought impacts for the state of South Dakota occurring between January 1, 2000 and September 30, 2023. Drought impacts are reported for nine categories, and within each report impacts are often reported for multiple categories. A screen shot showing a typical example of the information provided for each drought impact report is shown in Figure 3-55. In total, 681 discrete drought impacts exist within the 400 drought reports in the Drought Impact Reporter. The 681 impacts are classified as:[11]

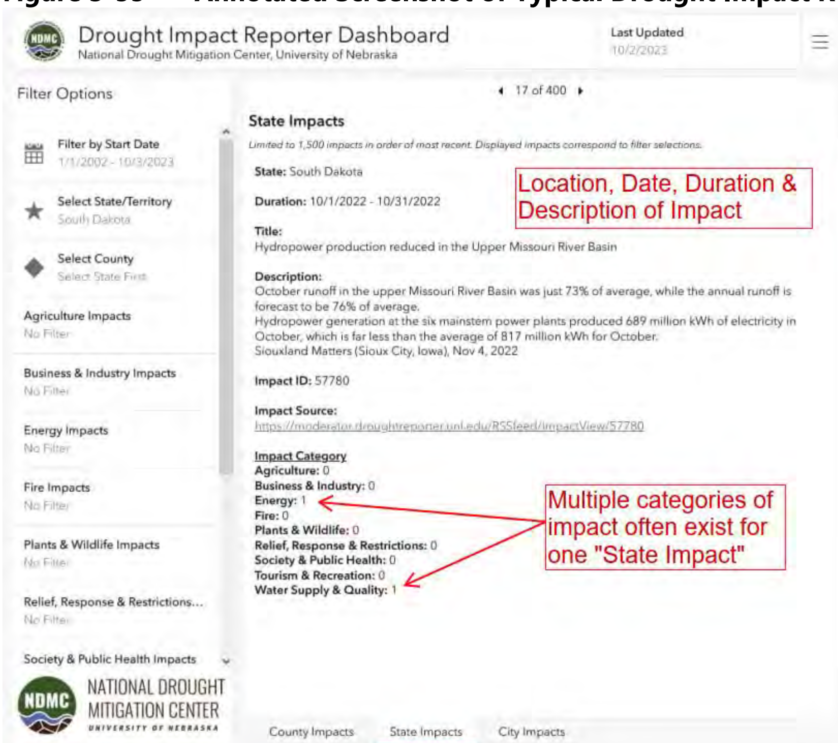
- Agriculture (41%)
- Business & Industry (6%)
- Energy (3%)
- Fire (2%)

10 https://www.drought.gov/data-maps-tools/drought-impact-reporter-dir
11 Definitions for each category are available at https://droughtreporter.unl.edu/help/dir/mapping.aspx

- Plants & Wildlife (10%)
- Relief, Response, & Restrictions (15%)
- Society & Public Health (11%)
- Tourism & Recreation (1%)
- Water supply & Quality (10%)

Interpreting the meaning of impact reports illustrates the difficulty of using quantitative data to understand the impact of drought. For example, a fire impact may be much less than or much greater than other categories of impact. Moreover, a given reported impact to Society & Public Health can be relatively minor or severe. The above data are arguably most useful as one indicator of many that characterize impacts from drought.

Figure 3-55 Annotated Screenshot of Typical Drought Impact Report



The National Centers for Environmental Information (NCEI) provides a valuable source of qualitative information about past drought events. Table 3-52 summarizes some of the most severe droughts in the State since 1889.

Table 3-53 South Dakota Droughts: 1889-2021

Date	Comments
November 2020 – August 2021	Starting from November 2020, a lack of significant precipitation as the agricultural season ended maintained severe to extreme drought conditions. The drought condition persisted through December and January, during which frozen ground provided little means for drought conditions to change, despite 100-175 percent of normal precipitation. Severe drought conditions developed in late February 2021, across much of north central and parts of central South Dakota. Precipitation departures since October 1st, 2020, had been from three-quarters of an inch to two and a quarter inches below normal or only 25 to 50 percent of normal. Severe to extreme drought conditions continued throughout April, especially over north central South Dakota. Through May and June 2021, severe to extreme drought conditions continued across north central South Dakota extending towards the James Valley and into

Date	Comments
	parts of central South Dakota. Severe to extreme drought conditions expanded across the area through the month of June due to much above average temperatures and much below average rainfall. Statewide, South Dakota recorded its 4th warmest and its driest June since record keeping began in 1895. Severe to extreme drought conditions continued from June into July across most of the area. Drought conditions were still prevailing across the State in August, although some improvement in drought conditions were observed by the month's end across portions of Minnehaha and Lincoln Counties.
October 2017	The severe drought across much of central and north central South Dakota at the beginning of October diminished and became confined to just western Corson and extreme northwestern Dewey Counties by the end of October
September 2017	Severe drought continued across most of central and north central South Dakota throughout much of September west of the James River Valley. There was some improvement towards the end of September. Periodic episodes of precipitation across the region had prevented widespread worsening of the drought conditions. The severe drought had begun across the region in early June. Several counties still had burn bans in place. Crops and pastureland continued to suffer from the long-term dryness. The spring and winter wheat production was at its lowest in years and more than 60 percent below long-term norms.
August 2017	Drought conditions improved some in August as a changing weather pattern had brought cooler conditions along with more frequent episodes of showers and thunderstorms. The average monthly temperatures across the drought region were from 3 to 5 degrees below normal. Monthly rainfall amounts were from 3 to 6 inches, ranging from one to nearly four inches above normal. There was a decrease in the area coverage of severe drought along with almost the elimination of the extreme drought region across north central South Dakota. In fact, the drought conditions jumped two categories from the 1st to the 31st from extreme to moderate drought over part of north central South Dakota. Due to the above normal rainfall, there was some improvement with the crops and pastureland across the region. Although, stock water supplies were still running short. Most of the counties across the region had lifted their burn bans by the end of August. There was also an increase in the number of sick or dead livestock due to nitrate poisoning from the drinking water. Stream flows were also up to at or above normal due to the heavier rainfall by the end of the month along with better topsoil and subsoil moisture. The drought continued into September.
June 2017	Governor Daugaard activates the Drought Task Force and on June 8, 2017, declares a drought emergency for the State. The 2017 drought is reported to have led to diminished crop production in the State and to have lasted into January 2018.
July 2016	Governor Daugaard activated the Drought Task Force due to the moderate and severe drought conditions in western portions of the State and extreme conditions in northeastern South Dakota. By August 2016 over 50% of the State was in moderate drought.
January-June 2013	Drought conditions continued over all southeast South Dakota in January. Precipitation was below to well below normal, although with the low midwinter normals, even greater precipitation would have been unlikely to change the dry soil conditions. There was little noted in the way of new effects of the drought, with the dry conditions giving a poor outlook for the spring and summer, including poor germination of the winter wheat crop during the dry fall. Water restrictions continued to be few during the winter because of the low water usage, but the area was becoming more vulnerable to even marginally weather if it developed in the spring and summer. Drought was generally listed as continued severe to extreme for the area.
October 2012	Drought conditions continued over all southeast South Dakota in October with well below normal rainfall keeping soil and vegetation dry. Rainfall for the month was below normal

Date	Comments
	everywhere, and less than half of normal in much of the area. Harvest of drought affected crops was completed, but there was no estimation available on how much yields were reduced. Winter wheat was planted on time, but the lack of moisture greatly hampered germination. Water restrictions were generally eased, with water use dropping off with the fall season. Drought was generally listed as continued severe to extreme for the area.
September 2012	Drought conditions continued over all southeast South Dakota with well below normal rainfall keeping soil and vegetation dry. Rainfall for the month varied from around half to less than a quarter of normal. Stress on crops that prevailed over the growing season became more evident with the start of harvest, although the amount of the reduced yields was still uncertain. Local governments continued to use water use restrictions in an effort to prevent serious water supply problems. Drought was generally listed as continued severe to extreme for the area.
August 2012	Drought conditions continued over all the area with below normal rainfall keeping soil conditions dry. Stress on crops continued even though August was less hot than July, with temperatures averaging only a little above normal. Crop damage was quite evident, though the amount of reduced yields and other damage which might become evident at harvest was uncertain. While reported water supply problems were not extreme, many local governments had water use restrictions in place. Drought was generally listed as severe to extreme for the area and was being compared to the worst of the dust bowl years, though not yet over as long a time period.
July – August 2012	Drought conditions became established over much of the State with long-term dry climate and soil conditions combining with much below normal rainfall during the month. Stress on crops increased and was continuous with no significant relief during the dry month. Hot weather added to the stress as it contributed to high evaporation. Crop damage in the form of reduced yields became certain, but the long remaining time to harvest and the unknown rainfall before that time made even rough damage estimates impossible. Severe general long-term non-agricultural water supply problems were not observed, but the continued long-term dry conditions raised fears of this for the future. Cattle sell-offs were also occurring across the region. Range and pasture conditions were poor to very poor with fire danger remaining a big issue. The severe drought continued into August.
June 2012	Long-term dry climate and soil conditions combined with well below normal rainfall to make the dry conditions more acute and short-term. This resulted in stress on crops developing during the month, mainly south of Interstate 90. After an abnormally dry fall and winter, short-term drought fears had been temporarily forestalled by spring rains. The rains had fallen shortly after an unusually early planning brought on by very warm late winter and early spring weather. However, the return to dry weather in June compounded the effects of the long-term dry conditions.
January –March 2012	The severe drought conditions from December continued across part of northeast South Dakota including the counties of Deuel, Codington, and Hamlin throughout March. The severe drought conditions would continue into February.
2007	Drought continued in some areas of South Dakota. The July 24, 2007, Drought Monitor for South Dakota showed that drought encompassed most of the State. Most of Fall River County was experiencing severe drought conditions that also reached north into southern Custer County.
2006	Fifty-six counties designated primary natural disaster areas by the USDA. The other 10 were contiguous to primary natural disaster areas and thus also eligible for assistance. For many areas, this was their seventh consecutive year of drought. The NWS cooperative observer 8 miles north northwest of Usta in Perkins County recorded a maximum temperature of 120 degrees on July 15th, which tied the previous all-time record high in South Dakota, first set on

Date	Comments
	July 5th, 1936, in Gann Valley. A woman died of heat exhaustion while hiking in the Badlands National Park on July 16th.
2005	Fifteen counties designated primary natural disaster areas by the USDA. Twenty-nine were contiguous to primary natural disaster areas and thus also eligible for assistance. In 2005, the Missouri River basin had experienced five consecutive years of below normal runoff. System storage was at a record low due to the combined impact of the drought and water allocation decisions made during the drought. Impacts included reduced hydropower production, loss of fish production, unusable boat ramps, and irrigation water supply problems. Source: South Dakota Engineer Society
2004	Thirty-four counties designated primary natural disaster areas by the USDA. Eighteen were contiguous to primary natural disaster areas and thus also eligible for assistance.
2003	Forty-three counties designated primary natural disaster areas by the USDA. Twenty were contiguous to primary natural disaster areas (in South Dakota or neighboring states) and thus also eligible for assistance.
2002	Many areas in South Dakota were devastated by drought in 2002. After a dry winter and spring, below normal rainfall for June brought severe drought conditions to the area. Much of the rainfall for June was below 50 percent of normal with much of the area receiving 20 to 40 percent of the normal rainfall. Some locations were at 10 to 15 percent of normal rainfall. Central and north central South Dakota were the hardest hit with the drought conditions. As a result of the severe dryness, a lot of grazing land and stock ponds dried up, and ranchers had to buy additional feed for their animals, transport them to healthier pastureland for grazing, or sell their herds prematurely. Crops suffered with much having to be cut up for hay or replanted. Water levels on lakes and rivers were also way down. Burn bans and voluntary or mandatory water restrictions were implemented across much of the area. All counties were declared drought disasters.
May/July 1992	Twenty-eight counties declared by governor as drought disaster areas: Aurora, Bon Homme, Buffalo, Butte, Campbell, Charles Mix, Corson, Dewey, Douglas, Edmunds, Haakon, Hand, Harding, Hughes, Hyde, Jackson, Jerauld, Jones, Lawrence, Lyman, Meade, Perkins, Stanley, Sully, Todd, Tripp, Walworth, and Ziebach.
1988	Statewide. Regional impact varied.
1985–1987	Western half of state during 1985; continued in Black Hills during 1986 and 1987. Rated as a 10- to 25-year event
1980–1982	Statewide. Rated as a 10- to 25-year event. Most severe in 1981.
1973–1977	Statewide, except Black Hills. Rated as a 10- to 25-year event. Most severe in 1976. Includes drought emergency declaration (FEMA-3015-EM) in 1976
1954–1962	Statewide. Rated as a 25-year event. Regional variations. Most severe in 1956 and 1959, except in the Black Hills where it was most severe in 1961.
1929–1942	Statewide. Rated as greater than a 25-year event. Dust Bowl years. Regional impact varied a little. Most severe in 1931, 1933, 1934, and 1936. Included in this period was a "plague" of grasshoppers
1910–1914	Western half of state. Regional impact varied. Most severe in 1911.
1889–1905	Statewide. Regional impact varied. Most severe between 1894 and 1896 and 1898 and 1901.

Source: NCEI

Probability of Future Occurrence

The distribution of drought across South Dakota is introduced in the Location section, above, especially in Figure 3-52. That figure shows a clear gradient in the number of days per year each county in South Dakota has experienced severe drought between 2000-2022, with the greatest occurrence of severe drought occurring in the western part of the state. The trend follows the general average precipitation trends, with the western portion of the State receiving much less than eastern half, and more prone to drought conditions. Based on paleoclimatic techniques such as tree ring research, which spans a period of roughly 400 years, multi-year droughts as significant as the 1930s drought or worse occur on average every 57 years. Based on historical records (10 in the past 118 years, counting the 2002-2007 dry spell and other multi- year events as one event) notable droughts have occurred somewhere in the State on average about every 12 years, which is equivalent of an 8% chance any given year. Table 3-49 and especially Figure 3-55 also provide some insight to typical drought frequency in South Dakota.

Multiple lines of evidence indicate that severe, regular droughts are a fixture of the South Dakota climate. Somewhere in the state, damaging drought typically occurs many times each decade. All indications are that this will continue into the future. Current predictions of climate change suggest the situation may even worsen in coming decades; an issue discussed in the following section.

Climate Change Considerations

Current projections are for climate change to cause drought to become generally worse in South Dakota, though it is unclear how much worse. The Fourth National Climate Assessment (2018) provides an in-depth analysis of climate change impacts on the U.S. on a regional basis. Chapter 22, *Northern Great Plains* summarized the impacts of climate change on the drought and heat conditions for the Northern Great Plains region, including South Dakota. Model projections paint a clear picture of a warmer future in the Northern Great Plains, with conditions becoming consistently warmer in two to three decades and temperatures rising steadily towards the middle of the century. This warming is projected to occur in conjunction with less snowpack and a mix of increases and reductions in the average annual water availability. Precipitation and streamflow projections show only modest changes, but many areas within the region are already subject to a high degree of year-to-year variability—both wet and dry years. Low-probability, but high-severity and high-impact, events are the result of large variability, including both extreme flood events like in 2011 and drought events like in 2012. This interannual variability implies greater uncertainty about future climate and about the potential for future flooding and drought. Temperature increases of 2°– 4°F projected by 2050 for the Northern Great Plains under the lower scenario (RCP4.5) are expected to result in an increase in the occurrence of both drought and heat waves; these projected trends would be greater under the higher scenario (RCP8.5).

Rising temperatures and extreme heat have consequences beyond drought. The Fourth National Climate Assessment also predicts a substantial rise in the number of days each year exceeding 95ºF, with days over 100ºF projected to double in number in the Northern Great Plains region by mid-century. These conditions will worsen health outcomes to some degree.

Vulnerability Assessment

The vulnerability assessment in the *Drought* section is arranged somewhat uniquely from other hazards. This SHMP update integrates the state drought mitigation plan, which has a sector-based analysis of vulnerability. We retain this sector-based orientation here and strive to provide adequate coverage of both state assets and jurisdiction assets.

Vulnerability to drought is what connects exposure (Figure 3-55) to impacts (Figure 3-54). Adaptive capacity prevents exposure from becoming impact. Understanding how South Dakota is vulnerable to drought and how its adaptive capacity mitigates its vulnerabilities are crucial to designing mitigation measures that will reduce impacts from this hazard.

Populations vulnerable to drought in South Dakota include those that depend on the agricultural industry, as well as people with low incomes. This is especially true for the elderly and very young, people who do not speak English well, and those with developmental, physical, or sensory disabilities. The impacts of drought on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from a drought, and they may be more likely to be uninsured or underinsured.

The 2015 Drought Plan provided a remarkably innovative assessment of vulnerability to drought and adaptive capacities that exist within South Dakota. The sector-based analysis is particularly useful to move beyond the typical agriculture-only focus on drought vulnerability to include a wide range of impacts that can be challenging to assess.

The 2015 Drought Plan was successful in providing useful insight to the most damaging hazard facing South Dakota but existed separate from the State Hazard Mitigation Plan. This 2023 SHMP revision incorporates much of the Drought Plan to facilitate a more comprehensive approach to hazard mitigation in South Dakota.

Integrating the Drought Plan into the Vulnerability Assessment section presents a logistical challenge in organizing content and verifying that all relevant analyses are included. Hazard Vulnerability sections for other hazard profiles in this HIRA update are arranged with five specific sections to facilitate compliance with HMP revision requirements (Table 3-53). The Drought Plan evaluates vulnerability to drought in five sectors. On one side, it is important in this HIRA update to present all information required by FEMA, while on the other side, the aim here is to use the rich insights provided by the Drought Plan to provide a much stronger basis for mitigation measures presented in Section 5. For the 2024 update, the typical vulnerability analysis sections have been mapped to a sector-based analysis according to Table 3-53.

Table 3-54 Vulnerability Assessment Content Location in 2024 HIRA

Typical Vulnerability Assessment Sections	Typical Content	Content Now Appears In
People	Historical and potential impact of each hazard on people	Health and Socioeconomic Sector; Also see Wildfire, Wildlife, and Tourism Sectors
Property	Impacts of each hazard on physical property such as structures, infrastructure, and possessions	Health and Socioeconomic Sector
State Assets and Critical Facilities and Infrastructure	In drought context, limited to reduced revenue from park entrance fees and fishing/hunting license sales	Health and Socioeconomic Sector
Economy	Analysis of economic impact. Including county tabulation of impacts	Health and Socioeconomic Sector
Environment and Cultural Resources	Environment Impacts to flora and fauna, air and water quality, wildfire, and erosion Cultural National Historic Preservation Act issues	Health & Socioeconomic Sector; Relevant discussion in Wildfire and Wildlife Sectors

The approach to the vulnerability assessment is both quantitative and qualitative. Quantitative elements of the vulnerability assessment were conducted where sound data existed to support this, or where data could be developed efficiently. A focus of the quantitative approach was to quantify impacts and the ability to reduce and mitigate those impacts, both short term and long term. Each sector analysis also includes recommendations on what data will be required to improve this approach in the future.

Qualitative information excels at addressing 'how' and 'why' questions about vulnerability that can be difficult to understand using quantitative information. Qualitative information can also provide an important confirmation of conclusions reached through quantitative analysis. Here, qualitative information, particularly data gained from interviews, is used to compliment the quantitative analysis.

Results are provided in map form where possible, based on spatial analysis in a GIS. The following sections provide relevant information on South Dakota water resources and a description of vulnerability by sector.

State Assets, Critical Facilities, and Infrastructure

Drought is a relatively unusual hazard, in that its impacts do not significantly damage state assets. Simply stated, the state does not produce crops or livestock or have assets that would be directly impacted by drought. Direct impact to state assets by drought is likely $0 in all parts of the state. However, *indirect losses* to the state certainly exist and are substantial. For example, a severe enough drought can limit hydropower production. This does not directly damage the hydropower facility, but it costs the state financially through reducing power generation. In addition, drought impacts can reduce tax revenue from lost economic activity and lead to increased costs to deploy the social safety net to affected people and businesses. Considered from this perspective, despite having no *direct* vulnerability of state assets to drought, the state still has a strong financial incentive to mitigate impacts from this hazard. The balance of this section evaluates the effects of drought on a sector-by-sector basis and provides substantial insight to the indirect effects of drought on the state.

South Dakota Water Resources

An understanding of the water resources of South Dakota aids in understanding of drought vulnerabilities. Precipitation in South Dakota averages about 19 inches/year but varies from under 17 inches/year in the northwest to over 26 inches/year in the southeast (Figure 3-56).

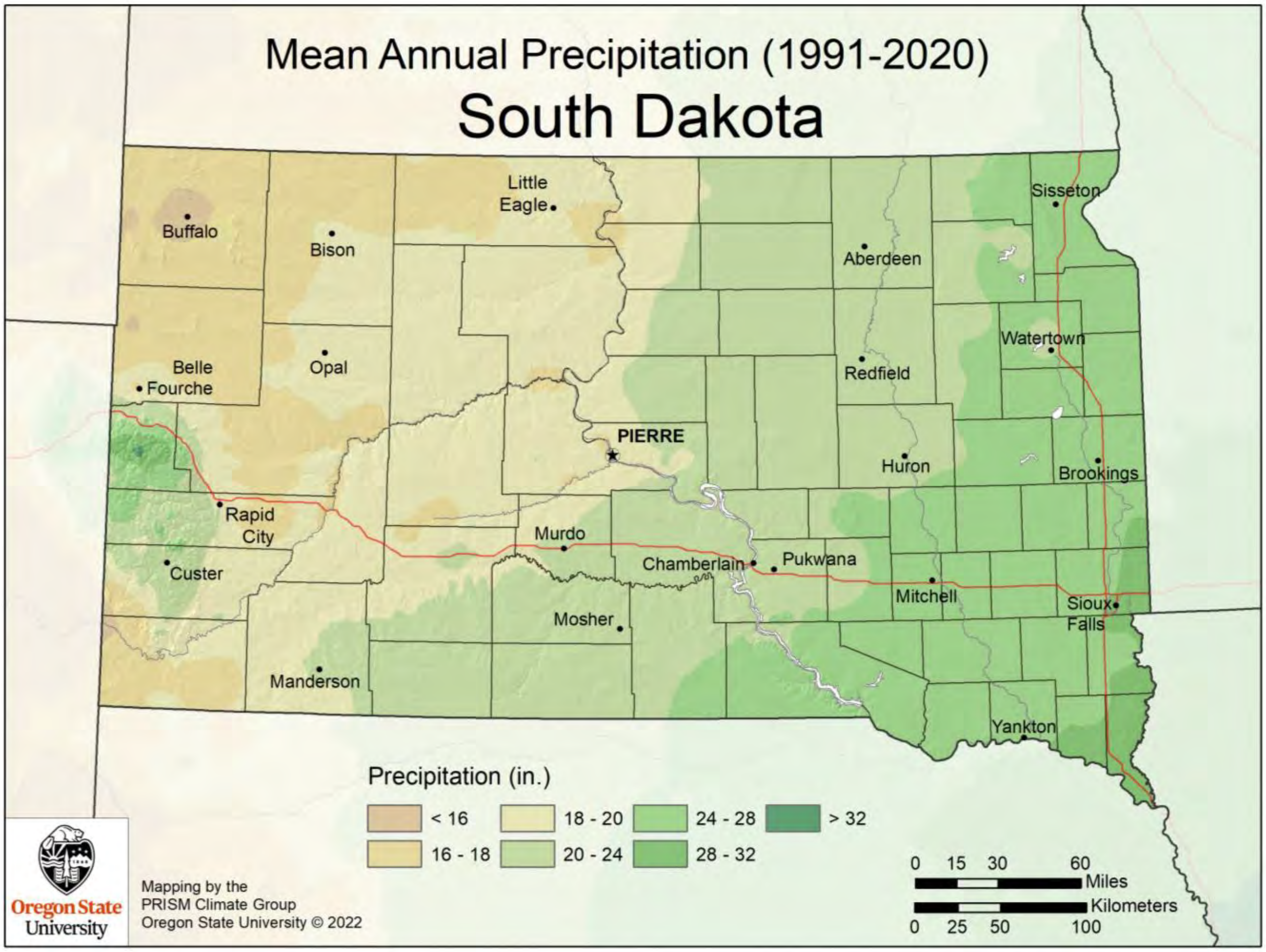
Water is generally available in South Dakota as surface water or as groundwater. Aquifers provide groundwater and are widely accessible using wells. A large proportion of surface water available for use is provided by the Missouri River System (Figure 3-57), especially via large reservoirs managed by the US Army Corps of Engineers Missouri River Basin Water Management Division (Corps). For operational purposes, the storage of each reservoir on the main stem of the Missouri is divided into the following four zones, pictured in Figure 3-58:

- Permanent Pool - includes about 25 percent of the system's storage capacity. It is operated to be full at all times to maintain a minimum amount of water in the reservoirs for minimum hydropower production, minimum irrigation diversion levels, and minimum reservoir elevations for the water supply, recreation, and fish and wildlife in and along the reservoirs and reservoir-based recreation.
- Carryover Multiple Use Zone - storage for irrigation, navigation, hydropower, water supply, recreation, water quality control, fish and wildlife. This zone is operated to maintain downstream river flows. These flows are still maintained in successive dry years although at lower levels. In years when there is not a drought, this zone is designed to be full prior to March 1, when the runoff year begins. During droughts, the storage in this zone supports the aforementioned eight authorized purposes, although at lower levels.
- Annual Flood Control and Multiple Use Zone - provides storage space for spring and summer runoff and is used year-round to support the eight authorized purposes. The Master Manual specifies that this zone be empty on or about March 1 of every year. Any water that is stored in this zone during the spring and summer is intended to be released prior to the next runoff season typically starting at the beginning of March.

- Exclusive Flood Control Zone - used to store floodwaters in extreme and unpredictable floods. It is emptied as quickly as downstream conditions permit.

Figure 3-59 shows the relative proportion of water use from groundwater and surface-water sources throughout South Dakota.

Figure 3-56 Average Annual Precipitation in South Dakota (1991-2020)

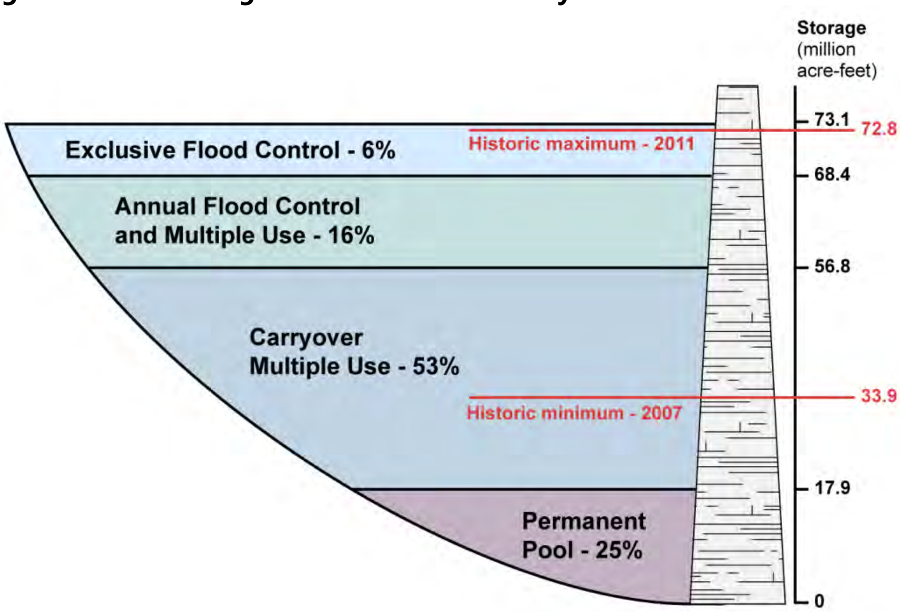


Copyright ©2023, PRISM Climate Group, Oregon State University, https://prism.oregonstate.edu
Map created 11-1-2023

Figure 3-57 Missouri River Basin

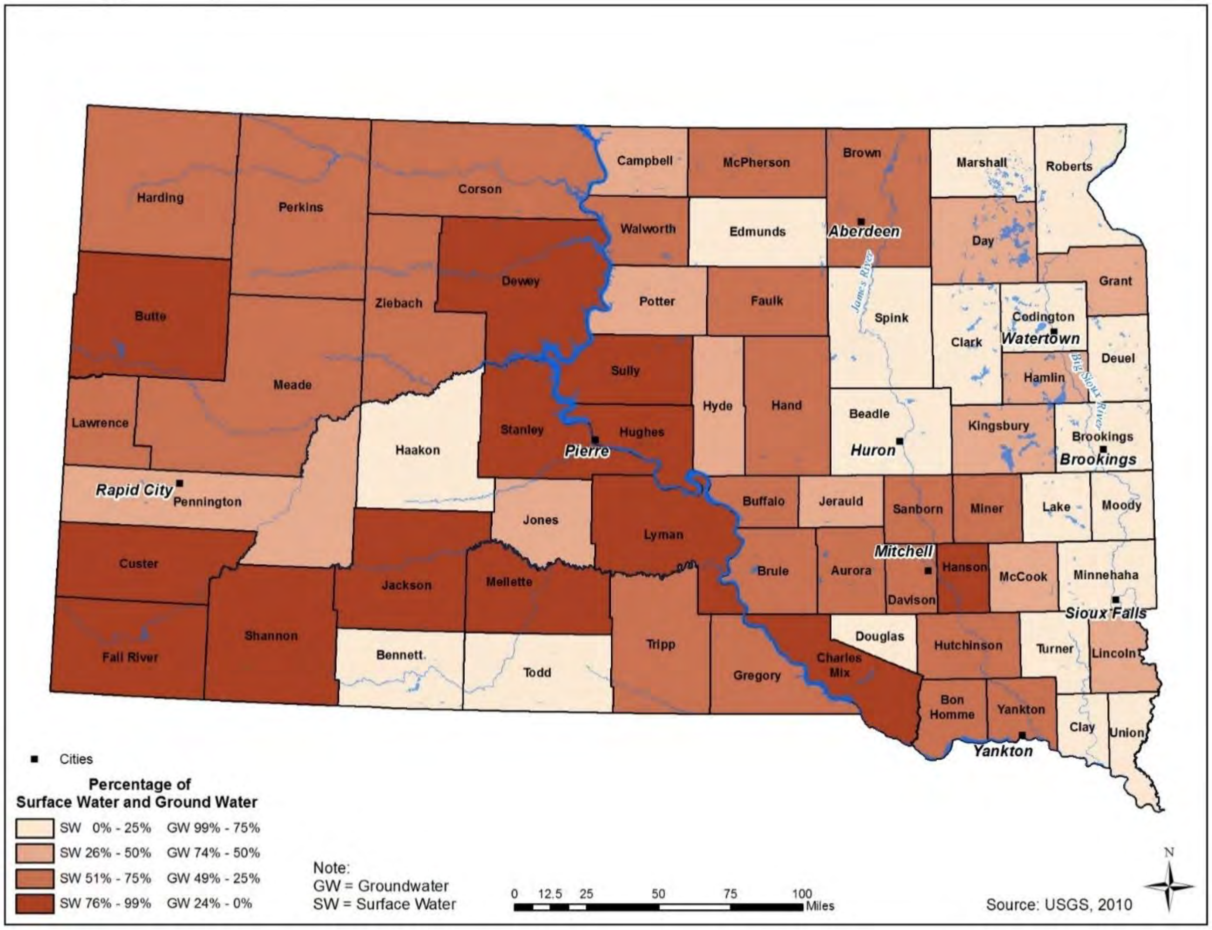
Source: GAO Map Resources (map) | GAO 14-741

Figure 3-58 Storage in the Missouri River System



Source: U.S. Army Corps of Engineers | GAO-14-741

Figure 3-59 Relative Source of Water Supply



Water availability plays a major role in the vulnerability of South Dakota to drought. Water availability is a relatively complex function of water supplies from groundwater and surface water, and the decisions made regarding how to divide that water among demands from agriculture, household use, and environmental needs.

Health and Socioeconomic Sector

Health and socioeconomic vulnerabilities to drought and extreme heat are wide ranging, often indirect, and in many cases are severe. Fortunately, many vulnerabilities are mitigated by substantial adaptive capacity, crop insurance is one such example. This section describes the impacts, vulnerabilities, and adaptive capacity of the Health and Socioeconomic Sector, arranged in discussions of:

- Health,
- Environment and Cultural Resources,
- Economy (including economic vulnerability of agriculture)
- Property, and
- State Assets, Critical Facilities, and Infrastructure.

Health

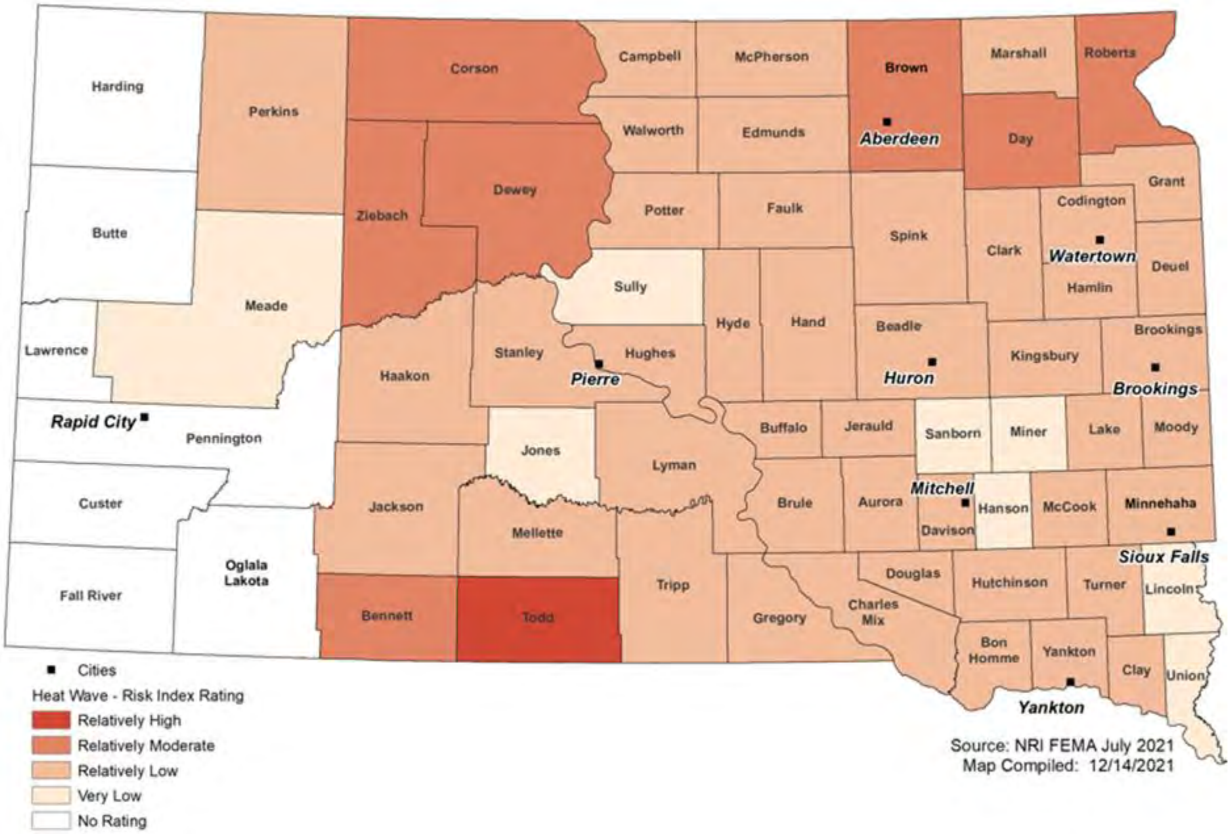
Beginning with the 2022 HIRA update, extreme heat is considered alongside drought. The impacts of extreme heat on health are profound. Extreme heat is among the most lethal natural hazards and some research shows to be responsible for more deaths than any other hazard.[12] Heat also causes a wide range of other health impacts. For example, recent and well-cited research has quantified a link between learning deficits and excessive heat in school classrooms.[13]

Drought is credited with causing a decline in public health due to "compromised quantity and quality of potable water, increased recreational risks, effects on air quality, diminished living conditions, compromised food and nutrition, and increased of incidence of illness and disease."[14] The NRI Heat Wave Risk Rating for South Dakota is presented in Figure 3-60.

Additional health and socioeconomic impacts can occur as the result of cascading impacts of drought and heat to the agricultural industry and subsequently throughout the economy. These impacts include greater unemployment, reduced income, poor housing sales, residential and business relocations, weakened tax base, diminished quality of life, and increased crime rates.[15] These impacts are all important and known to exist but are relatively poorly studied in South Dakota, particularly in a comprehensive fashion that would be valuable to hazard mitigation planning. Many of these issues are acknowledged in the section titled Adaptive Capacity, below.

12 Borden, Kevin A., and Susan L. Cutter. "Spatial patterns of natural hazards mortality in the United States." *International journal of health geographics* 7 (2008): 1-13.
13 Park, R. Jisung, Joshua Goodman, Michael Hurwitz, and Jonathan Smith. "Heat and learning." *American Economic Journal: Economic Policy* 12, no. 2 (2020): 306-339.
14 Kalis, Martin A., Mark D. Miller, and Rachel J. Wilson. 2009. Public Health and Drought. *Journal of Environmental Health* 27 (1):10-11.
15 Klein, Bobbie, and Brad Udall. 2004. 2008 Drought Impact Report, A report to the governor. *Natural Hazards Observer* (July 2004):5-6.

Figure 3-60 NRI Heat Wave Risk Rating by County in South Dakota



Environment and Cultural Resources

The vulnerability of environmental resources to drought is significant and wide ranging. In the past, losses from drought have occurred to plants, animals, wildlife habitat, and air and water quality. Drought has also degraded forest and landscape quality and exacerbated range fires. Drought has led toa loss of biodiversity and considerable soil erosion.

Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

Drought can also increase risk of wildfire. A prolonged lack of precipitation dries out vegetation, which becomes increasingly susceptible to ignition as the duration of the drought extends. A drought may also increase the speed at which dead and fallen trees dry out and become more potent fuel sources for wildfires. Drought conditions can also cause soil to compact, decreasing its ability to absorb water, making an area more susceptible to flash flooding and erosion.

Direct impact of drought on cultural resources is minimal compared to other hazards. Past impacts have degradation of plants and landscapes that increase vulnerability to future wind or water erosion. The Dust Bowl of the 1930s is an extreme example of this process. Increased erosion can degrade or remove cultural resources from their original locations. Erosional deposition can also bury cultural resources.

Recent interest in mitigating the vulnerability of cultural resources to erosion indicates the severity of this issue. Based on input from the SHMT, in 2021 the USDA Farm Service Agency (FSA) allowed most of the counties in South Dakota to apply for funding through the Emergency Conservation Program (ECP) to mitigate the effects of drought and/or wildfire. The State Historic Preservation Office alone received 765 ECP projects for consultation under Section 106 of the National Historic Preservation Act.

One additional impact drought deserves mention. Lower water levels, particularly in man-made reservoirs, can expose previously inundated cultural resources, creating opportunities for looting archaeological sites and cultural resources. It is unclear to what extent this has occurred in the past, but the potential for harm exists.

Economy

In contrast to social vulnerability and impacts to drought, much more can be said about the vulnerability of the South Dakota economy to drought. Experience has shown that economic impacts from severe drought can be extensive and long lasting. Industries that rely on large amounts of water, such as agriculture, are vulnerable to particularly severe impacts as water resources become limited. In addition, sector interdependence in the economy creates vulnerabilities. Indirect impacts can be substantial if drought impairs a wide range of sectors such as commerce, distribution, agriculture, tourism, related environmental resources, municipal and industrial water supply, key city assets, energy generation.

Considerable quantitative data exists to describe the economic impacts of drought. For example, farmers often protect themselves from economic impacts of drought by insuring all or a portion of their crop against drought losses. This is done through multi-peril crop insurance, which is underwritten by the RMA. The RMA, part of the USDA, maintains a database of crop insurance claims, which provides a handy, quantitative measure of drought impacts in South Dakota. Insured crop loss is often used as an indicator of broader impacts of drought.

Table 3-54 illustrates crop losses in all South Dakota counties under varying drought conditions, in 2002, 2012, and 2018. In these years, state-wide drought-related crop losses were roughly $295 million, $840 million, and $25 million, respectively. When adjusted for inflation (see Table 3-50), 2012 remains the most damaging drought year on record in terms of insured crop loss.

Key lessons can be drawn from the data reported in Table 3-54. First, the sensitivity of insured loss to drought is a measure of vulnerability to drought. In years with especially severe droughts, such as 2012, insured loss has proven to approach $1 billion, statewide. Whereas in more normal years, such as 2018, losses have been a very small fraction of what occurs during severe droughts.

A second lesson is that the losses reported in Table 3-54 can be interpreted as demonstrating the implementation of existing mitigation measures; the losses were insured. Undoubtedly, uninsured or uninsurable losses existed in these years, probably in proportion to insured losses. However, had the crop losses been uninsured, the impact to the South Dakota economy would be far greater. This is important context when interpreting Table 3-54.

A third lesson from Table 3-54 is that the variability of county-scale drought loss is considerably greater than the variability at the state level. Brown County, for example, incurred insured losses in the relatively normal or better-than-normal year 2018 that were 31% of what it incurred in the severe drought year 2012. Statewide, insured losses in 2012 were only 3.0% of losses in 2018.

Table 3-55 Crop Loss Due to Drought, 2002, 2012, 2018

County	2002 Indemnities ($)	2012 Indemnities ($)	2018 Indemnities ($)
Aurora	$9,981,468	$20,312,297	$17,944
Beadle	$16,888,079	$15,920,978	$75,547
Bennett	$3,031,438	$2,547,781	$452,317

County	2002 Indemnities ($)	2012 Indemnities ($)	2018 Indemnities ($)
Bon Homme	$6,868,510	$53,074,783	$231,878
Brookings	$387,848	$4,652,860	$86,658
Brown	$3,492,269	$3,867,983	$1,211,001
Brule	$10,078,871	$11,189,445	$77,061
Buffalo	$3,093,701	$5,442,786	$26,534
Butte	$570,113	$568,080	$72,594
Campbell	$3,352,881	$1,639,784	$440,231
Charles Mix	$14,953,511	$52,741,118	$73,451
Clark	$4,452,317	$6,613,557	$448,256
Clay	$1,250,351	$37,583,767	$1,027,786
Codington	$1,394,286	$6,544,813	$418,464
Corson	$4,422,324	$3,837,987	$1,084,173
Custer	$309,970	$617,713	$421,601
Davison	$7,885,578	$25,309,304	$200,729
Day	$979,621	$2,046,009	$301,942
Deuel	$371,275	$3,268,970	$184,154
Dewey	$2,612,684	$1,718,676	$407,325
Douglas	$5,463,319	$32,805,118	$14,369
Edmunds	$5,121,562	$3,333,600	$963,345
Fall River	$319,562	$1,659,373	$867,392
Faulk	$3,245,911	$3,244,005	$24,943
Grant	$218,744	$3,096,120	$665,014
Gregory	$4,700,874	$13,427,341	$136,750
Haakon	$4,439,525	$5,317,145	$443,221
Hamlin	$347,794	$5,296,778	$90,110
Hand	$12,896,771	$7,447,056	$3,471
Hanson	$3,298,202	$26,245,752	$155,279
Harding	$3,402,141	$1,841,929	$659,682
Hughes	$9,941,061	$5,915,209	$180,563
Hutchinson	$9,758,512	$94,572,548	$645,118
Hyde	$8,411,019	$4,555,116	$28,894
Jackson	$2,546,546	$1,749,899	$335,997
Jerauld	$5,164,721	$3,543,515	$42,350
Jones	$2,182,334	$2,660,595	$40,874
Kingsbury	$4,896,508	$4,912,931	$89,748
Lake	$1,167,346	$3,646,413	$112,215
Lawrence	$19,545	$83,794	$9,072
Lincoln	$139,801	$55,931,547	$1,287,250
Lyman	$9,304,102	$9,970,739	$600,595
McCook	$624,002	$45,295,473	$91,284
McPherson	$4,624,314	$4,338,115	$372,712
Marshall	$476,464	$1,021,099	$1,363,712
Meade	$4,288,087	$4,512,961	$1,009,011
Mellette	$1,187,891	$1,459,244	$210,054
Miner	$3,799,930	$6,899,052	$68,251
Minnehaha	$576,527	$29,759,062	$1,048,505
Moody	$311,254	$2,742,224	$210,384
Oglala Lakota	$1,188,991	$1,157,968	$424,217
Pennington	$3,261,621	$3,339,429	$1,476,641
Perkins	$8,077,696	$3,292,653	$506,923

County	2002 Indemnities ($)	2012 Indemnities ($)	2018 Indemnities ($)
Potter	$13,821,626	$3,994,871	$102,966
Roberts	$80,479	$880,552	$491,032
Sanborn	$3,651,509	$5,650,254	$127,382
Spink	$10,169,572	$8,827,121	$318,462
Stanley	$4,749,540	$1,951,946	$100,258
Sully	$18,609,676	$8,206,428	$40,962
Todd	$978,776	$1,580,025	$27,876
Tripp	$7,241,518	$15,736,702	$174,139
Turner	$1,379,258	$56,652,120	$711,393
Union	$131,241	$28,868,718	$634,841
Walworth	$5,895,543	$781,254	$277,892
Yankton	$3,498,560	$49,536,920	$785,405
Ziebach	$2,638,591	$1,636,631	$173,704
Total	$294,625,661.00	$838,876,036	$25,403,898

Source: USDA

Property

Drought does not typically have a direct impact on buildings, although an increase in expanding or collapsing soils due to soil moisture fluctuations could affect building foundations. Developed areas may experience damages to landscaping if water use restrictions are put in place, however these losses are not considered significant. There is not a consistent method or source to estimate and map expected loss to property by county from drought. The methods used by the NRI to calculate expected annual loss data reflect agricultural losses, not property losses.

State Assets and Critical Facilities and Infrastructure

In terms of direct impact to state assets, the greatest vulnerability to drought is lost entrance fee revenue at state parks that provide water-based recreational activities. Decreased sales of fishing, hunting, and boating licenses can similarly affect State revenue. The SD Game Fish and Parks (GFP) annual budget is particularly vulnerable to this economic impact of drought. The GFP does not track license sales in a way that makes the sales data easy to access or analyze patterns in drought years vs non-drought years. Tracking these data would allow for an economic analysis of the vulnerability of the GFP to drought. Based on an account in the Drought Impact Reporter the South Dakota Game, Fish, and Parks Department noted that the State lost approximately $1 million in pheasant hunter license fees during the 2005 drought. The drought conditions reduced pheasant populations and, corresponding, pheasant hunter numbers across the State.

Critical facilities and infrastructure are not particularly vulnerable to damage caused by drought. Drought damage rarely happens to existing buildings, infrastructure, and critical infrastructure.

More likely vulnerabilities to drought exist to the services provided by State assets, critical facilities, and infrastructure. For example, drought likely decreases the volume and potentially the quality of source water for municipal water supply. This increases water treatment costs. Simultaneously, drought increases water demand. It is not clear if this situation has ever led to a water supply disruption in South Dakota. However, this stress to municipal supply may plausibly lead to voluntary and mandatory water-use restrictions. Drought-associated water supply costs may also drive longer-term changes in water rates for customers.

Other impacts to the services provided by state assets, critical facilities, and infrastructure exist. As water levels decrease, boat docks often become unusable. This drives considerable economic costs, either to extend docks or to absorb the loss of revenue paid by dock users. Navigation of lakes and rivers can also become impaired during drought, further impacting user-fee revenue.

Adaptive Capacity

Substantial adaptive capacity also exists in the Health and Socioeconomic Sector to counter the vulnerabilities of the health and socioeconomic sector to drought. Crop insurance programs, promoting non-water-based tourism, mental health screening and healthcare, and access to air conditioning are some of the established adaptive capacities that reduce drought impacts on the health and socioeconomic sector. Table 3-55 presents a summary of the vulnerabilities and adaptive capacities relevant to drought impacts.

Table 3-56 Vulnerabilities and Adaptive Capacity, Health and Socioeconomic Sector

Public Health and Socioeconomic Subsector	Identified Vulnerabilities	Key Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
Health	• Impacts from extreme heat • Impaired water quality and air quality impact health • Compromised Food and Nutrition • Increases in illness and disease (asthma) • Increased Vector-borne disease • Potential for stresses to public water supplies due to extended drought	• Access to air conditioning • Urban forests that reduce heat islands in cities	• Increased monitoring and spatial analysis of drought-related impacts • Increased awareness and drought preparation by public agencies • Increased drought management plans at the municipal level to ensure adequate supply
Behavioral Health	• Increased incidence of mental and behavioral health problems (depression, anxiety, and suicide). • Increased substance Abuse	• Mental health screening (Lewis & Clark Behavioral Health) • Free, confidential support hot lines through Agriwellness Inc. that offer advice from financial experts, referrals to mental health providers, and vouchers for therapy sessions	• Increased public awareness about possible drought implications and the signs of behavioral health issues • Increased funding for behavioral health professionals especially in high vulnerability areas
Environment and Cultural Resources	• Flora and fauna • Habitat & landscapes • Air quality • Water quality • Increase of wildfire frequency	• Wildlife management • Water treatment infrastructure • Wildfire suppression	
Economy	• Agricultural losses • Water restrictions and increased unit prices can increase operating costs for industry • Secondary industry impacts due to decline of water-dependent customers, suppliers, or tourists	• Crop Insurance • Promote other tourism activities in the community not dependent on water	• Industry diversification • Coordinate with media to control messages going out • Cooperative alliances and community planning

Public Health and Socioeconomic Subsector	Identified Vulnerabilities	Key Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
	• Potential new industries may be deterred by uncertainty in water supply • Loss of income, unemployment, indebtedness		
Property	• Water restrictions, shortages	• Reduce irrigation	• Reducing landscaping water demand
State Assets, Critical Facilities, and Infrastructure	• Reduced revenue from entrance fees and hunting, fishing, and boating licenses • Water treatment costs	• PR campaigns to promote tourism during drought • Increased water rates • Water use restrictions	

Agriculture Sector

In terms of drought vulnerability, it is useful to consider the agriculture sector in three parts, dryland crops, irrigated crops, and livestock. Dryland crops are entirely dependent on precipitation and are especially vulnerable to damage by droughts. The large majority of crops in South Dakota are non-irrigated, dryland crops. Irrigated crops are significantly less abundant than dryland crops in South Dakota but are less vulnerable to drought. Livestock agriculture is largely composed of beef and dairy cattle. Livestock owners in South Dakota do raise other animals (e.g., pigs, sheep, goats, horses, etc.), but cattle remain more important economically.

Additional factors exist to influence the magnitude of financial impact from drought, notably heat, farming practices, and crop prices. Extreme heat increases the water demand of plants, making them especially prone to damage under drought conditions. Poor crop diversification and rotation can cause soil depletion, encourage weed growth, and ultimately degrade crops and leave them more prone to damage from drought. Additionally, the dryland farming practice of occasionally leaving fields fallow can cause erosion that depletes soils and leads future crop rotations more vulnerable to drought. Finally, the price of agricultural commodities is notoriously volatile and crop prices can substantially alter the financial damage done by drought.

Substantial adaptive capacity to mitigate drought impact also exists in South Dakota. Crop insurance and relief programs, irrigation, and farming practices such as rotating crops or grazing areas are some of the adaptive capacities that reduce drought impacts. Many more capacities either exist or are under consideration. Table 3-56 provides a summary of vulnerabilities and adaptive capacities for dryland crops, irrigated crops, and livestock agriculture in South Dakota.

Table 3-57 Vulnerabilities and Adaptive Capacity, Agriculture Sector

Agriculture Subsector	Identified Vulnerabilities	Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
Dryland Crops	• Dependence on precipitation • Vulnerability to erosion • Farming practices (e.g., repeatedly planting one crop on a field for multiple years in a row) • Extreme heat	• Crop insurance • Using supplemental irrigation • Crop rotation and best management practices • Create riparian pasture areas through the Game, Fish, and Parks Riparian Pasture Program • Federal disaster assistance programs through the Farm Service Agency o Noninsured Crop Disaster Assistance Program o Tree Assistance Program o Emergency Loan Program o Disaster Set-Aside Program o Emergency Conservation Program	• Using annual crops for forage to supplement perennial forages • Graze winter pastures briefly in early spring to stimulate grass growth • Eliminate or reduce unnecessary tillage • Create windbreaks, or spread straw or mulch over the ground • Diversify agricultural operations to include more drought tolerant crops
Irrigated Crops	• Not widely used • Expensive/not cost effective • Dependence on water source • Water quality issues • Extreme heat	• Crop insurance • Crop rotation • Federal disaster assistance programs through the Farm Service Agency o Noninsured Crop Disaster Assistance Program o Tree Assistance Program o Emergency Loan Program o Disaster Set-Aside Program o Emergency Conservation Program	• Use subsurface drip irrigation rather than pivot irrigation • Eliminate unnecessary tillage • Diversify agricultural operations to include more drought tolerant crops
Livestock	• Feed supplies tied to crop subsector vulnerability • Poor pastureland quality • Depleted water supplies • Extreme heat	• Rural water systems to supplement water supplies for livestock • Rotate feeding areas to improve forage utilization during droughts • Federal disaster assistance programs through the Farm Service Agency o Livestock Forage Disaster Program o Livestock Indemnity Program o Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish (ELAP)	• Reduce stocking rate on pastures and rangeland during droughts • Continue reduced stocking measures for at least one year after the drought ends • Breed drought/high heat-tolerant cattle.[16]

Wildfire Sector

Wildfire is significant hazard on its own (See Section 3.3.5) and a common secondary impact of drought in South Dakota. Drought alone is not enough to cause wildfires, but does increase wildfire frequency, magnitude, and duration. The State's semi-arid climate, highly flammable native vegetation, rugged terrain, and populated wildland-urban interface also contribute to its wildfire hazard. Although wildfires occur throughout the state, the grass and forestland areas west of the Missouri River represent the area

16 Paschal, Joe C. Breeding Drought (Heat) Tolerant Cattle. American Marketing Services. February 11, 2013. http://www.amscattle.com/2013/02/breeding-drought-heat-tolerant-cattle/, accessed April 21, 2015.

most prone to large wildfires. This area remains vulnerable due to the large areas of continuous fuels and the extreme burning conditions that can occur in the area.

South Dakota is vulnerable to drought-exacerbated wildfire for several reasons, notably the abundance of grassland and forests that are conducive to high rates of fire spread. Steep topography and mountain pine beetle infestation, particularly in the Black Hills, further encourages rapid fire spread. Extreme heat, commonly associated with drought, further amplifies fire spread. At the same time, continued development of residential properties in fire-prone areas increases both the potential ignition sources for wildfire and the potential for wildfire to cause damage and threaten lives.

Many sources of adaptive capacity help mitigate wildfire risk. For example, a well-established system of monitoring wildfire danger exists that provides triggers for mitigation actions such as burning restrictions. Promotion of the need to creating defensible space around structures and communities also reduces the potential for damage from wildfires. Table 3-57 provides a summary of vulnerabilities and adaptive capacities relevant to wildfire risk in South Dakota.

Table 3-58 Vulnerabilities and Adaptive Capacity, Wildfire Sector

<table>
<tr><th rowspan="2">Wildfire Subsector</th><th rowspan="2">Identified Vulnerabilities</th><th colspan="2">Adaptive Capacities</th></tr>
<tr><th>Existing or Implemented in the Past</th><th>Potential Options for Consideration</th></tr>
<tr><td>Forest Fires</td><td>• Plentiful fuel loads in Black Hills
• Climate change exacerbates fire potential and intensity
• West River is typically drier than East River and more susceptible to drought-caused wildfires</td><td>• Enact county or statewide burning restrictions as needed
• Issue controlled burning permits
• Limit fireworks displays
• Prescribed burns
• Weed control
• Create fire breaks and defensible space
• Develop wood utilization projects to reduce fire hazards around structures
• Training fire management personnel
• Complete, update, and implement CWPPs for each county
• Continue publicizing and implementing fire hazard and fuels mitigation cost-share program
• Banned Exploding Targets within the Black Hills Fire Protection District</td><td>• Build biomass plants to utilize dead trees and wood waste
• Cross-train fire management personnel in forest and rangeland fire response and suppression
• Have local fire departments develop WUI mitigation programs
• Fire Prevention Program</td></tr>
<tr><td>Rangeland Fires</td><td>• West River is typically drier than East River and more susceptible to drought-caused wildfires
• Grass fires spread quickly, even if the fuel is not completely dry</td><td>• Enact county or statewide burning restrictions as needed
• Issue controlled burning permits
• Limit fireworks displays
• Prescribed burns
• Weed control
• Perform proper maintenance on combines and tractors to prevent sparking
• Graze livestock on rangeland to thin fuels
• Create fire breaks and defensible space
• Training fire management personnel
• Complete, update, and implement CWPPs for each county
• Plant drought-resistant grasses
• Continue publicizing fire hazard and fuels mitigation cost-share program
• Built network of Single Engine Airtanker bases in Hot Springs, Lemmon, Pierre SD, along with bases in Valentine, Chadron and Alliance NE.</td><td>• Cross-train fire management personnel in forest and rangeland fire response and suppression
• Educate farmers and ranchers about importance of farm equipment maintenance and what to do if a tractor or combine fire ignites
• Encourage farmers/ranchers and government agencies to share their fire action plans, especially when their lands border one another
• Identify water supplies and other resources on farms and ranches that could be used during fire response and suppression activities
• Build a SEAT base at Mobridge.
• Enact “Redzone” areas to assist local VFD’s in suppressing prairie fires in drought years.</td></tr>
</table>

Wildlife Sector

South Dakota contains a diversity of wildlife and ecosystems, all of which can be negatively impacted by drought. The wildlife sector encompasses land-based and aquatic wild species and the habitat in which they live. Within South Dakota, the Department of Game, Fish & Parks (GFP) is responsible for managing wildlife resources.

While it is not possible to assign monetary value to South Dakota's wildlife and natural environment, it is important to acknowledge the role it plays in the state's economy. According to the GFP, 54% of South Dakotans participate in wildlife-associated recreation. In 2006 hunting and fishing generated a combined $350 million in retail sales and $162 million in hunting- and fishing-related salaries, wages, and income within South Dakota. In addition, wildlife watchers in South Dakota were estimated to have spent $183 million in trip expenditures and equipment costs in 2006[17].

Wildlife vulnerability to drought is complex and depends on a multitude of interrelated factors. The resilience of individual species to drought plays an important role. Other factors are important, such as the level of legal wildlife protection, the administration of water rights, and land management practices.

Adaptive capacities to limit damage caused by drought to wildlife commonly involve reducing human-pressures on wildlife. For example, programs promoting voluntary fishing limitations during summer afternoons reduce human-caused stress at the same time that drought-caused stress is most intense. Aspects of South Dakota water law that preserve sustainability of water use provides an especially valuable adaptive capacity. Many more capacities either exist or are under consideration. Table 3-58 provides a summary of vulnerabilities and adaptive capacities for the wildlife sector in South Dakota.

Table 3-59 Vulnerability and Adaptive Capacity, Wildlife Sector

Wildlife Asset	Identified Vulnerabilities	Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
Aquatic Wildlife Assets			
Fisheries resources	· Reduced trout abundance due to lower stream flows and higher water temperature.	· Relocate populations	· Improve monitoring of baseline conditions (conditions in normal years)
	· Fish kills in reservoirs due to lower lake levels and higher temperatures, and/or algae blooms	· Restock impacted areas after drought	
	· State Fish Hatcheries may be impacted due to lower inflows; i.e. fewer fish able to be supported, or low spawning success	· Voluntary angling restrictions during afternoons in summer months	
		· Voluntary angling closures	
Fishing habitat and access	· Degradation of aquatic habitat	· Modify fisheries management to address drought	· Include boat ramp construction money into the annual budget
	·Boat ramps become unusable if water levels drop too far	· Advertise water-based recreation that doesn't involve boating (i.e. open more swimming beaches)	· Develop drought reserve funds for use in a drought (i.e. funds for the construction of new boat ramps)

17 GFP, 2006 – reference http://gfp.sd.gov/agency/information/economic-impact.aspx.

Wildlife Asset	Identified Vulnerabilities	Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
	· Need to construct new boat ramps	· Environmental and recreational water rights can provide protection depending on seniority	· Lease flows from senior water right holders to maintain flows in the stream
	· Reduced number of fishing licenses during drought		
	· Smaller streams (i.e. in the Black Hills) may have significantly less flows or go dry		
	· Ephemeral streams may remain dry during the whole year		
Terrestrial Wildlife Assets			
Wildlife resources	· Over-winter forage conditions are impacted by summer drought, causing increased mortality in large game	· GFP manages the elk population as established in the elk management plan	
	· Wildlife (i.e. prairie dogs) encroaching on private land	· Adjust license sales by species type to reduce or increase harvest overall mortality	
	· Decreased forage and insects	· Study the correlation between severe winter weather and mule deer survival and recruitment	
	· Prevalence of disease during droughts (i.e. increased EHD in deer populations)	· Manage hunting licenses	
	· Increased mortality rate in species (i.e. pheasant & ungulates)		
	· Lower big & small game license sales		
	· Higher wildlife mortality from starvation, disease, parasites, and predation (especially young animals)		
	· Hibernation, migration, and breeding patterns can be thrown off by lack of food/water and changing weather patterns		
	· Wildlife enter populated areas in search of food and water, potentially resulting in more conflicts between humans and wildlife and even between livestock and wildlife.		
Wildlife habitat and access	· Degradation of terrestrial habitat	· GFP puts out news releases to warn hunters and wildlife viewers of dry conditions, precautions to take, and actions they can take if they spot a fire while in the field	
	· Release of CRP acres to emergency haying reduces habitat for wildlife	· Landscape-scale wildfire mitigation efforts	

Wildlife Asset	Identified Vulnerabilities	Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
	· State-owned Game Production Areas released to haying and grazing	· Conservation of wetland area through conservation easements and habitat improvements	
	· Private landowners deny access to hunters out of fire fears	· Adjust license sales by species type to increase harvest to reduce impact on forage.	
	· Dry-up of wetlands in the Prairie Pothole Region which is an important habitat for waterfowl		
	· Increased risk of wildfire		
	· Cottonwoods planted to provide bald eagle habitat don't survive tough droughts		

Tourism Sector

Tourism is an important industry in South Dakota. According to the Calendar Year 2022 Sales and Use Tax Report, taxable sales related to tourism was $1.2 billion.[18] The tourism industry provides an important diversification of the South Dakota economy and is especially significant in the Black Hills and Badlands region.

The vulnerability of the tourism sector to drought is largely economic in nature. For example, the economic dependence of an area on tourism is a crucial determinant of drought impact. How drought affects wildlife can drive impacts on tourism. The time of year of a drought may or may not affect locally-important tourism. Wildfire can impact tourism profoundly.

Measuring impacts of drought on the tourism sector is limited by poor data availability, especially at the county level. Past droughts have reduced hunting license purchases by as much as 20%. According to a 2011 report on the economic contribution of hunting in the State, the overall contribution was $597 million. If a 20% reduction occurs to the total economic contribution of this one tourist activity that could mean a drop of nearly $120 Million in tourism revenues. For context, the economic impact of drought related to this one tourism activity is roughly one-fourth of the amount of insured crop losses from drought in an average year.

As is true of other sectors, substantial adaptive capacity exists to mitigate drought impacts to the tourism sector. A crucial adaptive measure is to communicate with the public to reassure them of quality tourism opportunities despite the presence of drought. Communicating the availability of open boat ramps is crucial to boating and fishing tourism. In some cases, adaptive capacity is achieved through specific actions that help mitigate drought impacts. Installing boat ramps that can remain operable during times of low water levels is especially important. Snowmaking can mitigate a lack of natural snowfall and preserve skiing tourism. Table 3-59 provides a summary of vulnerabilities and adaptive capacities for the tourism sector in South Dakota.

18 South Dakota Department of Revenue, South Dakota Sales and Use Tax Report, Tourism Tax by County, Calendar year 2022, https://dor.sd.gov/media/x4bgxd5h/cy2022county-tourism.pdf

Table 3-60 Vulnerability and Adaptive Capacity, Tourism Sector

Tourist Activity	Identified Vulnerabilities	Adaptive Capacities: Existing or Implemented in the Past	Adaptive Capacities: Potential Options for Consideration
All	· Public perception of wildfires degrading enjoyment of tourist activities.	· Targeted messaging to reassure the public of quality of visits	
	· Lack of economic diversity		
Fishing / Boating	· Low water levels	· Administration of water rights (see below)	· Advertise water-based recreation that doesn't involve boating (i.e. open more swimming beaches
	· Smaller streams (i.e. in the Black Hills) may have significantly less flow or go dry	· Lease flows from senior water right holders to maintain flows in the stream	· Modify boating season length
	· Ephemeral streams may remain dry during the whole year		
Boating / Fishing Access	· Reduced access	· Relocate ramps	
	· Boat ramps become unusable if water levels drop too far	· Include boat ramp construction/extension money into the annual budget	
	· Need to construct new boat ramps	· Develop drought reserve funds for use in a drought (i.e. funds for the construction of new boat ramps)	
		· Communicate to the public which ramps are open and which are not	
Fishing	· Degradation of aquatic habitat Reduction in fishing licenses during drought	· Modify wildlife management to address drought	
Various Outdoor Recreation	· Fire restrictions resulting in less interest in camping/hiking/horseback riding, etc.	· Work with PR firms and media to control message, emphasize the positive.	
		· Provide information to public through media and tourism outreach to notify visitors of areas not impacted	
Skiing / Snowboarding	· Decline in skier/snowboarding visits due to lack of snow	· Snowmaking	· Work with PR firms and media to control message, emphasize the positive
		· Work with PR firms and media to control message, emphasize the positive	· Ski resorts can market other winter recreation activities
Golfing	· Watering restrictions for golf courses		· Increase irrigation efficiency by changing irrigation methods or timing (ex. water at night).

Tourist Activity	Identified Vulnerabilities	Adaptive Capacities	
		Existing or Implemented in the Past	Potential Options for Consideration
			· Increase use of xeriscaping and drought resistant grasses

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they relate to hazards. For example, the spread of larger and larger farming operations raised concerns in many plans over water usage. However, analysis of the water usage issue was not well developed in the context of a development concern in any plan. It is not possible to generalize the impact of development trends specific to drought hazard vulnerability, especially at a statewide level. Many drought impacts have a slow onset or are indirect. It is especially challenging to design research specific to drought vulnerability that provides the right context for mitigating drought-specific hazards. As of this SHMP update, no analysis exists to evaluate how recent or future development has or will affect vulnerability to drought hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to drought hazards. A key part of this research will be challenging to scope. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to drought hazards. A focus on mental health impacts is important.

Given the present state of knowledge, it is apparent that the effect of development trends on vulnerability to drought is ambiguous. It is not anticipated that development will affect drought vulnerability in the near future. A summary of the consequences of drought is provided in Table 3-60.

Table 3-61 Drought Consequence Table

Category	Narrative
Impact on the Public	Health impacts from extreme heat are arguably the most severe of any hazard. Health impacts also result from low water quality, and increased risk of infectious diseases/contamination. Reduced water supply could lead to water use restrictions; air quality from blowing dust could impair health.
Impact on the Economic Condition of the State	Agricultural economies are adversely affected if drought results in widespread loss of crop or yield reductions or livestock impacts. Agricultural supply and support industries can also be affected. Food costs increase due to higher costs or lack of production; reduced tourism and recreation revenue for activities reliant on precipitation (i.e., water sport industries, fishing, hunting). Local economy and finances dependent on consistent water supply or precipitation may be adversely affected for duration of drought
Impact on the Environment	Disruptions in wildlife and habitat, including increased animal mortality; decreased land quality; low stream flows; increased water contamination. May cause disruptions in wildlife habitat, resulting in an increasing interface with people, or reducing numbers of animals if forage becomes too sparse. Land quality can be negatively impacted by overgrazing during drought. Water quality can become degraded to the point of causing localized fish kills. Low stream flows and higher water temperatures will have negative impacts on riparian habitats and aquatic species
Impact on Property, Facilities, and Infrastructure	Infrastructure can be damaged by excessively dry expansive soil as it contracts; dams and ditches can experience structural damage due to decreased pore water pressure, damage caused by high sediment loads when pulling water from

Category	Narrative
	the bottom of reservoirs, and damage caused by debris flows and flooding following wildfires. Water treatment facilities may be stressed. Reduced hydroelectric power generation
Cascading Hazards	Wildfire, Flood, expansive soil issues

3.3.7. Tornado

Hazard Description

The NWS defines a tornado as a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one-mile wide and 50 miles long. In an average year, about 1,000 tornadoes are reported across the United States, resulting in approximately 80 deaths and more than 1,500 injuries.

Though climate data is available to explain a predisposition to tornadoes, there is no accurate way of predicting when or where a tornado may occur. Tornado systems have been linked to the development of temperature and wind flow patterns in the atmosphere, which can cause moisture, instability, lift, and wind shear. Expert predictions of these conditions begin first by modeling in the long-term and relying on critical analysis of satellite data, weather stations, balloon packages, airplanes, wind profilers, and radar-derived winds to pinpoint storm activity for the short-term.

Tornadoes typically occur in South Dakota in May, June, and July, but they can occur in any month. The greatest period of tornado activity (about 82 percent of occurrence) is from 11 a.m. to midnight. Within this time frame, most tornadoes occur between 4 pm and 6 pm.

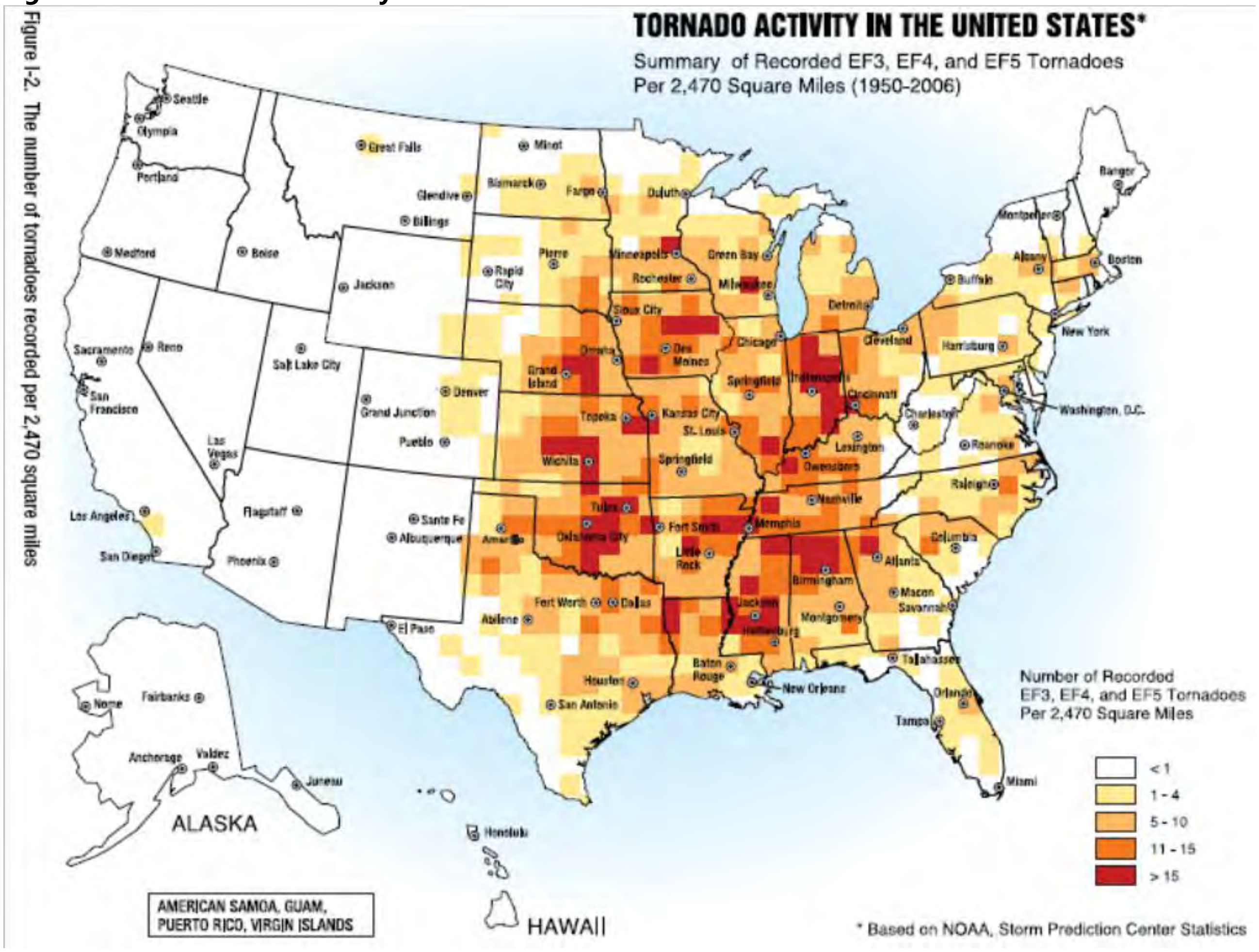
Location

Tornado disasters are often associated with Tornado Alley (the area from the Gulf to the Northern Great Plains that has high tornado incidence). South Dakota sits in the northern region of Tornado Alley and is susceptible to the specific conditions to which the formation of tornadoes has been attributed: warm Gulf air coming in contact with cool Canadian air fronts and dry air systems from the Rocky Mountains. The intersection of these three systems produces thunderstorm conditions that can spawn tornadoes. According to NOAA, tornadoes can occur at any location and from a wide variety of conditions. Western South Dakota, though not in the Tornado Alley, is still vulnerable to tornadoes of different strengths.

Figure 3-61 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 2,470 square miles between 1950 and 2006. Figure 3-62 illustrates the total number of tornadoes per county from 1955 to 2022. By noting the South Dakota data from these two maps and matching them up to the Wind Zone table (Table 3-65) in the Windstorm section, it appears that approximately 90 percent of South Dakota has a high tornado risk and 10 percent has a moderate tornado risk. A very small area in the northwest corner of the State has a low tornado risk.

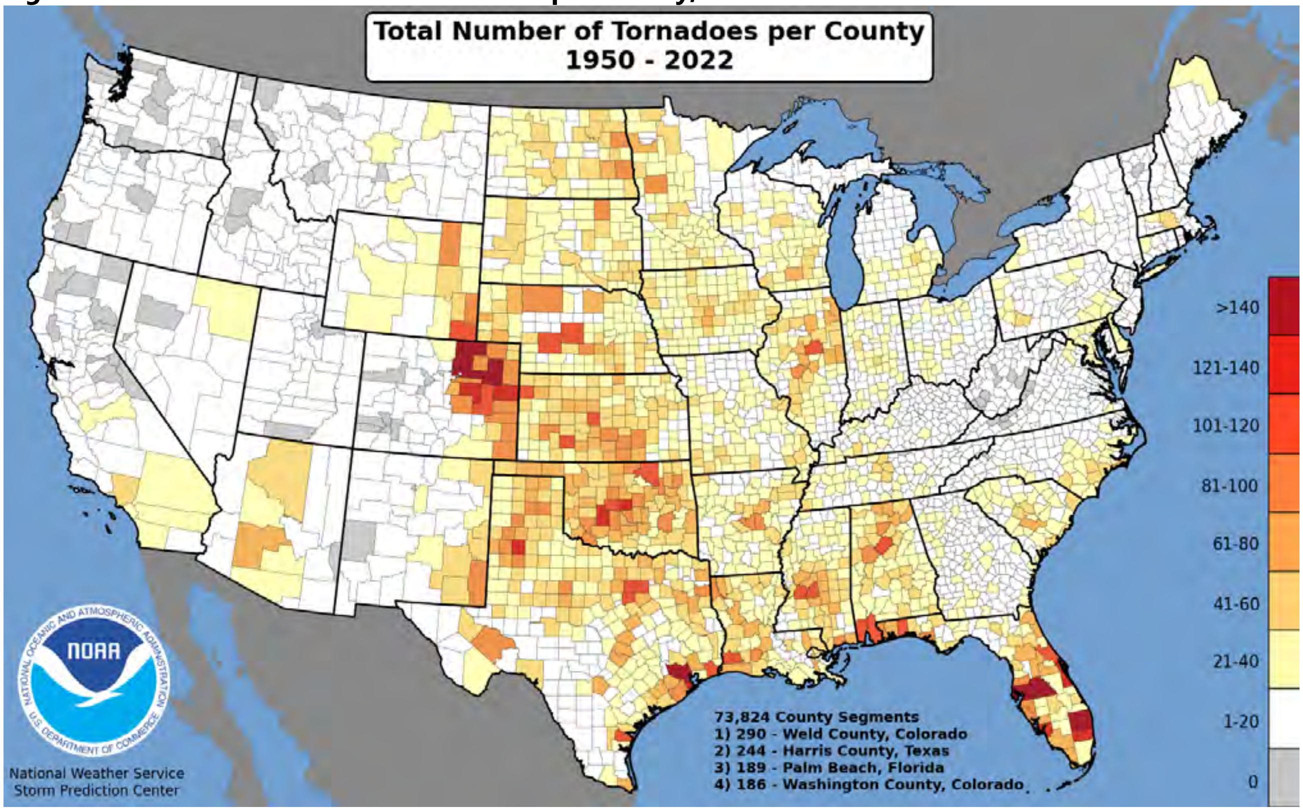
The future location of tornado hazards will be impacted by both climate change and development. Climate change will alter weather, which can reasonably be expected to affect tornadoes, is discussed further in the subsection below titled *Climate Change Considerations.* Development will alter the exposure of people and assets. How, how much, where, and how development occurs affects both exposure and vulnerability to tornadoes. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Figure 3-61 Tornado Activity in the United States



Source: Taking Shelter from the Storm (FEMA 2008)

Figure 3-62 Total Number of Tornadoes per County, 1955-2022



Source: NOAA

Past Events

According to the NCEI Storm Events Database, there were 726 tornadoes in South Dakota between 1950 and 2021 rated as an F1 or higher. Tornadoes reported in the database are in segments. One tornado can have multiple segments as the NCEI counts a new segment when county boundaries are crossed. So, the number of past occurrences is really a reflection of the number of past tornado segments. Total property damage for these events is estimated at $706,258,000. There were 27 deaths and 466 injuries in this time period. This number increases to 29 deaths and 466 injuries if all tornado events, including those smaller than an F1, are recorded. This suggests that South Dakota averages 10 tornadoes of F1 intensity or greater, $972,907 in damages, and seven injuries each year.

Figure 3-63 shows tornado paths of individual tornadoes where data was available.

Figure 3-63 Tornado Paths in South Dakota 1955-2019

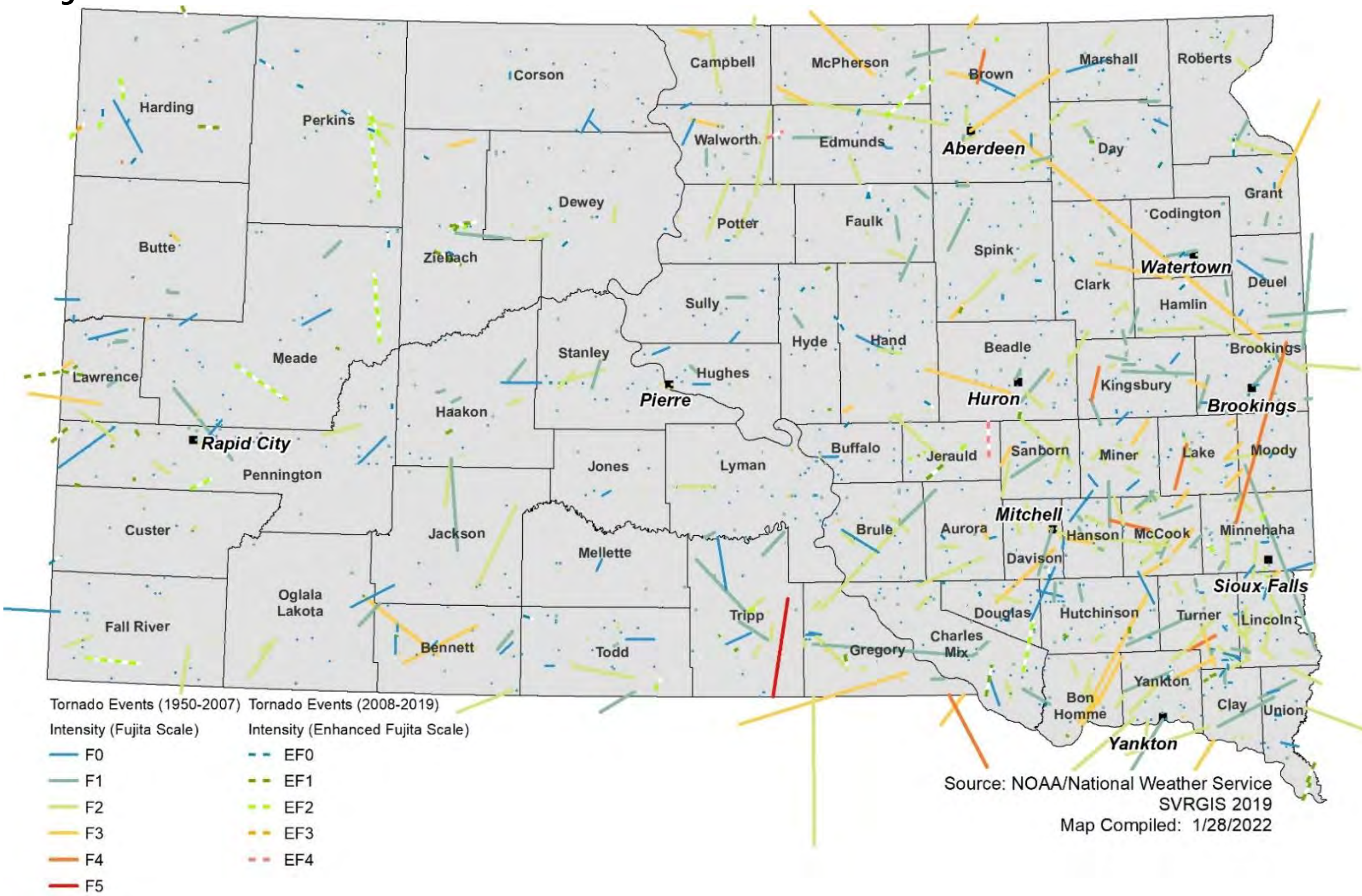


Table 3-62 South Dakota Tornadoes

Date	Comments
August 29, 2021	Based on Sentinel satellite imagery, the tornado spun up in Turner County around 2 miles west southwest of Lennox in a field southwest of the intersection of 464th Avenue and 279th Street. The tornado tracked east-northeast for around one-half mile and crossed into Lincoln County just south of the intersection of 279th Street and 464th Avenue. After another half mile, the tornado uprooted seven large cottonwood trees and damaged numerous others at the Lenkota Country Club. The tornado continued into the western portions of Lennox north of the city park, with a majority of damage to large trees between 4th and 5th Avenue as the path turned more eastward and eventually a bit southeastward. The most significant damage occurred as the tornado approached State Highway 17, with a trampoline deposited high in a gnarled tree along South Cherry Street, and the complete destruction of a shed just east of Highway 17. The tornado lifted about a quarter mile east of Highway 17, just east of Lennox. Areas south of the path experienced strong rear-flank winds. While in Turner County, the tornado was rated EFU, while in Lincoln County it was rated EF1. The average path width for the tornado was 100 yards. Property damage costs are a rough estimate. Damage was estimated to be $75,000 according to the NCEI database.
August 30, 2020	The tornado initially touched down in the pastureland east of South Dakota Highway 45, roughly 0.8 miles south of 184th Street. It continued to track north for roughly 0.6 miles, damaging a tree grove and fence line. The track then turned west northwest and crossed South Dakota Highway 45, roughly 0.2 miles south of 184th street. A southbound RV pulling

Date	Comments
	an enclosed trailer was struck. The trailer detached from the RV and the RV was lofted and rolled roughly 200 yards into a corn field on the west side of South Dakota Highway 45. The driver was pronounced dead at the scene. The tornado track continued west northwest through the corn field for an estimated 0.4 miles. The tornado was at its peak width and intensity at this point. Corn was completely flattened in some areas with a distinct convergent pattern. As the tornado weakened and roped out the path took a southwest turn and persisted for roughly another 0.6 miles before coming to an end in the corn field.
August 28, 2020	A tornado formed just southwest of the intersection of 203rd Street and 428th Avenue. During a brief touchdown and eastward travel, damage was limited to crops, marked by ground scour noted on high-resolution satellite data. The tornado lifted around a quarter mile east of 428th Avenue. Crop damage is an estimate from insured losses. Information provided by the USDA.
July 6, 2020	A long-lived supercell thunderstorm tracked east-southeast from Wyoming across parts of the northern Black Hills and west central South Dakota, including the Rapid City area. The storm produced hail as large as baseball size as it moved through Rapid City, with gusty winds as well. Significant damage to vehicles and property occurred in western and southern portions of Rapid City. The storm also produced an EF2 tornado over the northern Black Hills, where it snapped and uprooted large Ponderosa Pine trees.
July 4, 2020	A tornado touched down 3 miles north northwest of Wetonka causing significant damage to the Grassland Hutterite Colony. A large machine shop lost the roof and wall. A large, empty, anchored grain bin was completely removed from its base and the adjacent feed mill was significantly damaged. A 400 foot by 80-foot turkey barn was completely destroyed along with a smaller outbuilding. Debris from these two buildings was scattered in many directions. A trailer was flipped, freight storage unit rotated, and two other outbuildings had complete loss of roof panels. Roof and siding damage occurred to many of the residential buildings. Tree and crop damage had also occurred. The tornado tracked over 2 miles southeast, crossing McPherson County Highway 23 and ending about one mile north northeast of Wetonka. Debris from the Grassland Colony was dispersed along the entire track of the tornado.
September 10, 2019	A frontal boundary provided focus for convective development across south central South Dakota during the very late afternoon and early evening as a strong impulse moved in the southwest flow aloft. Initial discrete cells produced spotty hail and damaging wind, with MLCAPE values around 1500-2000 J/kg and 45-55 knots of deep layer shear. As cells spread eastward and developed into a line, the increase in low-level jet during the evening quickly increased the 0-3 km shear to 35-40 knots. Three QLCS tornadoes occurred within the city limits of Sioux Falls. In addition to the tornadoes, widespread wind damage to trees and spottier damage to residences were reported across much of the city. A total of nine people were injured in the storms around Sioux Falls. Repeated cells resulted in flash flooding by later evening and into the overnight hours.
August 6, 2019	A tornado developed and touched down in the heart of town near Washington and 7th streets, causing damage to several trees at the touchdown point. Shortly after, the tornado severely damaged several structures while tracking south, including leveling several buildings at the lumber yard, destroying the civic center, and causing significant damage to the school. The start of the school year was delayed by two weeks due to extent of the damage. Two people were (directly) injured by debris when a garage collapsed on them while moving vehicles to safety. Numerous power transmission poles and lines were removed by the tornado. Around 2 miles south southeast of Burke, the tornado struck a residence causing severe damage to the roof. Shortly thereafter, the tornado lifted before reaching the intersection of 295th Street and 345th Avenue after traveling a bit less than 4 miles. The path width reached a maximum of 75 yards within the city of Burke. Up to 3000

Date	Comments
	trees were damaged by the tornado in and near Burke. Property damage costs are rough estimates.
July 18, 2019	A brief land spout occurred during the initial phase of scattered thunderstorms which developed rapidly along a weak convergence boundary. The brief land spout touched down in a cornfield near the intersection of 467th Avenue and 258th Street in Crooks. The tornado traveled generally toward the east-southeast just on the north side of 258th Street, striking a farm outbuilding and removing several metal roofs panels at the very end of its track.
July 17, 2019	A tornado spun up around two miles north of Tripp, touching down just east of a railroad line east of State Highway 37 and north of 285th Street. The tornado tracked to the southeast, where it impacted a farmstead, causing significant damage to two barns and destroying a small outbuilding. The tornado continued across 411th Ave. where it removed the second story of a poorly constructed residence. Fortunately, the residents were not home at the time. After a mile on the ground, a third farmstead was struck tearing metal roofing from a barn. At this point, the tornado veered a bit more southward, finally lifting just after crossing U.S. HWY 18 near 412th Ave.
June 28, 2018	A tornadic thunderstorm tracked east-northeast from Montana across Harding County during the evening. The storm produced several tornadoes, including four in Harding County. The largest of the tornadoes was rated EF-3 and caused significant damage at a couple of ranches. Each event is described below: The tornado started south of Capitol, Montana and crossed the state line into South Dakota approximately ten miles south southwest of Camp Crook. The tornado produced considerable tree and structural damage west of South Camp Crook Road. It also lifted and destroyed some farm machinery, including a five-ton tractor that was found a few miles northwest in Montana. East of Camp Crook Road, a large farm outbuilding was destroyed, and its foundation was extracted from the ground and broken apart. The tornado was rated an EF-3 with peak wind speeds estimated around 136 mph. The tornado developed just south of SD Highway 20 near mile marker 17, where it snapped power poles and trees near a house. A farm outbuilding was also severely damaged, with most of its exterior walls collapsed. Based on video evidence, the tornado then continued northward across rural areas northwest of Buffalo and crossed Clanton Road before dissipating. The tornado was rated an EF-2 with peak wind speeds estimated near 115 mph. Based on eyewitness reports and video evidence, the tornado developed east of the first tornado near Johnson Draw and continued northeastward to near Waterhole Creek before dissipating. A home on Holcomb Place was damaged. The tornado was rated an EF2 with peak wind speeds were estimated near 120 mph.
June 13, 2016	A severe thunderstorm developed over the eastern slopes of the central Black Hills and tracked northeastward onto the plains. The storm produced large hail and eventually formed into a line of storms with strong wind gusts as it moved across the plains. An EF2 tornado developed as the storm moved north of Hermosa; Numerous pine trees were snapped along Murphy Road where the tornado initially formed. Several power poles were snapped where it crossed Highway 79. Several homes were badly damaged, and many outbuildings were destroyed as the tornado passed through the Spring Creek Acres subdivision. The property damage is estimated at $100,000
May 22, 2016	An EF2 tornado developed over southeastern Todd County and moved northeastward for about ten minutes. The tornado did not damage any structures as it tracked across fields for almost five miles. However, it did snap eight to ten power poles at the ground at the intersection of Littleburg Road and Hidden Timber Road. Several large trees in a shelter belt were snapped off and uprooted. Property damages are estimated at $10,000. The same storm produced an EF1 tornado in Tripp County and resulted in $25,000 in property damages.

Date	Comments
August 6, 2015	Thunderstorms produced damaging winds in southeast South Dakota during the afternoon and early evening of August 6th. The storms affected mostly Brookings County, but the first report was some distance away in Gregory County, and there were reports in Moody County also. There were also two tornadoes and one report of large hail. A tornado damaged the roof, gutters, and siding of three houses, damaged the roof, patio deck, chimney, and garage of another house, and damaged a fence. Damages estimated at $80,000.
June 19, 2015	A long-lived complex of severe thunderstorms tracked from southeastern Montana across northwestern South Dakota. The strongest storms produced hail to six inches in diameter, wind gusts over 80 mph, and a tornado in southern Meade County. Significant structure, property, and crop damage was reported in Butte and Meade Counties. Livestock were killed by the large hail in the Nisland area, with one rancher losing 35 sheep. The storms continued into south central South Dakota, but no reports were received due to a widespread power outage. A tornado touched down in rural southern Meade County, damaging buildings and tossing equipment at two ranches. Damage estimated at $100,000.
May 10, 2015	Thunderstorms over southeast South Dakota from late morning to the start of the evening on May 10th produced several tornadoes, including one that caused injuries and severe damage in Delmont in Douglas County. The thunderstorms also produced large hail, damaging winds, and flash flooding in locations extending to the eastern border of the State. A tornado, crossing into Douglas County from Charles Mix County, destroyed or damaged 84 structures in and near Delmont, and injured nine people in Delmont. About 50 of the homes and other structures were destroyed or severely damaged. The damage included numerous small farm buildings totally destroyed, most at four farms south of Delmont, several houses severely damaged, a large 100-year-old church severely damaged, and a newly constructed fire hall destroyed. Power lines and poles were down, and the town was without power and water for two days. 100 residents were displaced. Damages estimated at $1.5 million.
June 18, 2014	Thunderstorms during the evening of June 18th produced tornadoes in Jerauld County, with one tornado crossing briefly into Beadle County. The tornadoes included one that caused severe damage to Wessington Springs. There was also a report of large hail. A tornado severely damaged two-family farms, including destroying a farmhouse as the family took shelter in their basement. A couple in the house suffered minor injuries. The tornado also damaged trees, power poles, and power lines; and caused an unknown amount of crop damage. The tornado crossed briefly into Beadle County before lifting. Damage estimated at $325,000.
June 17, 2014	Thunderstorms during the late evening of June 17th produced a tornado near Humboldt South Dakota in Minnehaha County and large hail near Dolton in McCook County. The tornado blew down the exterior walls of a house, in which a family escaped injury by taking shelter in the basement. The tornado also tore the roof off a farm storage building, tore the metal roof off a metal building, blew down electrical poles, and caused tree damage, including several trees snapped off at the trunks. Damage estimated at $100,000.
October 4, 2013	A tornado crossed the Missouri River from Dakota County in Nebraska and entered Union County. The tornado severely damaged the roof of a house, and collapsed a chimney, carport and porch roof, and the walls of a garage in the same house. The tornado also caused tree damage, including trunks snapped, overturned an irrigation system, and damaged the roof, siding, and/or gutters of at least four other houses. Damage estimated at $450,000.

Date	Comments
May 28, 2013	A tornado touched down on the west side of Allen Road south of Allen and rolled a mobile home down a hill. It tore off the roof and collapsed several walls of a small stick-built house on the east side of the road before dissipating. Damage was estimated at $100,000.
June 22, 2012	A severe thunderstorm tracked eastward from Wyoming across southern Fall River County. The storm produced enormous hail near Edgemont and a tornado between Edgemont and Ardmore. The tornado damaged buildings on a ranch north of Ardmore and blew down power poles and trees. A large wooden barn was completely destroyed; its walls and roof were blown more than 100 yards away. Two large sheds lost roofs and walls, and smaller sheds were blown apart. A modular house sustained minor damage. Damage was estimated at $500,000.
June 12, 2011	A cluster of severe thunderstorms moved east from northeastern Wyoming and southeastern Montana across Harding and Butte Counties. The storms produced hail, wind gusts near 80 mph, and a small tornado west of Redig. The tornado destroyed part of a barn, rolled large steel calf shelters, blew down steel stockade walls, and lifted a calf shelter over a nine-foot fence.
May 9, 2011	A severe thunderstorm produced a tornado northeast of Wall and wind gusts to 60 mph over far eastern Meade County. A large electric transmission tower was crumpled, seven wooden power poles were snapped, and trees were snapped.
June 16, 2010	FEMA-1929-DR An intense low-pressure system developed across the Northern Plains states and impacted the region on June 17. At least 61 tornadoes were reported that afternoon and evening across North Dakota, South Dakota, and Minnesota. A supercell around Dupree and Faith spawned 16 or more tornadoes, with four and possibly five on the ground at the same time.
May 22, 2010	Severe weather shifted north as a low-pressure system tracked across the Northern Plains states on May 22. Isolated tornadoes were reported across portions of central South Dakota that afternoon. The most intense supercell produced a long-lived wedge tornado in and around Bowdle, South Dakota where numerous houses and farm buildings were destroyed, and cars were thrown into the air. It was rated as an EF4, but fortunately remained in rural areas and no injuries were reported. Tornadoes in Edmunds and McPherson Counties damaged 60 utility poles. FEM Electric customers on 40 meters were without power for 48 hours. Emergency repair and restoration costs for FEM Electric were estimated at $210,000.
July 9, 2009	Severe storms developed over Fall River County and moved eastward across southwestern and south-central South Dakota. The storms produced large hail and strong wind gusts. Two tornadoes were observed in Todd County and two tornadoes touched down in southern Tripp County. A small tornado touched down on a farm west of the intersection of 286th Street and 313th Avenue. The tornado blew a garage off its foundation, tipped over a combine, and snapped large cottonwood trees.
May 12, 2009	An F1 tornado traveled for eight miles with a width of 200 yards. The tornado touched down west of Dupree and tracked eastward before dissipating northeast of Dupree. It dented several grain bins, blew over a small mobile home and semi-trailer truck, tore sheet metal off sheds, and toppled a large communications tower.
June 5, 2008	An F1 tornado 100 yards wide damaged a path ten miles long. The tornado severely damaged a home, destroyed outbuildings, and damaged storage bins at a farm near Ravinia. The tornado also caused tree damage along its path. An F2 tornado caused damage to silos, farm buildings, power lines, and numerous trees southeast of Baltic.
May 29, 2008	An F-1 Tornado two miles long and 100 yards wide destroyed a barn, damaged or destroyed several outbuildings, scattered lumber across a field, and damaged trees and power lines. Damages were estimated at $100, 000.

Date	Comments
May 5, 2007	Severe Storms, Tornadoes, and Flooding (FEMA-1702-DR) Twenty-five tornadoes were recorded in southeast South Dakota. It was the most significant tornado outbreak in southeast South Dakota since June 24, 2003. The strongest tornado, an EF-3, occurred in Aurora County. On the ground for five miles, it did its most significant damage to a pheasant hunting lodge/preserve, where numerous buildings and trees were severely damaged and numerous adult and chick pheasants were lost. Winds were estimated at around 140 mph. In Bon Homme County, an EF-2 tornado was on the ground for six miles, severely damaging many homes, barns, outbuildings, and trees. An EF-2 tornado traveled through both McCook and Hanson Counties and was observed to be very large before it dissipated. Most of the damage was to trees and a junk yard. In western Hanson County, an EF-1 tornado damaged trees and took a roof off a building. In Yankton County, a tornado began at the Lewis and Clark Recreation Area and resulted in considerable tree damage and damage to homes. It was on the ground for approximately four miles. For a while, it was joined by a second tornado. These tornadoes were determined to be EF-1s based on the damage homes. High winds related to these storms damaged power distribution lines and poles in Bon Homme and Yankton Counties. Seven poles were damaged in Bon Homme County for a total of $13,014 in damages. Twenty-five poles were damaged in Yankton County for $34,809 in damages. 20 outages affected 214 customers, leaving them without power for roughly 9 hours. Source: NWS Sioux Falls and SHMT
September 16, 2006	Seven tornadoes touched down over southeast South Dakota. The strongest, an F2, was in McCook County and damaged several buildings and killed several cattle. An F1 tornado in Minnehaha County damaged some buildings and downed power lines. There was no damage reported from the other storms (F0s). Source: NWS Sioux Falls
August 26, 2006	Severe weather in east central South Dakota produced at least three tornadoes. In Beadle County, two tornadoes did considerable damage to farmsteads, power lines, and crops. One was a 24.5-mile-long-track F2/F3 tornado with winds up to 200 mph that measured between 400 and 500 yards at its widest. Another tornado touched down in Kingsbury County but did little to no damage. Source: NWS Sioux Falls
May 2, 2006	An F1 tornado touched down in Kingsbury County. While the tornado was generally F0, there were a couple of periods where it approached F1 intensity. It hit a hog operation, destroying a barn and two other outbuildings, downing several trees, and killing numerous hogs. Source: NWS Sioux Falls
June 24, 2003	Sixty-seven tornadoes touched down in South Dakota on this day. This rare occurrence tied the U.S. record at the time for the most tornadoes within a state in a 24-hour time period. However, the 67 tornado touchdowns recorded that day occurred in a period of less than eight hours. The strongest of the 67 tornadoes was an F4, which destroyed the town of Manchester and injured five people. Winds were estimated to be between 207 and 260 mph. The tornado warning issued by the NWS in Sioux Falls provided the residents of Manchester with 28 minutes of advance warning. The NWS offices in Aberdeen and Sioux Falls issued more than 350 warnings, statements, and storm reports on the evening of June 24. The 67 tornado touchdowns recorded that day represented a significant portion of the 85 total

Date	Comments
	tornado touchdowns recorded for all of 2003. Despite the historic events of this day and the destruction of the town of Manchester, no presidential disaster declarations were issued.
June 23, 2002	Four separate tornado tracks and two satellite tornadoes were confirmed across McPherson and Brown Counties. The first was an F0, the second an F1, the third and F3, and the fourth an F4. This was the first F4 tornado recorded in Brown County. *Source: NWS Aberdeen*
July 27, 2001	In Lincoln County, an F1 tornado downed numerous trees and damaged storage sheds and buildings along Main Street in Lennox, including the VFW (Veterans of Foreign Wars). *Source: NWS Sioux Falls*
July 11, 2000	An F2 tornado hit Lake County and damaged the Lake County Speedway. *Source: NWS Sioux Falls*
June 4, 1999	Severe Storms, Flooding, and Tornadoes (FEMA-1280-DR) A deadly tornadic storm moved across southwest South Dakota during the late afternoon and evening of June 4. Multiple tornadoes (F1 and F2) were observed from several supercells that moved toward the northeast from west of Chadron, Nebraska, to near Kyle, South Dakota, between 5:30 and 8:00 p.m. The most severe damage occurred where the paths of these storms passed near the community of Oglala in Oglala Lakota County (previously Shannon County), South Dakota. Oglala was heavily impacted by the tornadoes as were other smaller communities on the Pine Ridge Indian Reservation. The Red Cross estimated that 123 homes sustained major damage and an additional 139 sustained minimal damage. FEMA deemed 49 homes beyond repair and demolished them. In one area, all the telephone poles were snapped and tossed, mobile homes were thrown over 100 yards with debris strewn over a quarter of a mile, and a newly framed house was leveled with wood projectiles in the ground 100 yards downwind. The total public assistance damage for the disaster was $1,029,000. One person was killed and over 40 were injured; 22 required medical attention at area hospitals. The fatality was the first from a tornado in western South Dakota since 1939 and only the third ever recorded in western South Dakota. Very large hail was also reported in the area. Grapefruit-sized hail was observed two miles west of Oglala with golf ball and baseball-sized stones reported in Oglala itself.
May–June 1998	Flooding, Severe Storms, and Tornadoes (FEMA-1218-DR) By late afternoon of May 30, 1998, the atmosphere over the north central United States had become favorable to a significant outbreak of severe weather. At approximately 8:40 p.m., following a series of thunderstorm warnings and numerous funnel sightings in the area, a violent tornado struck the town of Spencer, South Dakota, approximately 45 miles west northwest of Sioux Falls in extreme western McCook County. Deemed the deadliest tornado in recorded South Dakota history, the F4 tornado killed 6 people, injured more than one-third of the town's 320 residents, and destroyed most of the town's 190 buildings, including all public and numerous private facilities. Only 12 structures were left standing in the entire town of Spencer. An assisted living center was destroyed, and since it had no basement, there was no protection from the tornado. Most of the fatalities were residents of the center. In addition to the town of Spencer, some farms in Hanson and McCook Counties were heavily damaged. Total damage was estimated at $18 million. During the storm, electrical service was out. Survivors reported that the warning siren system lost power prior to the touchdown of the tornado.
June 14, 1993	Pierre - Three homes damaged. No deaths. Arlington - Minor damage.
March 29, 1981	A winter storm front created a tornado near Martin, which destroyed a mobile home and injured one occupant.

Date	Comments
May 12, 1984	Clark and Codington Counties - 18 to 20 farmsteads and homes were directly affected and ten homes severely damaged.
June 19, 1979	Watertown - Damage to trees, roofs, and power lines. Bon Homme, Turner, Yankton, Hanson, Sanborn Counties - Tornado damage. Letcher - Tornado caused minor injuries with numerous reports of tree and building damage. Springfield - Tree damage.
June 1978	Aberdeen - On June 15 and 16, Aberdeen and Marshall County experienced tornadoes, hail, and some flooding. Five trailers were damaged by tornadoes. Marshall County had crop and building damage from hail and tornado winds
Summer 1977	Arlington - Minor damage.
July 23, 1973	Ft. Pierre/Pierre - The tornado began in Ft. Pierre where it did minor damage; one grain elevator and a few mobile homes were affected. It jumped the Missouri River and then “skipped” through Pierre. Houses and businesses were damaged, and a few homes were completely destroyed. Many mobile homes were either scattered about or piled upon one another. No deaths. Ten people were injured. Damage amounted to over half a million dollars.
June 18, 1967	Rapid City - One motel suffered heavy structural damage along with several other buildings in the city. No deaths. Three people were injured. Over $2 million in damage was done.
May 21, 1962	Gregory County - Several homes were destroyed as was farm equipment, automobiles, and livestock. Many miles of power poles and lines were also knocked down. Damage exceeded $500,000. Mitchell - Damage was estimated at about $2 million to Mitchell and the surrounding countryside.
July 31, 1949	Beresford and Elk Point - A series of tornadoes struck the countryside between Beresford and Elk Point in the southeast corner of the State. Property damage exceeded $1 million.
June 29, 1947	Howard and Carthage - Occurred in the rural area of Howard and Carthage. Damage was light. A barn and airplane hangar were damaged. One death resulted.
June 12, 1947	Turner/Yankton Counties - The rural area of Turner/Yankton Counties was struck by a tornado that did hundreds of thousands of dollars in damage. Barns, houses, and sheds were destroyed, and crop damage was listed as heavy. There were no recorded deaths or injuries.
July 9, 1932	South of Sioux Falls (Minnehaha County) - One person died, 11 were people injured, and damage was estimated at $150,000. A number of horses and cattle were killed or injured, buildings were knocked down, and telephone and power lines were destroyed. This tornado was from a storm that also dropped baseball-sized hail throughout the area.

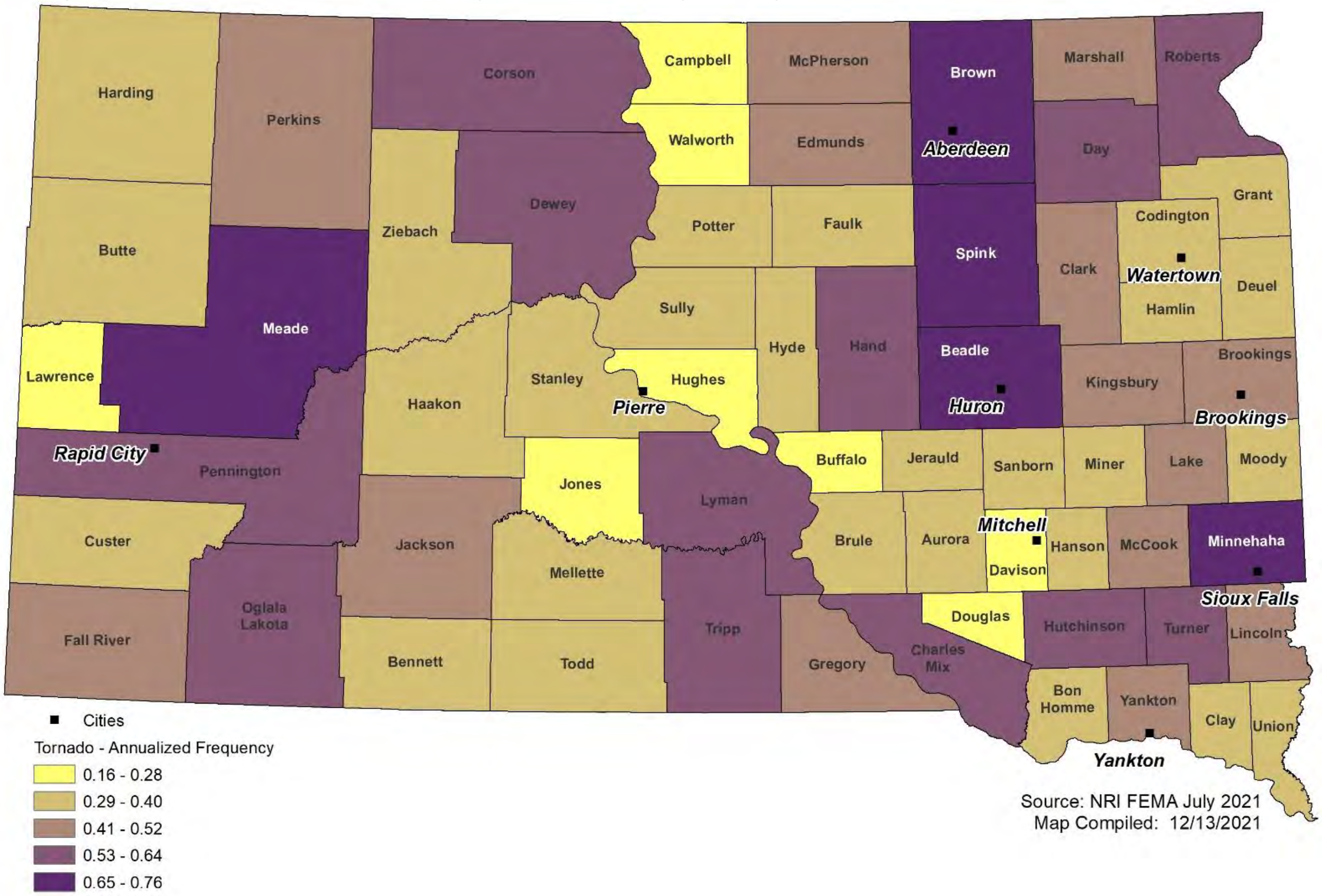
Source: NCEI, unless otherwise noted.

Probability of Future Occurrence

According to the National Center for Environmental Information, there were 726 tornadoes F1 or higher, in South Dakota between 1950 and 2021 (71 years). Based on this information, the probability that at least one tornado with a magnitude F1 or higher will occur in South Dakota is 10%.

Figure 3-64 depicts the annualized frequency of any tornado (F0/EF0 or higher) in each county based on the NRI and historical data, for the period of record of 1996 through 2019.

Figure 3-64 Annualized Frequency of Tornadoes by County



Magnitude/Severity (Extent)

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 3-62 shows the wind speeds associated with the original Fujita scale ratings compared to the Enhanced Fujita scale. Figure 3-65 shows the potential damage impacts from a tornado at each enhanced Fujita number.

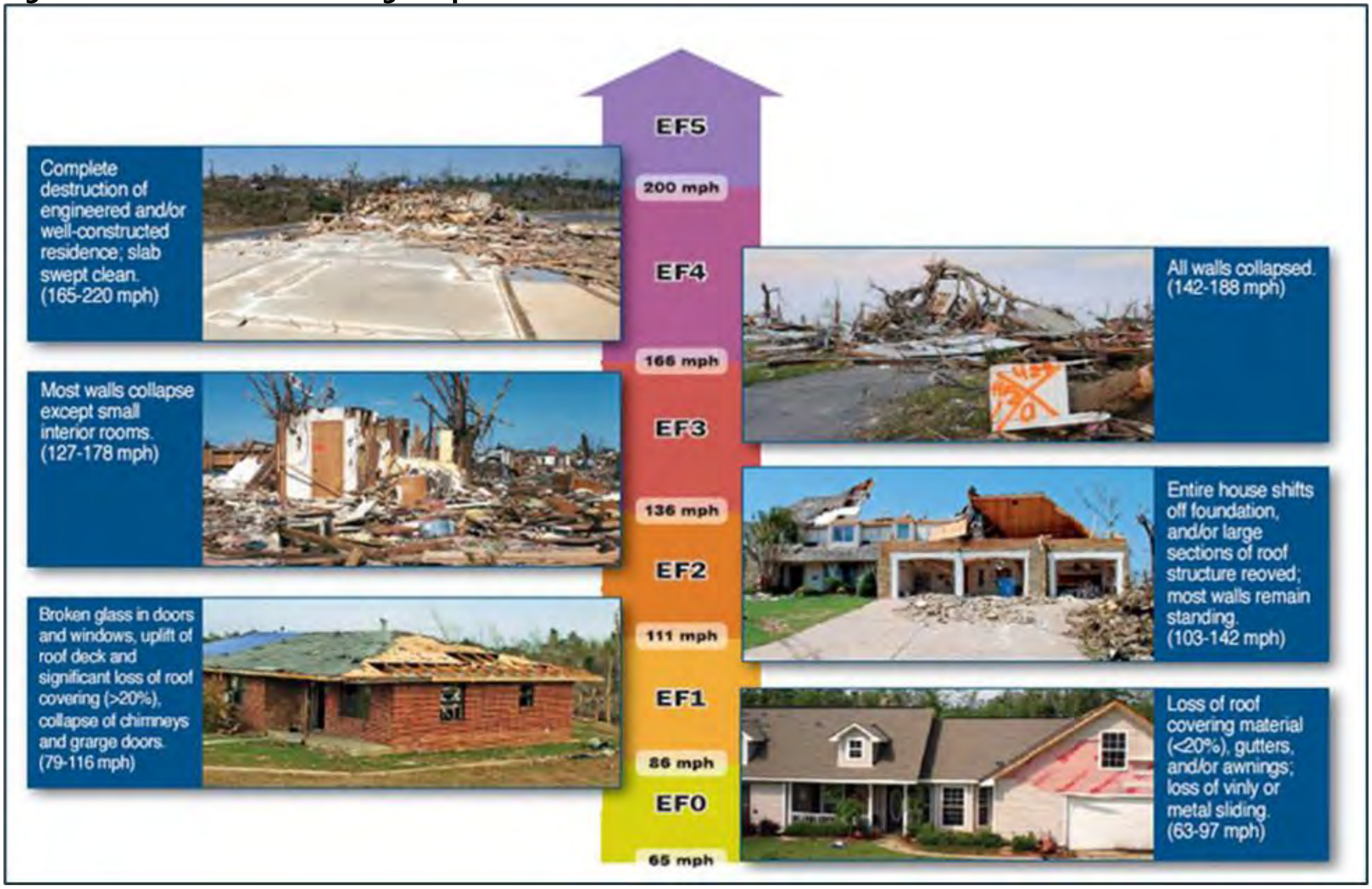
Table 3-63 The Fujita Scale and Enhanced Fujita Scale

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ Mile (mph)	3-Second Gust (mph)	EF Number	3-Second Gust (mph)	EF Number	3-Second Gusts (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

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ Mile (mph)	3-Second Gust (mph)	EF Number	3-Second Gust (mph)	EF Number	3-Second Gusts (mph)
5	261-318	262-317	5	200-234	5	Over 200

Source: NWS EF: Enhanced Fujita, F: Fujita, mph: Miles per Hour

Figure 3-65 Potential Damage Impacts from a Tornado



Source: National Oceanic and Atmospheric Administration

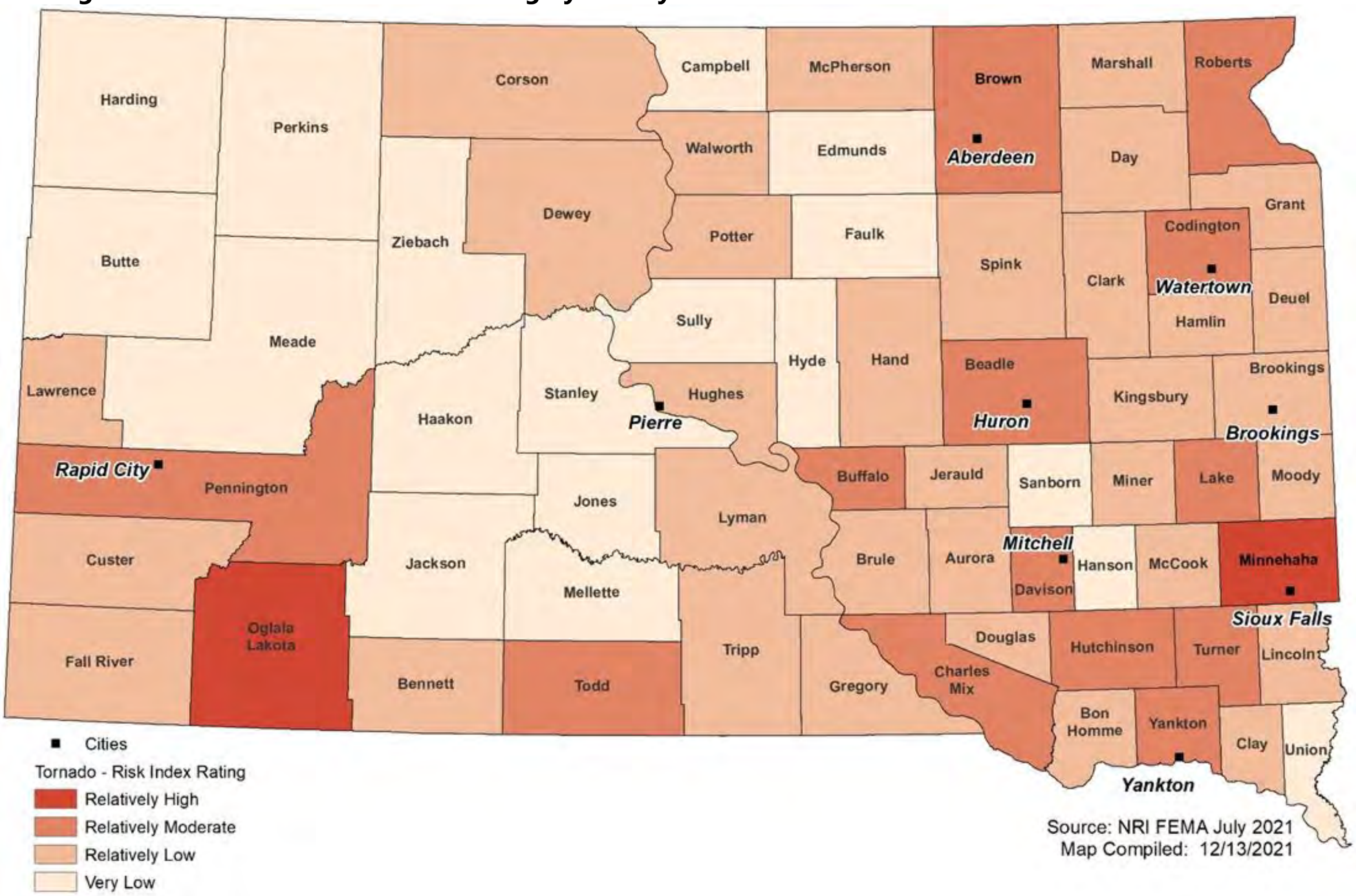
Climate Change Considerations

There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity. NASA's Earth Observatory has conducted studies which aim to understand the interaction between climate change and tornadoes. Based on these studies meteorologists are unsure why some thunderstorms generate tornadoes and others do not, beyond knowing that they require a certain type of wind shear. Tornadoes come from about 1 percent of thunderstorms, usually supercell thunderstorms that are in a wind shear environment that promotes rotation. As noted in the summer storm profile there are some studies that show a potential for a decrease in wind shear in mid-latitude areas. As there is a lot of uncertainty with the influence of climate change on tornadoes future updates to the mitigation plan should include the latest research on how the tornado hazard frequency and severity could change. The level of significance of this hazard should be revisited over time.

Vulnerability Assessment

While all 66 counties in the State of South Dakota are vulnerable to tornado hazards, every county in South Dakota is vulnerable to tornadoes, only Minnehaha and Oglala Lakota Counties have a relatively high-risk rating for tornadoes; this is likely a result of building exposure in Minnehaha and higher social vulnerability risk in Oglala Lakota Counties. Figure 3-66 illustrates the relative risk of South Dakota counties to tornadoes based on data in the NRI. Minnehaha County ranks #1 in South Dakota by numerical population increase 2010-2020 (Table 3-10), while Ogalala Lakota County is notable for having the highest social vulnerability score of any county in South Dakota (Figure 3-7).

Figure 3-66 NRI Tornado Risk Rating by County in South Dakota



People

Populations vulnerable to tornadoes include people caught outside during a storm and people without adequate shelter such as a basement or a safe room. The availability of sheltered locations such as basements, buildings constructed using tornado-resistant materials and methods, and public storm shelters all reduce the exposure of the population to tornado hazards.

Vulnerable populations in South Dakota include those that live in areas prone to tornadoes. This is especially true for the homeless, people with low income, the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, prisons, low-income housing areas, or temporary shelters, people who do not speak English well, tourists and visitors, and those with developmental, physical, or sensory disabilities.

The impacts of tornado hazards on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from a tornado, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to take cover or evacuate, so notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods.

People can be injured in a variety of ways during a tornado, including being directly picked up or thrown by wind gusts, being hit by debris, or being in a structure destroyed during a tornado. According to the NCEI, there were 726 tornadoes in South Dakota between 1950 and 2021 rated greater than an F1. In this time period, there were 27 deaths and 466 injuries, which averages out to approximately two deaths and seven injuries each year.

As of this SHMP update, little information exists regarding vulnerable populations in tornado hazard areas. In addition, much is known about the range of factors that contribute to tornado vulnerability, but which specific attributes contribute to each specific vulnerable population in South Dakota remains unknown. This type of analysis would be useful to improve future SHMP updates. Combining this type of a demographic analysis with projections of future tornado hazards would be especially valuable.

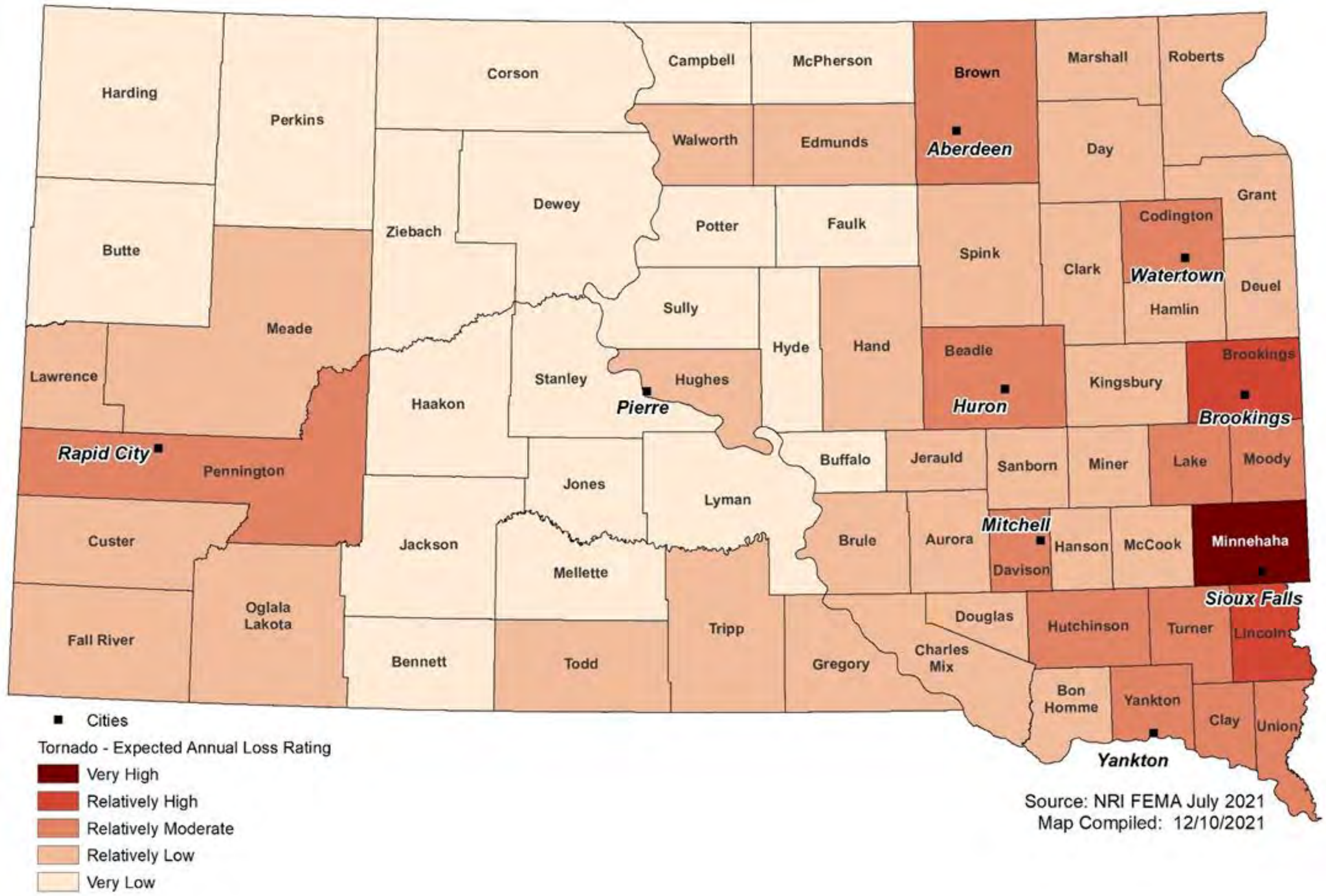
Property

To provide additional insight into potential losses caused by tornadoes, historic loss data were also analyzed on a statewide scale. Between 1950 and 2021, there were 726 tornadoes rated greater than an F1. Total property damage for these events is estimated at $706,258,000. This suggests that South Dakota averages 10 tornadoes rated F1 or greater and $10 Million in losses each year. Of these storms, seven resulted in major disaster declarations, with a total relief cost estimated at $180 million. This averages out to $2,583,254 million per major disaster. Based on the frequency of events, South Dakota averages one major disaster-level tornado every 330 events or approximately every 10 years.

Figure 3-67 shows the EAL rating for all South Dakota counties. Using data from the NRI tool, the EAL ratings are calculated using the annualized frequency and historic loss ratio for each county. Due to the population size, building exposure, as well as number of damaging past events, Minnehaha is the only county with a very high rating for EAL due to tornadoes. Brookings and Lincoln counties fall within the relatively high rating for expected annual losses for the same reasons. Minnehaha, Brookings, and Lincoln Counties rank as the #1, #5, and #3 most populated counties in South Dakota (Table 3-8) and #1, #6, and #2 fastest growing in terms of numerical population growth (Table 3-10).

As of this SHMP update, analysis of development trends in South Dakota is limited. No analysis exists to describe even present development in tornado hazard areas or how development is affecting vulnerable populations. Future SHMP updates may benefit from this type of analysis, especially if it projects future development and considers the effect of climate change on tornado hazards.

Figure 3-67 Expected Annual Loss Due to Tornadoes by County



State Assets, Critical Facilities, and Infrastructure

The most severe and direct impacts of tornado hazards on state assets are damage and destruction of buildings and overhead power distribution and communications infrastructure.

Secondary impacts of tornado damage often result from damage to infrastructure. For example, downed power and communications transmission lines often block safe access to roads or otherwise disrupt transportation. Disruption of transportation can create difficulties in reporting and responding to emergencies. Another example of secondary impacts of tornado hazards exists when gas lines are broken or overhead power lines are downed, both of which can start fires. These and other indirect impacts of a tornado can put tremendous strain on a community.

In the immediate aftermath of a tornado, the focus is on emergency services. Law enforcement activities focus on scene security. Fire and EMS personnel rescue the injured, put out any fires caused by broken gas lines or other similar hazards and assist in the cleanup. Utility crews restore power, phone, communications and other utility services. Public gathering places including (but not limited to) schools, community centers, shelters, nursing homes and churches, may have increased impacts at certain times of day if struck by a tornado. Due to the random nature of these hazards, a more specific risk assessment was not conducted for this plan.

Putting a specific dollar value on vulnerable state assets is possible, in the sense that tornado hazards can affect any part of the state (Figure 3-63), which makes all state assets vulnerable. Section 3.2.1 and especially Table 3-5 provide the value of state assets. While all parts of the state are vulnerable, in the sense they are exposed to tornado hazards, there is variability in that exposure. This is described at length in the section above titled, *Location*.

Not all assets are equally likely to be damaged if exposed to tornado hazards. However, it is possible to characterize the types of assets most likely to be damaged. Simply stated, buildings and overhead power infrastructure are especially likely to sustain damage from tornadoes. In fact, the Fujita Scale is based on the likely impacts to houses (Figure 3-65). Unfortunately, this is where a limitation exists in our knowledge. There has been no successful attempt to identify which specific state assets are most likely to sustain damage from tornadoes, or how this is statistically plays out in an average year.

To some degree, it seems plausible that that as climate change increases the severity of convective storms, we should expect an increase in tornado frequency and severity. However, the reality is more complex and it remains unclear if climate change will affect the tornado hazard either positively or negatively. The technical issue of scientific knowledge of climate change effects on tornadoes is addressed further in the section titled, *Climate Change Considerations*. Therefore, it is not scientifically defensible to speculate on how climate change will affect exposure of state assets to tornado hazards in South Dakota. Furthermore, it is not possible to express the impact of climate change on the statistical dollar value of damage experienced in a typical year. This is due largely to a gap in academic scientific understanding that is beyond the control of South Dakota. It is likely that at some point in the future this gap will be resolved.

Present and future development also affects damage from tornadoes. The vulnerability of state assets from tornado hazards is a function of the value of state assets in areas likely to experience these hazards; the more state assets are developed in areas affected by tornadoes, the greater the vulnerability of state assets to tornado hazards.

As described above, 100% of state assets exist in areas affected by tornado hazards and are therefore vulnerable to these hazards. In this sense, the impact of development on the vulnerability of state assets is equivalent to the value of state assets that are developed. However, putting a dollar value on how development will affect the *expected loss* of state assets in a typical year is more complex and runs into the same problems described above for valuing state assets likely to be damaged in a typical year. To be clear, it is hoped that reliable estimates of the statistical expected loss of state assets can be developed in future years as information gaps are resolved. Key gaps are identification of which specific state assets are most likely to sustain damage from tornadoes and what the likely replacement cost of those assets.

All of this is to say with confidence that all state assets are vulnerable to loss from tornado hazards (see Section 3.2.1 and especially Table 3-5). However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to tornadoes will be possible in future hazard mitigation plans.

Economy

Economic impacts are dependent on the size and path of the tornado. An EF5 tornado that hits a populated business area or other critical infrastructure could have a profound economic impact. Impacts to smaller businesses would likely be more pronounced, including longer-term closures due to more destruction. Other economic impacts could include increased insurance payouts and premiums. See also the average annual losses noted in the Property subsection.

Environment and Cultural Resources

Tornadoes can cause massive damage to the natural environment, uprooting trees and littering areas with debris. This is part of a natural process, and the environment will return to its original state in time.

Development Trends and Consequence Summary

As of this SHMP update, analysis of development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to tornado hazard vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to tornado hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to tornado hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to tornado hazards. A focus on housing type is an essential aspect of this research.

Despite gaps in the present state of knowledge, it is apparent that some of the counties identified in Figure 3-67 above with the greatest (very high and relatively high) expected annual losses are also among the counties with the greatest increase in housing units in the past 10 years, Minnehaha, Lincoln and Brookings counties. Vulnerability to tornadoes can be decreased through the implementation of development regulations that require safe rooms, basements, or other structures that reduce risk to people exposed to tornadoes.

Table 3-64 Tornado Consequence Table

Category	Narrative
Impact on the Public	Anyone without adequate shelter during an event at high risk of injury and death; impacts will be localized to the immediate area around the tornado path.
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure function or accessibility and uninsured damages; impact to transportation sector and movement of goods.
Impact on the Environment	Significant impact related to tree damage, possible cascading water quality issues from damaged water treatment facilities. Debris issues.
Impact on Property, Facilities, and Infrastructure	Buildings, vehicles, signage and/or any exposed or unsecured property may be affected during a tornado; property may be destroyed or have significant damage.
Impact on the Public Confidence in Government	Public holds high expectations of government capabilities for warning, public information, and response and recovery activities related to a tornado, high expectations for rapid restoration of critical facilities. Ability to respond and recover may be impaired if planning, response, and recovery is not timely and effective.
Impact on Responders	Exposure exists to personnel performing routine duties when event occurs; storm-related duties are primarily post-event; however unsafe structural or environmental conditions may persist during the response period.
Impact on Continuity of Operations and Continued Delivery of Services	Loss of facilities or infrastructure function or accessibility or ability to provide services; power interruption is likely if not adequately equipped with back-up generation.
Cascading Hazards	Hazardous Materials

3.3.8. Windstorm

Hazard Description

Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., is not a tornado). It is these winds, which can exceed 100 mph, that represent the most common type of severe weather in South Dakota 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. One type of straight-line wind is the downburst, which can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

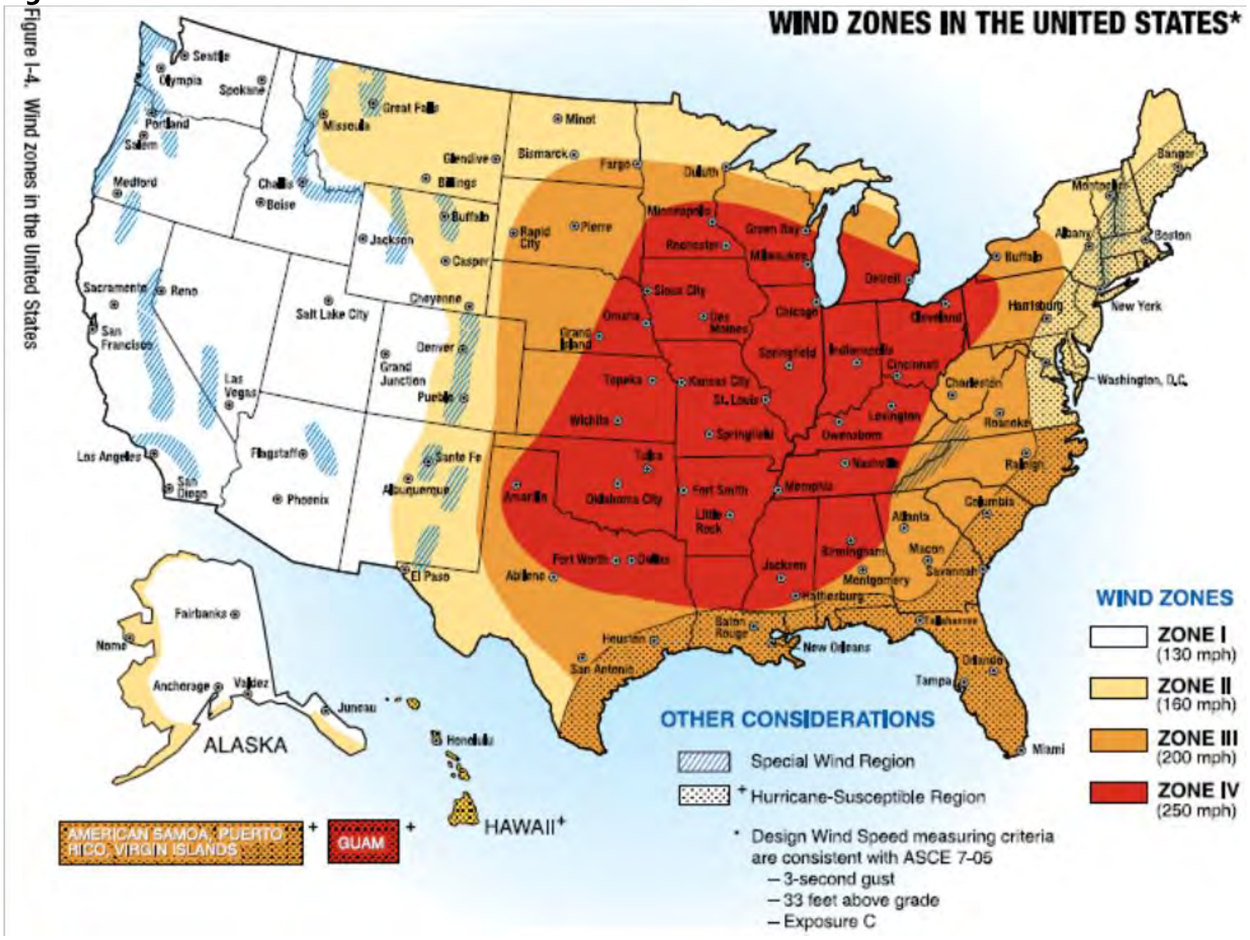
High winds and downbursts associated with thunderstorms over the Northern Plains typically happen between late April and early September, but given the right conditions, they can develop as early as March. They are usually produced by supercell thunderstorms or a line of thunderstorms that typically develop on hot and humid days. Straight-line winds may also exacerbate existing weather conditions, as in blizzards, by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms.

Location

The entire State is susceptible to high wind events. Figure 3-68 illustrates the wind zones in the United States. Most of South Dakota is in Zone III, which is vulnerable to winds up to 200 mph. The westernmost part of the State is in Zone II, which is susceptible to winds up to 160 mph.

The future location of windstorm hazards will be impacted by both climate change and development. Climate change will alter weather and is discussed further in the subsection below titled *Climate Change Considerations.* Development will alter the exposure of people and assets. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*.

Figure 3-68 Wind Zones in the United States



Source: Taking Shelter from the Storm (FEMA 2008)

Past Events

According to the NCEI Storm Events Database, there were 8,310 windstorm events (7,153 thunderstorm wind, 1,149 high wind, and eight strong wind events) in South Dakota between 1955 and 2021. There were 11 deaths and 149 injuries in this time period. Total property and crop damage for events between 1993 (when damage figures began being kept) and 2021 is estimated at $153,056,500. This suggests that South Dakota averages 126 wind events, $2,319,038 in wind losses, and approximately 2.3 injuries each year.

Figure 3-69 Wind Occurrences by Magnitude 1955-2019

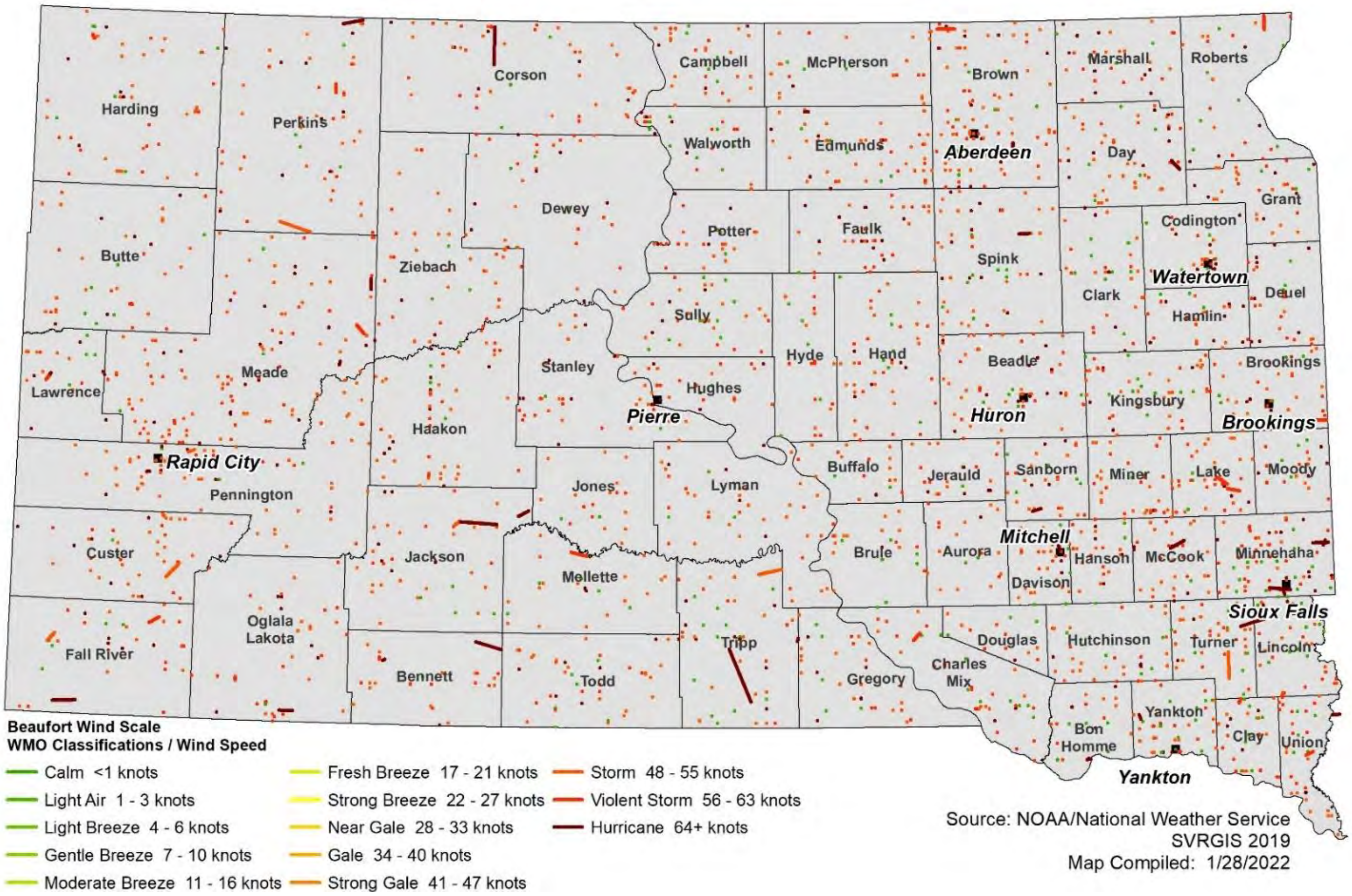


Table 3-65 South Dakota Wind Events

Date	Comments
August 28, 2021	Severe thunderstorms developed across north central South Dakota around midnight and proceeded east through the overnight hours. Of particular note, a long-track supercell produced severe weather from just east of the Missouri River in Walworth County along the length of Highway 12 through the rest of the State, a distance of about 180 miles. Additional severe thunderstorms developed across the area during and after this long-track supercell dissipated, during the mid-morning. The strongest storms produced tennis to baseball-sized hail and damaging wind gusts.
August 26, 2021	A broad, organized line of thunderstorms moved across north central and northeastern South Dakota during the early morning hours and produced damaging severe winds to near 80 mph at times. Winds of up to over 60 mph then developed on the backside of the system. Trees, branches, power lines and poles were downed, and some structural damage occurred including a grain bin that was destroyed, and a roof was torn off a building and a billboard along the northbound side of Interstate 29 was broken in half.
January 13, 2021	An intense low-pressure system slowly crossed the region, bringing a prolonged period of very strong northwesterly winds. A tight pressure gradient remained across the Northern Plains, with 36 hours of strong winds over much of the western South Dakota Plains. Gusts of 60 to 80 mph were reported across much of the area, with a few higher gusts from Buffalo to the Rapid City area. Some minor damage resulted with isolated power outages and tractor

Date	Comments
	trailers were tipped over on Interstate 90. Wind gusts rolled a semi-truck over on U.S. Highway 14 just west of De Smet.
June 9, 2020	Strong frontal forcing resulted in the redevelopment of elevated thunderstorms during the very early morning to the west of the band from the previous evening. Additional severe thunderstorms developed near a slowly advancing cold front during the late afternoon and evening hours across southeast South Dakota. Property damages were extensive including: A concrete silo was toppled and a door to a metal shed bent inward. Damage was done to several trees, and the covering was ripped off a hoop barn. On a farmstead, a concrete silo was toppled, trees uprooted, and windows broken on the house. Cattle and calf shelters were damaged. Several calves were killed. A barn was destroyed, along with damage to the roof and siding of a home. The main floor of a home was destroyed. A detached garage was also destroyed. Numerous trees were uprooted or snapped throughout Mt. Vernon. Several power poles were downed or snapped by wind. A semi-truck and trailer were tipped over along with damage to two other vehicles.
September 10, 2019	A long-lived severe thunderstorm moved east-northeast from Nebraska across south central South Dakota. In addition to the tornadoes, widespread wind damage to trees and damage to residences were reported. A total of nine people were injured in the storms around Sioux Falls. Repeated cells resulted in flash flooding by later evening and into the overnight hours.
July 17, 2019	A complex of thunderstorms developed during the evening across western South Dakota, moving east and becoming more organized as the low-level jet increased focus into south central and southeast South Dakota late at night. Three people were injured as the strong winds went through the Snake Creek Campground. Injuries occurred when tree branches fell on tents. Several campers rolled by high winds.
July 22, 2018	A long-lived supercell thunderstorm developed over eastern Haakon County and tracked southeast across south central South Dakota. The storm produced large hail and strong wind gusts across parts of the area. Estimated seventy mph winds blew a semi-truck and camper over on Interstate-90 west northwest of Okaton with some minor injuries. Part of the interstate was closed for a time to clean up the debris.
May 22, 2017	A line of showers and thunderstorms produced gusty north winds over eastern Pennington County. Sudden wind gusts caused a pickup pulling a camper on Interstate-90 near the New Underwood area to lose control. As the camper swayed across the highway, the top of the camper blew off and landed on the other side of the interstate. No one was injured.
August 11, 2016	A severe thunderstorm developed over southwestern Ziebach County and tracked northeast across southern portions of the county. The storm produced strong wind gusts around 70 mph.
September 4, 2016	Thunderstorms with damaging winds affected parts of southeast South Dakota from the Missouri River to Sioux Falls. The winds caused substantial damage to the City of Springfield in Bon Homme County. Damages included the destruction of six houses as well as damaging houses, damaging businesses, several unattached garages and destroying farm outbuildings and other farm structures. As well as causing widespread tree damage including knocking trees down. It is also reported that the wind moved a large boat 25 yards from a parked position. Property damage is reported to be $1 million.
February 18, 2016	A strong cold front crossed the region, bringing gusty northwest winds to much of western and south-central South Dakota. Wind gusts from 60 to 80 mph accompanied the front late on the 18th into the nighttime hours. Wind gusts around 65 mph redeveloped on the 19th across portions of northwestern South Dakota and the Black Hills as a tight pressure gradient remained in place over the Northern Plains.
July 30, 2013	A long-lived supercell thunderstorm developed over western Haakon County and moved south southeast across south central South Dakota. Very large hail was reported in some areas, along with strong wind gusts, and a small tornado near Philip. The wind-driven hail

Date	Comments
	caused extensive damage to houses from Corn Creek to Parmelee. The combination of large hail and wind caused extensive damage to buildings and vehicles around town.
June 21, 2013	A strong warm front along with very unstable air and strong deep layer winds brought several supercell thunderstorms along with a damaging line of thunderstorms/bow echo to parts of central and northeast South Dakota during the afternoon hours. Damaging winds up to 90 mph uprooted large trees and caused considerable structural and crop damage and loss of power to those in its path. The worst wind damage was located at Lake Poinsett, Watertown, and Milbank. A woman was killed, and her husband was seriously injured on Lake Poinsett when their lake house was destroyed. Numerous trees were downed along with many structures damaged or destroyed. Many trees had fallen onto homes, cabins, and trailers. The bowling alley in Clear Lake lost its roof along with numerous pole barns being destroyed along the storm's path. Thousands of people were also left without power. Four tornado touchdowns occurred along with hail up to the size of softballs. Isolated flash flooding also occurred. Codington, Hamlin, Grant, and Deuel Counties were all declared in a federal disaster declaration. Total damage estimates were around 1,100,000 dollars.
May 28, 2013	A line of thunderstorms produced a small tornado that touched down briefly and strong straight-line winds south of Allen. Straight-line wind damage was observed along BIA Road 22 southeast of Allen. The winds tore part of the roof off a small building and ripped shingles and metal roofing off two houses. A mobile home was rolled and completely smashed. A large cottonwood tree was snapped.
April 15, 2012	Very strong northerly winds affected southeast South Dakota during the evening of April 15th. Winds gusted to over 60 mph in parts of the area. A large outbuilding was destroyed near the western edge of Hitchcock, and a power pole standing in water was snapped off 4.5 miles east of Hitchcock.
April 2, 2012	A strong cold front passed through the region during the night. Strong north to northwest winds developed behind the front for several hours. The strongest winds occurred in the Rapid City area, where wind gusts to 65 mph were recorded. A semi-trailer was blown over on Interstate 90 six miles east of New Underwood.
April 30, 2011	A tight pressure gradient over the region resulted in strong northwesterly winds across western and central South Dakota. Sustained winds of 35 to 55 mph with gusts near 80 mph caused minor damage around Newell and Sturgis. The strongest winds were over the northwestern South Dakota Plains. A large metal sign at a campground east of Sturgis was blown over. A pickup truck and travel trailer were flipped over south of Bear Butte.
June 10, 2010	Damaging winds, not directly from thunderstorms, affected the Madison to Brookings South Dakota area during the morning of June 10th. High winds severely damaged a barn. The winds also caused tree damage, with a playhouse damaged by tree debris. Vehicles were damaged by flying tree debris.
May 24, 2010	An intense low-pressure system and cold front produced strong winds across southwestern South Dakota. Ahead of the low, strong south the southwest winds developed across south central South Dakota during the early afternoon. Behind the front, winds switched to the west across southwestern South Dakota in late afternoon. Sustained winds of 30 to 45 mph, with gusts to 70 mph, were recorded over much of the area. Some trees were downed by the wind. Minor damage occurred around the Hot Springs area.
August 7, 2009	A super cell thunderstorm developed across the northern Black Hills and moved eastward across the Sturgis area, southern Meade County, northeastern Pennington County, Haakon County, and northeastern Jackson County. The storm produced baseball-sized hail near Sturgis, then strong winds of 61 knots and hail larger than baseball-sized developed as the storm moved across the plains. The storm hit Sturgis during the annual motorcycle rally and

Date	Comments
	caused extensive damage to motorcycles, vehicles, and property. Minor injuries from the hail were also reported.
July 13, 2009	High winds developed behind an existing area of thunderstorms causing damage along with some injuries. Wind gusts to 50 to 70 mph were estimated or measured across parts of north central and northeast South Dakota. As a result, A mobile home was rolled twenty feet and destroyed by gradient winds associated with a weak low-pressure area. The mobile home was not tied down and caught fire as it rolled into a propane tank. The three people inside the mobile home at the time all escaped with minor injuries.
October 26, 2008	Strong northwest winds reached sustained speeds of 40 mph or more with gusts to around 60 mph over all of southeast South Dakota during the morning and afternoon of October 26. High winds sustained at 40 to 45 mph and gusting to over 60 mph caused damage to trees, shingles, and road signs. The tree damage included one very large weeping willow tree blown down in De Smet.
July 31, 2008	In the early morning hours of July 31st, a line of storms originating in North Dakota began to expand and surge southeast into northeast South Dakota. As the storms moved southeast, they began to tap into warmer, more humid air and rapidly evolve into a line of severe thunderstorms. Widespread damage occurred in a wide swath extending from Long Lake in McPherson County all the way into eastern Grant County and southern Big Stone County in Minnesota. The most extensive damage was generally found along and near U.S. Highway 12 from Aberdeen to Milbank. Several observing stations in the path of this system measured wind speeds ranging from 70 mph to over 115 mph. Estimated wind speeds from damage surveys indicated even stronger winds with peak speeds of 120 mph. Over fifty communities in northeast South Dakota and the surrounding rural areas received minor to major tree and structural damage as straight-line winds from 70 to 120 mph raced across the area. Webster and Waubay received the most extensive damage from the storms. Thousands of trees were snapped or uprooted, hundreds of grain bins were damaged or destroyed, hundreds of homes, businesses, and outbuildings were damaged or destroyed along with many power poles and miles of power lines downed. Many mobile homes, campers, and boats were damaged or destroyed along with many road and business signs. Countless homes, vehicles, and campers were also damaged by fallen trees. Thousands of acres of crops were also damaged or completely destroyed by the winds and hail. The greatest crop damage occurred in the Roslyn, Grenville, Eden, and Pickerel Lake areas in Marshall and Day Counties. Many acres of corn were blown down and not able to come back. The large hail combined with the strong winds also broke out countless windows in homes and vehicles along with damaging the siding on homes. Thousands of people were left without power for up to several days. Large hay bales were moved up to 700 yards by the high winds. A semi was overturned on Highway 12 near Webster, injuring the driver. Near Milbank on Highway 12, two other semis were blown off the road resulting in injuries to both drivers. A State Forestry Specialist said it was one of the worst tree damage events he has ever seen in the Webster area. A fifty-eight-year-old man died two miles north of Waubay during the cleanup after the storms when he was pinned between a backhoe and a tree.
June 26, 2008	On the evening of 26 June 2008, a compact upper-level low-pressure system tracking through the Northern Plains interacted with a very moist and unstable air mass over western and central South Dakota resulting in a widespread severe weather outbreak. Three confirmed tornadoes occurred briefly in western Dewey County. Little or no damage was reported, and all three tornadoes were rated EF-0. In addition to the tornadoes, multiple reports of large hail were received over Corson and Dewey Counties, including some to the size of baseballs near the communities of McLaughlin and Isabel. The large hail broke out many home and vehicle windows and damaged many roofs in Dewey, Corson, and Sully Counties. Significant wind damage occurred over sections of Sully County. There were multiple reports of wind gusts in excess of 70 mph, with the most concentrated swath of

Date	Comments
	damaging winds extending from near Sutton Bay, eastward to the city of Onida, then southeast to the community of Harrold. The storm survey began near Sutton Bay on Lake Oahe, where a wind gust of 92 mph was recorded. The most significant property damage was found further east near the community of Agar where multiple grain bins were either damaged or destroyed. Nine miles west of Agar, a barn was destroyed, and a large pine tree was snapped in half. Winds in this area were estimated to range from 80 to 100 mph. Near the intersection of Highways 1804 and 175th Street, several Western Area Power Administration (WAPA) electrical transmission towers were completely collapsed. This is consistent with wind speeds ranging from 130-140 mph. In the city of Onida, a bank roof was damaged, and the city was without power until the next day. Four miles north of Onida, a feed wagon was tossed nearly 40 feet. In Harrold, several railroad cars were tipped over. Also, of great significance during the event was the peak wind speed of 124 mph recorded at the Onida airport. This wind speed is the strongest wind gust ever measured in the Aberdeen County Warning Area (CWA) and the 4th strongest wind speed ever reported in South Dakota
January 27, 2008	Strong southwesterly winds developed across the Black Hills during the afternoon and persisted through much of the night. Wind gusts of 60 to 70 mph were common across the higher terrain of the Black Hills and the northern and eastern foothills. The strongest winds were noted in the Spearfish and Hermosa areas, where a few gusts exceeded 90 mph. The strong winds caused a semi-trailer to jack knife on interstate 90 in Spearfish. Downed tree branches, signs, and damage to roofs were also reported around Spearfish.
July 9, 2007	Severe storms produced wind gusts to 80 mph across south central South Dakota. Roofs were torn off two houses and a trailer house was rolled three times. No injuries were reported. Damage estimates were reported at $75,000.
November 19, 2006	Strong southwest winds developed during the evening across parts of the northern foothills. Winds gusted near 80 mph just west of Spearfish, while gusts over 50 mph were recorded in the Sturgis area. Several power poles and lines were downed in the Spearfish area, with minor damage around Sturgis.
August 18, 2006	Damaging winds associated with a line of thunderstorms moved through Lincoln County and were estimated between 50 and 80 mph. A downburst caused significant damage, especially to crops, which were shredded by windblown hail. Source: NWS Sioux Falls
May 23, 2006	Eighty mph straight-line winds damaged a Union County farm. Two outbuildings were destroyed, and a third building lost its roof. A fourth building was also damaged, and debris was strewn along a ¼ mile stretch. Tree damage was also documented in the area. Source: NWS Sioux Falls
April 17, 2006	Severe thunderstorms. The earliest reports of large hail and strong winds on record for northwestern South Dakota. Source: NWS Rapid City
June 7-8, 2005	This was one of the most damaging severe thunderstorm events of the past several years for central and northeast South Dakota. In the late afternoon of June 7, a line of thunderstorms developed across western South Dakota and moved east across the State and into west central Minnesota. Widespread damage was reported. Hundreds of grain bins and countless buildings were damaged or destroyed and numerous trees, power lines, and poles were downed. Winds of 60 to over 100 mph were reported. It illustrated the fact that extreme straight-line winds can do as much damage as tornadoes. Source: NWS Aberdeen

Date	Comments
March 10, 2005	Sustained winds of 40 to 45 mph with gusts above 60 mph persisted from mid-morning until late afternoon. The winds caused widespread tree damage with branches and smaller tree debris broken off. Several power lines were knocked down by the wind or by windblown debris. This resulted in several power outages, especially between the Missouri and James Rivers. Damages to buildings were mostly to shingles and gutters. However, a metal storage building was blown over at Mitchell. Also, at Mitchell, construction barriers were blown over, and windows were broken in two vehicles by blowing rocks. An aluminum recycling cage was blown away at Woonsocket. A window was blown out at a school in Freeman. In Sioux Falls, there was damage to the airport tower.
July 3-4, 2003	A line of severe thunderstorms developed in Montana and moved into and across North Dakota, South Dakota, and Minnesota. It brought large hail and winds over 80 mph at times to Brown, Marshall, and Roberts Counties, which resulted in widespread property and crop damage. Approximately 30 percent of Marshall County's 227,000 acres of crops were damaged or destroyed. Trees, branches, and power lines and poles were downed; roofs and siding were damaged from hail and fallen trees; farm outbuildings were damaged or destroyed; and many windows were broken out of homes and vehicles. A crop spraying plane at the Sisseton airport was thrown 450 feet and a 55,000-bushel grain bin in Claire City was blown off its foundation and flattened. On the opposite side of the State, a supercell thunderstorm developed over Lawrence County and moved into Meade County. It moved through Rapid City with 60 to 70 mph winds and moved quickly east-southeast across southwestern and south-central South Dakota producing 60 to 80 mph winds. The strong winds downed many trees and power lines from Rapid City to the Winner area. *Source: NCEI, NWS Aberdeen*
June 9, 2001	A severe windstorm struck portions of western South Dakota with gusts estimated to 80 mph. The greatest damage occurred in Philip and Wanblee. The damage was consistent with strong straight-line winds. *Source: NWS Rapid City*
August 1, 2000	A powerful thunderstorm moved into western South Dakota from northeast Wyoming. Winds in the Spearfish area, estimated at 90-110+ mph, were particularly devastating, causing a considerable amount of damage and several injuries. Strong downburst winds were responsible for most of the observed damage. As the storm approached Sturgis, it evolved into a bow echo with winds estimated at 65-80 mph that toppled and blew away merchandise tents that had been set up for the Sturgis Rally. Strong winds in excess of 70 mph were also noted in the Black Hawk, Piedmont, Rapid City, and Ellsworth AFB areas. *Source: NWS Rapid City*
June 3-4, 2000	Two severe thunderstorms brought strong straight-line winds to Clay and Union Counties. The first storm had wind gusts of 70-75 mph. The second storm had 60-65 mph wind gusts. Trees were damaged, and a picnic shelter was destroyed *Source: NWS Sioux Falls*
August 6, 1999	Downburst wind event in Meade County. Winds were estimated up to 70 mph at 8:05 p.m. as the front passed through the area. Numerous trees were damaged, and a few were blown down. The worst of the storm hit Ellsworth Air Force Base at 8:18 p.m. where they gusted to 89 mph. Between that time and 8:30 p.m., the wind speed did not drop below 50 mph at the base. Sensors measured gusts of 129 mph and 165 mph. Damage was minimal due the rural location. *Source: NWS Rapid City*
June 20, 1997	These severe thunderstorms brought strong straight-line winds, estimated at 80-90 mph, which caused widespread tree, crop, power line, and building damage and destruction in Davison County and injured eight people. The damage path was at least 15 miles wide by 50

Date	Comments
	miles long. Many people believed the damage was caused by a tornado, but the damage assessment proved otherwise. *Source: NWS Sioux Falls*

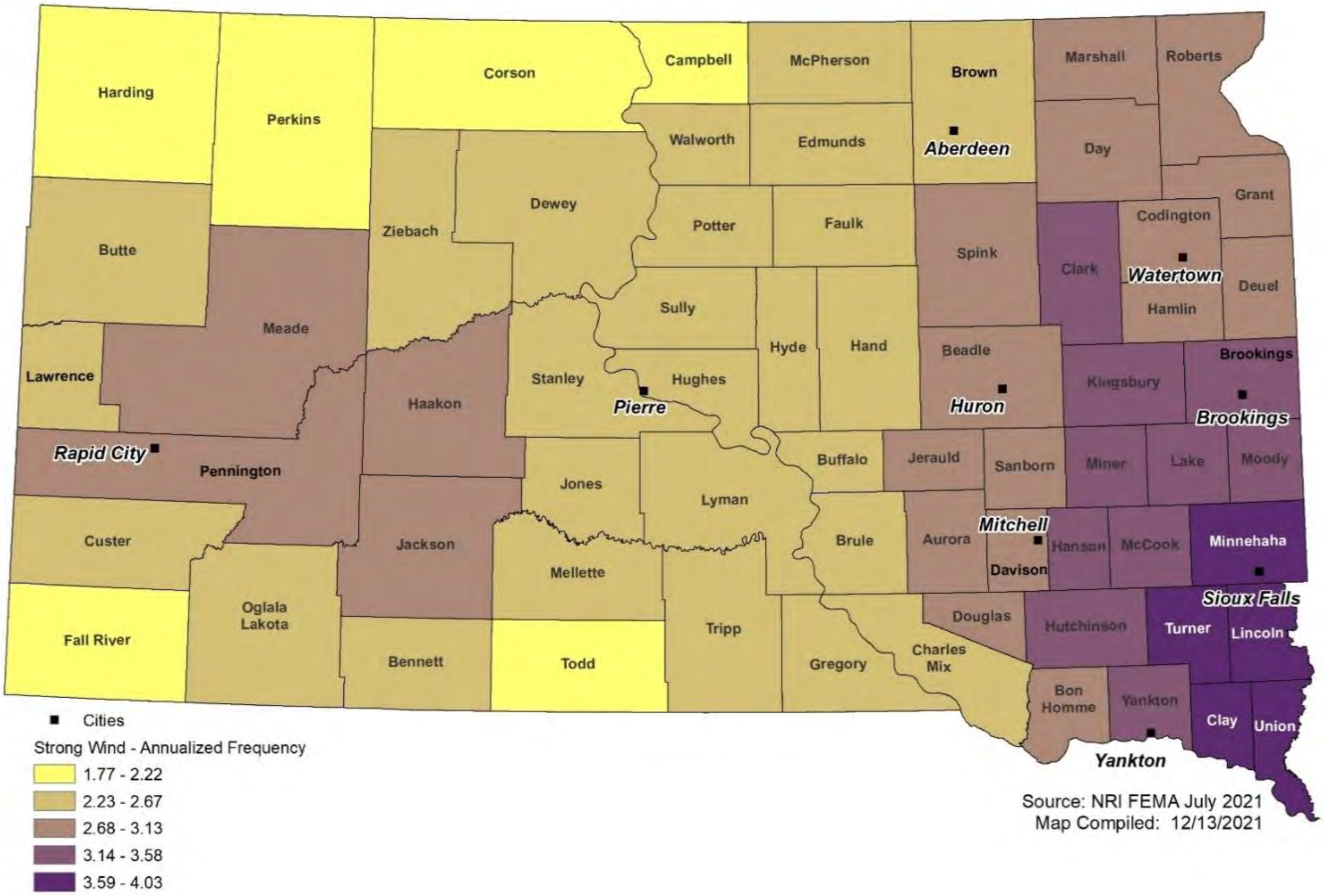
Source: NCEI, if not otherwise sourced

Probability of Future Occurrence

According to the NCEI Storm Events Database there were 8,310 wind events (excluding events from associated with snow, see event description above) in South Dakota between 1955 and 2021 (66 years). Based on this information, the probability that at least one damaging wind event will occur in South Dakota in any given year is 100 percent.

Figure 3-70 depicts the annualized frequency of recorded strong wind events each year from 1996 to 2020 in each county based on the NRI and historical data. Based on this data, the eastern and southeastern portions of the State experience the greatest number of wind events in a given year.

Figure 3-70 Annualized Frequency of Wind Events by County



Magnitude/Severity (Extent)

The magnitude and severity of wind events can be measured by the Beaufort Wind Scale. The replication of the scale only reflects land-based effects. Beaufort Level 12 events have occurred in South Dakota.

Table 3-66 Beaufort Wind Scale

Beaufort Number	Description	Windspeed (MPH)	Land Conditions
0	Calm	<1	Calm. Smoke rises vertically.
1	Light air	1 – 3	Wind motion visible in smoke.
2	Light breeze	3 – 7	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	8 – 12	Leaves and smaller twigs in constant motion.
4	Moderate breeze	13 – 17	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	18 – 24	Branches of a moderate size move. Small trees begin to sway.
6	Strong breeze	25 – 30	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic garbage cans tip over.
7	High wind, Moderate gale, Near gale	31 – 38	Whole trees in motion. Effort needed to walk against the wind. Swaying of skyscrapers may be felt, especially by people on upper floors.
8	Gale, Fresh gale	39 – 46	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	47 – 54	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over. Damage to circus tents and canopies.
10	Storm, Whole gale	55 – 63	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	64 – 72	Widespread vegetation damage. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 73	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Source: National Oceanographic and Atmospheric Association, http://www.spc.noaa.gov/faq/tornado/beaufort.html

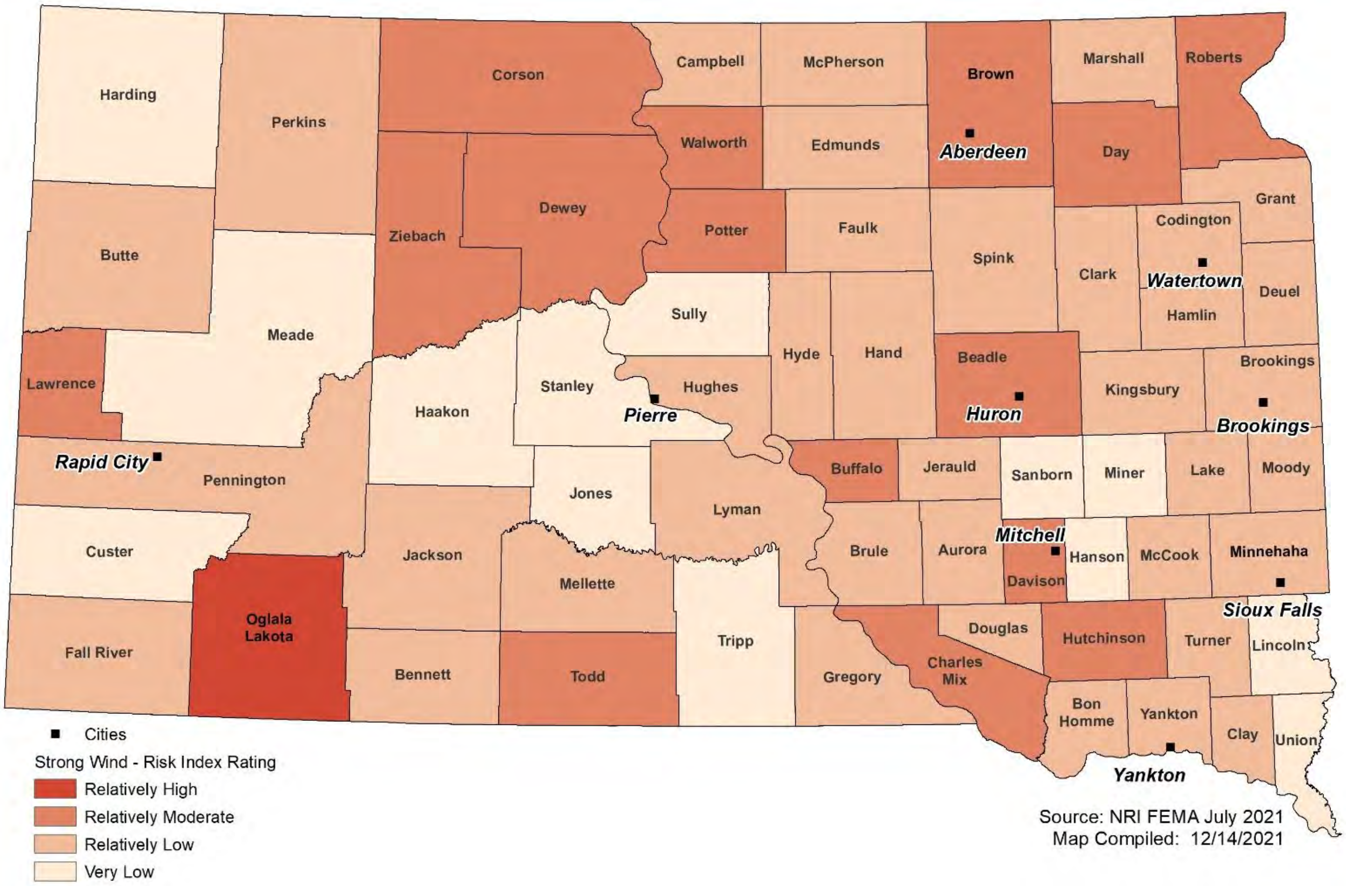
Climate Change Considerations

The Fourth National Climate Assessment reported a lack of sufficient data or research to quantify the magnitude of potential change that climate change may have on windstorms. The Fifth National Climate Assessment is not yet available in a single, electronically searchable product, but individual chapters and discussions do not appear to update this position. Future updates to this mitigation plan should include the latest research on how the windstorm hazard frequency and severity could change. The level of significance of this hazard should be revisited as scientific understanding improves.

Vulnerability Assessment

Every county in South Dakota is vulnerable to windstorm, but some counties have a higher risk than others. In addition, the vulnerability can vary slightly based on the severity of windstorm events. It is difficult to pick an area of higher vulnerability to windstorms in the State if all windstorm events are examined. Counties where at least 100 events have been recorded are fairly evenly distributed across the State. This is largely due to the counties' high ratings for building exposure and population density. In general, the counties with the greatest vulnerability to windstorm events are those in the Black Hills Region and those with major cities. Figure 3-71 illustrates the relative risk of South Dakota counties to tornadoes based on data in the NRI. Based on the NRI data Oglala Lakota is the only county that has a very high rating for windstorm events.

Figure 3-71 NRI Wind Risk Rating by County in South Dakota



People

It can be assumed that the State is exposed to some extent to wind events. Certain areas are more exposed due to geographic location and local weather patterns. According to the NCEI data since 1993 there has been 11 deaths and 149 injuries due to wind events. Statewide there is an average of 2.3 injuries every year due to wind events.

Vulnerable populations include the homeless, the elderly, low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Vulnerability is amplified for the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, prisons, low-income housing areas, or temporary shelters, people who do not speak English well, tourists and visitors, and those with developmental, physical, or sensory disabilities.

The impacts of windstorms on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from a windstorm, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may need more time to evacuate, so evacuation notices will need to be issued as soon as feasible, and communicated by multiple, inclusive methods. Windstorm-caused power outages can be life threatening to those dependent on electricity for life support. As noted in section 3.3.3 Summer Storm, statewide an estimated 9,922 Medicare Beneficiaries or 5% of total Beneficiaries (183,640) rely on electricity to live independently in their homes. These factors likely explain the ”high” wind risk rating assigned by the NRI for Ogalala Lakota County.

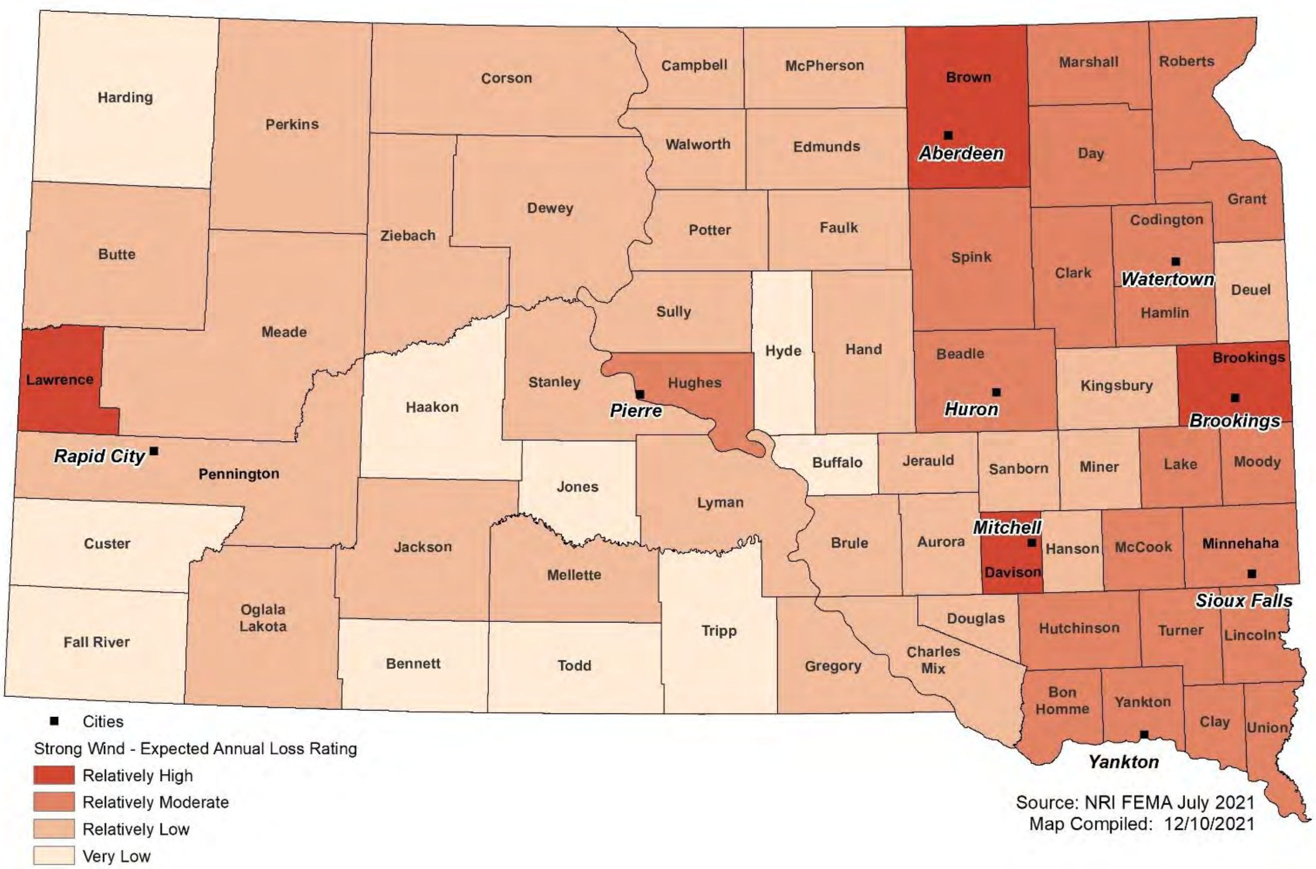
Property

All property is exposed during high wind events, but properties in poor condition or in particularly vulnerable locations may risk the most damage. Generally, damage is minimal and goes unreported. Property located under or near overhead lines or near large trees may be damaged in the event of a collapse.

To estimate potential losses to wind, historic loss data was analyzed. The NCEI data did not lend itself to county-by-county loss summaries, only a statewide summary. Based on historic loss information South Dakota averages 126 windstorms and $2.319 million in wind losses. In addition, South Dakota has experienced three windstorms that resulted in a disaster declaration. Of these three events, the event on July 22, 2005, was credited entirely to wind, while the other two events also included damages from flooding and/or tornadoes. The total FEMA disaster relief costs for these three events are estimated at over $121.6 million in 2012 dollars, with an average cost of $40.5 million (also in 2012 dollars.) Based on past events, South Dakota can expect a disaster declaration-level windstorm event every 2,342 events or once approximately every 21 years.

Figure 3-72 shows the EAL rating due to windstorm events for all South Dakota counties. Using data from the NRI tool, the EAL ratings are calculated using the annualized frequency and historic loss ratio for each county.

Figure 3-72 Expected Annual Losses due to Windstorm by County



As of this SHMP update, analysis of development trends in South Dakota is limited. No analysis exists to describe even present development in windstorm high hazard areas or how development is affecting vulnerable populations. Future SHMP updates may benefit from this type of analysis, especially if it projects future development and considers the effect of climate change on tornado hazards.

State Assets, Critical Facilities, and Infrastructure

High winds can cause significant damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating population, and disrupting ingress and egress. Cascading hazards caused by high winds can result in power loss; depending on the time of year, winds can also exacerbate snow and blizzards by creating deep snow drifts over roads and affecting the normal flow of traffic. Closures of highways could have secondary impacts on local economies.

Electrical infrastructure is especially vulnerable to impacts from severe wind. Additional discussion on vulnerability and potential losses due to severe wind on electric infrastructure can be referenced in section 3.4 Rural Electrical Cooperatives Considerations.

Lawrence, Brown, Brookings, and Davison Counties are rated by the NRI as having relatively high expected annual losses. Lawrence County ranks #9 among South Dakota Counties in numerical population growth (Table 3-10) and percent growth (Table 3-11). Brookings County ranks #6 and #8 in these categories, respectively. Expected loss is a function of both the physical hazard and the value of assets within a given area. Wind events can happen anywhere in the State with considerable impacts. Fortifying state assets that are particularly vulnerable to windstorm hazards has historically been done on a case-by-case basis or is implicitly included in maintenance and facility management. It is noted that Hughes County includes Pierre, the State capital, and has the highest concentration of state-owned buildings, facilities and employees. While rated 'moderate' in terms of vulnerability to the three hazards, it is reasonable to expect higher losses by virtue of the number and value of assets in this area.

Putting a specific dollar value on vulnerable state assets is possible, in the sense that windstorms can affect any part of the state, which makes all state assets vulnerable. Section 3.2.1 and especially Table 3-5 provide the value of state assets. While all parts of the state are vulnerable, in the sense they are exposed to windstorm hazards, there is variability in that exposure. This is described at length in the section above titled, *Location*.

Not all assets are equally likely to be damaged if exposed to windstorm hazards. However, it is possible to characterize the types of assets most likely to be damaged. Simply stated, building exteriors and overhead power distribution infrastructure are especially likely to sustain damage from windstorms. Damage is likely to resemble tornado damage, but will be far more widespread.

Unfortunately, this is where a limitation exists in our knowledge. There has been no successful attempt to identify which specific state assets are most likely to sustain damage from windstorms, or how this is statistically plays out in an average year.

To some degree, it seems plausible that that as climate change increases the severity of convective storms, we should expect an increase in windstorm frequency and severity. However, the reality is more complex and it remains unclear if climate change has or will affect the windstorm hazard. The technical issue of scientific knowledge of climate change effects on windstorms is addressed further in the section titled, *Climate Change Considerations*. Therefore, it is not scientifically defensible to speculate on how climate change has or will affect exposure of state assets to windstorm hazards in South Dakota. Furthermore, it is not possible to express the impact of climate change on the statistical dollar value of damage experienced in a typical year. This is due largely to a gap in academic scientific understanding that is beyond the control of South Dakota. It is likely that at some point in the future this gap will be resolved.

Present and future development affects damage from windstorms. It is possible to characterize the likely loss of state assets from windstorms as dependent on the value of state assets in areas likely to experience these hazards. In one sense, 100% of state assets are vulnerable to these hazards, therefore the impact of development on vulnerability is equivalent to the value of state assets developed. However, putting a dollar value on how development will affect the *expected loss* of state assets in a typical year is more complex and runs into the same problems described above for valuing state assets likely to be damaged in a typical year.

All of this is to say with confidence that all state assets are vulnerable to loss from windstorms (see Section 3.2.1 and especially Table 3-5). However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to windstorms will be possible in future hazard mitigation plans.

There has been no state-wide analysis of which state assets are most vulnerable to windstorm hazards. The present arrangement of identifying which assets are *exposed*, without further identifying which specific assets are most *vulnerable* to damage, limits the degree to which these hazards can be mitigated and is considered a knowledge gap.

In addition, no state-level evaluation exists of the vulnerability of state assets to windstorm hazards in a future affected by climate change. Nor has a state-wide assessment been done to describe how future demographic changes will affect the vulnerability of state assets to windstorm hazards or the consequence of essential infrastructure failures in the future. All of these studies would help local jurisdictions understand what they should plan for and help state-level analysis of shifting needs for hazard mitigation.

Economy

Economic impacts of severe wind are typically short-term. These events can disrupt travel into and out of all areas of the county and create perilous conditions for residents, tourists, and nature alike. Wind can also damage crops and impact the regional agricultural industry. A review of the USDA RMA records shows between 2007 and 2021 statewide there has been a total of $68,452,693 indemnity payments for a total 748,209 acres lost to wind. The estimated average annualized indemnity payments due to wind is $4,889,478.

Environment and Cultural Resources

The environment is highly exposed to high winds. Environmental impacts include the downing of trees and localized flattening of plants by high wind. Forested areas could experience blowdowns.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to windstorm hazard vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to windstorm hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to windstorm hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to windstorm hazards.

Despite gaps in the present state of knowledge, it is apparent that past mitigation actions to reduce vulnerability to windstorm hazards have been effective. Examples include establishing and maintaining early warning systems, undergrounding utility lines, maintaining safe rooms for taking refuge, and ensuring generators are available in key locations in the event of power outages caused by windstorms. Continued use of proven mitigation measures is a reasonable hazard mitigation approach in the immediate future. Future SHMP updates may improve upon this approach as research reduces gaps in knowledge regarding development, future windstorm hazards, and the present and future state of population vulnerability to windstorm.

Table 3-67 Windstorm Consequence Table

Category	Narrative
Impact on the Public	Anyone without adequate shelter during an event at high risk of injury; impacts will be localized to the immediate area around the windstorm; air quality from blowing dust could have detrimental health impacts.
Impact on the Economic Condition of the State	Potential damage to facilities or infrastructure; economic impacts from prolonged power outages.
Impact on the Environment	Significant impact related to tree damage. May contribute to soil erosion and dust storms.
Impact on Property, Facilities, and Infrastructure	Buildings, vehicles, signage and/or any exposed or unsecured property may be affected during a tornado; property may be destroyed or have significant damage. Older buildings more susceptible to damage.
Impact on the Public Confidence in Government	Ability to respond and recover may be impaired if planning, response, and recovery is not timely and effective.
Impact on Responders	Unsafe structural or environmental conditions may persist during the response period.
Impact on Continuity of Operations and Continued Delivery of Services	Loss of facilities or infrastructure function or accessibility or ability to provide services; power interruption is likely if not adequately equipped with back-up generation.
Cascading Hazards	Tornadoes and Summer Storms. Exacerbates wildfire, drought and winter storm hazards.

3.3.9. Hazardous Materials

Description

South Dakota's Codified Law Chapter 33-15 Emergency Management defines a hazardous material as "any material, including but not limited to, explosives, flammable liquids, flammable compressed gas, flammable solids, oxidizing materials, poisons, corrosive materials, and radiological materials, the loss of control or mishandling of which could cause personal injury or death to humans or damage to property or the environment." A hazardous materials incident can occur during production, storage, transportation, use, or disposal of said materials. These substances are most often released as a result of transportation accidents or chemical accidents in plants and can be caused and complicated by a different type of hazard event (e.g., flood, earthquake). They affect humans through inhalation, ingestion, and direct contact with skin. South Dakota is concerned about transportation, fixed facility, and pipeline hazardous materials incidents.

Transportation

Figure 3-73 illustrates South Dakota's transportation infrastructure. There is not a designated hazardous materials route map, but the interstates and other highways and railroads are the typical corridors that have hazardous materials being transported on them.

Figure 3-73 South Dakota Transportation Infrastructure

In transit, hazardous materials generally follow major transportation routes, including road, rail and pipelines, creating a risk area immediately adjacent to these routes. Information provided by the National Pipeline Mapping System (NPMS) indicate several pipelines conveying gas or hazardous liquids cross the planning area, these are shown in the figure below. Pipeline ruptures can result in major spills, or even explosions.

Fixed Facilities

Hazmat incidents can occur at a fixed facility or during transportation. Hazardous materials facilities are identified and mapped by the counties they reside in, along with the types of materials stored there. Some facilities contain extremely hazardous substances; these facilities are required to generate Risk Management Plans (RMPs) and resubmit these plans every five years. According to the Right-to-Know network database there are 162 RMP facilities located in South Dakota.

Along with RMP facilities is the Toxics Release Inventory (TRI). The TRI tracks the management of certain toxic chemicals that may pose a threat to human health and the environment. U.S. facilities in different industry sectors must report annually how much of each chemical is released to the environment and/or managed through recycling, energy recovery and treatment. (A "release" of a chemical means that it is emitted to the air or water or placed in some type of land disposal.) According to NRI mapping data there are 259 such known facilities in South Dakota.

Location

Hazardous materials incidents can happen throughout the State. Localities where hazardous materials are fabricated, processed, and stored as well as those where hazardous waste is treated, stored, and disposed of are most at risk for hazardous materials incidents. Additionally, localities along transportation corridors that carry these materials to their final destinations are also at risk. More than half of the transportation incidents between 1990 and 2021 occurred in Minnehaha and Pennington Counties, where the State's largest cities, Sioux Falls and Rapid City, are located (see the discussion on past events in the following section).

With the boom in the oil, gas and mining industries seen in the Northern Great Plains, the risk of hazardous materials from mining for resources has increased as new sites are developed. These facilities carry inherent risk for hazardous materials spills or accidents related to transportation of oil and gas extracted from these sites. The majority of these sites are west of the Missouri River and in the northwest and southwest corners of the State.

The future location of hazardous materials hazards is not expected to be impacted by climate change, but development will alter the exposure of people and assets. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*. Climate change is formally discussed in the subsection below titled *Climate Change Considerations*.

Pipelines

According to the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), South Dakota's pipeline system is as follows:

- Hazardous liquid line mileage: 803
- Gas transmission line mileage: 1,661
- Gas gathering line mileage: 0
- Gas distribution mileage: 4,570*
- Total pipeline mileage: 7,034

All mileages are for 2011 and are approximate as some data sources may not have contained a complete record of state pipeline mileage.
*Gas distribution service lines (the connection between the distribution line and the end user) are not included in the gas distribution mileage. The total number of such services is 193,628.

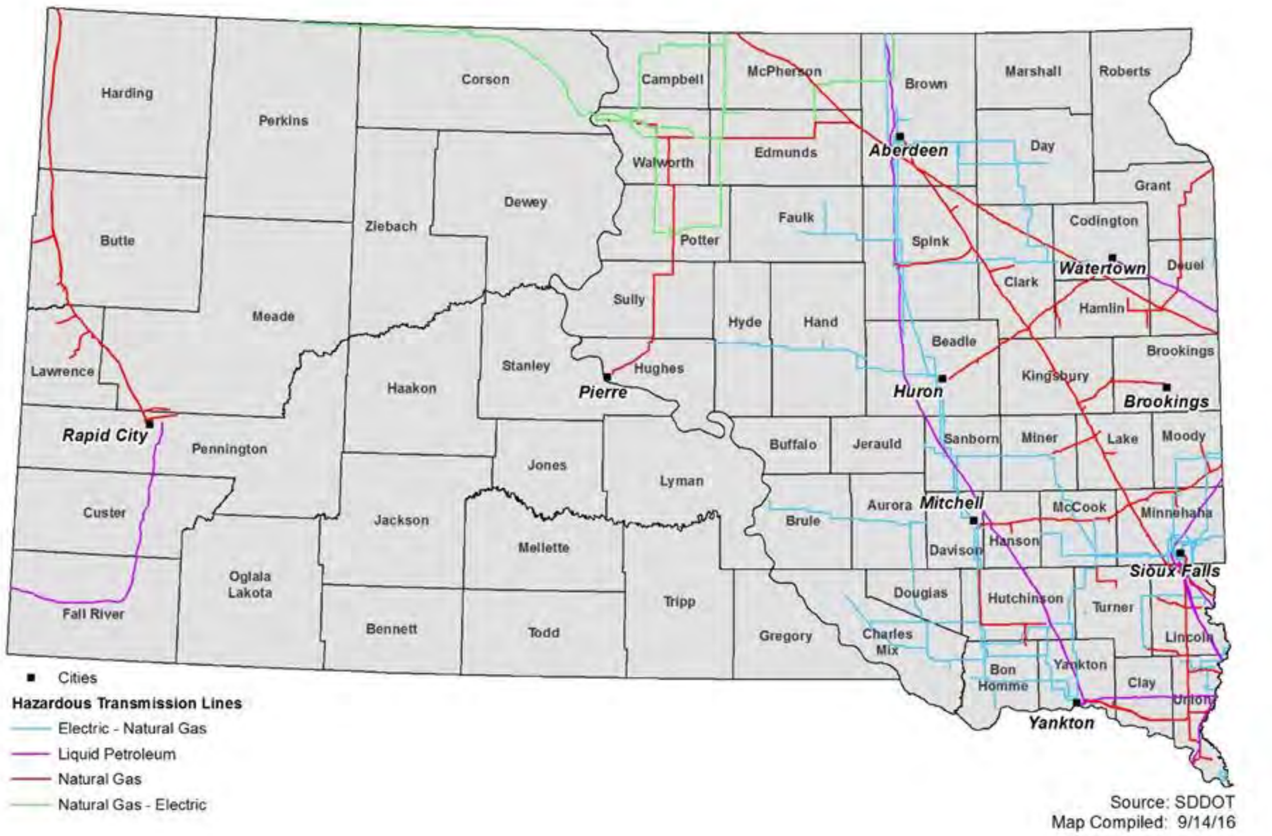
Table 3-67 shows the breakdown of gas transmission line and hazardous liquid line mileage by county. Note that some counties are not listed on the table. Figure 3-74 shows the location of these lines, the majority of which are located in the eastern half of the State.

Table 3-68 Gas Transmission Line and Hazardous Liquid Line Mileage by County

County	Gas Miles	Liquid Miles	Percent of Total
Lincoln	85	106	7.70%
Minnehaha	126	37	6.60%
Brown	83	53	5.50%
Clark	87	39	5.10%
Spink	71	46	4.70%
Butte	99	0	4.00%
Hutchinson	43	52	3.80%
Union	74	19	3.70%
Harding	84	0	3.40%
Kingsbury	67	16	3.30%
Yankton	22	60	3.30%
Deuel	53	24	3.10%
Beadle	19	51	2.80%
Meade	60	0	2.40%
Edmunds	56	0	2.30%
Hanson	20	37	2.30%
Clay	36	17	2.10%
Day	20	33	2.10%
McCook	40	12	2.10%
Walworth	54	0	2.10%
Fall River	0	50	2.00%
Hamlin	50	0	2.00%
Sully	50	0	2.00%
Lawrence	46	0	1.90%
Codington	28	12	1.60%
Lake	39	0	1.60%
McPherson	40	0	1.60%
Pennington	22	18	1.60%
Miner	8	26	1.30%
Grant	30	0	1.20%
Custer	0	29	1.10%
Sanborn	0	29	1.10%
Davison	16	8	1.00%
Marshall	0	26	1.00%
Moody	22	3	1.00%
Potter	26	0	1.00%
Turner	24	0	0.90%
Hughes	19	0	0.70%
Brookings	15	0	0.60%
Roberts	11	0	0.40%
Totals	1,660	803	100%

Source: PHMSA, http://primis.phmsa.dot.gov/comm/reports/safety/SD_detail1.html

Figure 3-74 South Dakota Hazardous Materials Transmission Lines

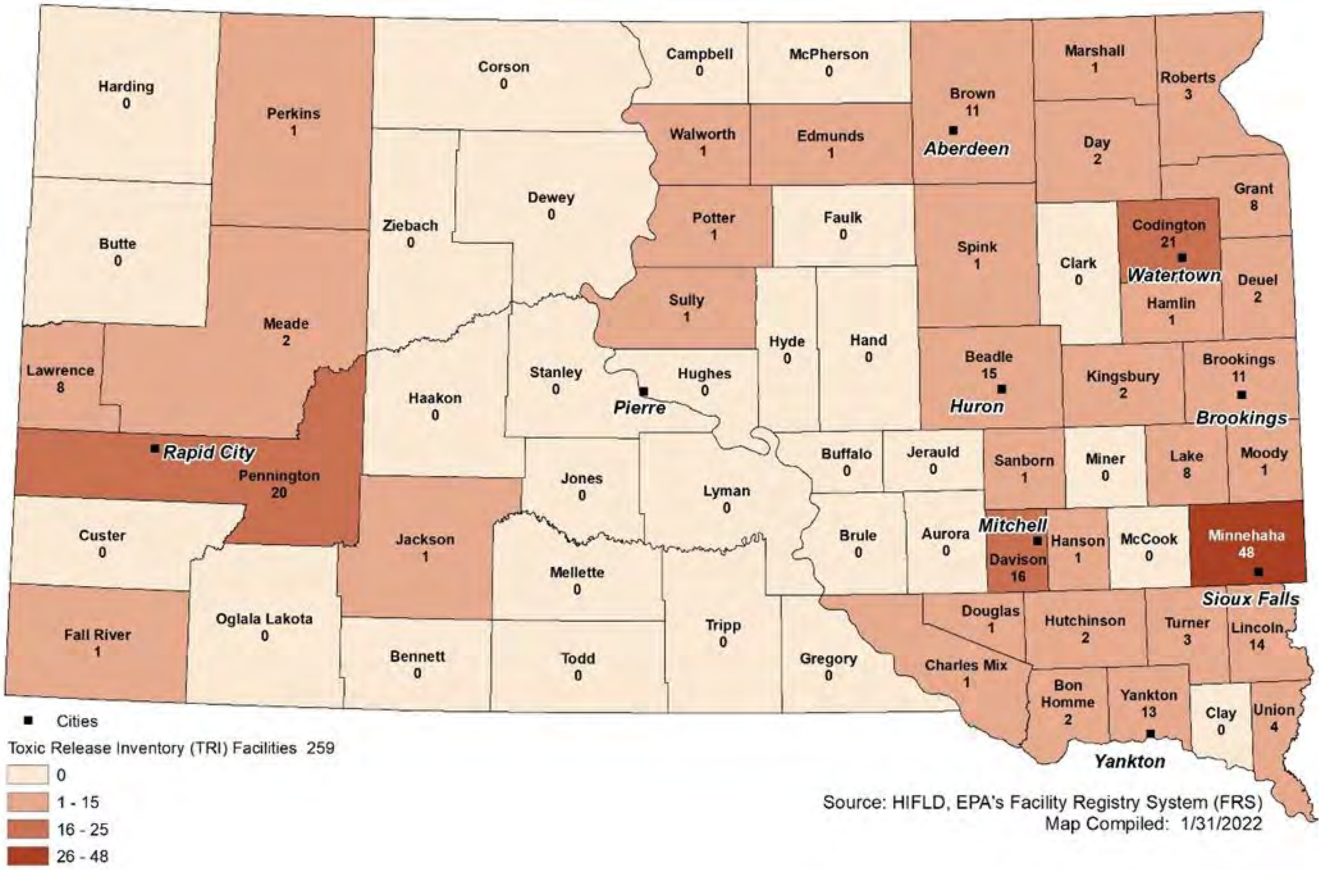


Fixed Facility

Figure 3-75 shows the number of Toxic Release Inventory Facilities (TRI) facilities in each county as of 2022. TRI Facilities are maintained in a database containing information on toxic chemical releases and other waste management activities in the United States. In correlation to the three largest cities in South Dakota of Sioux Falls, Rapid City and Watertown, each of their respective counties carry the largest amount of TRI Facilities.

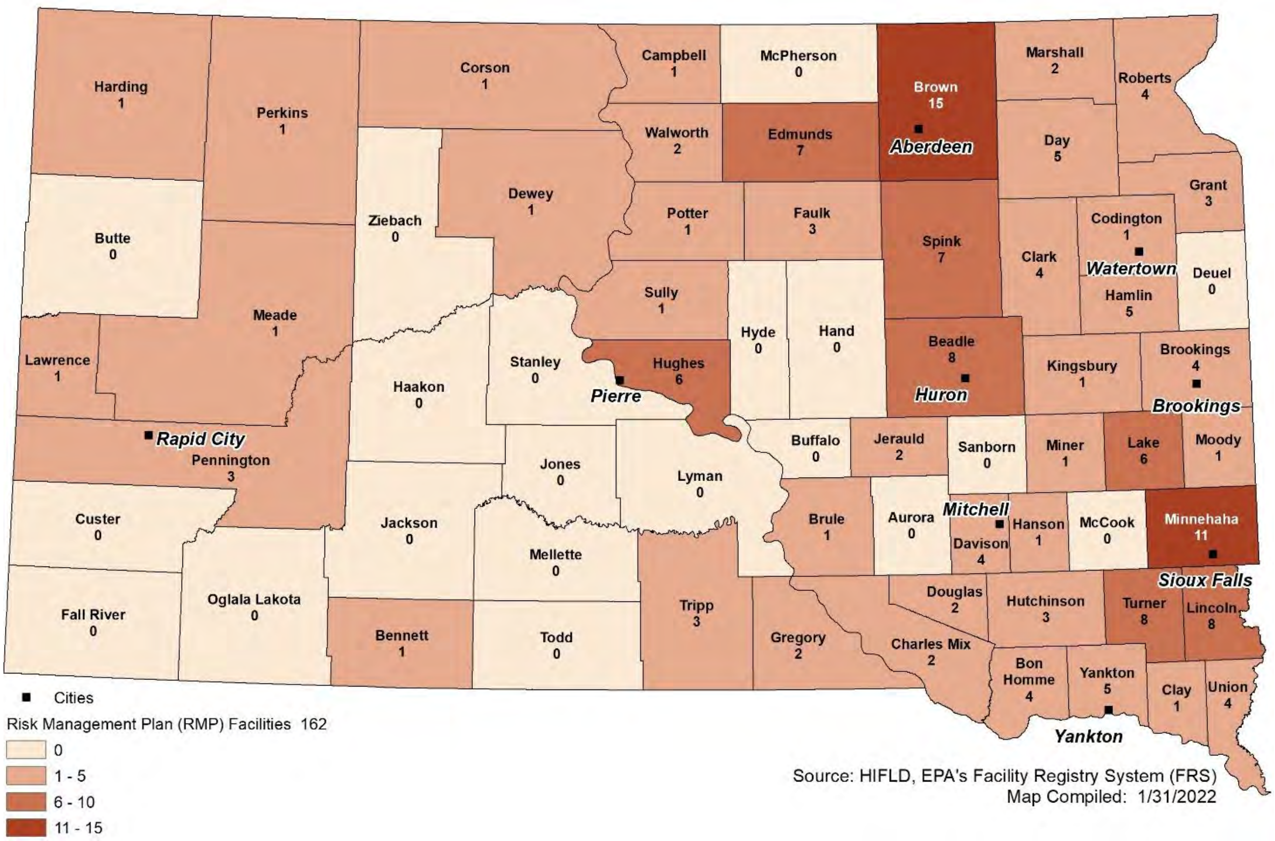
Minnehaha has the largest amount of these types of facilities with 48, Pennington County has 20 TRI Facilities. Watertown/Codington County has 21 total TRI Facilities and Davison County has 18. These four counties make up over 80% of the TRI Facilities.

Figure 3-75 South Dakota Toxic Release Inventory (TRI) Facilities



The counties with the most RMP facilities in South Dakota include Brown County with 15, Minnehaha County with 11 and Turner, Lincoln and Beadle Counties with 8 RMP facilities respectively. Minnehaha County has the highest population with South Dakota along with having the second highest number of chemical pipelines in the state. This information is displayed by county in Figure 3-76 below.

Figure 3-76 South Dakota Risk Management Plan Facilities



Past Events

Table 3-68 shows the Significant Pipeline Incidents in South Dakota from 2002-2021. Significant events are classified by the U.S. Dept. of Transportation, Pipeline & Hazardous Materials Safety Administration as including the following conditions:

- Fatality or injury requiring in-patient hospitalization
- $50,000 or more in total costs, measured in 1984 dollars
- Highly volatile liquid releases of 5 barrels or more
  - Or other liquid releases of 50 barrels or more
- Liquid releases resulting in an intentional fire or explosion

Gas distribution incidents caused by a nearby fire or explosion (aka Fire First incidents) that impacted the pipeline system are excluded.

Table 3-69 Significant Pipeline Incidents in South Dakota: 2002-2021

Years	# of Incidents	Fatalities	Injuries	Total Cost (2021 dollars)
2002	-	-	-	-
2003	-	-	-	-
2004	1	-	-	$249,250
2005	-	-	-	-
2006	-	-	-	-

Years	# of Incidents	Fatalities	Injuries	Total Cost (2021 dollars)
2007	2	-	-	$1,193,426
2008	1	-	-	$181,070
2009	-	-	-	-
2010	1	-	-	$252,581
2011	-	-	-	-
2012	2	-	-	$438,898
2013	-	-	-	-
2014	-	-	-	-
2015	1	-	1	$222,937
2016	2	-	-	$10,323,852
2017	1	-	-	$48,611,483
2018	1	-	-	$117,532
2019	-	-	-	-
2020	2	-	-	$425,357
2021	1	-	-	$224,788
Total	**15**	**-**	**1**	**$62,241,174**

Source: U.S. Department of Transportation, Pipeline & Hazardous Materials Safety Administration.

https://www.phmsa.dot.gov/data-and-statistics/pipeline/

As seen in table above, each pipeline incident has totaled into the hundreds of thousands to millions of dollars most years. The total of $62,241,174 in a 19-year time span equates to $3.2M in annualized damages.

During the 2021 HIRA update, one event of significance was found to have occurred on November 16, 2017 in Marshall County. The spill occurred along the Keystone Pipeline on farmland in the Town of Amherst. Initial reports from the U.S. DOT PHMSA estimated the spill released 210,000 gallons and was likely caused by mechanical damage during the construction of the pipeline in 2008. In April 2018, the local news source Aberdeen American News reported that a spokeswoman for the pipeline owner, TransCanada Corporation, estimated the spill to be 407,400 gallons, twice as much as was first reported in 2017. According to the PHMSA, this pipeline spill is now considered to the seventh largest onshore oil or petroleum product spill in the U.S. since 2010.

Transportation

The Hazardous Materials Incident Report Subsystem (HMIRS) of the PHMSA Hazardous Materials Information System was established in 1971 to fulfill the requirements of the federal hazardous materials transportation law. Unintentional releases of hazardous materials or the discharge of any quantity of hazardous waste must be reported. The federal law defines hazardous material as “a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous materials. The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 CFR 172.101).”

According to the U.S. Department of Transportation’s (DOT) Hazardous Materials Information System, South Dakota experienced 991 transportation incidents involving hazardous materials between 1990 and 2021. The total cost of damage from these incidents was $3,424,399. This suggests that South Dakota averages over 30 transportation incidents involving hazardous materials and $110,464 in related damage each year. Among these incidents there were 21 deaths and 87 injuries. Most incidents occurred on the highway.

The majority of the Hazardous Materials Incidents that have occurred within the last 30 years in South Dakota have occurred in the state's most populated counties. The incidents reflected below showcase the Hazardous Materials incidents reported to the Department of Transportation historically since 1990.

Table 3-70 Transportation Hazardous Materials Incidents, 1990-2021

County	# of Events	Fatalities	Total Injuries	Damages ($)	Evacuations
Minnehaha	200	2	19	975,000	1623
Pennington	104	1	12	550,836	-
Meade	60	-	12	-	31
Brown	37	-	2	160,000	136
Davison	34	-	4	-	45
Brookings	33	3	5	367,000	30
Lawrence	32	1	3	194,000	905
Grant	31	2	7	207,419	181
Beadle	25	-	-	-	-
Lincoln	24	-	3	190,000	26
Union	22	1	3	50,000	-
Yankton	21	-	1	-	20
Lake	20	-	2	-	306
Codington	18	-	-	-	-
Charles Mix	17	-	-	-	-
Hughes	16	-	-	-	-
Roberts	16	5	2	-	-
Turner	12	-	-	-	-
Custer	12	1	-	187,097	-
Brule	11	-	1	-	-
Dewey	11	-	-	-	-
Lyman	10	-	1	-	-
Harding	10	-	-	-	-
Edmunds	9	-	-	-	-
Moody	9	-	-	-	-
Spink	9	-	-	12,347	-
Stanley	9	-	-	500,000	40
Bon Homme	9	-	-	-	-
Marshall	8	-	-	-	-
Clay	7	-	-	-	-
Todd	7	-	-	-	-
Day	7	-	-	-	-
Hamlin	7	-	-	-	-
Potter	7	-	1	-	-
Fall River	7	-	-	-	-
Butte	7	2	-	-	-
Buffalo	6	-	-	-	-
Clark	6	-	1	-	-
Hutchinson	6	-	2	-	-
Tripp	6	-	-	-	-
Walworth	6	-	2	-	-
Kingsbury	5	-	1	-	-

County	# of Events	Fatalities	Total Injuries	Damages ($)	Evacuations
Shannon	5	-	-	-	-
Haakon	5	-	1	-	-
Bennett	4	-	-	700	-
Campbell	4	-	-	-	-
Faulk	4	-	-	-	-
Hand	4	-	-	-	-
Hyde	4	-	-	-	-
Jackson	4	-	-	-	-
McCook	4	-	-	-	-
Aurora	3	-	-	-	-
Deuel	3	-	-	-	-
Gregory	3	-	-	-	-
Miner	3	-	-	-	-
Sanborn	3	-	-	-	-
Sully	3	-	-	-	-
Ziebach	3	-	-	-	-
Jones	2	-	-	30,000	-
Corson	2	-	-	-	-
Douglas	2	-	-	-	-
Perkins	2	-	-	-	-
Hanson	1	-	-	-	-
Jerauld	1	-	-	-	-
Ogala Lakota	1	-	-	-	-
Mellette	1	-	-	-	-
McPherson	-	-	-	-	-
Total:	**991**	**21**	**87**	**$3,424,399**	**3,045**

Source: DOT's Office of Hazardous Materials Safety Incident Reports Database, https://hazmatonline.phmsa.dot.gov/

Probability of Future Occurrence

Fixed Facility

Not enough available data exists in order to calculate probability for a fixed facility incident. In general, these can be expected to occur less frequently than transportation-related incidents.

Transportation

According to the U.S. DOT's Hazardous Materials Information System, there were 991 transportation incidents involving hazardous materials in South Dakota between 1990 and 2021 (31 years). The largest number of incidents occurred within the state's most populated areas. Based on this, approximately 32 transportation incidents involving hazardous materials will occur in South Dakota annually.

Pipeline

According to the U.S. DOT's Office of Pipeline Safety, there were 15 pipeline incidents in South Dakota between 2002 and 2021. Based on this information, the probability that at least one pipeline incident will occur in South Dakota annually is 100%.

Magnitude/Severity (Extent)

Impacts that could occur from hazardous waste spills or releases include:

- Injury
- Loss of life (human, livestock, fish and wildlife)
- Evacuations

- Property damage
- Air pollution
- Surface or ground water pollution/contamination
- Interruption of commerce and transportation

Numerous factors go into the ultimate impacts of a hazardous materials release, including method of release, the type of material, location of release, weather conditions, and time of day. This makes it difficult to predict precise impacts. Materials found in South Dakota will have at least one of the impacts listed above, and probably more, but the location and type of incident will determine the magnitude.

Climate Change Considerations

Climate change is not anticipated to affect the frequency or severity of hazardous materials incidents.

Vulnerability Assessment

The counties in South Dakota contain energy pipelines, railroad tracks which carry many types of hazardous materials, and state highways running through the counties. A variety of hazardous materials originating in the Region or elsewhere are transported along these routes and could be vulnerable to accidental spills. Consequences can vary depending on whether the spill affects a populated area vs. an unpopulated but environmentally sensitive area.

As illustrated in Table 3-70, the top five counties and cities in South Dakota contain the largest amount of Toxic Release Facilities. Minnehaha and Codington counties where, Sioux Falls and Watertown are located respectively, have the most Toxic Release Inventory Facilities. Minnehaha County also possesses the highest amount of Hazmat Transportation Incidents in South Dakota since 1990, many of which have occurred in Sioux Falls. Pennington is second in that regard, with 104 hazmat transportation spills.

Table 3-71 South Dakota Top Counties for Hazardous Materials Facilities and Incidents

County	TRI Facilities Per County	RMP Facilities Per County	Transportation Incidents Per County (1990-2021)
Minnehaha	48	11	200
Codington	21	1	18
Pennington	20	3	104
Davison	16	4	34
Beadle	15	15	25
Total:	**120**	**34**	**381**

Potential losses can vary greatly for hazardous material incidents. For even a small incident, there are cleanup and disposal costs. In a larger scale incident, cleanup can be extensive and protracted. There can be deaths or injuries requiring doctor's visits and hospitalization, disabling chronic injuries, soil and water contamination can occur, necessitating costly remediation. Evacuations can disrupt home and business activities. Large-scale incidents can easily reach $1 million or more in direct damages.

People

Hazardous materials incidents can cause injuries, hospitalizations, and even fatalities to people nearby. People living near hazardous facilities and along transportation routes may be at a higher risk of exposure, particularly those living or working downstream and downwind from such facilities. For example, a toxic spill or a release of an airborne chemical near a populated area can lead to significant evacuations and have a high potential for loss of life.

In addition to the immediate health impacts of releases, a handful of studies have found long-term health impacts such as increased incidence of certain cancers and birth defects among people living near certain chemical facilities. However there has not been sufficient research done on the subject to allow detailed analysis.

Based on the data in the past events section, there are 2.8 injuries and 0.6 deaths annually from transportation incidents over a 31-year period. Note that some of these deaths and injuries may have been a result of a crash, vs. a result of the release.

Information regarding hazardous materials impacts on vulnerable populations remains an issue that is left to local HMPs and is therefore addressed indirectly in the SHMP. No analysis is available to explain how development will affect vulnerability to hazardous materials in the coming decades.

Property

The impact of a fixed hazardous facility, such as a chemical processing facility is typically localized to the property where the incident occurs. The impact of a small spill (i.e., liquid spill) may also be limited to the extent of the spill and remediated if needed. A blanket answer for potential impacts is hard to quantify, as different chemicals may present different impacts and issues. Property within a half mile in either direction of designated hazardous materials routes is at increased risk of impacts. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to property. However, some larger incidents involving pipelines, railroads, or explosive materials may cause significant and overwhelming damage to the surrounding communities. Based on the data in the past events section, $3.2M in annual losses associated with pipeline incidents, and $110k in annual damages associated with transportation incidents.

State Assets, Critical Facilities and Infrastructure

Impacts of hazardous material incidents on critical facilities are most often limited to the area or facility where they occurred, such as at a transit station, airport, fire station, hospital, or railroad. However, they can cause long-term traffic delays and road closures resulting in major delays in the movement of goods and services. These impacts can spread beyond the planning area to affect neighboring counties, or vice-versa. While cleanup costs from major spills can be significant, they do not typically cause significant long-term impacts to critical facilities.

A peculiar, but serious, deficiency exists in State GIS databases that affects determining a value of assets vulnerable to hazardous materials incidents. The State does not currently have consistent data on the location, type, and replacement values of most state assets. Table 3-5 "Summary of Insured State-Owned Buildings by State Agency" which includes estimated values was created from one database, which does not contain geocoding information. A different database was used to identify assets in hazard areas, such as for Table 3-28 "State Buildings at Risk to Flood Hazards" but that database does not include property values. Deconflicting and merging these databases and verifying them with the owning agency is a lengthy process that was not able to be done for this plan update. This has been identified as a need, see mitigation action 2-2.

Fortifying state assets that are particularly vulnerable to hazardous materials incidents has historically been done on a case-by-case basis or is implicitly done through facility management. There has been no state-wide analysis of which state assets are most vulnerable to hazardous materials incidents. The present arrangement of identifying which assets are *exposed* limits the degree to which these hazards can be mitigated. For example, it is not articulated at a statewide level which assets are most likely to be damaged by hazardous materials incidents or the degree to which that damage would disrupt lifelines and is considered a knowledge gap.

In addition, it is anticipated that climate change will not significantly impact hazardous materials incidents, but no state-level evaluation exists to confirm that conclusion. More significantly, no state-wide assessment been done to describe how demographic projections will affect the consequence of essential infrastructure failures in the future. Filling any of these information gaps would help local jurisdictions understand what they should plan for and help state-level analysis of shifting needs for hazard mitigation.

Estimating the potential dollar loss to state assets from hazardous materials incidents is not possible in this SHMP update, due largely to the aforementioned problem with State GIS databases. Estimates of the replacement costs of infrastructure in high-hazard zones may help prioritize mitigation actions in the future.

Economy

The primary economic impact of hazardous material incidents results in lost business, delayed deliveries, property damage, and potential contamination. Large and publicized hazardous material-related events can deter tourists and recreationists too. If incidents occur along major transportation corridors, they can temporarily close routes and result in traffic delays. Economic effects from major transportation corridor closures can be significant.

Environment and Cultural Resources

Hazardous material incidents may affect a small area at a regulated facility or cover a large area outside such a facility. Widespread effects occur when hazards contaminate the groundwater and eventually the municipal water supply, or they migrate to a major waterway or aquifer. Impacts on wildlife and natural resources can also be significant. These types of widespread events may be more likely to occur during a transportation incident, such as a pipeline spill, and can have far reaching and devastating impacts on the natural environment and habitats if they occurred near one of the wildlife refuges in Brown County.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to hazardous materials vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to hazardous materials hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to hazardous materials hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to hazardous materials hazards.

Despite gaps in the present state of knowledge, it is apparent that southeastern counties are more vulnerable to fixed facility incidents in general due to the relatively large number of facilities there.

Available data does not support further refinement of vulnerability to fixed facility or transportation incidents based on historic losses. Future development and population growth will likely increase exposure to hazardous materials. Future SHMP updates may improve mitigation of hazardous materials risks as future research improves our understanding of these risks

Table 3-72 Hazardous Materials Consequence Table

Category	Narrative
Impact on the Public	Impact is dependent upon characteristics of the chemicals associated with the incident. Health impacts from contamination in water or air; anyone without adequate shelter or appropriate protection during an event at high risk of injury and death.
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure; potential impact to tourism depending on severity and location of the event.
Impact on the Environment	Significant impact related to water quality and air quality; significant impact to animal habitats depending on location and severity.
Impact on Property, Facilities, and Infrastructure	Vulnerabilities to critical infrastructure, facilities, properties, equipment, vehicles, and communications and utility infrastructure.
Impact on the Public Confidence in Government	Ability to respond and recover may be questioned and challenged if planning, response, and recovery is not timely and effective.
Impact on Responders	Exposure exists to response personnel performing routine duties when event occurs; appropriate protection required.
Impact on Continuity of Operations and Continued Delivery of Services	Potential loss of facilities or infrastructure function or accessibility or ability to provide services.
Cascading Hazards	Explosions could result in grass or wildfires.

3.3.10. Geologic Hazards

Hazard Description

A geologic hazard is the result of a natural earth process resulting in impacts that pose a threat to life and/or property. For purposes of this plan, the geologic hazards profiled consists of landslides, mudflows, expansive soils, subsidence, and earthquakes.

Landslide

A landslide is a general term for a variety of mass movement processes that generate a downslope movement of soil, rock, and vegetation under gravitational influence. Landslides are a serious geologic hazard common to almost every state in the United States. It is estimated that nationally they cause up to $2 billion in damage and 25 to 50 deaths annually.

Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, earthquake shaking, and volcanic eruptions.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides.

Landslides are defined as a rapid slipping of a mass of earth or rock from a higher elevation to a lower level under the influence of gravity and water lubrication. More specifically, rockslides are the rapid downhill movement of large masses of rock with little or no hydraulic flow, similar to an avalanche. Water-saturated soil or clay on a slope may slide downhill over a period of several hours. Earthflows of this type are usually not serious threats to life because of their slow movement, yet they can cause blockage of roads and do extensive damage to property.

Mudflow

Mudflows (or debris flows) are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." A slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. A slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. After a wildfire, heavy rainfall can create mudflows that may increase risks to people, structures, and infrastructure located below such areas.

Damages from mudflows are covered under the NFIP; landslides are not.

Expansive Soil

Expansive soils contain clay which causes the material to increase in volume when exposed to moisture and shrink as it dries. They are also commonly known as expansive, shrinking and swelling, bentonitic, heaving, or unstable soils. The clay materials in swelling soils are capable of absorbing large quantities of water and expanding 10 percent or more as the clay becomes wet. The force of expansion is capable of exerting pressures of 15,000 pounds per square foot or greater on foundations, slabs, and other confining structures. The amount of swelling (or potential volume of expansion) is linked to five main factors: the type of mineral content, the concentration of swelling clay, the density of the materials, moisture changes in the environment, and the restraining pressure exerted by materials on top of the swelling soil. Each of these factors impact how much swelling a particular area will experience, but may be modified, for better or worse, by development actions in the area.

- **Low**—This soils class includes sands and silts with relatively low amounts of clay minerals. Sandy clays may also have low expansion potential if the clay is kaolinite. Kaolinite is a common clay mineral.
- **Moderate**—This class includes silty clay and clay textured soils, if the clay is kaolinite, and also includes heavy silts, light sandy clays, and silty clays with mixed clay minerals.
- **High**—This class includes clays and clay with mixed montmorillonite, a clay mineral which expands and contracts more than kaolinite.

Cracked foundations, floors and basement walls are typical types of damage done by swelling soils. Damage to the upper floors of the building can occur when motion in the structure is significant. Expansive soils will also shrink when they dry out. This shrinkage can remove support from buildings or other structures and result in damaging subsidence. Fissures in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling which places repetitive stress on structures.

Subsidence

Land subsidence is the sinking of the land over manmade or natural underground voids. Subsidence occurs naturally and also through man-driven or technologically exacerbated circumstances. Natural causes of subsidence occur when water in the ground dissolves minerals and other materials in the earth, creating pockets or voids. When the void can no longer support the weight of the earth above it, it collapses, causing a sinkhole depression in the landscape. Often, natural subsidence is associated with limestone erosion, but may also occur with other water-soluble minerals. Man-driven or technology-exacerbated subsidence conditions are associated with the lowering of water tables, extraction of natural gas, or subsurface mining activities. As the underground voids caused by these activities settle or collapse, subsidence occurs on the surface.

Subsidence can result in serious, localized structural damage to buildings, roads, irrigation ditches, canals, streams, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures. This results in direct economic losses to citizens as well as indirect economic losses through increased taxes and decreased property values.

Earthquake

An earthquake is the vibration of the earth's surface following a release of energy in the earth's crust. This energy can be generated by a sudden dislocation of the crust or by a volcanic eruption. Most destructive quakes are caused by dislocations of the crust. The crust may first bend and then, when the stress exceeds the strength of the rocks, break and snap to a new position. In the process of breaking, vibrations called "seismic waves" are generated. These waves travel outward from the source of the earthquake at varying speeds.

Earthquakes east of the Rocky Mountains are less frequent than in the western United States and are typically felt over a much broader region. Most of North America east of the Rocky Mountains has infrequent earthquakes, and the region from the Rockies to the Atlantic Ocean can go years without an earthquake large enough to be felt. Several U.S. states have never reported a damaging earthquake. The earthquakes that do occur in this region are typically small and occur at irregular intervals.

East of the Rockies it is difficult to determine the specific fault that is responsible for an earthquake since this vast region is far from plate boundaries, which are in the Atlantic Ocean, the Caribbean Sea, and in California and offshore from Washington and Oregon. Known faults do exist in this "stable continental region," but numerous smaller or deeply buried faults remain undetected, even most of the known faults are poorly located at depths typically associated with earthquakes. Additionally, it is difficult to determine if a fault is still active and capable of generating an earthquake. Consequently, in most areas east of the Rockies, the best guide to earthquake hazards is the earthquakes themselves.

South Dakota is somewhat more seismically active than other areas in the Northern Great Plains, although the earthquake magnitudes have been relatively minor to date. At least two mechanisms may be important in the generation of earthquakes. These include initiation of movement along pre-existing fractures due to crustal plate movements or movements due to glacial rebound. Ground motion accelerations can be calculated based upon historical seismic records, but the poor quality of the database does not allow great confidence to be placed in those calculations. These calculations show highs in ground motion acceleration that correspond reasonably closely with areas of greater earthquake frequency.

Location

The location of geologic hazards is discussed in the following four subsections, beginning with landslides.

The future location of geologic hazards will be impacted by both climate change and development. Climate change will alter weather, which affects soils and therefore affects many geologic hazards. Climate change effects on geologic hazards is discussed further in the subsection below titled *Climate Change Considerations*. Development will alter the exposure of people and assets. Development issues are discussed throughout this chapter, but are summarized further below in the subsection titled, *Development Trends and Consequence Summary*. The usefulness of future analysis of both development and climate change as they relate to geologic hazards and vulnerable populations is a recurring theme in both the *Geologic Hazards* section and the SHMP update.

Landslides

Areas that are generally prone to landslide hazards include existing old landslides, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used.

Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges, set back from the tops of slopes.

In certain areas of South Dakota landslides do occur. Figure 3-77 below illustrates areas of landslide susceptibility in South Dakota, indicating that landslides are most likely to occur in the Black Hills and Missouri River areas. Over the years, many landslides have been dealt with by the State of South Dakota and in particular the SDDOT. SDDOT has spent a lot of time stabilizing landslides throughout the State. Two of the larger slides were the U.S. 12 Missouri River Crossing at Mobridge and the U.S. 212 Missouri River crossing at Forest City. At Mobridge, stone columns were used for the first time in the United States to stabilize a clay-shale landslide. Forest City also used stone columns and incorporated the use of massive concrete shear pins installed by a slurry wall process to stabilize the approach berm. This was the first time in the United States that this technique was used to mitigate a landslide of this magnitude. A civil engineer, who was head of the SDDOT Geotechnical Activity Section from 1969 to 2001, achieved national recognition for his innovative work with these two landslides. A slide area also exists near Cheyenne Crossing along U.S. Highway 14A in Lawrence County. Road crews were engaged in landslide repair efforts at the site in 2012 and continuing into 2013. A potential landslide area existed near Yates Pond in Lawrence County along U.S. Highway 14A, but SDDOT mitigated this area in 2010.

Figure 3-77 South Dakota Landslide Incidence and Susceptibility

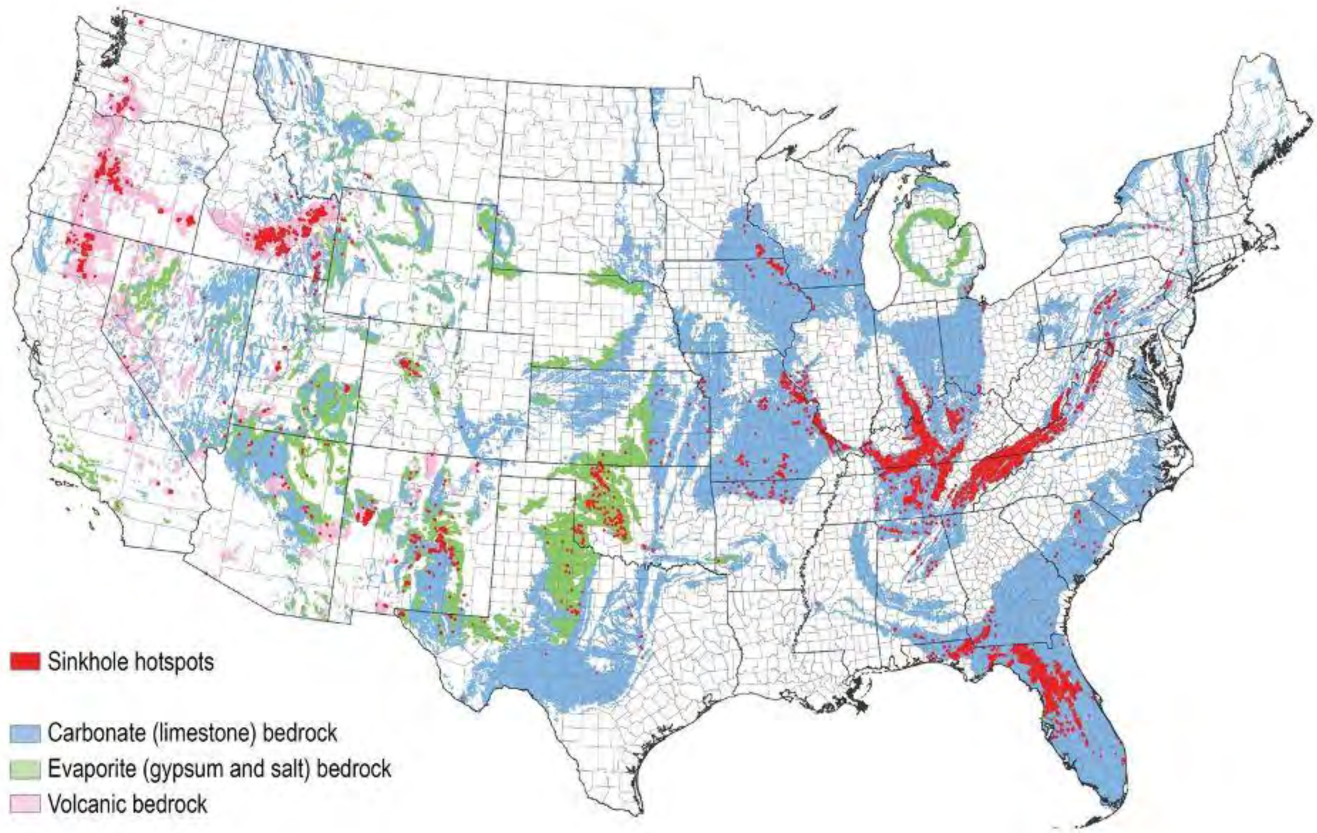
Source: U.S. Geological Survey, map generated by https://nationalmap.gov/

Subsidence

There are certain areas in South Dakota at risk to subsidence (see Figure 3-78). The Niobrara Formation (Upper Cretaceous) and its equivalents are the most widespread carbonate rocks in western Kansas, eastern Nebraska, and southeastern South Dakota. The Niobrara is generally covered by more than 50 ft. (15 m) of younger sediments. Small fissures, less than 1,000 ft. (300 m) long and up to 100 ft. (30 m) deep, are present, but they are not common and are generally irregularly spaced with 1,000 ft. (300 m) or more of solid rock between fissures.

In western South Dakota and adjacent parts of Wyoming and Montana, Paleozoic, and Cretaceous carbonate rocks, arched steeply upwards, encircle the structural dome that forms the Black Hills. Caves and open fissures are common in the Paleozoic carbonate rocks. A few caves contain many miles of passages but most of the cave passages and fissures in the Black Hills area only extend up to 3,000 ft. (900 m) in length and are generally less than 150 ft. (45 m) in depth. Closely spaced solution joints also are prevalent.

Figure 3-78 Karst Map of the Conterminous United States

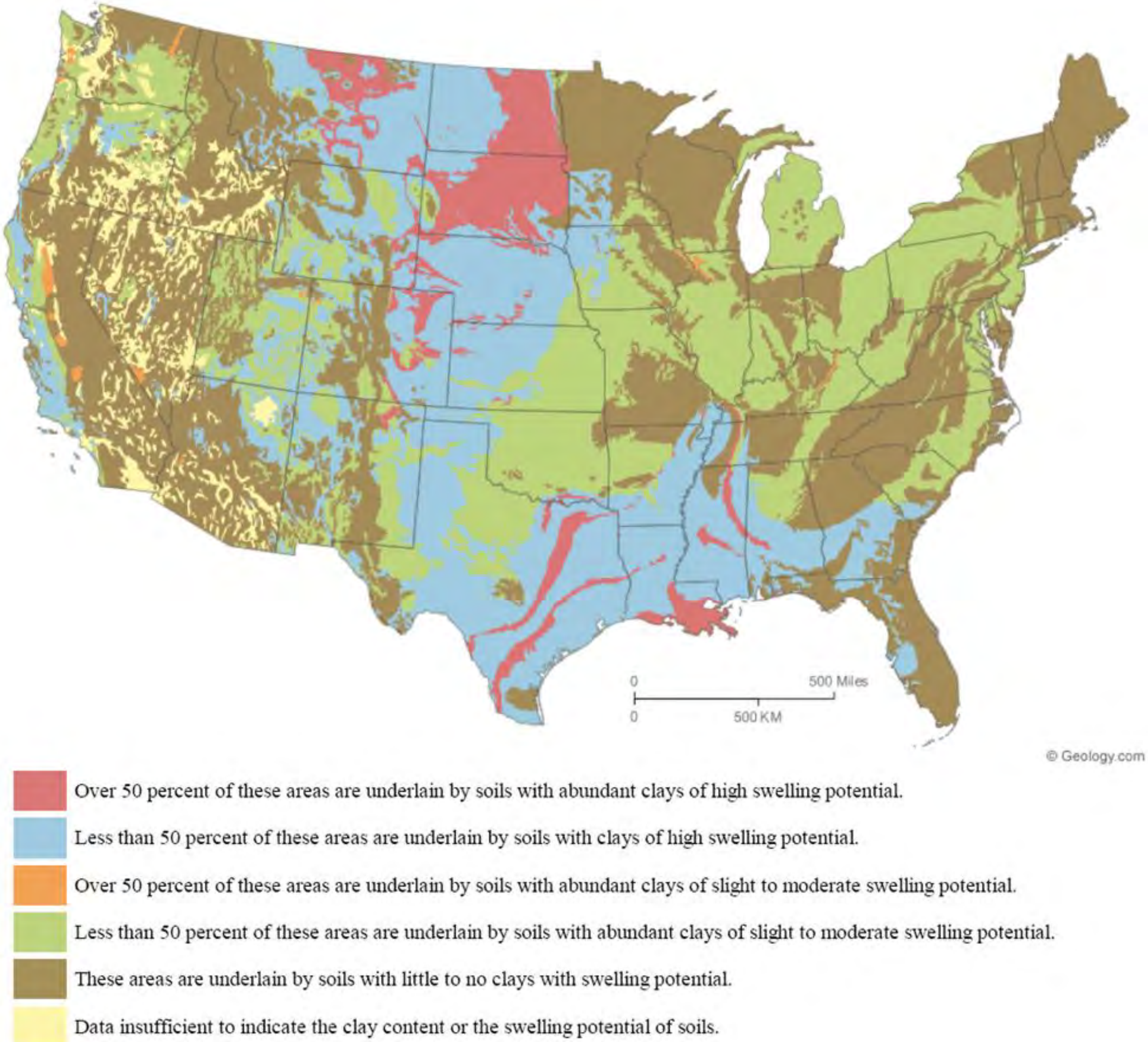


Source: USGS https://www.usgs.gov/media/images/karst-map-conterminous-united-states-2020

Expansive Soils

There are certain areas of South Dakota at risk to expansive soils. Figure 3-79 below shows the geographic distribution of soils which are known to have expandable clay minerals which can cause damage to foundations and structures. It also includes soils that have a clay mineral composition which can potentially cause damage. The map is meant to show general trends in the geographic distribution of expansive soils. It is not meant to be used as a property evaluation tool. It is useful for learning areas where expansive soils underlie a significant portion of the land and where expansive soils might be a localized problem. According to this map, most of the State has high potential for expansive soils.

Figure 3-79 Generalized Expansive Soils Nationwide



Source: The map above is based upon "Swelling Clays Map of the Conterminous United States" by W. Olive, A. Chleborad, C. Frahme, J. Shlocker, R. Schneider and R. Schuster. It was published in 1989 as Map I-1940 in the USGS Miscellaneous Investigations Series. Land areas were assigned to map soil categories based upon the type of bedrock that exists beneath them as shown on a geologic map. In most areas, where soils are produced "in situ", this method of assignment was reasonable. However, some areas are underlain by soils which have been transported by wind, water or ice. The map soil categories would not apply for these locations.

Earthquake

A zone of higher earthquake frequency extends from the northeastern corner of the State and a generally higher frequency of earthquakes is recorded along the eastern flank of the Black Hills and in the southwestern corner of the State. The earthquakes occurring in South Dakota appear to be concentrated along the Great Lakes Tectonic Zone and possibly along the boundaries of the structural provinces in the Precambrian, crystalline basement.

The Black Hills, being a structural dome, is full of faults and joints dating to the uplift some 50 million years ago. Very little strain now accumulates along them, so only small, rare earthquakes have occurred in the region during historic times. Work by several geologists during the last decade or so have shown that much of the region has widely spaced joints and faults breaking the earth's crust into blocks, each a township size in area. Fortunately, there is very little strain to release as earthquakes in South Dakota. In the south-central part of the State, the South Dakota Geologic Survey have mapped some of these blocks and have identified individual block-bounding faults that have moved 40 feet or more vertically and a few hundreds of feet horizontally in very small increments during the last 50 million years.

Past Events

Table 3-72 provides information regarding past landslides, mudflows, subsidence, and expansive soils.

Table 3-73 South Dakota Landslides and Mudflows

Date	Comments
January 8, 2021	A 300-foot long landslide forced the closure of Highway 240 south of Wall in Badlands National Park.
2012-2013	Road crews worked to repair a slide area near Cheyenne Crossing along U.S. Highway 14A in Lawrence County. Repair efforts included excavating landslide debris and constructing a new back slope.
2006	A landslide near Wasta in Pennington County took the water system out for a week.
August 8, 2004	A heavy rain at the rate of about one inch per hour fell over the area burned by the Grizzly Gulch fire in Lawrence County just six weeks before. The result was that the steep hillsides lost most of their topsoil, which flowed down into Deadwood. Hardest hit was the area of the Northern Hills General Hospital where a retaining wall was damaged, Whistler's Gulch Campground and Mile High Mobile Home Park, and properties along Sherman Street in Deadwood. Cleanup would have been well over one million dollars, but the use of a state prison work crew and volunteers reduced the out-of-pocket expense to property owners.
2001	A mudflow caused by heavy rain occurred after the Black Hills Grizzly Gulch Fire in 2001. The mudflow caused damage to many homes in the burn area or below.
June 1976	Flash Flooding, Mudslides (FEMA-511-DR) In a 24-hour period on June 13-14, 3 to 10 inches of rain fell in the northern Black Hills. And additional two to three inches of rain plus heavy snow was recorded over this area on the June 15 and 16. The runoff from this precipitation did considerable damage in the counties of Lawrence, Meade, Butte, and Harding. There was also a problem with mudslides and landslides.
May 1952	Sturgis/Deadwood - Heavy rains brought flash flooding that tore up streets and gas pipelines in Sturgis. Bridges were washed out and water erosion caused rockslides. Water damage and landslides also occurred in Deadwood.

Limited information was available regarding past impacts from swelling soils. Modern building practices often take this hazard into account and incorporate mitigation. The SDDOT does normal maintenance and accounts for this hazard in their construction practices, which does result in additional costs for mitigation and road maintenance.

Similarly, research for this HMP update yielded little information regarding past impacts from naturally-occurring subsidence. The hazard has existed in South Dakota, and has been studied to a relatively minor extent in the academic literature[19]. It remains unclear if *naturally occurring* subsidence is a significant issue in South Dakota.

A considerably larger, but still uncommon, subsidence hazard is caused by the collapse of voids left by past mining. This exists in parts of South Dakota and occasionally presents a man-made hazard. The town

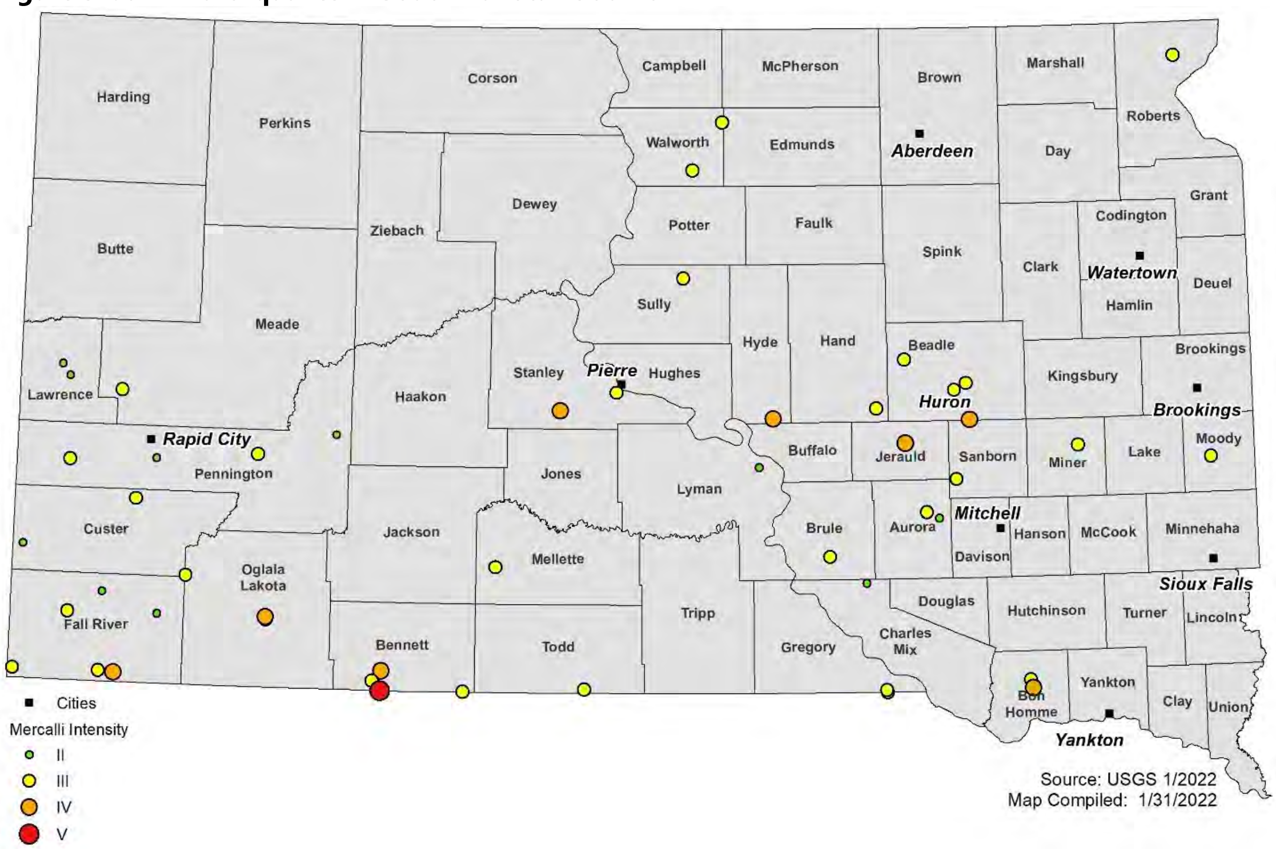
19 Rahn, P.H., & Davis, A.D. (1996). Gypsum foundation problems in the Black Hills area, South Dakota. Environmental & Engineering Geoscience, 2(2), 213-223.

of Lead, South Dakota was infamously destroyed and had to be relocated in 1925 due to subsidence of tens of feet caused by the town being undermined by the Homestake Mine. Other incidents continue to occur. In 2020, a sinkhole opened in Black Hawk, South Dakota, caused by a collapse in the abandoned Hideaway gypsum mine. The local Paha Sapa Grotto caving group explored the sinkhole and mapped its connection to mineshafts that extended directly under at least twelve homes. While mining-related sinkholes make for fascinating reading[20], they are essentially man-made hazards. In addition, modern mining practices and regulations have advanced to prevent this hazard, particularly regarding backfilling abandoned mineshafts. Nevertheless, a legacy of abandoned mines continues to present a difficult-to-predict man-made hazard.

According to the USGS, no major earthquakes have been reported in South Dakota since 1967. However, earthquakes have historically caused relatively minor damage in South Dakota. Documented damages include cattle stampedes, shaking buildings, falling, or rattling dishes and pictures, stuck doors and windows, cracked window glass, foundations heaving or cracking, wall and ceiling plaster cracks, and furniture moving. Table 3-73 and Figure 3-80 below provide the locations and information of past earthquakes in South Dakota which have caused noticeable impacts.

Table 3-73 below details notable earthquakes centered or felt in South Dakota, with details provided primarily by the USGS, as well as an abridged version of Carl A. von Hake's "South Dakota History" in Earthquake Information Bulletin, Volume 9, Number 1, January–February 1977.

Figure 3-80 Earthquakes in South Dakota 1906-2021



Source: U.S. Geological Survey

20 https://www.pahasapagrotto.org/hideaway-mine.html

Table 3-74 South Dakota Earthquakes

Date	Comments
June 4, 2021	Magnitude 3.7, 10 km northeast of Anoka, Nebraska along the South Dakota/Nebraska Stateline. Modified Mercalli Intensity (MMI) of V – Moderate
March 26, 2021	Magnitude 3.4, 10 km east of Edgemont
January 4, 2021	Magnitude 3.1, 5 km north of Tyndall
December 9, 2020	Magnitude 3.2, 10 km northwest of Bowdle
August 15, 2017	Magnitude 3.0, 8 km east of Agar
February 7, 2014	Magnitude 3.0, Northwest of Platte
December 12, 2013	Magnitude 3.5, South of Colonial Pine Hills
January 16, 2012	Magnitude 3.0 near Custer/Fall River/ Oglala Lakota County (previously Shannon County) borders
November 15, 2011	Magnitude 3.3 in Fall River County
November 14, 2011	Magnitude 4.0 in Fall River County
August 9, 2011	Magnitude 3.4 near Hughes/Stanley County border
September 25, 2009	Magnitude 3.8 at 10:11 am. 30 miles northwest of Belle Fourche
February 7, 2007	Maximum Intensity III - Magnitude 3.1, 4:35 a.m. 7 miles west southwest of Wasta, 17 miles west northwest of Wall
October 19, 2005	Magnitude 3.1
January 24, 2004	Magnitude 2.5
January 5, 2004	Magnitude 2.8
November 21, 2003	Magnitude 3.5
May 25, 2003	Intensity IV at Kyle and Gordon, III at Pine Ridge and Chadron - Magnitude 4.0, 1:32 a.m. 35 miles east of Pine Ridge, 115 miles southwest of Pierre
July 26, 2002	Magnitude 3.1
July 12, 1998	Magnitude 3.1
May 3, 1996	Magnitude 3.1
February 6, 1996	Intensity V - 9:10 a.m. 24 miles south southwest of Yankton (Magnitude 3.6). Felt by many people. The quake caused Gavins Point Dam personnel to conduct dam safety checks. Intensity V - 9:08 a.m. Northwest of Mt. Rushmore (3.7 Richter). Felt by many people who noticed typical earthquake ground movement. Both quakes were centered about 5 km below the surface. Neither quake can be definitely associated with any mapped fault, but both are near known or postulated faults
July 3, 1995	Intensity III - Southwest of Ft. Thompson (2.8 Richter)
March 18, 1994	Intensity III - Hot Springs (2.8 Richter)
September 5, 1993	Intensity III - Deadwood (2.7 Richter)
October 25, 1990	Intensity V - Aurora County north of Plankinton and west southwest of Storla
March 2, 1990	Intensity IV - Oglala Lakota County (previously Shannon County) north of Manderson
January 28, 1990	Intensity V - Oglala Lakota County (previously Shannon County) north of Manderson
November 26, 1989	Intensity III - Walworth County near Lowery
October 15, 1987	Intensity III - Beadle County northeast of Wessington
July 9, 1987	Intensity III - Beadle County near Virgil
May 25, 1986	Intensity IV - Sanborn County slightly northeast of Storla
March 4, 1983	Intensity VI - On Hyde–Buffalo County border south of Mac's Corner
November 15, 1982	Intensity V - Bon Homme County near Avon
July 11, 1982	Intensity V - Moody County near Egan
September 13, 1981	Intensity V - Bennett County southeast of Batesland on the Nebraska border
May 16, 1975	Intensity IV - Fall River County near Edgemont
October 19, 1971	Intensity IV - 3:15 p.m. Jackson County halfway between Kadoka and Norris. Glass rattled

Date	Comments
November 23, 1967	Intensity V - Lyman County east of Hamill near Tripp-Lyman County border. Magnitude 4.4, felt in Winner, Rosebud, White River areas. Many residents were frightened in Gregory, where furniture shifted, and windows cracked. Livestock stampeded through fences on some farms
Jun 26, 1966	Intensity VI - 5:59 a.m. Meade County between Bethlehem and Tilford. Magnitude 4.1, slight damage at Rapid City. At Keystone, well water was muddied for several hours. At Rapid City, concrete steps cracked away from a house and a patio cracked. At Deadwood, there was a fallen tree due to the shock. At Keystone, one observer reported he could see the ground moving. Pictures on walls bounced, buildings creaked, and dishes rattled. There was a gradual onset with a bumping swaying motion. In Rapid City, buildings creaked, and loose objects rattled. There was a rapid onset with a bumping motion, and moderately loud earth sounds were also heard
August 26, 1964	Intensity IV - Pennington County south of Wall in Badlands National Park
March 28, 1964	Intensity VII - Epicenter in western Nebraska. Magnitude 5.1. Duration: 10 seconds. Depth: 65.98 miles. (This quake was not actually in South Dakota but caused damage anyway. It is listed here to represent the danger from earthquakes that originate outside the State's borders)
March 27, 1964	Unknown strength due to proximity of the Great Alaska Quake - 9:00 p.m. Near Van Taussell, Wyoming. Felt throughout Black Hills with an apparent intensity of IV. (This quake was not actually in South Dakota but caused damage anyway. It is listed here to represent the danger from earthquakes that originate outside the State's borders)
March 24, 1964	Intensity V - 12:12 a.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. Felt by all at Wind Cave National Park. Small rocks fell in cave, buildings creaked, and loose objects rattled. Moderately loud, rumbling noise heard. Abrupt onset, trembling motion. Duration: 3–5 seconds
December 31, 1961	Intensity VI - 10:35 a.m. Stanley County near Wendte. Felt by many in Pierre. Slight damage. Plaster cracked, cement floors cracked, refrigerator doors shaken open, clothes dryer moved several inches. Fishermen along the Missouri River reported that the moment the quake struck; hundreds of fish jumped into the air. Buildings shook and loose objects rattled. Intensity V - Murdo - felt by many. Plaster on walls cracked, venetian blinds swayed, dishes rattled, faint earth sounds heard, trembling motion with abrupt onset. Intensity IV - Presho and Winner. Intensity I-III - Draper, Hayes, Huron, Midland, Onida, Philip, and White River
January 12, 1959	Intensity IV - 7:15 a.m. Spink County near Doland. Felt by many; rumbling sound followed by what sounded like a boiler explosion. Dishes and windows rattled
December 3, 1957	Intensity IV - 1:30 a.m. Davison County near Loomis. Awakened several people in Mount Vernon, where buildings creaked, and loose objects rattled. At Mitchell, houses shook, and windows and doors rattled. Livestock was "alarmed and all bunched up"
December 31, 1953	Intensity IV - Gregory County south of Burke
December 21, 1953	Intensity IV - Perkins County near Zeona
November 14, 1952	Intensity IV - Pennington County near Silver City
December 14, 1949	Intensity III - Gregory County near Dallas
Jun 3, 1949	Intensity IV - Potter County near Gettysburg
March 7, 1949	Intensity III - Hand County near Miller
August 25, 1947	Intensity IV - Gregory County near Bonesteel
July 23, 1946	Intensity VI - Jerauld County near Wessington Springs. In Wessington water mains cracked at two points
November 10, 1945	Intensity IV - 3:00 a.m. Bon Homme County east of Kingsbury and southeast of Tyndall. Rattled dishes

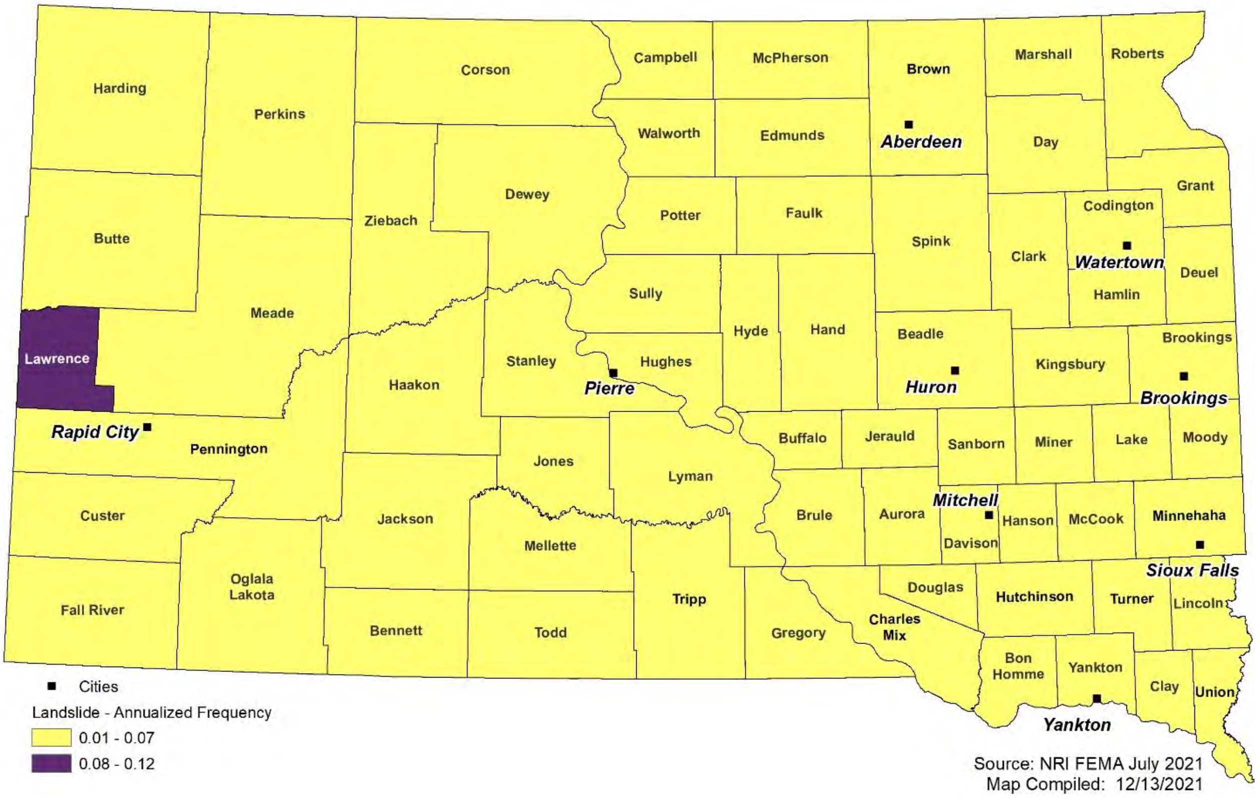
Date	Comments
May 16, 1943	Intensity IV - 12:40 p.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. Felt by many “like heavy trucks rumbling down the street.” Dishes rattled
March 11, 1942	Intensity III - 11:55 a.m. Meade County near Sturgis. Light shock felt in Deadwood, Fort Meade, Lead, Piedmont, Sturgis, Terraville, Trojan, Whitewood, and Black Hawk
May 25, 1941	Intensity V - 12:25 a.m. Custer County north northeast of Hot Springs near Fall River-Custer County border. In Hot Springs, one wall reported cracked. Pictures and light fixtures swayed in Hot Springs, Rapid City, and Martin. Not felt in Longvalley, Belvidere, Oelrichs, or Cottonwood
Jun 10, 1939	Intensity IV - 12:30 p.m. Gregory County on Nebraska border south of Fairfax. There was one shock of about 15 seconds duration. It was of a gradual bumping nature, direction northwest to southeast, with a rumbling sound
November 4, 1938	Intensity IV - 10:10 and 10:15 p.m. Gregory County near Whetstone Bay. Felt in Academy, Lake Andes, Burke, Colome, Dallas, Gregory, and Platte
October 11, 1938	Intensity V - 3:37 a.m. Minnehaha County between Renner and Sioux Falls. In Sioux Falls, buildings jarred, beds shook, dishes rattled, and pictures and other loose objects swayed. A rumbling subterranean noise came as a climax of the earthquake. The recording pens on water and electric meters at the municipal water works were jarred. Sioux Falls police received more than 50 calls from citizens. Intensity IV - Humboldt, Madison, Parker, Spencer, and Yankton. Intensity III and under - Canton, Centerville, Egan, Hudson, Lennox, Salem, Sherman, and Vermillion. Not felt in Beresford, Brookings, Howard, Mitchell, or Olivet
October 1, 1938	Intensity V - 4:15 p.m. Brule County near Chamberlain
January 2, 1938	Intensity IV - 11:05 a.m. Beadle County near Broadland
October 30, 1936	Intensity IV - Custer County north northeast of Hot Springs near Fall River. Not felt elsewhere
November 1, 1935	Intensity III - Moody County between Egan and the Minnesota border on Highway 34
August 30, 1934	Intensity IV - On the Brule and Charles Mix County border between Bijou Hills and Academy: Abrupt trembling motion accompanied by a rumbling sound, felt by many, small objects moved. Also felt in Pukwana
January 29, 1934	Intensity IV - 6:30 a.m. Marshall County north northwest of Kidder near Newark. Awakened several, dishes rattled, rumbling sound
January 17, 1931	Intensity IV - Aurora County east of Platte Lake and south of White Lake. Felt by many. Trembling motion with loud sounds
October 6, 1929	Strong Shock - 6:30 a.m. City of Yankton. Deep rumbling resembling distant thunder set windows rattling. Some dishes thrown from shelves. Felt around Yankton and at Gayville and Volin about 15 miles to the east
November 16, 1928	Intensity V - Pennington County near Mystic City. Felt at Custer and Rochford
December 30, 1924	Intensity IV - 10:10, 10:15, 10:20, and 10:30 p.m. - Custer County north northeast of Hot Springs near Fall River-Custer County border
January 2, 1922	Intensity VI - Brule County near Chamberlain
September 24, 1921	Intensity IV - Aurora County east of Platte Lake and south of White Lake
March 16, 1921	Intensity III - Minnehaha County near Sioux Falls at Lincoln County border
July 14, 1920	Intensity III - Fall River County near Oelrichs
June 29, 1916	Intensity III - Tripp County near Winner
February 24, 1916	Intensity III - Oglala Lakota County (previously Shannon County) -near Pine Ridge
October 23, 1915	Intensity V - Jackson County near Kadoka. Loud noises and some cracks in the ground
Jun 2, 1911	Intensity V - Beadle County near James River crossing into Sanborn County. Felt in the James River Valley
May 10, 1906	Intensity VI - Bennett County near southeast corner and on the Nebraska border. Felt from Rushville to Valentine, Nebraska

Date	Comments
March 14, 1900	Intensity III - 5:00a.m. Brown County near northeast corner of Richmond Lake. Intensity III - 3:00a.m. Brown County near northeast corner of Richmond Lake
December 6, 1899	Intensity IV - Hand County near Miller
October 12, 1895	Intensity V - Pennington County near Hayward
October 11, 1895	Intensity IV–V - Pennington County near Hayward. Felt at Rochford, Keystone, and Hill City
December 29, 1879	Intensity V - Yankton County near Yankton
August 17, 1876	Intensity IV - Lyman County near Lower Brule
October 9, 1872	Intensity V - At Sioux City, Iowa. Severe effects at Yankton and White Swan. Felt in all or most of South Dakota
February 9, 1872	Intensity III - Stanley County near Mission Ridge

Probability of Future Occurrence

Although historical landslide/mudflow/subsidence/expansive soil occurrence data is limited it can be assumed that these geological processes will continue to occur occasionally in the future. Landslides and expansive soils may typically occur most often during wet climate cycles or following heavy rains, but in limited areas of the State. Figure 3-81 below illustrates the projected annualized frequency of landslides in South Dakota from the NRI based off the frequency of past distinct events by census tract. According to these data, Lawrence County in the Black Hills Region is the county with the most elevated risk for landslides in the State. The differences between the annualized frequency of landslides map in Figure 3-81 and the landslide incidence and susceptibility map in Figure 3-77 are striking. The map in Figure 3-77 is generated from the USGS national map and has a dramatically greater resolution of the landslide hazard. In this update, the data shown in Figure 3-77 is used unless otherwise stated.

Figure 3-81 Annualized Frequency of Landslides in South Dakota

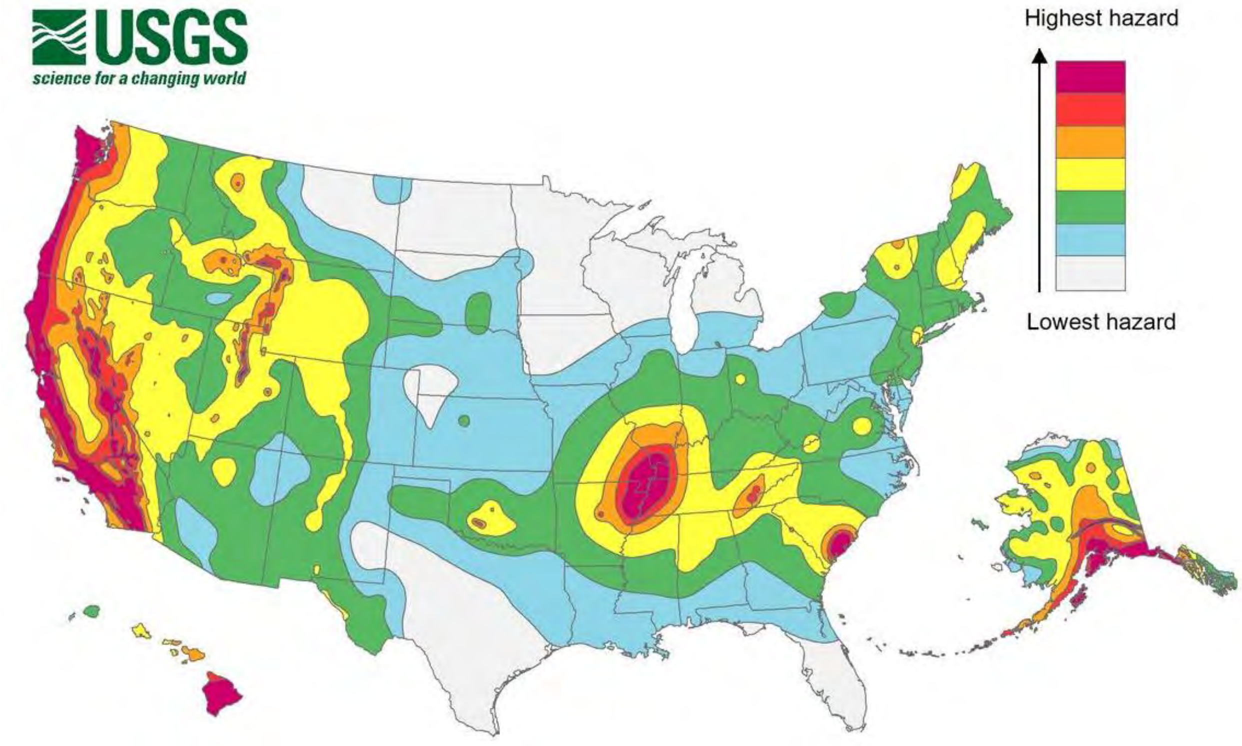


Source: NRI

South Dakota is relatively geologically stable based upon the sparse data available. However, there is potential for larger earthquakes than the magnitude 4.4 earthquake that struck the Black Hills in 1964. The U.S. Geological Survey estimates this risk as only a 10 percent chance of exceeding a 5.1 magnitude in any one 50-year period. The map in Figure 3-83 shows ground motions that have a 2 percent chance of being equaled or exceeded in a 50-year period.

Figure 3-82 below illustrates the State of South Dakota's probability for a large earthquake relative to the rest of the county. This map is an earthquake hazard map generated by the USGS showing peak ground accelerations, or the maximum acceleration of the ground during a given seismic event, which a 2 percent probability of being exceeded in 50 years. According to the SUGS, the maps is based on the most recent 2018 models for the conterminous U.S. and are based on seismicity and fault-slip rates and take into account the frequency of earthquakes of various magnitudes. According to this study, South Dakota is on the lowest end of the hazard scale compared to the rest of the county.

Figure 3-82 Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years



Source: U.S. Geological Survey, National Earthquake Information Center

Magnitude/Severity (Extent)

The extent of landslides and debris flow events within South Dakota range from negligible to significant, depending on the event. Landslides and rockslides can result in the destruction of infrastructure such as roadways, water and sewer lines, electrical and telecommunications utilities and drainage where they are present. There is relatively limited potential for complete destruction of buildings and death and injury from landslides and debris flow.

There is a high degree of exposure to expansive soils across much of South Dakota, however the potential magnitude of expansive soils events and damages is likely negligible. Sporadic impacts related to expansive soils have been reported thus far, primarily affecting road infrastructure. Because damages from expansive soils tend to happen gradually over an extended period of time, it is difficult to estimate the potential severity of a problem. Many deposits of expansive soils do not inflict damage over large areas. Instead, these deposits can often create localized damage to individual structures and supply lines, such as sidewalks, foundations, roads, railways, bridges, and power lines.

The greatest dangers associated with subsidence are related to property damages incurred by the hazard. There are minimal risks of injury and death from unexpected subsidence or accidental exposure to it, but a small risk exists. No injuries or deaths related to subsidence have been reported in South Dakota. Sudden and localized subsidence events, such as sinkholes, can cause damage to building foundations, roadways, and utilities, such as was the case in a 2020 event in Black Hawk that led to the displacement of 12 families when a sinkhole leading to an abandoned mine opened beneath their neighborhood.

For extent, the severity of an earthquake, or the amount of energy released during an earthquake is usually expressed in terms of intensity or magnitude as described further below.

Intensity: Intensity represents the observed effects of ground shaking at any specified location and earthquake shaking decreases with distance from the earthquake epicenter. Intensity is an expression of the amount of shaking at any given location on the ground surface based on felt or observed effects. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. Intensity is measured with the Modified Mercalli Intensity (MMI) scale. The intensity of ground shaking at a particular site or structure is a function of many factors including: 1) earthquake magnitude, 2) distance from the epicenter, 3) duration of strong ground motion, 4) local geologic conditions (soil type and topography), and 5) the fundamental period of the structure. A brief description of those factors is presented below. The Modified Mercalli Intensity scale is summarized in Table 3-74, along with the effects associated with the MMI scale. Damage typically occurs in MMI of scale VII or above, an intensity which has never been recorded in South Dakota.

Earthquake Magnitude: Magnitude represents the amount of seismic energy released at the hypocenter of an earthquake. It is based on the amplitude of the earthquake waves recorded. Seismologists have developed several magnitude scales; one of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter scale is numeric and has a logarithmic relationship between scale factors, so that a difference of one scale number represents a tenfold increase in measured amplitude, which in turn corresponds to an approximate 31x energy release difference when compared to the next whole number value. The Moment Magnitude scale (M_w, or M), which is a measurement of energy released by the movement of a fault and is the modern method used by seismologists to measure earthquakes. Overall, as the amount of energy released by an earthquake increases, the potential for ground shaking impacts also increases.

Table 3-75 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors, by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: USGS. http://earthquake.usgs.gov/learn/topics/mercalli.php

Climate Change Considerations

Climate change is not expected to directly affect the frequency or intensity of most geological processes which result in these hazards such as earthquake, expansive soils, or subsidence.

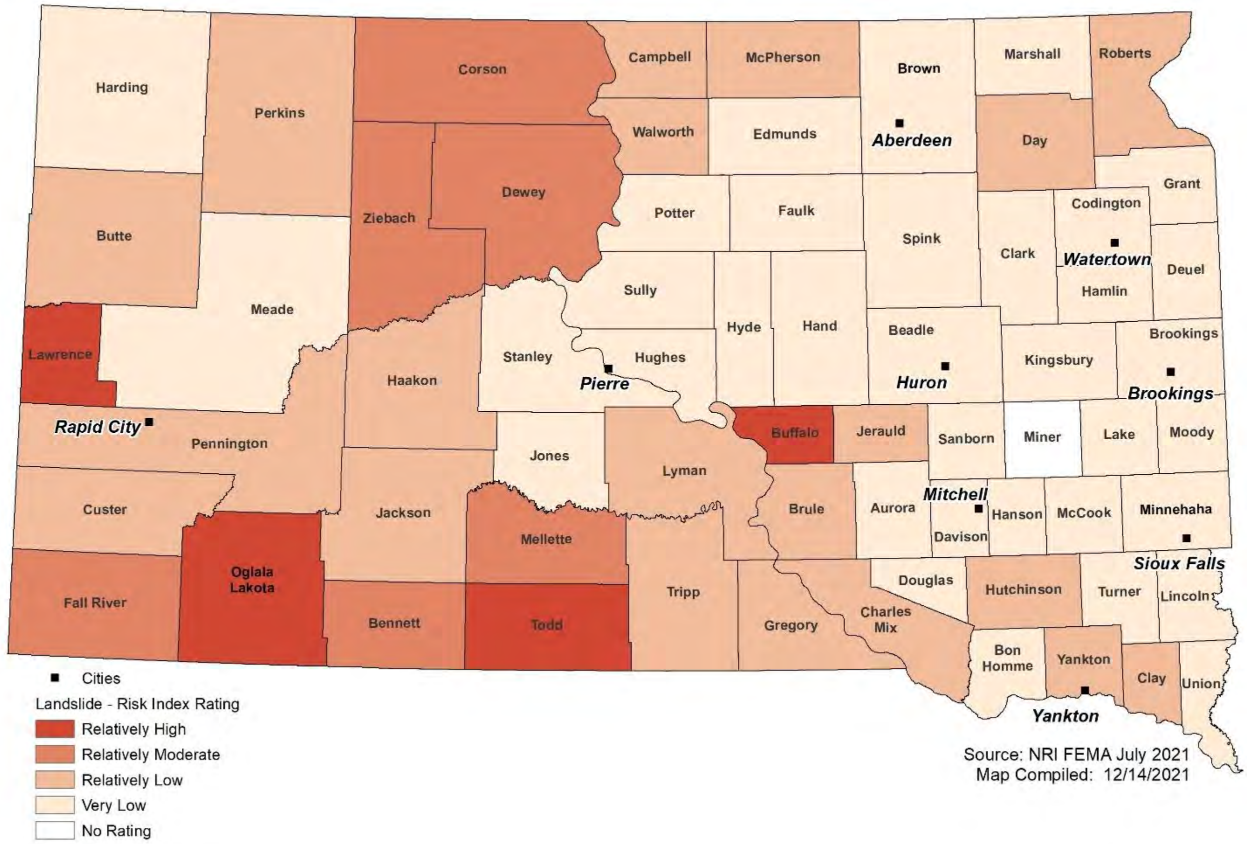
Landslides or mudflows however can be triggered by climatic events, such as periods of intense rainfall and runoff events. Projected climate change-associated variance in rainfall events may result in more high intensity events, which may increase landslide frequency. In addition, the increased potential of wildfire occurrence also escalates the risk of landslide and debris flows in the period following a fire, when slopes lack vegetation to stabilize soils and burned soil surfaces create more rainfall runoff. As climate change affects the length of the wildfire season, it is possible that a higher frequency of large fires may occur into late fall, when conditions remain dry, and then be followed immediately by more intense rainfall in the winter and spring months. As mentioned in other hazard profiles, the Fourth National Climate Assessment project more intense rainfall events for the Northern Great Plains over the coming century. Neither the Fourth or Fifth National Climate Assessment speaks to the effect of climate change or changing precipitation patterns on landslide hazards.

Vulnerability Assessment

The assessment of vulnerability to geologic hazards in South Dakota is somewhat complex, in that it considers five separate types of geologic hazards and while all of these hazards exist and could possibly happen, the past losses from some of these hazards is extremely low or perhaps zero. Naturally-occurring subsidence, expansive soils, and mudflows, in particular, do not appear to have caused damage in recent times.

Information from the NRI was available to provide a vulnerability assessment of earthquake and landslide. The NRI showed that risk from earthquake in South Dakota was essentially non-existent across each of the indicators used. Information was available through the NRI to analyze the State's vulnerability to landslide. The NRI defines risk as the potential for negative impacts as a result of a natural hazard and determines a community's risk relative to other communities by examining the EAL and social vulnerability in a given community in relation to that community's resilience. This composite risk rating is illustrated in Figure 3-83 below, showing the risk to landslide by county in South Dakota.

Figure 3-83 Landslide Risk Rating by County in South Dakota



A Hazus-MH annualized earthquake loss scenario was run for the entire nation and captured in the 'Hazus Estimated Annualized Earthquake Losses for the United States FEMA P-366,' which was updated in April 2023. The analysis computes two interrelated metrics to characterize earthquake risk: Annualized Earthquake Loss (AEL) and the Annualized Earthquake Loss Ratio (AELR). The AEL addresses two key components of seismic risk: the probability of ground motion occurring in a given study area and the consequences of the ground motion in terms of physical damage and economic loss. It takes into account the regional variations in risk.

The AEL annualizes expected losses by averaging them per year, which factors in historical patterns of frequent smaller earthquakes with infrequent but larger events to provide a balanced presentation of earthquake risk. The AEL values are also presented on a per capita basis, to allow comparison of relative risk across regions based on population.

The AELR is the AEL as a fraction of the replacement value of the building inventory and is useful for comparing the relative risk of different regions or events. The annualized loss ratio allows gauging the relationship between AEL and building replacement value. Similarly, this ratio can be used as a measure of relative risk between regions and, since it is normalized by replacement value, it can be directly compared across metropolitan areas, counties, or states.

According to the FEMA P-366 report, South Dakota ranked 51st (out of the 50 states plus Puerto Rico, U.S. Virgin Islands, and the District of Columbia) for AEL, with an AEL of $661,000. The State ranked 50th for the Annualized Earthquake Loss Ratio, indicating that while the earthquake risk in South Dakota may be much lower than most states, it has a building stock that may be less resistant overall to earthquake impacts.

People

Geologic hazards may cause turmoil, injury or death to people exposed to these hazards. Vulnerable populations in South Dakota include those that live within known high-hazard areas (described below), as well as people traveling through or recreating in areas prone to geologic hazards. Certain populations within these areas are particularly vulnerable. This may include the elderly and very young, those living in long-term care facilities, mobile homes, hospitals, prisons, low-income housing areas, or temporary shelters, people who are homeless or do not speak English well, tourists and visitors, and those with developmental, physical, or sensory disabilities. A combination of these traits likely explains the "high" rating assigned by the NRI for landslide risk in Lawrence, Ogalala-Lakota, Todd, and Buffalo Counties.

The impacts of geologic hazards on vulnerable populations can be more severe. Families may have fewer financial resources to prepare for or recover from geologic hazard events, and they may be more likely to be uninsured or underinsured. Individuals with disabilities may have limited evacuation or relocation options, so mitigation actions will need to accommodate these special needs.

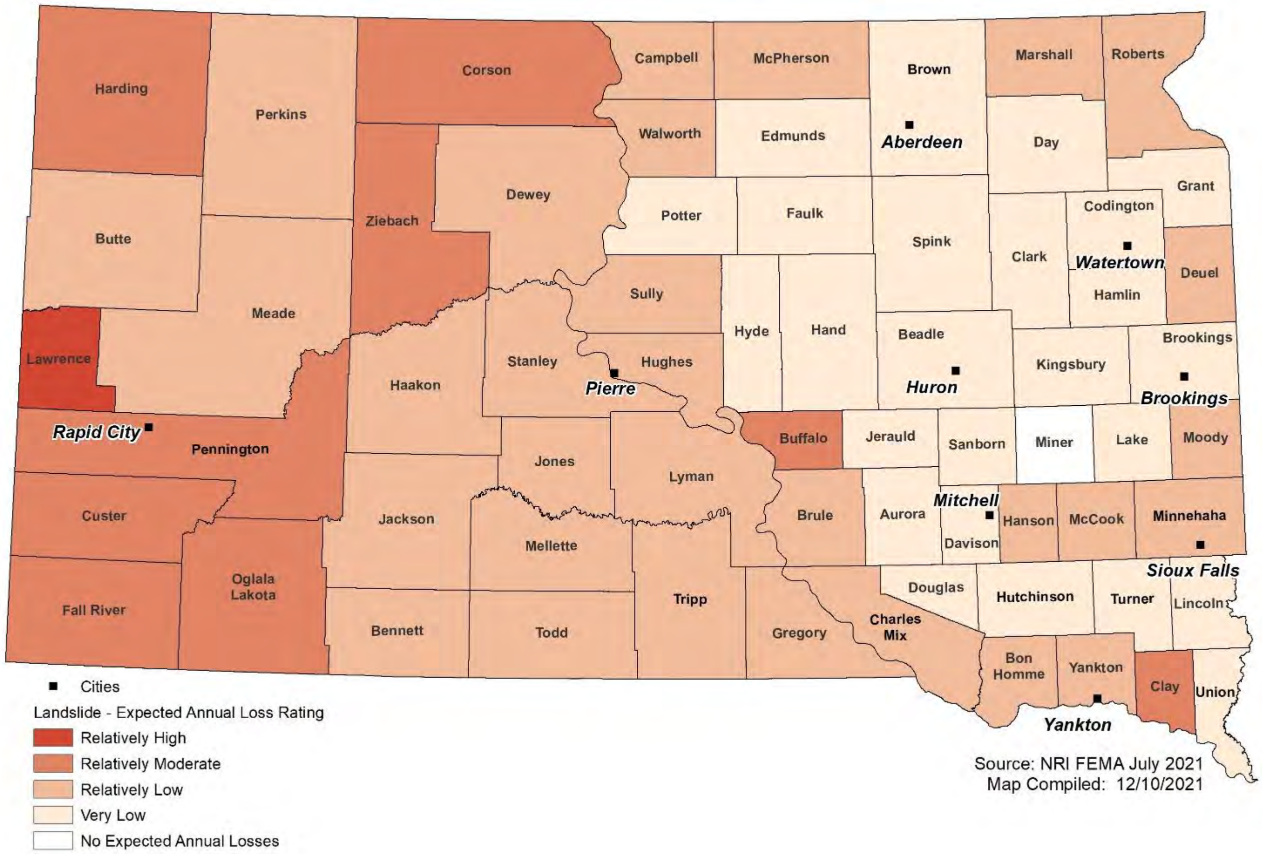
There have been no recorded deaths or injuries due to earthquakes in South Dakota, so the likelihood of this in the future is minimal, but still possible. Geologic hazards such as subsidence and expansive soils typically result in property damage, not risk to human life. Landslides have well-deserved reputations for causing injury and fatalities.

Property

Each geologic hazard is capable of damaging or destroying physical property. Landslides directly damage engineered structures in two general ways: 1) disruption of structural foundations caused by differential movement and deformation of the ground upon which the structure sits, and 2) physical impact of debris moving downslope against structures located in the travel path. For landslide specifically, information from the NRI for EAL was available as an indicator of risk. EAL represents the average economic loss in dollars resulting from natural hazards each year. It is calculated for each hazard type and quantifies loss for relevant consequence types: buildings, people, and agriculture. EAL is calculated using a multiplicative equation that includes exposure, annualized frequency, and historic loss ratio risk factors for 18 natural hazards, including landslide. Figure 3-84 below illustrates the EAL for landslide for each county in South Dakota. As the map shows, the highest expected annualized losses are for counties in the Black Hills Region in the southwest corner of the State, specifically in Lawrence County which has the highest landslide EAL at $400,000 per year.

No analysis is available to describe present development in areas prone to geologic hazards. Future SHMP updates may benefit from analysis of what is being built in geologic hazard zones, where and why this development exists, and if it presents a significant problem. Projections of future development as it relates to vulnerable populations and geologic hazard areas will be particularly helpful for planning actions that mitigate hazard risks. This is especially true if these studies also consider climate change in projections.

Figure 3-84 Landslide Expected Annual Loss Rating in South Dakota



The force exerted by earthquakes causes physical damage to buildings, especially those of unreinforced masonry construction. Unreinforced masonry building type structures consist of buildings made of unreinforced concrete and brick, hollow concrete blocks, clay tiles, and adobe. Buildings constructed of these materials are heavy and brittle, and typically provide little earthquake resistance. In small earthquakes, unreinforced buildings can crack, and in strong earthquakes, they have a tendency to collapse. These types of structures pose the greatest structural risk to life and safety of all general building types.

While specific loss estimates are unavailable, expansive soils and subsidence can cause damage in the form of heaving sidewalks, structural damage to walls and basements, the need to replace windows and doors, or dangers and damages caused by ruptured pipelines. Newer construction may have included mitigation techniques to avoid most damage from the hazard, but the dangers continue if mitigation actions are not supported by homeowners. For example, the maintenance of grading away from foundations and the use of appropriate landscaping near structures must be continued to prevent an overabundance of water in vulnerable soils near structures. While continued public education efforts may help increase compliance for landscaping and interior finishing mitigation actions, physical reconstruction of foundations is probably not feasible in all but the most heavily impacted of existing development.

State Assets, Critical Facilities, and Infrastructure

Potential exists for some of the geologic hazards profiled in this plan to damage state assets, critical facilities, and infrastructure. Extension, bending, and compression caused by ground deformation from earthquakes, landslides, subsidence, expansive soils, and mudflows can break lifelines. Failure of any component along the lifeline can result in failure to deliver service over a large region. Once broken, transmission of the commodity through the lifeline ceases, which can have catastrophic repercussions down the line: loss of power to critical facilities such as hospitals, impaired disposal of sewage, contamination of water supplies, disruption of all forms of transportation, release of flammable fuels, and so on. Therefore, the overall impact of lifeline failures, including secondary failure of systems that depend on lifelines, can be much greater than the impact of individual building failures. Linear infrastructure (roads, buried pipelines, etc.) tends to have the most risk to geologic hazards. Several landslide and mudslide occurrences noted in the past events section have resulted in damage to SDDOT infrastructure. Fortifying state assets that are particularly vulnerable to geologic hazards has historically been done on a case-by-case basis according to specific hazards or is implicitly included in maintenance and facility management.

A great deal is not known about which assets are in high hazard zones and are therefore vulnerable. Expansive soils are widespread and cover the entire state to some degree. In these cases, 100% of state assets are within the elevated hazard zones and are therefore vulnerable. Section 3.2.1 and especially Table 3-5 provide the value of state assets. In addition, it is potentially possible to characterize the types of assets most likely to be damaged. Simply stated, buildings are the most likely assets to sustain damage from expansive soils. In the case of expansive soils, buildings with foundations are especially troublesome; in the case of earthquakes, old buildings constructed to older building codes are most likely to suffer damage. In reality, neither of these hazards has caused much damage in recent times.

Unfortunately, this is where a limitation exists in our knowledge. A peculiar, but serious, deficiency exists in state GIS databases. The State does not currently have consistent data on the location, type, and replacement values of most state assets. Table 3-5 "Summary of Insured State-Owned Buildings by State Agency" which includes estimated values was created from one database, which does not contain geocoding information. A different database was used to identify assets in hazard areas, such as for Table 3-28 "State Buildings at Risk to Flood Hazards" but that database does not include property values. Deconflicting and merging these databases and verifying them with the owning agency is a lengthy process that was not able to be done for this plan update. This has been identified as a need, see mitigation action 2-2.

In addition, there has been no successful attempt to identify which buildings or other assets are most likely to sustain damage from expansive soils and earthquake hazards, or how this is statistically plays out in an average year.

Landslide hazards have a defined extent (see Figure 3-77). Only the state assets within the defined hazard zones are considered to be vulnerable to landslide hazards. Assets within the High Incidence and Susceptibility Zones are listed in Table 3-76. Hughes, Pennington, Bon Homme, and Yankton Counties are notable for having the most state assets located within the high-hazard zone for landslide. The previously described problem with databases of state assets prevents quantifying a dollar value of assets within this hazard zone. See Mitigation Action 2-2.

Table 3-76 State Assets at Risk to Landslide Incidence & Susceptibility

County	High Incidence	Moderate Incidence	High Susceptibility	Moderate Susceptibility	Total
Bon Homme County	-	35	-	-	**35**
Brule County	3	-	7	-	**10**
Butte County	-	-	8	13	**21**
Campbell County	-	-	-	5	**5**
Charles Mix County	2	-	11	-	**13**
Corson County	-	-	1	-	**1**
Custer County	4	-	-	-	**4**
Dewey County	-	-	5	-	**5**
Fall River County	-	-	5	3	**8**
Haakon County	-	7	2	-	**9**
Harding County	2	-	-	-	**2**
Hughes County	86	-	13	5	**104**
Jackson County	-	-	10	-	**10**
Jones County	-	-	8	-	**8**
Lyman County	1	-	16	-	**17**
Meade County	1	-	3	2	**6**
Mellette County	-	-	1	-	**1**
Pennington County	21	-	7	18	**46**
Perkins County	-	-	-	15	**15**
Potter County	-	-	-	9	**9**
Stanley County	2	-	8	-	**10**
Sully County	-	-	-	1	**1**
Todd County	-	-	1	-	**1**
Tripp County	-	-	12	-	**12**
Turner County	-	-	-	1	**1**
Walworth County	12	-	-	7	**19**
Yankton County	-	10	24	-	**34**
Ziebach County	-	-	2	-	**2**
Total	**134**	**52**	**144**	**79**	**409**

Source: Office of Emergency Management, U.S. Geological Survey

Naturally-occurring subsidence also has a defined extent, in the sense that it exists where certain geologic deposits exist relatively close to the surface. However, this area has not been delineated for South Dakota. As described above, it is not apparent that naturally-occurring subsidence causes any damage in South Dakota. The lack of a problem with regard to naturally-occurring subsidence may explain why high-hazard areas have not been mapped for this hazard in South Dakota. For hazard-mitigation planning purposes, the total vulnerability of State-owned assets is $0.

Man-made subsidence, especially related to mining, does occur with some regularity in South Dakota. The high-hazard areas for man-made subsidence are those areas where underground mining has occurred. Man-made hazards are largely outside the scope of this hazard mitigation plan update.

Climate change is not expected to affect earthquake, expansive soils, or subsidence hazards (see the section titled, *Climate Change Considerations*, above).

It can be inferred that climate change will increase landslide hazards, but this is difficult to confirm in the case of South Dakota with academic literature and no projections of this relationship have been made for the state. As described in the section titled, *Climate Change Considerations*, above, it is reasonable to expect more high intensity precipitation events in the future as climate change continues. Intense precipitation events are known to increase the geologic processes that lead to landslides. Therefore, it may be inferred that climate change will increase landslide frequency and/or severity. However, the academic literature on landslide risk and climate change is remarkably thin in any geographic area. The issue is apparently not addressed in any portion of the United States in recent National Climate Assessments. Academic literature that evaluates aspects of how climate change affects landslide hazards exists for some regions, but the coverage is remarkably thin, does not provide guidance for the north-central U.S., and is apparently completely absent in South Dakota. Certainly, there has been no attempt to quantify landslide risk under climate change scenarios. This is a knowledge gap that is beyond the control of the state of South Dakota, and it prevents any defensible assessment of the dollar value impact on state assets from landslides attributable to climate change.

Development can affect the vulnerability of specific state assets to geologic hazards. In the cases of expansive soils modern construction techniques can mitigate loss to future development.

The effect of development on landslide and subsidence hazards is more complex. Landslide hazards have defined high-hazard areas that extend to portions of the state and only development in these high-hazard zones is vulnerable to landslide and subsidence hazards. Development projections at the county level were identified as part of this plan, but not applied specifically to landslide hazard areas. Naturally-occurring subsidence is not a significant concern, though man-made subsidence is in some areas. Man-made subsidence may exist in areas of previous mining and is outside the scope of this plan.

As a practical matter, in most cases landslide hazards would typically be avoided or at least mitigated in new development. Locating a building outside of the high hazard zone is likely unless mitigation measures are taken. Simply stated, buildings or infrastructure are typically located or constructed to resist landslide hazards, which makes it hard to predict how future construction will affect state asset vulnerability or the statistical likelihood of annual loss.

All of this is to say with confidence that state assets are vulnerable to loss from geologic hazards. In the case of expansive soils, these hazards are present in all parts of the state and therefore all state assets are vulnerable (see Section 3.2.1 and especially Table 3-5). In the case of subsidence hazards, only man-made subsidence appears to cause damage in South Dakota, which is outside the scope of this plan. It is presently not possible to confirm any state assets are vulnerable to naturally-occurring subsidence hazards and for the purpose of this plan. Until it can be shown that naturally-occurring subsidence hazards in South Dakota have the potential to cause damage, it is assumed no exposure exists. In the case of landslide hazards, only the state assets within hazard zones are vulnerable and are specified above. However, there is value in gaining a more nuanced understanding of how state assets are affected. As the information gaps described above are filled, a better analysis of loss of state assets to geologic hazards will be possible in future hazard mitigation plans.

Economy

Damage resulting from geologic hazards can result in direct economic losses in the form of damage to buildings and property. These damages can also result in indirect losses, such as decreased property values in hazard exposure areas, the prolonged closure of businesses that are damaged, and the resultant lost wages and revenue if workers are not able to go to work and tourism is disrupted, such as was the case in the landslide incident which closed roads in Badlands National Park.

Transportation routes may become temporarily closed by landslides or mudflows, resulting in further economic disruption. These roads may be used to transport goods across the county or provide access by visitors and tourists. Depending on the amount of damage, the road may simply need to be cleaned off, or may require some level of reconstruction.

Environment and Cultural Resources

Each geologic hazard is primarily a natural process; however, they can have varying impacts to the natural environment, with the potential to permanently alter the natural landscape. For instance, earthquake effects on the environment, natural resources, and historic and cultural assets could be very destructive depending on the type of seismic activity experienced and secondary/cascading effects from an event (e.g., wildfire). The biggest impact would likely be on older properties such as wooden or masonry buildings, though reinforced masonry structures would be much more resilient during earthquakes.

Another example of the interconnectedness of these hazards is groundwater pumping and subsidence. In 2015, South Dakota was ranked 9th among states for the percentage of freshwater coming from groundwater, with the State relying on this method for 60% of its freshwater. Groundwater pumping can cause significant impacts to underground water resources, and the resulting subsidence events may further disrupt and alter the flow of surface or underground water, in a cyclical pattern of environmental degradation. Furthermore, soil compaction resulting from subsidence can permanently reduce aquifer capacity, impacting water supplies long into the future.

Abandoned mines and resultant subsidence can result in significant negative impacts on the environment. According to the USGS, ground subsidence can result in disturbances to the surface environment, damage to vegetation, and disruptions of the historical hydrological patterns. Additionally, fires can start by spontaneous ignition when water and air enter abandoned mine workings via subsidence cracks and pits. These fires can in turn spread to unmined coal as they create more cavities, more subsidence, and more cracks and pits through which air can circulate.

Development Trends and Consequence Summary

As of this SHMP update, analysis of future development in South Dakota is limited. Limited analyses exist to describe recent development or projected future development. The local plan roll-up (Section 3.1.2) showed some acknowledgement of development issues as they address to hazards, but it is not possible to generalize the impact of development trends specific to geologic hazard vulnerability, especially at a statewide level. No analysis exists to evaluate how recent or future development has or will affect vulnerability to geologic hazards at a state level. This is a clear knowledge gap.

Future SHMP updates may benefit from an explicit analysis of present and future development as it affects vulnerability to geologic hazards. It would be especially useful if future research considers climate change and explicitly identifies and describes populations most vulnerable to geologic hazards.

Despite gaps in the present state of knowledge, it is apparent that, in general, South Dakota has a much lower risk for geological hazards than most other western states, due to the flatter terrain in the central and eastern parts of the State and the overall lack of seismic activity. For most of the geologic hazards profiled, the greatest risk is concentrated in the Black Hills Region and along the Missouri River where geography makes processes such as landslides and mudflows more likely. Subsidence and expansive soils tend to occur as gradual and ongoing processes throughout the majority of the State, although they do not lead to significant or frequent losses or casualties. As counties such as Pennington and Lawrence see growth in population and housing units at a higher rate as well as higher probability of occurrences for geologic hazards relative to the rest of the State, their exposure and vulnerability inevitably increase as well. Steps to mitigate these risks should be taken as South Dakota accommodates future growth, such as mapping of hazard areas, adoption and enforcement of engineering and building codes for soil hazards, and ordinances to limit development on steep slopes.

Table 3-77 Landslides, Mudflows, Expansive Soils, Subsidence Consequence Table

Category	Narrative
Impact on the Public	Staff, recreationists, campers, property owners in remote areas may be at risk to injury or death from debris flows.
Impact on the Economic Condition of the State	Potential loss of facilities or infrastructure; potential impact to tourism and land development activities depending on severity; depending on nature of area where landslide occurs, many home-based businesses will be impacted due to destruction of property.
Impact on the Environment	Impacts to water quality; erosion and sedimentation may affect critical infrastructure and natural waterways.
Impact on Property, Facilities, and Infrastructure	Vulnerabilities to critical infrastructure, facilities, properties, equipment, vehicles, and communications and utility infrastructure within landslide extent.
Impact on the Public Confidence in Government	Ability to respond and recover may be questioned and challenged if planning, response, and recovery is not timely and effective.
Impact on Responders	Exposure exists to response personnel performing routine duties when event occurs.
Impact on Continuity of Operations and Continued Delivery of Services	Potential loss of facilities or infrastructure function or accessibility or ability to provide services. Power interruption is likely if near power lines.
Cascading Hazards	

Table 3-78 Earthquake Consequence Table

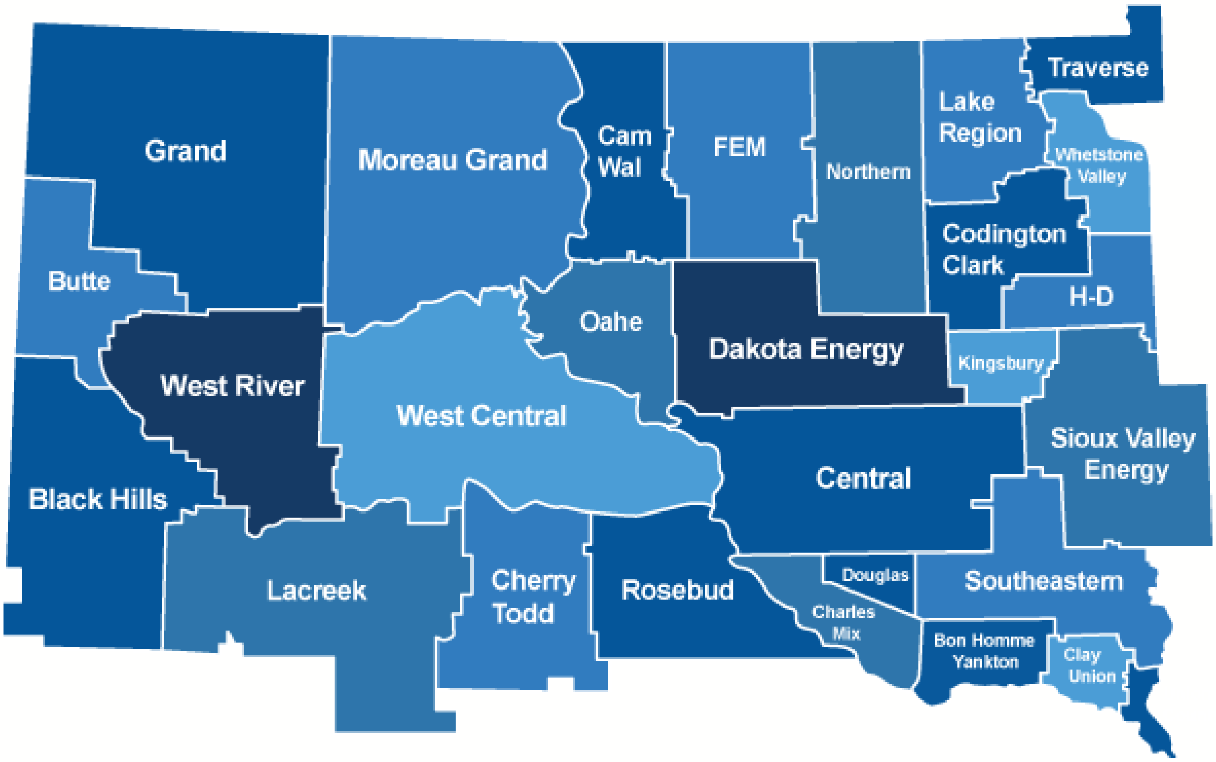
Category	Narrative
Impact on the Public	Increase in sheltering and evacuation demands; vulnerable populations along fault lines will be severely impacted; while likelihood of a damaging event is rare there is potential for mass for injury or death from structural and non-structural building elements
Impact on the Economic Condition of the State	Potential business impacts from facility damage, road closures and other transportation issues; potential loss of facilities or infrastructure function or accessibility and uninsured damages; debris management demands (costs/location)
Impact on the Environment	Environmental damage variable due to location and magnitude; possible cascading water quality issues from damaged water treatment facilities or impacts to ground and air quality from hazardous material leaks
Impact on Property, Facilities, and Infrastructure	Buildings, vehicles, signage, and/or any unsecured property may be damaged or destroyed during a significant event. Older and historic structures more vulnerable. Possible impacts to communications; expected damage to water treatment facilities, government buildings, public safety facilities, power generation and distribution, and healthcare facilities expected to be minor based on Hazus modeling. Potential for breaks and leaks in gas, water and wastewater utility lines and associated disruption

Category	Narrative
Impact on the Public Confidence in Government	Public holds high expectations of government capabilities for public information and response and recovery activities related to large-scale disaster events such as earthquake; high expectations for rapid restoration of critical lifelines
Impact on Responders	Unsafe structural or environmental conditions may persist during the response period putting search and rescue personnel and other responders at risk; structural damage to hospitals, fire stations, police stations; scale of event will likely overwhelm local resources and require mutual aid assistance from outside the area of impact
Impact on Continuity of Operations and Continued Delivery of Services	Loss of facilities or infrastructure function or accessibility or ability to provide services; power interruption is likely if not adequately equipped with back-up generation; large-scale of event will typically overwhelm emergency response and coordination services and may require mutual aid assistance from outside the impacted area
Cascading Hazards	Energy Disruption; Urban Fire; Dam/Levee Failure, Hazardous Materials

3.4. Rural Electric Cooperative Considerations

Since 2013 the Rural Electric Cooperatives (REC) have been engaged as participants in the state planning effort, including periodic updates to this HIRA. This discussion focuses on the potential hazard risks to RECs. There are 28 RECs that cover the state, as depicted in the map below.

Figure 3-85 South Dakota Rural Electric Cooperative Boundaries



Source: SDREA

3.4.1. REC Survey Results

During the 2021 update, a REC online survey was developed to guide RECs on the information needed for refining vulnerability and loss estimates in future updates. This included questions regarding hazard identification and vulnerability assessment from an REC perspective. The survey was distributed to the RECs through SD OEM and the SD Rural Electric Association. There were 17 responses out of the 28 RECs, a 60% response rate. In total there were 12 questions regarding hazards risk and vulnerability. Refer to Appendix I for the survey results.

Based on the survey most cooperatives are moderately (71%) to very (29%) concerned about the possibility of critical electrical infrastructure being impacted by a natural hazard. The natural hazards that have affected or damaged infrastructure in most cooperative services areas in the past were identified as windstorms, winter storms, summer storms, floods and tornadoes (winter storms were accidentally left off the survey, but based on past input from RECs it is certain this is a priority hazard). Past wildfire and geological hazard events were also noted as affecting or damaging critical electric infrastructure. Similarly, the hazards of most concern with the potential for future impacts are winter storms (implied), wind, summer storms, floods and tornadoes. Most of the cooperatives ranked the existing local capability to contend with hazard events in their respective service areas as being medium, with the exception of geological hazards which was ranked as low capability. Of those that responded to the survey, 29% stated their cooperative conducts an annual or bi-annual hazard analysis and risk assessment. While half responded as not performing or not being sure if their cooperative conducts annual risk assessments. Most of the cooperatives (69%) stated they have not conducted a loss avoidance study to quantify or demonstrate the value of infrastructure mitigation efforts. The remaining 31% have conducted a loss avoidance study in the past.

Nearly every cooperative that completed the REC survey (16 out 17) noted they have implemented the mitigation action of undergrounding electric lines in their service area. In response to asking about potential future mitigation actions, 94% chose undergrounding electric lines as being high importance to reduce impacts of natural hazard on service or critical infrastructure. Other future mitigation actions that ranked as high importance include pole replacement, facility backup generation, harden communications, and vegetation management. Similar to undergrounding electric lines, many of these potential future actions are already being implemented in various services areas. Of those that responded to the survey, 76% have received FEMA grant funding to strengthening infrastructure in the past. 100% of survey respondents were interested in leveraging FEMA grant funding in the future.

3.4.2. REC Vulnerability Analysis

Historically, winter storms, wind and tornadoes pose the greatest risk to power lines and facilities operated by the RECs. These hazards can knock down power lines, which tend to be the most vulnerable elements of the electrical grid. To determine how this risk may vary across the various RECs, an analysis was done to determine their intersection with counties with a high Expected Annual Loss for Winter Storms, Windstorm, and Tornadoes, based on the FEMA NRI (refer to the EAL maps in the Vulnerability subsections for each hazard section). As many RECs span multiple counties, a representative county was used in some cases as the basis for the selected EAL rating. A score was assigned to the EAL rating for each of the three hazards, summarized below.

- Very High 4
- Relatively High 3
- Relatively Moderate 2
- Relatively Low 1
- Very Low 0

The results of the analysis are summarized in Table 3-77. A cumulative score and rating are captured in the far right columns as an indication of relative cumulative hazard risk.

Table 3-79 Rural Electric Cooperative Hazard Vulnerabilities

Rural Electric Cooperative	Representative County	Winter Storm Expected Annual Loss Rating	Winter Scoring	Strong Wind Expected Annual Loss Rating	Wind Scoring	Tornado Expected Annual Loss Rating	Tornado Scoring	Cumulative scoring	Cumulative Rating
Black Hills Electric Cooperative, Inc.	Custer	Relatively Moderate	2	Very Low	0	Relatively Low	1	3	Relatively Low
Bon Homme Yankton Electric Association	Yankton	Relatively Low	1	Relatively Moderate	2	Relatively Moderate	2	5	Relatively Moderate
Butte Electric Cooperative, Inc.	Lawrence	Relatively Moderate	2	Relatively High	3	Relatively Low	1	6	Relatively Moderate
Cam Wal Electric Cooperative Inc.	Walworth	Relatively Moderate	2	Relatively Low	1	Relatively Low	1	4	Relatively Low
Central Electric Cooperative Inc.	Davison	Relatively Moderate	2	Relatively High	3	Relatively Moderate	2	7	Relatively High
Charles Mix Electric Association Inc.	Charles Mix	Relatively Low	1	Relatively Low	1	Relatively Low	1	3	Relatively Low
Cherry-Todd Electric Corporation	Todd	Relatively Moderate	2	Very Low	0	Relatively Low	1	3	Relatively Low
Clay-Union Electric Corporation	Clay	Relatively Low	1	Relatively Moderate	2	Relatively Moderate	2	5	Relatively Moderate
Codington-Clark Electric Cooperative	Codington	Relatively High	3	Relatively Moderate	2	Relatively Moderate	2	7	Relatively High
Dakota Energy Cooperative, Inc.	Beadle	Relatively Low	1	Relatively Moderate	2	Relatively Moderate	2	5	Relatively Moderate
Douglas Electric Cooperative	Douglas	Relatively Moderate	2	Relatively Low	1	Relatively Low	1	4	Relatively Low
FEM Electric Association	Edmunds	Relatively Moderate	2	Relatively Low	1	Relatively Low	1	4	Relatively Low
Grand Electric Cooperative, Inc.	Perkins	Relatively Moderate	2	Relatively Low	1	Very Low	0	3	Relatively Low
H-D Electric Cooperative, Inc.	Hamilton	Relatively Moderate	2	Relatively Moderate	2	Relatively Low	1	5	Relatively Moderate
Kingsbury Electric Cooperative, Inc.	Kingsbury	Relatively Low	1	Relatively Low	1	Relatively Low	1	3	Relatively Low

Rural Electric Cooperative	Representative County	Winter Storm Expected Annual Loss Rating	Winter Scoring	Strong Wind Expected Annual Loss Rating	Wind Scoring	Tornado Expected Annual Loss Rating	Tornado Scoring	Cumulative scoring	Cumulative Rating
LaCreek Electric Association, Inc.	Oglala Lakota	Relatively Moderate	2	Relatively Low	1	Relatively Low	1	4	Relatively Low
Lake Region Electric Association, Inc.	Day	Relatively High	3	Relatively Moderate	2	Relatively Moderate	2	7	Relatively High
Moreau-Grand Electric Cooperative	Dewey	Relatively High	3	Relatively Low	1	Very Low	0	4	Relatively Low
Northern Electric Cooperative Inc.	Brown	Very High	4	Relatively High	3	Relatively Moderate	2	9	Very High
Oahe Electric Cooperative	Hughes	Relatively High	3	Relatively Moderate	2	Relatively Low	1	6	Relatively Moderate
Rosebud Electric Cooperative	Tripp	Relatively Moderate	2	Very Low	0	Relatively Low	1	3	Relatively Low
Sioux Valley Energy	Minnehaha	Very High	4	Relatively Moderate	2	Very High	4	10	Very High
Southeastern Electric Cooperative, Inc.	Lincoln	Relatively High	3	Relatively Moderate	2	Relatively High	3	8	Relatively High
Traverse Electric Cooperative	Roberts	Relatively High	3	Relatively Moderate	2	Relatively Moderate	2	7	Relatively High
Union County Electric Cooperative, Inc.	Union	Relatively Low	1	Relatively Moderate	2	Relatively Moderate	2	5	Relatively Moderate
West Central Electric Association, Inc.	Stanley	Relatively Moderate	2	Relatively Low	1	Very Low	0	3	Relatively Low
West River Electric Association, Inc.	Pennington	Relatively High	3	Relatively High	3	Relatively Moderate	2	8	Relatively High
Whetstone Valley Electric Cooperative	Grant	Relatively High	3	Relatively Moderate	2	Relatively Low	1	6	Relatively Moderate

Based on this analysis, notable RECs with a cumulative risk from winter storm, windstorm, and tornadoes include:

Very High Cumulative Rating:

- Sioux Valley Energy
- Northern Electric Cooperative Inc.

Relatively High Cumulative Rating:

- Southeastern Electric Cooperative, Inc.
- West River Electric Association, Inc.
- Central Electric Cooperative Inc.
- Codington-Clark Electric Cooperative
- Lake Region Electric Association, Inc.
- Traverse Electric Cooperative

Relatively Moderate Cumulative Rating:

- Butte Electric Cooperative, Inc.
- Oahe Electric Cooperative
- Whetstone Valley Electric Cooperative
- Bon Homme Yankton Electric Association
- Clay-Union Electric Corporation
- Dakota Energy Cooperative, Inc.
- H-D Electric Cooperative, Inc.
- Union County Electric Cooperative, Inc.

In addition, wildfire can impact power lines in the Black Hills and parts of southeastern South Dakota (e.g. Lincoln County). The Black Hills, Butte, West River, and Southeastern RECs are more vulnerable to wildfires.

A GIS overlay of power facilities on flood and wildfire hazard areas to identify specific power plant facilities potentially at risk was completed during the 2021 HIRA Update. The results of analysis indicate two power plants in the state located within the 1% flood hazard areas, both of which are hydroelectric. These power plants are located in Charles Mix County, within the Charles Mix Electric Association boundary, and in Lawrence County within the Butte Electric Cooperative boundary. In total there are 46 power plants in the state located within a wildfire risk area. Of the 46 power plants, 17 are located within very high to moderate wildfire areas. The following table shows the results of the wildfire analysis. Appendix D has more specifics on these facilities.

Table 3-80 Power Plants Located within Very High to Moderate Wildfire Hazard Area

Wildfire Hazard Area	Cooperative	County	Count
Very High	Dakota Energy Cooperative	Hand	1
		Hyde	1
	Lake Region Electric Association	Roberts	1
		Total	**3**
High	Black Hills Electric Cooperative	Pennington	2
	Butte Electric Cooperative	Lawrence	1
	Codington-Clark Electric Cooperative	Clark	1
	Dakota Energy Cooperative	Hyde	1
	H-D Electric Cooperative	Deuel	1
	Sioux Valley Energy	Brookings	1

Wildfire Hazard Area	Cooperative	County	Count
		Total	**7**
Moderate	Cam Wal Electric Cooperative	Campbell	1
	Central Electric Cooperative	Lyman	1
		Brule	1
		Aurora	1
	Grand Electric Cooperative	Butte	1
	Oahe Electric Cooperative	Hughes	2
		Total	**7**

Source: HIFLD, WSP analysis

South Dakota has funded 39 power line burial projects with HMGP funds in an effort to reduce future disaster losses. Since 2005 the State has spent $19 million of HMA grant funding (primarily HMGP) in helping to bury approximately 700 miles of power lines as of 2021. These projects are summarized in Table 3-79 and will reduce future losses and increase power resiliency across the State.

Table 3-81 REC Mitigation Funding and Miles of Line Buried by County: 2013-2021

Rural Electric Cooperative	County	Miles	Total Obligated
Sioux Valley/City of Coleman	Moody	unknown	$70,680
Central	Aurora	14.5	$468,393
Dakota Energy	Beadle	49.25	$1,449,253
Kingsbury	Brookings	5.5	$106,291
Northern	Brown	29.25	$654,434
Central	Brule	9	$200,520
Central	Buffalo	3	$115,500
Butte	Butte	14.4	$913,085
Cam-Wal	Campbell	19.9	$382,086
Codington-Clark	Clark	16.5	$496,235
Codington-Clark	Codington	18	$642,412
Town of Colman	Colman	0.6	$125,500
Moreau-Grand	Corson	37	$1,028,140
Central	Davison	17.5	$451,742
Codington-Clark	Day	4	$107,516
H-D	Deuel	4	$127,200
Moreau-Grand	Dewey	6.3	$396,739
Douglas	Douglas	4.5	$332,085
FEM	Edmunds	28.95	$409,799
FEM	Faulk	24.2	$572,943
Whetstone	Grant	75.9	$1,746,322
City of Bryant	Hamlin	6.5	$401,344
H-D	Hamlin	8	$323,543
Dakota Energy	Hand	28.5	$711,750
Central	Hanson	19.75	$610,097
City of Pierre	Hughes	0.5	$140,902
Southeastern	Hutchinson	25	$948,546
City of Wessington Springs	Jerald	0.2	$29,682
West Central	Jones	4	$75,137
Kingsbury	Kingsbury	63.6	$1,137,801
West Central	Lyman	2.2	$104,820
FEM	McPherson	15.5	$385,359

Rural Electric Cooperative	County	Miles	Total Obligated
Central	Miner	9.5	$193,278
Traverse and Whetstone	Roberts	53.7	$1,160,323
Central	Sanborn	12	$541,479
Northern	Spink	18.5	$690,244
West Central	Stanley	5	$133,721
Oahe	Sully	2.45	$139,189
Cam-Wal	Walworth	34.95	$1,106,504
Total		692.1	$19,630,594

Source: OEM

South Dakota has also used FEMA Public Assistance Section 406 mitigation to fund power line strengthening, burial, and retrofitting as part of project worksheets (PW) during post-disaster reconstruction. The table below (Table 3-80) summarizes the number of projects and mitigation funding associated with Section 406 from disasters in 2008-2019 based on information provided by OEM and through an OpenFEMA data set. The damage category F mitigation dollars shown for DR1759 and DR1887 in the table below are primarily associated with power line burials or upgrades for RECs. DR1759 included funding for Grand Electric Coop and Butte Electric. DR 1887 included funding for Cam-Wal, Central, Dakota Energy, FEM, Grand, Moreau-Grand, and Whetstone Valley Electric cooperatives. Total mitigation funding from these two disasters is over $11M.

Table 3-82 FEMA Public Assistance Section 406 Project & Mitigation Funding: 2008-2020

DR#	Type	Year	Damage Category	# of PW's	Total
4469	Severe Storm(s)	2019	F	12	$670,461
4467	Severe Storm(s)	2019	F	3	$122,846
4463	Flood	2019	F	3	$49,122
4448	Severe Storm(s)	2019	F	7	$214,212
4440	Flood	2019	F	35	$7,568,987
4298	Winter Storm	2016	F	15	$2,268,759
4233	Flooding	2015	C	14	$117,882
4186	Tornado/Flooding	2014	C	48	$340,282
4155	Winter Storm	2013	F	24	$5,784,998
4137	Flood	2013	C	7	$30,141
4125	Flood	2013	C	19	$31,164
4115	Winter Storm	2013	F	1	$245,759
1984	Flood	2011	C	98	$745,578
1947	Flood	2010	D+E	8	$86,870
1938	Flood	2010	C	14	$712,318
1929	Tornadoes/Flooding	2010	C	4	$71,426
1915	Flood	2010	C	102	$294,124
1914	Winter Storm	2010	F	4	$381,044
1887	Winter Storm	2010	F	297	$9,596,751
1759	Winter Storm	2008	F	3	$1,458,213
Total					$30,790,937

Source: OEM and OpenFEMA Dataset: Public Assistance Funded Projects Details

3.5. Hazard Summary

Although the majority of the State is vulnerable to all the hazards identified and discussed previously, impacts may vary widely in different areas of the State and at different times of year. The hazards as identified in Table 3-1 have impacted or have the potential to impact the citizens and governments of the

State to one degree or another at any given time. However, based upon the research and analyses conducted for the HIRA over the years, it is evident that drought, floods, winter storms, wildfires, and tornadoes continue to require the most effort and expense in terms of response and recovery activities and their associated costs. The following is a summary of the key vulnerabilities, losses and consequences associated with each hazard, based on the HIRA. This summary was added to the HIRA in 2016 to provide a quick reference for planners in the development of mitigation strategies and was updated in 2021 as part of the HIRA update process.

Table 3-83 Hazard Risk Summary Table

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
Agricultural Pests and Diseases	• Significant pests and diseases include Foot and Mouth Disease, Trichomoniasis, Avian Influenza, West Nile Virus, Rabies, Asian Soybean Rust, Blight, Soybean Cyst Nematode. • Diseases tracked for plants include sunflowers, canola, safflower, field pea, chickpea, lentil, dry bean, soybeans, corn, alfalfa, flax, winter wheat, spring wheat, barley, oats, rye. • Diseases tracked for animals include cattle, swine, poultry, wildlife. • Cattle losses $52 M in 2010 due to respiratory, digestive and other diseases. • $22,878,707 in total indemnity payments between 2007 and 2020 for plant disease, mycotoxins, and insects; annual loss of $1,759,900. • 269,937 acres of field crops lost to plant disease and insects from 2007 to 2020. • Can have devastating impacts on agricultural economy statewide and beyond. • Agriculture sector impacts can be both direct (impacts to crops in the state) and indirect (impacts to the market from infestations elsewhere). • Livestock exposure is greatest west of the Missouri River. • Crop exposure is greatest east of the Missouri River. • Some outbreaks are associated with drought or warmer than typical winters (such as grasshoppers, anthrax).	• Risk to state owned/leased buildings and infrastructure is expected to be minimal. • Other critical infrastructure impacts are minimal.	• Climate change can alter and increase the range of many invasive weed species; increasingly powerful storms can exacerbate the spread of diseases; warmer temperatures can aid the spread of warm-weather pests into traditionally colder climates. • In general, climate change trends currently projected for the Northern Great Plains by the 4th National Climate Assessment indicate that South Dakota's overall climate may become more suitable for existing pests.	• Medium
Summer Storms (Hail and Lighting)	**Hail** • Hail impacts vary based on hail diameter, duration, location, and exposure. • Over 11,613 separate records of hail incidents between 1996 and 2020. • $8,648,990 in average annual property damage statewide between 1996-2020 for hail; total property damage of $207,575,750. • $1,869,542 average annual crop damage statewide between 1996 and 2020 for Hail; total crop damage of $44,869,000. Further, USDA crop indemnity payments due to hail have totaled $455,119,168 in the state from 2007 to 2020.	• Risk to state owned/leased buildings and infrastructure is expected to be minimal; the potential exists for hail damage to state-owned vehicles and roofs/windows of state facilities.	• As climate change warms the earth and affects weather patterns, science shows that storms have generally become more intense, however research specific to hail and lighting is sparse.	• Medium

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
	• Average hailstone size in the state is 1.15”; largest recorded is 8” (Vivian, Lyman County, 7/23/2010). • NCEI records 41 hail-related injuries; no hail related deaths between 1996 and 2020. • 95% of recorded incidents did not cause property damage, crop damage, injuries, or fatalities. **Lightning** • 124 separate records of damaging lightning incidents recorded between 1996 and 2020 based on the NCEI; this is likely under counted. • $203,842 average annual property damage statewide between 1996 and 2020 for Lightning; total property damage $4,892,200; only $5,000 in recorded crop damage during this timeframe. • NCEI records 17 lightning-related injuries; five lightning-related deaths between 1996 and 2020.	• Other critical infrastructure impacts minimal; potential for limited energy disruption caused by lightning; critical points should be protected from exposure to hail and lightning		
Flood (Including Dam and Levee Failure)	• The greatest impacts have historically been to the eastern half of the state, principally, the Big Sioux, Vermillion, and James River Basins, which have recurring problems. Flash flooding is more prevalent in the Black Hills region. • Flood Insurance policy analysis yielded: - The number of policies statewide has fluctuated greatly over the years, from 5,406 in 2010, 6,914 in 2012, 4,684 in 2016, to 2,912 in 2022. The higher policy count in 2012 is likely a carryover from flooding on the Missouri River in 2011 that generated a lot of interest in flood insurance. - Statewide there has been $56,271,948 in flood loss claims paid since 1978 – January 2022, an increase of $16,216,575 from the $40,055,373 sum noted previously in the 2016 HIRA. - Flood loss claims increased from 3,316 in 2010 to 3,344 as of mid-2016, and to 3,927 in 2022. - Flood loss claims result in an average annual loss of $1,278,908 • Repetitive loss properties (2 or more claims in a ten-year period) continue to be an issue. The 2021 repetitive loss statistics indicate: - In 2012, the total amount in repetitive loss claims was $6,700,481. As of 2021, the total had increased to $54,550,851.	• Risk to state owned/leased buildings and infrastructure includes the following based on GIS analysis: - There are state facilities potentially at risk to flooding in the following counties: Brown, Codington, Fall River, Hughes, Lawrence, McCook, Meade, Minnehaha, Moody, Pennington, Turner, Walworth, and Yankton. - Within the 1% Annual Chance NFHL category, 27 state facilities are at risk. According to the Critical Facility analysis	• Climate change science indicates increased potential for extreme rainfall events which could lead to increased flooding frequency, intensity, and losses. • Increased rainfall events could alter hydrologic conditions from the historic hydrologic conditions used to design dam safety parameters.	• High

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
	- The number of repetitive loss properties has almost doubled since 2018, to a total of 860, 32 counties now have repetitive loss properties, an increase of 4 counties since 2018. - The counties of Hamlin, Codington, Day, and Minnehaha have the most repetitive loss properties. • Based on analysis from the National Risk Index, the counties of Brown, Charles Mix, Minnehaha, Pennington, and Beadle have the highest level of risk. • Dam failure flooding is included in the flood hazard profile. Of the 2,573 dams, 156 are significant hazard and 86 are high hazard. The majority of these dams are west of the Missouri River including concentrations in the Black Hills and along the Missouri River corridor. Dam failure impact assessment is impaired by a lack of information, particularly with regard to digital mapping of inundation areas.	using State and HIFLD data, there are 2,572 facilities in the same hazard area, 2,362 of them being bridges. - Within the 0.2% Annual Chance NFHL category, 8 state facilities and 141 critical facilities are at risk. - Within the category "Area Protected by Levee," 10 state facilities and 77 critical facilities are at risk. - Facility valuation data was not available but could be used to refine exposure and loss estimates. • Road and bridge impacts have resulted in numerous and costly disaster assistance claims. • 15 high hazard potential dams at risk from 1% annual chance flood hazards		
Winter Storm	• According to the NCEI, there were 2,136 winter storms (snow and ice events) in South Dakota between January 1993 and December 2021, and 499 extreme cold events from January 1994 to December 2021. 20 deaths and 127 injuries were attributed to these events. • Total property damage for these events is estimated at $105 million dollars. • South Dakota averages 76 winter storms and $3.7 million in winter storm losses annually, as well as 18 extreme cold events each year.	• Winter storms have been particularly damaging to electric utilities. • Direct impacts to state owned facilities are not likely to result in losses, but winter	• EPA research indicates that the amount of winter precipitation and the number of days with heavy snowfall are projected to increase in northern states. A warming climate may	• High

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
	• Approximately 1.4 death every other year and 5 injuries each year. • $10 million in winter-related crop loss indemnities each year. • Cattle impacts have been significant. • According to data from the NRI tool, Brown and Minnehaha are the only counties that rate as very high expected annual losses due to winter storms, likely due to the larger populations in these areas and more development compared to the rural areas of the state.	storms can temporarily disrupt travel on local, state and federal highways and result in significant expenses associated with snow removal and first responders assisting stranded travelers.	also result in warmer winters. • According to the Fourth National Climate Assessment, rising temperatures in the Northern Great Plains have resulted in shorter snow seasons and rapid melting of winter snowpack.	
Wildfire	• Wildfire expected annual losses from the NRI noted that the counties of Pennington (Very High), Meade, Custer, Fall River, and Oglala Lakota, a have the greatest wildfire risk based on an analysis of historic fire occurrence, WUI housing units, and population. • The greatest concentration of Wildland Urban Interface (WUI) structures is located in and around the communities in the Black Hills. Rapid City and bedroom communities within a five-mile radius of the city represent the greatest concentration of structures located in the forested areas of the Black Hills. The population of new residents in the WUI is growing, especially in Custer, Pennington, and Meade Counties. • In addition to the Black Hills National Forest, there are fire-prone smaller forested areas on the Custer National Forest in Harding County, and BIA Trust and tribal lands on the Pine Ridge Reservation of Oglala Lakota County, and the Rosebud reservation of Todd County.	• State fire suppression costs have been more than $2M annually. • An analysis conducted as part of the 2015 Drought Mitigation Plan noted a significant increase in fires, acres burned, and suppression costs in drought years. • Risk to state owned/leased buildings and infrastructure includes a number of state (101) and local critical facilities (6,110) located in very high, high and moderate risk areas. A more refined vulnerability analysis would be	• Wildfire conditions across South Dakota are likely to worsen in the future due to climate change given that climate projections indicate continued increasing summer temperatures and milder temperatures overall, thus an extended fire season.	• High

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
		needed to determine site-specific risks. • Other critical infrastructure impacts include impacts to rural electric infrastructure.		
Drought (including Extreme Heat)	• Notable droughts have occurred somewhere in the state on average about every 12 years, which is equivalent of an 8% chance any given year. • Severe drought years can have a devastating financial impact on South Dakota's agricultural industry. • Over a 15-year period from 2008-2022, insured crop losses in South Dakota due to drought averaged $505.7 million annually. • Livestock impacts were estimated at $162 million for the 2012 drought and $92 million in the 2013 drought. • Water supply and water quality impacts have been greatest along the Missouri River corridor counties. • Quantifying losses to sectors other than agriculture is challenging due to data limitations.	• Direct losses to state owned/leased buildings and infrastructure is expected to be minimal. • State parks in South Dakota are likely to suffer the greatest impacts from drought, particularly those that provide water-based recreational activities. Direct losses to the state can include lost revenue from park access fees and loss in hunting and fishing license revenue. • Other critical infrastructure impacts include impacts to water facilities, reduced hydroelectric power generation during low flows.	• Climate change science indicates changing extremes in precipitation are projected across all seasons, including higher likelihoods of both increasing heavy rain and snow events and more intense droughts. The Northern Plains will remain vulnerable to periodic drought because much of the projected increase in precipitation is expected to occur in the cooler months while increasing temperatures will result in additional evapotranspiration. Regarding temperatures and extreme heat, warmer and more extreme temperatures can exacerbate drought impacts and result in consequences regardless of drought.	• High

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
Tornado	• South Dakota's location in the northern region of Tornado Alley makes it susceptible to the formation of tornadoes due to warm Gulf air coming in contact with cool Canadian air fronts and dry air systems from the Rocky Mountains. The intersection of these three systems produces thunderstorm conditions that can spawn tornadoes. • According to the NCEI Storm Events Database, there were 2,437 tornadoes, of which 726 were F1 or higher, in South Dakota between 1950 and 2021 (71 years). Based on this information, the probability that at least one tornado will occur in South Dakota in any given year is 100%. • Annualized losses are estimated at nearly $706 million. • Maps of tornado paths indicate a higher likelihood east of the Missouri River and in the southeastern part of the state. • While all counties in the state are vulnerable to tornadoes according to data in the NRI tool, Minnehaha and Oglala Lakota Counties have a relatively high-risk rating for tornadoes; this is likely a result of building exposure in Minnehaha and higher social vulnerability risk in Oglala Lakota counties.	• Risk to state owned/leased buildings and infrastructure is expected to be limited due to the low likelihood of direct impacts. There are four state owned facilities located in Lincoln County, which has the highest vulnerability to tornadoes. • Other critical infrastructure impacts include impacts to rural electric infrastructure and the potential for direct impacts to local critical facilities.	• There presently is not enough data or research to quantify the magnitude of change that climate change may have related to tornado frequency and intensity.	• Medium
Windstorm	• According to the NCEI, there were 8,310 windstorm events (7,153 thunderstorm wind, 1,149 high wind, and 8 strong wind events) in South Dakota between 1955 and 2021. There were 11 deaths and 149 injuries in this time period. • Total property and crop damage for events between 1993 (when damage figures began being kept) and 2021 is estimated at $153,056,500. • This suggests that South Dakota could experience 126 wind events, $2.3 million in wind losses, and approximately 2.3 injuries each year. • In general, the counties with the greatest vulnerability to windstorm events are those in the Black Hills region and those with major cities.	• Each very highly ranked county has multiple state-owned critical facilities at risk however direct damages are expected to be minimal if buildings are built to modern codes and standards. • Windstorms can create power outages	• There presently is not enough data or research to quantify the magnitude of potential change that climate change may have on windstorms.	• Medium

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
		and exacerbate winter storms.		
Hazardous Materials	• Includes both fixed facility and transportation/mobile (air, road, pipeline, rail). • Impacts dependent on type of chemical, type of release, mode, area of release, environmental factors. • U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) statistics indicate 991 reported hazmat incidents (air, highway, water, railway) between 1990-2021 The total cost of damage associated with these incidents was $3,424,399. • This suggests that South Dakota averages over 30 transportation incidents involving hazardous materials and $110,464 in related damage each year. • Counties with the most pipelines and potentially higher exposure to an incident are Lincoln, Minnehaha, Brown, Clark, Spink, Butte, Hutchinson, Union, Harding, and Kingsbury; most of these are in the eastern third of the state. • The state has 259 Toxic Resource Inventory facilities and 162 Risk Management Plan facilities; most of these are located in areas with higher populations including Minnehaha, Codington, Pennington, Davison and Beadle.	• Risk to state owned/leased buildings and infrastructure is expected to be minimal; higher risk to facilities that store hazardous materials, or those facilities close to designated transportation routes.	• None expected.	• Moderate
Geologic Hazards – Includes Expansive soils, Subsidence Earthquake Landslide	• Includes expansive soils, subsidence, landslide, mudflow, and earthquake. • Extensive expansive soils distribution across state based on US-wide mapping. • Subsidence (sinkhole) potential with Karst terrain in Black Hills, southeast. • Landslides in Black Hills and Missouri River Bluff counties; NRI expected annual losses from landslides greatest in Lawrence County • Expected losses from earthquakes are very low; According to the 2023 FEMA P-366 report, South Dakota ranked 51st (out of the 50 states plus Puerto Rico, U.S. Virgin Islands and the District of Columbia) with an Annualized Earthquake Loss of $661,000.	• Risk to state owned/leased buildings and infrastructure thus far is largely limited to state highways and bridges. • Other critical infrastructure impacts likely to be limited but could include impacts to bridges, pipelines, water	• None expected.	• Low

Hazard	Vulnerability Summary/Problem Statements	State Facility and Critical Infrastructure Impacts	Climate Change Impacts	Overall Planning Significance
	• A 300-foot-long landslide forced the closure of Highway 240 in Badlands National Park in 2021.	distribution systems, roads, and other linear facilities.		

4 STATE CAPABILITY ASSESSMENT

44 CFR Part 201 Requirement:
The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives. *[The State mitigation strategy shall include a] discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including:* *An evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and]* *A discussion of State funding capabilities for hazard mitigation projects[.]* *[In order to be eligible for the reduced cost share authorized for the FMA and SRL programs, the State plan must identify] specific actions the State has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties) and specifies how the State intends to reduce the number of such repetitive loss properties. In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Demonstration that the plan is integrated to the extent practicable with other State and/or regional planning initiatives (comprehensive, growth management, economic development, capital improvement, land development, and/or emergency management plans) and FEMA mitigation programs and initiatives that provide guidance to State and regional agencies.* *Demonstration that the State is committed to a comprehensive state mitigation program, which might include any of the following:* *A commitment to support local mitigation planning by providing workshops and training, State planning grants, or coordinated capability development of local officials, including Emergency Management and Floodplain Management certifications.* *A statewide program of hazard mitigation through the development of legislative initiatives, mitigation councils, formation of public/private partnerships, and/or other executive actions that promote hazard mitigation.* *A comprehensive, multi-year plan to mitigate the risks posed to existing buildings that have been identified as necessary for post-disaster response and recovery operations.* *A comprehensive description of how the State integrates mitigation into its post-disaster recovery operations.*

The State of South Dakota has established a comprehensive, multi-faceted state hazard mitigation program. State mitigation initiatives are integrated with Federal Emergency Management Agency (FEMA) programs and are designed to focus federal and state programs in support of local planning efforts. State mitigation planning is integrated with other state emergency management efforts as well as other state and regional planning initiatives.

True success in reducing the statewide risk of all hazards requires strong collaboration among state agencies, federal agencies, local, and tribal governments. Thus, while the SHMP is written to be a stand-alone document, it is closely linked to other state plans and program initiatives. Throughout the 2024 Plan update process, other plans, programs, and initiatives were reviewed to ensure they were integrated into the Plan. This section outlines the capabilities and activities of state agencies that support hazard mitigation, and how those programs are integrated with the SHMP. The integration of the SHMP with other state planning initiatives primarily occurs through the assessment of state capabilities, cross-referencing between different plans, and with participation on planning committees and policy commissions.

Supporting local mitigation efforts is a top priority for the state. In order to prioritize these needs, an assessment of local capabilities is included in Section 4.6. That section also summarizes local risk reduction capabilities, as well as completed and identified mitigation actions noted within the LHMPs.

4.1. 2024 Updates to the Capability Assessment

The state's capability assessment has been updated to reflect changes to risk reduction policies, programs, and funding opportunities that are managed by the various state agencies and cooperating federal agencies. At the December 15, 2022 SHMT kickoff meeting, agencies were asked to review their respective capabilities within the previous SHMP and complete a questionnaire answering the following three questions:

1. What programs does your agency provide that support risk reduction activities?
2. What policies does your agency enforce that encourage mitigation measures?
3. What funding opportunities does your agency offer for risk reduction, community resiliency, and mitigation activities?

The results of this input were summarized and reviewed at the April 6, 2022, meeting and used to inform the update of this plan.

During the 2024 plan update, the SHMT reviewed the mitigation-related plans and programs of other state and regional agencies. Since response and recovery plans and programs also typically have a mitigation component, the SHMT also incorporated those plans in this review. The purpose of this review was to identify changes, updates, and/or additions since the 2019 Mitigation Plan update to incorporate relevant data and capabilities into the mitigation plan and to better understand areas where mutual responsibilities and policies could be leveraged.

The local capability assessment section was also updated based on a review of local hazard mitigation plans (LHMPs) conducted in 2023, and documents local capabilities self-identified in those plans.

Finally, the capability assessment was expanded to better describe coordination and integration efforts between agencies and stakeholders, to ensure the SHMP is part of a comprehensive statewide program of hazard mitigation, risk reduction, and increased resiliency, in accordance with the Enhanced Plan requirements of 44 CFR §201.5.

4.2. Integrated Hazard Mitigation Planning

44 CFR Part 201 Requirement:
The mitigation planning process should…be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives. *[The State mitigation strategy shall include an] evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas.*
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Demonstration that the plan is integrated to the extent practicable with other State and/or regional planning initiatives (comprehensive, growth management, economic development, capital improvement, land development, and/or emergency management plans) and FEMA mitigation programs and initiatives that provide guidance to State and regional agencies.* *Demonstration that the State is committed to a comprehensive state mitigation program, which might include… the development of legislative initiatives, mitigation councils, formation of public/private partnerships, and/or other executive actions that promote hazard mitigation.*

4.2.1. South Dakota Hazard Mitigation Team (SHMT)

The South Dakota Hazard Mitigation Team (SHMT) is the principal body responsible for coordinating the state's comprehensive hazard mitigation program. The SHMT coordinates the integration of all state hazard mitigation and risk reduction efforts with the SHMP by ensuring that all member agencies are aware of the data, programs, and priorities of other state agencies, and how they can be integrated into their own plans. Through the SHMT, OEM planners are made aware of the data, programs, and priorities of other state agencies. Conversely, other agencies become more knowledgeable about mitigation policies and programs and how they can be integrated into their own plans.

The SHMT was established via a series of Executive Orders on April 4, 2007, and updated by a Governor's letter dated December 10, 2019, which remained effective for the current Plan update. The Governor charged the SHMT with "eliminating or reducing the physical and financial impacts of natural disasters upon the governments and citizens of South Dakota by implementing a statewide Hazard Mitigation Program based upon Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act." The duties and responsibilities of the team are identified as:

- Meet periodically to review and update the State Multi-Hazard Mitigation plan as needed or at least every five years.
- Establish statewide hazard mitigation goals and objectives.
- Establish priorities for categories of hazard mitigation projects.
- Review and evaluate hazard mitigation grant applications for funding approval within the guidelines of the State Multi-Hazard Mitigation Plan.
- Assist in the writing, preparation, and coordination of the State Multi-Hazard plan.

The SHMT consists of individuals from the following agencies, as designated by the Governor:

- South Dakota Office of Emergency Management – Chair
- Office of the Governor
- Governor's Office of Economic Development
- Department of Tourism
- Department of Agriculture and Natural Resources
- Department of Game Fish and Parks

- Department of Health
- Department of Transportation
- Bureau of Administration, Office of Risk Management
- South Dakota State University, State Climatologist
- Department of Tribal Relations

In situations where expertise is required beyond that available within the SHMT, the SHMO will identify those needs and make a request through the Governor's Authorized Representative (GAR) for additional assistance. The GAR will contact the recommended agencies for such supplemental assistance.

The SHMT has met 9 times since 2019, on the following dates:

- June 16, 2021 (HIRA project kickoff)
- September 23, 2021 (HIRA update)
- December 16, 2021 (HIRA update)
- April 27,2022 (HIRA advisory committee)
- September 21, 2022 (planning)
- December 15, 2022 (planning)
- April 6, 2023 (planning)
- June 15, 2023 (planning)
- September 21, 2023 (planning)
- February 8, 2024 (TBD)

Most of these meetings were primarily focused on updates the HIRA update and this HMP update, but several also included reviewing and approving mitigation projects. Many SHMT meetings are held in conjunction with meetings of the USACE Silver Jackets program, which helps improve participation and coordination with federal agencies and other stakeholders.

4.2.2. State Drought Task Force

Another critical interagency coordinating structure is the State Drought Task Force (DTF), which has been particularly active during times of drought. The task force is co-chaired by the Department of Agriculture and Natural Resources and the Office of Emergency Management and consists of various state agencies including the Governor's Office, Department of Agriculture and Natural Resources, Department of Game, Fish and Parks, South Dakota National Guard, and Bureau of Information and Telecommunications. The goal of this task force is to monitor drought conditions by gathering the best, most current data available and to make sure that South Dakotans have access to that information as quickly as possible. The group coordinates the exchange of drought information among government agencies and agriculture groups, fire managers, and water-supply organizations. The task force also monitors the impact of drought on economic sectors of the state. Citizens affected by drought are provided with a forum in which they can ask questions about drought conditions and obtain information on help available to them. (http://drought.sd.gov/)

The Task Force oversaw the development of the South Dakota Drought Mitigation Plan, which provides a strategy for the state to reduce the impacts of drought-related water shortages over the short and long term. The Drought Plan was completed in November 2015 as a hazard-specific supplement to the SHMP. There are two major components of the plan: the mitigation strategy and vulnerability assessment. Mitigation actions from the Drought Plan that were ranked as having a High priority are included in the Mitigation Strategy section of this Plan.

Other drought-related initiatives included attending the Western Governors' Drought Forum and a series of five regional workshops and webinars. Each regional Drought Forum workshop featured a case study on drought management. South Dakota OEM participated as a partner in the forum, which included attendance at a forum on drought impacts and solutions for various sectors in Tempe, Arizona (October 2014), Sacramento, California (November 2014), and Las Vegas, Nevada (December 2014).

DTF members also joined SDSU representatives at the NIDIS Missouri River Basin Regional Drought Early Warning System development in 2014. The purpose of this effort was to bring together a diverse group of federal, state, tribal, local partners, and stakeholders from the water- and land-management communities, to discuss and understand decision-makers' needs for drought, climate, weather, and water-related information and improving our capacity to meet those needs across the Missouri Basin. This included engagement with participants from several South Dakota tribes at a workshop in Rapid City in September 2014.

The Drought Task Force was reactivated by the Governor on June 8, 2017, to monitor drought conditions across the state and remains active as of September 2023. Meetings are held as needed. Topics discussed included:

- Current and forecasted drought conditions
- Agricultural and water supply impacts
- Wildfire outlook
- A review of agency capabilities as per the Drought Plan
- Coordination with USACE

4.2.3. State Laws, Regulations & Policies

The South Dakota State Hazard Mitigation Plan is an important component of state-level programs for the management of disasters and their impacts. The plan is written to comply with all relevant federal laws and regulations, as described in Section 1.1, and to be consistent with and supportive of all state policies, plans, and implementation procedures that govern mitigation-related programs. The South Dakota laws, regulations, and policies that are most relevant to the hazard mitigation program are described below.

SD Codified Law § 34-48A: Emergency Management

The primary state law regulating hazard mitigation in South Dakota is South Dakota Codified Laws Title 34 – Public Health and Safety, Chapter 48A – Emergency Management § 34-48A.

The purpose of this section is "to ensure that preparation of this state will be adequate to deal with an emergency or disaster, and to provide for the common defense and to protect the public peace, health, and safety and to preserve the lives and property of the people of the state." §34-48A forms the legal basis for OEM's activities, to include hazard mitigation.

SD Codified Law § 41-20A: Fire Prevention and Suppression

This law establishes the Division of Wildland Fire within the Department of Agriculture, charging them with "prevention, fire suppression, <u>fuels mitigation and reduction</u>, education, and training of homeowners, the public, and firefighters, along with other duties or responsibilities as may be necessary to fulfill the purpose of this chapter." [Emphasis added.] This section also establishes the state fire suppression special revenue fund, which is used primarily to pay for firefighting costs but can also fund fire prevention measures.

SD Codified Law § 11-2: County Planning & Zoning

Section 11-2-12 – States that the purpose of comprehensive plans is for "protecting and guiding the physical, social, economic, and environmental development of the county; to protect the tax base; to encourage a distribution of population or mode of land utilization that will facilitate the economical and adequate provisions of transportation, roads, water supply, drainage, sanitation, education, recreation, or other public requirements; to lessen governmental expenditure; and to conserve and develop natural resources." This supports the goals of mitigation planning by protecting critical facilities, lessening governmental expenditures, and conserve natural resources.

Other planning chapters establish roles and responsibilities of various planning entities throughout the various levels of government, from municipal to state.

SD Codified Law § 11-4: Municipal Planning & Zoning

Requires a comprehensive plan to, among other things, "secure safety from fire, panic, and other dangers; to promote health and the general welfare".

SD Codified Law § 11-7: County and Municipal Housing and Redevelopment

Establishes the various boards/commissions that can practice eminent domain, approve housing/redevelopment plans, rules around affordable housing, etc.

SD Codified Law § 11-10: Building Codes and Standards

SD Codified Law § 11-10 adopts the current (2021) edition of the International Building Code (IBC) as the state standard for new construction anyplace that has not adopted other local standards. The section exempts "any residential structure, mobile or manufactured home or farmstead and any accessory structure or building thereto" from these standards. While South Dakota law does not mandate that local governments must adopt building codes, §11-10 states that if any local government does adopt any construction code or standards, they must comply with the IBC. However, the section does allow local jurisdictions to "adopt an ordinance allowing local administration and enforcement of the design standard."

Efforts by the state to coordinate and encourage local adoption of building codes are described below in Section 4.6.5. See also Section 5.2.3, Item 2-1 for a mitigation action pertaining to the integration of floodplain management ordinances into local building codes.

SD Codified Law § 31-14: Maintenance and Inspection of Bridges and Culverts

SD Codified Law § 31-14 specifies inspection requirements for bridges and culverts on non-state highways. The law requires that culverts be inspected annually by the township board of supervisors or the county highway superintendent. County highway superintendents are also responsible for inspecting all bridges in their county "at reasonable intervals." The chapter further specifies that all such bridges and culverts "shall be maintained and kept clean at the expense of the township."

SD Codified Law § 46 and 46A: (Dry-Draw and Non-navigable Stream Dams) Water Rights

This law establishes all rights and responsibilities related to the use of water in the state. Section 46-4 details dams along dry-draws and non-navigable streams; it establishes the right of individuals to build dams along dry-draws and non-navigable streams in the state without requiring a permit for appropriating water use, provided the dam does not impound any more than twenty-five acre feet of water. Section 46-5-47 prohibits persons from "constructing facilities on any watercourse to control floods for the purpose of preventing or alleviating damage without a permit issued". Section 46-7-5 establishes the right of the state's Chief Engineer to inspect any works, including abandoned works and high-hazard dams, to determine whether they are safe or not. If works are found to be unsafe, the chief engineer shall notify the owner and shall order the owner to make changes necessary to secure the safety of the works, allowing a reasonable time, not to exceed six months, for putting the works in a safe condition. The order may specify that if the owner fails to make the repairs in the time allowed, the chief engineer may enter the property and put the works in a safe condition. Additionally, Section 46-7-5.7 establishes provisions which exempt the Chief Engineer and the State of South Dakota from the obligation to secure the safety of privately owned high-hazard dams when the owner of said dam refuses to correct an unsafe condition identified.

SD Codified Law § 46A governs Water Management in the state. Amongst several other details, this law establishes that "The general health, welfare, and safety of the people of the State of South Dakota are dependent upon the conservation, development, management, and optimum use of all this state's water resources". This opening statement could support hazard mitigation efforts which also seek to conserve water resources and availability in South Dakota.

Executive Orders: SHMT Agency Designation

As noted above in Section 4.1, the South Dakota Hazard Mitigation Team (SHMT) has been established through a series of Executive Orders and Governor's letters. In FEMA's comments on the 2019 SHMP, the Executive Order designating the SHMT duties and membership was highlighted as "a best practice and example for other states in how to increase commitment and engagement across state agencies." The following is a list of the executive orders that designate SHMT membership and collaboration:

- Executive Order 93-12, dated October 19, 1993
- Executive Order 97-14, dated October 21, 1997
- Executive Order 2003-12, dated December 8, 2003
- Executive Order 2007-07, dated April 4, 2007
- Governor's Letter to SHMT Members, dated October 23, 2014
- Executive Order 2019-29, dated December 10, 2019

SHMT Policies

<u>HMGP State Match Policy</u>: In some cases, the state may cover a portion of the required 25% local match on FEMA HMGP grants to provide further incentives to utilize the funding and provide additional financial assistance to communities with a demonstrated need. The policy is discussed in detail in Section 4.3.2.

<u>Home Mitigation Project Policy</u>: This policy, originally adopted by the SHMT in August 2011, established that acquisition projects are the only mitigation projects related to private residences that will be funded with HMGP funds. The SHMT later amended this policy to also allow relocation projects.

<u>Pre-Disaster Mitigation Plan Policy</u>: In order to foster LHMP updates with limited planning funds, the SHMT decided in April 2012 that all applications for mitigation plan funding going forward must have a minimum of two bids and a brief explanation of the selection process. If at least two bids are not submitted with the application, no funding will be considered for the applicant until they can successfully fulfill the requirement.

Other Regulations

While state law or regulations do not include any restrictions on development in floodplains or other hazard areas, local flood damage prevention ordinances regulate building and development in Special Flood Hazard Areas. OEM also works with NFIP communities to promote participation in the CRS program, which strengthens local floodplain management practices; see Section 4.3.1 below.

4.2.4. State Hazard Mitigation Capabilities and Program Integration Summary

South Dakota's integrated hazard mitigation program leverages the respective hazard mitigation capabilities of the agencies represented on the SHMT. Table 4-1 summarizes all capabilities identified by participating state agencies in terms of programs, policies, and funding sources. Those capabilities that are **bolded** in the table are discussed in the following sections (Sections 4.3 and 0) that provide more details in relation to the specific agencies. Funding sources are discussed in more detail in Section 5.3. Federal partners also play an important role in hazard mitigation in South Dakota. These are summarized in Table 4-2.

Table 4-1 Summary of State Hazard Mitigation Capabilities by Agency

Plan Section	Agency	Programs	Policies	Funding
4.3.1	SD Office of Emergency Management	SHMT Lead Drought Task Force co-chair NFIP Risk Map Repetitive Flood Loss Properties State Emergency Operations Plan State Recovery Plan State Hazard Mitigation Plan Public Outreach and Education Severe weather awareness campaign PA reservists to help during and after a disaster	Home Mitigation Project Policy Pre-Disaster Mitigation Plan Policy HMGP State Match Policy Local floodplain ordinances	Hazard Mitigation Grant Program Pre-Disaster Mitigation Grant Program Flood Mitigation Assistance Public Assistance Section 406 Increased Cost of Compliance Coverage Emergency Management Performance Grant General funds
4.3.2	Division of Wildland Fire	Wildland Fire Suppression (Including Black Hills Protection District and Community Wildfire Protection Plans) Fire Suppression Prescribed Fire Wildland Fire Training Fire Aviation Support Fire Management Hazardous Fuels Mitigation Volunteer Fire Assistance Grants Federal Excess Personal Property (FEPP) and Firefighter Property (FFP) Wildfire-Related Dispatch Fire Prevention Firewise	Burn permitting requirements Preparedness activities	Volunteer Fire Assistance Grants
4.4.1	SD Department of Agriculture and Natural Resources (DANR)	SHMT member Drought Task Force co-chair Dam Safety Oil and Gas Initiative Geologic Information and Maps Hazardous Waste and Hazardous Waste Manage Firms List Mineral and Mining Spills and Spills Database	Flood Control Project Permitting Requirements Dam Permitting Requirements	State fire suppression special revenue fund Water and Waste Funding General funds

Plan Section	Agency	Programs	Policies	Funding
		Watershed Protection Wellhead Protection Drinking Water Ground Water Quality Flood Drainage Technical Assistance Stormwater Conservation (Forest Action Plan) Beat the Beetles MPB Black Hills Grasshopper Management Pest and Disease Control Soil, wind, water		
4.4.2	SD Department of Transportation	SHMT member Emergency Relief Program SD Strategic Highway Safety Plan SD DOT Annual Report SD Statewide Long Range Transportation Plan DOT Strategic Plan SD511.com 511 Travel Information Public Outreach and Education SDDOT Bridge Inspection Program		Emergency Relief Funding General funds
4.4.3	State Historic Preservation Office	SHMT member Public education on historic property mitigation National Historic Preservation Act review and mitigation recommendations	National Historic Preservation Act – Section 106	Deadwood Fund Grant General funds
4.4.4	SD Department of Health – Office of Public Health Preparedness and Response	SHMT member Hospital Preparedness Program (HPP) Public Health Emergency Preparedness Program (PHEP) SD Department of Health 2020 Plan	Preparedness Activities – planning, training, and exercises across 15 capabilities for public health and hospital preparedness	Office of the Assistant Secretary for Preparedness and Response (ASPR) Funding Center for Disease Control Funding (PHEP) General funds
4.4.5	SD Bureau of Information and Telecommunications	GIS Data and Training State Radio System SD Public Broadcasting Business Continuity LiDAR data		BIT is an unfunded agency. Tasks must be funded by the requesting agency.

Plan Section	Agency	Programs	Policies	Funding
	South Dakota Housing Development Authority	Homebuyer education Governor's House Program Rental assistance Developer trainings	Renewal Projects utilizing federal funding require compliance with flood insurance requirements per P.L. 93-234 and evaluation of flood hazards per EO 11988.	Various funding programs including affordable housing and housing tax credits.
4.4.6	SD Office of Risk Management	SHMT member Property Insurance Boiler Insurance Aviation Insurance Fidelity Bond Risk audits of state government buildings Public entity pool for liability	Loss Control Committees	Extraordinary Training Fund General funds
4.4.7	SD Office of Homeland Security	THIRA Homeland Security & Emergency Management Senior Advisory Committee ACAMS assessments for government buildings, hospitals, and schools Regional Response Teams		State Homeland Security Grant for funding of radios, communication towers, generators, shelters, warning sirens, regional response teams General funds
4.4.8	SD Game, Fish, and Parks	SHMT member Statewide Comprehensive Outdoor Recreation Plan Private Lands Habitat and Access Strategic Plan Habitat and Access Programs for Landowners Wildlife Damage Management	GF&P Commission	State funds for dam maintenance General funds
4.4.9	South Dakota State University (SDSU) Extension	State Climatologist SHMT member		
4.4.10	Department of Tribal Relations			

Table 4-2 Summary of Federal Partner Capabilities In South Dakota

Plan Section	Agency	Programs	Policies	Funding
4.5.1	US Army Corp of Engineers (Omaha and St. Paul Districts)	Silver Jackets Floodplain Management Service Program Continuing Authorities Program General Investigations Construction General Planning Assistance to States and Tribes Tribal Partnership Program Operation and Maintenance Drought Assistance	Executive Order 1198 to avoid spending federal dollars in the floodplain PL84-99 Emergency Preparedness, Response, and Recovery	General Investigations Floodplain Management Service Program Technical Assistance for Drought, Landslides, Mudslides Planning Assistance Section 22 Assistance Section 203 Tribal Partnerships
4.5.7	Federal Highway Administration	FHWA National Bridge Inspection Program	Emergency Relief Manual	SD DOT Emergency Relief (ER) Program
4.5.3	Natural Resource Conservation Service	Drought Assistance		Environmental Quality Incentives Program Initiatives
4.5.4	US Geological Survey	Flood Inundation Mapping Program National Earthquake Information Center (NEIC) “Did You Feel It?” Program Cooperative Water Program National Streamflow Information Program WaterUse Program WaterAlert & WaterNow applications Hydrologic Investigation Program WaterWatch Program Groundwater Level Monitoring Programs		National Earthquake Hazards Reduction Program (NEHRP) USGS receives only a portion of the budget from federal funding, the balance of activities is funded from full or matching dollars from other federal, state, and local partners.
4.5.8	Housing and Urban Development (HUD)			Community Development Block Grant – Disaster Recovery Grants (CDBG_DR)
4.5.5	National Weather Service	StormReady Weather-Ready Nation Ambassadors Severe weather and flood warnings Weather and flooding safety guides NOAA radio broadcasts Storm Spotter training Lightning Safety Toolkit/Recognition		

Plan Section	Agency	Programs	Policies	Funding
4.5.6	US Bureau of Land Reclamation	WaterSMART Program Water Conservation Field Services Program Rural Water Supply Program Resource Management and Planning National Irrigation Water Quality Program Flood Hydrology and Consequences Group Drought Program Dam Safety Building Seismic Safety Program Snowpack and Reservoir Levels		

Table 4-3 below identifies which departments/agencies have subject matter expertise in each of the hazards identified in Section 3 Hazard Identification and Risk Assessment (HIRA). This was created to demonstrate how the SHMP planning process and the statewide mitigation program includes state agencies with expertise across all identified hazards. The table also serves as an easy reference for which agencies can be consulted when discussing mitigation options for different hazards and highlights the comprehensive all-hazards nature of South Dakota's hazard mitigation program.

Table 4-3 State/Regional Agency Hazard Expertise

State Agency (SHMT Members are bolded)	Agricultural Pests/Disease	Flood	Summer Storm	Winter Storm	Wildfire	Drought	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
Bureau of Administration – Office of Risk Management										
Bureau of Information and Telecommunications										
Department of Agriculture and Natural Resources (DANR)	X	X			X	X			X	X
Department of Tribal Relations										
DANR – Division of Environmental Services		X				X			X	
DANR – Division of Financial and Technical Services – Geological Survey		X				X				X

State Agency (SHMT Members are bolded)	Agricultural Pests/Disease	Flood	Summer Storm	Winter Storm	Wildfire	Drought	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
DANR – Division of Financial and Technical Services – Watershed Protection		X				X				
Department of Health – Office of Public Health Preparedness & Response	X	X							X	
Department of Public Safety – Office of Emergency Management	X	X	X	X	X	X	X	X	X	X
Department of Public Safety – Office of Homeland Security									X	
Department of Tourism					X	X				
Department of Transportation		X		X					X	X
Game, Fish & Parks	X	X				X				X
Governor's Office of Economic Development										
South Dakota Housing Development Authority										
State Emergency Response Committee									X	
State Historic Preservation Office										
SDSU Extension – State Climatologist		X	X	X	X		X	X		
Regional Planning Districts										
Rural Electric Cooperatives			X	X	X			X		
Silver Jackets		X								

Table 4-4 shows which SHMT members and other state agencies relate to each of seven sectors defined in the 2022 FEMA State Mitigation Plan Review Guide. This helps demonstrate cross-sector coordination and integration by ensuring state government is adequately addressing all sectors during the ESHMP planning process, and as part of the broader statewide hazard mitigation program. The table helps identify which agencies have expertise in and the responsibility or authority to implement mitigation actions with other planning initiatives and mitigation programs into ongoing state activities that achieve risk reduction and resilience.

Table 4-4 State/Regional Agency Integration by Sector

Agency/Organization (SHMT Members are bolded)	Emergency Management	Economic Development	Land Use Development	Housing	Health & Social Services	Infrastructure	Natural & Cultural Resources
Bureau of Administration – Office of Risk Management	X					X	
Bureau of Information and Telecommunications		X				X	
Department of Agriculture and Natural Resources (DANR)	X	X	X		X	X	X
DANR – Division of Environmental Services		X	X				X
DANR – Division of Financial and Technical Services – Geological Survey		X	X			X	X
DANR – Division of Financial and Technical Services – Watershed Protection			X			X	X
Dept. of Health – Office of Public Health Preparedness & Response	X				X		
Department of Public Safety – Office of Emergency Management	X	X	X	X	X	X	X
Department of Public Safety – Office of Homeland Security	X				X	X	
Department of Tourism		X					
Department of Transportation	X		X			X	X
Game, Fish & Parks			X				X
Governor's Office of Economic Development		X	X	X			
South Dakota Housing Development Authority		X		X			
State Emergency Response Committee	X					X	
State Historic Preservation Office			X				X
SDSU Extension – State Climatologist		X	X				X
Regional Planning Districts	X	X	X				
Rural Electric Cooperatives						X	
Silver Jackets	X					X	

4.3. Department of Public Safety

4.3.1. South Dakota Office of Emergency Management (OEM)

44 CFR Part 201 Requirement:
The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives. *[The State mitigation strategy shall include a] discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area.* *[In order to be eligible for the reduced cost share authorized for the FMA and SRL programs, the State plan must identify] specific actions the State has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties) and specifies how the State intends to reduce the number of such repetitive loss properties. In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Demonstration that the plan is integrated to the extent practicable with other State and/or regional planning initiatives (comprehensive, growth management, economic development, capital improvement, land development, and/or emergency management plans) and FEMA mitigation programs and initiatives that provide guidance to State and regional agencies.* *Demonstration that the State is committed to a comprehensive state mitigation program, which might include any of the following:* *A commitment to support local mitigation planning by providing workshops and training, State planning grants, or coordinated capability development of local officials, including Emergency Management and Floodplain Management certifications.* *A statewide program of hazard mitigation through the development of legislative initiatives, mitigation councils, formation of public/private partnerships, and/or other executive actions that promote hazard mitigation.*

An office within the state Department of Public Safety, the South Dakota Office of Emergency Management (OEM) provides leadership for the overall state mitigation strategy and works in collaboration with other state agencies to ensure that the various mitigation programs complement each other and work toward achieving the state's overall mitigation strategy.

There are several programs administered by OEM related to the development and implementation of the state mitigation strategy. These programs include:

OEM Mitigation Section

The OEM Mitigation Section is the primary state entity responsible for coordinating and facilitating technical assistance for local hazard mitigation planning. The Mitigation Section is comprised of the State Hazard Mitigation Officer (SHMO), two Mitigation Specialists, and the state NFIP coordinator.

The SHMO and the rest of the Mitigation Section are responsible for coordinating and supporting the SHMT, as detailed in Section 4.2.1 above. The Mitigation Section maintains the State Hazard Mitigation Plan and assists local jurisdictions with the development and updates of local hazard mitigation plans. Mitigation Section staff works to promote mitigation activities, works with jurisdictions and agencies to identify potential projects, maintains a strong public outreach effort on the mitigation grant processes and requirements, and maintains a database of all the projects for programmatic and finance performance. Staff assists subapplicants with submitting complete applications, provides technical assistance to all subapplicants in all aspects of the grants process, and serves as a liaison between subapplicants and FEMA Region VIII. Staff completes the state quarterly report, based on reporting from subapplicants, and submits the report to FEMA. The Staff ensures projects follow the approved scope of work, conducts final project inspections, reviews all requests for close-out, and submits final project and disaster close-out requests to FEMA. The Mitigation Section also maintains the state HGMP Administrative Plan and develops a Hazard Mitigation Program Strategy for each federally declared disaster, which lays out disaster-specific mitigation objectives, identifies mitigation actions, and provides a framework for implementing long-term cost, effective measures to minimize future disaster damages statewide.

Hazard Mitigation Grants and Program Management

OEM funds mitigation activities in the state primarily through federal grant programs, supplemented by state, federal, and private/NGO programs. These grants are described in detail in Section 5.3.2. The demonstrated effective use and management of hazard mitigation grant funding are discussed in Section 5.4.

National Flood Insurance Program (NFIP)

The state promotes overall flood risk reduction and sound floodplain management practices through its support of FEMA's National Flood Insurance Program (NFIP). Participation in the NFIP is completely voluntary (although some states require NFIP participation as part of their flood plain management program) by cities and participation is on a community rather than an individual basis. Participating in the program allows those who want to purchase flood insurance for their insurable property, whether it is a home or other property. Almost every type of walled and roofed building that is principally above ground and not entirely over water may be insured if it is in a participating community.

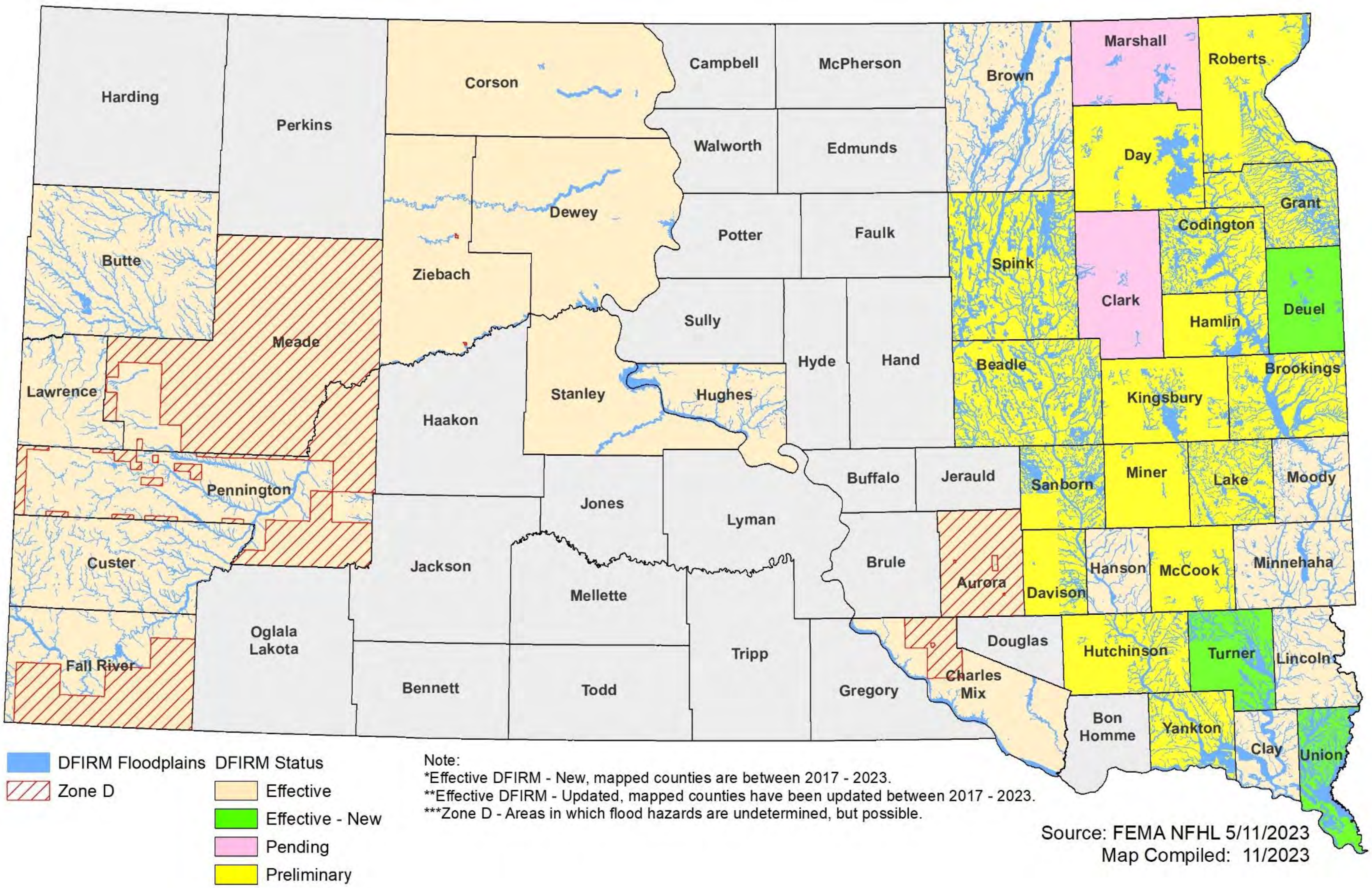
The state has designated a state NFIP Coordinator within OEM who administers, promotes, and provides training on all aspects of the NFIP, including providing technical assistance to local communities on floodplain management, flood insurance, and map-related issues. The NFIP Coordinator provides information at commission meetings to communities that currently do not participate in the NFIP and meets with county and city commissioners to maintain awareness, create a desire to learn more about the programs, and assist in resolving issues relating to program compliance and floodplain management. The NFIP Coordinator conducts approximately 10-12 Community Assistance Visits each year. Pamphlets and/or manuals are distributed to local officials outlining the NFIP. A Floodplain Administrators Directory and information bulletin are prepared and distributed biannually to local floodplain administrators and FEMA.

OEM regularly coordinates with FEMA on in implementation of the NFIP. FEMA focuses on the identification and enforcement requirements and South Dakota's efforts are on assisting communities, tribes and other entities in support of the NFIP, including: CRS, NFIP community program and ordinance adoptions, community implementation of effective flood loss reduction measures, and through efforts of the active Silver Jackets team. The State NFIP Coordinator participates in meetings with FEMA and communities throughout the year.

Figure 4-1 shows South Dakota's Digital Flood Insurance Rate Map (DFIRM) coverage as of November 1, 2023. Thirty-three counties currently have effective DFIRMS and seventeen counties have preliminary maps, an increase of nine since the 2019 Plan update. South Dakota has made significant progress in this area since 2011, when only seventeen counties had effective DFIRMs.

As of September 2023, there are a total of 238 communities throughout the State of South Dakota participating in the NFIP, according to NFIP Community Status Book at https://www.fema.gov/flood-insurance/work-with-nfip/community-status-book. This is nine more communities than were participating at the time of the 2019 plan update. The list of participating communities is included in Appendix E.

Figure 4-1 Communities Mapped for Digital Flood Insurance Rate Maps (DFIRM)



For the last several years, SDOEM has been working with FEMA to map 27 eastern counties. The status for those counties as of October 1, 2023 are listed below:

- Codington (RP): Preliminary Products in QR3. Possible mapping updates. Compass reviewing recent LOMRs and Big Sioux Floodway data for impacts.
- Davison: Initiated Due Process tasks. KDP4 approved.
- Moody: Preliminary products in Compass ready for QR3. Working with MIPhelp to resolve AMP issues.
- Lincoln: Sending 621 Letters. Preliminary Products in QR3. Resolved AE to AO change.
- Minnehaha: Sending 621 Letters. Preliminary Products in QR3. Resolving Levee Zone updates, Effective Drawdown, and Unaccredited Levee.
- Beadle: QR4 Pt. 1. complete. Waiting for federal register notification to publish & initiate QR4 pt.2.
- Spink: QR4 Pt. 1. complete. Waiting for federal register notification to publish & initiate QR4 pt.2.
- McCook: QR4 Pt. 1. complete. Resolving issue with Purchase Geography to correct Town of Spencer.
- Yankton: QR4 Pt. 1. complete. Waiting for federal register notification to publish & initiate QR4 pt.2.
- Brookings: Federal Register published 10/12. Working on Appeal Start materials QR4 Pt 2. Meeting with City on 10/19 to discuss LOMCs and other follow-up items ahead of appeals start.
- Lake: Currently in the appeal period.
- Miner: In Internal review of Final Map products ahead of QR5/7.
- Hamlin: Completed Appeals on 8/15. Discussed comments from the City of Estelline. Sent acknowledgement and preparing response.
- Sanborn: Working through Final Map Product tasks.
- Hanson (RP): In internal review ahead of QR5/7. SID 600 exception approved.
- Kingsbury: In QR5/7 review process. 11/22 LFD.
- Hutchinson: In QR5/7 review process. 11/8 LFD.
- Roberts: In QR5/7 exception approved. On track for 10/25 LFD.
- Grant: Issued LFD on 9/27. Continuing 6 month compliance period processing.
- Day: Issued LFD on 9/13. Continuing 6 month compliance period processing.
- Clark: LFD Issued 7/11. Continuing 6 month compliance period processing.
- Marshall: LFD Issued 6/21. Continue with 6 month compliance processing.

Floodplain Ordinances

The state has a recommended flood ordinance, but no statewide rules or regulations related to floodplain development. The adoption and enforcement of floodplain ordinances, including provisions such as administration of substantially damaged properties, is handled at the county and municipal level and detailed in the floodplain ordinances for communities participating in the NFIP. One challenge is that floodplain mapping is changing in many communities as maps are updated through RiskMAP. OEM staff has worked with many communities that have new floodplain maps going effective by providing technical assistance on updating their local ordinances, permitting processes, and general technical assistance. Staff continues to review floodplain determinations for future development in or near the Special Flood Hazard Area.

OEM disseminates a printed mailing with support information of a model ordinance, resolution, and NFIP enrollment application form encouraging the non-participating NFIP communities to join the NFIP. This has resulted in three South Dakota sanctioned communities submitting recent enrollment packages. Other highlights include:

- City of Clear Lake – Ordinance and enrollment materials submitted on 10/17/23 to FEMA. Not enrolled as of 11/14/23.
- Town of Hudson – Ordinance and enrollment materials submitted to FEMA on 9/28/23. Not enrolled as of 11/14/23.
- Town of Raymond – Adopted compliant ordinance sent to FEMA and State on 9/11/23. New maps on 1/11/24.
- Marshall County is finalizing their latest ordinance using the latest state approved version of the ordinance. Staff conducted commissioners to visit in July 2023. The County will be submitting the final ordinance to FEMA for review. Maps are going effective on December 21, 2023.
- Town of Olivet – FEMA and the State are waiting on the final signed ordinance from the community.
- Town of Willow Lake – Staff (Heidi Madsen) is reviewing existing regs and planning to adopt compliance regs before Jan 11, 2024.

Repetitive Flood Loss Strategy

South Dakota's Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties are detailed and analyzed in Section 3.3.2. The SHMP has created an objective under Goal 2 related to "reducing the number of repetitive flood loss structures." During the 2019 update, a more specific mitigation action was developed titled "Map repetitive flood loss properties to identify concentrations of properties or high losses and identify potential mitigation options." This more specific repetitive flood loss strategy is being conducted in cooperation with the USACE Silver Jackets and will result in the mitigation of more properties in the future. See the mitigation strategy in Section 5.2 for more information. Since 2019 OEM staff sent mailings to each community with Repetitive Loss or Severe Repetitive Loss properties to notify them of the FMA program, application process, and deadline. This mailing has resulted in one RL applying for an FMA grant for a property acquisition/demolition.

Community Assistance Program – State Support Services Element (CAP-SSSE)

The Community Assistance Program – State Support Services Element (CAP-SSSE) program provides funding to states for technical assistance to communities in the NFIP, and for evaluating community performance in implementing NFIP floodplain management activities. In this way, CAP-SSSE helps to:

- Ensure that the flood loss reduction goals of the NFIP are met,
- Build state and community floodplain management expertise and capability, and
- Leverage state knowledge and expertise in working with their communities.

In previous plans, South Dakota participated in CAP-SSSE. However, this arrangement has been discontinued. FEMA is now responsible to do Community Assistance Visits (CAVs) to verify compliance with the Community Assistance Program (CAP). These visits assess the community's floodplain management program; assist the community and its staff in understanding the NFIP and its requirements; and assist the community in implementing effective flood loss reduction measures when program deficiencies or violations are discovered. These CAV meetings often identify, prevent, and resolve floodplain management issues before they develop into problems that require enforcement actions and monetary penalties. The State NFIP Coordinator participates in some CAVs with FEMA, but the main focus for the state is now CRS and to get new communities signed up for the NFIP program. Enforcement actions are done by FEMA.

South Dakota continues to support CAP-SSSE, despite the State declining this funding opportunity beginning in FY21. Through a partnership with FEMA the CAP-SSSE activities are coordinated and have continues; FEMA focuses on the identification and enforcement requirements and South Dakota's efforts are on assisting communities, tribes and other entities in support of the NFIP, including: CRS, NFIP community program and ordinance adoptions, community implementation of effective flood loss reduction measures, and through efforts of the active Silver Jackets team. The State NFIP Coordinator participates in meetings with FEMA and communities throughout the year. Recently, the State NFIP Coordinator encouraged the communities of the City of Freeman, Town of Fulton, Town of Olivet, Town of St Lawrence, Town of Hudson, and City of Clear Lake to adopt an ordinance and enroll in the NFIP. The State NFIP Coordinator continues to outreach to the communities where the remaining Severe Repetitive Loss properties are located. The outreach has resulted in the first Flood Mitigation Assistance grant award since 2005 to mitigate a Severe Repetitive Loss of property in the City of Milbank.

Community Rating System (CRS)

OEM encourages communities to join the Community Rating System (CRS), which provides discounts on flood insurance premiums for communities that go above and beyond the minimum requirements of the NFIP. The NFIP Coordinator assists local NFIP participating communities in joining the CRS Program by providing general technical assistance, conducting entry CAVs, and offering state support for activities credited for points by CRS. State support may include:

- Obtaining copies of surface water discharge permits issued by DANR for industrial operations within the particular community (5 CRS points),
- Obtaining the emergency preparedness plans for any hydraulic dams within the community and state dam safety program (45 CRS points),
- Providing NFIP informational handouts and pamphlets to be displayed in the building permit kiosk area of the local government administration building (2 CRS points per handout).

Interested communities are required to have a successful CAV meeting six months prior to their CRS application submittal.

As of December 2023, eight South Dakota communities (one county and seven cities) participated in the CRS, with 839 policies in force in the state receiving a $55.7k CRS discount. The CRS classes for those eight communities range from 7-9 and qualify for 5%-15% discounts. CRS requires communities to go above the NFIP minimum standards in their floodplain ordinances in order to be eligible for the program. OEM's goal is to add two new CRS communities each year which will continue to promote higher floodplain standards in South Dakota Sound floodplain management is also promoted through the Silver Jackets program.

In 2023, the Cities of Sioux Falls and Watertown had their CRS ratings upgraded from Class 8 to Class 7 due to completing additional floodplain management activities.

Risk Mapping, Assessment, and Planning (Risk MAP)

FEMA's Risk MAP is an action-driven program that emphasizes community participation, adopting mitigation plans, communicating risk to citizens, implementing mitigation actions to reduce risk, and utilizing mitigation plans to secure grant funding. Through Risk MAP, FEMA provides information to enhance local mitigation plans, improve community risk awareness outreach, and increase local resilience to flooding. Through collaboration with state, tribal, and local entities, Risk MAP delivers quality data that increases public awareness and leads to action that reduces risk to life and property.

As a participant in FEMA's Risk MAP Program South Dakota is currently analyzing the flood risk for 27 counties in the eastern part of the state using the two-dimensional HEC-RAS 5.0.1. Not only is the project identifying the boundary limits of the 100-year and 500-year floodplains, but also produces water surface elevations for multiple lower return periods, model - backed flood depth information for these identified floodplains, the corresponding water surface elevations, and velocity grids of potential floodwaters. The floodplains were derived from new state-collected LiDAR, which is a much more accurate terrain source than the older USGS topographic maps used during initial flood mapping in the past. For counties west of the existing FEMA Risk Map project area, there are efforts to collect LiDAR for the rest of the State. The long-term goal is to hopefully have a base-level engineering flood risk assessment run for the entire state of South Dakota.

State OEM staff attended numerous local government meetings with FEMA to discuss the mapping project and attempted to gather structure information needed for the new hydraulic models. The State is actively promoting the availability of this newly produced flood risk assessment data – which can be downloaded at http://bit.ly/SDakotaMapJournal – to local officials through newsletters, emails, and conversations, so individuals are truly aware of their potential flood risk. The State is urging communities to utilize this data for future planning purposes and to develop potential flood mitigation projects in elevated risk areas; and is currently coordinating with FEMA on local meetings starting in 2019 to begin sharing the latest version of the flood risk maps before going preliminary and eventually effective.

Rehabilitation of High Hazard Potential Dams (HHPD) Program

The Rehabilitation of High Hazard Potential Dams (HHPD) program provides technical, planning, design, and construction assistance in the form of grants for the rehabilitation of eligible high hazard potential dams. Eligible applicants must be eligible subrecipients, which include non-federal governments and non-profit organizations. Both the state and the local/tribal subrecipient have requirements they must meet for a project to be eligible for HHPD funding. In a state or territory with an enacted dam safety program, the State Administrative Agency, or an equivalent state agency, is eligible to apply for the HHPD grant. Each eligible state may submit only one HHPD grant application.

Eligible high hazard potential dams are defined as non-federal dams:

- Located in a state or territory with a dam safety program
- Classified as high hazard potential by the dam safety agency in the state or territory where the dam is located
- With a current, approved emergency action plan by the state or territorial dam safety agency
- Failing to meet minimum dam safety standards of the state or territory and poses an unacceptable risk to the public

The State of South Dakota has not previously participated in the HHPD program, since the program requirements were released after the approval of the 2019 ESHMP. With the approval of this plan update, the State intends to participate in the program. The program's administrative requirements are similar to those of HMA, including elements that must be addressed through the state and local HMPs. DANR's Dam Safety Section solely manages the program in South Dakota. Due to the newest of the program being implemented after the current SHMP was approved, the State did not pursue this funding opportunity until the FY24 cycle. In February 2024, the State submitted its first application for HHPD funding.

Currently, the South Dakota Chapter of the USACE Silver Jackets has a project called High Hazard Dam Inundation Mapping – Hydraulic Modeling, occurring for four dams. The dams are Lake Corsica in Douglas County, Redfield Dam in Spink County, Marindahl in Yankton County, and Willow Creek in Brown

County. USCAE continues coordinating recent data availability with DANR Dam Safety for the dams with ongoing studies.

An area for improvement would include a year-round outreach to interested and eligible dam owners and soliciting feedback from federal partners, dam owners, and non-profits that may play a role in dam safety across the State.

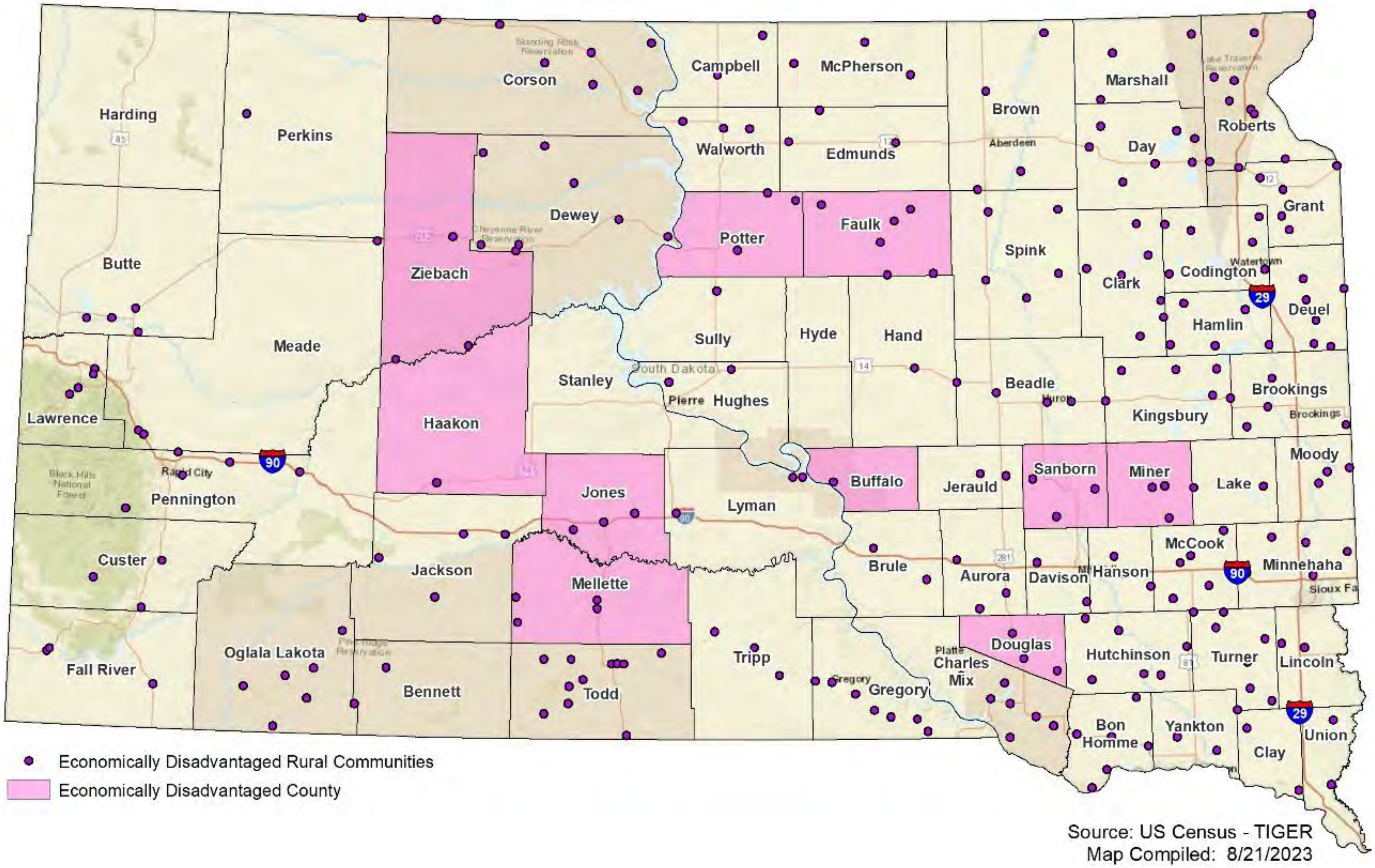
Another challenge to access the funding for this relatively new grant program is in part due to prerequisite requirements to address all dam risks in local hazard mitigation plans. OEM will be providing technical assistance and trainings to help overcome this challenge, including hosting G318 training focusing on the FEMA Policy Guide requirements including the High Hazard Potential Dam elements.

Economically Disadvantaged Rural Communities

FEMA defines an economically disadvantaged rural community as a community of 3,000 or fewer individuals identified by the applicant that is economically disadvantaged, with residents having an average per capita annual income not exceeding 80% of the national per capita income. The term replaces "small, impoverished communities" as defined at 42 U.S.C. § 5133(a). Economically disadvantaged rural communities are eligible for an increase in cost share up to 90% federal / 10% non-federal for FEMA grants to include the BRIC program.

According to the U.S. Census Bureau, the per capita income of the United States is $41,804, 80% of which equates to $33,443. There are ten counties and 257 cities, towns, villages, or places in South Dakota that qualify as economically disadvantaged rural communities. These communities are mapped in Figure 4-2; the complete list of communities can be found in Appendix C.

Figure 4-2 Economically Disadvantaged Rural Communities



Community Disaster Resilience Zones

The Community Disaster Resilience Zones Act of 2022 seeks to build disaster resilience across the nation by creating and designating resilience zones that can focus assistance and support to areas that need it most. These zones are disadvantaged communities that have high natural hazard risks based on combined risks of annualized estimated losses to buildings, people, and agriculture from natural hazards; social vulnerability; and community resilience. Designated communities will receive targeted federal support to become more resilient to natural hazards and extreme weather worsened by the climate crisis. FEMA will use these zones to focus resilience activities as well as to encourage other federal agencies, the private sector, nonprofit and philanthropic organizations, and private equity to invest in resilience projects. FEMA is authorized to provide additional assistance for mitigation projects that reduce natural hazard risk in, or primarily benefiting a designated zone, including a cost share adjustment under certain FEMA mitigation grant programs.

On September 6, 2023, FEMA announced 483 census tracts as Community Disaster Resilience Zones. One tract in South Dakota was included in this designation: census tract #965100, located in Custer County. The state will work with Custer County to identify mitigation projects that may qualify for increased funding under this act.

Hazard Mitigation Training Program

The OEM Mitigation Section develops and promotes mitigation training to meet the needs of subapplicants and other stakeholders. Starting with Fiscal Year 2013, OEM adopted a comprehensive training program for emergency management stakeholders. These requirements were adopted in response to changes in grant guidance from the U.S. Department of Homeland Security. The guidance calls for an increased number of trainings and exercises with a strong all-hazards focus. The program also lists recommended courses, course scheduling, and instructor qualifications/requirements.

The multi-year SD training plan includes several recommended courses focusing on mitigation, to include G-318 Local Mitigation Planning and G-393 Mitigation for Emergency Managers. The state has supported local Certified Floodplain Manager (CFM) exam refresher/study courses as a commitment to enhance local floodplain manager knowledge and expertise. Mitigation-related training courses and workshops conducted since the 2019 Plan update include:

- G393 Mitigation for Emergency Managers:
  - March 19, 2019, Pierre
  - January 22, 2020, Sioux Falls
  - January 8, 2021, virtual delivery
  - December 3, 2021, Rapid City
  - October 13, 2022, Pierre
  - April 27, 2023, Pierre

- G318 Local Mitigation Planning
  - March 28, 2019, Pierre
  - November 14, 2019, Pierre

- Floodplain Management Training:
  - March 14, 2023, Watertown
  - March 15, 2023, Mitchell
  - March 16, 2023, Sioux Falls
  - April 17, 2023, Rapid City
  - April 18, 2023, Pierre

- MGT- 310 THIRA/SPR
  - Scheduled March 7, 2024, Pierre

- Certified Floodplain Manager Exam Study Session
  - September 12, 2018, Rapid City

Other OEM Plans and Program Initiatives

Other mitigation activities OEM is involved in include:

- The **South Dakota State Emergency Operations Plan (SEOP)** establishes policy for state government agencies in their response to the threat of natural, technological, or national security emergency/disaster situations. It documents the policies, concept of operations, organizational structures, and specific responsibilities of state agencies in their response to provide for the safety and welfare of citizens. It also addresses the need for preparedness, response, recovery, and mitigation activities to enhance the state's overall capability to cope with potential hazards.

  The SEOP is organized around Emergency Support Functions (ESFs). ESF #14, Long-Term Recovery and Mitigation, specifically addresses the integration of mitigation activities into post-disaster recovery "to reduce or eliminate risk." This includes the effective management of HMA grants, PA Section 406 grants, and other grant programs. The ESF #14 section states

  - "Long-term community recovery and mitigation efforts are forward-looking, [and] market-based…with attention to mitigation of risk in future incidents," and
  - "The state uses the post-Incident environment as an opportunity to measure the effectiveness of previous community recovery and mitigation efforts."

  Primary and supporting agencies are tasked to:

  - "Establish procedures to integrate pre-incident planning and risk assessment with post-incident recovery and mitigation efforts."
  - "Produce digital mapping that guides recovery and mitigation efforts."

  See also Section 6.3.2 for discussion of how the SHMP informs and is integrated into the SEOP.

- The **State Disaster Recovery Plan** builds on the policies and procedures in the ESF 14 section of the SEOP described above, to ensure the most efficient and effective state coordination to assist local jurisdictions in the recovery phase of any disaster. The Recovery Plan is structured similarly to the SEOP but is organized around Recovery Support Functions (RSFs). Mitigation is primarily addressed under the Community Planning and Capacity Building RSF, which places "an emphasis on the integration of hazard mitigation throughout the continuum of pre- and post-disaster recovery planning and implementation." As the Primary Entity, OEM is tasked to:

  - "Aid communities in identifying mitigation opportunities through hazard risk assessments"
  - "Support development of local and tribal mitigation plans.

  See Section 5.4.4 Integration of Mitigation into Post-Disaster Recovery Operations for more information. See also Section 6.3.3 for the discussion of how the SHMP informs and is integrated into the Recovery Plan.

- **bReadySD** is a statewide emergency preparedness program with tips, events, and tools you can use to talk with your family about having a plan in the event of a disaster. https://bready.sd.gov/

- The **OEM website** includes mitigation-related material, including answers to questions such as "Are counties required to complete a Pre-Disaster Mitigation plan?", "What are a community's responsibilities to participate in NFIP?", and "How do I know if I should have flood insurance?"
- OEM co-chairs the **State Drought Task Force** as discussed in Section 4.2.2.
- Over the years, OEM mitigation staff has developed a GIS map of all mitigation projects in South Dakota since 1992. The team tracks the location, subapplicant, status, federal share, and the project's funding opportunity. In 2023, the team developed multiple story maps that provided how-to guides with project-specific checklists of the most commonly developed project types. These story maps have received positive reviews from the grant writers and subapplicants applying for our HMA grants. The goal is to provide grant writers with a one-stop shop for the latest guidance, tips, and tricks for a successful grant application.
- Staff has provided numerous workshops on completing a complete Benefit-Cost Analysis to grant writers and communities. This technical assistance is vital to a successful grant application, as there have been numerous changes in how the BCA is completed. One recent positive change is the ability to include social benefits for projects that directly affect citizens and their homes. Including social benefits has increased the benefit-cost ratio past a passing ratio in numerous grant applications.
- In addition to the State-led technical assistance to subapplicants, the State has also utilized the newly formed Regional Technical Assistance team. The RTA has provided valuable assistance in reviewing two competitive projects for the Building Resilient Infrastructure and Communities (BRIC) grant. The guidance and recommendations from the RTA have directly resulted in the State's first competitive grant award in the BRIC grant for the community of Mobridge. This grant will make their local drinking water intake more resilient to future natural disasters.
- By providing funding for Hydrologic and Hydraulic (H&H) Studies and project scoping applications, the state is supporting these communities in understanding and mitigating the risks associated with flooding. The allocation of $1.6M for 25 H&H Studies/Project Scoping projects is a significant investment in disaster resilience. These studies will likely play a crucial role in developing effective flood mitigation strategies and infrastructure projects. The fact that some of these studies are already transitioning into Hazard Mitigation Assistance (HMA) projects or securing funding from other sources is a positive sign of the impact and value of the initial investment.

4.3.2. Division of Wildland Fire

South Dakota Wildland Fire has 10 separate but interdependent program functions. None of the program functions can stand-alone and still meet the responsibilities of the agency as defined by state law. The 10 functional program areas are:

- Fire Suppression
- Prescribed Fire
- Wildland Fire Training
- Fire Aviation
- Fire Management
- Hazardous Fuels Mitigation
- Volunteer Fire Assistance
- Federal Excess Personal Property (FEPP) and Firefighter Property (FFP)
- Dispatch

- Fire Prevention

Community Wildfire Protection Plans

The enactment of the Healthy Forests Restoration Act (HFRA) in 2003 provided incentive to communities to develop Community Wildfire Protection Plans (CWPPs). These plans are used by the SD Wildland Fire Suppression Division (SDWFS) and US Fish & Wildlife Service (USF&WS) to give consideration and priorities to local communities regarding their forest management and hazardous fuel reduction projects. CWPPs typically address issues such as wildfire response, hazard mitigation, community preparedness, and/or structure protection. Currently Butte, Custer, Perkins, Stanley, Pennington, Meade, Fall River, and Lawrence Counties as well as Rapid City have CWPPs. Under these plans, National Fire Plan fuel mitigation grants are administered by the South Dakota Wildland Fire Division to meet hazardous fuel reduction projects around "communities at risk" identified in the CWPP's.

Firewise Program

Firewise is a program run by the National Fire Protection Association (NFPA) that teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action to prevent losses. Communities develop an action plan that steers their residential risk reduction activities, while engaging and encouraging their neighbors to become active participants in building a safer place to live.

Nine South Dakota communities are currently Firewise participants, all in the Black Hills area. Mountain Plains I and II, subdivisions located on the west side of Spearfish, became the first Firewise Community in South Dakota in 2003 and was one of the original pilot program sites; they have worked hard over the years to maintain that status, and are one of the few communities to reach 20 years of recognition. The Department of Agriculture, Wildland Fire Division is the lead agency for administering the Firewise program.

Black Hills Forest Fire Protection District

The Black Hills Forest Fire Protection District (BHFFPD) was created in state law in 1941 as a community risk reduction strategy to protect the Black Hills area from "unusual fire dangers". All open burning is banned in the BHFFPD unless a permit is first obtained from either the State of South Dakota or the Black Hills National Forest. The permit process reduces the chances of escaped open fires burning structures and other man-made improvements.

4.3.3. South Dakota State Fire Marshal

The State Fire Marshal's office is a division within the South Dakota Department of Public Safety, and assists fire departments throughout South Dakota with training, fire reporting and investigation, public education, fire prevention and code compliance. The State Fire Marshal's Office has adopted the International Building, Fire, and Mechanical codes. Under Statutory Authority, the State Fire Marshal's Office is charged with regulating and overseeing:

- The construction, addition, remodeling and inspections that occurs in all K-12 schools.
- Reviewing and approving plans for flammable and combustible liquid and propane facilities.
- Reviewing and approving plans in cooperation with Department of Social Services for any licensed child care (daycare) facilities.
- Providing technical assistance to the SD Department of Health with plan and code review on licensed Lodging Facilities (Hotel/Motel) when requested.
- Administering the Pressure Vessel, Boiler inspection and licensing program.
- Providing assistance to the SD Office of State Engineer with plan and code review for State Buildings under construction, addition, renovation or inspection, when requested.

The State Fire Marshal also is available to assist local jurisdictions, when requested, for plan and code interpretation, for buildings that are under the local jurisdictions control.

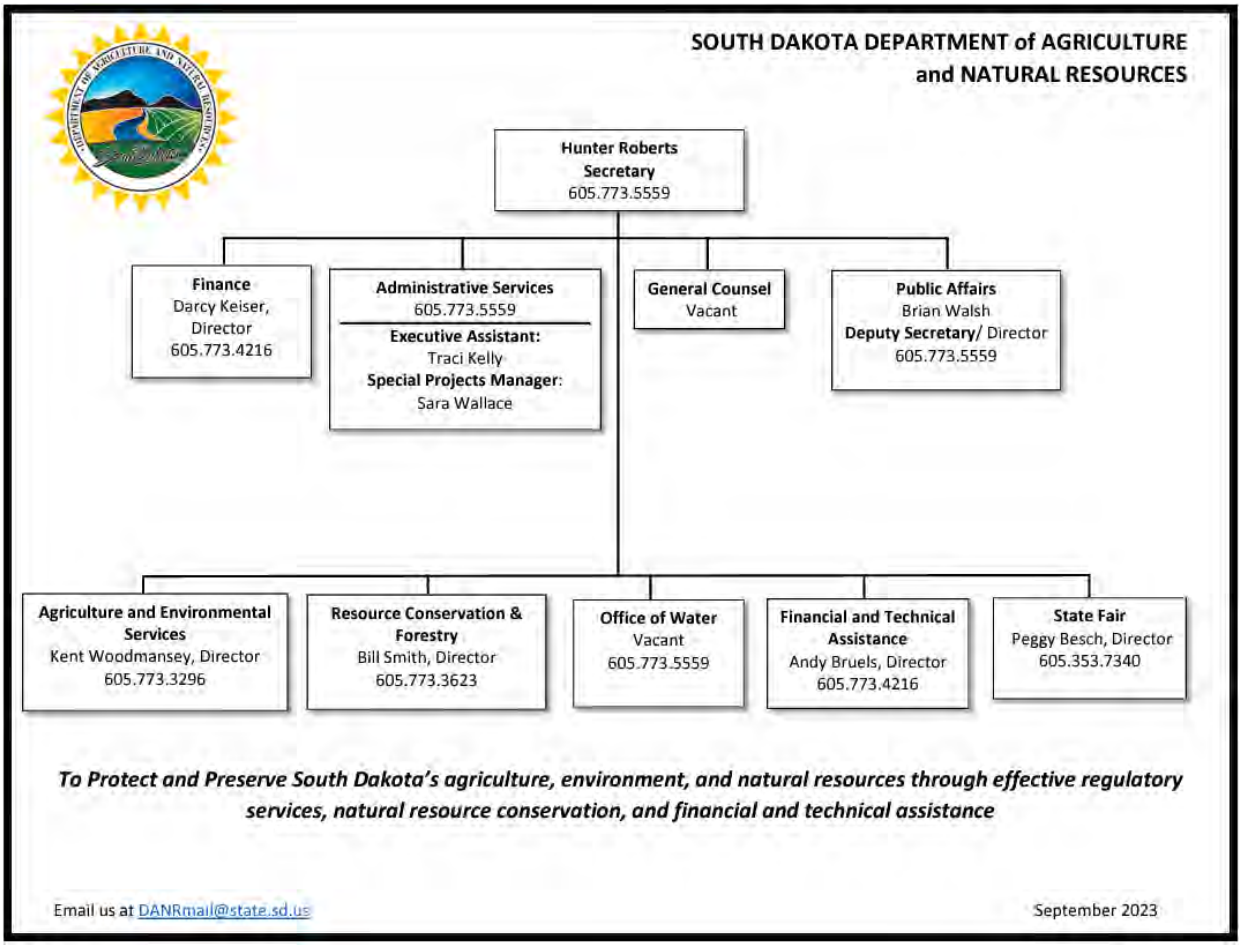
4.4. Other State and Regional Agencies

44 CFR Part 201 Requirement:
The mitigation planning process should include coordination with other State agencies…and be integrated to the extent possible with other ongoing State planning efforts. *[The State mitigation strategy shall include a] discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area.*
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Demonstration that the plan is integrated to the extent practicable with other State and/or regional planning initiatives (comprehensive, growth management, economic development, capital improvement, land development, and/or emergency management plans).*

4.4.1. South Dakota Department of Agriculture & Natural Resources (DANR)

The Department of Agriculture & Natural Resources (DANR) was formed in 2021 by merging the Department of Agriculture (SDDA) and the Department of Environment and Natural Resources (DENR).

Figure 4-3 South Dakota Department of Agriculture & Natural Resources



Source: DANR

In addition to encouraging mitigation through programs and policies, the DANR promotes resiliency amongst ranchers and farmers through public outreach campaigns. As discussed in Section 4.2.2, DANR co-chairs the State Drought Task Force and regularly coordinates with OEM through participation on the Task Force and SHMT. Several other mitigation related programs, policies, and funding opportunities exist within DANR; these are outlined in the Capabilities Matrix, with the most significant described in the following sections.

Hazard Mitigation Grant Program Post Fire

Beginning with federal Fiscal Year 2017, FEMA began providing HMGP funds for mitigation following Fire Management Assistance declarations. DANR's Division of Wildland Fire has worked closely with OEM to develop and implement guidance for HMGP Post Fire grant funding. The state prioritizes funding for the area of the burn scar, the watershed, and the county included in the declaration; remaining funds may be awarded to other mitigation action across the state.

OEM continues to work with DANR on developing immediate actions and tasks that need to be accomplished after the fire, and other mitigation actions to assist in the restoration of the burn scar area. OEM and DANR are coordinating to develop shovel-ready projects that can be submitted quickly following the next FMAG award. DANR and OEM are also developing an Environmental Planning and Historic Preservation Programmatic Agreement to facilitate a quicker approval of pre-selection mitigation actions for future funding opportunities. Mitigation Action 4-3 (page 5-15) will further enhance coordination for this program.

Water and Wastewater Funding

DANR's Division of Financial and Technical Assistance is responsible for evaluating the natural resources of the state and providing technical and financial assistance for the protection, restoration, and development of those resources. One program found under this division is Water and Wastewater Funding. Reviews of projects seeking funding through the Board of Water and Natural Resources are conducted through this program. Projects requesting funding must be on the State Water Facilities Plan (https://danr.sd.gov/Funding/docs/2022SWP.pdf). Other funding found through this board includes:

- Small Community Planning Grant Program – Provides small communities with 2,500 people or less with funds to hire a consultant to develop a preliminary engineering study, a rate analysis, or a project specific engineering report.
- Consolidated Water Facilities Construction Program – Provides grants and loans for small water, wastewater, and watershed projects.
- Clean Water State Revolving Fund Program – Provides low interest loans for wastewater, storm sewer, and nonpoint source projects.
- Drinking Water State Revolving Fund Program – Provides low interest loans for drinking water projects.
- Solid Waste Management Program – Provides grants and loans for solid waste and recycling projects.
- State Water Resources Management System – Provides grants and loans for projects that have been established by the Legislature as a priority objective for water resources management in South Dakota.

Water and Waste Funding also works with staff from Rural Development to coordinate state and federal financial assistance when applicants request financial assistance from both agencies. Program staff work with the SD DOT concerning water/wastewater projects that are concurrent with a road project and with the State Revolving Fund concerning water/wastewater projects that are deemed to be green infrastructure type projects. For more information on funding sought through SD DANR's Water and Waste Funding Program, visit http://DANR.sd.gov/dfta/wwf/wwf.aspx.

South Dakota Dam Safety Program

The National Dam Safety Program (NDSP) is a partnership of state agencies, federal agencies, and other stakeholders that encourages and promotes the establishment and maintenance of effective Federal and state dam safety programs to reduce the risks to human life, property, and the environment from dam related hazards.

The NDSP is implemented through the DANR as the South Dakota Dam Safety Program. Requirements for dam building, including permitting and the Safety of Dams rules, are administered through DANR. Details on the status of the dams in South Dakota (high hazard, significant hazard, low hazard) are included in Section 3. DANR receives FEMA State Assistance Grant funding to reduce risks to life and property associated with dams, increase awareness of the benefits and risks related to dams, and advance the state practice of dam risk management. DANR holds a dam owner/operator inspection training class every 3-4 years a part of these activities. DANR Water Rights Program section is the lead agency for implementing this program.

For more information on the Dam Safety Program, visit https://danr.sd.gov/OfficeOfWater/WaterRights/Dams/DamSafety.aspx.

Geological Survey Program

The Geological Survey Program performs scientific investigations designed to generate information on South Dakota's geologic and hydrologic resources. Recently efforts have concentrated on to completing countywide assessments of geologic and hydrologic resources in the eastern half of the state. With the completion of the countywide studies, the focus is now centered on the protecting the state's natural resources. The Survey has begun long term efforts to monitor the water quality of the state's shallow aquifers as well as produce more detailed mapping of the shallow aquifers in the state. A network of 144 observation wells in 25 aquifers monitors the present quality of shallow ground water resources in the state, as well as examines short- and long-term trends in water quality.

State Emergency Response Commission (SERC)

The South Dakota State Emergency Response Commission (SERC) was created to implement the state elements of the Emergency Planning and Community Right-To-Know Act (EPCRA). The SERC assists with local emergency planning committee plan development and reviews local plans for completeness; reviews local plans to determine the level of threat from an accidental release of dangerous chemicals and the local capability to adequately respond to those releases; prepares recommendations for action to be taken to develop and coordinate emergency response capabilities, including the feasibility of regional emergency response; evaluates various options and prepares a recommendation concerning funding based on user fees to support on-going emergency planning activities and incident response preparedness; develops recommendations for future state emergency response commission structure; designates local emergency planning districts and supervises and coordinate the activities of the local emergency planning committees; and coordinates and implements federal grants for training of local emergency planning committees and public sector employees.

The SERC meets quarterly and is coordinated and supported by DANR. The Commission is composed of ten individuals, including the Secretaries of the Departments of Agriculture and Natural Resources, Transportation, and Public Safety or their designees, as well as the Director of the Division of Emergency and Disaster Services. The remaining six members are appointed by the Governor, to include: an elected or appointed member of a political subdivision, a member of the chemical industry, a person actively engaged in an agricultural business, a health care professional, a member of a fire department, and a member of a local emergency planning committee.

South Dakota Forest Action Plans – Assessment and Strategy

South Dakota's forest action plan provides a comprehensive summary of the five forest types that occur in the state and establishes priority landscapes for targeting management resources. These forests are examined in terms of extent, condition, values, threats, ownership, needs, problems, and opportunities. The Statewide Strategy provides direction for addressing the issues and threats facing these forests and details strategies, existing resources, needs, partners, and monitoring (https://www.stateforesters.org/districts/south-dakota/).

Beat the Beetles Mountain Pine Beetle Control Plan

The infestation of pine beetles in the Black Hills has led to dead and dying pine trees, which increase the chances of wildfire. In 2013, South Dakota House Bill 1050 appropriated $2 million for mountain pine beetle suppression. This project allowed the Black Hills National Forest to implement effective pine beetle mitigation tactics on up to 248,000 acres in critical areas. This included large-scale thinning and timber harvest on approximately 48,000 acres. Due largely to these efforts, the mountain pine beetle population in the Black Hills has dropped to acceptable levels. Forest Health personnel from DANR and USFS continue to monitor this situation and all potential forest health threats.

Integration Activities

Additional examples of recent integration activities involving DANR programs and staff include:

- The DANR Big Sioux Flood Information System, which came online in 2018, has the ability to predict the severity of flood events under a range of climatic events and is intended to support the implementation of appropriate countermeasures to mitigate the impacts to life and property in extreme events. The project was a collaborative effort of State and local government and utilized a consultant team.
- Staff from DANR served a term in 2017-2018 on the National Integrated Drought Information System (NIDIS) Executive Council. The NIDIS program was authorized by Congress in 2006 (Public Law 109-430) with an interagency mandate to coordinate and integrate drought research, building upon existing federal, tribal, state, and local partnerships in support of creating a national drought early warning information system.
- Staff from DANR participates on a team comprised of staff members from several other state and federal agencies to develop and implement an Upper Missouri River – Plains Snow and Soil Moisture Monitoring Network as authorized by Congress in the Water Resources Development Act of 2014, the Water Resources Reform and Development Act of 2016 and the America's Water Infrastructure Act of 2018.
- From 2016 through 2018, DANR worked with SD DOT, DPS, BIT, local governments, and the private sector to create the Big Sioux River Flood Information System, a web-based tool that can be used by government officials and the general public to predict the impact of flood events in the Big Sioux River Basin.
- DANR leverages the existing USGS stream gauges in the state by adding their own stream sensors. The USGS stream gages provide real-time streamflow monitoring and long-term historical record and are used by the NWS and others in making flood forecasts and flood monitoring. The new DANR stream sensors are in place to provide water flow information at water quality monitoring sites DANR maintains for regulating water quality on public waters. NWS also leverages this information in order to have additional locations to make flood forecasts and provide better flood monitoring. The Big Sioux River Flood Information System discussed above uses real-time river stage information from both the USGS sites and the DANR sites in the hydrologic and hydraulic modeling for predictive purposes.

4.4.2. South Dakota Department of Transportation (SDDOT)

The mission of the SDDOT is to efficiently provide a safe and efficient transportation system. Programs administered under this department include transportation inventory management; road and bridge design, construction, maintenance, and inspection; and public safety outreach campaigns.

Emergency Relief (ER) Program

The Emergency Relief (ER) program is administered by the SDDOT in conjunction with the FHWA. Roads and bridges on Federal-aid highways that are damaged as a direct result of a natural disaster or catastrophic failure from an external cause are eligible for ER funds. Federal-aid highways are public roads that are classified as arterial, urban collectors, and major rural collectors. Highways that are classified as minor rural collectors or local roads are not eligible for ER funding even if other federal-aid funds have been used on those roads. For example, "off system" bridges that were replaced with federal-aid funds or non-highway projects that were constructed with enhancement funds are not eligible for ER funding. State roadway classification maps identify these routes and their designations. The FHWA publication "Guidance for the Functional Classification of Highways" has descriptions of the functional classifications. It is available at http://www.fhwa.dot.gov/policy/ohpi/hpms/fchguidance.cfm.

Title 23 Code of Federal Regulations (23 CFR) Part 668, Subpart A provides that an event generally must have caused at least $700,000 (federal share) in eligible damage for the event to be eligible for ER funding. Disaster damage less than $700,000 (federal share) is generally considered to be heavy maintenance or routine emergency repair. For exceptions to this damage threshold, see 23 CFR 668.105(j). By policy, a minimum $5,000 in repair costs per site is used to determine if sites are eligible for ER funds. Sites that have sustained less than $5,000 in damage are generally considered to be heavy maintenance. Chapter II, Section C-3, "Damage Estimate under $5,000 per Site" provides further guidance on the definition of a site.

The ER program generally provides funding to repair and restore highway facilities to pre-disaster conditions. ER funds are not intended to replace other federal-aid, state, or local funds for new construction, to correct non-disaster related deficiencies, or to otherwise improve highway facilities." (FHWA Emergency Relief Manual, May 2013 – https://www.fhwa.dot.gov/reports/erm/er.pdf)

The Local Roads Map Viewer and additional information on the ER program are available at https://dot.sd.gov/doing-business/local-governments/emergency-relief-er.

Integration Activities

Additional examples of recent integration activities involving SDDOT programs and staff include:

- SDDOT developed The South Dakota Department of Transportation (SDDOT) Environmental Procedures Manual, 2019, which provides guidance to SDDOT, consultants, and contractors performing environmental services associated with SDDOT transportation projects. The Environmental Procedures Manual (EPM) states that mitigation measures are incorporated in all proposed actions and must be considered for all impacts, regardless of their significance. The EPM is updated periodically to address changes to environmental laws and regulations and to include the latest avoidance, minimization, and mitigation techniques. https://dot.sd.gov/doing-business/environmental/about-environmental.
- SDDOT runs the state Bridge Inspection Program, as part of the Federal Highway Administration's (FHWA's) National Bridge Inspection Program. All structures that are defined as highway bridges located on all public roads are inspected on an interval of 12, 24, or 48 months, depending on the category of bridge. Public safety is first and foremost. FHWA conducts an annual review of the SDDOT bridge inspection program to enhance an already robust bridge inspection program.
- SDDOT collaborates with the FHWA on an interdisciplinary scour team that convenes on an as-needed basis to review scour critical bridges and mitigation measures.

4.4.3. South Dakota State Historic Preservation Office

The State Historic Preservation Office (SHPO) manages the National Register of Historic Places program of the National Park Service in South Dakota. An office within the Department of Education, the program surveys, inventories, and registers historic properties; monitors state, federal, and local government activities that affect cultural and historic resources; provides advice on preservation methods; promotes public education on historical properties; and supports municipal and county historic preservation commissions to advance the state's economic, social, and education objectives. The State Historic Preservation Officer reviews state and local project submittals for FEMA grant funding. The SHPO is on the SHMT and reviews mitigation projects, such as those submitted for FEMA grant funding, for compliance with the National Historic Preservation Act (NHPA). One grant program, described below, could be used toward mitigation projects in the State.

Deadwood Fund Grant

This grant is funded by a portion of the gambling revenue generated in Deadwood, South Dakota. Grants range from $1,000 to $25,000 and are given toward projects that retain, restore, or rehabilitate historic buildings, structures, and archaeology sites for commercial, residential, or public purposes. Rehabilitation projects can include improvements to historical structures that have been damaged by a disaster.

Integration Activities

Additional examples of recent integration activities involving SHPO programs and staff include:

- OEM coordinates with SHPO closely on all mitigation projects. During a home buy-out project in Waubay, special reports and pictures had to be taken of historic homes and reviewed with SHPO before the homes could be approved for demolition.
- SHPO coordinated with OEM and FEMA on the rehab of Garrison Dam, which is listed in the National Register of Historic Places.
- OEM staff reviews all project files before they are destroyed to share any significant historical data/pictures for SHPO archives.
- The Whitewood Creek Flood Damage Mitigation project recently was initiated in the National Historic Landmark of Deadwood. This required extensive consultation amongst OEM, FEMA, SHPO, the City of Deadwood, and the National Park Service.

4.4.4. South Dakota Department of Health (DOH) – Office of Public Health Preparedness and Response

The mission of the Office of Public Health Preparedness and Response is to develop and maintain the relationships, infrastructure, and expertise necessary to prepare for and respond to public health emergencies. A wide range of public health services to prevent disease, promote health, and ensure access to needed, high-quality health care is supported through this office. Two programs are described in detail below.

Hospital Preparedness Program

The primary focus of this program is to provide leadership and funding to enhance the infrastructure of hospitals to plan for, respond to, and recover from mass casualty events. Funding is used to improve surge capacity and enhance community and hospital preparedness for public health emergencies.

Public Health Emergency Preparedness Program (PHEP)

PHEP funding provides approximately $700 million annually to 50 states, four localities, and eight US territories for building and strengthening their abilities to respond to public health incidents. To be eligible for this federal funding, the State has identified 15 public health preparedness capabilities under the following categories that are defined by the Center for Disease Control to help assist state and local planners in identifying gaps in preparedness, determining specific priorities, and developing plans for building and sustaining capabilities:

- Bio-surveillance
- Community Resilience
- Countermeasures and Mitigation
- Incident Management
- Information Management
- Surge Management

SD DOH maintains the state Pandemic Influenza plan, which was originally published in 2006. Goal 3 of the SD DOH Strategic Plan 2020-2025 states that by October 2023, DOH will be prepared to respond to pandemic influenza, will update the Pandemic Influenza Annex, and distribute it to their incident management team. These activities are currently in the process of being finalized. Additional DOH plans include a Points of Dispensing plan and a Strategic National Stockpile plan, which is response-oriented and incorporates mitigation planning.

Integration Activities

Additional examples of recent integration activities involving DOH programs and staff include:

- DOH was a major collaborator on the Drought Task Force during development of the 2015 South Dakota Drought Mitigation Plan. DOH directed a vulnerability assessment of the Health and Socioeconomic Sector, focusing on both Physical/Public Health and Behavioral Health. The assessment used the Social Vulnerability Index (SOVI) developed by the University of South Carolina's Hazards and Vulnerability Research Institute to measure the social vulnerability of South Dakota counties to environmental hazards. The analysis identified adaptive capabilities that could address the vulnerabilities and made recommendations for future actions and further studies, several of which fed directly into Mitigation Actions. (See Table 5-4, Actions DMP 1.4, DMP 1.5, and DMP 5.3).

4.4.5. South Dakota Bureau of Information and Telecommunications (BIT)

The Bureau of Information and Telecommunications (BIT) is made up of the following areas: Administration, Data Center, Development, Telecommunications, and South Dakota Public Broadcasting. The BIT Service Desk provides assistance to state employees in a variety of ways from information and technology computing, helpdesk and desktop management, and telephone service needs. Mitigation-related tasks taken on by this agency are funded by the requesting agency. BIT works closely with OEM on flood inundation mapping, and BIT houses the IT infrastructure OEM uses to map mitigation projects and post them on their website.

The following programs that support mitigation are administered by the SD BIT.

Geographic Information Systems

State agencies utilize the GIS infrastructure to take advantage of the centrally located data by creating web applications to publish their data to the Internet. GIS is used for many applications from flood prediction and management to tax rate evaluation. Online maps and GIS data are available via the SD GIS website (https://opendata2017-09-18t192802468z-sdbit.opendata.arcgis.com/)). GIS informal training is offered to GIS users within the state government. SD BIT has been involved in creating statewide LiDAR data that is used by localities for planning and zoning purposes.

State Radio System

This system includes over 24,000 registered radios that provide public safety communication to South Dakota law enforcement, first responders, public safety, and supporting agencies at the local, state, federal, and tribal level.

Digital Dakota Video Network (DDN)

The DDN is a statewide interactive video communication that provides an integration of platforms and is used to provide a meeting pipeline across the State of South Dakota and the global community.

South Dakota Public Broadcasting (SDPB)

SDPB is a statewide TV and radio broadcaster. It is the statewide point of contact for the Emergency Alert System and Amber Alert System.

The South Dakota Network (SD.Net)

SD.Net allows community members to listen to live and on-demand hearings and floor debates of the SD Legislature, as well as many more types of events.

Business Continuity

Data storage is provided through a secure and reliable environment by using technologies that provide redundancies and the ability to restore lost or damaged data. Business continuity refers to activities performed daily to maintain service, consistency, and recovery for applications defined as critical business functions. Client service includes the executive, legislative, and judicial branches as well as constitutional and elected offices.

Integration Activities

Additional examples of recent integration activities involving BIT programs and staff include:

- BIT coordinates with many state, regional, local, and tribal agencies on the development and implementation of FirstNet.
- BIT works with OEM at Technical Advisory Group meetings to ensure all state agencies have the data they need to support each other during a disaster.
- BIT facilitates LiDAR collection that is used by many state agencies during their project developments.

4.4.6. South Dakota Office of Risk Management

Under the State Bureau of Administration, the mission of the SD Office of Risk Management (SD ORM) is to efficiently and effectively protect the assets of the state of South Dakota in the conduct of governmental activity. This mission is accomplished through the use of risk management and insurance programs as well as safety and loss techniques. Programs to reduce risk include property, boiler, and aviation insurance; fidelity bonds; risk audits of state government buildings; and a public entity pool for liability. Loss Control Committees, comprised of employees within their agencies, are strongly encouraged to be implemented in all areas of state government. These committees normally meet on a quarterly basis and are responsible for reviewing loss history and safety and health concerns in their respective arena, as well as to conduct a walk-through of their buildings and grounds to identify and correct any hazards. In addition, the Extraordinary Training Fund provides funding toward training programs that can help reduce risk to the state government.

Integration Activities

Additional examples of recent integration activities involving Office of Risk Management programs and staff include:

- The ORM has included language in policies and training materials with the intent of mitigating environmental impacts by the following specified activities, such as the use of risk analysis and a go/no-go decision-making criteria.
- The ORM worked with OEM to improve insurance coverage for state government buildings. In the past, the state would take out policies on individual buildings only after a building was impacted by a disaster. Now all state government buildings are covered under an insurance policy; thus, only the deductible needs to be funded when a Presidential disaster is declared. This includes flood insurance and impacts.

4.4.7. South Dakota Office of Homeland Security

The South Dakota Office of Homeland Security (SDOHS) works to prevent terrorism, enhance security, and support response for all-hazards incidents. SDOHS was established in 2003 to address terrorism-related threats in South Dakota. Since its creation, SDOHS has broadened its scope to focus on an inclusive, all-hazards approach to homeland security as well as expanded partnerships in the state at all levels of government and in the private sector. To meet their mission, the SDOHS oversees several programs, as described below.

SDOHS develops and maintains the State Homeland Security Strategic Plan, which identifies the state's capabilities in preparing for human-caused hazards. SDOHS also manages the state's Critical Infrastructure Protection Program (CIPP), and conducts CIPP assessments of government buildings, hospitals, and schools. These activities help state, local, and tribal governments to identify facility-based vulnerabilities and to build critical infrastructure protection programs.

South Dakota Law Enforcement Telecommunications System (SD LETS)

The SD LETS is a public safety communications network for law enforcement, courts, public safety agencies, and criminal justice professionals across South Dakota. These organizations use SD LETS to send and receive information, transmit data, and share communications across the state regarding important public safety matters. SD LETS also verifies South Dakota's warrants, offender files, protection order files, and probation and parole files. SD LETS interfaces with the national-level system to provide communications between federal, state, and government agencies.

Homeland Security Grants

The SDOHS provides grant funding through an application and award process to state agencies, law enforcement, counties, cities, tribes, schools, and other agencies to protect and recover from acts of terrorism and catastrophic events. The grants assist city, county, state, and tribal governments secure the resources needed to prevent, respond to, and recover from hazards. These grants have been used to purchase radios, communication towers, generators, shelters, and warning sirens, and to support regional response teams.

South Dakota Fusion Center (SDFC)

The SDFC compiles, analyzes, and disseminates criminal intelligence to support terrorism prevention and the investigation of criminal activity. It functions as a part of the National Fusion Center System that serves as a focal point for threat-related information. The SDFC identifies emerging threats while enhancing the capability of safety partners by receiving, gathering, analyzing, and disseminating criminal intelligence and public safety data in a timely and actionable manner.

Integration Activities

Additional examples of recent integration activities involving SDOHS programs and staff include:

- SDOHS works closely with OEM and other agencies on equipment purchases and other grant projects. A good example is the purchase of generators for critical facilities. Some communities may apply for both mitigation funds and homeland security funds for these projects or may be ineligible for one program but eligible for another. Close coordination between SDOHS and OEM helps reduce duplication, verifies prioritization, and helps ensure grant funds are used efficiently.

Threat and Hazard Identification and Risk Assessment (THIRA)

The Threat and Hazard Identification and Risk Assessment (THIRA) is used by South Dakota to better understand its threats and hazards, and how the impacts may vary according to time of occurrence, season, location, and other community factors. This knowledge helps the state establish informed and defensible capability targets, and commit appropriate resources drawn from the whole community to close the gap between a target and a current capability, or for sustaining existing capabilities. As noted in Section 3.1.4, South Dakota's THIRA, originally developed in 2012 and updated periodically, is an all-hazards risk assessment that analyzes the State's capabilities toward addressing natural, human-caused, and technological hazards. The THIRA was updated most recently in 2023.

Development of the South Dakota THIRA follows the process outlined in CPG 201 "Threat and Hazard Identification and Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR) Guide." The THIRA is primarily a capability assessment process, but it uses an all-hazards risk assessment as its foundation. The THIRA adds context to the hazard information and risk assessment provided by the ESHMP and identifies desired outcomes and target capabilities based on the core capabilities established by the National Preparedness Goal. The HIRA (Section 3) of the ESHMP is utilized as a key input in the ongoing development of the THIRA. In turn, information from the THIRA, particularly in the planning scenarios, is integrated into the HIRA section of this ESHMP. See Section 6.3.1 for more details on how these plans interact.

Homeland Security and Emergency Management Senior Advisory Committee

The Homeland Security and Emergency Management Senior Advisory Committee (HSEMSAC) provides recommendations for the administration of Homeland Security and Emergency Management programs throughout the state. Committee representatives include:

- Animal Industry Board
- Attorney General's Office
- Bureau of Information and Telecommunications
- Chiefs of Police Association
- Department of Tribal Relations
- Governor's Office of Tribal Relations
- Native American Tribes
- OEM Regional Coordinators
- SD Department of Agriculture and Natural Resources
- SD Department of Game, Fish and Parks
- SD Department of Health
- SD Department of the Military
- SD Department of Public Safety
- SD Fusion Center
- SD National Guard
- SD Office of Homeland Security
- SD Highway Patrol
- Sheriffs Association
- State Radio Communications
- Taskforce 1
- U.S. Department of Homeland Security

4.4.8. South Dakota Game, Fish & Parks

Game, Fish & Parks serves the public in the management and enjoyment of South Dakota's outdoor resources. The Game, Fish & Parks Commission, by legislative mandate, serves as the advocate and liaison between Game, Fish & Parks and its stakeholders – the people of South Dakota. The law enforcement team protects outdoor resources by responding to violations. Game, Fish & Parks actively seeks partnerships for wildlife habitat management and hunting access as well as supporting cooperative research opportunities. Game, Fish & Parks also offers services such as wildlife damage control. A variety of technical resources for managing habitat and maintaining South Dakota's natural resources are available on the South Dakota Game, Fish & Parks website (http://gfp.sd.gov/wildlife/private-land/technical.aspx).

Statewide Comprehensive Outdoor Recreation Plan

The South Dakota Department of Game, Fish and Parks (GFP) – Division of Parks and Recreation maintains and promulgates the South Dakota Statewide Comprehensive Outdoor Recreation Plan, last updated in 2018. This plan analyses and lays out a plan for "how to best meet the needs of our citizens to provide quality, accessible outdoor recreational facilities in our state." This includes strategies and measures related to hazard mitigation, such as:

The Plan's Strategy #2, states to "Be vigilant against potential threats, including fires, floods, pollution, infestations, overuse and abuse of outdoor recreation lands.", and describes steps to attain that strategy:

- Continue to train staff in controlled burning and firefighting methods and coordinate with appropriate agencies, as needed.
- Research common and alternative methods for land management and protection.
- Continue to monitor small head dams.
- Collaborate amongst agencies to fight insect infestations, including the pine beetle, Emerald Ash Borer and others.
- Monitor and take action in areas where there is over-use and/or abuse of the land, such as compaction on trails, erosion and other negative impacts to park lands and waters.

Chapter 4, Wetlands Component, also describes how wetlands can provide natural mitigation against hazards, through actions such as flood attenuation and reduction, water quality enhancement, erosion control, and sediment retention.

Integration Activities

Additional examples of recent integration activities involving GFP programs and staff include:

- The revision of the GFP 2021-2022 STRATEGIC PLAN to include a new focus on improving existing aquatic and terrestrial habitat on private and public lands through partnerships.
- GF&P collaborated with local conservation districts, cities, organizations and the Natural Resources Conservation Service (NRCS) to make repairs to Murdo Dam and Belvidere Dam after they were damaged in 2019 floods.
- GF&P created a Habitat Stamp Program that brought in funds that allowed efforts to address the aging dam infrastructure around the state.
- GF&P expanded their program for periodic inspections of roadways, small dams, and bridges.
- GFP worked closely with multiple state, local, and federal agencies on a shoreline stabilization project in Oacoma, which successfully mitigated the sliding issue of the hillside. The complexity of this project and the number of agencies involved highlights the successful partnerships built over many years.

4.4.9. South Dakota Housing Development Authority

South Dakota Housing Development Authority (SD Housing) was created by the South Dakota Legislature in 1973 with a stated mission to provide opportunities for quality, affordable housing for South Dakotans. SD Housing is a self-supporting, nonprofit entity known for providing innovative financing solutions to create and preserve affordable housing. SD Housing utilizes housing bonds, tax credits, and other federal and state resources to fund housing programs which provide mortgage and downpayment assistance, housing construction and rehabilitation, homelessness prevention, rental assistance, and educational opportunities.

Integration Activities

Examples of recent integration activities involving housing programs and staff include:

- OEM coordinated with the SD Housing Executive Director to review Chapter 3 HIRA during the 2023-2024 update. Feedback was provided regarding adding additional considerations for homeless populations as particularly vulnerable to hazards including flood, summer and winter storms, tornadoes and windstorms.
- See also OEM coordination in the section on Planning and Development Districts and Comprehensive Economic Development Strategies.

- OEM recognizes that coordination with the housing sector will be an area of focus in next five years and next HMP update cycle.

4.4.10. South Dakota State University (SDSU) Extension

The South Dakota State University (SDSU) Extension is the state's leading source of unbiased, vetted, and relevant new knowledge generated from research. As a cornerstone of SDSU's land-grant university mission, SDSU Extension empowers citizens to be more competitive in a growing global economy through education and technical training or assistance.

SDSU Extension's purpose is to foster a learning community environment that empowers citizens to advocate for sustainable change that will strengthen agriculture, natural resources, youth, families, and the communities of South Dakota. In pursuit of this purpose, several core values support the mission of SDSU Extension and provide the foundation for the organization. They include:

- A defined public value
- A learning community focus
- Prioritized effort
- Access for all citizens
- A setting that is inclusive, collaborative, and sustainable
- A culture that embraces change

State Climatologist

The South Dakota State Climate Office is the recognized climate office for South Dakota supplying climate and drought information, data, tools, outlooks, and a variety of other climate-related information. Information is available to residents involved in agriculture, industry, public safety, and the general public through websites, social media, print and electronic media.

Census Data Center

The SDSU Census Data Center operates as a cooperative venture between the U.S. Census Bureau and South Dakota State University.

The Center assists people in successfully accessing census data for effective decision-making and sometimes just plain curiosity. The Center takes on special projects for organizations that have special data needs, develops projects, and seeks funding to provide more and better data to the citizens and communities of South Dakota. Finally, the Center provide training to help people more effectively use the census data and presentations about our findings using the data. Their work is informed by a state-wide advisory committee.

Integration Activities

Additional examples of recent integration activities involving SDSU programs and staff include:

- SDSU developed a Holistic Ranch Management Program to put into practice a holistic approach to ranch management. The program helps ranchers develop economic and climate resilience by offering ideas about ranching as part of a diverse ecological system.
- 2023 marks the 10-Year anniversary of the Seasonal Riparian Area Management Program that partnered with landowners to maintain healthy riparian areas to address common water resource concerns and improve water quality in streams, rivers, and lakes within the Big Sioux River watershed.
- Multiple resources and planning strategies were put into place for the purpose of educating communities and assisting local governments in building sustainable places through diversifying risk, building trust and social capital in South Dakota, creating more affordable housing, creating

checklists for communities facing disasters, and getting the community connected with the right emergency information sources.
- The State Climatologist has partnered with OEM during local mitigation planning classes (G318) to present to students on climate change, the studies that SDSU is completing, and how to address climate change in local mitigation plans.

4.4.11. Rural Electric Cooperatives

The state continues to work with the Rural Electric Cooperatives (RECs) to improve the integration of mitigation practices throughout the state's electrical system. This group represents 28 distribution cooperatives and 3 generation and transmission cooperatives. OEM meets and coordinates with the RECs on a recurring basis through interaction with the Rural Electric Association and individual RECs. The Rural Electric Association was represented as a stakeholder and participated in ESHMT meetings during the update of the 2024 HMP. The HMP has covered the RECs since 2011, making all the private-nonprofit RECs eligible for mitigation funding through the HMGP.

Of particular note, the RECs have been working proactively to harden their systems by burying power lines. As of 2023, more than 700 miles of power lines had been buried. Much of this has been accomplished using state and federal mitigation funding, but the RECs also bury lines with their own funding. In a survey on South Dakota mitigation spending conducted in early 2023, the 38 RECs received $19,559,914 in mitigation grant funds over the last five years, an average of $3,911,983 per year; during that same five-year period, they reported spending approximately $226,415,575 of their own funds in line hardening activities.

South Dakota's total electricity net generation was three times greater in 2022 than it was in 2007, primarily because of increased generation from wind. In 2022, wind provided more than half the state's total electricity net generation, up from about one-fifth in 2019. In 2021, wind surpassed the state's previous leading electricity source, hydroelectric power, for the first time, when 6 of the 10 largest power plants in South Dakota by generation were wind powered. South Dakota's remaining net generation comes almost entirely from coal and natural gas. Coal's contribution declined from more than half of the state's net generation in 2008 to about one-tenth in 2022; natural gas-based net generation was almost 6% in 2022; and petroleum, biomass, and solar energy also contributed small amounts. There are no nuclear power plants in the state.

The RECs have also been very active in gathering and quantifying data on losses avoided due to mitigation efforts; see Section 5.4.6 for details.

[We have requested updated information from the SDREA]

Integration Activities

Additional examples of recent integration activities involving the RECs include:

- OEM coordinates with the RECs to maintain a list of shelf-ready line-hardening projects, to ensure that funding opportunities are not missed. The OEM mitigation team further coordinates with the individual RECs on the priority of projects, application status, and completion of projects using REC funds.
- The RECs work with linemen and tree trimming contractors to ensure trees are within a safe distance of power lines. They also conduct extensive public outreach and education, through electrical safety literature, outreach materials, and public service announcements.
- OEM attends SDREA meetings of General Managers, Operation Managers and Office Managers at least annually, to present any changes to the Public Assistance and Hazard Mitigation Assistance programs and provide updates to funding opportunities and programmatic changes.

- OEM works diligently when impending weather threatens REC infrastructure. Staff work seamlessly to share weather and damage information such as EOC forecast packages and the REC Sperry-Piltz Ice Accumulation (SPIA) Index. The SPIA Index is a scale for rating ice storm intensity, based on the expected ice accumulation as a result of a storm and the expected damage a storm inflicts on human-built structures, especially those exposed to overhead utility systems. Additionally, while monitoring the SDREA outage map, OEM can begin to assess which REC's in the state have been affected and to confirm with SDREA if outages are a result of significant pole damage or substation outages.

4.4.12. Rural Water Systems

South Dakota Association of Rural Water Systems (SDARWS) is an organization formed to monitor legislation, avoid duplication of efforts by sharing problems and solutions, and communicate with state and federal agencies concerning funding and regulations. The Association operated as a Steering Committee until January 1976, at which time the State of South Dakota granted a nonprofit corporation charter. There are 33 Rural Water Systems across the state that provide water.

The Source Water Protection Program (SWPP) is a joint project with the U.S. Department of Agriculture Farm Service Agency and the National Rural Water Association, a non-profit water and wastewater utility membership organization. The SWPP is designed to help prevent pollution of surface and groundwater used as the primary source of drinking water by rural residents. Program technicians and specialists from the USDA Natural Resources Conservation Service (NRCS) and the Farm Service Agency identify areas for pollution prevention and work with state rural water associations to create local teams to create a Rural Source Water Protection plan to promote clean source water. The plan identifies voluntary actions that farmers and ranchers can install to prevent source water pollution. This grassroots level effort educates and informs rural residents about steps they can take to prevent water pollution and improve water quality.

4.4.13. Planning and Development Districts

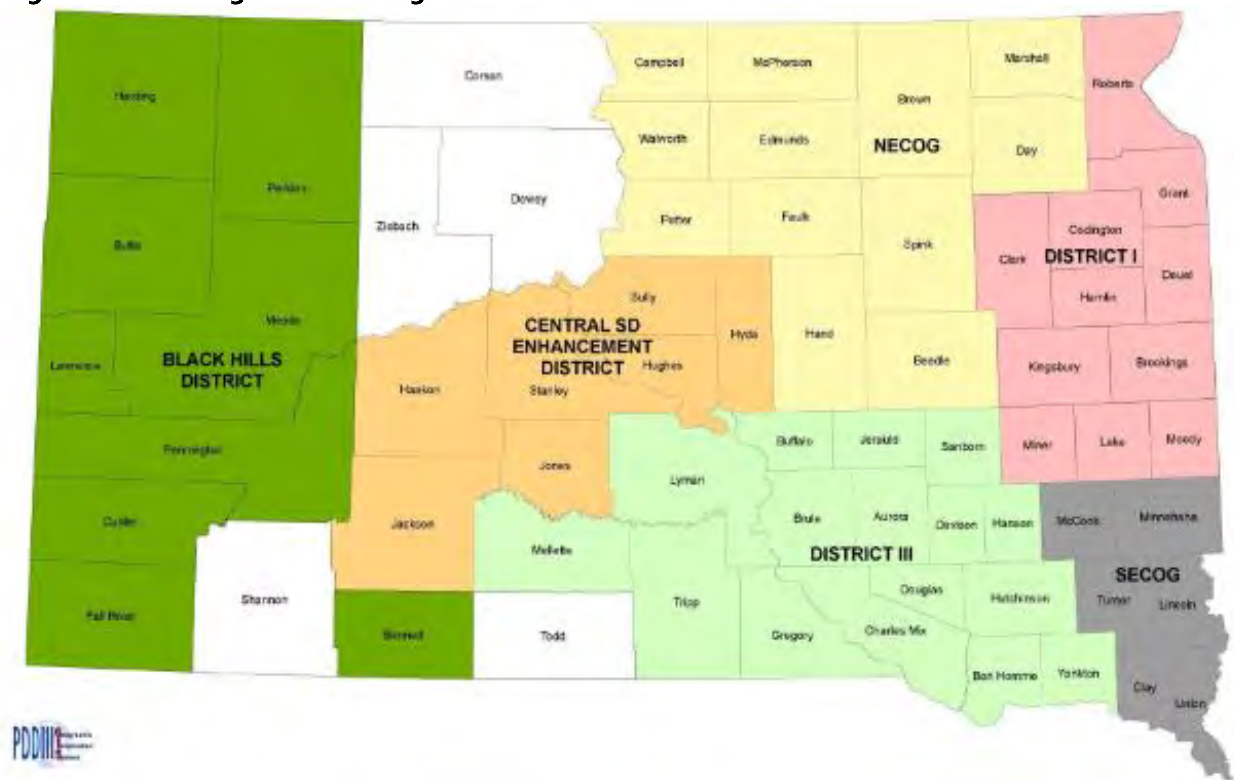
South Dakota's Planning and Development Districts were established with the purpose of improving and enhancing local communities and their economies. On December 4th, 1970, Governor Frank Farrar issued an executive order to establish the boundaries of six multi-county Planning and Development Districts, through the use of the South Dakota Codified Law (Joint Powers Statutes), which allows local governments to cooperate in undertaking planning and development activities. The districts were grouped by populations of counties in order to make districts of larger populations to pool money, provide more resources, and help manage and integrate federal grants into local programs. The six Planning and Development Districts were structured to satisfy the requirements of multiple federal agencies such as the U.S. Department of Housing and Urban Development (HUD) and the U.S. Department of Commerce's Economic Development Administration (EDA).

The First District, which was the pilot district organized before the other five districts, became an Economic Development District (EDD) in 1973. All other Districts have followed suit to also become EDDs (White and Watrel, 2013). The Planning Districts are quasi-governmental and have no legal, regulatory, or tax authorities. There is no requirement for local governments to implement or comply with policies of the district and as shown in Figure 4-4, not every county is associated with a district as it is voluntary to participate.

Each district is unique in terms of the services they provide and how they are structured. Services related to emergency management including recovery and mitigation are key services that many of the Planning

Districts offer. State policy is that if a county chooses to use a Planning District to write their Local Hazard Mitigation Plans (LHMP), then no bidding is required as the Planning Districts are considered an extension of state government. As of 2023, the Districts were responsible for writing and/or providing technical assistance for the majority of Local Hazard Mitigation Plans in the state. With the Districts' 48-year history of serving communities through local plan development, South Dakota's Planning and Development Districts have the knowledge of local communities that allows them to be more cognizant of mitigation and how to incorporate basic principles of mitigation into other planning efforts, including economic development and comprehensive planning.

Figure 4-4 Regional Planning Districts



Source: Planning & Development District III https://DANR.sd.gov/des/gw/Sourcewater/SWAP%204%20Folder/Planning_Districts_2006.pdf

Comprehensive Economic Development Strategy

The origins of South Dakota's Planning and Development Districts stem from state encouragement to support regional opportunities for economic development. As mentioned above, every Planning and Development District has also been designated by the U.S. Economic Development Administration (EDA) as an Economic Development District (EDD). One requirement of becoming an EDD is the implementation of a Comprehensive Economic Development Strategy (CEDS). A CEDS is a plan that focuses on strategies for regional economic development. The planning process for a CEDS is designed to increase a region's capacity by building a foundation in which the public sector can work with the private sector to create economic prosperity and resiliency for the region. There are four required sections of a CEDS: Background Summary, SWOT Analysis (which is required to consider natural hazard and climate change risk), Strategic Direction/Action Plan, and an Evaluation Framework. CEDS in South Dakota acknowledges the risk natural hazards pose to their regions through the SWOT analysis, specific goals and objectives, and within the specific chapter *Disaster and Economic Recovery and Resiliency*. Table 4-5 below summarizes where hazards are mentioned and have been incorporated within the South Dakota Regional Comprehensive Economic Development Strategy plans. Housing considerations are also noted.

Table 4-5 References to Hazards in Regional CEDS

Planning Development District	Location in CEDS
South Eastern Council of Governments (2019 -2024)	**Chapter II – Background –** references the region's struggle with detrimental weather patterns including storms, tornadoes, flooding, and drought. **Environment** (pg. 34) – Wetlands and Flood Plains- references the region is prone to flooding and speaks to the National Flood Insurance Program and working with communities to stay compliant with the program and assist with drafting floodplain ordinances. **Natural Disasters** (pg. 37) – Table on Federal Disaster Declarations in Region **Hazardous Waste and Toxic Contamination** (pg. 39) – Notes EPA Superfund site in the region, speak to LEPCs in the region. **Goals and Objectives** (pg. 50) – Goal 8: "Increase the region's resiliency to disasters" Objectives: "Provide technical assistance to communities to assess vulnerability to disasters; Assist communities with pre-disaster planning activities; Assist communities with pre-disaster mitigation and disaster recovery activities". **Table 21: Partnership Relationships** (pg. 61) – Lists specific relationships/agencies the Planning District works with regularly "to facilitate greater community and economic development in region". **Chapter VI – Strategic Projects, Programs, and Activities** – Table 22: Development Projects – Several projects are related to Goal 8 "increase regions resiliency to disasters" including: Property acquisition projects, generator upgrades, safe rooms, and municipal ordinances updates. **Chapter IX** – Disaster and Economic Recovery and Resiliency – broken up by Pre-Disaster Preparedness, Post-Disaster Planning and Implementation, and Economic Redevelopment.
Black Hills Council of Local Governments (2019-2024)	**SWOT Analysis** (pgs. 13-17) - Results of SWOT analysis indicate the following: Strengths = Regional partnerships, environment, growing population, business taxes, connectivity, utilities, regional airport, and transportation system, air and water quality; Weakness = low economic diversity, low wages, housing, workforce shortage, childcare options, public transportation, underemployment, lack of industrial/business parks. Opportunities = Federal gov institutions, tourism, agriculture, Sanford lab, healthcare, recreation, history; Threats = natural disasters, local support for economic development, monopolies. **Regional Challenges** (pg. 16) In any given year natural hazards, like drought, blizzards, hail, pests, diseases, and wildfires all have the potential to inflict losses on our local producers. **Vitality and Resiliency Strategy and Partner Organization Table** (pg. 19) – Reference South Dakota OEM and FEMA as partners **Action Plan** (pgs. 19-21) Strategies for community vitality and resilience include the development of programs and policies to address housing needs; providing assistance in the development and funding of infrastructure projects (water, roads, internet, etc.); providing assistance in developing and implementing pre-disaster mitigation plans; incorporating resiliency strategies into local comprehensive plans; provide mapping resources to help articulate assets and existing conditions in communities; and assist in the development of economic development capacity building workshops for EDOs, elected officials, and community/business leaders.

Planning Development District	Location in CEDS
Central South Dakota Enhancement District (2023-2028)	**Chapter V – Agriculture** (pg. 11) – Identifies major threats to the State's most valuable industry (farming and ranching) which are natural disasters, changing climate conditions, and extreme weather. **Chapter VII – SWOT** (pg. 13) – Results of SWOT analysis indicate the following: Strengths = lifestyle, leadership, vitality, relationships, economy, government, education, and transit system; Weaknesses = incomplete or missing disaster plans, community infrastructure, workforce availability, low regional collaboration, silo economy/budgets, low industry diversification, distance between communities, healthcare staff, and recreation. Opportunities = development and housing, daycare, youth and leadership retention, new businesses, tourism, economic diversification, and recreation; Threats = mediocrity vs. progress mentality, misinformation and limited sources, varying regulations, low housing contractors, workforce demands, mental healthcare, declining & aging population, and geopolitical boundaries. **Chapter VIII - Strategic Action Plan** (pg. 14)– Top survey responses to community/economic development priorities are improving access to affordable housing; attracting and retaining youth/companies/workers; developing retail and service businesses; and improvements to infrastructure and quality of life. **Chapter IX – XIII** (pgs. 15-23) Provides the goals and objectives for each identified development priority. Workforce Goal 2.3 – Consider collaboration opportunities with state and federal government. Workforce Goal 3.1 – Increasing broadband access and promoting available wireless technology. Economic Growth Goal 1.4 – Execute regional assessment to identify where infrastructure expansion and needs exist. Economic Growth Goal 2.3 Partner with local entities to educate about succession and long-term planning. Community Goal 1.2 Community gathering opportunities for networking. Community Goal 2.4 Infrastructure development (clean water, etc.) Housing Goal 1.1 Working with Legislators to expand housing infrastructure funding. Housing Goal 1.3 Leveraging partnership opportunities with local/regional transportation services. Housing Goal 3.3 Explore alternative housing development opportunities. **CEDS Strategy Implementation Summary Table** (pg. 24) Lists strategies and activities related to the goals noted above.
Planning & Development District III (2014-2019)	**Section I: Background Information – Environment** (pg. 43-44) – Notes Superfund sites, Hazardous Waste Sites, and 100-year floodplains Section V: Strategic Projects, Programs, and Activities – Describes how the previous CEDS planning period was impacted by specific events including "Unprecedented Missouri River Flooding" and "Major Drought" Section VIII: Disaster and Economic Recovery and Resiliency (pg. 108)
First District Association of Local Governments (2022- 2024)	**Executive Summary – CEDS Goals and Objectives** (pgs. 4-5) – Provides development and organizational goals and objectives generated by the CEDS Committee to guide policy and action for the next three years. **Community Development Goal** (pg. 4) To strengthen our communities and counties by enhancing their capacity to enhance the physical environment and public facilities. Objectives: Provide assistance to communities, counties and other entities for the development and maintenance of public facilities and infrastructure systems. Provide assistance to local governments in developing strategic community/economic development plans, ordinances, and regulations. **Regional Development Goal** (pgs. 4-5): Promote regional collaboration efforts in regard to issues and projects that affect northeast South Dakota.

Planning Development District	Location in CEDS
	Objectives: Collaborate on regional projects that will have long term impact in the First District region. Promote regional development strategies. Improve intergovernmental cooperation and coordination. **Economic Development Goal** (pg. 5) Improve the economic conditions and opportunities for all segments of the economy. Objectives: Provide assistance to retain and expand existing businesses and industries. Enhance public and private partnerships to address economic development needs in the region. **Organizational Goal** (pg. 5): Implement management policies, practices and reporting procedures that will allow the First District to operate in an effective, efficient, and responsive manner. Objectives: Adjust products and services offered by First District based on the evolving needs of its membership. **SWOT Overview** (pgs. 21-25) Strengths = quality of life, education, economy, leadership in workforce and economy, infrastructure, transportation network, energy costs, unemployment, gov and regional orgs; Weaknesses = available workforce, declining population, retail, development, distance to markets, affordable housing, business opportunities, employment opportunities, aging infrastructure, inadequate air service, low education levels, limited capacity and resources for infrastructure improvements, childcare options, and communication infrastructure. Opportunities = attracting youth, businesses, and workers; access to housing; grow/attract new industries to diversify economy; business development assistance; enhance public infrastructure; develop a "buy local" effort; energy development; agri-product processing; unified, regional marketing strategy; workforce development; promote low costs and quality of life; and grow the population. Threats = attracting/retaining youth, skilled workers, families; low recognition as destination for businesses/tourism; uncertainty of public funding for services and infrastructure improvements; attracting new leadership in government; external competition; infrastructure maintenance costs; worker retention; and low business succession planning. **Economic Resiliency - Pre-Disaster Preparedness** (pg. 44) The District's Geographic Information System (GIS) technology and associated tools support local emergency planning and projects involving Drainage impacts; Fire evacuation routing; and Flood water projections. **Economic Resiliency - Economic Redevelopment** (pg. 45) In the event of a disaster the First District is committed to long-term recovery efforts that focus on redeveloping communities and restoring their economic viability by providing local officials and necessary stakeholders with access to regional demographic, economic, and hazard vulnerability data; establishing relationships with local officials and non-government organizations that may provide data, funding, technical expertise, and other resources to promote short, medium, and long-term economic recovery; providing support to non-profit organizations associated with long-term recovery efforts incorporating principles of disaster resiliency strategies into existing and upcoming planning and development plans; promoting hazard mitigation strategies within a city's comprehensive planning process to promote disaster resiliency and increased economic sustainability. **Appendix D – Environmental Baseline** (pg. 72) There are no superfund sites, no major manufacturers of pesticides, and no Nonattainment Areas for criteria pollutants within this planning region. **Appendix E – Strategy Partners** (pgs. 80-82) **Economic Resiliency** (pg. 44-47) – Pre-Disaster Preparedness, Post-Disaster Planning and Implementation, Economic Development, Planning for Economic Recovery and Resiliency in Response to Covid-19 Pandemic

Planning Development District	Location in CEDS
	Appendix B – Region's Geography – (pg. 57) Table 9 Federal Disaster Declarations **Appendix D- Environmental Baseline** – (pg. 74) Figure 22 Regional Floodplains
Northeast Council of Governments (2019-2024)	**STRATEGIC PARTNERS Table 14: Partnership Relationships** (pg. 34) includes State OEM as a partner. **ECONOMIC RESILIENCE** (pg. 39) **Pre-disaster Preparedness** - NECOG works with communities and organizations across the region to prevent, protect, respond to, and recover from a broad range of threats and hazards. **Economic Resilience** – Is a component of all activities associated with economic development in the region. **APPENDIX B: ADDITIONAL REGIONAL INFORMATION - Environmental Characteristics** (pgs. 59-60) There are no superfund sites, no major manufacturers of pesticides, no sole source drinking water aquifers, no well-head protection areas, and no Nonattainment Areas for criteria pollutants under the Clean Air Act. Eleven of the twelve NECOG counties participate in the National Flood Insurance Program. **Federal Disaster Declarations** (pg. 56) Table 26 – Lists 10 events between 2008-2017. **STRATEGIC DIRECTION AND ACTION PLAN** (pgs. 24-26) Community Development Objective 1: Provide assistance to communities, counties and other entities for the development and maintenance of public facilities and infrastructure systems. Community Development Objective 2: Assist in updating hazard mitigation, disaster mitigation and/or emergency planning documents. Technical Assistance Objective 1: Enhance the capabilities of local governments. **SWOT Overview** (pgs. 23) Strengths = quality of life, workforce ethics, jobs, and resources, low cost of living, education, infrastructure, transportation network, available land for development, unemployment, gov and regional orgs, internet, healthcare. Weaknesses = declining population, affordable housing, retail, development, distance to markets, parochialism, number of Tech Schools, aging infrastructure, funding for infrastructure, access to interstate, employment opportunities, and childcare options. Opportunities = strong business climate, promoting skills development and Tech Education, promoting low costs and quality of life, attracting businesses and workers, downtown revitalization, energy development, expanding public transportation, grow/attract new industries to diversify the economy, enhancing public infrastructure, access to housing, and value-added agriculture. Threats = attracting/retaining families and skilled workers, low business succession planning, available workforce, Gov budgets/political environment, external competition, low agri-product prices, infrastructure maintenance costs, workforce retention, aging rural water systems, and attracting new leadership in government.

Comprehensive Economic Development Plans and Hazard Mitigation Plans both have the goal of increasing a community's capability to withstand or avoid the shock of a disaster. During the planning process for a CEDS, it is encouraged to consider other regional planning efforts and integrate or leverage federal funds and private resources, to advance regional goals and objectives. As shown in Table 4-5, South Dakota Planning and Development Districts have already made an effort to incorporate hazards and their risks into the regional CEDS. Similar to hazard mitigation plans, which are required to be updated every five years to qualify for federal funding, CEDS are also required to be updated every five years in order for a region to qualify for EDS assistance.

Integration Activities

Additional examples of recent integration activities involving the Planning Districts include:

- OEM stays in regular contact with each planning district regarding the development of mitigation project applications, even when there is not an open funding opportunity. OEM has encouraged submission of project applications at any time to allow sub-recipients to have shelf ready projects ready when a funding opportunity arises. OEM staff has presented mitigation program updates at all the planning district board meetings and SECOG Resource Fair. At these presentations, staff are available afterwards to discuss the independent community projects that often lead to a site visit. Without these presentations, the mitigation program would not reach as many communities to assist in funding their mitigation projects.
- Beginning in 2016, OEM has coordinated with the planning districts to increase the mitigation section of the districts' CEDS; this coordination will continue in the future to provide guidance and funding opportunities to the local communities. There may be future opportunities to update the CEDS and local hazard mitigation plans simultaneously, or at a minimum developing guidance on how each planning process can benefit from integrating specific information found within each plan.

4.4.14. Additional State Plans and Programs

Continuity of Operations Plans (COOPs)

Continuity of Operations Plans (COOPs) prepares stakeholders to continue completing their essential functions during any incident or emergency that may disrupt normal operations. In South Dakota, all state agencies are required to create and maintain a COOP for their agency. Planners with OEM coordinate planning efforts, host continuity training opportunities and manage the state continuity planning software tool to ensure all state agencies and several other entities are able to continue completing their essential functions when any array of circumstances might otherwise interfere with normal operations.

COOPs detail the mission essential functions that are critical to that agency's overall operation, the resources (including personnel and equipment) needed to perform those functions, and what actions are being taken or need to be taken to secure those resources against loss. Agencies are encouraged to coordinate with OEM on any needed actions that may be eligible for mitigation funding.

SD Emergency Management Association (SDEMA)

OEM promotes mitigation efforts through the SD Emergency Management Association (SDEMA) at the association's annual conference by providing updates to funding opportunities that the regional representatives distribute to their members. This conference provides an opportunity for local and tribal emergency managers to engage with the state OEM mitigation team.

Volunteer Organizations Active in Disasters (VOAD)

South Dakota has a state VOAD group that meets periodically utilizing the partnerships that have been developed through the National VOAD, along with some additional partnerships.

Several VOAD organizations have been working with the Oglala Sioux Tribe since a 2016 windstorm damaged and destroyed many homes. The VOADs are helping construct new buildings that are more wind-resistant, building strong stick structures instead of unsecured trailers, not using vinyl siding, and other measures. The reservation did not have access to homes like this until VOAD partners started building them.

Great Plains Fire Safe Council

The Great Plains Fire Safe Council, which is a separate non-state volunteer organization, holds public outreach meetings to talk about fire prevention subjects such as burning brush piles appropriately, vegetation clearance around structures to meet Firewise recommendations, fire resistive plants, etc. There are monthly meetings where a number of subjects are discussed, such as determining which large public events (home shows, sports shows, etc.) are coming up to potentially have a booth at, Wildfire Awareness Month activities to host/participate in, etc. The goal of this organization is to be citizen-driven and supported by the state/federal land management agencies. The Council also supports fire service agencies with various fire prevention messages across the state.

Growth Management, Capital Improvement, and/or Land Development Plans

Regarding capital improvement planning the South Dakota Department of Agriculture and Natural Resources does not have any specific requirements for design or mitigation. Typically, DANR leaves the design sizing of the storm sewers up to the engineers and the communities to work out what is the best and most practical for them, or what is in accordance with local codes and standards. Designing for even a 25-year storm can be expensive and may provide a limited benefit for the cost. Most of DANR projects design for the more frequent 5-year storm; this helps keep costs reasonable and improves the system, and while it will not fully handle the larger storms it still helps to convey the flows. South Dakota Governor's Office of Economic Development also allows the community/engineer to design the project and then requests DANR to review the plans.

4.4.15. Effective Use of State Capabilities for Mitigation

The State of South Dakota remains committed to using all available mitigation capabilities as effectively and efficiently as possible, to maximize risk reduction while working with limited funding. Additionally, in order to be approved as an "enhanced" plan state, South Dakota has a commitment to implementing a comprehensive mitigation program. This is documented with actionable and tangible steps to advance:

- Statewide programs, initiatives, and plans that advance mitigation and resilience
- Summarized in Subsections 4.3 and 4.4
- mitigation training and capability building, and
    - Summarized in 4.6.2
- support local hazard mitigation plan development.
    - Summarized in 4.6.3

In general, the SHMT noted that local communities across the state have shown a strong commitment to mitigation through the increase in both the number and quality of local mitigation plans. Regarding FEMA mitigation programs the state has been very efficient in its use of available mitigation grant funding (PA, FMAG, HMGP, HMGP Post Fire, BRIC, FMA), as discussed in detail in Section 5.4.1. This includes funding being over-subscribed for all HMGP funding opportunities with backup projects, so if a selected project is not awarded, there is a backup to put into its place. Another goal is to maximize 406 mitigation funding following every federal disaster declaration. The fact that small, rural jurisdictions are often unable to afford the local match requirement for mitigation projects has been a major obstacle to furthering local mitigation in the past; however, the state's policy for providing a portion of the 25% local match when local governments are unable to afford it, as discussed in Section 4.3.2, has been successful in overcoming this limitation.

As discussed in Section 4.4.11, the Rural Electric Cooperatives (RECs) have a successful working relationship with OEM and have leveraged HMGP funding to supplement the considerable mitigation work on their own, burying and hardening power lines. The result is a more resilient power grid in many areas of the state and reduced public expenditures in the future from winter storms and other hazards that affect power lines.

Despite the state's excellent track record of effectiveness, the SHMT identified several opportunities for improvement. Some of these improvements are addressed in the Plan's mitigation strategy in Section 5.

Because others are mostly process improvements internal to OEM, and some of them are contingent upon anticipated FEMA policy changes, the planning team did not feel they warranted specific mitigation actions. OEM will be working on addressing all of them in the coming years.

- Local awareness of mitigation programs and roles often suffers due to frequent turnover in local government administrations. Therefore, it is important for OEM to continue to provide mitigation training for local officials (see Section 4.3.1).
- The length of time the grant process takes is another barrier to entry for some potential applicants. OEM will continue to do what it can to expedite the process on their end and provide technical assistance to applicants that require help.
- PA 406 and Resilient Infrastructure funding provide opportunities to fund a broader array of mitigation projects.
- Potential changes to FEMA's acquisition program to more of a post-disaster recovery program could result in more interest in home buyouts following a disaster.
- Another improvement could be the development of a resource list for matching funds for local and tribal government reference.
- As mentioned in Section 4.4.1, SDDA and OEM have started conservations about developing an Environmental Planning and Historic Preservation Programmatic Agreement to facilitate a quicker approval of pre-selection mitigation actions for future funding opportunities. This issue is addressed by mitigation action 4-3 (p5-15).
- Considering the new HGMP Post Fire funding opportunity, OEM is working to develop a list of shovel-ready projects in fire prone areas that can easily be updated and submitted when funding becomes available. This idea builds on the notable success the state has had maintaining a similar list of shovel-ready power line hardening projects, as discussed in Section 4.4.11.
- As noted in Section 3.4.6, limited information was available for this update regarding the development of future state facilities. Collecting better data on existing and future state facilities to allow for more detailed analysis is an improvement identified for the next ESHMP update and is addressed in Mitigation Action 2-2 (p5-24).
- Building Codes: The main challenge is that South Dakota is a home rule state, which means that building code adoption and enforcement are entirely determined by local governments. Many state agencies encourage building codes at the local level and/or are actively pursuing hazard-specific codes at the state level.
- State / Federal Funding Timelines: Differing funding timelines is a huge obstacle towards integrating state programs with federal programs. The fact that oftentimes these programs have differing timelines prevents program meshing. At this time there is no simple solution, though documenting this challenge in the ESHMP will ensure that this is a topic of continued attention and to ensure that future awareness of this obstacle remains identified.
- Programmatic Constraints: Individual programmatic constraints will always be a challenge when utilizing any state or federal program. Awareness of this challenge and continued coordination across and between state and federal agencies is the first step towards finding potential solutions.
- Volume of New Programs: The sheer volume of new programs available at both the state and federal levels is an obstacle for many local communities and state agencies. There is a great need for education across the board and only through close, on-going collaboration can this challenge be solved.

4.5. Integration with Federal/National Mitigation Programs and Initiatives

44 CFR Part 201 Requirement:
The mitigation planning process should include coordination with…appropriate Federal agencies [and] interested groups and be integrated to the extent possible with…other FEMA mitigation programs and initiatives.
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Demonstration that the plan is integrated to the extent practicable with…FEMA mitigation programs and initiatives that provide guidance to State and regional agencies.*

For the 2014 plan update, the SHMT teamed with the Silver Jackets to form an interagency committee. This process proved to be very effective, and so it was used again for the 2019 and 2024 updates. In addition to the state agencies described above, the Silver Jackets is comprised of several federal agencies working to reduce risk in South Dakota. Those federal agencies are outlined in the following subsections.

4.5.1. FEMA Region VIII

OEM works in close partnership with FEMA Region VIII to prepare for, respond to, and recover from disasters. Many federal mitigation funding opportunities, policies, and programs are administered by FEMA and carried out at the state level by OEM; more information on these programs can be found in Sections 4.3 and 5.3.

Annual Mitigation Consultation Meetings

The OEM Mitigation Section meets with FEMA mitigation staff at least annually to "to have an open and honest dialogue about what FEMA is doing well, as well as what we could improve upon to provide better service to South Dakota. The intended outcome is to continue to provide support to South Dakota's entire mitigation program and enhance the State's capabilities to advance mitigation action." Topics discussed at recent consultation meetings include:

- ESHMP update and review of enhanced plan status
- Climate resilience
- Rural Electric Cooperatives (RECs) considerations and survey results
- Critical Facility Inventory, Asset Inventory, and Evaluation
- FEMA National Risk Index
- Flood Vulnerability update
- Local and Tribal Hazard Mitigation Plan Rollup
- Local and Tribal Planning Updates
- Updated FEMA mitigation planning policies
- FEMA grants, to include HMGP, BRIC, FMA, Storm Act
- Programmatic Environmental Assessments
- Risk MAP Updates
- NFIP updates
- State and Federal Agency mitigation activities
- Outreach, training, and presentation opportunities.

The notes from these consultation meetings are included in Appendix F.

FEMA Grant Outcomes (FEMA GO)

OEM staff have been active participants in the FEMA Grant Outcomes (FEMA GO) initiative, formerly known as Grants Management Modernization (GMM). FEMA GO brings together a group of stakeholders via calls and workshops to develop the new FEMA Grant Platform that will replace ten legacy systems with one cloud-based platform for all FEMA grants. Membership includes state and tribal representatives, as well as the FEMA Regions, and field representatives in business process, governance, policy, and technology domains.

Hazard Mitigation Assistance External Stakeholder Working Group

The External Stakeholder Working Group is made up of 12 individuals, including:

- Three state or territory representatives
- Three local/regional representatives
- Three tribe representatives
- Two FEMA Hazard Mitigation Assistance Regional staff representatives
- One FEMA Headquarters Hazard Mitigation Assistance Branch Chief

This working group is integral to the process of moving the HMA grants away from eGrants and NEMIS to the new grants platform. The activities of the ESWG include:

- Operate as a working body that acts as a bridge between federal staff and state, local, tribal, and territorial representatives, by providing individual members insight and external perspective on the program's priorities, issues, and resources.
- Support FEMA as it streamlines and strengthens Hazard Mitigation Assistance program delivery overall.
- Provide appropriate customer service to external stakeholders.
- Delve more deeply into issues identified during the annual Hazard Mitigation Stakeholder Workshop to ensure FEMA is providing a consistent experience for external stakeholders.
- Bring unique perspectives on the program's communications and offer insight into or help craft communication-related resources.
- Act as the point of contacts for other non-federal stakeholders.
- Amplify hazard mitigation messages through professional networks.

4.5.2. U.S. Army Corps of Engineers (USACE)

The U.S. Army Corp of Engineers (USACE), Omaha, and St. Paul Districts support engineering and construction services in the areas of water resources, design, construction, and environmental restoration. They are involved in flood management projects, wetlands restoration, dam and lake projects, drought and flood relief, and disaster preparedness. The capabilities described below showcase the USACE's ability in flood hazard mitigation.

Silver Jackets

The Silver Jackets program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce risks associated with flooding and other natural hazards. The teams are developed and led at the state level with the support of federal partners. In South Dakota, the Silver Jackets team was established in 2012 with membership representing the USACE, FEMA Region VIII, USGS, NOAA/National Weather Service, US Bureau of Reclamation, US Geological Survey, South Dakota Office of Emergency Management, South Dakota Department of Agriculture and Natural Resources, South Dakota Department of Transportation, and South Dakota Bureau of Information and Telecommunications.

The Silver Jackets team meets quarterly. Through a collaborative process, the team strives to:

- Facilitate strategic, integrated life-cycle risk management, including response, recovery, preparedness, and mitigation actions to reduce the threat, vulnerability, and consequences of flooding and other hazards in the State of South Dakota.
- Create or supplement a collaborative mechanism to solve flooding and other hazard issues and recommend mitigation measures.
- Foster leveraging of available agency resources and information.
- Increase and improve flooding and other hazard communication and outreach.
- Develop more comprehensive regional risk management strategies.
- Integrate mitigation measures into recovery actions.

As noted above and throughout Section 2 Planning Process, South Dakota has leveraged the Silver Jackets program by holding joint meetings with the SHMT to improve stakeholder participation in the ESHMP update process.

The South Dakota Flood History Project was created by the team and placed 22 flood history signs in communities across South Dakota along with developing an interactive story map hosted by the South Dakota State Historical Society Archives. The signs and story map detail significant flood events across South Dakota dating from 1881 to 2019. The signs are placed in active public areas communicating the communities' flood risk and standing as a constant reminder that floods happen in the state. The stories include the personal impacts to residents, how the communities have worked to reduce their flood risk, and highlight the value of establishing and maintaining mitigation measures.

Floodplain Management Service Program

This program enables the USACE to provide technical services, planning assistance, guides and pamphlets for floodplain management to help prevent or reduce flood damage by using structural and/or nonstructural mitigation measures. All activities under this program are 100 percent federally funded.

Other USACE programs that enhance mitigation include:

- Risk Assessments
- Risk Communication
- Dam Safety Program
- Levee Safety Program
- Flood Risk Management Program
- Civil Works Emergency Management Program

4.5.3. Natural Resource Conservation Service

The NRCS provides information and assistance to farmers who are affected by the drought in South Dakota. They administer the Environmental Quality Incentives Program Initiatives, as well as numerous Farm Bill programs that provide technical and financial assistance to farmers and ranchers to install conservation practices.

The state has leveraged NRCS Emergency Watershed Protection funding when available, although that program is usually underfunded and seldom has funding available when needed following a disaster. Each drought year this program is discussed, and NRCS offers what they can to the declared drought counties.

4.5.4. U.S. Geological Survey

The USGS provides information on South Dakota's rivers, streams, ground water, and water quality. The organization operates an extensive network of stream-gaging stations in the state, many of which form the backbone of flood-warning systems. The StreamStats program for South Dakota is a web-based GIS program that provides users with access to analytical tools that are useful for water-resources planning and management, and for engineering design applications, such as the design of bridges. This program allows users to obtain streamflow statistics, drainage basin characteristics, and other information on streams. The Flood Inundation Mapping Program is designed to help state and local communities understand flood risks and make cost-effective mitigation decisions. The USGS also heads flood studies and reports on areas of South Dakota that are prone to flooding.

South Dakota's mitigation efforts align with a variety of USGS programs, including:

- National Earthquake Information Center (NEIC)
- National Earthquake Hazards Reduction Program (NEHRP)
- "Did You Feel It?" program
- Geologic hazard mapping

Section 4.4.1 discusses how DANR works with USGS to coordinate information from USGS stream gauges and DANR stream sensors. NEHRP funding has not been leveraged due to the relatively low earthquake risk in South Dakota.

4.5.5. National Weather Service (NWS)

Part of the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS) has three (3) offices in South Dakota, in Sioux Falls, Aberdeen, and Rapid City. They provide severe weather and flood warnings, and NOAA All-Hazards Weather Radio broadcasts. They also offer storm spotter training, training hundreds of South Dakotans each year in how to recognize and protect themselves from severe storms. NWS also provides weather and flooding safety guides, in addition to cooperating with OEM in the development of the *Tommy the Turtle* children's books discussed in Section 2.4.1.

Section 4.4.1 discusses how NWS uses information from both USGS stream gauges and DANR stream sensors for flood prediction and monitoring.

StormReady

The StormReady outreach and training program is a nationwide program that helps communities better protect citizens during severe weather, encourages communities to take a proactive approach to improving local hazardous weather operations, and provides guidance to emergency managers on how to improve hazardous weather operations. There are 33 StormReady entities in South Dakota as of September 2023, including 17 counties, 11 communities, 1 tribe, 2 hospitals, 1 university, 1 federal government facility, South Dakota OEM, South Dakota Department of Health, and 45 cooperating schools and businesses.

Weather-Ready Nation Ambassadors

The Weather-Ready Nation (WRN) Ambassador initiative is a NOAA-NWS effort to formally recognize NOAA partners who are improving the nation's readiness, responsiveness, and overall resilience against extreme weather, water, and climate events. As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather. In effect, the WRN Ambassador initiative helps unify the efforts across government, non-profits, academia, and private industry toward making the nation more ready, responsive, and resilient against extreme environmental hazards. WRN is a strategic outcome where society's response should be equal to the risk from all extreme weather, water, and climate hazards.

To be officially recognized as a WRN Ambassador, an organization must commit to:

- Promoting Weather-Ready Nation messages and themes to their stakeholders;
- Engaging with NOAA personnel on potential collaboration opportunities;
- Sharing their success stories of preparedness and resiliency; and
- Serving as an example by educating employees on workplace preparedness.

As of September 2023, eight South Dakota organizations have been recognized as WRN Ambassadors:

- South Dakota Department of Health
- South Dakota Department or Transportation
- South Dakota Highway Patrol
- South Dakota Office of Emergency Management
- South Dakota Science and Technology Authority
- South Dakota State University
- South Dakota State University (SDSU) Extension
- South Dakota Canoe and Kayak Association

Lightning Safety Toolkits/Recognition

The Lightning Safety Toolkit program is intended to increase lightning safety and preparedness at outdoor venues. These toolkits have been developed with the input and best practices of key stakeholders. This program is a key component of NOAA's commitment to a Weather Ready Nation. Sites that show a commitment to lightning safety by filling out the appropriate toolkit will be listed on the website as a lightning safety site.

4.5.6. U.S. Bureau of Reclamation

The Bureau of Reclamation (BOR) is the largest wholesaler of water in the country delivering trillions of gallons of water to more than 31 million people and having a water storage capacity of 140 million acre-feet. It is the second largest producer of hydroelectric power in the US that is annually, on average, 40 billion kilowatt-hours. The BOR provides one out of five Western farmers with irrigation water for 10 million acres of farmland that produces 60% of the nation's vegetables and 25% of its fruits and nuts.

The Bureau is a water management agency with a Strategic Plan outlining numerous programs, initiatives and activities that will help the Western states, Native American tribes, and others meet new water needs and balance the multitude of competing uses of water in the West. Their mission is to assist in meeting the increasing water demands of the West while protecting the environment and the public's investment in these structures. Programs, initiatives, and activities include:

- WaterSMART Program
- Water Conservation Field Services Program
- Rural Water Supply Program
- Resource Management and Planning
- National Irrigation Water Quality Program
- Flood Hydrology and Consequences Group
- Drought Program
- Dam Safety
- Building Seismic Safety Program

- Snowpack and Reservoir Levels

4.5.7. Federal Highway Administration

The Federal Highway Administration (FHWA) was created on October 15, 1966, after having had several predecessor organizations. The mission of FHWA is to deliver a world-class system that advances safe, efficient, equitable, and sustainable mobility choices for all while strengthening the Nation's economy. The South Dakota FHWA division office provides leadership and guidance to the SDDOT in planning, construction, and maintenance of transportation projects. They help to ensure that roads, bridges, and tunnels are safe and continue to support economic growth and environmental sustainability.

As discussed in Section 4.4.2, FHWA and SDDOT coordinate closely on the National Bridge Inspection Program and interdisciplinary scour team. The SDDOT Emergency Relief (ER) program, also detailed in Section 4.4.2, is funded through the FHWA.

4.5.8. Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery Grants (CDBG_DR)

HUD provides flexible grants to help cities, counties, and states recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. In response to Presidentially declared disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) Program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG Disaster Recovery (CDBG-DR) assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources. The Governor's Office of Economic Development administers CDBG-DR funding for the State of South Dakota.

HUD works with OEM and the Governor's Office of Economic Development when CDBG-DR funds are made available after a disaster. HUD has very specific guidelines for providing money to low to moderate income counties in the disaster declared counties, and they rely on the state's expertise to help seek out projects in these areas. Several powerline burial projects have been done with CDBG-DR funds.

4.6. Local Capability Assessment and Integration

44 CFR Part 201 Requirement:
[The State mitigation strategy shall include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include…Demonstration that the State is committed to a comprehensive state mitigation program, which might include any of the following: *A commitment to support local mitigation planning by providing workshops and training, State planning grants, or coordinated capability development of local officials, including Emergency Management and Floodplain Management certifications.* *The State provides a portion of the non-Federal match for HMGP and/or other mitigation projects.* *To the extent allowed by State law, the State requires or encourages local governments to use a current version of a nationally applicable model building code or standard that addresses natural hazards as a basis for design and construction of State sponsored mitigation projects.*

The State of South Dakota has a strong history of working with local governments to reduce their risk from hazards. Maintaining this relationship is a top priority for OEM and the SHMT. This section describes the state's policies and processes for assisting local governments with hazard mitigation planning and projects.

Section 4.7 breaks out tribal information separately to highlight the unique nature of the State's relationship with the tribes.

4.6.1. Local Technical and Financial Assistance

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.
44 CFR Part 201 Enhanced Plan Requirement:
Demonstration that the State is committed to a comprehensive state mitigation program [might include]: *A commitment to support local mitigation planning by providing workshops and training, State planning grants, or coordinated capability development of local officials.* *The State provides a portion of the non-Federal match for HMGP and/or other mitigation projects.*

OEM provides funding and technical assistance to local governments, to include provision of funds, plan development assistance, technical assistance for developing risk assessments, G318 trainings for hazard mitigation planning, benefit cost analysis (BCA) training, and tribal planning assistance.

The SHMO works with each county in the state to support the development of local mitigation plans. The SHMO performs a preliminary review of each plan prior to submitting it to FEMA. It is the goal of the SHMO to support plan development for every county in the state, to ensure it meets FEMA's requirements, as well as supporting the maintenance and updates of these plans. During the planning process for the 2023 State Plan, 64 counties and 6 tribal governments had FEMA approved hazard mitigation plans or plans in the process of being updated. In total, 97% of the counties and 67% of the tribes in the state are covered by an approved local mitigation plan. The SHMO will continue regular meetings with each county to ensure maintenance and required updates for all local plans are performed. To further incentivize the development of local hazard mitigation plans, OEM is requiring plans as a condition of receiving FEMA Emergency Management Performance Grant funding.

Technical assistance is a cradle-to-grave program for the mitigation staff. The OEM mitigation staff provides technical assistance to any potential applicant upon inquiry. Staff conducts site inspections, discusses grant opportunities, and provides guidance on application development. This assistance continues upon application submission to ensure that the application is complete as strongly as possible prior to submission to FEMA. At and after the grant award, mitigation staff conducts periodic project inspections and visits to ensure that the sub-recipient is successful while meeting all the grant requirements.

As documented in the Hazard Mitigation Grant Program Administrative Plan dated February 28, 2023, the SHMO coordinates the review of each project application for funding eligibility in FEMA's Hazard Mitigation Assistance programs. The State Hazard Mitigation Team (SHMT) serves as a review and prioritization panel for the Hazard Mitigation Grant Program (HMGP).

OEM in collaboration with the SHMT awards mitigation grant funds and completes the required paperwork and monitoring process for those funds. In addition, the State Hazard Mitigation Officer has coordinated multiple technical assistance activities. These include trainings for flood planning assistance and awareness, BCAs, and tribal planning assistance. See Section 4.3.1 for a discussion of mitigation training opportunities provided by OEM. OEM also provides technical assistance in the completion of BCAs for applicants that have little-to-no experience conducting BCAs.

State Assistance with Local Matching Funds

Many small towns and townships in South Dakota want to build resiliency but cannot afford the 25% local matching funds required by many hazard mitigation grants. To better assist local governments, the SHMT has adopted a policy that authorizes the state to provide a portion of the matching funds when it is deemed necessary and appropriate. The SHMT uses the following criteria to determine which projects should receive a state funding match:

- No state match will be provided towards the completion of local hazard mitigation plans.
- The sub-recipient must prove they are under financial stress and demonstrate that their project cannot be funded without the help of a state share. Sub-recipients can prove financial stress by submitting documents illustrating their financial situation and the hardship they would encounter if they were required to fund the entire 25% share.
- A sub-recipient who applies for hazard mitigation projects in a county that has been included in a Presidential disaster declaration and has received Public Assistance (PA) funds within the last five years is eligible for a 20% state funding match.

Applicants who submit projects located outside of a disaster county are eligible to receive a 10% state funding match.

This policy has been very successful in stimulating local mitigation projects, and the state has provided as much as a 20% funding match for several local projects, such as for completion of tornado shelters in Pierre and Pukwana. Projects that have received a 10% match are: City of Groton Generator, City of DeSmet Generator, Town of Delmont Tornado Safe Rooms, Town of Lesterville Generator, and Yankton County/Boy Scouts of America Tornado Safe Rooms.

4.6.2. Prioritizing Local Assistance

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs which should include:

44 CFR Part 201 Requirement:
Consideration for communities with the highest risks,
Repetitive loss properties, and
Most intense development pressures.
Further that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities.

As noted previously, providing assistance to local governments is a top priority for the state hazard mitigation program. The following section discusses how the SHMT screens and prioritizes project applications. In particular, the SHMT and OEM help local jurisdictions develop and maintain current local hazard mitigation plans in compliance with the Disaster Mitigation Act of 2000. OEM encourages jurisdictions that have an LHMP due to expire within 3 years to apply for BRIC or HMGP (7% Planning when available) funding to assist with the update. Plans that have expired or are close to expiring receive a higher priority. The information gathered in this Plan is available to the local communities for use when developing their own plans.

The State Hazard Mitigation Team recognizes that some counties are more vulnerable to certain hazards than others. Section 3.5 Risk Assessment Summary and Conclusions summarizes the key vulnerabilities, losses and consequences associated with each hazard identified in the HIRA and highlights how those impacts vary from county to county. The SHMT and OEM use that information to help prioritize funding and assistance between different jurisdictions.

See also Section 5.4.2 on eligibility criteria that is used to screen proposed mitigation projects.

4.6.3. Local Plan Integration

44 CFR Part 201 Requirement:
[The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.
[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities

As of December 2023, 62 (94%) of South Dakota's 66 counties are covered by FEMA-approved hazard mitigation plans. This is an improvement from 60 counties (91%) reported in the 2019 ESHMP. The remaining 4 counties have expired plans and the counties are working to update them. Of the 62 approved county plans, 19 will expire in the 2024.

Each local plan was reviewed for the following components:

- Hazards
- Local Capabilities
- Mitigation Actions (completed and identified)
- Estimated Losses
- Growth and Development Trends

Information from the local plans is integrated throughout the HIRA. Section 3.1 discusses how hazards affecting local jurisdictions were identified and prioritized using information from local plans. Information from local plans was used through the hazard profiles (Section 3.2) and vulnerability Sections (3.3 and 3.4). Table 3-13 in Section 3.2.5 summarizes the growth and development trends identified in the local plans. A spreadsheet that is included as Appendix H (electronic) summarizes the hazard rankings and vulnerability data from local plans. Funding sources identified in the local plans are included in Section 5.3.

4.6.4. Local Plan Review Process

Local hazard mitigation plans are submitted to OEM electronically. If there are any findings for corrections, OEM either calls or sends an email to the submitting jurisdiction. Staff keep track of where each plan is within the review process. They are typically reviewed in the order they are received, and within 30 days of receipt, unless there or circumstances requiring an expedited review. The number of plans submitted each quarter varies based on the update schedule for each plan.

Once OEM finds a plan to be complete and compliant with the requirements, they submit it to FEMA Region VIII for their review. FEMA has 45 days to provide comments back to the state or send up an approvable pending adoption letter. If revisions are required by FEMA, OEM notifies the submitting jurisdiction via email and offers to host a conference call to discuss the necessary revisions. All correspondence and notifications from OEM are distributed electronically.

4.6.5. Local Capabilities Overview

44 CFR Part 201 Enhanced Plan Requirement:
To the extent allowed by State law, the State requires or encourages local governments to use a current version of a nationally applicable model building code or standard that addresses natural hazards as a basis for design and construction of State sponsored mitigation projects.

Mitigation capabilities vary greatly between South Dakota's 66 counties and 9 Tribes. Variation in capabilities may result from many factors, including where the jurisdiction is located in relation to the hazard extent, regional economies impacting local tax base, political support, full-time or part-time personnel, regular maintenance of and adherence to community and operational plans, and the strength of regulation enforcement.

The above referenced plans were reviewed to compile information on local mitigation programs and capabilities. Data on each capability was collected from available local hazard mitigation plans and was then compiled into a master spreadsheet (Appendix H – electronic) to facilitate the detailed review and comparison between jurisdictions. Table 4-6 presents a summary of the policies, programs, and administrative, and technical capabilities identified in local mitigation plans during the 2024 planning process, along with a comparison to those identified in the 2014 plan.

Table 4-6 Summary of Local Capabilities

Capability	# Identified in 2019 Plan	# Identified in 2024 Plan	% Identified in 2024 Plan	% Increase 2019 – 2024
Local Emergency Operations Plan	61	58	83%	-5%
State Hazard Mitigation Plan Review/Incorporation	59	59	84%	0%
Emergency Operations Center/Incident Command System Interface	58	58	83%	0%
Hazard Mitigation Interagency Team/Local Emergency Planning Committee	57	57	81%	0%
Designated Storm Shelters	56	56	80%	0%
Zoning/Planning Commission	54	54	77%	0%
Emergency Power	54	54	77%	0%
NFIP/Strict Development Regulations in Flood Hazard Zones/Floodplain Management Program	53	55	79%	4%

Capability	# Identified in 2019 Plan	# Identified in 2024 Plan	% Identified in 2024 Plan	% Increase 2019 – 2024
Outdoor/Indoor Warning System/Proactive Weather Program	51	51	73%	0%
Public Awareness Campaigns/CERT/Citizen Corp	48	48	69%	0%
HAZUS Incorporation or Ability to Access	48	48	69%	0%
Comprehensive Plan	47	47	67%	0%
Fire Bans and Public Water Restrictions During Dry Periods	45	45	64%	0%
Regular Training for Emergency Responders	44	44	63%	0%
Equipment to Handle Fire/Wildfire	43	43	61%	0%
Pre-Planning for Winter Operations	41	41	59%	0%
Equipment for Winter Storm Response	39	39	56%	0%
Drainage Ordinance	37	37	53%	0%
Mutual Aid Agreements with other fire departments	36	36	51%	0%
GIS Data and Mapping	35	35	50%	0%
Building Code	34	34	49%	0%
Weather Spotters	33	33	47%	0%
Public Safety Programs for Public and Children	32	32	46%	0%
Flood Damage Prevention Ordinance	32	32	46%	0%
Continual Maintenance of Infrastructure (Electrical, Lift Stations, Sewer, Drain)	29	29	41%	0%
Regular Dam and Culvert Inspections and Maintenance	29	30	43%	3%
Radio Station Weather Announcements	26	26	37%	0%
NOAA Weather Radio	23	23	33%	0%
Regular Road Maintenance and Repair	23	23	33%	0%
Elevation Certificate/Ordinance	23	23	33%	0%
Response Plan in Case of Dam Failure	19	19	27%	0%
SD Electric Cooperatives Mutual Aid Plan	18	18	26%	0%
Emergency Exercises to Test Emergency Plans	18	18	26%	0%
Digital Infrastructure Mapping	17	17	24%	0%
Equipment to Respond to Hazardous Materials Incidents	16	16	23%	0%
Storm Ready	16	16	23%	0%
Monitor Drought Situation	15	15	21%	0%
Catalogue and Track Hazardous Materials	11	11	16%	0%
CWPP	11	11	16%	0%
Stormwater Master Plan/Ordinance	10	10	14%	0%
911 Addressing	10	10	14%	0%
Capital Improvement Plan	9	9	13%	0%
Stored Sandbags for Flood Fighting Operations	9	9	13%	0%
Tree-Trimming near Power Lines	8	8	11%	0%
Increased Security, Communication, and Educational Outreach to Prevent Terrorism	7	7	10%	0%
NIMS Compliant	7	7	10%	0%
Fire Mitigation Plan	6	6	9%	0%
Contingency Plans	6	6	9%	0%
Regional Terrorism Response Plan	1	1	1%	0%

Several capabilities identified in the county and tribal plans can assist with the implementation of local and state mitigation actions. Planning and regulatory capabilities (e.g., plans, codes, ordinances, planning mechanisms) have the highest percentage of identification in local plans. Most local plans, 79%, identified participating in the National Flood Insurance Program or having a floodplain management program, a 4% increase from the previous plan. Overall, ordinances related to developing in floodplains, fire bans, water use restrictions and drainage were most commonly identified in the local plans. Over half of the local plans (67%) identified having a comprehensive plan, a tool that communities can use to determine where future development can and should be directed. Each local jurisdiction is unique and may have additional regulatory or planning capabilities that are not listed in the table above.

In addition to planning and regulatory capabilities, administrative capabilities such as having the staff implement plans and enforce regulations were also captured in the local capability assessment. A majority of local plans noted having a zoning and/or planning commission that is charged with making land use decisions. Of the local jurisdictions whose capabilities were evaluated, 81% identified having a Hazard Mitigation Interagency Team or Local Emergency Planning Committee (LEPC). This team or committee is often charged with ensuring hazardous materials emergency response plans are up to date as well as contributing to the Local Emergency Operations Plan, which a majority of local mitigation plans (83%) identified as having in place. However, Local Emergency Operations Plans saw a 5% drop since the 2019 plan. The LEPC is often responsible for conducting public awareness campaigns, which may be one reason why 69% of local plans identified having conducted a public awareness campaign since 2019. In smaller communities, the ability to have full-time staff is often financially challenging. The counties that participate in one of the six Planning and Development Districts discussed in Section 4.4.12 can supplement local staff with the District by providing planning and technical assistance including GIS support.

A high percentage of local plans (84%) identified reviewing and/or incorporating information from the 2019 State Hazard Mitigation Plan, including the risk information that informed the local risk analysis using the software HAZUS and GIS. In addition to the use of HAZUS and GIS, other technical capabilities such as designated storm shelters, emergency power, outdoor/indoor warning systems, and hazard specific equipment (fire/wildfire and winter storm response) were also common capabilities identified in local plans.

The 2019 Plan noted that local mitigation planning had increased tremendously since the previous Plan update. As Table 4-6 shows, most mitigation capabilities have stayed the same or increased slightly since 2019. This results primarily from the large push between 2014-2019 having made such a significant improvement in easy-to-improve capabilities. The focus for the last 5 years has been on maintaining those capabilities. As noted before, SD OEM has focused on assisting counties in joining the NFIP; this has resulted in a 4% increase in NFIP participation since 2018, with more counties expected to join when current mapping efforts are completed. A complete inventory of the capabilities identified in the local plans is included in Appendix H. OEM recognizes that many of the listed capabilities are more effective for disaster response than hazard mitigation. The State Hazard Mitigation Officer continues to work with the local communities on improving the local hazard mitigation plans.

Local Adoption of Building Codes

Building codes are among the most important and effective mitigation capabilities a state and local government can have. The State of South Dakota has adopted building codes but does not mandate city or counties to adopt codes. If a city or county chooses to adopt building codes, they must at minimum follow the state code. Of the local plans reviewed for this update, 49% have adopted building codes, which represents a 21% increase from the 2014 update.

In 2014, the SHMT identified a mitigation action to "Coordinate with South Dakota Building Officials' Association to integrate floodplain management ordinances into local building codes" (See Section 5.2.3, Action 2-1.) This action was retained for the 2024 Plan update.

OEM has been working with the South Dakota Building Officials' Association to verify if floodplain management ordinance regulations are integrated and correspond to the adopted building code provisions at the local government level. The South Dakota State government has adopted the 2021 Edition of the International Building Code (IBC 2021), as published by the International Code Council. However, local government enforcement of IBC 2021 is not mandated at the state level. Thus, there are various towns and counties across South Dakota that have a building official and an office that issues building permits, and other communities that do not. When a community has not adopted IBC 2021, South Dakota Codified Law 11-10-6 Standards for New Construction Where Building Code Ordinance Has Not Been Adopted is triggered. SDCL 11-10-6 requires any new construction that commenced after 7/1/2018, within a community that has not adopted an ordinance prescribing standards for new construction, must have the design standard based on IBC 2021.

When IBC 2021 is properly followed and enforced, the communities can rely on the flood provisions of the IBC to fulfill their responsibilities for participation in the NFIP, provided development other than buildings are also regulated. Because requirements for utilities and equipment are specified in the IBC (by reference to ASCE 24), there are no gaps or conflicts if one or more of the codes that govern mechanical, plumbing, and fuel gas installations is not adopted.

The South Dakota Building Officials' Association reached out to officials from South Dakota's seven CRS communities (Aberdeen, Rapid City, Madison, Meade County, Parkston, Spearfish, and Watertown) during 2018 and 2019 meetings to ensure the communities' adopted higher floodplain standards or revisions have been reflected within their adopted building code. The State of South Dakota has inserted into their building code regulations (SDCL 11-10-5) that more restrictive building code requirements or revised requirements can be put in place, as long as the higher standards are legally made effective upon their adoption and subsequently filed with the local auditor's office.

Community Comprehensive Plans

A comprehensive plan is an official document adopted by cities and counties that states a community's overarching vision, goals, policies and strategies to help guide future land use decisions and preserve and protect community assets. The plan is not a regulatory document but is often tied to the approval criteria for development applications. Comprehensive plans cover all aspects of a community including land use, transportation, housing, the economy, and the environment.

South Dakota regulations state the purpose of a county comprehensive plan is to protect and guide "the physical, social, economic, and environmental development of the county; to protect the tax base…" (SL 1941, ch 216, § 3; SDC Supp 1960, § 12.20A03; SL 1967, ch 20, § 2; SL 1975, ch 113, § 6). Similarly, state regulations for municipalities' comprehensive plans emphasize the protection of a community's health and general welfare by "encouraging the most appropriate use of land." However, South Dakota does not require either county or municipality comprehensive plans to address natural or man-made hazards. There continues to be an opportunity for communities to incorporate information from risk and vulnerability analysis of local hazard mitigation plans into local comprehensive plans to ensure future development is directed away from areas at risk of certain hazards. OEM has had preliminary discussions with one of the Planning and Development Districts (See Section 4.4.12) about improving the integration of mitigation planning into comprehensive plans; this possibility will be explored further in the coming months.

Comprehensive planning is a service that all six Planning and Development Districts in the state offer. (See Section 4.4.12.) Many of the districts have written comprehensive plans, comprehensive economic development plans, and the local hazard mitigation plans for communities. The districts will continue to be a resource for communities to help protect people and property by guiding future land use decisions away from known hazard areas.

Local Challenges and Capability Gaps

While there are numerous effective mitigation initiatives and capabilities at the local level in South Dakota, there are also challenges and obstacles that may hinder or prohibit certain mitigation activities for local governments, these are detailed above in. Funding availability is an often-cited issue in the local mitigation plans, as is having the adequate level of staffing to conduct many mitigation activities. South Dakota is a largely rural state, and many communities across the state lack the staffing and capacity to conduct their own outreach and engagement activities with vulnerable populations. While private and non-profit entities which provide services and outreach efforts with underserved populations do exist, they may be limited in capacity and the working relationships between these entities and local governments are sometimes lacking. Additionally, local governments may not have thorough data at hand on who in their community may be vulnerable or underserved.

Another obstacle cited is having the technical expertise to analyze climate data, or knowing how to navigate the myriad climate and equity tools available, to then implement this data in mitigation planning. This has also been noted throughout the ESHMP as not only an opportunity for improvement, but also related to numerous state mitigation strategies in Section 5.2.3 which aim to develop, identify, and disseminate data on climate and natural hazards to the local level for integration in the local mitigation planning process. In order to accomplish this, the state process will focus on disseminating information used in this ESHMP update and in efforts identified in the mitigation strategy to the developers of local plans via email, social media, Direct Technical Assistance (DTA) efforts led by OEM, and other existing outreach channels. The schedule for this process will be done between the approval of this ESHMP and the next 5-year update.

Other challenges to the local implementation of mitigation activities include:

- Local Match Capability: A lack of available local match is an obstacle for many of the state's communities, especially for those that are rural and have limited funding resources. Local education about how many of these grant programs are reimbursable is one potential solution, to enable communities to plan ahead for these funding needs. Other solutions currently utilized by the state include: on-going coordination with partner agencies to identify additional funding resources, encouraging the development of regional (multi-county) plans or projects, and providing technical support relating to utilizing in-kind match. In the future, the state may also want to consider providing state funds to help cover some or all of these local match requirements. State of South Dakota has identified the local's ability to meet the grant matching requirements and have implemented a ten percent state match for HMGP and BRIC grants, to assist to elevate this obstacle.
- Local Technical Expertise to Apply for Funding: Local capacity and technical expertise for grant application development and management is a challenge for many communities. The state does provide technical support to assist communities in leveraging many of these programs, but the complexity and time requirements of many programs are an obstacle that many cannot overcome. This topic has recently been acknowledged by many different program leads and solutions are possible, but they must come at the program level.
- Local HMP Siloing: HMP development is most always led by local emergency managers who may not have experience with community planning. Educating locals on the benefits of involving a broad range of community sectors is a solution, one that may be supported by the new FEMA planning policy that took effect in 2023.

- Local Capacity and Capability: The largest challenge to local implementation of mitigation policies, programs, and capabilities is adequate staffing and resources. This is especially true for rural communities with limited funding capital. Providing technical support and educating locals on available resources is the best solution that the state can provide. Specifically engaging underserved communities can also be an obstacle for communities who do not have existing networks and support organizations specific to these groups. Connecting locals to available state staff to help identify associated resources is a solution. A third related challenge involves providing communities with the best available data and resources relating to climate change and its impacts on hazard events.
- High Hazard Potential Dam Program: There are several challenges to reducing risk from HHPDs. The first is educating dam owners on the differences between rehabilitation projects and mitigation projects so that they apply to the correct funding source - HHPD or HMA, respectively. An additional challenge with HHPDs is the extremely limited construction funding available in the HHPD grant program. The fiscal constraints of the program have, to date, limited the funding potential to about 10% of a single project's costs.
- Local Challenges in Addressing the Needs of Underserved Communities:
    - Lack of Resources and Funding: Limited financial resources may hinder the implementation of targeted programs and initiatives for underserved communities. Difficulty in securing grants or funding specifically designated for addressing the needs of vulnerable populations.
    - Limited Staff Capacity: Insufficient personnel or expertise to adequately assess and address the unique challenges faced by underserved communities. Overburdened staff may struggle to dedicate time and effort to comprehensive outreach and support initiatives.
    - Communication Barriers: Language barriers or cultural differences may impede effective communication and engagement with underserved populations. A lack of culturally sensitive outreach materials or strategies can hinder the dissemination of critical information. Elderly and more rural populations may have limited access to digital communication resources.
    - Community Engagement and Participation: Building trust and encouraging active participation from underserved communities can be challenging, impacting the success of mitigation initiatives.
    - Data and Information Gaps: Incomplete or inadequate data on the specific vulnerabilities and needs of underserved populations may hinder effective planning. Difficulty in accessing reliable data to inform decision-making and prioritize mitigation efforts for these communities.
- Local Challenges in Addressing the Impacts of Climate Change:
    - Limited Awareness and Understanding: Lack of awareness and understanding of the local impacts of climate change may result in a lack of urgency or prioritization in mitigation efforts. Insufficient knowledge about the specific vulnerabilities of the community to climate change.
    - Economic Disadvantage in Rural Communities: Economic constraints in rural areas may limit the ability to implement costly climate adaptation measures. Dependence on agriculture or other climate-sensitive industries may exacerbate the economic impacts of climate change.

- Lack of Infrastructure Resilience: Aging or inadequate infrastructure may be more vulnerable to climate-related events, increasing the community's overall susceptibility. Challenges in securing funding for infrastructure improvements to enhance resilience.
- Resistance to Change: Resistance or lack of buy-in from community members or local authorities may impede the adoption of climate-resilient practices and policies. Balancing short-term priorities with long-term climate mitigation goals can be challenging.

4.6.6. Local Mitigation Actions Overview

As part of the 2024 planning process, completed and identified mitigation actions from a total of 69 local and tribal plans were captured and summarized. The database is included as an electronic Appendix (Appendix H). Capturing available local information on mitigation actions allows the State and local jurisdictions to see what progress in implementing mitigation projects has taken place and what gaps may still exist. The following tables show how localities in South Dakota plan to mitigate risk in the future and what types of actions local jurisdictions have already taken to decrease their risk to the hazards that pose a risk to their community.

Table 4-7 Comparison of Current Local Mitigation Actions, 2019 vs. 2024

Identified Actions	2019	% of 2019 Plans with ID'd Project	2024	% of 2024 Plans with ID'd Project	% Change 2019-2024
Flood Control/Management	16	23.2%	29	100.0%	**76.8%**
Promote NFIP/Flood Insurance to nonparticipating communities	8	11.6%	17	58.6%	**47.0%**
Stormwater Improvement/Drainage and Culvert Improvement	44	63.8%	26	89.7%	**25.9%**
Storm Shelter/Tornado Safe Room	45	65.2%	26	89.7%	**24.4%**
New Warning System/Warning System Improvement	34	49.3%	20	69.0%	**19.7%**
Tree Removal	16	23.2%	12	41.4%	**18.2%**
Improve traffic safety/road improvements	36	52.2%	20	69.0%	**16.8%**
Implement/Improve 911 Emergency/First Responder System	7	10.1%	7	24.1%	**14.0%**
Land Use Policies/Zoning Enforcement/Building Code/Drainage Ordinance/Wildfire Policy	31	44.9%	17	58.6%	**13.7%**
Generator/Power Backup	37	53.6%	19	65.5%	**11.9%**
Powerline Burial/Improvement	31	44.9%	15	51.7%	**6.8%**
Develop Severe Weather Preparedness Plans (mass sheltering, business continuation, debris removal)/Conservation Plans/HazMat Plans	30	43.5%	14	48.3%	**4.8%**
Elevation/Acquisition/Relocation/Floodproofing	15	21.7%	7	24.1%	**2.4%**
StormReady®	15	21.7%	7	24.1%	**2.4%**
Install Stream Gauges	4	5.8%	2	6.9%	**1.1%**
Purchase/Improvement of EMS Equipment (Fire, Ambulance, Police)	19	27.5%	7	24.1%	**-3.4%**
Improvement to Emergency Communication System	20	29.0%	7	24.1%	**-4.8%**

Identified Actions	2019	% of 2019 Plans with ID'd Project	2024	% of 2024 Plans with ID'd Project	% Change 2019-2024
Debris Removal	11	15.9%	3	10.3%	**-5.6%**
Public Awareness and Education Campaigns	54	78.3%	21	72.4%	**-5.8%**
Install Snow fence/Plant Living Wind/Snow breaks	21	30.4%	7	24.1%	**-6.3%**
Continued NFIP Compliance/Encourage NFIP Participation/CRS	38	55.1%	14	48.3%	**-6.8%**
Firefighter/Flood Manager/Volunteer/GIS Training/Exercises/Certification	31	44.9%	10	34.5%	**-10.4%**
Controlled Burns/Burn Bans/Vegetation Management/Firebreaks/Defensible Space	34	49.3%	10	34.5%	**-14.8%**
Improve/Create Mapping and/or Facility and Data Inventory (Infrastructure, Critical Facilities, Flood, Vulnerable Populations)	33	47.8%	9	31.0%	**-16.8%**
Software/Technology Improvements for Data Analysis	17	24.6%	2	6.9%	**-17.7%**
Create/Continue partnerships with non-profits, private organizations/citizens, neighboring emergency managers, and transportation agencies	33	47.8%	8	27.6%	**-20.2%**
TOTAL	**680**		**336**		**6.7%**

Between 2019 and 2024, there was a 50.6% decrease in the total reported number of proposed mitigation actions and projects identified in local plans (680 projects in 2019 vs. 336 projects in 2024). This is primarily due to a difference in the number of PDM plans that could be analyzed, which were 69 PDM plans in 2019 and just 29 PDM plans in 2024. In this situation, it is not possible to make a line-for-line comparison of the change in the number of projects; consequently, the percentage of change of projects reported in Tabe 4-7 reflects an average increase/decrease based on the number of plans received.

From 2019 to 2024, the average percentage of planned mitigation projects across the State increased by nearly 6.7%. The five mitigation actions that saw the greatest increase in local plans in 2024 were: Flood Control/Management (+76.8%), Promote NFIP/Flood Insurance to Nonparticipating Communities (+47%), Stormwater improvements/drainage and culvert improvements (+25.9%), Storm Shelter/Tornado Safe Room (+ 24.4%), and New Warning System/Warning System Improvement (+19.7%). The numbers indicate that flood mitigation is currently the highest mitigation priority in South Dakota.

Many of the actions identified in the local plans are supported by actions in the state's mitigation strategy. As shown in Table 4-8 below, many of the state's mitigation actions will support the most commonly identified actions in local plans. For example, the limited amount of local funding for flood control projects in local communities was often listed in those local plans as a major obstacle for project implementation. The state plays a key role in leading those mitigation efforts through coordination and collaboration with communities. As a result of past concerted efforts, FEMA reduced the state's Risk Rating to 2.0, which equates to an approximate 15% savings for Flood Insurance policy holders in the state. Continuing to provide resources to complete and fund local mitigation projects will be crucial for the state to keep local communities engaged and focused on mitigation.

Table 4-8 Comparison of Most Commonly Identified Local Mitigation Actions and Related State Mitigation Actions

Local Mitigation Action	Related State Mitigation Actions
Flood Control/Management (29 Plans)	2-3: Support the purchase and relocation of structures within floodplains and other hazard prone areas through local project applications. 2-4: Support and encourage flood control projects through state & local project applications. 2-5: Support and encourage elevation or acquisition of structures in flood prone areas through local project applications. 2-10: Map repetitive flood loss properties to identify concentrations of properties or high losses and identify potential mitigation options.
Promote NFIP/Flood Insurance to nonparticipating communities (17 Plans)	2-1: Coordinate with the South Dakota Building Code Officials Association to integrate floodplain management ordinances into local building codes. 4-2: Promote insurance – Many different forms of insurance are available to cover damages incurred by various natural hazards. The state will encourage residents, farmers, and business owners to purchase insurance appropriate for their risk.
Stormwater improvements/drainage and culvert improvements (26 Plans)	2-4: Support and encourage flood control projects through state & local project applications. 3-3: Encourage removal of debris in waterways (i.e., near bridges, culverts, within stream channels). 3-4: Support and encourage drainage improvement projects through local applications (i.e., proper sizing). 3-5: Support and encourage routine inspections of utilities and infrastructure for damage and weaknesses. Support the development of projects at the local, tribal, or state level to mitigate deficiencies, up to and including replacement where feasible.
Storm Shelter/Tornado Safe Room (26 Plans)	1-1: Support the construction and operation of hardened shelters / saferooms through local project applications.
New Warning System/Warning System Improvement (20 Plans)	1-2: Support the distribution of NOAA weather radios through local project applications. 1-3: Coordinate public outreach/ education regarding shelter locations and warning systems. Develop brochures, websites, news briefs, and other media to notify the public of shelter locations and what sounds to expect from the warning systems.

*Note: DMP label represents actions identified in the State Drought Mitigation Plan

Completed Local Mitigation Actions

The process of capturing completed local mitigation actions started with the 2014 Plan Update, although at that time only 38 local plans were available to review. Additionally, it should be noted that during the 2024 review of plans, there were instances of completed actions being removed from plan updates, or no identified completed actions referenced, making it difficult to compare progress of the completion of mitigation actions between 2019 and 2024. Nevertheless, capturing available local information on completed actions informs the State and local jurisdictions on the progress in the implementation of mitigation projects and what gaps may still exist.

Table 4-9 Summary of Completed Local Mitigation Actions, 2024

Completed Actions	2024
Stormwater Improvement/Drainage and Culvert Improvement	15
New Warning System/Warning System Improvement	11
Generator/Power Backup	10
Passage of Hazard Specific Mitigation Policy	10
Improve Emergency Communication Capabilities	9
New Storm Shelter	8
Completion of Hazard Specific Mitigation Plan (i.e. CWPP, HazMat, Dam)	7
Flood Control/Management	7
Powerline Burial/Improvement	5
Firefighter/Flood Manager/Volunteer Training/Exercises/Certification	5
Tree Removal/Trimming	4
Improve Data/Mapping Capabilities	4
Road Infrastructure Improvement	4
Elevation/Acquisition/Relocation	2
Purchase of Winter Storm/Firefighting/EMS Equipment	1
TOTAL	**102**

The mitigation actions that have had the greatest increase in completed projects since the 2019 Plan Update (Refer to Table 4-5 in the 2014 Plan Update) include Stormwater Improvement/Drainage and Culvert Improvement, new warning system/warning system improvement, Generator/Power Backup, and Passage of Hazard Specific Mitigation Policy.

Projects to improve flood control and flood management that were completed between 1992-2002 included the construction of flood control dams (2), minor flood control projects (8), and most importantly, the inclusion of flood-related projects as a major goal in the state's mitigation priorities.

The Fort Randall Dam, Gavins Point Dam, Big Bend Dam, and the Oahe dams were major flood control projects that also provide the benefits of making water available for irrigation and the generation of hydroelectricity. Further, the state collaborated with local governments to identify Flood Control and Multiple Use Zones for the purpose of providing storage space for spring and summer runoff, which is released prior to the next runoff season typically starting at the beginning of March.

4.7. Tribal Capability Assessment and Integration

Much of the material presented in the previous section on Local Government Capabilities and Integration also applies to South Dakota's Native American tribes. However, the unique nature, challenges, and legal status of the tribes makes it worthwhile to discuss several issues separately.

4.7.1. Prioritizing Assistance to Tribes

The state has made significant effort into increasing tribal engagement in hazard mitigation planning, particularly since 2019. The state Department of Tribal Relations was involved throughout the ESHMP planning process. The State wants all the Tribes to have an approved plan and has invited all tribes to join with their overlapping Counties in multi-jurisdictional planning as an alternative to completing their own plans. This approach has yielded cost efficiencies and improved interagency coordination at the local, tribal, and state levels.

Notes from the state's annual coordination meetings with FEMA (discussed in Section 4.5.1 above) reflect frequent discussion of tribal concerns, to include:

- Improved coordination
- Status of tribal hazard mitigation plans
- Technical Assistance and training to tribes
- Tribal project applications
- Tribal Direct Grantee status
- Disaster requests from tribal governments
- Difficulties meeting match requirements

4.7.2. Tribal Plan Integration

Of the nine recognized tribes in South Dakota, six (67%) are currently covered under approved hazard mitigation plans. The number of approved tribal plans is the same as in 2019 but has more than tripled since 2014 when only two tribes (23%) had hazard mitigation plans. Of the three tribes not covered with approved plans, two have expired HMPs and are working on updates; additionally, the Lower Brule Sioux Tribe is developing their first mitigation plan. However, three of the seven approved plans expire in 2024.

These plans were reviewed and included along with the local plans, as discussed in Section 4.6 above.

Table 4-10 South Dakota Tribal Mitigation Planning Status

Tribe	Current HMP?	Notes
Cheyenne River Sioux Tribe	No	Expired plan, update in progress
Crow Creek Sioux Tribe	Yes	Joint plan with Buffalo County
Flandreau Santee Sioux Tribe	Yes	
Lower Brule Sioux Tribe	Yes	Plan expires in 2024
Pine Ridge Reservation	Yes	Joint plan with Oglala Lakota County, expires in 2024
Rosebud Sioux Tribe	Yes	Plan expires in 2024
Sisseton Wahpeton Oyate	Yes	
Standing Rock Sioux Tribe	No	Expired plan, update in progress
Yankton Sioux Tribe	No	New plan in development

4.7.3. Tribal Capabilities Overview

None of the tribal hazard mitigation plans updated since 2019 reported any change in mitigation capabilities. SD OEM will work with tribal contacts to determine where capability enhancements are needed and feasible.

4.7.4. Tribal Integration in State Mitigation Strategy

Section 5 details the state's Mitigation Strategy. As discussed in Section 5.1, the 2024 SHMP included Goal #6 which addressed improving local and tribal partnerships. This was a goal established during the 2018-2019 planning process of the 2019 HMP, to highlight the progress the state has made in improving relations with tribal governments, particularly with hazard mitigation planning, as well as increase focus on improvements that remain:

- Goal 6 – Increase partnerships with tribal nations.
- Objective 6.1 – Support cooperation with tribes on mitigation and recovery efforts.

A number of state mitigation actions detailed in Table 5-4 include the tribes as partners listed in Responsible Departments. There are also six mitigation actions specifically focusing on the tribes, as shown in the following table. (See Table 5-4 for more details on these actions.)

Table 4-11 State Mitigation Actions Specific To Tribes

Goal	Action #	Mitigation Action	Priority
4	4-3	Enhance and streamline coordination with the State Historic Preservation Officer, Tribal Historic Preservation Officer (as applicable), and other agencies on applicable projects.	High
6	6-1	Inform tribes of mitigation, public assistance, individual assistance, and SBA funding opportunities to help reduce risks and recover from disasters.	High
6	6-2	Continue working with tribal governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	High
6	6-3	Increase outreach and interaction with local, tribal, and federal agencies.	High
6	6-4	Encourage tribal representatives to coordinate with local planning personnel for joint initiative development and increase data sharing. Engage more closely with tribal entities in the drought planning and mitigation process.	High

Table 4-13 below shows mitigation actions listed in the six tribal hazard mitigation plans. As above, because two of the plans are joint tribal-county plans, some of these actions may not be specific to the tribes.

Table 4-12 Tribal Mitigation Actions Identified and Completed in 2024 Plans

Mitigation Actions	Identified	Completed
Generator/Power Backup Acquisition	5	-
Storm Shelter/Tornado Safe Room – identification or obtaining resources needed for facilities	5	-
Flood Control and Management Projects	3	1
Improve traffic safety/road improvements	3	-
New Warning System/Warning System Improvement	3	-
Public Awareness and Education Campaigns/local outreach	3	-
Stormwater Improvement/Drainage and Culvert Improvement	3	1
Create/Continue partnerships with non-profits, private organizations/citizens; Create/Review Mutual aid agreements with neighboring emergency managers, and transportation agencies	2	-
Develop Severe Weather Preparedness Plans (mass sheltering, business continuation, debris removal)/Conservation Plans/HazMat Plans/debris management	2	1
Implement/Improve 911 Emergency/First Responder System	2	-
Install Snow fence/Plant Living Wind/Snow breaks	2	-
Land Use Policies/Zoning Enforcement/Building Code/Drainage Ordinance/Wildfire Policy	2	-
Promote NFIP/Flood Insurance to nonparticipating communities/Explore benefits of participating in CRS	2	
Tree Removal /hazardous fuel reduction	2	-
Firefighter/Flood Manager/Volunteer/GIS Training/Exercises/Certification	1	-
Improve/Create Mapping and/or Facility and Data Inventory (Infrastructure, Critical Facilities, Flood, Vulnerable Populations)	1	-
Powerline Burial/Improvement	1	-
Purchase/Improvement of EMS Equipment (Fire, Ambulance, Police)	1	-
StormReady Participate/Renew Status	1	-
Continued NFIP Compliance/Encourage NFIP Participation/CRS	0	-
Controlled Burns/Burn Bans/Vegetation Management/Firebreaks/Defensible Space	0	-
Debris Removal	0	-
Elevation/Acquisition/Relocation/Floodproofing/Retrofitting	0	-
Improvement to Emergency Communication System	0	-
Install Stream Gages	0	-
Passage/Enforcement of Hazard Specific Mitigation Policy	0	1
Software/Technology Improvements for Data Analysis	0	-

5 MITIGATION STRATEGY AND PROGRESS

44 CFR Part 201 Requirement:
[The State plan must include a] Mitigation Strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. *[The mitigation strategy shall include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses.* *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts and changes in priorities…*

This chapter describes the state's strategy for reducing losses from the hazards identified in Section 3 Hazard Identification and Risk Assessment (HIRA). It includes the goals and objectives that frame the mitigation strategy, specific mitigation action undertaken or proposed by the state, available sources of mitigation funding, and how the state ensures those funds are used effectively and efficiently.

South Dakota's mitigation strategy emphasizes the need to ensure communities become better able to withstand hazards in the long term, while at the same time improving their residents' overall quality of life. By avoiding unnecessary exposure to hazard risks, communities will save lives, reduce property damages and minimize the social, economic and environmental disruptions that commonly follow hazard events. This SHMP addresses the needs of current residents and also considers the needs of future generations. The focus on an integrated, future-oriented approach will result in more disaster-resilient communities.

5.1. Hazard Mitigation Goals and Objectives

This section describes the goals and objectives that guide South Dakota's mitigation program. The goals are general guidelines articulating what the state wants to achieve. The objectives are more specific, measurable, and achievable descriptions of how the state will implement each goal. These objectives are then used to develop specific mitigation actions (see Section 5.2) taken to achieve loss reduction.

The goals and objectives approved by the SHMT for 2024 are listed below in Table 5-1. They were developed to encompass all mitigation needs identified by stakeholders, including local and tribal communities. The goals and objectives are not prioritized and are written to be applicable to all hazards identified in the HIRA. The state encourages local and tribal governments, and other mitigation partners to consider the state's goals and objectives when developing their mitigation strategies.

Table 5-1 Mitigation Goals and Objectives

Goal 1	Reduce injuries and loss of life from hazards
Objective 1.1	Reduce the number of injuries/fatalities due to all hazards
Objective 1.2	Maintain and improve public health and safety outreach activities/programs

Goal 2	Reduce damage to existing and future structures within hazard areas
Objective 2.1	Reduce the number of repetitive flood loss structures
Objective 2.2	Reduce the number of structures lost by wildfires
Objective 2.3	Reduce the number of structures within the Special Flood Hazard Area and other identified local flood risk areas
Objective 2.4	Reduce the number of structures/infrastructure at risk to geologic hazards
Objective 2.5	Improve state asset and hazard databases to enable identification of structures within hazard areas

Goal 3	Reduce the losses to critical facilities, utilities, and infrastructure from hazards
Objective 3.1	Reduce the number of power outages
Objective 3.2	Reduce negative impacts to water supply and sewage treatment systems
Objective 3.3	Improve reliability of communications during/following hazard events

Goal 4	Reduce impacts to the economy, the environment, and cultural resources from hazards
Objective 4.1	Reduce loss to natural resources (i.e. forest and watershed health)
Objective 4.2	Reduce impacts to cultural resources (i.e. historical/tribal)
Objective 4.3	Reduce agricultural losses
Objective 4.4	Reduce economic losses to recreation and tourism
Objective 4.5	Improve water availability monitoring and drought impact/vulnerability assessment
Objective 4.6	Increase public awareness and education
Objective 4.7	Enhance mechanisms to provide water supplies to areas of shortage during droughts
Objective 4.8	Reduce water demand and encourage water conservation
Objective 4.9	Reduce drought impacts to South Dakota's economy, people, state assets, cultural resources and environment
Objective 4.10	Evaluate changes in drought frequency and severity

Goal 5	Support and assist local mitigation capabilities and efforts
Objective 5.1	Encourage locals to participate in risk reduction measures
Objective 5.2	Continue to maintain and enhance intergovernmental and interagency stakeholder coordination with respect to drought

Goal 6	Increase partnerships with tribal nations
Objective 6.1	Support cooperation with tribes on mitigation and recovery efforts

5.1.1. 2024 Updates to the Goals and Objectives

As part of the 2022 HIRA update, the state developed a summary of the key vulnerabilities, problem statements, and losses and consequences associated with each hazard. This information, as summarized in Table 3-72 Hazard Risk Summary Table, was provided as a handout during the April 6, 2023, planning meeting. The SHMT members reviewed the preliminary results of the local and state vulnerability assessments and validated that the goals and objectives from the 2019 Plan remain relevant for the 2024 Plan.

As previously discussed in Section 4.2.2, the 2015 South Dakota Drought Mitigation Plan was integrated into the 2024 ESHMP. As part of that integration, the goals of the Drought Plan were integrated with the HMP goals as new Objectives 4.5-4.10 and 5.2.

The group concluded that the existing goals and objectives from the 2019 Plan remain relevant and re-adopted them without changes aside from the addition of the new objectives from the Drought Plan.

5.2. Mitigation Actions

44 CFR Part 201 Requirement:
[The State plan shall include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified. *[The] plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts and changes in priorities….*
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include… *Established eligibility criteria for multi-hazard mitigation measures.* *A system and strategy by which the State will conduct an assessment of the completed mitigation actions and include a record of the effectiveness (actual cost avoidance) of each mitigation action.* *Demonstration that the State is committed to a comprehensive state mitigation program, which might include…A comprehensive, multi-year plan to mitigate the risks posed to existing buildings that have been identified as necessary for post-disaster response and recovery operations.*

This section presents the identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions to address the goals and objectives defined earlier. Many of the actions were developed during legacy planning meetings as the SHMP has been updated over the years. Each update cycle presents an opportunity to review and revise the mitigation actions to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities. Key vulnerabilities and problem statements from the updated HIRA were also considered in the update of mitigation actions. Coordinated and integrated mitigation efforts were stressed whenever possible, as is evidenced by the number of multi-agency projects listed in the Mitigation Actions Table.

A few ongoing mitigation actions were revised and updated for 2024 and one new action was created. Many mitigation actions were integrated from the Drought Plan.

The SHMT has confirmed these actions with the understanding that approval of this plan does not obligate the state to complete each project before the next required update in 2029. The SHMT understands that the 2029 plan update must demonstrate progress in statewide mitigation efforts. This progress may be in the form of the actions listed below or additional actions that assist in reaching the goals and objectives outlined in this plan. The South Dakota Office of Emergency Management (OEM) will coordinate an annual joint meeting of the SHMT and Silver Jackets to review the matrix of mitigation actions and discuss progress made or opportunities to pursue progress of each action, as described further in Section 6.2.

5.2.1. Process Used to Evaluate and Prioritize Mitigation Actions

During the 2024 update, the SHMT and Silver Jackets members reviewed the STAPLEE criteria shown below to evaluate and identify priority levels for the hazard mitigation actions. The SHMT will continue to support a diverse range of mitigation actions to ensure a comprehensive approach to reducing risk to all hazards across the entire state. A top priority of the SHMT for the 2020–2024 period was to improve the quality of hazard mitigation planning efforts for local and tribal governments; as described in Section 4.6.1 there has been much progress made, but this remains a high priority for the 2024-2029 period.

The state uses the following guiding principles to evaluate and prioritize proposed mitigation actions so that limited grant funds are used most effectively. These guiding principles are intended to be flexible and adaptable across state agencies and funding sources. During the 2024 Plan update cycle, action priorities were revisited and new actions were prioritized according to the process noted below.

In evaluating proposed mitigation actions, the SHMT used the STAPLEE criteria: Social, Technical, Administrative, Political, Legal, Economic, and Environmental. The STAPLEE criteria are commonly used in mitigation planning and are summarized in **Error! Reference source not found.**. Based on SHMT consensus, each action was then assigned one of the following priorities:

High priority actions strongly support reduction of high-risk hazards, achieve hazard mitigation goals as outlined in this plan, and eliminate or greatly lessen the impact of future incidents. These may also include actions that have a higher possibility for implementation in the near term (i.e., funding is available or current political feasibility supports the action).

Medium priority actions may be educational, outreach, or maintenance actions. They may include small mitigation projects that would minimize severity but not mitigate hazards completely. Medium priority actions are less urgent but still significant toward improving the state's resiliency.

Low priority actions are generally the responsibility of the local community. The state supports these projects but is often unable to provide the authority to implement them, does not have sufficient resources to do so, or else has judged the benefits/impact of the action to be a low priority.

Table 5-2 STAPLEE Criteria

STAPLEE Review and Selection Criteria
Social
• Is the proposed action socially acceptable to the state or jurisdiction and surrounding community? • Are there equity issues involved that would mean one segment of the state and/or community is treated unfairly? • Will the action cause social disruption?
Technical
• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action considering other state or jurisdiction goals?
Administrative
• Can the state or jurisdiction implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political
• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal
• Is the state or jurisdiction authorized to implement the proposed action? • Are there legal side effects? Could the activity be construed as a taking? • Will the state or jurisdiction be liable for action or lack of action? • Will the activity be challenged?
Economic
• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs considered? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the state or jurisdiction? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other state or jurisdiction goals?

• What benefits will the action provide?
Environmental
• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

5.2.2. Progress on 2019 Mitigation Actions

Since the development of its initial State Hazard Mitigation Plan in 2004, South Dakota has achieved significant progress in reducing the risk of natural hazards. The SHMT reviewed the mitigation actions from the 2019 ESHMP and updated the status of each.

Due to the continuous and ongoing nature of most state-level mitigation activities, only one action from the 2019 Plan was identified as having been completed as of 2024.

- Action 6-5: Provide the drought plan to local and tribal governments to encourage the development of water conservation plans.

Significant progress has been made in many of those actions, as shown below in **Error! Reference source not found.** in the 2024 Status and Notes column. Each Goal has seen progress in multiple related mitigation actions. Many actions were revised or updated for 2024; these are noted in **Error! Reference source not found.**.

Additionally, the 47 actions from the 2015 Drought Plan have been added as Mitigation Actions where appropriate. Several Drought Plan actions were combined to be more succinct. Progress on those actions is noted in **Error! Reference source not found.**.

5.2.3. Mitigation Action Plan

The updated mitigation actions are provided in **Error! Reference source not found.**, organized by goal to demonstrate how each mitigation activity contributes to the overall mitigation strategy. For each mitigation action, the table provides the priority level, type of mitigation activity, potential funding sources, the responsible department(s), and the status of the action as of 2024. In the Responsible Department(s) column, the agency with primary responsibility is in **bold** font; the current representative on the State Hazard Mitigation Team for the noted Responsible Departments will be contacted for updates and progress reports on the mitigation actions.

The "2024 Status and Notes" column provides more specifics, including the status of implementation, how each mitigation action is being implemented, and if the mitigation action is being imported from the Drought Plan. The status of each action is defined as follows.

- New - New mitigation action in 2024 SHMP update
- Not Started - Work has not begun
- In Progress - Work has begun but not completed
- Continuous - Ongoing on a regular basis with no specific end date
- Completed - The action has been finished
- Deleted - The action is no longer relevant and is being deleted

The State of South Dakota recognizes that local governments are key partners in the identification and implementation of hazard mitigation projects. As such, many of the actions are related to supporting local project applications and linked to local plans, where specific local actions and projects are identified. See Section 4.6.6 Local Mitigation Actions Overview and Table 4-5 Comparison of Most Commonly Identified

Local Mitigation Actions and Related State Mitigation Actions for more information and discussion on this topic. As part of the 2024 planning process, completed and identified mitigation actions from a total of 72 local and tribal plans were captured and summarized in a spreadsheet/database. The database is included as electronic Appendix H.

Table 5-3 South Dakota 2024 Hazard Mitigation Actions

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 1 Action 1-1	Provide State Direct Technical Assistance (SDTA) prioritizing local project applications, assist communities statewide with securing funding to support the construction and operation of hardened shelters / saferooms.	High	Structure & Infrastructure Projects	HMGP, CDBG, BRIC, OEM budget, GF&P Budget, County and Municipal budgets, Private funds	**OEM**, GF&P, HUD, FEMA, Local/Tribal Gov., Private Citizens	Continuous. GFP continuing to provide shelters in state park facilities where appropriate.
Goal 1 Action 1-2	Support the distribution of NOAA weather radios through providing SDTA to local project applications.	High	Structure & Infrastructure Projects	HMGP, CDBG, EMPG, Local, SHSGP, GF&P	**OEM,** GF&P, SDOHS, FEMA, NWS, Local/ Tribal Gov., Private Businesses, Citizens	Continuous. Modified in 2024 to remove reference to Outdoor Early Warning Systems, because the SHMT does not support siren projects. OEM provides technical assistance with project applications.
Goal 1 Action 1-3	Coordinate public outreach/ education regarding shelter locations and warning systems. Develop brochures, websites, news briefs, and other media to notify the public of shelter locations and what sounds to expect from the warning systems.	Medium	Education, Awareness, & Outreach	EMPG, BRIC, HMGP, Local Gov. budgets, Private Businesses	**OEM,** SD Public Safety – Fire Marshal's Office, NWS, Local/Tribal Gov.	Continuous. Implemented as part of OEM severe weather awareness campaign and broader public outreach program www.bReadySD.sd.gov.
Goal 1 Action 1-4	Provide technical assistance on public education & outreach efforts for all hazards awareness and safety. This should include the impacts of poor air and water quality and vector-borne illnesses resulting from drought conditions.	High	Education, Awareness, & Outreach	EMPG, BRIC, HMGP, Homeland Security Grants	**OEM,** Local/Tribal Gov.	Continuous. Modified in 2024 to incorporate action from Drought Plan. OEM provides technical assistance to other state, regional, and local agencies, in addition to their own outreach & education efforts www.bReadySD.sd.gov.
Goal 1 Action 1-5	Further analyze climate change effects in South Dakota to include frequency of flood events and other hazards. Action will help the State identify where to concentrate mitigation projects, as well as who to target for mitigation projects. Disseminate relevant information, via email or other means as	Medium	Data & Studies	Staff time, Silver Jackets	**SDSU - State Climatologist,** OEM, Silver Jackets, NWS	Continuous. Ongoing research of climate change, especially as it affects SD water resources. Additional analysis is needed for Summer Storms and certain areas that are more affected by climate change and storms. Analyze 100-year flood event frequencies across the state to determine trends or higher risk areas. Also, consider

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
	applicable, with developers of local mitigation plans to help fill information gaps.					frequency analysis for drought and winter storms (including ice storms). Action will help the state identify where to concentrate mitigation projects, as well as who to target for mitigation projects.
Goal 1 Action 1-6	Increase or maintain surveillance and monitoring activities for drought-specific public health issues (e.g. West Nile surveillance, private well testing for water quality).	High	Data & Studies	Div of BH Staff time	**Division of Behavioral Health**	Continuous. Integrated from Drought Plan in 2024. Provide input at DTF meetings and coordinate with other agencies on this topic. Monitor related impacts noted in the online Drought Impact Reporter.
Goal 1 Action 1-7	Develop strategies to assist behavioral health providers if they become overwhelmed or need assistance from other providers of the Division of Behavioral Health.	High	Technical Assistance	Div of BH Staff time	**Division of Behavioral Health**	Continuous. Integrated from Drought Plan in 2024. Increase outreach and communication to behavioral health providers during drought to assess needs
Goal 1 Action 1-8	Develop strategies for mental health and substance abuse agencies to ensure referrals are made to providers in the areas that are impacted.	Medium	Technical Assistance	Div of BH Staff time	**Division of Behavioral Health**	In Progress Integrated from Drought Plan in 2024.
Goal 1 Action 1-9	Develop systems and processes to monitor heat-related morbidity and mortality and evaluate mitigation options.	High	Data & Studies	Dept of Health Staff time, academic research	**Dept of Health**	New for 2024. SD will pursue monitoring heat-related health effects in the context of hazard planning. By the next SHMP update, the extent and nature of heat impacts on health should be clearer, which will help establish a need, if any, to mitigate heat impacts and help guide the development of mitigation actions.
Goal 1 Action 1-10	Coordinate with public and private dam owners to assess dams with increased development downstream that could change the dam's hazard potential. Use a combination of one-on-one calls, in-person	Medium	Data & Studies	DANR Staff time	**DANR Dam Safety**, Dam Owners, USACE, FEMA	New for 2024.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
	meetings, site visits, and other forums. Develop a plan to address identified risks and impacts, to include additional public outreach to engage impacted communities around risk reduction.					
Goal 1 Action 1-11	Work with SDSU Census Data Center to analyze recent and projected development trends at the state and local level. This data will help identify high growth areas that intersect with hazard areas and may result in increased vulnerability if not mitigated. This will also help better understand vulnerable communities and underserved populations in the state and identify ways to better enhance equity in disaster mitigation. The State will help disseminate relevant information, via email or other means as applicable, with developers of local mitigation plans to help fill information gaps.	Medium	Data & Studies	OEM Staff time, academic research	**SDSU, OEM**	New for 2024. This would help meet state mitigation planning requirement Element S7a: summary of recent development and potential or projected development in hazard-prone areas based on state and local government risk assessments, including: 1. Changes in population demographics that may affect vulnerability to hazard events, including socially vulnerable and underserved communities. 2. Changes to the vulnerability of state assets. 3. Changes in development that could impact jurisdictions most threatened by the identified hazards based on local risk assessments, including the potential impacts of climate change.
Goal 1 Action 1-12	Work with local and tribal governments to engage with communities identified as Economically Disadvantaged Rural Communities or as Community Disaster Resilience Zones to better understand their makeup, needs, and strengths. Identify and implement projects to reduce their risk and increase their resiliency.	High	Data & Studies	OEM Staff time to identify projects; BRIC, HMGP, SHSGP, DANR, Rural Development	**OEM,** Local/Tribal Gov, FEMA	New for 2024.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 2 Action 2-1	Coordinate with South Dakota Building Code Officials Association to integrate floodplain management ordinances into local building codes.	Medium	Planning & Regulations	OEM and partner internal staff time OEM	**OEM,** Local/Tribal Gov, FEMA	Continuous. When IBC is properly followed and enforced in South Dakota, communities can rely on the flood provisions of the IBC to fulfill their responsibilities for participation in the NFIP, provided development other than building is also regulated. Because requirements for utilities and equipment are specified in the IBC (by reference to ASCE 24), there are no gaps or conflicts if one or more of the codes that govern mechanical, plumbing, and fuel gas installations are not adopted.
Goal 2 Action 2-2	Improve the state facilities database by capturing classification and valuation information.	Low	Data & Studies	SD Bureau of Administration Risk Management, Internal staff time	**SD Bureau of Administration - Risk Management,** SD BIT	In Progress. Utilized for updates of 2016 and 2021 HIRA for State Plan Risk Management has added all buildings valued at $100K or more. There are still some improvements that need to be made to refine vulnerability assessments to state facilities. One of these is the need to be able to categorize and link the geospatial database with the Risk Management agency tabular database. The geospatial database does not have valuations, which prohibits the ability to refine loss estimates.
Goal 2 Action 2-3	Through SDTA, build capacity for the purchase and relocation of structures within floodplains and other hazard prone areas through local project applications.	High	Structure & Infrastructure Projects	HMGP, BRIC, FMA, Local, USACE, NRCS-EWPP	**OEM,** Local/Tribal Gov, USACE, FEMA, NRCS	Continuous. OEM provides technical assistance with project applications See Section 5.3.1 regarding Home Mitigation Project Policy
Goal 2 Action 2-4	Through SDTA, build capacity and interest in flood control projects through state & local project applications.	High	Structure & Infrastructure Projects	HMGP, BRIC FMA, CDBG, SD DANR, Rural Development, Local, USACE NRCS-ACEP	**SD DANR,** OEM SD, GOED USACE FEMA NRCS Local/Tribal Gov.	Continuous. To date, low related applications partly due to technical requirements for BCA and application, and uncertain funding. New flood hazard maps completed under Risk MAP may generate more

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
						interest in areas where the floodplain expanded from previous FIRMs.
Goal 2 Action 2-5	Through SDTA, support and encourage elevation or acquisition of private structures in flood prone areas through local project applications.	Low	Structure & Infrastructure Projects	HMGP BRIC FMA DANR Local USACE CDBG	**OEM,** Local/Tribal Gov, USACE FEMA	Continuous. Modified in 2014 to include acquisition projects. SHMT has not approved any elevation projects to date; the priority has been to relocate or acquire properties. There is some interest in the elevation of properties located in closed basins. OEM provides technical assistance with project applications.
Goal 2 Action 2-6	Coordinate with state departments and agencies through surveys and other mechanisms to identify private and state-owned structures in hazard areas and replacement values.	Medium	Data & Studies	Risk MAP/ FEMA, Silver Jackets	**OEM SD Bureau of Admin. - Risk Management,** SHMT members, Local/Tribal Gov, FEMA. Silver Jackets	Continuous. This action should be revisited and updated when new flood mapping in the eastern third of the state becomes final.
Goal 2 Action 2-7	Through SDTA, support & encourage fire risk reduction projects (fire breaks / fuel breaks, defensible spaces) between private structures, as well as state-owned assets, and forested areas through local project applications.	Medium	Natural Systems Protection	Wildland Fire, HMGP BRIC USFS SD GF&P BLM Private Citizens	**OEM,** Local/Tribal Gov. USFS. SD GF&P. Private Citizens	Continuous. SDDPS works with local landowners to create a safe zone around property to prevent damage from wildfire. DPS creates fire breaks by cleaning wooded areas. DPS administers the Beat the Beetle campaign. Moving forward this action will also include and evaluate potential state assets at-risk to determine the need for mitigation projects to reduce losses to these assets.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 2 Action 2-8	Through SDTA, support communities to participate in Firewise, develop CWPPs, and participate in other fire protection programs to minimize risks to wildfire through outreach on relevant programs and related funding opportunities.	Medium	Technical Assistance	Wildland Fire, USFS, BLM, FEMA HMGP-Post Fire, Private Citizens	**USFS**, SD GF&P, Private Citizens, OEM, Local/Tribal Gov. FEMA	Continuous. The DPS conducts outreach efforts to minimize fire. For example, SDWF hosts a variety of activities in the Black Hills area during Wildfire Prevention Month (May). OEM conducts outreach on new HMGP-Post Fire funding opportunities.
Goal 2 Action 2-9	Through SDTA, support bank stabilization and other geohazard risk reduction through local project applications.	Medium	Natural Systems Protection	Various Depts, EDA, Coast Guard, Local, HMGP, FHWA, NRCS: EQIP, ACEP, EWPP	**(Lead varies by project & funding)** SD DANR, SD GF&P, OEM, SDDOT, Local/Tribal Gov, FEMA, Coast Guard, USACE, NRCS, USGS	Continuous. SDDOT routinely completes banks stabilization projects to protect the highway network as needed. Haakon PCN 04XU, Pennington 08RV, Custer 06QK, Davison 05UY, etc., are recent/current examples.
Goal 2 Action 2-10	Map repetitive flood loss properties to identify concentrations of properties or high losses and identify potential mitigation options.	Medium	Data & Studies	Internal OEM staff time	**OEM,** Silver Jackets, Local/Tribal Gov.	Continuous. 26 H&H Studies were completed with HMA funding
Goal 2 Action 2-11	Address information gaps identified during the plan update process and going forward to better inform risk assessment and resiliency planning. The State will help disseminate relevant information, via email or other means as applicable, with developers of local mitigation plans to help fill information gaps.	Medium	Data & Studies	Internal OEM staff time; HMGP, BRIC	**OEM**	New for 2024.
Goal 3 Action 3-1	Through SDTA, support the improvement to existing power lines through local project applications. (i.e., power line burial, spoiler installation, pole strengthening & heavier wires).	High	Structure & Infrastructure Projects	HMGP BRIC Local PA-406 Utilities REC's RUS loans	**OEM,** PUC, SD Rural Electric Association, Local/Tribal Gov, FEMA	Continuous. Loss avoidance studies have documented the effectiveness of upgrading power lines to mitigate hazards. See 5.4.8 Loss Avoidance Case Studies

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 3 Action 3-2	Enable the purchase of generators for backup power to critical infrastructure / storm shelters through SDTA. Conduct regular testing for preparedness.	High	Structure & Infrastructure Projects	Local & Municipal Utilities, HMGP, BRIC, EMPG SHSGP	**OEM,** PUC, SD DOH, Local/Tribal Gov, SD OHS, FEMA	Continuous. 38 generator projects to date.
Goal 3 Action 3-3	Through coordination with SDDOT, continue the removal of debris in waterways (i.e., near bridges, culverts, within stream channels).	High	Natural Systems Protection	SD DOT, Local, Tribal, Water development districts	**(Lead varies by project & funding)** SD DOT, DANR, GF&P, Local/Tribal Gov, Water Districts, Watershed Districts, NRCS, USACE, BOR	Continuous. SDDOT continually removes debris from bridges and culverts on the state system. Culverts and bridges are routinely inspected, maintained, and/or replaced to ensure proper function. On the local system, there is no check of local entities to ensure that they are doing this for structures funded through the state, although the state informs them of the requirement to regularly inspect their structures.
Goal 3 Action 3-4	Through SDTA, support and enable drainage improvement projects through local applications (i.e., proper sizing).	High	Structure & Infrastructure Projects	HMA - BRIC, Local	**OEM, Local Gov, Tribal Gov,** DANR, GOED, Local Watershed Districts, Water Districts	Continuous. SD GOED continues to approve funding for water, sewer, storm sewer, and public infrastructure projects through the CDBG program during regular application cycles.
Goal 3 Action 3-5	Continue routine inspections of state-owned utilities and infrastructure for damage and weaknesses. Support the development of projects at the local, tribal, or state level to mitigate deficiencies, up to and including replacement where feasible.	High	Structure & Infrastructure Projects	Rural Access Infrastructure Fund, HMA - HMGP, Local	**OEM,** Local Gov, Tribal Gov, DANR, GOED, Local Watershed Districts, Water Districts	Continuous. Modified in 2024 to include repair and replacement. SD DOT performs bridge inspections every two years and culvert inspections every five years. SD DANR's Dam Safety Inspection Program requires all high hazard dams to be inspected every three years. In 2021-2023, the South Dakota Legislature created the Rural Access Infrastructure Fund to help townships and counties repair and replace culverts and bridges on township and county secondary roads. This funding is in addition to the 10% state match for 404 and 406 mitigation programs.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 3 Action 3-6	Maintain and enhance the operational resilience of the state digital radio system through regular training and exercises.	Medium	Training & Exercises	Internal staff time with OEM, BIT	**OEM,** BIT, SD National Guard, Local/Tribal Gov.	Continuous. SD Wildland Fire held drills and training on the digital radio in 2023, mostly 8 line and medical incident training. Tests of the digital radio system defined comms holes in the Black Hills, especially along the I-90 corridor around Piedmont.
Goal 3 Action 3-7	Reduce number of private or state-owned dams susceptible to high flow/flood events through re-evaluation of design capacity and development of updated emergency preparedness plans.	Medium	Structure & Infrastructure Projects	USACE, FEMA Dam Safety funds, BOH	**DANR**, GF&P, School & Public Lands, Local Government, USACE Silver Jackets, Reclamation. HHPD	Continuous. GFP did a 3-year comprehensive study to identify issues with GFP owned dams and are in the process of addressing those deficiencies.
Goal 4 Action 4-1	Promote agricultural modifications to lessen the impacts of drought such as crop rotation, drought resistant crops, no till, etc. Conducted through outreach and education efforts, such as social media and SDSU Extension.	Medium	Education, Awareness, & Outreach	SDDA NRCS: EQIP, CSP, ACEP Private Citizens	**DANR,** Extension Service, Private Citizens, Local/ Tribal Gov, USDA, NRCS	Continuous. Actively promoted by Extension Service and on their website.
Goal 4 Action 4-2	Promote insurance – Many different forms of insurance are available to cover damages incurred by the various natural hazards. The state will encourage residents, farmers, and business owners to purchase insurance appropriate for their risk.	Medium	Education, Awareness, & Outreach	Internal staff time OEM SDDA SDSU Extension,	**OEM SDDA** SDSU Extension, DOLR – Insurance, Local/Tribal Gov. FEMA, USDA	Continuous. OEM promotes NFIP flood insurance through meetings and ad campaigns. During spring, the state will coordinate flood outreach presentations with FEMA Region 8, NWS, US Army Corps of Engineers, US Geological Survey, and local officials as part of the National Flood Safety Awareness platform. Promotion of the FEMA RiskMAP Journal, where individuals can view information and download the new flood maps/GIS data to better understand their risk.
Goal 4 Action 4-3	Enhance and streamline coordination with the State Historic Preservation Officer, Tribal Historic Preservation Officer (as applicable), and other agencies on applicable projects.	High	Planning & Regulations	Internal staff time OEM SHPO, DANR, GF&P	**OEM SHPO, DANR, GF&P, THPO, FEMA,**	Continuous. SHPO and FEMA executed a new Programmatic Agreement in 2021 that is applicable for immediate responses to federally declared

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
					USFWS, USACE, etc.	disasters and for mitigation projects in which FEMA is directly involved. SHPO and FSA are developing a Programmatic Agreement, which would include ECP projects.
Goal 4 Action 4-4	Develop and deploy targeted messaging aimed at educating and informing travelers during drought, fire, and flood events. Coordinate communication for in-state and out-of-state tourists, including social media, email databases, tourism industry partners, schools, and public service announcements.	Low	Education, Awareness, & Outreach	SD Dept of Tourism & State Dev. Chambers of Commerce	**SD Dept of Tourism and State Development** SD GF&P SD GOED	Continuous. Modified in 2024 to incorporate actions from Drought Plan. Department of Tourism has messages from past events that can be quickly customized for new or upcoming events.
Goal 4 Action 4-5	Increase monitoring and assessment of impacts from drought to economics, losses, and human factors. Provide guidance to state agencies on data collection in order to track drought impacts from year to year. Develop data assessment for drought impacts to tourism, including data on hotel occupancy and the tourism promotion tax; could also include Deadwood gaming handle. Develop business impact assessment to determine how businesses (i.e. seed / fertilizer / equipment dealers, truckers, grain elevators, livestock auctions, etc.) are affected during drought.	High	Data & Studies	DTF Staff time	**Drought Task Force**	Continuous. Integrated from multiple Drought Plan actions in 2024. The vulnerability assessment in the Drought Mitigation Plan has recommendations for data collection needed to improved drought impact assessment. The NDMC currently collects data on a wide range of drought impacts. The State Climate Office actively encourages people to report impacts to NDMC.
Goal 4 Action 4-6	Convene the Drought Task Force annually to discuss sector-based data collection to continually enhance the drought plan.	High	Planning & Regulations	DTF Staff time	**Drought Task Force**	Continuous. Integrated from Drought Plan in 2024. DTF continues to meet at least annually to discuss ongoing efforts and ensure they are not shelved without being looked at from year to year.
Goal 4 Action 4-7	Update and refine aquifer mapping to better quantify volume and location of water resources.	High	Data & Studies	DANR Staff time	**DANR Geological Survey**	In Progress. Integrated from Drought Plan in 2024. The DANR Geological Survey is nearing completion of updating county studies, including aquifer mapping, in the eastern half of

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
						the State. More detailed mapping of shallow aquifers state-wide has begun.
Goal 4 Action 4-8	Maintain and expand weather and climate monitoring/ observations through SD Mesonet, DOT, and other similar statewide networks. Increase weather and climate monitoring and expand manual / automated data network on precipitation, hydrology, soil moisture/ infiltration to support drought assessment.	High	Data & Studies	NWS; USGS; NRCS; DANR;	**SDSU Extension;** NWS, USGS, NRCS, DANR, FSA, SDDA	In Progress. Integrated from Drought Plan in 2024. SDDOT partially funds the current USGS stream gage network, provides road conditions through 511, funds hydrological research, etc. SDSU Extension has recently contracted with others to further increase the number of weather monitoring locations in western SD. Funding is in place through at least 2026, though work is anticipated to continue beyond.
Goal 4 Action 4-9	Develop instream flow protections and secure water rights for fish and wildlife conservation.	High	Technical Assistance	NRCS; DANR;	**DANR Water Rights Program, Game, Fish and Parks,** SD Water Management Board	Not Started Integrated from Drought Plan in 2024. The South Dakota Water Management Board has issued water right permits to entities to protect instream flow in the state's river and streams.
Goal 4 Action 4-10	Enhance operational resiliency by pre-positioning water resources to support fire suppression activities.	Medium	Technical Assistance	DPS Staff time	**DPS Wildland Fire**	Not Started Integrated from Drought Plan in 2024.
Goal 4 Action 4-11	Create tax credit incentives for efficient water use.	High	Planning & Regulations	Staff time	**SD Legislature**	Not Started. Integrated from Drought Plan in 2024. No bills have been discussed to date related to this action.
Goal 4 Action 4-12	Develop more efficient irrigation systems.	High	Technical Assistance	Staff time Private sector	**SDDA**, SDSU Extension	Continuous. Integrated from Drought Plan in 2024. Monitor private sector and technological advances in irrigation systems. Issues are discussed at SDSU extension meetings with producers.
Goal 4 Action 4-13	Develop livestock water systems for less reliance on ponds.	Medium	Technical Assistance	EPA, NRCS; DANR;	**SDDA and SDSU Extension**, USDA	Continuous. Integrated from Drought Plan in 2024.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
						SDSU Extension coordinates with NRCS, who conducts relevant programs.
Goal 4 Action 4-14	Implement long-term restoration of grasslands.	Medium	Planning & Regulations	EPA, NRCS; DANR;	**SDDA**	Not Started Integrated from Drought Plan in 2024.
Goal 4 Action 4-15	Identify and enhance habitats that are most susceptible to drought. Critical habitats will be identified through implementation of this action that may be most susceptible to drought and include recommendations for enhancement.	Low	Planning & Regulations	EPA, NRCS; DANR;	**Game, Fish & Wildlife**	Not Started Integrated from Drought Plan in 2024.
Goal 4 Action 4-16	Create studies on drought frequencies and future changes.	Medium	Data & Studies	NWS, NRCS; DANR;	**State Climate Office, Various SDSU Depts**	Not Started Integrated from Drought Plan in 2024.
Goal 5 Action 5-1	Support and continue public outreach efforts regarding methods to reduce losses due to natural hazards. The State will disseminate outreach and education methods via multiple channels, such as email, social media, or bReadySD.	Medium	Education, Awareness, & Outreach	EMPG BRIC HMGP	**OEM,** Local Gov, Tribal Gov, OHS, DOH, NWS, SDDA, USDA, FEMA, NRCS	Continuous. OEM provides technical assistance to other state, regional, and local agencies, in addition to their own outreach & education efforts bReadySD
Goal 5 Action 5-2	Continue working with local governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	High	Technical Assistance	BRIC HMGP	**OEM,** FEMA	Continuous. 68 tribal and county plans updated since 2019.
Goal 5 Action 5-3	Through SDTA, support and encourage safer building practices in local communities to reduce risk from all hazards.	Medium	Education, Awareness, & Outreach	Staff time	**OEM,** DOLR, Local/Tribal Gov.	Continuous. OEM encourages and provides technical assistance on related practices.
Goal 5 Action 5-4	Create "Drought Tools" website for South Dakota.	Medium	Education, Awareness, & Outreach	Staff time, BIT	**BIT**, DTF	In Progress. Integrated from Drought Plan in 2024. The website www.sdresponse.sd.gov is under transformation and the drought information will be fully housed on the DANR website in the future.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 5 Action 5-5	Create public awareness campaigns that various agencies can use for water conservation, fire prevention, etc. Disseminate public awareness and information (e.g., fliers, brochures, PSAs, social media). Coordinate drought messaging across State agencies.	Medium	Education, Awareness, & Outreach	DTF Staff time	**Drought Task Force**	Continuous. Integrated from Drought Plan in 2024. See above on the SD response website. Social media is now the preferred education and dissemination method to get information quickly to the public. Both DANR and DPS share drought information by social media. SDSU Extension ensures media outlets are aware of the meetings and when they are taking place. Wildland Fire has a Firewise program they work with citizens to mitigate their homes from forest fires.
Goal 5 Action 5-6	Via outreach and education efforts to local jurisdictions, encourage local level drought planning. Increase community / local level drought planning assistance. Identify leaders at local level (i.e., create Drought Ready Communities).	High	Planning & Regulations	Staff time, BoR, Water Smart grants	**SDSU Extension**, State OEM, NIDIS	Integrated from Drought Plan in 2024. Continuous. OEM encourages counties to develop drought annexes to their LEOP.
Goal 5 Action 5-7	Create and keep current a web-based state burn ban map.	High	Education, Awareness, & Outreach	Wildland Fire, Staff time	**DPS Wildland Fire Division**	Integrated from Drought Plan in 2024. Continuous. This is maintained at www.sdresponse.gov as burn bans are put in place at the County level.
Goal 5 Action 5-8	Increase awareness and education for drought planning ranchers. Educate producers on technical assistance available through DANR Resource Conservation and Forestry Division.	Medium	Education, Awareness, & Outreach	Staff time	**SDSU Extension,** Farm Credit Services, NIDIS	Continuous. Integrated from Drought Plan in 2024. SDSU Extension hosts meetings to discuss with producers on what they can do to mitigate crop losses in drought years.
Goal 5 Action 5-9	Recommend development of drought-resistant rural water systems through SDSU extension meetings with producers.	High	Technical Assistance	Staff time	**SDSU Extension**	Continuous. Integrated from Drought Plan in 2024. Communicate this at SDSU extension meetings with producers.
Goal 5 Action 5-10	Recommend counties increase support of local volunteer fire departments to prepare/fund suppression activities before and during drought through targeted communications.	High	Planning & Regulations	Staff time, county funds	**DPS Wildland Fire**	Continuous. Integrated from Drought Plan in 2024. Increase outreach and communication to local volunteer fire departments in advance of and during drought conditions.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 5 Action 5-11	Increase NIDIS interactions and planning efforts related to drought and drought early warning systems through continued coordination efforts.	High	Planning & Regulations	Staff time, NIDIS	**State Climate Office**	Continuous. Integrated from Drought Plan in 2024. Continue efforts to coordinate with NIDIS and participate in NIDIS Missouri River Basin Drought Early Warning System (DEWS). DEWS may be completed within a couple of years.
Goal 5 Action 5-12	Use existing outreach and education efforts, such as social media and SDSU Extension, to promote catching water in cisterns in the southwestern part of South Dakota	Low	Education, Awareness, & Outreach	Staff time	**SDSU Extension**	Not Started Integrated from Drought Plan in 2024.
Goal 5 Action 5-13	Use existing outreach and education efforts, such as social media and SDSU Extension, to promote water-friendly landscaping and planting of drought-resistant lawns	Medium	Education, Awareness, & Outreach	Staff time	**SDSU Extension**	Continuous. Integrated from Drought Plan in 2024. Relevant outreach materials posted to SDSU Extension website in 2021.
Goal 5 Action 5-14	Enhance outreach outside of the Black Hills fire district for mitigating damages in rural areas; potential capabilities of reducing agricultural losses due to fire	Low	Education, Awareness, & Outreach	DPS Staff time	**DPS Wildland Fire**	Not Started Integrated from Drought Plan in 2024.
Goal 5 Action 5-15	Via outreach and education efforts to local jurisdictions, recommend to local communities the creation of drought mitigation plans where applicable	Medium	Education, Awareness, & Outreach	OEM Staff time	**OEM**	Not Started Integrated from Drought Plan in 2024.
Goal 5 Action 5-16	Continue to maintain the Drought Task Force website to promote information on current drought conditions.	Medium	Education, Awareness, & Outreach	DTF Staff time	**Drought Task Force / BIT**	Not Started Integrated from Drought Plan in 2024.
Goal 6 Action 6-1	Inform tribes of mitigation, public assistance, individual assistance, and SBA funding opportunities to help reduce risks and recover from disasters.	High	Technical Assistance	OEM Staff time, FEMA PA, SBA	**OEM** SD Tribal Relations, FEMA Tribal Relations, Tribal Gov.	Continuous. Tribes usually go directly to FEMA (Nation to Nation) for disaster declarations rather than going through the state. FEMA Region 8 Tribal Relations, SD Tribal Relations, and OEM meet with tribes pre- and post-disaster to inform tribes of the recovery programs and how to access them.

Goal & Action	Mitigation Action	Priority	Mitigation Type	Potential Funding	Responsible Departments	2024 Status and Notes
Goal 6 Action 6-2	Continue working with tribal governments to develop approvable hazard mitigation plans and eligible mitigation project grant applications.	High	Technical Assistance	OEM Staff time, FEMA - HMGP and BRIC	**OEM** SD Tribal Relations, FEMA Tribal Relations, Tribal Gov.	Continuous. Recent progress in improving and expanding tribal mitigation planning. OEM has been working with all tribes to develop HMPs, either on their own or in cooperation with the counties. OEM actively solicits mitigation projects from tribes.
Goal 6 Action 6-3	Increase outreach and interaction with local, tribal, and federal agencies related to drought through NIDIS and the Drought Task Force	Medium	Planning & Regulations	DTF Staff time	**Drought Task Force**	Continuous. Integrated from Drought Plan in 2024. The state climatologist, along with NIDIS provided a climate change public forum and shared data showing how the climate has changed in 125 years. The forum allowed attendees to share ways they are managing drought and other extremes in the weather patterns.
Goal 6 Action 6-4	Engage with tribal representatives to coordinate with local planning personnel for joint initiative development and increase data sharing. Engage more closely with tribal entities in the drought planning and mitigation process.	High	Planning & Regulations	OEM Staff time	**Tribal Relations**, OEM	Continuous. Integrated from Drought Plan in 2024. OEM continues to encourage this. Continue efforts in coordination with NIDIS and the National Drought Mitigation Center (NDMC)
Goal 6 Action 6-5	Coordinate with tribes to identify and implement mitigation capability enhancement activities where needed and feasible.	Medium	Planning & Regulations	OEM Staff time	**Tribal Relations**, OEM	New in 2024.

5.2.4. Comprehensive Mitigation Strategy

South Dakota's mitigation strategy is designed to target all hazards that significantly impact the state. During the 2024 SHMP update process, the SHMT reviewed all current and proposed mitigation actions to ensure the mitigation strategy addresses all hazards identified in Section 3 Hazard Identification and Risk Assessment. Table 5-4 lists all the mitigation actions from **Error! Reference source not found.** and notes which hazards they address. This analysis indicates that the 2024 SHMP includes mitigation actions that will reduce vulnerabilities to each hazard identified in Section 3. Many of the actions address multiple hazards.

Table 5-4 Mitigation Actions by Hazards Addressed

Action #	Mitigation Action	Agricultural Pests/Diseases	Flood	Summer Storm	Winter Storm	Wildfire	Drought/Heat	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
1-1	Shelters/ Safe Rooms		X	X	X	X		X	X	X	
1-2	Sirens, weather radios		X	X	X	X		X	X	X	
1-3	Shelter education & outreach		X	X	X	X		X	X	X	
1-4	All-hazards education & outreach	X	X	X	X	X	X	X	X	X	X
1-5	Climate change analysis		X			X	X				
1-6	Monitor drought-health issues	X				X	X				
1-7	Support behavioral health during drought	X	X	X	X	X	X	X	X	X	X
1-8	Mental health referrals to providers	X	X	X	X	X	X	X	X	X	X
1-9	Monitor heat mortality						X				
1-10	Coordinate with dam owners		X								
1-11	Analyze development trends	X	X	X	X	X	X	X	X	X	X
1-12	Economically Disadvantaged Rural Communities	X	X	X	X	X	X	X	X	X	X
2-1	Building codes		X	X	X	X		X	X	X	X
2-2	State facilities database		X	X	X	X	X	X	X	X	X
2-3	Purchase & relocation of at-risk structures		X								X
2-4	Flood control projects		X								
2-5	Elevation/acquisition of structures in floodplain		X								

Action #	Mitigation Action	Agricultural Pests/Diseases	Flood	Summer Storm	Winter Storm	Wildfire	Drought/Heat	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
2-6	Identify structures in hazard areas		X	X	X	X		X	X	X	X
2-7	Wildfire risk reduction: defensible space, breaks					X					
2-8	Wildfire risk reduction: Firewise, CWPPs, etc..					X					
2-9	Bank stabilization & geohazard risk reduction		X								X
2-10	Repetitive loss strategy		X								
2-11	Address information gaps	X	X	X	X	X	X	X	X	X	X
3-1	Power line hardening		X	X	X			X	X		
3-2	Backup generators		X	X	X	X		X	X	X	X
3-3	Debris removal in waterways		X	X							
3-4	Drainage improvements		X	X							
3-5	Inspection and repair of utilities & infrastructure		X	X	X	X		X	X	X	X
3-6	Maintain state digital radio system		X	X	X	X		X	X	X	X
3-7	Reduce susceptibility of dams		X								X
4-1	Drought agricultural modifications	X					X				
4-2	Promote insurance	X	X	X	X	X	X	X	X	X	X
4-3	SHPO/THPO coordination		X	X	X	X		X	X	X	X
4-4	Tourism & recreation promotion		X			X	X				
4-5	Monitor drought impacts, data collection	X				X	X				
4-6	DTF & drought data strategy	X				X	X				
4-7	Aquifer mapping						X				
4-8	Weather & drought monitoring	X	X	X		X	X		X		
4-9	Instream flow protections & water rights for habitat	X				X	X				
4-10	Water & wildfire suppression					X	X				

Action #	Mitigation Action	Agricultural Pests/Diseases	Flood	Summer Storm	Winter Storm	Wildfire	Drought/Heat	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
4-11	Tax incentives for water conservation						X				
4-12	Irrigation efficiency	X					X				
4-13	Non-pond livestock water	X					X				
4-14	Grassland restoration	X				X	X				
4-15	Enhance habitats	X				X	X				
4-16	Study drought frequency	X				X	X				
5-1	Public outreach to reduce natural hazards losses	X	X	X	X	X	X	X	X		X
5-2	Local HMPs and projects	X	X	X	X	X	X	X	X	X	X
5-3	Safer building practices		X	X	X	X		X	X	X	X
5-4	Drought Tools website	X		X		X	X				
5-5	Create awareness campaigns: wildfire, water use, other	X				X	X				
5-6	Encourage local drought planning					X	X				
5-7	Burn ban map					X	X				
5-8	Drought education and TA for ranchers	X				X	X				
5-9	Drought-resistant rural water systems						X				
5-10	Support volunteer fire departments					X	X				
5-11	Increase NIDIS engagement					X	X				
5-12	Promote rainwater harvesting						X				
5-13	Promote water-efficient landscaping					X	X				
5-14	Outreach – reduce ag loss to wildfire (non-BHFD)					X	X				
5-15	Encourage local drought mitigation planning	X				X	X				
5-16	Public outreach – DTF website	X				X	X				
6-1	Technical & funding assistance to tribes	X	X	X	X	X	X	X	X	X	X

Action #	Mitigation Action	Agricultural Pests/Diseases	Flood	Summer Storm	Winter Storm	Wildfire	Drought/Heat	Tornado	Windstorm	Hazardous Materials	Geologic Hazards
6-2	Tribal HMPs and projects	X	X	X	X	X	X	X	X	X	X
6-3	Increase local, tribal, fed interaction – drought	X				X	X				
6-4	Engage tribes in drought planning, projects	X				X	X				
6-5	Capability Enhancement	X	X	X	X	X	X	X	X	X	X

A comprehensive hazard mitigation program needs to coordinate with multiple sectors, not just emergency management. FEMA identifies seven sectors in the 2015 FEMA State Mitigation Plan Review Guide as essential to coordinate with:

- emergency management.
- economic development.
- land use and development.
- housing.
- health and social services.
- Infrastructure, and
- natural and cultural resources.

Analysis of how the 67 mitigation actions in the 2024 ESHMP (listed in **Error! Reference source not found.**) address each of these seven sectors helps illustrate the impact inter-sectoral collaboration in the ESHMP update process. The mitigation actions created for this ESHMP tend to address the concerns of diverse stakeholders. On average, each sector is addressed by 35 mitigation actions and no sector is addressed by fewer than 28 actions or more than 56 actions. On average, each mitigation action addresses 3.7 of the seven sectors listed above. Over 90% of the mitigation actions address more than one sector. In addition, mitigation actions also address the seven sectors equitably and thoroughly.

5.3. Funding Sources

44 CFR Part 201 Requirement:
[The State mitigation strategy shall include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.
44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include…Demonstration that the State has the capability to effectively manage the HMGP as well as other mitigation grant programs, including a record of the following: *Meeting HMGP and other mitigation grant application timeframes and submitting complete, technically feasible, and eligible project applications with appropriate supporting documentation;* *Preparing and submitting accurate environmental reviews and benefit-cost analyses;* *Submitting complete and accurate quarterly progress and financial reports on time; and* *Completing HMGP and other mitigation grant projects within established performance periods, including financial reconciliation.*

South Dakota uses a variety of sources to fund state and local mitigation activities. While much of the funding comes from the federal government, additional funding comes from state and local governments as well as private organizations. The state, through OEM, has instituted an effective and comprehensive all-hazard mitigation program. Through a variety of programs, and the wise use of available federal and state funds, the state has been successful in mitigating areas against the devastating effects of disasters. South Dakota remains committed to a comprehensive state hazard mitigation strategy, including the effective state management of all FEMA Hazard Mitigation Assistance grant programs.

OEM is successful in administering federal mitigation programs. The Hazard Mitigation Assistance (HMA) program, administered in collaboration with FEMA, serves the needs of the state for implementing hazard mitigation projects. The state recognizes there is limited funding available for hazard mitigation projects. The State Hazard Mitigation Officer (SHMO) and the South Dakota Hazard Mitigation Team (SHMT) administer funds for local projects requiring the local communities to provide the 25% match required for receipt of federal funds. (In some cases, the state has provided a portion of the 25% match; see Section 4.6.1.)

Section 322 of the Disaster Mitigation Act of 2000 provides for a significant increase in HMGP funding available to states with an enhanced mitigation plan. It therefore requires South Dakota to demonstrate its ability and commitment to manage HMA grants effectively to ensure it advances the tenets and benefits of mitigation as comprehensively as possible. South Dakota is committed to a comprehensive state hazard mitigation strategy included the effective state management of all FEMA Mitigation Division grant programs. See Section 5.4 for details.

During the 2024 Plan update process, the SHMT identified many sources of federal, state, local, and private funding that have been used to implement risk reduction or mitigation activities or could potentially be used in the future. These sources of funding are summarized in Table 5-5.

Table 5-5 Mitigation Funding Sources in South Dakota

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
AmeriCorps	Federal	Corporation for National & Community Service	None	Provides funding for volunteers to serve communities, including disaster prevention. AmeriCorps/Vista has assisted local communities with wildfire mitigation projects.
Assistance to Firefighters program – Fire Prevention & Safety (FP&S) Grants	Federal	FEMA	State Fire Marshal	Fire Prevention & Safety (FP&S) Grants support projects that enhance the safety of the public and firefighters from fire and related hazards.
Highway Bridge Replacement and Rehabilitation Program	Federal	FHWA	SDDOT	Provides funding to enable states to improve the condition of highway bridges through replacement, rehabilitation, and systematic preventive maintenance. Also includes the National Historic Covered Bridge Preservation Program.
Bureau of Indian Affairs (BIA)	Federal	BIA	None	BIA's Tribal Wildfire Prevention programs provide leadership, training, and guidance to develop strategies to reduce the number of human-caused fires on Indian Reservations. The Fuels Management Program provides funding to reduce hazardous vegetation both in and outside the WUI.
Clean Water Act Section 319 Grants	Federal	EPA	None	Provides grants for a wide variety of activities related to non-point source pollution runoff mitigation.
Community Assistance Program (CAP)	Federal	FEMA, NFIP	OEM	Product-oriented financial assistance program directly related to the flood loss reduction objectives of the NFIP.
Community Development Block Grant – Disaster Recovery/Mitigation (CDBG-DR/MIT)	Federal	HUD	GOED	Often following a disaster, the state may receive a CDBG-DR/MIT Supplement intended for mitigation and disaster recovery projects in the affected areas. Funding can be used to acquire properties in hazard prone areas. Since CDBG funds lose their federal identify they can also be used to supplement state or local match requirements on other funds such as FEMA HMA grants. Funding also supports public facilities including water and wastewater.
Community Fire Protection Program	Federal	USDA	None	Mitigation delivered via USDA Forest Service and Private Forestry Coop Fire Program.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Economic Development Administration Grants and Investments	Federal	U.S. DOC, EDA	None	Invests and provides grants for community construction projects, including mitigation activities.
Emergency Community Water Assistance Grants	Federal	USDA	None	$150,000 to $500,000 available to rural communities with populations over 10,000 people with a median household income less than $65,900. Provides assistance to communities who have experienced a decline in quantity or quality of drinking water as a result of an emergency including drought.
Emergency Management Performance Grant (EMPG)	Federal	FEMA	OEM	The EMPG program provides a yearly allocation of funding to support state and local emergency management programs. This has included providing some funding for local mitigation plans, mitigation-oriented studies, and related activities.
Emergency Relief (ER) Program	Federal	US DOT – FHWA	SDDOT	Provides funds for roads and bridges on Federal-aid highways that are damaged as a direct result of a natural disaster or catastrophic failure from an external cause.
Emergency Watershed Protection (EWP)	Federal	USDA, NRCS	None	Provides funding and technical assistance for emergency measures such as floodplain easements in impaired watersheds. Funding available through the Simplified Acquisition Procedures (SAP) ranges from $25K to $100K. Funded through contracts between project sponsors and the NRCS. There are no grants. The NRCS pays 75% of the costs.
Environmental Quality Incentives Program (EQUIP)	Federal	USDA, NRCS	None	Provides funding and technical assistance to farmers and ranchers to promote agricultural production and environmental quality as compatible goals.
Fire Management Assistance Grants (FMAG)	Federal	FEMA	SDDA	Provides fire suppression support to states when loss of life and property are imminent. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.
Flood Mitigation Assistance (FMA) Program	Federal	FEMA	OEM	Repetitive flood loss property reduction and projects that mitigate losses to NFIP insured properties.
Forest Land Enhancement Program	Federal	USDA, DNRC	None	Provides educational, technical, and financial assistance to help landowners implement sustainable forestry management objectives
Forest Legacy Program	Federal	USFS	None	Program providing funding to protect private forest lands that are environmentally, economically, and socially critical. This program reduces development in the wildland-urban interface.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Hazard Mitigation Grant Program (HMGP)	Federal	FEMA	OEM	Post-disaster multi-hazard mitigation funding. Starting in 2018, FEMA made HMGP Post Fire funds available for states, territories, and tribes with an FMAG declaration.
Hazard Mitigation Grant Program (HMGP) Post-Fire Assistance	Federal	FEMA	OEM	Post Fire assistance is available to help communities implement hazard mitigation measures after wildfire disasters. Provides hazard mitigation grant funding to state, local, territorial, and tribal governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration.
High Hazard Potential Dam (HHPD) Program	Federal	FEMA	OEM	Provides federal funds to eligible states for pass through to non-Federal governmental organizations or nonprofit organizations for the rehabilitation of dams that fail to meet minimum dam safety standards and pose unacceptable risks to life and property.
Homeland Security Grant Program (HSGP)	Federal	DOJ, DHS	SDOHS	Homeland security activities identified in the state and local strategic plans. Funding supports threat & hazard and risk identification for natural, technological, and human-caused hazards. Some prevention activities may be considered mitigation.
Housing and Urban Development (HUD) Grants	Federal	HUD	GOED	Provides a number of grants related to safe housing initiatives.
Hydrologic Research Grants	Federal	NOAA	None	Up to $125,000 to conduct joint research and development on pressing surface water hydrology issues common to national, regional, local operational offices. Eligible applicants are federally recognized agencies of state or local governments, quasi-public institutions such as water supply or power companies, hydrologic consultants, and companies involved in using and developing hydrologic forecasts.
Individual Assistance (IA)	Federal	FEMA, State	OEM	Following a disaster, funds can be used to mitigate hazards when repairing individual and family homes.
In-Lieu Fee Program Mitigation Projects	Federal	USACE	None	Restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Department of the Army permits.
Mitigation Banks	Federal	USACE	None	Mitigation Banks are sites approved by the Corps to sell compensatory mitigation credits for projects resulting in unavoidable impacts to waters of the U.S. When a permit is issued that requires compensatory mitigation,

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
				the permit will specify how many credits are required to be purchased at an approved mitigation bank.
National Dam Safety Program	Federal	FEMA	DANR	Promotes dam safety through dam inspections, training on dam safety, and dam monitoring.
National Earthquake Hazards Reduction Program (NEHRP)	Federal	FEMA	None	Provides money to support enhanced earthquake risk assessments in local hazard mitigation plans and other earthquake hazard mitigation and preparedness activities.
National Fire Plan	Federal	USDA, DOI	None	Provides pre-disaster funding for primarily wildland fire mitigation, but also planning for all hazards.
National Weather Service (NWS)	Federal	NWS	None	NWS offers storm spotter training, along with weather and flooding safety guides. They can also sometimes provide funding to support severe weather signage in parks or other public places.
National Wildlife Wetland Refuge System	Federal	USFWS	None	Provides funding for the acquisition of lands into the federal wildlife refuge system.
North American Wetland Conservation Fund	Federal	USFWS	None	Provides funding for wetland conservation projects.
NRCS Conservation Programs	Federal	USDA, NRCS	None	Provides funding through a number of programs for the conservation of natural resources.
Partners for Fish and Wildlife	Federal	USFWS	None	Provides financial and technical assistance to landowners for wetland restoration projects in "Focus Areas" of the state.
Planning Assistance to States	Federal	USACE	None	Provides assistance to states in planning for the development, utilization, and conservation of water and related land resources.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Pre-Disaster Mitigation (PDM) Program	Federal	FEMA	OEM	Being replaced by BRIC. Grants for specific multi-hazard mitigation projects, including planning.
Building Resilient Infrastructure and Communities (BRIC)	Federal	FEMA	OEM	Replaces PDM, greater focus on hazard resilience and other aspects.
Public Assistance (PA) Section 406 funds	Federal	FEMA, State	OEM	Following a disaster, funds can be used to mitigate hazards when repairing damages to a public structure or infrastructure. Wildfire mitigation is also eligible under emergency protection if life is in imminent danger.
Public Health Emergency Preparedness Program (PHEP)	Federal	CDC	SD DOH-OPHPR	
Risk MAP Program	Federal	FEMA, NFIP	OEM	Establishes or updates floodplain mapping and multi-hazard risk products.
Rural Development Grants	Federal	USDA-Rural Development	None	Provides grants and loans for infrastructure and public safety development and enhancement in rural areas. Provides $100,000 or 75% of the total project, whichever is less.
Rural Fire Assistance Grant*	Federal	NIFC	None	Funds fire mitigation activities in rural communities.
Rural Utilities Service (RUS)	Federal	USDA-Rural Development	None	RUS administers programs that provide much-needed infrastructure or infrastructure improvements to rural communities. These include water and waste treatment, electric power, and telecommunications services.
Small Business Administration (SBA) Pre-Disaster Mitigation Loan Program	Federal	SBA	None	Provides low-interest loans to small businesses for mitigation projects.
Small Flood Control Projects (USACE Section 205)	Federal	USACE	None	Authorizes use of USACE to do feasibility and construction of small flood control projects

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Silver Jackets	Federal	USACE	None	Can provide funding for flood related studies, public awareness, risk analysis, and flood response plans. Construction of small flood control projects.
State Water Resources Research Act Program	Federal	USGS	None	USGS in cooperation with the National Institutes for Water Resources supports an annual call for proposals to focus on water problems and issues that are of a regional or interstate nature or relate to a specific program priority identified by the Secretary of the Interior and the Institutes.
Surface Transportation Block Grant (STBG) Program	Federal	FHWA	None	This program replaces the former Transportation Enhancement (TE) and Transportation Alternatives Program (TAP) grants. STBG provides funding for transportation alternatives and environmental mitigation projects.
United States Coast Guard (USCG)	Federal	USCG	None	USCG administers two grant programs designed to promote boating safety.
US Department of Justice (DOJ) Office of Justice Programs (OJP)	Federal	DOJ-OJP	DPS	DOJ-ODP provides a number of grants and awards focused on crime prevention to state and local law enforcement agencies and other eligible recipients.
United States Geological Survey (USGS)	Federal	USGS	None	USGS issues competitive grants and cooperative agreements to support research in earthquake hazards, the physics of earthquakes, earthquake occurrence, and earthquake safety policy.
Water2025 Challenge Grant Program for Western States	Federal	Bureau of Reclamation	None	Up to $250,000 for projects that can be completed within 24 months and that reduce conflicts through water conservation, efficiency, and markets
Water Conservation Field Services Program	Federal	Bureau of Reclamation	None	Up to $25,000 for projects that improve water use efficiency and improve water management practices
WaterSMART – Drought Response Program	Federal	Bureau of Reclamation	None	Provides for contingency planning, resiliency projects, and emergency response actions.
Watershed Processes and Water Resources	Federal	USDA	None	$100,000 available. Sponsors research that addresses two areas: (1) understanding fundamental watershed processes; and (2) developing appropriate technology and management practices for improving the effective use of water (consumptive and non-consumptive) and protecting or improving water quality for agriculture and forestry production

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Watershed Processes and Water Resources – National Research Initiative Standard Research (Part T)	Federal	USDA	None	$500,000 available. Innovative research in understanding fundamental processes that affect the quality and quantity of water resources at diverse spatial and temporal scales, ways on improving water resource management in agriculture, forested, and rangeland watersheds, and developing appropriate technology to reach those goals.
Deadwood Grant	State	SHPO	SHPO	Awarded to projects that retain, restore, or rehabilitate historic buildings, structures, and archaeology sites for commercial, residential, or public purposes.
Drinking Water State Revolving Fund	State	DANR	DANR	Funds projects that improve water use efficiency and improve water management practices. Interest rates and terms are 2.25% for up to 10 years or 3.0% for 11-20 years.
Rural Access Infrastructure Fund (RAIF)	State	DOT	DOT	Established in 2021 to help counties and townships inventory their small structures, plan needed improvements, and pay for the cost of repair or replacement. Funds are distributed in proportion to the number of eligible culverts and small bridges in each county.
Small Community Planning Grant Program	State	DANR	DANR	The Small Community Planning Grant Program was established to promote a proactive approach to water and wastewater infrastructure management. The grant is available to systems serving a population of 2,500 or fewer.
South Dakota Dept of Public Safety (SDDPS) Wildland Fire	State	SDDPS Wildland Fire	SDDPS Wildland Fire	The state fire suppression special revenue fund primarily pays for firefighting activities but can also fund fire prevention activities.
South Dakota Department of Game, Fish and Parks (GF&P)	State	GF&P	GF&P	GF&P implementation of shelters in state park facilities
South Dakota Office of Emergency Management (OEM) funding	State	FEMA, Others	OEM	Hazard Mitigation Grant Program Building Resilient Infrastructure and Communities Pre-Disaster Mitigation Grant Program Flood Mitigation Assistance Public Assistance Section 406 Increased Cost of Compliance Coverage Emergency Management Performance Grant
State Water Plan	State	DANR	DANR	Large costly water projects that are seeking significant state cost share participation must be identified on the State Water Resources Management System portion of the State Water Plan.

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
Water and Wastewater Funding	State	DANR	DANR	Projects requesting funding must be on the State Water Facilities Plan
James River Water Development District	Local	JRWDD	None	The James River Water Development District participates in the planning and implementation of programs and projects that support the restoration of the James River Watershed and ecosystem.
Local Government Funding	Local	Local Government	None	Local government funding could be leveraged as partial or complete funding for mitigation.
Resource Conservation and Development (RCD) Councils	Local	RCDs	None	RCDs provide leadership and assistance to communities, local units of government, and individuals to conserve the natural resources, improve the environment, and develop economic opportunities.
School Districts	Local	School Districts	None	District funding could be leveraged for tornado safe room projects.
Siouxland Interstate Metropolitan Planning Council (SIMPCO)	Local	SIMPCO	None	SIMPCO serves over 75 local governments, special districts, school districts, and non-profit organizations in the Tri-State area. SIMPCO partners with local governments in long-range planning, community development activities, and professional regional program management, which foster intelligent growth, economic development, and safe, accessible transportation.
American Red Cross	Private	Red Cross	None	The Red Cross provides training and tools to assist local responders and citizens in the aftermath of a disaster. They provide information for homeowners on protecting their properties from future damage, and supply resources for mold remediation after a flood, which helps mitigate against future health problems.
CoBank	Private	CoBank	None	CoBank is a national cooperative bank serving vital industries across rural America. The bank provides loans, leases, export financing, and other financial services to agribusinesses and rural power, water, and communications providers.
National Rural Utilities Cooperative Finance Corporation (CFC)	Private	CFC	None	CFC is a nonprofit finance cooperative that provides industry expertise, flexibility, and responsiveness to serve the needs of rural electrical utilities, to include long-term shelf financing for electric infrastructure, emergency lines of credit for power restoration after disasters, specialized financing including loan syndications and loan resales through Farmer Mac and

Name	Level	Source Agency	Managing State Agency	Purpose of Funding
				other partners, strategic planning and financial analysis, and financial education and training.
Private Electric Companies	Private	Electric Companies	None	
Rural Electric Cooperatives (RECs)	Private	RECs	None	The RECs have invested significant funding into line hardening, to include meeting matching funds for HMA-funded projects.
South Dakota Electrical Council	Private	Electrical Council	None	The South Dakota Electrical Council is a non-profit organization supporting the electrical industry in South Dakota. While not typically a source of direct funding, they are an important resource and a critical partner.
South Dakota Rural Electric Association (REA)	Private	REA	None	SD REA provides leadership, training, communication, legislative representation, and other services to member electric cooperatives. While not typically a source of direct funding, they are an important resource and a critical partner.
Rural Water Systems (RWS)	Private	RWSs	None	
Water Development Districts (WDDs)	Private	WDDs	None	

5.3.1. Hazard Mitigation Assistance (HMA) Program

The primary source of funding for South Dakota's mitigation activities is FEMA's Hazard Mitigation Assistance (HMA) program. The HMA program consists of three grants: the Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation (PDM) Program which has been replaced by the Building Resilient Infrastructure and Communities (BRIC), and the Flood Mitigation Assistance (FMA) Program. These three grants are described in detail in the following sections.

OEM recognizes their regulatory responsibilities for all HMA grants: the state, serving as the recipient, has primary responsibility for project management and accountability of funds as indicated in 2 CFR Part 200. The state is responsible for ensuring that subrecipients meet all program and administrative requirements.

OEM is committed to monitoring and providing technical assistance to all eligible and funded subrecipients. The SHMO, project manager, and/or technical support staff attend subrecipient meetings to ensure the policies and procedures are explained correctly. OEM has developed numerous forms and worksheets that have proven very successful; these materials can be found in the HMGP Administrative Plan and are discussed in the following section on HMGP. The OEM Program Guide breaks out local emergency management programs, including mitigation and grants management, and identifies roles and responsibilities. OEM also directs local governments to FEMA's *Local Mitigation Planning Handbook and Review Guide* as well as multiple hazard data resource websites.

For specifics on HMA grant funds awarded and expended in South Dakota, see Section 5.4.1.

Hazard Mitigation Grant Program (HMGP)

The purpose of the Hazard Mitigation Grant Program (HMGP) is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration to reduce the risk of loss of life and property from future disasters. HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The Hazard Mitigation

South Dakota's program for managing HMGP grants is described in detail in OEM's HMGP Administrative Plan, last updated on February 28, 2023, which is incorporated here by reference. The HMGP Administrative Plan details procedures and forms for:

- Identification of and Notification to Potential Applicants
- Determination of Eligibility
- Application Procedures
- Submission of Projects and Appeal of Decisions
- Project Application Review
- Financial Management
- Project Administration
- Designation of Applicant's Agent
- State-Local Assistance Agreements
- Tracking All Federal and Recipient Funds Commitment to Each Program Group
- Payment Management System Drawdown Process
- Project Evaluation
- Project Closeout Procedures

In August 2011, the SHMT approved the Home Mitigation Project Policy, establishing that acquisition projects are the only home/residence specific mitigation projects that will be funded by HMGP. The only exception is if the home is deemed to be a historical property by the State Historical Preservation Office, in which case the home is eligible for either relocation or acquisition if the home cannot be relocated. This policy also states that if a homeowner accepts mitigation funds for acquisition or relocation then they are not eligible to receive funds for the same purpose in the future. The program remains a voluntary program for each individual homeowner and each project must have a local government entity sponsoring their application. In Day County, specifically in the City of Waubay and around Bitter and Blue Dog Lakes, all homes must be below the elevation of 1,811 feet (FMSL NGVD29) in order to be eligible for acquisition or relocation.

Hazard Mitigation Grant Program Post Fire (HMGP-PF)

HMGP also has Post Fire assistance available to help communities after wildfire disasters. HMGP Post Fire (HMGP-PF) provides assistance for hazard mitigation measures that substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster, or any area affected by a fire for which assistance was provided under Section 420 Fire Management Assistance Grant (FMAG). As of March 2024, the State of South Dakota has had four declared FMAGs that resulted in the State receiving HMGP-PF. The post-fire opportunities include the following funding amounts that were fully utilized for mitigation: the South Dakota Legion Lake Fire/South Dakota Vineyard Fire (FM-5229-SD/FM-5272-SD that were combined into 5229 for a total of $850,016.00) in 2017, the South Dakota Vineyard Fire (FM-5272-SD) in 2018, the South Dakota Schroeder Fire (FM-5384-SD & $778,778.00) in 2021, and the South Dakota Auburn Fire (FM-5418-SD & $1,048,736.00) in 2021.

Pre-Disaster Mitigation Grant (PDM) Program

The Pre-Disaster Mitigation (PDM) program is essentially being replaced with BRIC, which is described in the next section. The PDM program was created to encourage sub-applications to the annual PDM grant program, local Emergency Managers throughout the state are encouraged to review their local hazard mitigation plans annually and submit applications for funding as applicable. These are competitive, non-disaster specific grants. Local project sub-applications are sent to the SHMO for initial review. In the case of multiple sub-applications, they are provided to the SHMT for ranking as part of the state's overall grant submittal. OEM uploads the information into eGrants and submits to FEMA. FEMA typically notifies if the sub-applicants are successful in the national competition within 6-12 months of grant submittal.

The SHMT requires that all applications for mitigation plan funding have a minimum of two bids from qualified consultants and a brief explanation on the bid solicitation and selection process. If at least two bids are not submitted with the application, no funding will be considered for the applicant until they can successfully fulfill the requirement.

Similar to HMGP, projects funded through PDM are monitored quarterly through an online FEMA-sponsored database and SMARTLINK application.

Building Resilient Infrastructure and Communities (BRIC)

The BRIC program essentially replaced PDM within FEMA's HMA programs. BRIC provides states set-aside and nationally competitive funds on an annual basis so that measures can be taken to reduce or eliminate the risk of natural hazards.

The Disaster Recovery Reform Act (DRRA), Public Law 115-254, was enacted on October 5, 2018, and made numerous legislative changes to the Robert T. Stafford Relief and Emergency Assistance Act (Stafford Act). Section 1234 of the DRRA amended Section 203 of the Stafford Act to allow FEMA to establish the BRIC grant program. The BRIC program is made available to states on an annual basis as a competitive grant and through state-specific set-aside dollars. The state administers the BRIC program and is responsible for selecting projects for funding from the applications submitted. The state then forwards selected applications to FEMA for national competitive selection and eligibility determination by officially uploading and submitting them into FEMA GO grant administration tool.

Objectives of the BRIC grant program are:

- To support state, local, and tribal governments through capability- and capacity-building;
- To encourage and enable innovation while allowing flexibility, consistency, and effectiveness;
- To promote partnerships and enable high-impact investments to reduce risk from natural hazards with a focus on critical services and facilities, public infrastructure, public safety, public health, and communities;
- To reduce future losses and minimize impacts on the Disaster Relief Fund (DRF);
- To promote equity, including helping members of disadvantaged groups and prioritizing 40 percent of the benefits to disadvantaged communities; and
- To support the adoption and enforcement of building codes, standards, and policies that will protect the health, safety, and general welfare of the public, taking into account future conditions, prominently including the effects of climate change, and have long-lasting impacts on community risk reduction, including for critical services and facilities and for future disaster costs.

Flood Mitigation Assistance Program (FMA)

Similar to BRIC, FMA funding is typically made available on an annual basis. Funding can be used for flood mitigation projects that include mitigation of at least one NFIP-insured structure, preferably for multiple structures. There is a portion of funds that can be used to pay for the flood-related elements of a multi-hazard mitigation plan. South Dakota has received very little FMA funding to date. If FMA funds become available, OEM sends out notifications about flood mitigation funding to all participating NFIP communities and all County Emergency Managers. Eligible communities are contacted and informed of the availability of FMA funding and related technical assistance. The state NFIP Coordinator assists these communities with development of individualized mitigation plans and ensures that communities submit viable, complete FMA applications. These applications are forwarded to FEMA for review. FEMA-approved projects are monitored to ensure completion in accordance with project scope and grant agreements. Award letters and funds are distributed by the state to approved communities on a reimbursement basis.

Advance Assistance (AA) and Project Scoping

Section 1104 of the Sandy Recovery Improvement Act (SRIA) authorized the use of Advance Assistance (AA) to accelerate the implementation of HMGP in the disaster recovery environment. Beginning with the FY2018 grant cycle, FEMA also authorizes AA payments for FMA grants. The BRIC grant program similarly allows funds for "project scoping" activities that function similarly to AA funds. In all cases, the comes from a portion of the authorized funding amount, not in addition to the approved grant amount. Requesting AA/project scoping funds is at the state's discretion.

The state may request AA/project scoping funds to:

- Pursue hazard mitigation opportunities early in disaster recovery.
- Develop mitigation strategies and obtain data to prioritize, select, and develop complete HMGP applications in a timely manner.
- Expedite the development of eligible applications.
- Work with sub-applicants on alternative analysis for proposed activities initially determined ineligible.
- Submit complete project applications up to or over the HMGP ceiling by the application deadline.

The state may use AA/project scoping funds for the following activities:

- Obtain staff or resources to develop a cost-share strategy and identify potential match funding.
- Evaluate facilities or areas to determine appropriate mitigation actions.
- Incorporate environmental considerations early into program decisions.
- Collect data for Benefit Cost Analysis (BCA), environmental compliance, and other program requirements.

- Scope and prioritize hazard mitigation projects (including state coordination of local projects) to incorporate sustainability, resilience, and renewable building concepts.
- Develop hazard mitigation projects, including cost effectiveness, engineering design, and feasibility actions.
- Incorporate strategic funds management principles into mitigation project work schedules and budgets that will facilitate compliance with the legislative requirement to expend obligated funds within 24 months.
- Conduct meetings, outreach, and coordination with potential sub-applicants and community residents to identify potential participants for property acquisition and demolition or relocation projects.
- Conduct engineering design and feasibility studies for larger or complex community drainage projects or critical facility retrofits (such as for phased projects).
- Conduct hydrologic and hydraulic studies for unmapped flood zones or Approximate A-Zone areas where communities propose to submit hazard mitigation projects.
- Perform professional cost estimation services to aid consistency in project budgeting across sub-applications.
- Rectify data consistency needs for other project application categories, including Environmental and Historic Preservation (EHP), cost sharing mechanisms, and work schedules.
- Complete necessary documents for deed restricted properties such as acknowledgment of voluntary participation and the Model Acknowledgement of Conditions for Mitigation of Property in a Special Flood Hazard Area with FEMA Grant Funds for property acquisition projects.

If the state chooses to utilize AA/project scoping funds, it understands:

- A grant application form (HMGP, FMA. or BRIC) must be submitted to the Regional Mitigation Division Director.
- The application must identify the proposed use of funds, including costs in sufficient detail for each proposed activity and milestones for submitting completed applications to FEMA.
- AA/project scoping funds are subject to the same cost-share requirements and Strategic Funds Management requirements as the base grant funding.
- Requests for AA/project scoping funds must not exceed 25% of approved grant funding, or $10 million (whichever is less).
- AA is part of the approved grant funding amount (no additional funds are available for AA).
- No benefit-cost analysis is required for AA/project scoping funds prior to the release of those funds. However, AA/project scoping funds may provide the critical avenue for producing benefit-cost ratios to determine project eligibility.

Requirements and deliverables associated with AA/project scoping funds and resulting HMGP applications may include:

- Documentation of accomplishments: the state must submit documentation to FEMA to support the accomplishment of all activities listed in the application.
- Submission of projects up to the grant funding amount: FEMA expects the state to submit complete project applications up to or over the available grant funding amount by the final project application deadline.
- Accounting for use of funds: For accounting and audit purposes, the state must submit sufficient financial detail to demonstrate that no costs claimed under AA/project scoping funds are duplicated in subsequent HMGP project applications or in State Management Cost budgets.

- Documentation of environmental considerations: The state must document that effects to the environment and historic resources were considered early in planning and project scoping processes. This requirement is in addition to ensuring environmental compliance.

Prior to 2018, South Dakota had not applied for AA funding. For the Building Resilient Infrastructure and Communities 2024 grant cycle, the mitigation staff is working with engineering firms to provide guidance and assistance to have sub-applicants apply for project scoping funds to complete hydrologic and hydraulic studies to assist in their project scoping activities.

5.3.2. Other FEMA Grants Programs

Public Assistance Program Section 406 Funding

South Dakota also uses FEMA's Public Assistance (PA) Program Section 406 funding to implement mitigation activities following a declared disaster. See Section 5.4.4 below for details.

Rehabilitation of High Hazard Potential Dams (HHPD) Program

FEMA's Rehabilitation of High Hazard Potential Dams (HHPD) program is described in Section 4.3.1. The program provides technical, planning, design, and construction assistance for activities that reduce dam risk and increase community preparedness. The State of South Dakota has not received funding under the HHPD program, since the program requirements were released after the approval of the 2019 ESHMP. With the approval of this plan update, the State intends to participate in the program.

Emergency Management Performance Grant (EMPG)

Many mitigation activities are eligible expenses under the Emergency Management Performance Grant (EMPG) and are allowed by the state. A good example is OEM's use of EMPG funds to complete the 2024 HIRA Update, as described in Section 2.

State Homeland Security Grant Program (SHSGP)

The State Homeland Security Grant Program (SHSGP) is able to fund many mitigation activities as long as they have a viable nexus to terrorism. As example, from 2012 through 2023 South Dakota has used $4,002,550 of SHSGP funds to purchase 83 generators, 22 transfer switches, and 89 outdoor early warning sirens.

5.4. Effective Use of Available Mitigation Funding

44 CFR Part 201 Enhanced Plan Requirement:
Enhanced State Mitigation Plans must include…Documentation of the State's project implementation capability, identifying and demonstrating the ability to implement the plan, including: *A system to determine the cost effectiveness of mitigation measures, consistent with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, and to rank the measures according to the State's eligibility criteria.* *Demonstration that the State has the capability to effectively manage the HMGP as well as other mitigation grant programs, including a record of the following:* *Meeting HMGP and other mitigation grant application timeframes and submitting complete, technically feasible, and eligible project applications with appropriate supporting documentation;* *Preparing and submitting accurate environmental reviews and benefit-cost analyses;* *Submitting complete and accurate quarterly progress and financial reports on time; and* *Completing HMGP and other mitigation grant projects within established performance periods, including financial reconciliation.* *A comprehensive description of how the State integrates mitigation into its post-disaster recovery operations.*

The State of South Dakota is committed to making the most effective and efficient use of available FEMA mitigation funds. As discussed in Section 4.6.1 the state advertises when funds are available, solicits input from local governments and tribes regarding needed mitigation projects, actively encourages and assists with project applications, and helps cover a portion of the local matching funds when possible. The state has also made local and tribal hazard mitigation plans a priority so that communities are eligible to apply for FEMA mitigation funding.

5.4.1. Demonstrated Use of Mitigation Funding

The state has been very effective at using the maximum available mitigation funds following presidential disaster declarations. Figure 5-1 summarizes the amount of HMGP grants awarded to the State of South Dakota, and jurisdictions within, for disasters from 2010-2023. Other hazard mitigation grants the state has received since 2010 are shown in Table 5-6. These tables again show the state has been very effective at utilizing the available funding through numerous mitigation grant programs, including the more recent programs such as BRIC and HMGP Post Fire grant funds. As of March 2024, the HHPD grant program has not yet been leveraged for dam-related mitigation activities.

Figure 5-1 Recent HMGP Grants in South Dakota, 2010-2022

Disaster #	Disaster Year	Federal Share Obligated	Disaster #	Disaster Year	Federal Share Obligated
1886	2010	$205,183	4186	2014	$6,845,570
1887	2010	$33,575,155	4233	2015	$430,669
1914	2010	$1,250,736	4298	2017	$1,830,175
1915	2010	$7,390,098	4440	2019	$10,514,752
1929	2010	$537,580	4463	2019	$1,336,346
1938	2010	$406,980	4467	2019	$210,553
1947	2010	$431,924	4469	2019	$4,785,002
1984	2011	$26,122,034	4527	2020	$3,787,621
4115	2013	$8,134,070	5229	2017	$1,889,635
4125	2013	$375,717	5384	2021	$1,462,433
4137	2013	$628,204	5418	2021	$677,545
4155	2013	$29,983,160	**Total**		**$142,811,141**

Source: SD OEM

Table 5-6 Non-HMGP Grants in South Dakota, 2010-2022

Grant #	Federal Share Obligated
PDM 2010	$777,333
PDM 2014	$2,252,738
PDM 2015	$504,748
PDM 2016	$143,350
PDM 2017	$628,940
PDM 2018	$1,257,174
PDM 2019	$1,103,463
PDM Total	**$6,667,746**
BRIC 2020	$706,778
BRIC 2021	$2,760,381
BRIC 2022	$4,549,823
BRIC Total	**$8,016,983**
FMA 2022	$257,222
FMA Total	**$257,222**
Grand Total	**$14,941,951**

Source: Office of Emergency Management, attained 10/2023

The number of mitigation projects submitted across the state is shown in Table 5-7 by county. Figure 5-2 shows the location of those projects enacted in South Dakota. (Note the map does not show projects that were not approved, withdrawn, or are still pending.

Table 5-7 Mitigation Project Status by County, 1992-2022

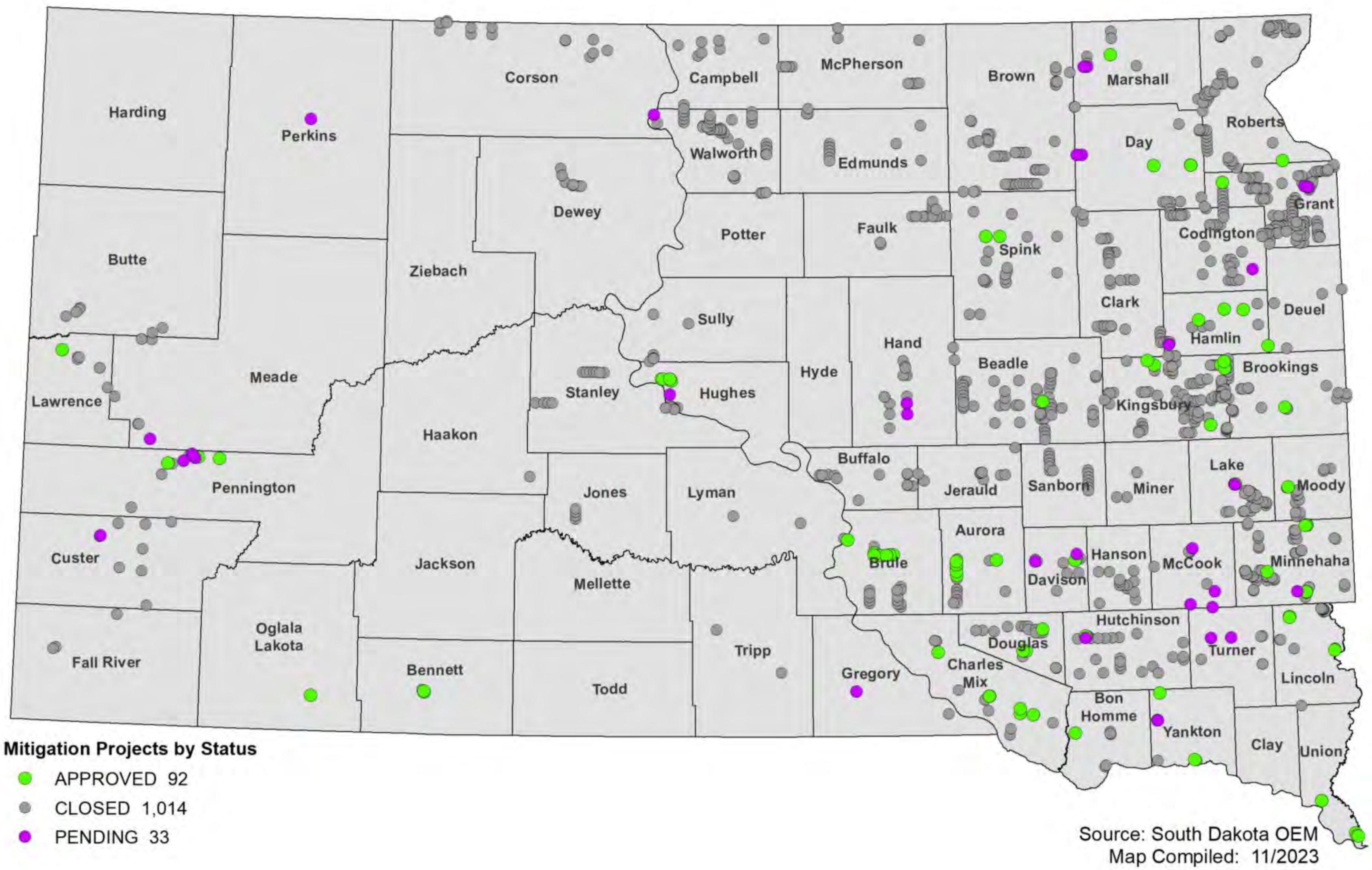
Counties	Approved	Closed	Not Approved / Denied	Pending	Withdrawn	Total	Federal Share Obligated
Aurora	6	13	-	-	4	**23**	$3,304,178
Beadle	1	62	-	-	3	**66**	$8,895,519
Bennett	2	1	-	-	-	**3**	$763,541
Bon Homme	1	5	-	-	-	**6**	$665,540
Brookings	1	17	-	-	-	**18**	$4,154,617
Brown	-	47	-	-	-	**47**	$11,903,352
Brule	9	14	-	-	-	**23**	$3,647,223
Buffalo	-	15	-	-	-	**15**	$579,409
Butte	-	1	-	-	-	**1**	$28,297
Campbell	-	8	-	-	-	**8**	$2,021,176
Charles Mix	9	13	-	-	1	**23**	$2,463,676
Clark	-	26	-	-	1	**27**	$2,209,151
Clay	-	-	-	-	-	**-**	**-**
Codington	-	33	-	1	2	**36**	$3,946,850
Corson	-	14	-	-	-	**14**	$11,752,630

Counties	Approved	Closed	Not Approved / Denied	Pending	Withdrawn	Total	Federal Share Obligated
Custer	-	8	1	1	1	**11**	$2,135,753
Davison	1	8	1	2	2	**14**	$3,134,573
Day	4	38	-	2	3	**47**	$20,335,828
Deuel	-	4	-	-	-	**4**	$503,087
Dewey	-	7	-	-	-	**7**	$2,777,173
Douglas	3	16	1	-	-	**20**	$2,839,212
Edmunds	-	13	-	-	-	**13**	$931,344
Fall River	-	3	-	-	-	**3**	$586,835
Faulk	-	18	1	-	3	**22**	$1,915,213
Grant	1	104	-	2	2	**109**	$26,317,228
Gregory	-	1	-	1	-	**2**	$63,975
Haakon	-	1	-	-	-	**1**	$12,338
Hamlin	4	20	-	1	-	**25**	$5,919,983
Hand	-	13	-	2	3	**18**	$3,999,569
Hanson	-	13	1	-	-	**14**	$2,317,842
Harding	-	-	-	-	-	**-**	**-**
Hughes	5	8	3	1	-	**17**	$8,620,494
Hutchinson	1	31	1	1	2	**36**	$8,647,952
Hyde	-	-	-	-	2	**2**	$0
Jackson	-	-	-	-	1	**1**	$1,738
Jerauld	-	11	-	-	1	**12**	$631,790
Jones	-	4	-	-	-	**4**	$300,548
Kingsbury	7	94	-	-	1	**102**	$12,285,426
Lake	2	31	-	1	7	**41**	$7,847,995
Lawrence	1	7	1	-	-	**9**	$2,737,639
Lincoln	2	14	-	-	3	**19**	$15,088,774
Lyman	-	3	-	-	1	**4**	$4,128,269
Marshall	1	5	-	2	-	**8**	$391,343
McCook	-	6	-	3	-	**9**	$1,973,683
McPherson	-	11	-	-	-	**11**	$770,420
Meade	-	11	-	1	2	**14**	$4,303,367
Mellette	-	-	-	-	-	**-**	**-**
Miner	-	3	-	-	-	**3**	$308,778
Minnehaha	16	49	-	1	6	**72**	$13,935,334
Moody	1	17	1	-	-	**19**	$3,099,027
Oglala Lakota	1	-	-	-	-	**1**	$558,380
Pennington	3	5	-	4	-	**12**	$3,425,785
Perkins	-	-	-	1	-	**1**	$11,053

Counties	Approved	Closed	Not Approved / Denied	Pending	Withdrawn	Total	Federal Share Obligated
Potter	-	-	-	-	-	**-**	**-**
Roberts	1	51	-	-	6	**58**	$6,906,255
Sanborn	-	16	-	-	2	**18**	$2,492,992
Spink	2	19	-	-	1	**22**	$4,454,396
Stanley	-	15	-	-	-	**15**	$2,463,159
Sully	-	5	-	-	-	**5**	$329,056
Todd	-	-	-	-	-	**-**	**-**
Tripp	-	2	-	-	-	**2**	$9,955
Turner	-	5	-	3	1	**9**	$964,349
Union	5	1	1	-	1	**8**	$3,059,261
Walworth	-	46	-	1	3	**50**	$7,981,056
Yankton	2	8	-	2	1	**13**	$853,030
Ziebach	-	-	-	-	-	**-**	**-**
Total	**92**	**1,014**	**12**	**33**	**66**	**1,217**	**$248,706,415**

Source: Office of Emergency Management, attained 10/2023

Figure 5-2 South Dakota Mitigation Projects by Status, 1992-2022



Up through 2011, the state spent an average of 87% of available mitigation funds. This was largely because mitigation staff would input enough applications to reach the HMGP ceiling; when projects were deemed ineligible, partially eligible, or came in under budget, the resulting remaining funds often had to be returned to FEMA. Starting with DR-1984, staff began submitting additional applications to account for potential project attrition; and beginning with DR-4115, OEM staff have submitted project applications worth twice the amount of available funding. Since this policy went fully into effect with DR-4115, the state has spent 99.8% of available HMGP funds. While this practice does create additional work for OEM staff and local governments, unfunded project applications are retained on file for future funding opportunities.

To ensure maximum use of available funds, the state maintains a backlog of "shovel-ready" projects it can fund if "new" project applications are not sufficient. Primarily among these are power line burial projects associated with the Rural Electric Cooperatives (RECs). As discussed in Section 4.4.11, the RECs have been very proactive about hardening their systems by burying power lines and similar tasks. While the bulk of this has been accomplished with the RECs' own funding, the state assists with grant funding whenever possible.

The state has completed a wide variety of mitigation projects over the years, as summarized in Table 5-8, both in terms of the magnitude of federal partnership and the type of project (Figure 5-3) and the variety of projects (Figure 5-4). The SHMT ensured that all Goals and Objectives were addressed by at least one mitigation action and that all hazards identified in the HIRA were addressed by at least one mitigation action. South Dakota has also been proactive about using mitigation funds to acquire properties located in hazard areas and either relocating or converting them to different uses with reduced vulnerability, as shown in Table 5-9.

Table 5-8 Summary of Mitigation Projects Conducted by Project Type, 1992-2022

Project Type	Count	Federal Share Obligated	Funding Sources
Acquisition of Private Real Property (Structures and Land) – Riverine	76	$17,693,296	BRIC, HMGP, FMA, PDM
Advanced Assistance	30	$2,538,069	BRIC, HMGP, HMGP-PF, PDM
Flood Control – Dam	2	$675,000	HMGP
Generators	74	$6,402,046	BRIC, HMGP, HMGP-PF
Grade Raise	1	$0	HMGP
Infrastructure Protective Measures (Roads and Bridges)	14	$10,880,746	HMGP
Infrastructure Protective Measures (Roads and Bridges); Stormwater Management – Culverts	4	$15,986	HMGP
Infrastructure Protective Measures (Roads and Bridges); Stormwater Management – Culverts; Stormwater Management – Detention/Retention Basins	1	$400,367	PDM
Other Equipment Purchase and Installation	8	$228,400	HMGP
Other Minor Flood Control	8	$349,298	FMA, HMGP
Relocation of Private Structures-Riverine	7	$463,690	HMGP, PDM
Retrofitting Private Structures – Wildfire	2	$459,471	PDM
Safe Room (Tornado and Severe Wind Shelter) – Public Structures	36	$8,041,943	BRIC, HGMP, HMGP-PF, PDM

Project Type	Count	Federal Share Obligated	Funding Sources
Shoreline Stabilization (Riprap, Etc.)	14	$11,289,179	HMGP
Stormwater Management – Culverts	31	$20,691,703	FMA, HMGP, PDM
Stormwater Management – Detention/Retention Basins	9	$1,603,157	FMA, HMGP, PDM
Stormwater Management – Diversions	13	$1,887,942	HMGP, PDM
Stormwater Management – Flapgates/Floodgates	5	$1,369,695	HMGP
Utility Protective Measures (Electric, Gas, Etc.)	826	$156,510,758	BRIC, HMGP, HMGP-PF, PDM
Vegetation Management – Wildfire	6	$1,849,578	HMGP, PDM
Warning Systems	20	$659,696	HMGP, HMGP-PF
Warning Systems; Generators	7	$673,267	HMGP
Water and Sanitary Sewer System Protective Measures	23	$4,023,127	HMGP
Total	**1,217**	**$248,706,415**	

Source: Office of Emergency Management, attained 10/2023

Table 5-9 Properties Acquired or Relocated Out of Hazard Areas (1992-2022)

Disaster/Grant	Properties Acquired	Properties Relocated
1886	-	1
1887	3	-
1915	3	2
1984	2	1
4186	1	-
4233	2	-
4440	46	2
4463	1	-
4467	2	-
4469	5	-
PDM 2007	1	-
PDM 2008	1	-
PDM 2016	1	-
PDM 2017	-	1
PDM 2018	2	-
PDM 2019	2	-
FMA 2007	1	-
FMA 2022	1	-
BRIC 2022	2	-
Total	**76**	**7**

Source: Office of Emergency Management, attained 10/2023

OEM tracks the location and status of all FEMA-funded mitigation projects using a geo-located database that can be viewed and queried in an online map server. This database began in 2013 using Google Earth, and in 2015 was migrated to OEM's GIS layer and an online web-map. The database is updated following the award of mitigation projects through the HMA program (PDM, FMA or HMGP) and is located at https://sdemergencymgmt.maps.arcgis.com/apps/webappviewer/index.html?id=65b3fa57815f45b5ac828d371fc94f76. This database provides the foundation for tracking losses avoided and mitigation effectiveness, which is described further in Section 5.4.2. Sample maps from this database are below.

Figure 5-3 Mitigation Projects by Federal Share Obligated in South Dakota, 2023

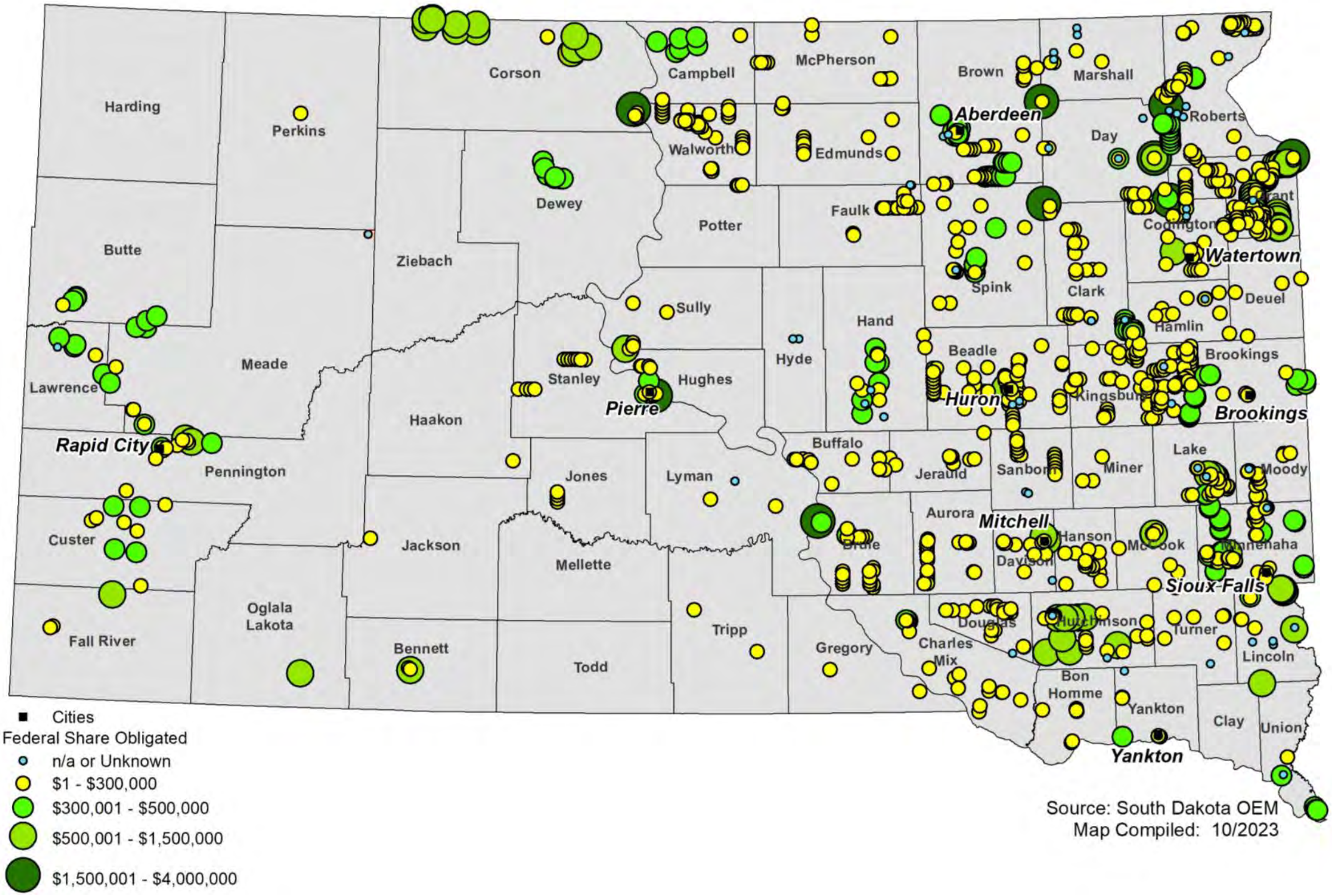
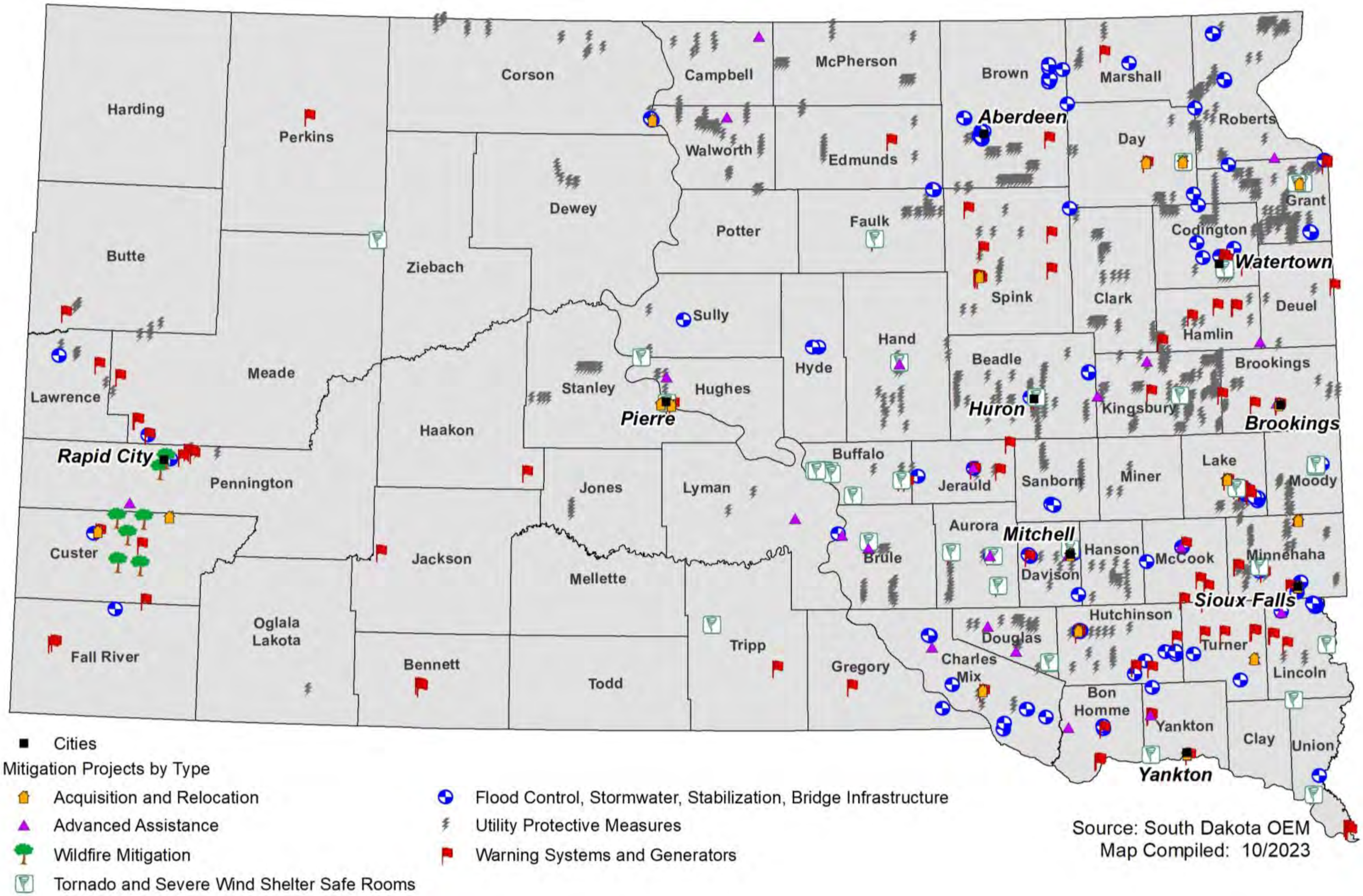


Figure 5-4 Mitigation Projects by Type of Project, 2023



5.4.2. Subgrant Application Review and Prioritizing

Following a disaster declaration, OEM provides a notice of funding availability in accordance with the procedures outlined in the state's HMGP Administrative Plan. PDM & FMA grants generally follow similar procedures as deemed appropriate by OEM and the SHMT. This includes requesting a notice of interest from potential sub-applicants that includes a brief project description, location, work schedule, cost estimate, and explanation of how the proposed project solves or mitigates a problem. Following receipt of notices of interest, initial eligibility is determined by OEM. Upon completion of the initial eligibility review, full project applications are then requested from sub-applicants with eligible hazard mitigation projects.

Upon receipt of each completed sub-application, OEM reviews the submitted documents to ensure that adequate information has been provided and that the projects will meet the minimum criteria as defined by 44 CFR §206.434 and §206.436. Following the project's document review, and any site visits or meetings with sub-applicants deemed necessary; OEM conducts final preparation of the selected sub-applications for submittal to FEMA. OEM will prioritize sub-applications in a manner consistent with the guiding principles and project weighting described in the HMGP Administrative Plan. Unlike PDM and FMA prioritization, however, HMGP prioritization may happen multiple times during the 12-month application period due to the urgency of a post-disaster environment in affected communities.

The SHMT objectively reviews a project application in terms of federal criteria and the pre-determined state goals (such as the mitigation actions prioritized in Section 5.2). They look at the priority level of the project type, review the benefit-cost analysis, and determine whether the project will help achieve the state's identified goals and objectives. Much of the focus over the last several years has been on power line burials; however, the SHMT is working to encourage a more diverse range of project types.

As noted in Section 5.2.1, the SHMT used the STAPLEE Selection Criteria to prioritize the state's mitigation actions. These criteria are also referred to during review of project applications. Priority is given to projects that address high risk hazards and multiple hazards. Prioritization between jurisdictions is based on the greatest need and largest impact in reducing risk, to include impacts on underserved and vulnerable communities.

The SHMT also reviews project applications to ensure they meet all eligibility criteria of the proposed funding program(s). This first requires determining if the project is being submitted by an eligible applicant. OEM's HMGP Administrative Plan, Section VIII, details applicant eligibility for HMGP projects; other grant streams may have different eligibility requirements. If a project is potentially eligible for multiple funding sources, funding sources are prioritized based on how well the project matches program priorities, how competitive the funding program is, and the timeline to apply for funding.

Assuming the applicant is eligible to receive grant funds, the project itself must then be screened for eligibility, based on any of the following:

- The specific disaster situation.
- The degree to which a project addresses known hazards.
- Location of affected areas.
- Availability of funds.
- Unique program requirements of the funding source.
- Current state and/or local hazard mitigation priorities.
- Number/type of mitigation projects submitted by local governments.

Eligibility criteria will vary depending on the source of federal or state funding. For example, all hazard mitigation projects submitted for HMGP funding consideration must meet the criteria outlined in 44 CFR

§206.434, and reiterated in the HMGP Administrative Plan. To meet FEMA's minimum hazard mitigation project eligibility criteria, the project must:

- Have significant beneficial impact(s) on the declared disaster area (project may be located outside the disaster area).
- Independently solve the problem or are a functional part of a larger project where there is assurance that, as a whole, the larger project will be completed.
- Substantially reduce the risk of damage, hardship, loss, suffering, or death which would result from a future disaster.
- Apply to a repetitive problem, or one that poses a significant risk if left unresolved.
- Contribute to the long-term solution of the problem.
- Show affordable operation and maintenance costs which the local jurisdiction is committed to support.

The SHMT further screens all proposed projects to ensure they align with the goals and objectives of the mitigation program as described in Section 5.1. The SHMT reviews projects to determine if they:

- Fall within the goals and objectives of South Dakota's Hazard Mitigation Plan.
- Protect lives and reduce public risk.
- Reduce the level of damage vulnerability in existing structures and developed property.
- Avoid inappropriate future development in areas that are vulnerable to the hazard(s).
- Show development and implementation of state or local comprehensive programs, standards, and regulations that reduce future damage.
- Provide a long-term mitigation solution in locations which experience repetitive damage.
- Reduce the number of vulnerable structures through acquisition, relocation, or retrofitting.
- Address secondary damage issues (such as landslides resulting from floods or wildfires).
- Protect or restore wetlands and floodplains.
- Restore or protect natural resources, recreational areas, open space, or other environmental values.
- Improve the capability or effectiveness to report time-sensitive information, relay information, or warn the public.
- Improve the capability of state agencies and county or local governments to exchange time-sensitive information during the disaster.
- Increase public awareness of the hazard(s), preventive measure(s), and emergency response(s) to the hazard(s).

Further details regarding the State of South Dakota's policies on providing funding are explained in the Hazard Mitigation Grant Program Administrative Plan.

5.4.3. Mitigation Program Management Performance and Capability Enhancements

Table 5-10 lists the HMA Grants Management performance requirements and a summary of the general best practices implemented by OEM to meet program requirements.

Table 5-10 HMA Grant Management Performance Requirements and Best Practices

HMA Program Management Performance Requirements	Review Element	State of South Dakota Activities and Best Practices
All applications and amendments are submitted by the end of each program's respective application period.	E2-a	All HMGP sub-applications are submitted to FEMA through the National Emergency Management Information System (NEMIS) within 12 months from the date of the disaster declaration. All FMA and PDM applications are submitted to FEMA through the eGrants system within the application cycle. OEM remains committed to addressing deficiencies in submitting applications on time and addressing the need for RFIs on most applications.
All applications were entered into FEMA's electronic data systems (FEMA Go, NEMIS, eGrants).	E2-b	See above
A complete Minimum Criteria Checklist for Project Sub-applicants or equivalent documentation is prepared for all sub-applications.	E2-c	As a standard practice of OEM, Minimum Criteria Checklist are submitted with each application, along with all scoping letters and responses.
All applications are determined to be complete by FEMA within 90 days of submittal or selection for further review.	E6.d	OEM Mitigation Section works closely with sub-applicants to completely respond to Requests for Information (RFIs) to ensure they are complete and no additional RFIs will be requested.
All applications and amendments … including all data requested by FEMA to support cost effectiveness determinations and environmental/historic preservation compliance reviews.	E3-a	FEMA's Environmental Review & Historic Preservation Compliance Checklist is submitted with each application. OEM Mitigation Section carefully reviews BCAs to ensure completeness and all supporting documentation is included
All progress reports were submitted complete and on time. Information in reports must accurately describe grant activities, including data related to the completion of individual property acquisitions.	E4-a	OEM Mitigation Section has consistently achieved a score of 95% and above in FEMA's Quarterly Progress Report Scorecard which evaluates timeliness, completeness, and reasonableness of submitted quarterly reports.
All federal financial reports (FFR) SF-425 were submitted on time and accurately describe grant activities as described in the HMA Guidance.	E4-b	As the Mitigation Section continues to consolidate request for reimbursement reviews across all programs (CDBG-DR, HMGP, PDM, FMA, PA) standard operating procedures will continue to be developed and implemented across these programs.
State consistently complied with the Financial Management Standard requirements described in 2 CFR §200.300 to §200.309.	E4-c	The OEM Mitigation Section requires subrecipients to follow state bid laws and procurement standards and encourages subrecipients to contact the Procurement Technical Assistance Center to assist in any procurement questions/concerns.
All work as part of HMA subawards was completed by the end of Period of Performance.	E5-a	OEM Mitigation Section works closely with subrecipients to ensure work will be completed within the allotted Period of Performance (POP) through proactive communication, monitoring of project milestones outlined in the project application, review of quarterly reports, and monitoring of project expenses submitted to date.
There were no major findings on single audits obtained by the state related to HMA programs.	E5-b	The State Department of Legislative Audit will perform regular auditing of the HMA Administered programs as programmatically required. Should any findings be

HMA Program Management Performance Requirements	Review Element	State of South Dakota Activities and Best Practices
		identified during auditing, those findings will be shared with FEMA Region VIII and a performance plan will be developed to address any concerns as needed.
All grant close-out activities, including financial reconciliation, were completed within 90 days from the end of the performance period.	E5-c	OEM has closed out all plans, projects, and grants within 90 days of the end of the period of performance as required.
Actual expenditures have been documented and are consistent with SF-424A or SF-424C.	E5-d	During quarterly reporting and at grant closeout, subrecipients are required to submit invoices and copies of checks or other pay instruments to demonstrate proof of payment consistent with SF-424A/424C before any reimbursements are processed.

As part of this Enhanced Plan update process, OEM evaluated their grants management performance to identify areas for improvement. Staff identified the most challenging management issues as being:

- Receiving complete applications from sub-recipients.
- Receiving complete and quantitative quarterly reports from sub-recipients.

OEM's goal is to submit complete sub-applications that do not require additional FEMA requests for information (RFIs).

- The most common RFIs have been for additional EHP clearances that usually result in a Class III archeological survey.
- RFIs are occasionally requested for additional documentation to support the BCA.

Therefore, OEM is implementing several improvements to grants management capabilities, including:

- Having an open application period all year long with established individual funding opportunities for each separate Notice of Funding Opportunity/HMGP disaster.
- Establishing an earlier application deadline to allow OEM staff to send RFIs for the sub-recipients to provide missing information.
- Continuing to foster enhanced technical assistance from project scoping/development, application, and grant award, through project oversight and closeout.

5.4.4. Integration of Mitigation into Post-Disaster Recovery Operations

FEMA's Section 404 hazard mitigation and Section 406 hazard mitigation grants both provide post-disaster mitigation assistance. However, they are distinct programs with key differences in their scope, purpose, and funding.

Section 406 grants are attached to Public Assistance (PA) program projects. The 406 funding is used to support mitigation measures in conjunction with the repair of disaster-damaged facilities and is limited to declared counties and eligible damaged facilities. Section 406 is applied on parts of a facility that were damaged by the disaster, and the mitigation measures must directly reduce the potential of future, similar disaster damages to an eligible facility.

FEMA uses a Project Worksheet (FEMA Form 90-91) to document details of the project, including a detailed description of the disaster-related damage, dimensions, and the associated scope of work (SOW) and costs. For those projects with a total cost below the established minimum project threshold as established by FEMA each fiscal year ($125,500 for 2018), the project is termed "small" and may be developed by the individual applicant, subject to a validation process by FEMA. Once FEMA obligates a small project, FEMA does not adjust the approved amount of an individual small project. The federal cost share is also funded in full, based on the cost estimate, at the time of obligation. For those projects with a total cost greater than the established minimum project threshold, the project is termed a "large" project and is funded based on documented actual costs for eligible work. Incorporation of mitigation measures into each of these PA projects is possible in many instances. Mitigation measures must be cost effective, which includes not exceeding 15% of the total eligible repair cost or not exceeding 100% of the total eligible repair cost of a pre-approved mitigation measure, as provided in FEMA Guidance document FP-104-009-2 Public Assistance Program and Policy Guide, Appendix J.

Section 404 grants are used to reduce future risk or reduce damages in facilities that were not damaged in the declared disaster. The entire state – not only presidentially declared counties – may qualify for 404 mitigation projects. The 404 grant is managed by the state under funding provided via HMGP. Section 404 grants may be used in conjunction with 406 mitigation funds to bring an entire facility to a higher level of disaster resistance, when only portions of the facility were damaged by a declared disaster event.

As discussed in Section 4.3.6, the State Disaster Recovery Plan addresses the importance of mitigation in post-disaster recovery. The Community Planning and Capacity Building function places "an emphasis on the integration of hazard mitigation throughout the continuum of pre- and post-disaster recovery planning and implementation." As the Primary Entity, OEM is tasked to aid communities in identifying mitigation opportunities through hazard risk assessments within local hazard mitigation plans.

The underlying guiding principle of OEM's Public Assistance recovery delivery is that every project slated for repair under the PA program should be reviewed for potential inclusion of 406 mitigation. Lessons learned from recent disasters were leveraged in the development of these guidelines. Maximizing the use of 406 funds is also a standard objective included in all state Incident Action Plans.

OEM strongly encourages local communities to adopt codes and standards that reduce hazard exposure to infrastructure and development. This initiative has a twofold impact; first, new development and infrastructure will be less likely to be impacted by disasters when they occur. Additionally, in instances of federally declared disasters, FEMA's Public Assistance program will cover the costs to repair the structure according to adopted codes and standards so long as those are uniformly applied by communities prior to a disaster.

Table 5-11 summarizes the number of projects and amount of mitigation funding associated with Section 406 from disasters in 2010-2018.

Table 5-11 FEMA Public Assistance Section 406 Funding: 2010-2023

DR#	Type	Year	Damage Category	Project Worksheet Count	Total
4718	Flooding	2023	C, D, G	25	$282,997 as of 11/2023
4664	Severe Storm/ Wind/Tornado/ Flooding	2022	E, F	2	$4,820 as of 11/2023
4656	Severe Storm/ Wind/Tornado/ Flooding	2022	C, E, F, G	10	$58,084 as of 11/2023
4469	Severe Storm/ Tornado/Flooding	2019	C, D, E, F, G	39	$1,878,546
4467	Severe Storm/ Tornado/Flooding	2019	C, D	4	$329,880

DR#	Type	Year	Damage Category	Project Worksheet Count	Total
4463	Severe Storms and Flooding	2019	C, D, G	14	$179,545
4440	Winter Storm/ Snowstorm/Flooding	2019	C, D, E, F, G	95	$1,391,320
4298	Winter Storm	2016	F	15	$2,268,759
4233	Flooding	2015	C	14	$117,882
4186	Tornado/Flooding	2014	C	48	$340,282
4155	Winter Storm	2013	F	24	$5,784,998
4137	Flood	2013	C	7	$30,141
4125	Flood	2013	C	19	$31,164
4115	Winter Storm	2013	F	1	$245,759
1984	Flood	2011	C	98	$745,578
1947	Flood	2010	D+E	8	$86,870
1938	Flood	2010	C	14	$712,318
1929	Tornados/Flooding	2010	C	4	$71,426
1915	Flood	2010	C	102	$294,124
1914	Winter Storm	2010	F	4	$381,044
1887	Winter Storm	2010	F	297	$9,596,751
				TOTAL	**$20,707,096**

5.4.5. Determining Cost-Effectiveness of Proposed Mitigation Measures

A key criterion for mitigation projects to be eligible for funding is that they must be cost-effective. The primary method of estimating the cost-effectiveness of a proposed mitigation action is by conducting a Benefit Cost Analysis (BCA).

In order to ensure a consistent approach in determining the cost-effectiveness of all mitigation projects, South Dakota uses FEMA's BCA module and process, which is consistent with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs. A BCA assesses a mitigation project based on the project, hazard, and benefit data provided in a grant application. OEM encourages applicants to pre-screen their proposed mitigation projects by using an upper-bound analysis, so an early determination of cost-effectiveness can be made. Upper-bound analyses are also used to identify projects that are not cost-effective.

As discussed in Section 4.1.8, Hazard Mitigation Training Program, OEM periodically conducts trainings and workshops for local and tribal governments on mitigation grants processes, to include how to conduct a BCA. OEM also provides technical assistance on BCAs to sub-applicants who may not be familiar with the process.

A positive benefit-cost ratio (greater than one) does not necessarily guarantee that a hazard mitigation project will be approved. However, by applying project specific information to the BCA module, it is possible to get a good look at the mitigation potential associated with a project. The results of this analysis can also help communities evaluate current and future mitigation projects and adjust their overall mitigation strategy accordingly.

The SHMT requires a BCA be completed for all mitigation projects seeking funding through from FEMA. All state agencies are further encouraged to complete BCAs for internally funded projects to ensure consistency across the program. A completed BCA helps evaluate the effectiveness not just of the individual action, but of the overall mitigation program, and provides feedback to inform mitigation strategy updates.

The following section summarizes the three-step process used to determine a mitigation project's cost-effectiveness.

Step 1 – Screen Project Application Data

The first part of the process is screening the project application to gather data related to cost-effectiveness, to include economic, environmental, and engineering data. Because this data is often limited or unavailable, the amount of data available often determines the type of benefit-cost analysis used. The screening process involves three separate but related tasks. Each task is conducted simultaneously and is essential to developing an overall profile of the project before conducting the benefit-cost analysis.

- Engineering Review: This review, conducted by the applicant, establishes whether the project is feasible from an engineering standpoint and whether it will reduce damage as claimed. The reviewer may suggest changes to make the project more efficient in reducing damage and loss.
- Environmental Assessment: This part of the screening process alerts reviewers to any potential environmental concerns raised by the project.
- Project Application Data Review: This part of the screening process determines whether the application contains sufficient information and data for input into the benefit-cost model.

Table 5-12 shows the type of data that must be obtained from mitigation project applications in order to conduct a BCA. The examples below are key data used for analyzing flood, tornado, and wildfire hazard mitigation projects. Nevertheless, the same basic information and analysis is needed for mitigation projects related to any type of hazard.

Table 5-12 Examples of Key Data Needed for Analyzing Project Applications

Subject	Flood Project Data	Tornado Safe Room Project	Wildfire Project Data
Hazard Data (often not included in application)	Flood insurance study data or historical flood data from the application	Windspeed Zone	Average Burn Recurrence Interval from state and local fire hazard maps or FEMA BCA tool
First Floor Elevation	Is this available from engineering surveys or can it be estimated from observed flood depths?	Not applicable	Not applicable
Scope	What problem does the project address? How vulnerable is the building, item, or area?	Same as flood	Same as flood
Cost	Is there a well-documented cost-estimate or only a rough estimate?	Same as flood	Same as flood
Useful Lifetime	How long will the project provide protection (mitigation) against damage and losses?	Same as flood	Same as flood

Subject	Flood Project Data	Tornado Safe Room Project	Wildfire Project Data
Economic Considerations	What is the square footage of the building? What are the replacement values of the building (or other facility) and contents?	Not applicable	Same as flood
Occupancy	Not usually applicable	Occupancy by hour	Not usually applicable
Function	What is the function of the facility and is it entirely or partially related to emergency response and recovery?	Same as flood	Same as flood
Damage Estimates – With Mitigation	What type of building is it? Why does damage occur? What is the historically observed damage?	Not applicable (life safety mitigation)	Value of timber to be sold within proposed project area, and Fire suppression costs for one typical fire event within proposed project area
Damage Estimates - Without Mitigation	How effective will the mitigation project be in reducing future damage? (Reduced damage can be percent or dollar values)	Not applicable (life safety mitigation)	Same as flood

Step 2 – Conduct a Benefit-Cost Analysis

The second part of the process is determining which BCA tool to use based on the results of Step 1. If the data in the project application is more or less complete, then a more robust method of analysis can be used. For project applications with incomplete or limited data, FEMA has developed a streamlined process for determining project cost-effectiveness without all data included.

At its most basic level, a BCA determines whether the cost of investing in a mitigation project today (the "cost") will result in sufficiently reduced damage in the future (the "benefits") to justify spending money on the project. If the benefit is greater than the cost, then the project is cost-effective; if the benefit is less than the cost, then the project is not cost-effective. The Benefit-Cost Ratio (BCR) is a way of stating whether benefits exceed project costs, and by how much. It is figured by dividing the benefits by the costs. If the result is 1.0 or greater, then the project is cost-effective.

Example 1: The project cost is $1,000, and the value of damage prevented after the mitigation measure is $2,000. The BCR ($2,000/$1,000) is 2.0. Because the dollar value of benefits exceeds the cost of funding the project, and the BCR is greater than 1.0, the project is cost-effective.

Example 2: The project cost is $2,000, and the value of damage prevented after the mitigation measure is $1,000. The BCR ($1,000/ $2,000) is of 0.50. Because the cost of funding the project exceeds the dollar value of the benefits, and the BCR does not meet the 1.0 required for cost-effectiveness, the project is not cost-effective.

While these examples are oversimplifications, the process and the associated benefit-cost analysis calculations are basically the same for all mitigation projects. It is important to understand that benefit-cost analysis is essentially the same for each type of hazard mitigation project. The only differences are the types of data that are used in the calculations. The types of data depend on whether the project is for floods, tornadoes, or earthquakes.

Three approaches are used to determine a project's benefit-cost ratio: lower-bound analysis, upper-bound analysis, and best estimate. The lower-bound and upper-bound methods are used in many cases to make final determinations of cost-effectiveness when there is limited data. In other cases, quick screening analysis with these approaches yields inconclusive results and additional data and screening may be required. Best estimate analysis produces the most accurate results.

Lower-Bound Analysis

Lower-bound analysis is a powerful tool that can demonstrate that projects are cost-effective even if the available data is not complete. A project's cost-effectiveness can sometimes be determined by using only one or two key pieces of data. The lower-bound analysis was developed with this in mind.

The lower-bound analysis considers only some of a project's benefits (those that are the most important or those for which data exist) and ignores other benefits that may be difficult to estimate or for which data may not be available. In other words, this analysis purposely uses only a few pieces of information, and undercounts or ignores other benefits that may be gained by implementing the project. If results indicate that a project is cost-effective, then no further analysis is needed, and no additional data has to be collected. Lower-bound analyses should not be used to rank or set priorities among projects, as they only determine broadly if a project is cost-effective.

Lower-bound analysis, at a glance:

- It should be used when data is incomplete.
- It can determine that a project is cost-effective.
- It cannot determine that a project is not cost-effective.
- It uses data for one or two significant benefits.

Upper-Bound Analysis

If a lower-bound analysis shows that a project is not cost-effective, then the next step is an upper-bound analysis. Sometimes an upper-bound analysis is used if, at first glance, the project appears not to be cost-effective. Like lower-bound analysis, upper-bound analysis relies on limited project data. Upper-bound analysis, however, also uses professional judgment to estimate which input data will produce the highest reasonable benefits.

It is extremely important to note that upper-bound analysis cannot determine if a project is cost-effective because it relies on the highest reasonable estimate of benefits. An upper-bound analysis can only determine whether the project BCR is less than 1.0 and thus is not cost-effective. As with lower-bound analyses, upper-bound analyses should not be used to rank or set priorities among projects.

Upper-bound analysis, at a glance:

- It can only determine that a project is not cost-effective.
- It is often used as the next step if the lower-bound analysis is negative (not cost-effective).
- It is used if a project initially appears unlikely to be cost-effective.
- It uses the highest reasonable estimate of benefits for a project.
- It analyzes as many inputs as possible, assigning the highest reasonable value to each.

Best Estimate Analysis

A best estimate analysis is used when the project application data is complete or nearly complete. This analysis provides a more accurate BCR because it considers more data in the analysis. Because this method of benefit-cost analysis provides the best estimate of cost-effectiveness, it can be used to rank or prioritize competing projects.

Best estimate analysis, at a glance:

- It should be used when the project application data is complete, or almost complete.

- It produces a more accurate analysis than lower-bound and upper-bound analyses.
- It determines whether a project is cost-effective or not cost-effective.
- BCR can be used for ranking or setting priorities among projects.

Step 3 – Review the Results of the Analysis

There are three possible outcomes to a benefit-cost analysis: the project is deemed cost-effective (BCR > 1.0), the project is deemed not cost-effective (BCR < 1.0), or there is not sufficient data to make a determination.

Typically, if the project is cost-effective as determined by a lower-bound or best estimate analysis, then no further analysis or additional data collection is required, and the application moves to the next level in the funding process. If the project is not cost-effective as determined by an upper-bound or best estimate analysis, then no further analysis or additional data collection is required, and the project is rejected. If the cost-effectiveness of a project cannot be adequately determined, then additional data must be collected.

5.4.6. Post-Event Determination of Losses Avoided and Project Effectiveness

Assessing the performance of hazard mitigation measures is critical to substantiate the value of mitigation efforts, and loss avoidance assessment results help assure prudent use of limited public resources. A loss avoidance assessment is a method of measuring the effectiveness of hazard mitigation projects. Projects completed in the past provide a return on investment (ROI), which communicates the value of mitigation measures and informs future allocation of resources for the highest and best use. Assessing the performance of hazard mitigation measures is critical to substantiate the value of mitigation efforts; evaluating the effectiveness of mitigation efforts also helps assure prudent use of future resources.

OEM conducts a loss avoidance assessment after each Presidential Disaster Declaration and may do so after non-declared disasters where warranted. These post-event assessments use real event data to evaluate the impacts that were prevented by completed mitigation projects. Specifically, the assessment reports dollars saved due to mitigation measures (losses avoided) and calculates a ROI by comparing the cost of the project to actual losses avoided over time.

Loss avoidance assessments demonstrate the fiscal benefits associated with mitigation activities and support sound decision making related to public funding. Moreover, this assessment provides insight that the state and local communities can use to identify effective mitigation activities, improve mitigation strategies, and increase communities' resilience to natural hazards.

This assessment is limited to evaluating losses avoided in terms of direct physical damages and displacement costs. The impacts of fatalities and injuries can be included using FEMA's Value of a Statistical Life (VSL). However, the analysis does not typically include other, less-quantifiable impacts such as loss of critical services, roadway closures, and human impacts (mental stress or lost productivity).

The methodology noted below is used to assess the effectiveness of FEMA-funded hazard mitigation projects in the State of South Dakota. The process can be used for state-funded mitigation projects: however, most departments have their own procedures to follow. This analysis follows a 4-phase process:

Phase 1: Project Identification and Selection

When a significant hazard event occurs anywhere in the state, OEM staff will compare the location of the event to a database of completed or ongoing mitigation projects. If there is a project or projects within the impacted area, the next step is to review what data is available for the project. Project data may come from the application scope of work, BCA, or other sources.

- Review data from hazard events.

- Compare the area affected by the incident/disaster to the database of mitigation projects. Are there any completed or ongoing mitigation projects in the impacted area?

[OR] Are there any mitigation projects in areas not impacted by the incident/disaster, which could be used to extrapolate losses that could have been reduced if the incident/disaster had happened in that area?

- Is the mitigation project of a type that could potentially reduce losses from the incident/disaster?
- Was a pre-event Benefit Cost Analysis (BCA) done for the project?
- Is there adequate data for the project to calculate effectiveness?
- What was the cost of the mitigation project?
- Projects that have adequate data available are advanced to Phase 2.

Phase 2: Hazard Event Analysis

OEM then reviews data on the hazard event. This information may come from a variety of sources, such as local observation, local damage assessments, NOAA/NWS reports, and field investigations. First, it must be confirmed that the hazard did in fact affect the project area. Second, was the hazard event severe enough to have caused damage if the project had not been in place. Technical resources may be needed to support analysis of the event (e.g., determining the recurrence interval of a rain or flood event). Wherever possible, effectiveness should be measured in terms of interconnected hazards rather than simply looking at one event (e.g., fire mitigation efforts may also be effective at decreasing flood losses).

- Was the hazard event severe enough to have caused damage if the project had not been in place?
- Has there been an estimation of the recurrence interval of the event? (i.e. – 100-year storm, 500-year flood, etc.)

If the hazard caused damage to the project, or would have in the absence of mitigation, the project is advanced to Phase 3.

Phase 3: Loss Avoidance Analysis

If sufficient quantitative data exists, an evaluation of the project is completed to compare the damage sustained with the damage that would likely have been sustained without mitigation.

- Is there enough information to make a quantitative evaluation?

[OR] Is there enough information to make a qualitative analysis and discussion summarizing the benefits (i.e., What would have been damaged if the project had not been in place?) and effectiveness (i.e., did the project perform as intended?) of the mitigation action?

- Calculate the damage that actually occurred with the mitigation action in place, referred to as Mitigation Project Complete (MPc).
- Calculate or estimate the damage that would likely have occurred if the mitigation action had not been taken, referred to as Mitigation Project Absent (MPa).
- MPa – MPc = Losses Avoided

Note: MPa is most often calculated based on past incidents that impacted this or similar areas.

Injuries and fatalities can be incorporated into damage estimates using the Value of a Statistical Life (VSL). FEMA currently uses the following VSLs:

- Deaths: $6.6M per individual
- Injuries: $2.2M per individual

Phase 4: Project Effectiveness and Documentation

The Loss Avoided is then compared to the project cost to determine the project's Return on Investment (ROI), similar to how the Benefit Cost Ratio (BCR) is calculated in a pre-event BCA (Section 5.4.1).

$$\text{Return on Investment (ROI)} = \frac{\text{MPa} - \text{MPc}}{\text{Cost of Project}}$$

The results of this assessment should then be documented in a memorandum or other report and provided to the SDOEM Mitigation Section.

If there is not enough information to make a quantitative evaluation, a qualitative analysis and discussion can be accomplished that summarizes the benefits (i.e., general losses avoided) and effectiveness (i.e., did the project perform as intended?) of the mitigation action. The results of the loss avoidance analysis will be documented in a memorandum and shared with SHMT members. Wherever possible, effectiveness should be measured in terms of interconnected hazards rather than simply looking at one event. For example, fire mitigation efforts may also be effective at decreasing flood losses.

5.4.7. Loss Avoidance Analysis Tool (LAAT)

The web-based, Loss Avoidance Analysis Tool (LAAT) is a database of the mitigation project data necessary to complete Phase 1 of a loss avoidance study and is a data collection tool for the hazard event data necessary to complete Phase 2 of a loss avoidance study. A prototype tool was developed as part of the 2019 SD Hazard Mitigation Plan update. A User Guide for the LAAT website has been developed and distributed.

The LAAT builds upon the efforts of OEM staff to track mitigation projects in a GIS database since 2013, as previously noted in Section 5.4.1. The database is updated following the award of mitigation projects through the HMA program (PDM, FMA, or HMGP). Over time, the database will be expanded to include all applicable mitigation projects led or funded by state agencies, beyond those funded by HMA. The LAAT database may be updated at any time to include additional project information. In addition, FEMA PA project locations are also able to be referenced in the web map application. This can be useful for the identification of areas of repetitive damages such as gravel road or culvert repairs, which might benefit from hazard mitigation.

Since a loss avoidance study measures the benefits of a completed project based upon an actual event the LAAT has the ability for the user to locate a hazard event by uploading a shapefile of the affected area or drawing an approximate area on the interactive map. A storm event data collection form allows the user to input details about the event. The user can spatially select those mitigation projects within the hazard event area and do a simple export to show the calculated loss avoidance.

This information and the results of completed loss avoidance studies will be incorporated into mitigation success stories, which can be included in the following section in future updates to this plan.

5.4.8. Loss Avoidance Case Studies

Power Line Burials

The state is proud of its success in burying power lines. From 2005-2023, the state spent $19.7M of HMA grant funding (primarily HMGP) to help bury power lines, while the RECs are spent on average more than $45M each year of their own money for line hardening, including line burial. Overall, more than 700 miles of power lines were buried as of late 2023.

Data provided by the RECs show that line hardening prior to the 2016 Christmas storm prevented losses estimated at $407,500 compared to damage sustained from past high windstorms and ice accumulation.

The cost of hardening/burying the specific sections affected by the storm was $783,457. This means the project has recouped 52% of its costs after just one storm; the cost savings will only continue to grow after additional storms.

Spring Creek Culverts

Lincoln County spent $1.8M of HMGP funding and local matching funds to upsize box culverts and drainage channelization on Spring Creek. Shortly thereafter, the creek flooded and the culverts performed as designed, preventing flooding in many county/township roads and the Town of Schindler, as had happened in previous floods. This project led Lincoln County to remap the area; post-project hazard mapping removed all structures from the Spring Creek floodplain.

USACE Dam/Levee Projects

Through the Silver Jacket's participation in the 2018-2019 SD HMP update process, the Omaha District's Chief of Flood Risk and Floodplain Management was able to provide some insight on the U.S. Army Corps of Engineers (USACE) loss avoidance studies for dam and levees in South Dakota. In summary, since 1948, USACE dams and levees in South Dakota have prevented flood losses equal to almost $189M (in 2018 dollars). This corresponds to an average of $1.2M of losses avoided annually. Improvements to the Sioux Falls levee system, completed by the City of Sioux Falls in cooperation with the USACE, removed 1,600 structures from the floodplain.

USACE Property Acquisitions and Relocations

Since 2000 but largely between 2000-2003, the USACE has relocated 81 properties out of the floodplain near Pierre and has acquired and demolished an additional 47 structures and/or properties.

City of Mitchell/Avera Queen of Peace Storm Sewer Upgrade

This project included upgrades to the currently undersized and inadequate storm drainage system serving the east-central region of the City of Mitchell as well as the Avera Queen Pease Medical Campus. During higher rain events, this undersized storm sewer became overwhelmed, causing the Avera Queen of Peace Hospital to activate a floodgate at the entrance to their emergency room. This would result in non-ambulatory patients being brought through the hospital from the east entrance and wheeled through the hospital to the emergency room. This $1,504,663 project installed larger storm sewer catch basins and pipes to capture and transfer the stormwater from the hospital to an above-ground detention basin where discharge is metered into Firesteel Creek. Since the project's completion, the new storm sewer system has resulted in no loss of services for the hospital or complicated emergency room access due to heavy rain events.

6 PLAN IMPLEMENTATION AND MAINTENANCE

44 CFR Part 201 Requirement:
[The Standard State Plan Maintenance Process must include] *[An] established method and schedule for monitoring, evaluating and updating the plan.* *A system for monitoring implementation of mitigation measures and project closeouts* *A system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy*
44 CFR Part 201 Enhanced Plan Requirement:
[The Plan must] be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities and resubmitted for approval to the appropriate Regional Administrator every 5 years. *[The State is encouraged to] review its plan in the post-disaster timeframe to reflect changing priorities.*

6.1. Monitoring, Evaluating, and Updating the Plan

Hazard mitigation planning is a continuous and ongoing process. South Dakota is committed to maintaining an ongoing effort to monitor and evaluate mitigation program implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized. Policies and procedures established in this plan reflect the current emergency management and hazard mitigation philosophy at both the state and national levels. Changes in hazard mitigation programs and/or priorities, including changes in legislation and available funding, may necessitate modifications to this plan. A major disaster could also prompt modifications to this plan. Finally, the state will submit an updated Hazard Mitigation Plan to FEMA for review and approval every five years as required by DMA 2000.

As described in Section 4.2.1, the South Dakota Hazard Mitigation Team (SHMT) is the principal body responsible for coordinating the state's comprehensive hazard mitigation program. Section 4.3.1 explains the South Dakota Office of Emergency Management (OEM) Mitigation Section's role in coordinating the SHMT, and its overall responsibility to maintain and implement the SHMP.

6.1.1. Annual Review

The SHMT will meet annually to review and evaluate the status of the SHMP and the mitigation program overall. This meeting will typically be held in conjunction with one of the quarterly Silver Jackets meetings and will review:

- Mitigation goals & objectives
- Significant hazard incidents during the past year
- Any needed updates to the HIRA
- Any outdated information
- Any identified gaps in the mitigation strategy
- Changes in state, federal, local, or tribal capabilities
- Standard and enhanced plan compliance
- Status of local and tribal mitigation plan adoption
- Results of the most recent FEMA consultation visit

Additionally, OEM will meet annually with FEMA Region VIII mitigation staff to review the state's enhanced plan status and associated requirements to validate that South Dakota remains in compliance.

6.1.2. Post-Disaster Review

The SHMT will also meet following every declared disaster, although this meeting may be deferred until their next regular meeting at the SHMT's discretion. Similarly, major changes in federal mitigation programs or legislation could necessitate a special meeting of the SHMT. The purpose of the post-disaster review is to assess opportunities for mitigation projects and mitigation funding.

Approximately 2 years before this Plan is due to expire (i.e., 3 years after the date of approval), the SHMT will convene to lay out a road map for the next Plan update process. The SHMT will review the process used during the 2024 update process and decide on any changes that should be made to that process for the next update.

In addition to updating this hazard mitigation plan, following every declared disaster the SHMO will coordinate an update of the state's HMGP Administrative Plan if one is needed.

6.2. Monitoring Progress and Effectiveness of Mitigation Activities

Just as reviewing the overall mitigation program is an ongoing process, so is reviewing and evaluating mitigation actions themselves.

6.2.1. Annual Progress Assessment

The SHMT will meet annually to review and evaluate ongoing mitigation actions. This may be a separate meeting held in conjunction with a quarterly Silver Jacket's meeting, or it may be combined with the mitigation program review meeting described in 6.1. This meeting will review the Mitigation Actions Table (Section 5.2.3), adding Implementation Notes and/or Progress Notes as available. Progress will be measured by reviewing each identified action and noting whether efforts have begun or not, in the same fashion as was conducted during the review and update of the mitigation strategy for this 2024 ESHMP. For actions that progress has begun on, notes on the status will be updated as well to provide details on the progress made, what work is still needed for completion, and any changes factors or priorities that impact the action. By tracking the status and completion of actions, the state can assess progress toward plan goals and capture success stories in mitigation. Progress and success will be measured in terms of:

- Numbers of actions completed
- Numbers of actions in-progress
- Summarizing actions completed by goals as an indication of enhanced resilience
- Tracking and highlighting losses avoided by mitigation efforts

6.2.2. Monitoring Implementation of Mitigation Measures and Project Closeouts

OEM will continue to annually review applications for submittal for BRIC grants. OEM will also maintain a list of proposed or contemplated projects that could quickly be turned into applications for new projects when HMGP funds or other grant funds become available. These applications will be evaluated and prioritized using the same process and criteria as described in Section 5.2.1, unless the SHMT elects to use different criteria.

The progress of funded projects is tracked via a quarterly reporting system. In addition, they are physically inspected every two years while under construction. The state follows project closeout procedures as outlined in the HMGP Administrative Plan. These procedures require the sub-grantee to request the closeout of the project by letter addressed to the SHMO. The SHMO coordinates via letters to and from FEMA for preparation of final notice that the project was completed in accordance with FEMA approvals. Project closeout procedures are detailed in the HMGP Administrative Plan.

The process described above focuses primarily on FEMA-funded mitigation projects, as required by grant guidance. However, the same principles apply to all mitigation activities, the progress of which will be monitored in a similar manner.

6.2.3. Post-Disaster Review of Mitigation Measures

As noted in Section 6.1 above, the SHMT will also meet following every declared disaster, although this meeting may be deferred until their next regular meeting at the SHMT's discretion. An additional purpose of this post-event meeting is to determine if any mitigation projects were impacted by the disaster, and whether or not it is possible to evaluate the effectiveness of those projects in reducing losses or damage.

The process for post-event determination of project effectiveness is detailed in Section 5.4.2.

6.3. Integrating the SHMP Into Other Plans

Section 4 discussed in detail how the SHMP is integrated with other local, state, regional, and national/federal mitigation programs. However, the Plan's utility is not limited to just mitigation programs. Properly implemented, the SHMP should serve as the foundational document of the state's emergency management program. The Hazard Identification and Risk Assessment (HIRA) Section in particular helps establish the scope of the emergency management program; everything emergency management does should relate back in one way or another to the hazards the jurisdiction faces.

The following section provides some guidance on how the State of South Dakota will use the updated SHMP to inform and improve other state plans, procedures, and programs.

6.3.1. Threat and Hazard Identification and Risk Assessment (THIRA)

The State of South Dakota Threat and Hazard Identification and Risk Assessment (THIRA) is described in Section 4.4.8. CPG 201 "Threat and Hazard Identification and Risk Assessment (THIRA) establishes Step 1 as "Identify the Threats and Hazards of Concern" and lists HIRAs and HMPs as possible sources of threat/hazard information. While the South Dakota SHMP does not address technological or human-caused hazards, for natural hazards it contains all the information needed to complete Step 1.

The criteria for selecting which Threats/Hazards are "of concern" are defined as:

- Factor #1: Likelihood of a Threat or Hazard Affecting a Community
- Factor #2: The Impacts of a Threat or Hazard

Each natural hazard profiled in the HIRA (Section 3.2) contains a section analyzing the probability of future events, which provides a data-driven answer to Factor #1. Similarly, the vulnerability assessment sections of the HIRA (3.3 and 3.4) address what impacts can realistically be expected from both routine and extreme events of each hazard, which specifically addresses Factor #2.

Step 2 of CPG 201 is to "Give the Threats and Hazards Context" by creating a scenario for each hazard of concern, with specifics like time of day, area, and magnitude of the event, which are then used to establish capability targets for each of the 32 core capabilities. All the natural hazards profiled in the SHMP contain detailed information to ensure the hazard scenarios are plausible. For some hazards, such as flood or earthquake, detailed Hazus modeling runs have been done that can easily be incorporated as THIRA scenarios. Other hazards include details on the most extreme historical events on record that can quickly be updated to modern scenarios.

Note that while FEMA requires the SHMP be updated every five years, the THIRA is required to be updated every three years. The SHMT in coordination with the Office of Homeland Security will determine whether or not to update the SHMP's HIRA section along with the 3-year THIRA update.

6.3.2. State Emergency Operations Plan (SEOP) and Related Response Plans

As noted in Section 4.3.6, the State Emergency Operations Plan (SEOP) is organized around Emergency Support Functions that are all-hazards in nature. But the plan also contains hazard-specific incident annexes containing information and concerns specific to each hazard type. These annexes were written based on the data and analysis in the HIRA, and in most cases quote directly from the SHMP to define the hazard and the risk to South Dakota. The current SEOP (dated 2022 but updated quarterly by section) contains incident annexes for hazards identified in the HIRA. (Because the SEOP is not a public document, this Plan will not list all hazards, annexes, etc. contained in the SEOP.)

Conversely, the section pertaining to Emergency Support Function #14, Long-Term Recovery and Mitigation, specifically addresses the integration of mitigation activities into post-disaster recovery "to reduce or eliminate risk." Section 5.4.4 Integration of Mitigation into Post-Disaster Recovery Operations addresses how post-disaster mitigation will continue to address the goals, objectives, and procedures of the overall SHMP.

Several other operational or functional response plans associated with the EOP are also influenced by information contained in the SHMP. These plans include but are not limited to:

- Damage Assessment Plan: A review of Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction can help identify what areas to initially prioritize following a hazard event. Similarly, a review of Section 3.4 Assessing Vulnerability and Estimating Potential Losses of State Facilities can help identify what state-owned facilities need to be assessed following a hazard event.

- Debris Management Plan: Hazus runs conducted for earthquake and flood scenarios include an estimate of how many tons of debris would likely be generated by those scenarios. These estimates can be used as bounding limits for how much and what type of debris generation is likely to be required, as well as what areas are most likely to see heavy debris generation.

- Evacuation & Sheltering Plan: A review of Section 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction can help identify what areas are more likely to need evacuation in different hazard scenarios. The sections on Growth and Development and Social Vulnerability (3.3.1 and 3.3.2) can help identify not only how many people would potentially be impacted by disasters, but how many are likely to need assistance with transportation, special medical or sheltering needs, etc. This review can also help evaluate the impacts of multiple or cascading hazards, so that evacuees are not relocated into an area that puts them at risk from other hazards.

6.3.3. Recovery Plan

As noted in Section 4.3.5, the State of South Dakota Disaster Recovery Plan builds on the policies and procedures in the ESF 14 section of the SEOP described above, to ensure the most efficient and effective state coordination to assist local jurisdictions in the recovery phase of any disaster. The Recovery Plan is organized around nine Recovery Support Functions (RSFs):

- Agriculture and the Environment
- Commodity PODs
- Community Planning & Capacity Building
- Disaster Recovery Centers
- Economic Recovery
- Health & Social Services
- Housing and Other Needs Assistance
- Infrastructure Systems
- Population Reception

The FEMA publication Pre-Disaster Recovery Planning Guide for State Governments notes "much of the research involved in the development of mitigation plans can be used to inform the pre-disaster recovery planning effort. The State mitigation plan is a very useful starting point for research for the pre-disaster recovery plan.

"The pre-disaster recovery planning process will benefit from and build upon hazard mitigation as:

- The mitigation planning process identifies local hazards, risks, exposures, and vulnerabilities;
- Implementation of mitigation policies and strategies will reduce the likelihood or degree of disaster-related damage, decreasing demand on resources post-disaster;
- The process will identify potential solutions to future anticipated community problems; and
- Mitigation activities will increase public awareness of the need for disaster preparedness.

"Pre-disaster recovery planning efforts also increase resilience by:

- Establishing partnerships, organizational structures, communication resources, and access to resources that promote a more rapid and inclusive recovery process;
- Describing how hazard mitigation will underlie all considerations for reinvestment;
- Laying out a process for implementation of activities that will increase resilience; and
- Increasing awareness of resilience as an important consideration in all community activities."

Similarly, the risk and vulnerability data in the SHMP should help inform the post-disaster recovery planning process, especially by ensuring that recovery plans fully take into account the dangers posed by other hazards, rather than focusing exclusively on the most recent hazard event. Section 3.2 State Assets is also a useful resource to help identify critical resources that may have been impacted by the disaster, which can help target damage assessment efforts in the immediate aftermath of the disaster.

See also Section 5.4.4 Integration of Mitigation into Post-Disaster Recovery Operations for more information on this topic.

6.3.4. Continuity of Operations Plans (COOP)

All departments and agencies of South Dakota State government are required to maintain a Continuity Of Operations Plan (COOP) that details that agency's critical functions and how they will protect those functions in order to continue to provide services during a disaster or interruption. By defining and describing the hazards facing the state, including frequency and severity, the HIRA informs agency COOP plans by giving context to what types of disasters of interruptions are most likely to occur.

Appendix A

Acronyms

Acronyms

- AA – Advance Assistance
- ACAMS – The Association of Certified Anti-Money Laundering Specialists
- ACEP – Agricultural Conservation Easement Program
- AELR – Annualized Earthquake Loss Ratio
- APHIS – Animal and Plant Health Inspection Service
- ASCE – American Society of Civil Engineers
- ASPR – Assistant Secretary for Preparedness and Response
- BCA – Benefit Cost Analysis
- BHFFPD – Black Hills Forest Fire Protection District
- BHSU – Black Hills State University
- BIA – Bureau of Indian Affairs
- BIT – SD Bureau of Information and Telecommunications
- BLM – Bureau of Land Management
- BOR – Bureau of Reclamation
- BRIC – Baseline Resilience Indicators for Communities
- BRIC – Building Resilient Infrastructure and Communities
- BSE – Bovine Spongiform Encephalopathy, also called 'Mad Cow Disease'
- BSR – Brown Stem Rot
- CAP – Community Assistance Program
- CAP-SSSE – Community Assistance Program – State Support Services Element
- CCWDSI – Cervid Chronic Wasting Disease Surveillance Identification Program
- CDBG-DR – Community Development Block Grant – Disaster Recovery
- CDBG-DR/MIT – Community Development Block Grant – Disaster Recovery/Mitigation
- CEDS – Comprehensive Economic Development Strategy
- CFC – Cooperative Finance Corporation
- CFM – Certified Floodplain Manager
- CFO – Chief Financial Officer
- CFR - Code of Federal Regulations
- CIPP – Critical Infrastructure Protection Program
- COOP – Continuity of Operations Plan
- CPG – Comprehensive Preparedness Guide
- CPI – Consumer Price Index
- CRP – Conservation Reserve Program
- CRS – Community Rating System
- CWA – County Warning Area
- CWD – Chronic Wasting Disease
- DANR – Department of Agriculture and Natural Resources
- DDN – Digital Dakota Video Network
- DENR – Department of Environment and Natural Resources
- DEWS – Drought Early Warning System
- DFIRM – Digital Flood Insurance Rate Map
- DHS – Department of Homeland Security
- DOH – South Dakota Department of Health
- DOI – Department of the Interior
- DOJ – Department of Justice
- DOLR – Department of Labor and Regulation

- DOT – Department of Transportation
- DPS – Department of Public Safety
- DRF – Disaster Relief Fund
- DTF – State Drought Task Force
- EAL – Expected Annual Loss
- EAP – Emergency Action Plan
- ECP – Emergency Conservation Program
- EDA – Economic Development Administration
- EDD – Economic Development District
- EDEN – Extension Disaster eNetwork
- EHP – Environmental and Historic Preservation
- ELAP – Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish
- EMAP – Emergency Management Accreditation Program
- EMPG – Emergency Management Performance Grant
- EMS – Emergency Medical Services
- EOC – Emergency Operations Center
- EPCRA – Emergency Planning and Community Right-To-Know Act
- EPM – Environmental Procedures Manual
- EQIP – Environmental Quality Incentives Program
- EQUIP – Environmental Quality Incentives Program
- ER – Emergency Relief Program
- ESF – Emergency Support Function
- ESHMP – Enhanced State Hazard Mitigation Plan
- ESWG - External Stakeholder Working Group
- EWPP – Emergency Watershed Protection Program
- FEMA – Federal Emergency Management Agency
- FEMA GO – FEMA Grant Outcomes
- FEPP – Federal Excess Personal Property
- FFP – Firefighter Property
- FFR – Federal Financial Reports
- FHWA – Federal Highway Administration
- FIRM – Flood Insurance Rate Maps
- FMA – Flood Mitigation Assistance
- FMAG – Firefighter Mitigation Assistance Grant
- FMD – Foot and Mouth Disease
- FMSL – Fitted Mean Sea Level
- FP&S – Fire Prevention & Safety Grants
- FRED – Flood-Proofing, Relocation, Elevation or Demolition
- FSA – USDA Farm Service Agency
- GAR – Governor’s Authorized Representative
- GFP or GF&P – the South Dakota Game, Fish, and Parks Department
- GHIPM – Grasshopper Integrated Pest Management
- GIS – Geographic Information System
- GMM – Grants Management Modernization
- GOED – Governor's Office of Economic Development
- HFRA – Healthy Forests Restoration Act
- HI – Heat Index
- HIFLD – Homeland Infrastructure Foundation Level Database

- HIRA – Hazard Identification and Risk Assessment
- HMA – Hazard Mitigation Assistance
- HMEP – Hazardous Materials Emergency Preparedness
- HMGP - Hazard Mitigation Grant Program
- HMIRS – Hazardous Materials Incident Report Subsystem
- HMP – Hazard Mitigation Plan
- HSEMSAC – Homeland Security and Emergency Management Senior Advisory Committee
- HUD – Housing and Urban Development
- HVRI – University of South Carolina's Hazards and Vulnerability Research Institute
- IA – Individual Assistance
- ICC – Increased Cost of Compliance
- JRWDD – James River Water Development District
- LAAT – Loss Avoidance Analysis Tool
- LAL – Lightning Activity Level
- LHMP – Local Hazard Mitigation Plan
- LiDAR – Light Detection and Ranging
- MMI – Modified Mercalli Intensity
- MPa – Mitigation Project Absent
- MPB – Mountain Pine Beetles
- MPc – Mitigation Project Complete
- mph – Miles per Hour
- NASS – National Agricultural Statistics Service
- NBI – National Bridge Inventory
- NCEI – National Centers for Environmental Information
- NDMC – National Drought Mitigation Center
- NDSP – National Dam Safety Program
- NECOG - Northeast Council of Governments
- NEHRP – a National Earthquake Hazards Reduction Program
- NEIC – National Earthquake Information Center
- NEMIS – National Emergency Management Information System
- NFIP – National Flood Insurance Program
- NFPA – National Fire Protection Association
- NGO – Nongovernmental Organization
- NHPA – National Historic Preservation Act
- NID – National Inventory of Dams
- NIDIS – National Integrated Drought Information System
- NIFC – National Interagency Fire Center
- NLCD – National Land Cover Database
- NOAA – National Oceanic and Atmospheric Administration
- NPMS – National Pipeline Mapping System
- NRCS – Natural Resources Conservation Service
- NRI – National Risk Index
- NWS – National Weather Service
- ODP – Office for Domestic Preparedness
- OEM – Office of Emergency Management
- OJP – Office of Justice Programs
- OMB – Office of Management and Budget
- OPHPR – Office of Public Health Preparedness

- ORM – Office of Risk Management
- PA – Public Assistance
- PDM – Pre-Disaster Mitigation Program
- PHEP – Public Health Emergency Preparedness
- PHMSA – Pipeline and Hazardous Materials Safety Administration
- POP – Period of Performance
- PRRS – Porcine Reproductive and Respiratory Syndrome
- PRV – Pseudorabies, also known as Aujesky's Disease or mad itch
- RAIF – Rural Access Infrastructure Fund
- RAPT – Resilience Analysis and Planning Tool
- RCD – Resource Conservation and Development
- REC – Rural Electric Cooperatives
- RMA – USDA's Risk Management Agency
- RMP – Risk Management Plans
- ROI – Return on Investment
- RSF – Recovery Support Functions
- RUS – Rural Utilities Service
- RWS – Rural Water Systems
- SAP – Simplified Acquisition Procedures
- SBA – Small Business Administration
- SD LETS – South Dakota Law Enforcement Telecommunications System
- SDARWS – South Dakota Association of Rural Water Systems
- SD DANR – South Dakota Department of Agriculture & Natural Resources
- SDDOT – South Dakota Department of Transportation
- SDDPS – South Dakota Department of Public Safety
- SDEMA – South Dakota Emergency Management Association
- SDFC – South Dakota Fusion Center
- SDOHS – The South Dakota Office of Highway Safety
- SDPB – South Dakota Public Broadcasting
- SDREA – South Dakota Rural Electric Association
- SDS – Sudden Death Syndrome
- SDSU – South Dakota State University
- SDWF – South Dakota Department of Public Safety Wildland Fire Division
- SDWFS – South Dakota Wildland Fire Suppression Division
- SEOP – State Emergency Operations Plan
- SERC – State Emergency Response Commission
- SF – Standard Form
- SFHA – Special Flood Hazard Area
- SHELDUS – Spatial Hazard Events and Losses Database for the United States
- SHMO – State Hazard Mitigation Officer
- SHMT – State Hazard Mitigation Team
- SHPO – State Historic Preservation Office
- SHSGP – State Homeland Security Grant Program
- SIMPCO – Siouxland Interstate Metropolitan Planning Council
- SOVI – Social Vulnerability Index
- SOW – Scope of Work
- SPI – Standardized Precipitation Index
- SPIA – Sperry-Piltz Ice Accumulation

- SPR – Stakeholder Preparedness Review
- SRIA – Sandy Recovery Improvement Act
- SRL – Severe Repetitive Loss
- STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, Environmental
- STBG – Surface Transportation Block Grant
- SWOT – Strengths, Weaknesses, Opportunities, Threats
- SWPP – Source Water Protection Program
- TAP – Transportation Alternatives Program
- TB – Tuberculosis
- TE – Transportation Enhancement
- THIRA – Threat and Hazard Identification and Risk Analysis
- THPO – Tribal Historic Preservation Office Program
- TRI – Toxics Release Inventory
- USACE – U.S. Army Corps of Engineers
- USCG – United States Coast Guard
- USDA – United States Department of Agriculture
- USFS – US Fish and Wildlife Service
- USGS – United States Geologic Survey
- VOAD – Volunteer Organizations Active in Disasters
- VS – Vesicular Stomatitis
- VSL – FEMA's Value of a Statistical Life
- WAPA – Western Area Power Administration
- WHP – USDA Wildfire Hazard Potential
- WNV – West Nile Virus
- WRN – Weather-Ready Nation
- WUI – Wildland Urban Interface

Appendix B

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Appendix C

South Dakota Population and Growth by County

Table C-1 Overall Population Growth by County

County	2010 Population	2020 Population	# Change from 2010 to 2020	% Change from 2010 to 2020
Aurora	2,745	2,747	2	0.07%
Beadle	18,169	19,149	980	5.39%
Bennett	3,430	3,381	-49	-1.43%
Bon Homme	7,023	7,003	-20	-0.28%
Brookings	33,314	34,375	1,061	3.18%
Brown	38,408	38,301	-107	-0.28%
Brule	5,309	5,247	-62	-1.17%
Buffalo	2,077	1,948	-129	-6.21%
Butte	10,298	10,243	-55	-0.53%
Campbell	1,386	1,377	-9	-0.65%
Charles Mix	9,287	9,373	86	0.93%
Clark	3,645	3,837	192	5.27%
Clay	13,932	14,967	1,035	7.43%
Codington	27,938	28,325	387	1.39%
Corson	4,182	3,902	-280	-6.70%
Custer	8,445	8,318	-127	-1.50%
Davison	19,885	19,956	71	0.36%
Day	5,588	5,449	-139	-2.49%
Deuel	4,312	4,295	-17	-0.39%
Dewey	5,662	5,239	-423	-7.47%
Douglas	2,973	2,835	-138	-4.64%
Edmunds	3,983	3,986	3	0.08%
Fall River	6,845	6,973	128	1.87%
Faulk	2,357	2,125	-232	-9.84%
Grant	7,241	7,556	315	4.35%
Gregory	4,217	3,994	-223	-5.29%
Haakon	1,847	1,872	25	1.35%
Hamlin	5,989	6,164	175	2.92%
Hand	3,345	3,145	-200	-5.98%
Hanson	3,419	3,461	42	1.23%
Harding	1,250	1,311	61	4.88%
Hughes	17,642	17,765	123	0.70%
Hutchinson	7,200	7,427	227	3.15%
Hyde	1,396	1,262	-134	-9.60%
Jackson	3,274	2,806	-468	-14.29%
Jerauld	2,007	1,663	-344	-17.14%
Jones	975	917	-58	-5.95%
Kingsbury	5,075	5,187	112	2.21%
Lake	12,368	11,059	-1,309	-10.58%
Lawrence	24,657	25,768	1,111	4.51%
Lincoln	51,548	65,161	13,613	26.41%

County	2010 Population	2020 Population	# Change from 2010 to 2020	% Change from 2010 to 2020
Lyman	3,877	3,718	-159	-4.10%
Marshall	4,683	4,306	-377	-8.05%
McCook	5,649	5,682	33	0.58%
McPherson	2,429	2,411	-18	-0.74%
Meade	26,951	29,852	2,901	10.76%
Mellette	2,100	1,918	-182	-8.67%
Miner	2,316	2,298	-18	-0.78%
Minnehaha	182,882	197,214	14,332	7.84%
Moody	6,367	6,336	-31	-0.49%
Oglala Lakota*	14,218	13,672	-546	-3.84%
Pennington	108,242	109,222	980	0.91%
Perkins	3,033	2,835	-198	-6.53%
Potter	2,340	2,472	132	5.64%
Roberts	10,374	10,280	-94	-0.91%
Sanborn	2,336	2,330	-6	-0.26%
Spink	6,598	6,361	-237	-3.59%
Stanley	2,983	2,980	-3	-0.10%
Sully	1,438	1,446	8	0.56%
Todd	9,882	9,319	-563	-5.70%
Tripp	5,512	5,624	112	2.03%
Turner	8,272	8,673	401	4.85%
Union	15,029	16,811	1,782	11.86%
Walworth	5,511	5,315	-196	-3.56%
Yankton	22,684	23,310	626	2.76%
Ziebach	2,826	2,413	-413	-14.61%

Source: United States Census Bureau

Table C-1 10 Largest Counties by Population

10 Largest Counties	2010 Population	2020 Population	# Change from 2010 to 2020	% Change from 2010 to 2020
Minnehaha County	169,468	197,214	27,746	16.37%
Pennington County	100,948	109,222	8,274	8.20%
Lincoln County	44,828	65,161	20,333	45.36%
Brown County	36,531	38,301	1,770	4.85%
Brookings County	31,965	34,375	2,410	7.54%
Meade County	25,434	29,852	4,418	17.37%
Codington County	27,227	28,325	1,098	4.03%
Lawrence County	24,097	25,768	1,671	6.93%
Yankton County	22,438	23,310	872	3.89%
Davison County	19,504	19,956	452	2.32%

Source: United States Census Bureau

Table C-2 10 Smallest Counties by Population

10 Smallest Counties	2010 Population	2020 Population	# Change from 2010 to 2020	% Change from 2010 to 2020
Faulk County	2,364	2,125	-239	-10.11%
Buffalo County	1,912	1,948	36	1.88%
Mellette County	2,048	1,918	-130	-6.35%
Haakon County	1,937	1,872	-65	-3.36%
Jerauld County	2,071	1,663	-408	-19.70%
Sully County	1,373	1,446	73	5.32%
Campbell County	1,466	1,377	-89	-6.07%
Harding County	1,255	1,311	56	4.46%
Hyde County	1,420	1,262	-158	-11.13%
Jones County	1,006	917	-89	-8.85%

Source: United States Census Bureau

Table C-3 Counties Experiencing Population Loss

10 Smallest Counties	2010 Population	2020 Population	# Change from 2010 to 2020	% Change from 2010 to 2020
Brule County	5,255	5,247	-8	-0.15%
Tripp County	5,644	5,624	-20	-0.35%
Spink County	6,415	6,361	-54	-0.84%
Bon Homme County	7,070	7,003	-67	-0.95%
Lyman County	3,755	3,718	-37	-0.99%
Sanborn County	2,355	2,330	-25	-1.06%
Dewey County	5,301	5,239	-62	-1.17%
Lake County	11,200	11,059	-141	-1.26%
Bennett County	3,431	3,381	-50	-1.46%
Deuel County	4,364	4,295	-69	-1.58%
Fall River County	7,094	6,973	-121	-1.71%
McPherson County	2,459	2,411	-48	-1.95%
Edmunds County	4,071	3,986	-85	-2.09%
Walworth County	5,438	5,315	-123	-2.26%
Moody County	6,486	6,336	-150	-2.31%
Todd County	9,612	9,319	-293	-3.05%
Haakon County	1,937	1,872	-65	-3.36%
Corson County	4,050	3,902	-148	-3.65%
Miner County	2,389	2,298	-91	-3.81%
Day County	5,710	5,449	-261	-4.57%
Perkins County	2,982	2,835	-147	-4.93%
Douglas County	3,002	2,835	-167	-5.56%
Campbell County	1,466	1,377	-89	-6.07%
Mellette County	2,048	1,918	-130	-6.35%
Gregory County	4,271	3,994	-277	-6.49%
Jackson County	3,031	2,806	-225	-7.42%
Marshall County	4,656	4,306	-350	-7.52%
Hand County	3,431	3,145	-286	-8.34%
Jones County	1,006	917	-89	-8.85%
Faulk County	2,364	2,125	-239	-10.11%
Hyde County	1,420	1,262	-158	-11.13%
Ziebach County	2,801	2,413	-388	-13.85%
Jerauld County	2,071	1,663	-408	-19.70%

Source: United States Census Bureau

Appendix D

State Owned and Leased Facilities in Flood and Wildfire Zones

Table D-1 State Buildings at Risk to 1% Chance Hazus Flood Hazards by County – Hazus and FEMA NFHL

Flood Type	Subregion	Building	State Agency	Building Name	Address
1% Chance Hazus	Turner County	2116	DEPT OF TRANSPORATION	Hurley Loader Shed 448 Sq Ft	28306 SD Highway 19, Hurley, South Dakota, 57036
1% Chance Hazus	Turner County	2114	DEPT OF TRANSPORATION	Hurley Woodframe Salt Shed	28306 SD Highway 19, Hurley, South Dakota, 57036
1% Chance Hazus	Walworth County	3009	DEPT OF TRANSPORATION	Selby 50x95 Truck Maint Shop	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3021	DEPT OF TRANSPORATION	Selby Abrasive Shed	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3002	DEPT OF TRANSPORATION	Selby Maint Shop	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3210	DEPT OF TRANSPORATION	Selby Maint Shop Site	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3055	DEPT OF TRANSPORATION	Selby Pole Building	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3089	DEPT OF TRANSPORATION	Selby Salt Storage Shed	US-83, Selby, South Dakota, 57472
1% Chance Hazus	Walworth County	3203	DEPT OF TRANSPORATION	Selby Scale Site Jct Of Us 12	US-83, Selby, South Dakota, 57472
1% Chance NFHL	Pennington County	699	BUREAU OF ADMINISTRATION	Federal Property Warehouse	604 Box Elder Rd W, Box Elder, South Dakota, 57719
1% Chance NFHL	Minnehaha County	4471	DEPT OF GAME, FISH & PARKS	Big Sioux Recreation Area	410 W Park St, Brandon, South Dakota, 57005
1% Chance NFHL	Pennington County	4516	DEPT OF GAME, FISH & PARKS	Gfp Cleghorn Hatchery	4725 Jackson Blvd, Rapid City, South Dakota, 57702
1% Chance NFHL	Lawrence County	4580	DEPT OF GAME, FISH & PARKS	Gfp Mcnenny Hat	19619 Trout Loop, Spearfish, South Dakota, 57783
1% Chance NFHL	Lawrence County	4261	DEPT OF HEALTH	Lawrence Co Health	9 Kirk Rd, Deadwood, South Dakota, 57732
1% Chance NFHL	Brown County	4100	DEPT OF HUMAN SERVICES	Human Services	404 Moccasin Dr, Aberdeen, South Dakota, 57401
1% Chance NFHL	Yankton County	7431	DEPT OF LABOR & REGULATIONS	Career Learng Center-Southeast Job Link	1200 W 21st St, Yankton, South Dakota, 57078
1% Chance NFHL	Minnehaha County	492	DEPT OF LABOR & REGULATIONS	Sioux Falls One Stop Center	811 E 10th St, Sioux Falls, South Dakota, 57103
1% Chance	Pennington	7924	DEPT OF PUBLIC SAFETY	Rapid City Regional Office	2050 W Main St, Ste 1, Rapid City, South

Flood Type	Subregion	Building	State Agency	Building Name	Address
NFHL	County				Dakota, 57702
1% Chance NFHL	Brown County	1254	DEPT OF REVENUE	Dept Of Revenue Field Office	419 Moccasin Dr, Aberdeen, South Dakota, 57401
1% Chance NFHL	Codington County	1267	DEPT OF REVENUE	Dept Of Revenue Field Office	715 S Maple, Watertown, South Dakota, 57201
1% Chance NFHL	Brown County	5123	DEPT OF REVENUE	Lottery	404 Moccasin Dr, Aberdeen, South Dakota, 57401
1% Chance NFHL	Minnehaha County	650	DEPT OF SOCIAL SERVICES	Division Of Social Welfare	811 E 10th St, Sioux Falls, South Dakota, 57103
1% Chance NFHL	Brown County	1015	DEPT OF TRANSPORATION	Aberdeen Salt Storage Shed	2555 Highway 12 W, Aberdeen, South Dakota, 57401
1% Chance NFHL	Lawrence County	4108	DEPT OF TRANSPORATION	Deadwood Abrasive Storage Shed	57 Crescent Dr, Deadwood, South Dakota, 57732
1% Chance NFHL	Lawrence County	4073	DEPT OF TRANSPORATION	Deadwood Maintenance Shop	57 Crescent Dr, Deadwood, South Dakota, 57732
1% Chance NFHL	Lawrence County	4237	DEPT OF TRANSPORATION	Deadwood Maintenance Shop Site	57 Crescent Dr, Deadwood, South Dakota, 57732
1% Chance NFHL	Lawrence County	4078	DEPT OF TRANSPORATION	Deadwood Storage Shed	57 Crescent Dr, Deadwood, South Dakota, 57732
1% Chance NFHL	Fall River County	4014	DEPT OF TRANSPORATION	Edgemont Maintenance Shop	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4207	DEPT OF TRANSPORATION	Edgemont Maintenance Shop Site	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4044	DEPT OF TRANSPORATION	Edgemont Salt Sand Storage Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4208	DEPT OF TRANSPORATION	Edgemont Stockpile Site	28576 Old Highway 18, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4090	DEPT OF TRANSPORATION	Edgemont Stockpile Site Building	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4016	DEPT OF TRANSPORATION	Edgemont Storage Salt Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Fall River County	4060	DEPT OF TRANSPORATION	Edgemont Storage Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
1% Chance NFHL	Minnehaha County	2003	DEPT OF TRANSPORATION	Valleysprings Rest Area Shed	57068, Valley Springs, South Dakota
1% Chance	McCook	143	UNIFIED JUDICIAL SYSTEM	Courthouse - McCook Co	130 W Essex Ave, Salem, South Dakota,

Flood Type	Subregion	Building	State Agency	Building Name	Address
NFHL	County				57058
				Total	**36**

Source: Hazus-MH, FEMA NFHL, South Dakota OEM, WSP GIS Analysis

Table D-2 State Buildings at Risk to 0.2% Chance Hazus Flood Hazards by County – Hazus and FEMA NFHL

Flood Type	Subregion	Building	State Agency	Building Name	Address
0.2% Chance NFHL	Hughes County	40	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	Thorpe Building	701 E Sioux Ave, Pierre, South Dakota, 57501
0.2% Chance NFHL	Minnehaha County	5100	DEPT OF HEALTH	Board Of Med & Osteop	101 S Mall Ave, Sioux Falls, South Dakota, 57104
0.2% Chance NFHL	Moody County	9107	DEPT OF MILITARY	00001 Flandreau Armory	710 W Community Dr, Flandreau, South Dakota, 57028
0.2% Chance NFHL	Meade County	9122	DEPT OF MILITARY	Sturgis Fms (Metal Storage Building)	701 14th St, Sturgis, South Dakota, 57785
0.2% Chance NFHL	Lawrence County	464	DEPT OF REVENUE	Gaming Commission	87 Sherman St, Deadwood, South Dakota, 57732
0.2% Chance NFHL	Lawrence County	634	DEPT OF SOCIAL SERVICES	Dept Of Social Services	20 Cliff St, Deadwood, South Dakota, 57732
0.2% Chance NFHL	Codington County	5171	OFFICE OF THE ATTORNEY GENERAL	Watertown Criminal Investigation Division	801 Jenson Ave SE, Watertown, South Dakota, 57201
0.2% Chance NFHL	Lawrence County	140	UNIFIED JUDICIAL SYSTEM	Courthouse - Lawrence Co	78 Sherman St, Deadwood, South Dakota, 57732
				Total	**8**

Source: Hazus-MH, FEMA NFHL, South Dakota OEM, WSP GIS Analysis

Table D-3 State Buildings at Risk to Levee NFHL

Flood Type	Subregion	Building	State Agency	Building Name	Address
Levee NFHL	Minnehaha County	702	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	Sdn Communications	2900 W 10th St, Sioux Falls, South Dakota, 57104
Levee NFHL	Minnehaha County	4555	DEPT OF GAME, FISH & PARKS	Gfp Regional Office	4500 S Oxbow Ave, Sioux Falls, South Dakota, 57106
Levee NFHL	Minnehaha County	476	DEPT OF HEALTH	Board Of Pharmacy	3701 W 49th St, Sioux Falls, South Dakota, 57106
Levee NFHL	Minnehaha County	463	DEPT OF HEALTH	Empire Office Building	4305 S Louise Ave, Sioux Falls, South Dakota, 57106
Levee NFHL	Minnehaha County	384	DEPT OF HEALTH	Health Department	1200 N West Ave, Sioux Falls, South Dakota, 57104
Levee NFHL	Minnehaha County	5190	DEPT OF HUMAN SERVICES	Disability Determination Services	3109 W 41st St, #100, Sioux Falls, South Dakota, 57105
Levee NFHL	Minnehaha County	659	DEPT OF HUMAN SERVICES	Rehabilitation Center	2900 W 11th St, #101, Sioux Falls, South Dakota, 57104
Levee NFHL	Minnehaha County	9125	DEPT OF MILITARY	Sioux Falls Foss Field Complex	801 W National Guard Dr, Sioux Falls, South Dakota, 57104
Levee NFHL	Minnehaha County	357	DEPT OF PUBLIC SAFETY	Driver License Exam	2501 W Russell St, Sioux Falls, South Dakota, 57104
Levee NFHL	Minnehaha County	8969	DEPT OF REVENUE	Dept Of Revenue Field Office	809 N Elmwood Ave, Sioux Falls, South Dakota, 57104
				Total	**10**

Source: Hazus-MH, FEMA NFHL, South Dakota OEM, WSP GIS Analysis

Table D-4 State Buildings at Risk to Wildfire Hazard- Very High

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Very High	Pennington County	497	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio Tower Site-Seth Bullock	251 Forest St, Hill City, South Dakota, 57745
Very High	Custer County	1107	DEPT OF GAME, FISH & PARKS	Csp Barn	13329 US-16A, Custer, South Dakota, 57730
Very High	Custer County	1124	DEPT OF GAME, FISH & PARKS	Csp Game Lodge	13329 US-16A, Custer, South Dakota, 57730
Very High	Custer County	1145	DEPT OF GAME, FISH & PARKS	Csp Norbeck Welcome Center	13329 US-16A, Custer, South Dakota, 57730
Very High	Custer County	4620	DEPT OF GAME, FISH & PARKS	Gfp Custer State Park	13329 US-16A, Custer, South Dakota,

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
					57730
Very High	Custer County	9781	DEPT OF PUBLIC SAFETY	Excel	25292 Badger Clark Rd, Custer, South Dakota, 57730
Very High	Custer County	9784	DEPT OF PUBLIC SAFETY	Gymnasium	25292 Badger Clark Rd, Custer, South Dakota, 57730
Very High	Custer County	9782	DEPT OF PUBLIC SAFETY	Quest	25292 Badger Clark Rd, Custer, South Dakota, 57730
Very High	Custer County	9783	DEPT OF PUBLIC SAFETY	Shop	25292 Badger Clark Rd, Custer, South Dakota, 57730
Very High	Custer County	4255	DEPT OF TRANSPORATION	Hermosa Stockpile Site	57744, Hermosa, South Dakota
Very High	Pennington County	4245	DEPT OF TRANSPORATION	Pennington Co Excess Land	57751, Keystone, South Dakota
Very High	Pennington County	4247	DEPT OF TRANSPORATION	Pennington Co Excess Land	57751, Keystone, South Dakota
Very High	Pennington County	4217	DEPT OF TRANSPORATION	Rimrock Gravel Stockpile Site	57702, Rapid City, South Dakota
Very High	Custer County	116	UNIFIED JUDICIAL SYSTEM	Courthouse - Custer Co	411 Mt Rushmore Rd, Custer, South Dakota, 57730
				Total	**14**

Table D-5 State Buildings at Risk to Wildfire Hazard- High

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Custer County	496	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	Bear Mt Src Tower Site	FS Rd, Custer, South Dakota, 57730
High	Pennington County	7973	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	Golden West Skyline	3850 Skyline Dr, Rapid City, South Dakota, 57701
High	Hand County	1201	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	Hand Co Tower Site	57362, Miller, South Dakota
High	Pennington County	4405	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	Kbhe Public Broadcast & Src	3650 Skyline Dr, Rapid City, South Dakota, 57701
High	Custer County	73	BUEREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio & Public Broadcasting	57730, Custer, South Dakota

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Custer County	4459	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio And Public Broadcasting	57730, Custer, South Dakota
High	Pennington County	65	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio Skyline Dr @ Kbhe	Skyline Dr, Rapid City, South Dakota, 57701
High	Fall River County	61	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio Tower Site	45 Battle Mountain Rd, Hot Springs, South Dakota, 57747
High	Marshall County	7654	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio Tower Site	Hillhead, South Dakota
High	McPherson County	4392	BUREAU OF INFORMATION AND TELECOMMUNICATIONS	State Radio Tower Site	SD Highway 10 & 355th Ave, Leola, South Dakota, 57456
High	Lawrence County	5191	DEPT OF AG & NATURAL RESOURCES	Denr Gilt Edge Site	11898 Gilt Edge Rd, Deadwood, South Dakota, 57732
High	Custer County	9771	DEPT OF CORRECTIONS	Administration & Wards	12279 Brady Dr, Custer, South Dakota, 57730
High	Custer County	9772	DEPT OF CORRECTIONS	Laundry	12279 Brady Dr, Custer, South Dakota, 57730
High	Custer County	9774	DEPT OF CORRECTIONS	Penitentiary Unit	12279 Brady Dr, Custer, South Dakota, 57730
High	Custer County	9773	DEPT OF CORRECTIONS	Power House & Shop	12279 Brady Dr, Custer, South Dakota, 57730
High	Custer County	4092	DEPT OF GAME, FISH & PARKS	Custer Abrasive Storage Building	115 Centennial Dr, Custer, South Dakota, 57730
High	Custer County	4067	DEPT OF GAME, FISH & PARKS	Custer Maint Shop	115 Centennial Dr, Custer, South Dakota, 57730
High	Custer County	4214	DEPT OF GAME, FISH & PARKS	Custer Maint Shop Site	115 Centennial Dr, Custer, South Dakota, 57730
High	Custer County	4101	DEPT OF GAME, FISH & PARKS	Custer Sign Shop	115 Centennial Dr, Custer, South Dakota, 57730
High	Custer County	4069	DEPT OF GAME, FISH & PARKS	Custer Storage Shed	115 Centennial Dr, Custer, South Dakota, 57730
High	Custer County	4015	DEPT OF GAME, FISH & PARKS	Custer Sylvan Lake Loader Shed	115 Centennial Dr, Custer, South Dakota, 57730
High	Hughes County	4587	DEPT OF GAME, FISH & PARKS	Farm Island Shop	1301 Farm Island Rd, Pierre, South Dakota, 57501
High	Pennington County	4516	DEPT OF GAME, FISH & PARKS	Gfp Cleghorn Hatchery	4725 Jackson Blvd, Rapid City, South Dakota, 57702

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Pennington County	4506	DEPT OF GAME, FISH & PARKS	Gfp Co	333 Main St, Hill City, South Dakota, 57745
High	Custer County	4507	DEPT OF GAME, FISH & PARKS	Gfp Co & Trappe	12168 US-16, Custer, South Dakota, 57730
High	Lawrence County	4580	DEPT OF GAME, FISH & PARKS	Gfp Mcnenny Hat	19619 Trout Loop, Spearfish, South Dakota, 57783
High	Lawrence County	4511	DEPT OF GAME, FISH & PARKS	Gfp State Farm	2130 Christensen Dr, Spearfish, South Dakota, 57783
High	Hand County	6104	DEPT OF GAME, FISH & PARKS	Lake Louise Recreation Area	35250 191st St, Miller, South Dakota, 57362
High	Edmunds County	843	DEPT OF HEALTH	Bowdle Health Care Center	8001 5th St, Bowdle, South Dakota, 57428
High	Custer County	4273	DEPT OF HEALTH	Custer Co Doh	447 Crook St, Ste 2, Custer, South Dakota, 57730
High	Lawrence County	4261	DEPT OF HEALTH	Lawrence Co Health	9 Kirk Rd, Deadwood, South Dakota, 57732
High	Oglala Lakota County	7508	DEPT OF LABOR	Dept Of Labor	57770, Pine Ridge, South Dakota
High	Pennington County	9086	DEPT OF MILITARY	00001 Aircraft Maintenance Hangar	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9008	DEPT OF MILITARY	00001 Csms #2 Location Hwy 16 B	1205 US-16-TRUCK E, Rapid City, South Dakota, 57701
High	Hughes County	9101	DEPT OF MILITARY	00001 Pierre Readiness Center	57501, Pierre, South Dakota
High	Pennington County	9087	DEPT OF MILITARY	00002 Aircraft Maintenance Hangar #2	4750 Guard Rd, Rapid City, South Dakota, 57703
High	Pennington County	9036	DEPT OF MILITARY	00003 Rapid City Airport Armory	4750 Guard Rd, Rapid City, South Dakota, 57703
High	Pennington County	9001	DEPT OF MILITARY	00i23 Credit Union	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9040	DEPT OF MILITARY	100 Duke Corning Armory	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9058	DEPT OF MILITARY	105 Oms #2	2823 W Main St, Rapid City, South Dakota, 57702

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Pennington County	9013	DEPT OF MILITARY	122 Starbase Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9014	DEPT OF MILITARY	123 Starbase Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9007	DEPT OF MILITARY	140 Storage	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9070	DEPT OF MILITARY	159 Ordinance Storage	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9002	DEPT OF MILITARY	160 Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9042	DEPT OF MILITARY	170 Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9010	DEPT OF MILITARY	180 Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9012	DEPT OF MILITARY	201 Visitor Center	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9060	DEPT OF MILITARY	250 Generals Quarter	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9066	DEPT OF MILITARY	350 Coyote Den	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9011	DEPT OF MILITARY	360 Dvq	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9018	DEPT OF MILITARY	370 Boq	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9019	DEPT OF MILITARY	380 Boq	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9016	DEPT OF MILITARY	420 Jfhq	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9003	DEPT OF MILITARY	450 Conference Center	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9043	DEPT OF MILITARY	456 Usp&Fo Warehouse	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9083	DEPT OF MILITARY	550 Health Clinic	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9084	DEPT OF MILITARY	554 Chapel	2823 W Main St, Rapid City, South Dakota, 57702

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Pennington County	9004	DEPT OF MILITARY	560 Physcial Fitness Center	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9006	DEPT OF MILITARY	570 Ration Breakdown	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9061	DEPT OF MILITARY	580 House	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9005	DEPT OF MILITARY	660 Pcs Warehouse Storage Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9009	DEPT OF MILITARY	670 Storage Building	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9037	DEPT OF MILITARY	801 Barracks	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9017	DEPT OF MILITARY	802 Barracks	2823 W Main St, Rapid City, South Dakota, 57702
High	Pennington County	9015	DEPT OF MILITARY	803 Barracks	2823 W Main St, Rapid City, South Dakota, 57702
High	Hughes County	9100	DEPT OF MILITARY	Pierre Ts Rg	57501, Pierre, South Dakota
High	Pennington County	708	DEPT OF PUBLIC SAFETY	Great Plains Dispatch (Wildland Fire)	8123 S Highway 16, Rapid City, South Dakota, 57702
High	Hughes County	3214	DEPT OF PUBLIC SAFETY	Public Safety Site Sd34	57501, Pierre, South Dakota
High	Pennington County	7924	DEPT OF PUBLIC SAFETY	Rapid City Regional Office	2050 W Main St, Ste 1, Rapid City, South Dakota, 57702
High	Beadle County	1213	DEPT OF TRANSPORATION	Beadle County Borrow Pit	57350, Huron, South Dakota
High	Pennington County	7922	DEPT OF TRANSPORATION	Coal Gasification Plant	S SD-79, Rapid City, South Dakota, 57702
High	Tripp County	3248	DEPT OF TRANSPORATION	Colome Stockpile Site	57528, Colome, South Dakota
High	Custer County	4227	DEPT OF TRANSPORATION	Custer Stockpile Site	57730, Custer, South Dakota
High	Lawrence County	4108	DEPT OF TRANSPORATION	Deadwood Abrasive Storage Shed	57 Crescent Dr, Deadwood, South Dakota, 57732
High	Lawrence County	4073	DEPT OF TRANSPORATION	Deadwood Maint Shop	57 Crescent Dr, Deadwood, South Dakota, 57732

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
High	Lawrence County	4237	DEPT OF TRANSPORATION	Deadwood Maint Shop Site	57 Crescent Dr, Deadwood, South Dakota, 57732
High	Lawrence County	4078	DEPT OF TRANSPORATION	Deadwood Storage Shed	57 Crescent Dr, Deadwood, South Dakota, 57732
High	Campbell County	3105	DEPT OF TRANSPORATION	Herreid Abrasive And Salt Dome	10613 US Highway 83, Herreid, South Dakota, 57632
High	Campbell County	3103	DEPT OF TRANSPORATION	Herreid New Cold Storage Building	10613 US Highway 83, Herreid, South Dakota, 57632
High	Campbell County	3100	DEPT OF TRANSPORATION	Herreid New Shop	10613 US Highway 83, Herreid, South Dakota, 57632
High	Campbell County	3251	DEPT OF TRANSPORATION	Herreid Shop Site	10613 US Highway 83, Herreid, South Dakota, 57632
High	Pennington County	4087	DEPT OF TRANSPORATION	Hill City Salt Storage Shed	24032 Highway 385, Hill City, South Dakota, 57745
High	Beadle County	1233	DEPT OF TRANSPORATION	Huron Stockpile Site	57350, Huron, South Dakota
High	Hyde County	1283	DEPT OF TRANSPORATION	Hyde Highmore R/W	57345, Highmore, South Dakota
High	Pennington County	4099	DEPT OF TRANSPORATION	Keystone Wye Abrasive Shed	US-16, Keystone, South Dakota, 57751
High	Pennington County	4019	DEPT OF TRANSPORATION	Keystone Wye Loader Shed	US-16, Keystone, South Dakota, 57751
High	Pennington County	4018	DEPT OF TRANSPORATION	Keystone Wye Truck Strg Bldg	US-16, Keystone, South Dakota, 57751
High	Oglala Lakota County	4232	DEPT OF TRANSPORATION	Oglala Stckpl Site	57764, Oglala, South Dakota
High	Pennington County	4230	DEPT OF TRANSPORATION	R/City So Yard/79s Stockpile Site	5801 S SD-79, Rapid City, South Dakota, 57702
High	Pennington County	4008	DEPT OF TRANSPORATION	Rapid City Hwy44 Storage Shed	11485 W Highway 44, Rapid City, South Dakota, 57702
High	Pennington County	4051	DEPT OF TRANSPORATION	Rapid City Salt Storage Shed/South	5801 S SD-79, Rapid City, South Dakota, 57702
High	Pennington County	4002	DEPT OF TRANSPORATION	Rapid City Sign Storage Shed	5801 S SD-79, Rapid City, South Dakota, 57702
High	Pennington	4053	DEPT OF TRANSPORATION	Rapid City South Yard Abrasive	5801 S SD-79, Rapid City, South Dakota,

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
	County			Shed	57702
High	Pennington County	4031	DEPT OF TRANSPORATION	Rapid City Storage Shed/South	5801 S SD-79, Rapid City, South Dakota, 57702
High	Marshall County	1225	DEPT OF TRANSPORATION	Veblin Stockpile Site	57270, Veblen, South Dakota
High	Todd County	3112	DEPT OF TRANSPORATION	White River 50x90 Cold Strg Bldg	26522 US-83, White River, South Dakota, 57579
High	Todd County	3099	DEPT OF TRANSPORATION	White River Abrasive Dome	26522 US-83, White River, South Dakota, 57579
High	Todd County	3008	DEPT OF TRANSPORATION	White River Maint Shop	26522 US-83, White River, South Dakota, 57579
High	Todd County	3202	DEPT OF TRANSPORATION	White River Maint Shop Site	26522 US-83, White River, South Dakota, 57579
High	Todd County	3050	DEPT OF TRANSPORATION	Wht River Slt Storage Shed	26522 US-83, White River, South Dakota, 57579
				Total	**101**

Table D-6 State Buildings at Risk to Wildfire Hazard- Moderate

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Walworth County	9112		00001 Mobridge Readiness Center	1213 Lake Front Dr, Mobridge, South Dakota, 57601
Moderate	Union County	5013		Adams Homestead & Nature Preserve	272 Westshore Dr, North Sioux City, South Dakota, 57049
Moderate	Fall River County	9702		Administration Building	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Meade County	423		Afb Hosp Ped Clinic 28th Med Grp	2900 Doolittle Dr, Ellsworth Afb, South Dakota, 57706
Moderate	Lawrence County	4602		Agriculture	11361 Nevada Gulch Rd, Lead, South Dakota, 57754
Moderate	Pennington County	4515		Agriculture/Forestry	3305 1/2 W South St, Rapid City, South Dakota, 57702
Moderate	Hughes County	3090		Airplane Hanger Jcp Leasing	4300 Airport Rd, Pierre, South Dakota, 57501
Moderate	Hughes County	3076		Airport Warehouse	4300 Airport Rd, Pierre, South Dakota, 57501
Moderate	Pennington	648		Archaeological Research Center	217 Kansas City St, Rapid City, South Dakota, 57701

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
	County				
Moderate	Fall River County	9708		Barn	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Butte County	4076		Belle Fourche Cold Storge Shed	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4085		Belle Fourche Cover All Salt Sand	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4071		Belle Fourche Heated Truck Storge	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4009		Belle Fourche Lab Building	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4075		Belle Fourche Maint Shop	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4007		Belle Fourche Salt Storage Shed	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Butte County	4228		Belle Fourche Shop Site	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Lawrence County	7950		Bhsu E Y Berry Library	1200 University St, Spearfish, South Dakota, 57799
Moderate	Lawrence County	7403		Black Hills Education Connection	208 E Colorado Blvd, Spearfish, South Dakota, 57783
Moderate	Fall River County	9713		Boiler Plant	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9718		Canyon Cottages	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Pennington County	7520		Career Learning Center	730 E Watertown St, Rapid City, South Dakota, 57701
Moderate	Hughes County	196		Central Printing Plant	E 4th St, Pierre, South Dakota, 57501
Moderate	Deuel County	1038		Clear Lake Cold Storage Shed	510 Highway 22 W, Clear Lake, South Dakota, 57226
Moderate	Deuel County	1036		Clear Lake Cold/Salt Brine Storage Bldg	510 Highway 22 W, Clear Lake, South Dakota, 57226
Moderate	Deuel County	1098		Clear Lake New Maintenance Shop	510 Highway 22 W, Clear Lake, South Dakota, 57226
Moderate	Deuel County	1021		Clear Lake Salt Storage Shed	510 Highway 22 W, Clear Lake, South Dakota, 57226
Moderate	Deuel County	1215		Clear Lake Shop Site	510 Highway 22 W, Clear Lake, South Dakota, 57226
Moderate	Codington County	1266		Codington Surplus Land	57263, South Shore, South Dakota
Moderate	Pennington County	8989		Commerce Park Subdivision	1444 Fountain Plaza Dr, Rapid City, South Dakota, 57702
Moderate	Hughes County	89		Communication Van - Attorney General	1302 US-14, Pierre, South Dakota, 57501
Moderate	Corson County	689		Corson County Src Site	57642, McLaughlin, South Dakota
Moderate	Fall River County	123		Courthouse - Fall River Co	906 N River St, Hot Springs, South Dakota, 57747

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Hughes County	132		Courthouse - Hughes Co	104 E Capitol Ave, Pierre, South Dakota, 57501
Moderate	Kingsbury County	138		Courthouse - Kingsbury Co	101 2nd St SE, De Smet, South Dakota, 57231
Moderate	Lawrence County	140		Courthouse - Lawrence Co	78 Sherman St, Deadwood, South Dakota, 57732
Moderate	Pennington County	151		Courthouse - Pennington Co	315 Saint Joseph St, Rapid City, South Dakota, 57701
Moderate	Ziebach County	167		Courthouse - Zeibach Co	68 S Main St, Dupree, South Dakota, 57623
Moderate	Hughes County	373		Cultural Heritage Center	900 Governors Dr, Pierre, South Dakota, 57501
Moderate	Pennington County	4103		Dahl Fine Arts Center	703 Kansas City St, Rapid City, South Dakota, 57701
Moderate	Kingsbury County	9155		De Smet Armory	403 3rd St SW, De Smet, South Dakota, 57231
Moderate	Kingsbury County	4451		De Smet High School	405 3rd St SW, De Smet, South Dakota, 57231
Moderate	Kingsbury County	1085		De Smet Maint Abrasive Building	20455 SD-25, De Smet, South Dakota, 57231
Moderate	Kingsbury County	1054		De Smet Maint Shop	20455 SD-25, De Smet, South Dakota, 57231
Moderate	Kingsbury County	1217		De Smet Maint Shop Site	20455 SD-25, De Smet, South Dakota, 57231
Moderate	Kingsbury County	1053		De Smet Salt Brine Shed	20455 SD-25, De Smet, South Dakota, 57231
Moderate	Kingsbury County	1065		De Smet Salt Storage Shed	20455 SD-25, De Smet, South Dakota, 57231
Moderate	Lawrence County	7503		Dept Of Labor	1300 North Ave, Spearfish, South Dakota, 57783
Moderate	Pennington County	7521		Dept Of Labor	2330 N Maple Ave, Ste 1, Rapid City, South Dakota, 57701
Moderate	Pennington County	586		Dept Of Revenue Field Office	1520 Haines Ave, Ste 3, Rapid City, South Dakota, 57701
Moderate	Lawrence County	634		Dept Of Social Services	20 Cliff St, Deadwood, South Dakota, 57732
Moderate	Todd County	642		Dept Of Social Services	Marge Ln, Mission, South Dakota, 57555
Moderate	Deuel County	4270		Deuel Co Pha / Co. Memorial Hosp.	701 3rd Ave S, Clear Lake, South Dakota, 57226
Moderate	Deuel County	840		Deuel County Memorial Hospital	701 3rd Ave S, Clear Lake, South Dakota, 57226
Moderate	Hughes County	99986		Division Of Banking	1601 N Harrison Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	99993		Dmp - Banking Building	1601 N Harrison Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	99990		Dmp - Chc Changing Times	900 Governors Dr, Pierre, South Dakota, 57501
Moderate	Hughes County	99989		Dmp - Chc Main Panel	900 Governors Dr, Pierre, South Dakota, 57501
Moderate	Pennington County	355		Driver License Exam	1301 E Catron Blvd, Rapid City, South Dakota, 57701

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Hughes County	17		East Truck Bypass Shop	1500 N Garfield Ave, Pierre, South Dakota, 57501
Moderate	Fall River County	4409		Edgemont High School	57735, Edgemont, South Dakota
Moderate	Fall River County	4014		Edgemont Maint Shop	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Fall River County	4207		Edgemont Maint Shop Site	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Fall River County	4044		Edgemont Salt Sand Storage Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Fall River County	4208		Edgemont Stockpile Site	28576 Old Highway 18, Edgemont, South Dakota, 57735
Moderate	Fall River County	4090		Edgemont Stockpile Site Building	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Fall River County	4016		Edgemont Storage Salt Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Fall River County	4060		Edgemont Storage Shed	28278 Dewey Rd, Edgemont, South Dakota, 57735
Moderate	Hughes County	3001		Emergency Management Storage	3100 Airport Rd, Pierre, South Dakota, 57501
Moderate	Fall River County	9724		Enclosed Walkway - Bldg 2/3	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	4249		Fallriver Co Excess Land	57747, Hot Springs, South Dakota
Moderate	Fall River County	4250		Fallriver Co Excess Land	57747, Hot Springs, South Dakota
Moderate	Fall River County	4251		Fallriver Co Excess Land	57747, Hot Springs, South Dakota
Moderate	Pennington County	699		Federal Property Warehouse	604 Box Elder Rd W, Box Elder, South Dakota, 57719
Moderate	Meade County	9032		Ft Meade Rti Complex	54 Sheridan St, Fort Meade, South Dakota, 57741
Moderate	Marshall County	2205		Ft Sisseton State Park Cmd Ofcr Residenc	11907 434th Ave, Lake City, South Dakota, 57247
Moderate	Lawrence County	464		Gaming Commission	87 Sherman St, Deadwood, South Dakota, 57732
Moderate	Hughes County	1029		George S Mickelson Criminal Justice Cent	1302 US-14, Pierre, South Dakota, 57501
Moderate	Pennington County	4535		Gfp Co	15555 Lonesome Dove St, Box Elder, South Dakota, 57719
Moderate	Butte County	4505		Gfp Co	19127 US Highway 85, Belle Fourche, South Dakota, 57717
Moderate	Gregory County	4533		Gfp Co & Trappe	122 E 5th St, Burke, South Dakota, 57523
Moderate	Meade County	4512		Gfp Co Pilot Tr	20680 132nd Ave, Sturgis, South Dakota, 57785
Moderate	Lawrence County	4588		Gfp Hardy Camp	22107 US-85, Lead, South Dakota, 57754
Moderate	Pennington County	5011		Gfp Outdoor Campus West	4130 Adventure Trl, Rapid City, South Dakota, 57702

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Meade County	4593		Gfp Park District	20680 132nd Ave, Sturgis, South Dakota, 57785
Moderate	Fall River County	4590		Gfp Park District - Fall River Cons Offi	646 Jennings Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9714		Guest House	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Custer County	4107		Hermosa 60x85 Heated Trk Strg	14311 Broken Spoke Pl, Hermosa, South Dakota, 57744
Moderate	Custer County	4096		Hermosa Abrasive Shed	14311 Broken Spoke Pl, Hermosa, South Dakota, 57744
Moderate	Custer County	4062		Hermosa Storage Shed	14311 Broken Spoke Pl, Hermosa, South Dakota, 57744
Moderate	Pennington County	4066		Highway Patrol	2220 Eglin St, Rapid City, South Dakota, 57703
Moderate	Hughes County	369		Hillsview Plaza	3800 SD Highway 34, Pierre, South Dakota, 57501
Moderate	Fall River County	4236		Hot Springs Maint Shed Site	27660 US-385, Hot Springs, South Dakota, 57747
Moderate	Fall River County	4074		Hot Springs Maint Shop	27660 US-385, Hot Springs, South Dakota, 57747
Moderate	Fall River County	4043		Hot Springs Salt Sand Storage Shed	27660 US-385, Hot Springs, South Dakota, 57747
Moderate	Fall River County	4027		Hot Springs Salt Storage Shed	27660 US-385, Hot Springs, South Dakota, 57747
Moderate	Fall River County	4021		Hot Springs Storage Cold Shed	27660 US-385, Hot Springs, South Dakota, 57747
Moderate	Turner County	2116		Hurley Loader Shed 448 Sq Ft	28306 SD Highway 19, Hurley, South Dakota, 57036
Moderate	Turner County	2114		Hurley Woodframe Salt Shed	28306 SD Highway 19, Hurley, South Dakota, 57036
Moderate	Lyman County	3004		I90 Wbl Lyman Co Rest Area Storage	Vivian, South Dakota
Moderate	Walworth County	6106		Indian Creek Recreation Area	12905 288th Ave, Mobridge, South Dakota, 57601
Moderate	Dewey County	3085		Isabel Cold Storage Building 50x90	Hillsview Rd, Isabel, South Dakota, 57633
Moderate	Dewey County	3104		Isabel New Abrasive Dome	Hillsview Rd, Isabel, South Dakota, 57633
Moderate	Dewey County	3030		Isabel New Shop	Hillsview Rd, Isabel, South Dakota, 57633
Moderate	Dewey County	3250		Isabel New Shop Site	Hillsview Rd, Isabel, South Dakota, 57633
Moderate	Hughes County	5117		Kebach Building	3442 E SD Highway 34, Pierre, South Dakota, 57501
Moderate	Hughes County	6		Kebach Building/Sdwp Minimum Unit H	3442 E SD Highway 34, Pierre, South Dakota, 57501
Moderate	Kingsbury County	1287		Kingsbury Excess Land	57231, De Smet, South Dakota
Moderate	Hughes County	91		Klein Building	221 S Central Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	12		Kneip Building	700 Governors Dr, Pierre, South Dakota, 57501

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Hughes County	99988		Kneip Building 3rd Floor	700 Governors Dr, Pierre, South Dakota, 57501
Moderate	Jackson County	4403		Kzsd Public Broadcast & Src	22760 Buzzard Butte Rd, Long Valley, South Dakota, 57547
Moderate	Fall River County	9715		Laundry/Commissary	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Lawrence County	493		Lawrence Co Dept Of Health	930 N 10th St, Spearfish, South Dakota, 57783
Moderate	Lawrence County	4274		Lawrence Co Doh	930 N 10th St, Spearfish, South Dakota, 57783
Moderate	Lawrence County	4204		Lawrence Co Excess Land	57783, Spearfish, South Dakota
Moderate	Hughes County	39		Mackay Building - State Library	800 Governors Dr, Pierre, South Dakota, 57501
Moderate	Fall River County	9711		Maintenance Garage	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9712		Maintenance Shop	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9701		Men's Building	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Todd County	3081		Mission Abrasive Shed 3600 Sq	756 W 2nd St, Mission, South Dakota, 57555
Moderate	Todd County	3038		Mission Cold Storage Building	756 W 2nd St, Mission, South Dakota, 57555
Moderate	Todd County	3070		Mission Maint Shop	756 W 2nd St, Mission, South Dakota, 57555
Moderate	Todd County	3234		Mission Maint Shop Site	756 W 2nd St, Mission, South Dakota, 57555
Moderate	Todd County	3236		Mission Port Of Entry Site	US-83 & US-18, Mission, South Dakota, 57555
Moderate	Hughes County	450		New Health Lab	615 E 4th St, Pierre, South Dakota, 57501
Moderate	Charles Mix County	5188		North Point Recreation Area	38180 297th St, Lake Andes, South Dakota, 57356
Moderate	Butte County	4010		Northern Plains Squad Office	10921 SD-34, Belle Fourche, South Dakota, 57717
Moderate	Fall River County	4003		Oelrichs Maint Shop	29201 Highway 385, Oelrichs, South Dakota, 57763
Moderate	Fall River County	4229		Oelrichs Maint Shop Site	29201 Highway 385, Oelrichs, South Dakota, 57763
Moderate	Fall River County	4045		Oelrichs Salt Sand Storage Shed	29201 Highway 385, Oelrichs, South Dakota, 57763
Moderate	Fall River County	4070		Oelrichs Salt Storage Shed	29201 Highway 385, Oelrichs, South Dakota, 57763
Moderate	Fall River County	4068		Oelrichs Storage Shed	29201 Highway 385, Oelrichs, South Dakota, 57763
Moderate	Pennington County	4046		Parts Central Building	415 Main St, Rapid City, South Dakota, 57701
Moderate	Jackson County	4252		Pennington Co Excess Land	57750, Interior, South Dakota

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Day County	6105		Pickerel Lake Recreation Area	12980 446th Ave, Grenville, South Dakota, 57239
Moderate	Hughes County	3000		Pierre Airport Hanger	4300 Airport Rd, Pierre, South Dakota, 57501
Moderate	Hughes County	58		Pierre Exam Station (Rented)	314 S Central Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	59		Prospect Building - Business Services	215 E Prospect Ave, Pierre, South Dakota, 57501
Moderate	Fall River County	4408		Public Broadcasting	57735, Edgemont, South Dakota
Moderate	Pennington County	4469		Public Broadcasting Microwave Site	57761, New Underwood, South Dakota
Moderate	Fall River County	9717		Pump House #1	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9710		Pump House #2	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Hughes County	7517		R Center Building	3415 Airport Rd, Pierre, South Dakota, 57501
Moderate	Pennington County	9167		Range Road Readiness Center	3740 Range Rd, Rapid City, South Dakota, 57702
Moderate	Pennington County	4102		Rapid City 2nd Abrasive Shed	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4082		Rapid City Abrasive Building	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4035		Rapid City Cold Storage Shed	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4037		Rapid City Maintenance Shop Bldg A	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4040		Rapid City Mtrls Lab Shed	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4036		Rapid City Reg Office	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4244		Rapid City Region Office Site	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4038		Rapid City Repair Shop Bldg B	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4104		Rapid City Salt Brine Shed	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	5186		Rapid City School Warehouse	3801 S Highway 79, Rapid City, South Dakota, 57701

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Pennington County	4039		Rapid City Slt Storage Shed?Bldg D	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	7406		Rapid City University Center	4300 Cheyenne Blvd, Box Elder, South Dakota, 57719
Moderate	Pennington County	4048		Rc Area Specialty Crew Bldg F	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Pennington County	4105		Rc Reg Complex-New Strg Bldg	2300 Eglin St, Rapid City, South Dakota, 57703
Moderate	Hughes County	45		Real Estate Commission	221 W Capitol Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	300		S D Federal Surplus Agency	118 W Capitol Ave, Pierre, South Dakota, 57501
Moderate	Hughes County	198		Saint Charles	E Capitol Ave & S Euclid Ave, Pierre, South Dakota, 57501
Moderate	Pennington County	4503		Sdda Regional Office	3305 W South St, Rapid City, South Dakota, 57702
Moderate	Walworth County	3009		Selby 50x95 Truck Maintenance Shop	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3021		Selby Abrasive Shed	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3002		Selby Maintenance Shop	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3210		Selby Maintenance Shop Site	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3055		Selby Pole Building	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3089		Selby Salt Storage Shed	US-83, Selby, South Dakota, 57472
Moderate	Walworth County	3203		Selby Scale Site Jct Of Us 12	US-83, Selby, South Dakota, 57472
Moderate	Fall River County	9728		Sewer Vault House	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Meade County	494		Sly Hill State Radio Site	1114 Foothills Rd, Sturgis, South Dakota, 57785
Moderate	Pennington County	631		Social Service Child Support	510 N Campbell St, Rapid City, South Dakota, 57701
Moderate	Lawrence County	9144		Spearfish Armory	University St, Spearfish, South Dakota, 57799
Moderate	Fall River County	9721		Staff Garage - Armbruster	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9706		Staff Garage - Richardson	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9726		Staff Garage - Walker	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
Moderate	Fall River County	9719		Staff House - Armbruster	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9722		Staff House - Payton	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9705		Staff House - Richardson	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9720		Staff House - Walker	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Pennington County	604		State Radio - Bmd Building	2635 Dyess Ave, Unit A, Rapid City, South Dakota, 57701
Moderate	Lawrence County	74		State Radio & Public Broadcast	Terry Peak Lodge
Moderate	Campbell County	692		State Radio Tower Site	57632, Herreid, South Dakota
Moderate	Pennington County	417		Stockgrowers Building	426 St Joseph St, Rapid City, South Dakota, 57701
Moderate	Meade County	4028		Sturgis Cold Storage Building	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	9122		Sturgis Fms (Metal Storage Building)	701 14th St, Sturgis, South Dakota, 57785
Moderate	Meade County	4234		Sturgis Maintenance Shop Site	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4095		Sturgis Maintenance Shop	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4106		Sturgis New 40x60 Abrasive Shed	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4083		Sturgis Salt Sand Storage	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4047		Sturgis Storage Shed	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4065		Sturgis Storage Shed	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Meade County	4000		Sturgis Storage Shed	1100 Otter Rd, Sturgis, South Dakota, 57785
Moderate	Hughes County	15		Sutherland Building - Public Safety	118 W Capitol Ave, Pierre, South Dakota, 57501
Moderate	Fall River County	9723		Tunnel - Boiler Plant/Bldg 1	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Fall River County	9725		Tunnel - Boiler Plant/Bldg 3	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Pennington County	4089		Wall Abrasive Storage Building	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington County	4059		Wall Cold Storage Shed	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington	4025		Wall High School	401 South Blvd W, Wall, South Dakota, 57790

Wildfire Hazard	Subregion	Building	State Agency	Building Name	Address
	County				
Moderate	Pennington County	4013		Wall Maintenance Shop	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington County	4216		Wall Maintenance Shop Site	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington County	4012		Wall Salt Storage Shed	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington County	4041		Wall Salt/Equip Storage Shed	212 2nd Ave, Wall, South Dakota, 57790
Moderate	Pennington County	4049		Wasta Abrasive Shed	30 Highway 1416, Wasta, South Dakota, 57791
Moderate	Pennington County	4224		Wasta Maintenance Shop Site	US-14 E, Wasta, South Dakota, 57791
Moderate	Fall River County	9707		Water Tower	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
Moderate	Pennington County	5163		Wdt Badlands Building	Mickelson Dr, Rapid City, South Dakota, 57703
Moderate	Pennington County	9173		West Camp Rapid Russell Cabin	1001 S 44th St, Rapid City, South Dakota, 57702
Moderate	Pennington County	9172		West Camp Rapid Russell House	1001 S 44th St, Rapid City, South Dakota, 57702
Moderate	Fall River County	9703		Women/Couples/Ncu/Scu/Dietary Building	2500 Minnekahta Ave, Hot Springs, South Dakota, 57747
				Total	**211**

Source: USDA Wildfire Risk to Communities, South Dakota OEM, WSP GIS Analysis

Appendix E

National Flood Insurance Program (NFIP) and Community Rating System (CRS) Information

Federal Emergency Management Agency
NFIP Insurance Report
SOUTH DAKOTA

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	[AURORA COUNTY]							
460001	PLANKINTON, CITY OF	$ 1,056	0	1	2	$ 476,000	2	$ 99,980
	County Total :	$ 1,056	0	1	2	$ 476,000	2	$ 99,980
	[BEADLE COUNTY]							
460251	BEADLE COUNTY *	$ 3,171	0	2	6	$ 1,738,000	17	$ 299,410
460003	HURON,CITY OF	$ 1,286	0	0	2	$ 700,000	6	$ 68,674
	County Total :	$ 4,457	0	2	8	$ 2,438,000	23	$ 368,084
	[BON HOMME COUNTY]							
460252	BON HOMME COUNTY *	$ 686	0	0	1	$ 350,000	0	$ 0
460142	TABOR, TOWN OF	$ 1,266	0	0	2	$ 578,000	2	$ 24,184
	County Total :	$ 1,952	0	0	3	$ 928,000	2	$ 24,184
	[BROOKINGS COUNTY]							
460051	AURORA, CITY OF	$ 283	0	0	1	$ 42,000	1	$ 10,360
460253	BROOKINGS COUNTY*	$ 27,545	0	31	42	$ 7,014,000	64	$ 735,740
460004	BROOKINGS, CITY OF	$ 8,443	0	10	17	$ 2,508,000	23	$ 186,983
460005	BRUCE, CITY OF	$ 2,818	0	1	2	$ 290,000	11	$ 33,851
	County Total :	$ 39,089	0	42	62	$ 9,854,000	99	$ 966,934
	[BROWN COUNTY]							
460007	ABERDEEN, CITY OF	$ 68,085	0	38	93	$ 24,820,000	406	$ 2,487,761
460006	BROWN COUNTY *	$ 9,118	0	12	17	$ 2,433,000	58	$ 626,131
460008	COLUMBIA, CITY OF	$ 0	0	0	0	$ 0	1	$ 21,300
460009	FREDERICK, TOWN OF	$ 6,005	0	5	5	$ 689,000	7	$ 70,814
460179	GROTON, CITY OF	$ 444	0	1	1	$ 128,000	5	$ 27,921
460294	HECLA, CITY OF	$ 0	0	0	0	$ 0	2	$ 5,688
460065	STRATFORD, TOWN OF	$ 0	0	0	0	$ 0	1	$ 7,284
460011	WESTPORT, TOWN OF	$ 3,466	0	4	4	$ 278,000	8	$ 39,166
	County Total :	$ 87,118	0	60	120	$ 28,348,000	488	$ 3,286,065

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	[BRULE COUNTY]							
460284	BRULE COUNTY *	$ 0	0	0	0	$ 0	6	$ 110,836
460164	CHAMBERLAIN, CITY OF	$ 0	0	0	0	$ 0	1	$ 142,021
	County Total :	$ 0	0	0	0	$ 0	7	$ 252,857
	[BUTTE COUNTY]							
460012	BELLE FOURCHE, CITY OF	$ 23,542	0	13	22	$ 3,647,000	11	$ 11,833
460236	BUTTE COUNTY*	$ 5,510	0	5	6	$ 908,000	1	$ 0
	County Total :	$ 29,052	0	18	28	$ 4,555,000	12	$ 11,833
	[CAMPBELL COUNTY]							
460256	CAMPBELL COUNTY *	$ 0	0	0	0	$ 0	1	$ 165,942
460132	POLLOCK, CITY OF	$ 513	0	0	1	$ 140,000	0	$ 0
	County Total :	$ 513	0	0	1	$ 140,000	1	$ 165,942
	[CHARLES MIX COUNTY]							
460257	CHARLES MIX COUNTY *	$ 1,427	0	0	2	$ 406,000	0	$ 0
460212	PLATTE, CITY OF	$ 2,857	0	0	2	$ 494,000	3	$ 186,300
460224	WAGNER, CITY OF	$ 532	0	0	1	$ 126,000	0	$ 0
461204	YANKTON SIOUX TRIBE	$ 1,155	0	0	2	$ 465,000	8	$ 317,960
	County Total :	$ 5,971	0	0	7	$ 1,491,000	11	$ 504,260
	[CLARK COUNTY]							
460258	CLARK COUNTY *	$ 1,205	0	0	2	$ 700,000	8	$ 142,000
460013	CLARK, CITY OF	$ 4,549	0	9	10	$ 759,000	1	$ 5,069
460014	WILLOW LAKE, TOWN OF	$ 0	0	0	0	$ 0	3	$ 42,850
	County Total :	$ 5,754	0	9	12	$ 1,459,000	12	$ 189,919
	[CLAY COUNTY]							
460259	CLAY COUNTY*	$ 6,250	0	0	9	$ 2,900,000	11	$ 50,296
460015	VERMILLION, CITY OF	$ 325	0	0	1	$ 280,000	1	$ 658

Federal Emergency Management Agency
NFIP Insurance Report
SOUTH DAKOTA

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	County Total :	$ 6,575	0	0	10	$ 3,180,000	12	$ 50,954
	[CODINGTON COUNTY]							
460260	CODINGTON COUNTY*	$ 12,713	0	3	16	$ 4,153,000	34	$ 664,346
460306	FLORENCE, TOWN OF	$ 689	0	0	1	$ 350,000	0	$ 0
460016	WATERTOWN, CITY OF	$ 184,148	0	79	233	$ 49,698,000	430	$ 5,799,972
	County Total :	$ 197,550	0	82	250	$ 54,201,000	464	$ 6,464,318
	[CORSON COUNTY]							
461219	STANDING ROCK INDIAN RESERVATION	$ 670	0	0	1	$ 350,000	0	$ 0
	County Total :	$ 670	0	0	1	$ 350,000	0	$ 0
	[CUSTER COUNTY]							
460018	CUSTER COUNTY*	$ 17,177	0	11	23	$ 5,461,000	30	$ 475,214
460019	CUSTER, CITY OF	$ 4,315	0	3	3	$ 910,000	12	$ 44,715
460230	HERMOSA, TOWN OF	$ 6,340	0	7	11	$ 1,468,000	9	$ 125,590
	County Total :	$ 27,832	0	21	37	$ 7,839,000	51	$ 645,519
	[DAVISON COUNTY]							
460020	DAVISON COUNTY*	$ 4,053	0	1	7	$ 1,706,000	9	$ 689,274
460021	MITCHELL, CITY OF	$ 15,369	0	3	26	$ 4,825,000	14	$ 151,128
460022	MOUNT VERNON, CITY OF	$ 537	0	0	1	$ 208,000	0	$ 0
	County Total :	$ 19,959	0	4	34	$ 6,739,000	23	$ 840,402
	[DAY COUNTY]							
460261	DAY COUNTY *	$ 2,694	0	2	3	$ 729,000	139	$ 2,877,788
461201	GRENVILLE, TOWN OF	$ 0	0	0	0	$ 0	7	$ 203,901
460226	WAUBAY, CITY OF	$ 835	0	1	1	$ 201,000	114	$ 1,067,486
460227	WEBSTER, CITY OF	$ 2,822	0	1	1	$ 320,000	1	$ 3,704
	County Total :	$ 6,351	0	4	5	$ 1,250,000	261	$ 4,152,879

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	[DEUEL COUNTY]							
460262	DEUEL COUNTY *	$ 0	0	0	0	$ 0	1	$ 3,758
	County Total :	$ 0	0	0	0	$ 0	1	$ 3,758
	[DEWEY COUNTY]							
461203	CHEYENNE RIVER INDIAN RESERVATION DEWEY	$ 629	0	1	1	$ 250,000	0	$ 0
	County Total :	$ 629	0	1	1	$ 250,000	0	$ 0
	[DOUGLAS COUNTY]							
460234	ARMOUR, CITY OF	$ 336	0	1	1	$ 142,000	1	$ 520
	County Total :	$ 336	0	1	1	$ 142,000	1	$ 520
	[EDMUNDS COUNTY]							
460264	EDMUNDS COUNTY *	$ 1,035	0	0	2	$ 700,000	5	$ 2,980
	County Total :	$ 1,035	0	0	2	$ 700,000	5	$ 2,980
	[FALL RIVER COUNTY]							
460238	FALL RIVER COUNTY*	$ 6,278	0	3	3	$ 396,000	0	$ 0
460027	HOT SPRINGS, CITY OF	$ 8,580	0	4	5	$ 802,000	1	$ 25
	County Total :	$ 14,858	0	7	8	$ 1,198,000	1	$ 25
	[FAULK COUNTY]							
460175	FAULKTON, CITY OF	$ 685	0	0	1	$ 350,000	3	$ 5,206
	County Total :	$ 685	0	0	1	$ 350,000	3	$ 5,206
	[GRANT COUNTY]							
460156	BIG STONE CITY, CITY OF	$ 1,637	0	1	1	$ 850,000	8	$ 65,650
460266	GRANT COUNTY*	$ 1,929	0	3	3	$ 587,000	9	$ 77,827
460200	MILBANK, CITY OF	$ 3,981	0	2	4	$ 503,000	9	$ 93,925
460031	REVILLO, TOWN OF	$ 385	0	1	1	$ 48,000	1	$ 4,701

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	County Total :	$ 7,932	0	7	9	$ 1,988,000	27	$ 242,103
	[GREGORY COUNTY]							
460267	GREGORY COUNTY *	$ 1,121	0	0	2	$ 541,000	3	$ 167,335
	County Total :	$ 1,121	0	0	2	$ 541,000	3	$ 167,335
	[HAAKON COUNTY]							
460268	HAAKON COUNTY *	$ 670	0	0	1	$ 350,000	1	$ 0
460033	PHILIP, CITY OF	$ 11,198	0	8	9	$ 699,000	1	$ 0
	County Total :	$ 11,868	0	8	10	$ 1,049,000	2	$ 0
	[HAMLIN COUNTY]							
460035	CASTLEWOOD, CITY OF	$ 4,352	0	3	5	$ 870,000	5	$ 39,257
460036	ESTELLINE, CITY OF	$ 622	0	0	1	$ 280,000	9	$ 33,198
460034	HAMLIN COUNTY*	$ 23,218	0	4	37	$ 9,817,000	417	$ 5,086,955
	County Total :	$ 28,192	0	7	43	$ 10,967,000	431	$ 5,159,410
	[HAND COUNTY]							
460269	HAND COUNTY *	$ 685	0	0	1	$ 350,000	6	$ 77,210
	County Total :	$ 685	0	0	1	$ 350,000	6	$ 77,210
	[HANSON COUNTY]							
460153	ALEXANDRIA, CITY OF	$ 0	0	0	0	$ 0	2	$ 10,047
460270	HANSON COUNTY *	$ 7,363	0	1	6	$ 1,368,000	8	$ 156,881
	County Total :	$ 7,363	0	1	6	$ 1,368,000	10	$ 166,928
	[HUGHES COUNTY]							
460039	BLUNT, CITY OF	$ 15,316	0	11	11	$ 1,233,000	24	$ 180,150
460271	HUGHES COUNTY *	$ 5,191	0	3	4	$ 614,000	2	$ 4,605
460040	PIERRE, CITY OF	$ 31,639	0	7	26	$ 8,620,000	61	$ 508,827

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	County Total :	$ 52,146	0	21	41	$ 10,467,000	87	$ 693,582
	[HUTCHINSON COUNTY]							
460041	HUTCHINSON COUNTY*	$ 4,235	0	1	4	$ 1,157,000	3	$ 203,139
460199	MENNO, CITY OF	$ 0	0	0	0	$ 0	3	$ 33,400
460042	PARKSTON, CITY OF	$ 3,894	0	2	5	$ 518,000	6	$ 41,143
	County Total :	$ 8,129	0	3	9	$ 1,675,000	12	$ 277,682
	[HYDE COUNTY]							
460272	HYDE COUNTY *	$ 0	0	0	0	$ 0	1	$ 0
	County Total :	$ 0	0	0	0	$ 0	1	$ 0
	[JERAULD COUNTY]							
460273	JERAULD COUNTY*	$ 667	0	0	1	$ 350,000	0	$ 0
	County Total :	$ 667	0	0	1	$ 350,000	0	$ 0
	[KINGSBURY COUNTY]							
460275	KINGSBURY COUNTY*	$ 0	0	0	0	$ 0	36	$ 346,950
460189	LAKE PRESTON, CITY OF	$ 0	0	0	0	$ 0	1	$ 35,340
	County Total :	$ 0	0	0	0	$ 0	37	$ 382,290
	[LAKE COUNTY]							
460276	LAKE COUNTY *	$ 36,057	0	4	66	$ 16,264,000	134	$ 4,622,009
460044	MADISON, CITY OF	$ 57,724	0	48	72	$ 12,746,000	169	$ 3,408,807
	County Total :	$ 93,781	0	52	138	$ 29,010,000	303	$ 8,030,816
	[LAWRENCE COUNTY]							
460045	DEADWOOD, CITY OF	$ 13,220	0	4	8	$ 2,526,000	6	$ 8,249
460094	LAWRENCE COUNTY *	$ 19,727	0	10	16	$ 4,139,000	15	$ 64,705
460190	LEAD, CITY OF	$ 2,337	0	1	2	$ 334,000	0	$ 0
460046	SPEARFISH, CITY OF	$ 24,328	0	22	42	$ 9,949,000	19	$ 206,265

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	County Total :	$ 59,612	0	37	68	$ 16,948,000	40	$ 279,219
	[LINCOLN COUNTY]							
460047	CANTON, CITY OF	$ 0	0	0	0	$ 0	1	$ 0
460114	HARRISBURG, CITY OF	$ 2,294	0	1	2	$ 573,000	2	$ 511,512
460277	LINCOLN COUNTY*	$ 33,775	0	10	38	$ 11,841,000	25	$ 867,461
460060	SIOUX FALLS, CITY OF	$ 281,832	0	36	205	$ 70,743,000	198	$ 5,295,377
460143	TEA, CITY OF	$ 3,822	0	0	3	$ 1,505,000	1	$ 1,832
	County Total :	$ 321,723	0	47	248	$ 84,662,000	227	$ 6,676,182
	[LYMAN COUNTY]							
460050	KENNEBEC, TOWN OF	$ 2,743	0	6	6	$ 303,000	14	$ 166,603
460278	LYMAN COUNTY *	$ 686	0	0	1	$ 350,000	2	$ 226,226
	County Total :	$ 3,429	0	6	7	$ 653,000	16	$ 392,829
	[MARSHALL COUNTY]							
460159	BRITTON, CITY OF	$ 0	0	0	0	$ 0	1	$ 6,599
460125	LANGFORD, TOWN OF	$ 0	0	0	0	$ 0	1	$ 46,566
460279	MARSHALL COUNTY *	$ 604	0	0	2	$ 490,000	10	$ 91,028
	County Total :	$ 604	0	0	2	$ 490,000	12	$ 144,193
	[MCCOOK COUNTY]							
460280	MCCOOK COUNTY *	$ 1,050	0	0	2	$ 420,000	2	$ 10,013
460052	MONTROSE, CITY OF	$ 5,330	0	3	5	$ 1,011,000	15	$ 395,186
460053	SALEM, CITY OF	$ 4,495	0	6	9	$ 1,245,000	3	$ 38,506
460140	SPENCER, TOWN OF	$ 544	0	0	1	$ 191,000	2	$ 3,605
	County Total :	$ 11,419	0	9	17	$ 2,867,000	22	$ 447,310
	[MEADE COUNTY]							
460054	MEADE COUNTY *	$ 5,971	0	2	5	$ 1,455,000	12	$ 35,287
461198	PIEDMONT, CITY OF	$ 1,010	0	1	2	$ 425,000	0	$ 0
460055	STURGIS, CITY OF	$ 48,158	0	37	43	$ 7,554,000	10	$ 17,494

Federal Emergency Management Agency
NFIP Insurance Report
SOUTH DAKOTA

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	County Total :	$ 55,139	0	40	50	$ 9,434,000	22	$ 52,781
	[MINNEHAHA COUNTY]							
460058	BALTIC, TOWN OF	$ 2,935	0	1	2	$ 250,000	1	$ 6,185
460296	BRANDON,CITY OF	$ 1,867	0	2	4	$ 1,043,000	2	$ 0
460166	COLTON, CITY OF	$ 518	0	0	1	$ 350,000	0	$ 0
460059	DELL RAPIDS, CITY OF	$ 18,426	0	10	13	$ 1,995,000	67	$ 736,983
460180	HARTFORD, CITY OF	$ 851	0	1	1	$ 182,000	0	$ 0
460057	MINNEHAHA COUNTY *	$ 37,512	0	24	56	$ 13,800,000	122	$ 1,576,035
	County Total :	$ 62,109	0	38	77	$ 17,620,000	192	$ 2,319,203
	[MOODY COUNTY]							
460062	FLANDREAU, CITY OF	$ 1,487	0	2	2	$ 525,000	9	$ 75,292
460235	MOODY COUNTY *	$ 9,694	0	9	9	$ 1,087,000	39	$ 573,048
460063	TRENT, TOWN OF	$ 2,073	0	2	3	$ 328,000	23	$ 192,082
	County Total :	$ 13,254	0	13	14	$ 1,940,000	71	$ 840,422
	[PENNINGTON COUNTY]							
460089	BOX ELDER, CITY OF	$ 27,711	0	42	55	$ 5,689,000	24	$ 138,990
460116	HILL CITY, CITY OF	$ 20,184	0	6	9	$ 2,405,000	2	$ 0
460231	KEYSTONE, TOWN OF	$ 30,464	0	13	18	$ 6,472,000	4	$ 2,348
460092	NEW UNDERWOOD, CITY OF	$ 670	0	2	2	$ 266,000	0	$ 0
460064	PENNINGTON COUNTY *	$ 69,571	0	39	70	$ 14,405,000	39	$ 130,645
465420	RAPID CITY, CITY OF	$ 93,607	0	38	93	$ 30,863,000	69	$ 218,211
	County Total :	$ 242,207	0	140	247	$ 60,100,000	138	$ 490,194
	[ROBERTS COUNTY]							
460071	CORONA, TOWN OF	$ 840	0	1	2	$ 163,000	1	$ 227
460286	ROBERTS COUNTY*	$ 15,735	0	10	22	$ 4,693,000	62	$ 737,881
460072	SISSETON, CITY OF	$ 3,806	0	2	2	$ 199,000	8	$ 15,646
	County Total :	$ 20,381	0	13	26	$ 5,055,000	71	$ 753,754

Federal Emergency Management Agency
NFIP Insurance Report
SOUTH DAKOTA

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	[SANBORN COUNTY]							
460097	ARTESIAN, TOWN OF	$ 0	0	0	0	$ 0	2	$ 3,897
460074	SANBORN COUNTY *	$ 0	0	0	0	$ 0	7	$ 40,590
460075	WOONSOCKET, CITY OF	$ 2,549	0	5	5	$ 1,441,000	5	$ 2,465
	County Total :	$ 2,549	0	5	5	$ 1,441,000	14	$ 46,952
	[SPINK COUNTY]							
460081	REDFIELD, CITY OF	$ 1,870	0	1	3	$ 515,000	10	$ 144,847
460076	SPINK COUNTY *	$ 10,192	0	6	10	$ 1,874,000	67	$ 871,660
	County Total :	$ 12,062	0	7	13	$ 2,389,000	77	$ 1,016,507
	[STANLEY COUNTY]							
465419	FORT PIERRE, CITY OF	$ 77,825	0	31	68	$ 19,800,000	97	$ 1,273,672
460287	STANLEY COUNTY *	$ 19,405	0	5	23	$ 7,428,000	21	$ 1,281,536
	County Total :	$ 97,230	0	36	91	$ 27,228,000	118	$ 2,555,208
	[SULLY COUNTY]							
460210	ONIDA, CITY OF	$ 0	0	0	0	$ 0	1	$ 1,513
460288	SULLY COUNTY *	$ 690	0	0	1	$ 350,000	4	$ 21,280
	County Total :	$ 690	0	0	1	$ 350,000	5	$ 22,793
	[TODD COUNTY]							
460202	MISSION, CITY OF	$ 240	0	1	1	$ 48,000	4	$ 1,937
	County Total :	$ 240	0	1	1	$ 48,000	4	$ 1,937
	[TURNER COUNTY]							
460086	DAVIS, TOWN OF	$ 3,106	0	4	4	$ 304,000	8	$ 125,275
460290	TURNER COUNTY *	$ 1,268	0	0	2	$ 700,000	10	$ 215,840
	County Total :	$ 4,374	0	4	6	$ 1,004,000	18	$ 341,115

Federal Emergency Management Agency
NFIP Insurance Report
SOUTH DAKOTA

CID	Community Name	Total Premium	V-Zone	A-Zone	No. Policies	Total Coverage	Total Claims Since 1978	Total Paid Since 1978
	[UNION COUNTY]							
460087	NORTH SIOUX CITY, CITY OF	$ 9,995	0	1	14	$ 5,535,000	20	$ 145,697
460242	UNION COUNTY*	$ 156,700	0	37	202	$ 68,165,000	411	$ 5,153,756
	County Total :	$ 166,695	0	38	216	$ 73,700,000	431	$ 5,299,453
	[YANKTON COUNTY]							
460091	MISSION HILL, TOWN OF	$ 910	0	1	2	$ 443,000	0	$ 0
460088	YANKTON COUNTY*	$ 24,527	0	6	31	$ 7,422,000	44	$ 1,006,099
460093	YANKTON, CITY OF	$ 17,730	0	5	16	$ 4,760,000	20	$ 626,896
	County Total :	$ 43,167	0	12	49	$ 12,625,000	64	$ 1,632,995
	[ZIEBACH COUNTY]							
460169	DUPREE, CITY OF	$ 376	0	0	1	$ 210,000	1	$ 0
460292	ZIEBACH COUNTY *	$ 0	0	0	0	$ 0	2	$ 3,427
	County Total :	$ 376	0	0	1	$ 210,000	3	$ 3,427
	State Total :		**0**	**797**	**1,992**	**$ 502,417,000**	**3,943**	**$ 56,550,449**

Federal Emergency Management Agency
NFIP Policy and Claims Report
SOUTH DAKOTA

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
AURORA COUNTY	2	$ 476,000	$ 1,056	2	$ 99,980
BEADLE COUNTY	8	$ 2,438,000	$ 4,457	23	$ 368,084
BON HOMME COUNTY	3	$ 928,000	$ 1,952	2	$ 24,184
BROOKINGS COUNTY	62	$ 9,854,000	$ 39,089	99	$ 966,934
BROWN COUNTY	120	$ 28,348,000	$ 87,118	488	$ 3,286,065
BRULE COUNTY	0	$ 0	$ 0	7	$ 252,857
BUTTE COUNTY	28	$ 4,555,000	$ 29,052	12	$ 11,833
CAMPBELL COUNTY	1	$ 140,000	$ 513	1	$ 165,942
CHARLES MIX COUNTY	7	$ 1,491,000	$ 5,971	11	$ 504,260
CLARK COUNTY	12	$ 1,459,000	$ 5,754	12	$ 189,919
CLAY COUNTY	10	$ 3,180,000	$ 6,575	12	$ 50,954
CODINGTON COUNTY	250	$ 54,201,000	$ 197,550	464	$ 6,464,318
CORSON COUNTY	1	$ 350,000	$ 670	0	$ 0
CUSTER COUNTY	37	$ 7,839,000	$ 27,832	51	$ 645,519
DAVISON COUNTY	34	$ 6,739,000	$ 19,959	23	$ 840,402
DAY COUNTY	5	$ 1,250,000	$ 6,351	261	$ 4,152,879
DEUEL COUNTY	0	$ 0	$ 0	1	$ 3,758
DEWEY COUNTY	1	$ 250,000	$ 629	0	$ 0
DOUGLAS COUNTY	1	$ 142,000	$ 336	1	$ 520
EDMUNDS COUNTY	2	$ 700,000	$ 1,035	5	$ 2,980
FALL RIVER COUNTY	8	$ 1,198,000	$ 14,858	1	$ 25
FAULK COUNTY	1	$ 350,000	$ 685	3	$ 5,206
GRANT COUNTY	9	$ 1,988,000	$ 7,932	27	$ 242,103
GREGORY COUNTY	2	$ 541,000	$ 1,121	3	$ 167,335
HAAKON COUNTY	10	$ 1,049,000	$ 11,868	2	$ 0
HAMLIN COUNTY	43	$ 10,967,000	$ 28,192	431	$ 5,159,410
HAND COUNTY	1	$ 350,000	$ 685	6	$ 77,210
HANSON COUNTY	6	$ 1,368,000	$ 7,363	10	$ 166,928
HUGHES COUNTY	41	$ 10,467,000	$ 52,146	87	$ 693,582
HUTCHINSON COUNTY	9	$ 1,675,000	$ 8,129	12	$ 277,682
HYDE COUNTY	0	$ 0	$ 0	1	$ 0
JERAULD COUNTY	1	$ 350,000	$ 667	0	$ 0
KINGSBURY COUNTY	0	$ 0	$ 0	37	$ 382,290
LAKE COUNTY	138	$ 29,010,000	$ 93,781	303	$ 8,030,816
LAWRENCE COUNTY	68	$ 16,948,000	$ 59,612	40	$ 279,219
LINCOLN COUNTY	248	$ 84,662,000	$ 321,723	227	$ 6,676,182
LYMAN COUNTY	7	$ 653,000	$ 3,429	16	$ 392,829
MARSHALL COUNTY	2	$ 490,000	$ 604	12	$ 144,193

Federal Emergency Management Agency
NFIP Policy and Claims Report
SOUTH DAKOTA

County	Number Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
MCCOOK COUNTY	17	$ 2,867,000	$ 11,419	22	$ 447,310
MEADE COUNTY	50	$ 9,434,000	$ 55,139	22	$ 52,781
MINNEHAHA COUNTY	77	$ 17,620,000	$ 62,109	192	$ 2,319,203
MOODY COUNTY	14	$ 1,940,000	$ 13,254	71	$ 840,422
PENNINGTON COUNTY	247	$ 60,100,000	$ 242,207	138	$ 490,194
ROBERTS COUNTY	26	$ 5,055,000	$ 20,381	71	$ 753,754
SANBORN COUNTY	5	$ 1,441,000	$ 2,549	14	$ 46,952
SPINK COUNTY	13	$ 2,389,000	$ 12,062	77	$ 1,016,507
STANLEY COUNTY	91	$ 27,228,000	$ 97,230	118	$ 2,555,208
SULLY COUNTY	1	$ 350,000	$ 690	5	$ 22,793
TODD COUNTY	1	$ 48,000	$ 240	4	$ 1,937
TURNER COUNTY	6	$ 1,004,000	$ 4,374	18	$ 341,115
UNION COUNTY	216	$ 73,700,000	$ 166,695	431	$ 5,299,453
YANKTON COUNTY	49	$ 12,625,000	$ 43,167	64	$ 1,632,995
ZIEBACH COUNTY	1	$ 210,000	$ 376	3	$ 3,427
State Total :	**1,992**	**$ 502,417,000**	**$ 1,780,586**	**3,943**	**$ 56,550,449**

Federal Emergency Management Agency
Community Rating System Overview Report
SOUTH DAKOTA

CID	Community Name	County	Class Rating	Effective Date	CRS Coordinator	ISO Rep	Total Points
460007	ABERDEEN, CITY OF	BROWN COUNTY	9 /5%	10/01/2017	Robin Bobzien	Constance Lake	626.0
460016	WATERTOWN, CITY OF	CODINGTON COUNTY	7 /15%	04/01/2023	Brandi Hanten	Constance Lake	1,501.0
460042	PARKSTON, CITY OF	HUTCHINSON COUNTY	9 /5%	05/01/2014	Jessica Semmler	Nathan Marshall	793.0
460044	MADISON, CITY OF	LAKE COUNTY	8 /10%	05/01/2014	RYAN HEGG	CONSTANCE LAKE	1,205.0
460046	SPEARFISH, CITY OF	LAWRENCE COUNTY	9 /5%	05/01/2014	Robert Reiling	Nathan Marshall	562.0
460060	SIOUX FALLS, CITY OF	LINCOLN COUNTY, MINNEHAHA COUNTY	7 /15%	10/01/2023	Albert Schmidt	Constance Lake	1,559.0
460054	MEADE COUNTY *	MEADE COUNTY	9 /5%	10/01/2015	Tonya Vig	Nathan Marshall	727.0
465420	RAPID CITY, CITY OF	PENNINGTON COUNTY	7 /15%	05/01/2013	MARY BOSWORTH	Nathan Marshall	1,532.0

Total Communities: 8

Federal Emergency Management Agency
CRS Insurance Savings Report
SOUTH DAKOTA

CID	Community Name	County	Class Rate		TOTAL	SFHA *	XSTD/AR/A99 **
460007	ABERDEEN, CITY OF	BROWN COUNTY	9 /5%	**Per Policy**	$ 39	$ 43	$ 36
				Per Community	$ 3,584	$ 1,624	$ 1,960
460016	WATERTOWN, CITY OF	CODINGTON COUNTY	7 /15%	**Per Policy**	$ 81	$ 167	$ 37
				Per Community	$ 18,937	$ 13,174	$ 5,763
460042	PARKSTON, CITY OF	HUTCHINSON COUNTY	9 /5%	**Per Policy**	$ 41	$ 43	$ 39
				Per Community	$ 205	$ 87	$ 118
460044	MADISON, CITY OF	LAKE COUNTY	8 /10%	**Per Policy**	$ 74	$ 90	$ 41
				Per Community	$ 5,316	$ 4,325	$ 990
460046	SPEARFISH, CITY OF	LAWRENCE COUNTY	9 /5%	**Per Policy**	$ 30	$ 28	$ 33
				Per Community	$ 1,280	$ 614	$ 666
460060	SIOUX FALLS, CITY OF	LINCOLN COUNTY,MINNEHAHA COUNTY	7 /15%	**Per Policy**	$ 111	$ 310	$ 68
				Per Community	$ 22,653	$ 11,143	$ 11,510
460054	MEADE COUNTY *	MEADE COUNTY	9 /5%	**Per Policy**	$ 63	$ 94	$ 42
				Per Community	$ 314	$ 187	$ 127
465420	RAPID CITY, CITY OF	PENNINGTON COUNTY	7 /15%	**Per Policy**	$ 104	$ 174	$ 54
				Per Community	$ 9,680	$ 6,772	$ 2,907

Average Savings Per Policy: $ 68

Total Community Savings: $ 61,969

*** SFHA (Zones A, AE, A1-A30, V, V1-V30, AO, and AH): Discount varies depending on class**

**** SFHA (Zones A99, AR, AR/A, AR/AE, AR/A1-A30, AR/AH, and AR/AO): 10% discount for Classes 1-6; 5% discount for Classes 7-9**

***** Preferred Risk Policies are not eligible for CRS Premium Discounts**

Appendix F

FEMA Enhanced Plan Validation Audit And Annual Consultation Visit Notes

South Dakota State Enhanced Plan Validation Audit

September 22, 2023, 10:00 – 11:30 a.m. MT

Virtual Meeting

NOTES

Attendees

State:

Jim Poppen, Mitigation Manager/State Hazard Mitigation Officer
Blaire Jonas, Mitigation Specialist
Kyle Kafka, Mitigation Specialist
Marc Macy, Project Engineer

FEMA:

Vanessa Castillo, Planning, Engineering, and Tribal Services Branch Chief
Melanie Steck, HMA Branch Chief (Non-Disaster)
Joan Huston, Acting HMA Branch Chief (Disaster)
Logan Sand, Senior Community Planner
Ariana Borrello, Community Planner
Melissa Ryder, Community Planner
Margaret Doherty, Senior Program Specialist
Christy Weiser, Mitigation Specialist
Laura Weinstein, CERC contract support

This meeting is a requirement of the enhanced plan and must be held annually. Today's format will go through the Enhanced State Mitigation Capability Validation Summary of Findings spreadsheet. The spreadsheet and minutes from this discussion will be submitted to the headquarters team as evidence the meeting took place.

This time is valuable to touch base on South Dakota's program, the enhanced planning requirements, how it is going, and how FEMA can provide additional support.

E1: Standard State Responsibilities

Has the state followed through with standard mitigation commitments in relation to the hazard mitigation planning program?

(E1a): Review local hazard mitigation plans before submitting to FEMA Region 8.

Jim: The state strives to engage communities that have approximately three years remaining on their mitigation plans. This allows them to initiate funding and start planning for the next plan update.

The state is revisiting plan reviews with the new guidance. Jim recently conducted his first review in 12 years due to a staff member's departure. FEMA held a helpful call with the state to review the required revisions and ensure the team was reviewing to the expectations of the new policy.

The state's goal is to achieve 100% coverage.

Logan: The state has achieved an impressive 98% coverage. We look forward to meeting on October 14 to synch up and ensure consistent interpretation and application of requirements.

Regarding plan review comments, we encourage more substantial State input. We understand that you work extensively with communities during the plan writing process. If there is room to expand your comments within the plan review tool in the future, please take the opportunity to do so.

(E1b): Provide hazard mitigation planning training and technical assistance.

Jim: When we engage with the different planning districts, the initial query is typically "What has changed since the last plan update? How has the policy evolved?" It is worth noting that there have been several newcomers joining the planning districts. This influx of new personnel could lead to better attendance at the upcoming G318 Local Mitigation Planning Workshop. While we are certainly not averse to training, we must ensure that when state and FEMA staff members conduct training sessions, we have a sufficient number of local planners and emergency managers in attendance. Either the Advanced Professional series or the 393 course are mandatory training sessions that emergency managers must complete.

Vanessa: Would the training location affect attendance?

Jim: Pierre, South Dakota, is approximately a three-hour drive from all districts. Shifting the location would not significantly reduce commute times.

We did consider online training, but there are concerns about participants multi-tasking and not paying full attention. In-person sessions provide value.

Logan: G318 tends to be more successful in person as it encourages more dialogue.

Have you had discussions with jurisdictions to convey the significance of the changes?

Blaire: Most districts do not perceive the changes as significant.

E2: Integrated Planning
Has there been integration at the state with the following sectors and federal programs? What have the outcomes been?

(E2a): State sectors that need to be addressed: emergency management, economic development, land use and development, housing, health and social services, infrastructure, natural and cultural resources.

Jim: For many of these sectors, mitigation is not their primary role. We must convey the importance of implementing resilience activities and frame it so that everyone understands its relevance to their work.

Changes have been made to the Federal Highway Design Standards that the Department of Transportation uses. These changes involve implementing larger and more effective mitigation around culverts and bridges, as well as enhancing highway design. It is still a work in progress.

When we reviewed the actions from the 2019 plan and discussed them with agencies, some were hesitant to admit that they had not made progress. We have tried to foster an environment where it is acceptable to be realistic and acknowledge when there has not been progress. However, if an action remains important, we want to find ways to continue pursuing it.

Logan: How has your experience been working with WSP?

Jim: We hold biweekly touchpoint meetings, which are essential to keep everyone moving forward. During these meetings, if there is an action item, we understand that we must complete it within the next two weeks so that we can proceed to the next item. We did not have this level of rigor during the Hazard Identification and Risk Assessment process a few years ago, and we have learned from that experience.

Logan: Have they been successful in facilitating engagement from other state partners through the process?

Jim: We are currently in a good place regarding engagement. We have emphasized the importance of participation, and things are progressing in the right direction.

(E2b): Federal programs that need to be addressed: HMA Programs, NFIP, CRS, Risk MAP, Dam Safety Program, and others as applicable.

Jim: We are cognizant of maximizing every available dollar. We tend to oversubscribe on the Hazard Mitigation Grant Program (HMGP), often doubling the applications in case some projects encounter issues. It is more challenging with High Hazard Potential Dams (HHPD) because it falls under a different department. We have had discussions with the state department to ensure funding eligibility. However, its response has been that it lacks staff to implement the new program. It is currently working on one application for this grant cycle, but it is beyond the Department of Public Safety's purview. Funds will not flow through our office. We will want to monitor this program.

We do not participate in the Community Assistance Program, State Support Services Element, although we still support its activities.

Logan: Rich and Jamie serve as the FEMA Region 8 HHPD contacts. Please feel free to engage with them if any questions arise.

Jim: I would like to give a shoutout to the region's Technical Assistance team. I do not believe our project would have been selected without their valuable guidance.

Logan: We are still awaiting updates on the Building Resilient Infrastructure and Communities (BRIC) and Flood Mitigation Assistance (FMA) notices of funding opportunity due the impending government shutdown. We will make adjustments to the application period.

E3. State Mitigation Capabilities

Has the state demonstrated commitment to a comprehensive mitigation program?

(E3a): Initiatives that demonstrate commitment are: funding, leadership initiatives, codes and ordinances, trainings/technical assistance, and partnerships.

Jim: Our open house meetings kick off next week, and they will be held biweekly. Having a 10% state match is a huge win for us. It demonstrates the benefits of enabling financially challenged communities to access cost sharing. Also, through the implementation of Economically Disadvantaged Rural Community guidelines for Community Disaster Resilience Zones (CDRZ), it is essentially a free project. We hope that it will encourage more applications and gain traction.

Logan: Please let us know how we can support your training and capacity building efforts. Is there anything specific you would like Region 8 to assist you with?

Jim: When travel becomes feasible, having Christy come up to see the projects and landscape of South Dakota would be a great benefit. It helps to see firsthand what the landscape is like and the activities that are ongoing.

Joan: Yes, we need to get out in our states, meet with our partners, and observe projects. It goes a long way to understand what is happening on the ground and build partnerships. At the very least, it should be done once a year.

Katie's team (the Technical Assistance team) also handles project scoping. If we can align scoping and ideation with communities, we can demonstrate what an eligible project could look like under BRIC or Hazard Mitigation Assistance (HMA). This is another good option to explore.

E4. Process for Using Funds and Assessing Actions
Are the processes described in the SHMP still accurate in relation to its capabilities to implement mitigation?

(E4a): Process to rank and prioritize mitigation actions.

Jim: With the recent disasters, we have had the HM Branch and the joint field office (JFO) identify projects and which ones are getting a hazard mitigation plan (HMP) done. We can leverage this list to discuss potential opportunities for effective utilization of 404 funding.

Joan: Are you conducting a loss avoidance study?

Jim: We have a tool from our last plan update that we have not used much. It allows us to delineate areas where damage occurred and assess if mitigation was done in the area. However, we currently lack sufficient data to support estimations. Improving our losses avoided data is a priority.

Joan: I would like to use a similar methodology to enhance our storytelling. When we award or close out projects, it would be beneficial to specify the losses avoided.

Jim: One of the rural electric cooperatives, FDM Electric, wrote a letter indicating the loss of 20 poles following a disaster. Their estimate was that it would have been a loss of over 200 poles if we had not buried them. It is a great example of losses avoided.

Logan: To echo Joan's point, we must share the story and highlight the financial savings transparently.

Jim: In our office, Jason frequently emphasizes this. For example, we buried many problematic overhead lines, resulting in smaller disasters. Whether it is through 404 or 406 programs or the JFO, you all need to highlight your work and the return on investment these programs provide.

(E4b): Process to assess the effectiveness of mitigation actions and use results to inform the mitigation strategy moving forward.

No additional comments.

E5. Using All Available Funds
Is the state effectively using existing mitigation programs to achieve mitigation goals?

(E5.a): *The enhanced plan must document how the state has fully made use of the funding available through the FEMA assistance programs (for example, PA C-G, HMGP, PDM, and FMA).*

Melanie: Jim said it best when he mentioned that we consistently oversubscribe. We have good statistics regarding the utilization of 406 funds.

(E5.b): *The enhanced plan must document how the state effectively uses existing state programs to achieve its mitigation goals.*

Jim: Rural electric cooperatives often utilize Rural Utility Services (RUS) funds for projects outside of ours. They also invest a significant amount of their own funds. During our last plan update, we conducted a survey to understand their efforts beyond FEMA funding. They indicated initiatives like installing improved utility poles for increased system resilience.

Vanessa: The EPA has a new grant opportunity focused on clean drinking water. It targets underserved, low-capacity, and tribal communities. It is a valuable opportunity, and we should spread the word.

Jim: The timing is particularly relevant because Aurora-Brule Rural Water System is dealing with a significant slide issue, and the grant could assist the team.

Logan: Let us know how we can best assist you in targeting these programs. New programs are constantly emerging. Would it help if we kept you updated?

Jim: You do not know what you do not know. I believe it would help to receive information about available programs, and we can assess if they align with our needs.

Logan: The Technical Assistance team is well-equipped to explore these programs and identify where they may be a good fit.

E6. Application Submittals
With regard to HMA, is the state maintaining the capability to meet application timeframes and submitting complete project applications?

(E6.a) Are all applicants and amendments submitted by the end of each program's respective application period?

All criteria are met. No further comments.

(E6.b) Are all applicants entered into FEMA's electronic data systems (such as, NEMIS and/or eGrants)?

All criteria are met. No further comments.

(E6.c) Is the Eligibility and Completeness Checklist prepared for all applications?

All criteria are met. No further comments.

(E6.d) Are all applications determined to be complete by FEMA within 90 days of submittal or selection for further review?

Joan: I would like to offer my commendation to Christy for managing the workload and getting us caught up. I also want to extend kudos to Jim. We recognize that staff has been stretched thin.

Jim: I could not be happier with the progress we are making and what is on the horizon. Thank you for providing us with additional staff support.

Christy: Your team does a great job in its responsiveness and timeliness. We are effectively and efficiently working through the backlog.

E7. BCA and EHP Capability
With regard to HMA, is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses?

(E7.a) Are all applications and amendments determined to be complete by FEMA within 90 days of submittal or selection for further review, including all data requested by FEMA to support Cost Effectiveness determinations and environmental/ historic preservation compliance reviews?

All criteria are met. No further comments.

E8. HMA Quarterly Reports
With regard to HMA, is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time?

All criteria are met.

Jim: We implement a cradle-to-grave approach. We cross-share information about closeouts, payments, quarter reporting, etc. Kyle is doing a great job leading this process.

Kyle: The changes in reporting processes, particularly FEMA Grants Outcomes (FEMA GO), pose challenges.

Joan: We are aware that the reporting function in FEMA GO has had issues. Once it is fixed, it should improve the accuracy of the data. We appreciate your patience.

E9. HMA Project Closeouts

With regard to HMA grant programs, is the state maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation?

Jim: Ideally, we should not need extensions, but the pandemic threw a wrench into things. The ability to discuss this with the region is greatly appreciated. Without these extensions, many communities would have had to withdraw their projects and we would not have been able to utilize funds.

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We are anticipating a few grants next year to be closed.

I would like to give a shoutout to Cindy for encouraging us to apply for the Pre Disaster Mitigation (PDM) 18 overrun. The mentioned community is excited about it. They have removed about 68 structures through the acquisition program.

Joan: Extensions often depend on factors beyond your control, such as the government shutdown situation. We recognize your hands are tied with regard to that.

Closing Remarks/Questions

Jim: I would like to highlight the Story Map created by Blaire Jonas, which is already showing benefits for registration on Community GO.

We are anticipating the release of the State Management Cost Job Aid. This is crucial because it is how we fund our staff. We must ensure those funds are awarded.

Joan: We are very close to creating the Management Cost Job Aid. We will do a webinar once it is done.

Jim: Regarding the 212 series, we do not anticipate being able to do anything until the beginning of the year. We will not make any announcements until we have firm dates in place.

We are excited to discuss HMPs on October 14 and get better guidance, recommendations and interpretations so that we are all on the same page.

Logan: Please bring your tough questions.

Jim: If there is a prolonged government closure, can we do conditional work so construction can start?

Joan: We have raised that question with legal. There must be a financial element to an award, so unfortunately, legal says no.

Logan: Are you anticipating the state plan to head our way at the beginning of the year?

Jim: We will start to review sections of the plan shortly. We expect to submit it around the Christmas/New Year time frame.

Logan: Feel free to have the Region 8 Mitigation Planning Team do a courtesy review of plan sections prior to a formal submission.

Jim: Are there any plan requirements that we are not fully meeting or need to make sure that we meet with our updated plan?

Logan: None that are jumping out from the planning side of the house.

Review of R8 State Enhanced Guidance Crosswalk

Jim: Do tribal plans count against us on E7c?

Logan: No, sovereign nations are not part of the state data point.

Blaire: Can you provide us with a copy of the "Minimum Criteria Checklist" if one exists?

- It can be found on page 595 of the guidance in the appendices.

Vanessa: I recommend attending the HMA office hours.

Jim: With regard to E9b, the number of applications that we see now is smaller than before. Many communities are so small that they do not have the ability to take on more grants or match funds. We push everything to our various partners, and they push it down to the towns, cities, counties, etc. I do not have staff to meet with everyone one-on-one. We will see how WSP helps us address this requirement. We would also appreciate FEMAs guidance to help us reach communities.

Logan: I recommend grouping communities together from a regional resilience lens. There only needs to be one fiscal recipient. The Fix the Bricks program in Utah uses this approach. A regional approach could be an option to consider.

Vanessa: A state agency can also be a subapplicant. It can apply on behalf of a number of lower-capacity communities.

Jim: We need to have a discussion with Custer County regarding the CDRZ Designation and its implications. We will reach out to Michael Sawyer (also include Vanessa Castillo please) to schedule a meeting and ensure they have a clear understanding of what this designation entails for them.

Vanessa: I recommend reaching out to the Technical Assistance team as well. We are also trying to figure out what the CDRZ designation means. As such, I would like to participate in this conversation. Once you coordinate with the team, let us know, and we will participate in the discussion.

Jim: I want to implement a benefit-cost analysis training. There are a lot of new planners and engineers that would benefit from this training.

Enhanced Validation for South Dakota's Hazard Mitigation Program

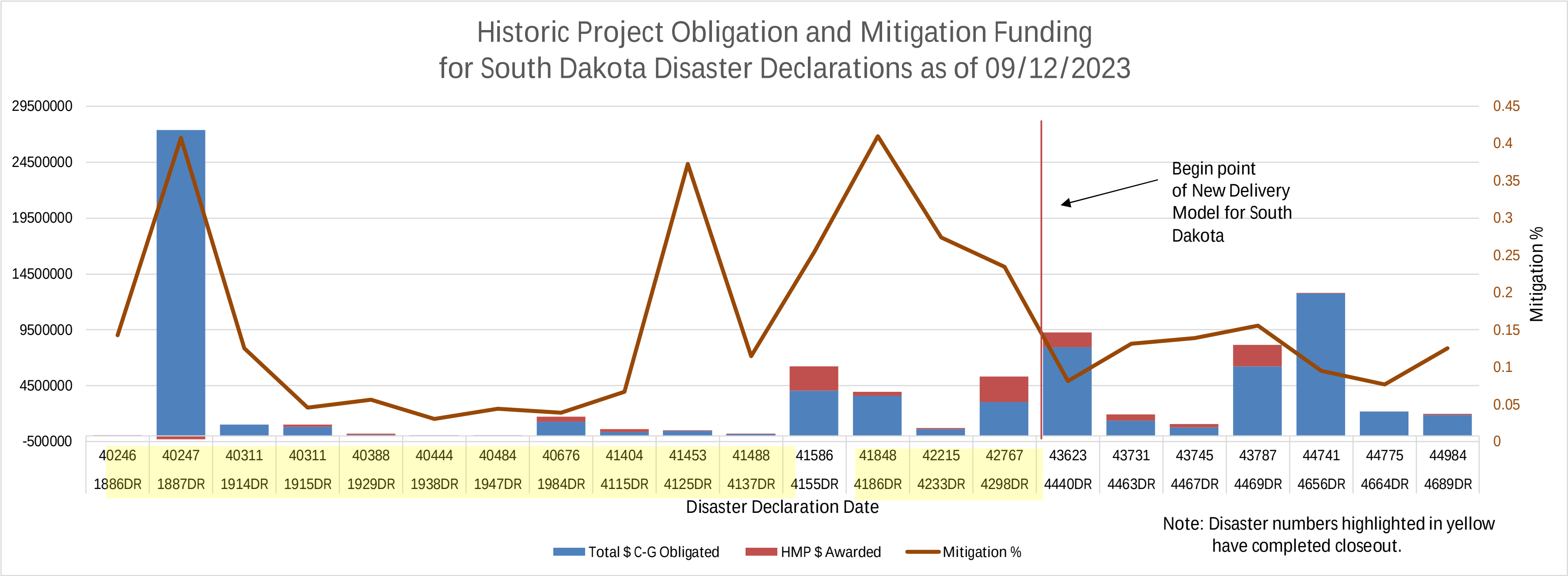
Meeting Date: September 22, 2023

Performance Period Assessed: Fiscal Year 2023

Element	Requirement		Subrequirement	Additional Region 8 Guidance	State's Self Validation Feedback (Requirement Met Y/N)	FEMA Validation Feedback (Requirement Met Y/N)
Enhanced Requirement E1: Standard State Responsibilities	Has the state followed through with standard mitigation commitments in relation to the hazard mitigation planning program?	a.	Review local hazard mitigation plans before submitting to FEMA Region VIII.	The state will review a majority, if not all, local hazard mitigation plans within 45 days of receipt (both initial submissions and subsequent revised plan submissions). Most plans should come to FEMA with very minor or no required revisions. SD OEM and FEMA will continue regular communication (reports, calls) about the plans currently being reviewed, deadlines, transmittal of plans between agencies, and addressing any inconsistent interpretation of local planning requirements.	Yes. All plans are submitted onward to FEMA review within 45 days of receipt.	Y. South Dakota has 98.1% of its population covered by Approved and APA plans - great job working to keep local plans active and approved. We appreciate the State's willingness to ensure alignment in how we interpret the new mitigation planning requirements, and look forward to our conversation in October. Additionally we will be expecting to see more consistent coments from the State on strengths and opportunities for local plans when submitted to FEMA for review.
		b.	Provide hazard mitigation planning training and technical assistance.	The state is responsible for providing training to local governments to support the development and implementation of their hazard mitigation plans. There is no specific number of trainings per year needed and their format (i.e. providing technical assistance at planning kick-off meetings) can be flexible.	Yes. SD OEM has and continues to look for opportunities to promote planning training in the most productive way. For example, SD OEM hosted a webinar to debut the new planning guidance standards to local jurisdictions. SD OEM has also created online examples for new guidance standards.	Y. We we like to continue to find ways to partner on trainings and technical assistance. The Planning Team is ready to support the delivery of a G-318 course, particularly now that the new local planning policy guidance is in effect.
Enhanced Requirement E2: Integrated Planning	Has there been integration at the state with the following sectors and federal programs? What have the outcomes been?	a.	State sectors that need to be addressed: emergency management, economic development, land use and development, housing, health and social services, infrastructure, natural and cultural resources.	The state will work with agencies and groups that represent the identified sectors for the implementation of their hazard mitigation program. The intent of this requirement is to demonstrate *actual* integration of mitigation into ongoing state activities to achieve risk reduction. There should be tangible examples to point to for each partnership. If integration with any of these sectors isn't practicable, an explanation will suffice.	Yes. Only routine business has occurred with listed agencies and groups since the last review. The SD OEM has held planning meetings to update the SHMP with the agencies listed to participate and contribute. SD OEM also has regulations in statue that HMGP selections must be presented to our State Hazard Mitigation Team that is composed of agency officials.	Y. We are looking forward to seeing continued integrated planning across State agencies and other parnters as part of the forthcoming E-SHMP update.
		b.	Federal programs that need to be addressed: HMA Programs, NFIP, CRS, Risk MAP, Dam Safety Program, and others as applicable.	The state will utilize, or be involved with, these federal programs and resources to advance the state's risk reduction. If integration or utilization of these programs or resources isn't practicable, an explanation will suffice.	SD OEM continues to utilize HMGP, FMAG, and BRIC funds successfully. SD OEM continues to scope for FMA-eligible projects and notified all local floodplain managers to highlight the grant opportunity. SD OEM continues to encourage communities to join the CRS program. NFIP continues to participate in Community Coordination Outreach (CCO) meetings. As more communities receive updated maps, the NFIP Team expects more engagement and is planning to schedule training events across the state. The Dam Safety Program resides within the SD DANR.	Y. The BRIC RTA team in the PETS Branch is available to support the State and local communities develop robust and competitive projects for FEMA's BRIC grant program.
Enhanced Requirement E3: State Mitigation Capabilities	Has the state demonstrated commitment to a comprehensive mitigation program?	a.	Initiatives that demonstrate commitment are: funding, leadership initiatives, codes and ordinances, trainings/technical assistance, and partnerships.	A comprehensive state mitigation program is one that has a broad range of activities (see box to the left) that targets risk reduction for hazards in South Dakota, includes various state agencies and sectors, and is coordinated to increase statewide resilience. The combination of activities should show a commitment to mitigation.	During the year since the last review, SD OEM has provided open-house style, virtual application technical assistance development sessions, has implemented co-review working sessions to complete FEMA's ART, and is working to bring the 212/213/214 training series to SD. SD OEM continues to support local subapplicants with funding 10% cost-share of the total project cost for regular, 5% Initiative, and Project Scoping projects	Y. We would like to find ways to support capacity building and partnerships.
Enhanced Requirement E4: Processes for Using Funds and Assessing Actions	Are the processes described in the SHMP still accurate in relation to its capabilities to implement mitigation?	a.	Process to rank and prioritize mitigation actions.	This process, documented in the SHMP, helps determine how to select projects to fund.	The SHMT convenes to review projects per HMGP and HMGP-FMAG grants; prioritization remains the same as prior years for projects that create the greatest benefit for the largest amount of people.	Y.
		b.	Process to assess the effectiveness of mitigation actions and use results to inform the mitigation strategy moving forward.	This process, documented in the SHMP, will assess the effectiveness of completed actions in the state. Effectiveness is typically based on cost factors (i.e. losses avoided) but may also include other beneficial functions. Ideas that have been discussed between SD OEM and FEMA are loss avoidance studies, documenting success stories, and utilizing partnerships like the SHMT and Silver Jackets.	SD OEM captures and tracks all mitigation applications and records them on a publicly available database. This is a resource that can be used by local or county jurisdictions as a resource. There is potential to explore loss avoidance results in the upcoming SHMP update.	Y.
Enhanced Requirement E5: Using All Available Funds	Has the state documented effective usage of available mitigation funds?	a.	Demonstration of full use of FEMA funds through programs such as HMGP, HMGP-PF, BRIC, FMA, and PA Mitigation (406).	For any applicable funding programs, the state needs to show that to the extent practicable, they used all funds available to them. Submitting over the limit for HMGP (i.e. having wait list projects) and submitting the full application limit for non-disaster grants shows full commitment to full usage. For programs like 406 under PA, setting a target and allocating resources to strive towards those goals shows a commitment.	SD is currently experiencing significant increases to construction costs, making some subapplicants rebid projects numerous times to achieve a competitive bid. Since the last review period, SD OEM has over-submitted the limit for all HMGP grants. SDOEM also stresses the importance of utilizing the Public Assistance 406 mitigation opportunities early in the PA process. Since 2010, SD applicants have received over $8.3 million in 406 mitigation funds. Cat C - Roads and bridges - $1,418,533.90, Cat D - Water control facilities - $1,344,927.11, Cat E - Public buildings and contents - $34,648.07, Cat F - Public utilities - $5,343,266.19, Cat G - Parks, recreation, and other facilities - $216,616.04 for a total of $8,357,991.31	Y. Since June of 2022, South Dakota has declared three new Region 8 disasters (4656DR, 4664DR, and 4689DR). These three disaster declarations have resulted in 103 Public Assistance (PA) obligated permanent work projects, of which, 10 projects utilized 406/PA Mitigation funding. This shows that an average of 10% of the PA projects since June of 2022 had mitigation funding. Also, these three disasters obligated $16.8M in PA funding and obligated an additional $131K in 406/PA Mitigation funding. Therefore, South Dakota has utilized the 406 program to fund post disaster PA mitigation projects. The state also provides back up projects in case a project is withdrawn.
		b.	Demonstration of effective use of other funds, either federal or state, that were utilized to support hazard mitigation.	While full use of routine mitigation programs is important, the state should also seek other venues for implementation. This is an opportunity for the state to show other federal, state, or even non-governmental funds to support hazard mitigation.	SD OEM promotes subapplicants utilizing funding beyond the mitigation program. For example, SD DOT utilizes the updated FHWA design standards when designing roads by increasing design standards, essential for enhancing infrastructure durability and preparedness for various environmental challenges. SD GFP utilizes rip rap to fortify shorelines in areas with higher erosion risk.	Y. The state submitted a project that will also utilize SDDOT funds in conjuncction with a mitigation project.

Element	Requirement		Subrequirement	Additional Region 8 Guidance	State's Self Validation Feedback (Requirement Met Y/N)	FEMA Validation Feedback (Requirement Met Y/N)
Enhanced Requirement E6: HMA Application Submittals	With regard to HMA grant programs, is the state maintaining the capability to meet application timeframes and submitting complete project applications?	a.	Are all applicants and amendments submitted by the end of each program's respective application period?	HMGP extensions are allowed; however, extension requests must be complete, on time, and with adequate justification. The cumulative extension for any given disaster may not exceed 180 days. NOTE: Extensions should be the exception, not the rule.	Yes. Extensions are still infrequent and done on a case-by-case request basis.	Y. All extension requests have been complete and prior to the PoP end date.
		b.	Are all applicants entered into FEMA's electronic data systems (such as, NEMIS and/or eGrants?	none.	Yes; SD OEM completes all data entry to NEMIS, eGrants, and FEMA GO.	Y.
		c.	Is the Eligibility and Completeness Checklist prepared for all applications?	Applicable to HMA only.	Yes; Every application as submitted for funding has a completed E&C.	Y.
		d.	Are all applications determined to be complete by FEMA within 90 days of submittal or selection for further review?	90 days = All applications are determined to be complete by FEMA after the 1st RFI response.	No. While there has been a major increase in action items being processed at FEMA, there is still a big time difference between expectations and reality. The recent assignment of the HMO has shown a reduction in time delays and has shown major improvements across all aspects of the grant cycle.	Y.
Enhanced Requirement E7: BCA and EHP Capability	With regard to HMA grant programs, is the state maintaining the capability to prepare and submit accurate environmental reviews and benefit-cost analyses?	a.	Are all applications and amendments determined to be complete by FEMA within 90 days of submittal or selection for further review, including all data requested by FEMA to support Cost Effectiveness determinations and environmental/ historic preservation compliance reviews?	90 days = All applications are determined to be complete by FEMA after the 1st RFI response. Environmental reviews shall include the following: - Alternatives analysis that takes EHP considerations into account. - Complete responses to the EHP review section of applications, including supporting documentation. - Complete correspondence with appropriate resource/regulatory agencies to identify concerns.	SD OEM staff have participated in smaller reviews with FEMA staff for more direct, hands-on review of different project BCAs. SD OEM believes they are making noticeable improvements in an area identified as a previous weakness. SD OEM has good programmatic experience with EHP compliance.	Y. The state sends all required responses to RFI's in a very timely manner.
Enhanced Requirement E8: HMA Quarterly Reports	With regard to HMA grant programs, is the state maintaining the capability to submit complete and accurate quarterly progress and financial reports on time?	a.	Have all progress reports been completed and submitted on time?	none	Yes; all QPRs are completed and returned in full and on time.	Y.
		a.1	Does the information in the reports accurately describe grant activities, including data related to the completion of individual property acquisitions?	none	Yes; all QPRs are sufficiently thorough.	Y.
		b.	Have all Federal financial reports (FFR), Standard Form (SF) SF-425 been submitted on time?	none	Yes; all required forms are signed and submitted on time.	Y.
		b.1	Does the information in the reports accurately describe grant activities, as described in the HMA Guidance?	none	Yes.	Y.
		c.	Is there compliance with the Financial Management Standard requirements described in 2 CFR §§200.300 to 200.309?	Awards prior to December 26, 2014 are subject to requirements described in 44 CFR Part 13.	Yes.	Y.

Element	Requirement		Subrequirement	Additional Region 8 Guidance	State's Self Validation Feedback (Requirement Met Y/N)	FEMA Validation Feedback (Requirement Met Y/N)
Enhanced Requirement E9: HMA Project Closeouts	With regard to HMA grant programs, is the state maintaining the capability to complete HMA projects within established performance periods, including financial reconciliation?	a.	Has all work as part of HMA subawards been completed by the end of Period of Performance as described in the HMA Guidance?	POP extensions are allowed; however, extension requests must be complete, on time, and with adequate justification. NOTE: Extensions should be the exception, not the rule. Subawards - Subaward closeout packages are submitted to FEMA no later than 180 days from project completion. All subaward closeout packages are determined to be complete by FEMA after the 1st RFI response.	SD OEM for the majority meets the 180 day requirement for submitting closeout packets, and this is another area SD OEM hopes to improve. SD OEM is still learning the best system to process SRMC payments, which occur prior to grant close-out and has slowed the close out process.	Y. If an extension is required it has been submitted in a timely manner.
		b.	Have there been no major findings on the last single audit obtained by the state related to HMA programs?	none	There have been none.	Y
		c.	Have all grant close-out activities been completed within 90 days from the end of the performance period?	Awards - Award closeout package will be submitted to FEMA no later than 90 days from end of the period of performance. All closeout packages are determined to be complete by FEMA after the 1st RFI response. Award closeout extensions are allowed; however, extension requests must be submitted at least 60 days prior to the deadline with adequate justification. NOTE: Extensions should be the exception, not the rule.	SD OEM has not closed any grants since the last year. SD OEM does expect to close BRIC 20, DR-4467, and PDM 19 in this coming year.	Y
		d.	Are all expenditures consistent with SF-424A or SF-424C?	none	Yes.	Y



Historic Project Obligation and Mitigation Funding
for South Dakota Disaster Declarations as of 09/12/2023
29500000
24500000
19500000
14500000
9500000
4500000
-500000
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Mitigation %
Begin point of New Delivery Model for South Dakota
40246 1886DR
40247 1887DR
40311 1914DR
40311 1915DR
40388 1929DR
40444 1938DR
40484 1947DR
40676 1984DR
41404 4115DR
41453 4125DR
41488 4137DR
41586 4155DR
41848 4186DR
42215 4233DR
42767 4298DR
43623 4440DR
43731 4463DR
43745 4467DR
43787 4469DR
44741 4656DR
44775 4664DR
44984 4689DR
Disaster Declaration Date
Note: Disaster numbers highlighted in yellow have completed closeout.
Total $ C-G Obligated
HMP $ Awarded
Mitigation %

South Dakota Silver Jackets & State Mitigation Program Consultation

SUMMARY REPORT

Attendance

State:

Heather Allemang, State Hazard Mitigation Officer, SD OEM
Jason Bauder, Deputy Director, SD OEM
Travis Dovre, Director of Administration, Governor's Office of Economic Development
Laura Edwards, State Climatologist, South Dakota State University Extension
Leon Ellis, State Risk Manager, Bureau of Administration
Mark Freund, State GIS Coordinator
Christopher Johnson
Blaire Jonas, Mitigation and Flood Insurance, SD OEM
Jason Jungwirth, Aquatic Habitat and Access Coordinator, SD Department Game, Fish and Parks
Kyle Kafka, Mitigation Specialist, SD OEM
Whitney Kilts, Engineer, SD DANR, Water Rights and Dam Safety
Marc Macy, Project Engineer, SD OEM
Kevin Marton, Bridge Hydraulic Engineer, SD Department of Transportation
Jesseca Mundahl, Assistant Administrator, SD Department of Health, Office of Public Health Preparedness and Response
Jim Poppen, Mitigation and Recovery Team Lead, SD OEM
Mark Rath, Natural Resources Engineer, SD Dept of Ag and Natural Resources
Nicole Schneider, Senior Policy Analyst, SD Dept of Tribal Relations
Autumn Stout, Administrative and Logistics Team Lead, SD OEM

FEMA:

Nicole Aimone, Mitigation Division Deputy Director
Dawn Brabenec, Risk Analysis Branch Chief
Parker Crowe, Community Planner
Margaret Doherty, Risk MAP Program Specialist
Nicole Edwards, Tribal HMA Grants Specialist
Patricia Gavelda, HMA Grants Management Specialist
Steve Hardegen, Environmental Officer

Mike Hillenburg, Hazard Mitigation Assistance Branch Chief
Alice Kersting, Equity Program Analyst
Rob Pressly, Community Planner
Logan Sand, Acting Senior Community Planner
Laura Weinstein, CERC contract support

Federal Partners:

Nolan Choquette, USACE Omaha District, Floodplain
Mike Gillispie, Sr. Service Hydrologist, NWS Sioux Falls
Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District
Tony Krause, Hydraulic Engineer, USACE
Melissa Smith, Service Hydrologist, NWS Rapid City

Other Non-State or Federal:

Amy Carr, Mitigation Planner, Wood Consulting
Jeff Brislawn, Mitigation Lead and HIRA Project Manager, Wood Consulting
Christopher Johnson, Mitigation Planner, Wood Consulting

Meeting Objectives and Outcomes

The goal of a state consultation is to strengthen partnerships and discuss resources so that we can all work toward our mitigation goals together. This meeting is one among many of the conversations we have day to day, but this one focuses specifically on aligning a larger number of mitigation partners, projects and goals. The consultation gives us all an opportunity to 1) discuss how each perspective contributes to risk reduction, 2) identify and foster opportunities for collaboration and partnerships, and 3) discuss the state's mitigation program, as well as specific needs and opportunities for support.

Discussion Questions

- What mitigation and adaptation activities are going on in your programs across the state and federal agencies?
- How can partnerships be leveraged to achieve programmatic goals and who are the key partners?

Overview and Welcome

Nicole Aimone, Mitigation Division Deputy Director, FEMA R8; Logan Sand, Senior Community Planner (A), FEMA Mitigation Division, FEMA R8

Every year, FEMA holds a more formal meeting with each state in Region 8. Over the years they have evolved to be more partnership oriented. There is overlap in our missions and it is wonderful to have the opportunity to connect more formally, build partnerships and talk about shared objectives. We use this time to see where synergies overlap with mitigation projects, initiatives and with the Silver Jackets.

FEMA frequently shares the South Dakota Plan and Enhanced Plan with other states in Region 8 and across the nation because it is a great best practice example.

State Consultation

State HIRA Updates

Heather Allemang, State Hazard Mitigation Officer; Jeff Brislawn, Wood Consulting; Amy Carr, Wood Consulting

- Update started in spring 2021
- Primary Team
    - Kyle Kafka, SD OEM
    - Wood Environment and Infrastructure Solutions

Hazard Identification and Prioritization Update

- Hazards identified at the state level largely align with the highest risk hazards identified in local plans.
- 2021/2022 plan hazards include agricultural pests and disease, drought, floods (flash, long-rain, snowmelt, and dam and levee failure), geological hazards (landslides, mudflows, expansive soils, subsidence and earthquakes), hazardous materials, tornadoes, summer storms, wildfire and winter storm.

Hazard Profiles Update

- Climate change considerations
    - Logan Sand noted that FEMA has new resources for Climate Resilience to support assessing climate change risks, mitigation planning/funding and community capacity building: https://www.fema.gov/sites/default/files/documents/fema_resources-climate-resilience.pdf.
- Rural Electric Considerations and Survey
    - 16 responses received (50% of RECs in the state).
    - 12 questions to gather information on the vulnerability and capabilities of Cooperatives.
    - Windstorm was the number one hazard that has adversely impacted infrastructure.
    - Top 5 implemented mitigation actions – underground electric, pole replacement, vegetation management, infrastructure relocation and improved guys/anchors.
    - 75% of respondents have received FEMA grant funding in the past to strengthen infrastructure. 100% were interested in receiving FEMA funding in the future.
    - Four responding organizations conducted loss avoidance studies.
        - Survey did not indicate which organizations conducted studies.
        - FEMA is interested in reviewing the studies.

Critical Facility Inventory, Asset Inventory and Evaluation

- Identification of state assets, what will be affected, and what losses the state will experience.
- Aligning state assets to the FEMA Community Lifeline Framework to position for grant opportunities.
- Seeking additional information about assets: facility type, who maintains/operates and value.
    - Leon Ellis will provide Jeff Brislawn data on value and who maintains. Facility use is more challenging because many buildings are not used as originally intended.

Vulnerability Assessment/Loss Estimate

- FEMA National Risk Index
    - Leverages available source data for natural hazard and community risk factors (social vulnerability, community resilience, expected annual loss) to develop a baseline relative risk measurement for each US county and census tract.
    - Provides better data on some hazards, like landslide, where only minimal data previously existed.
- Flood Vulnerability update
    - Map annualized frequency by county to create composite findings.
    - Leverage the risk index to inform plan.
- Local and Tribal Hazard Mitigation Plan Rollup
    - Reviewed all county and tribal plans in the state, with specific focus on those which have been updated since 2016.
    - Flood was the most profiled hazard, followed by wildfire, drought, tornado and severe winter storm.
    - Hazards most frequently ranked as High Significance included severe winter storm, drought, windstorm, flood and extreme cold and ice storms.
    - Several new hazards were identified since the last plan rollup, such as subsidence, avalanche, heavy rain and heavy snow.
    - Trending towards more of a focus on natural hazards versus "manmade" hazards since the last HIRA update.
- EMAP Consequence Assessment and Risk Summary Table update

Planning Team Meeting and HIRA finalization

- SHMT meeting #2 September 2021
- Final HIRA January 31, 2022

Local and Tribal Mitigation Planning Updates

Heather Allemang, State Hazard Mitigation Officer; Nicole Edwards, Tribal Mitigation Specialist; Logan Sand, Senior Community Planner (A)

Local Planning Update

- 2019 was a busy year in South Dakota.
- 2020 brought a lot of uncertainty with the pandemic.
    - Local plans got behind schedule and experienced a lapse in Pre-Disaster Mitigation program coverage.
- To date, all counties have finished the planning process.
- All counties have an approved plan status.

Tribal Planning Update

- Working with Fort Peck and EPA on a partnership.
- Want to form more partnerships with other tribal entities across Region 8 in the future.

State and Local Mitigation Plan Guidance

- FEMA is updating its state and local mitigation planning guidance.
- Rollout is expected to begin the end of January or first part of February 2022.
- Increased emphasis on equity and climate change.

- FEMA will be working closely with OEM as each policy is rolled out. Education and training will be available.
- Will go into effect about 1 year after release.

BRIC and HMGP - COVID

Heather Allemang, State Hazard Mitigation Officer; Mike Hillenburg, HMA Branch Chief

Building Resilient Infrastructure and Communities (BRIC)

- Awards coming out soon for FY20.
    - State set aside was $600k.
    - Received applications received for county PDM plan updates, acquisitions, and project scoping studies.
    - Submitted one project for national competitive funding. Not successful.
- BRIC set aside for FY21 was $1million
    - Application deadline was December 1.
    - Currently reviewing submitted applications.
    - Similar projects as last year - several counties applying to update plans, project scoping. There was an uptick in utility-focused power line burial projects.
    - Submitting at least one, maybe two, projects for national competitive funding.

HMGP - COVID

- South Dakota has just over $2.7 million in funding for projects.
- Project application deadline is June 1, 2022.
- Will be distributing more information and reminders shortly.
- State will use HMGP - COVID to submit an application to update the state mitigation plan.

HMA

- The Infrastructure Bill provides additional funding in several programs.
    - Flood Mitigation Assistance Program. $700 million per year nationwide.
- BRIC also received additional funds. Will increase the pot by $1 billion over the next five years.
- Storm Act – passed into law last year.
    - $500 million over next five years.
    - Revolving loan program.
    - Supports mitigation of water systems, wastewater systems, other infrastructure, communities and small business development projects.
    - Headquarters is working with a task force to put together the program quickly.
    - More information to come.

Environmental and Historic Preservation

Steve Hardegen, Regional Environmental Officer

Programmatic Environmental Assessments

- Last year during this meeting, we talked about use of Programmatic Environmental Assessments (EAs) as a tool to get agencies on the same page and to streamline projects.
- Following that conversation, the state requested that EHP draft a Programmatic EA for watershed resiliency projects in South Dakota.

- EA expands categories.
    - Previously, the categoric exclusions were limited to 300 feet of stabilization work.
- Programmatic EA also developed in CO and UT.
- Document is currently in the public comment period.
- Programmatic EAs are structured so other programs can easily adopt them.
- Bio engineering – need to educate about integration into the process and what it means.

Executive Order 13690

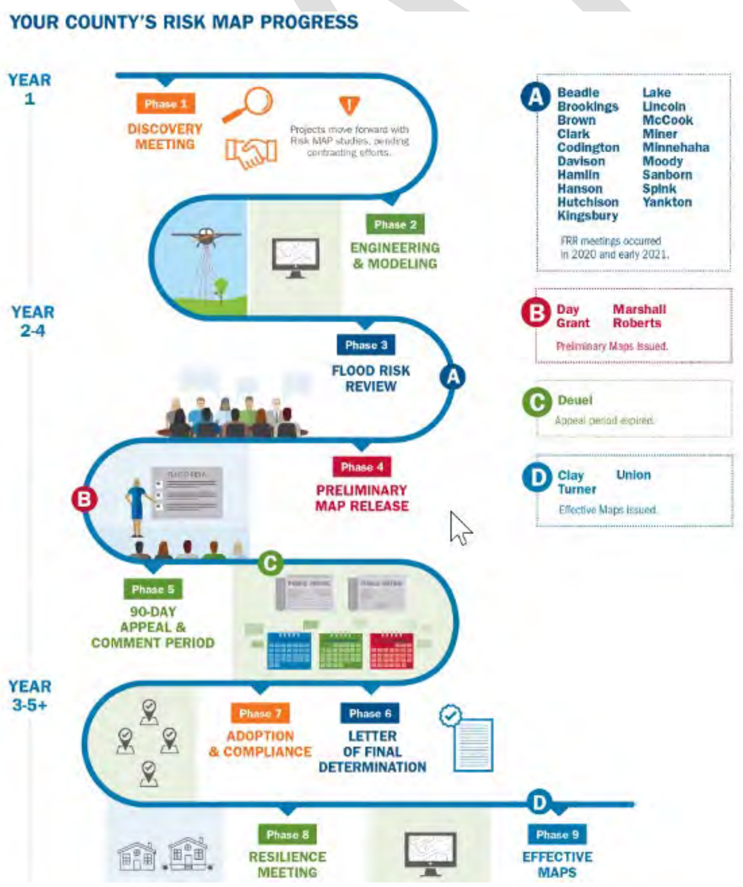
- Reinstated per the Biden administration. Redefines what the floodplain is and holds agencies to a higher standard of floodplain management.
- FEMA is redrafting guidance and acting as advisor to other federal agencies on what standards would look like.

Risk MAP Updates

Margaret Doherty, Risk MAP Program Specialist

- Counties indicated in blue in the graphic below are past the Flood Risk Review phase.
- Next spring and summer will bring a flurry of outreach with communities as the preliminary maps get released and we move through the formal adoption process.

Figure 1. Timeline for all Risk MAP projects in South Dakota



- FEMA developed a virtual conference room for residents to learn about flood risk and floodplain management.
- Piloted the virtual room in Day County.
- Will use the virtual conference room when presenting floodplain maps during upcoming Risk MAP meetings.

Figure 2. Risk MAP Virtual Conference Room

Round the Table Agency Activities and Updates

Marc Macy, Project Engineer; Jim Poppen, Mitigation and Recovery Team Lead

- The community of White Lake joined the National Flood Insurance Program (NFIP).
    - Previously unmapped.
- At the end of November 2021, we developed and sent a letter to other non-participating communities in South Dakota to raise interest in the NFIP.
- March to April 2022, OEM will host six floodplain management one-on-one trainings.
    - Will focus on substantial damage, floodplain development permitting, and will provide information on CRS.
    - More information will be provided shortly.
- Communicating with the Lofton Tribe in Roberts County about adopting a flood damage prevention ordinance.
- Disseminated a newsletter in October containing course dates for the upcoming Emergency Management Institute.
- In early 2022, we will be going to one of the western counties and giving a presentation on CRS and getting new floodplain administrators up to speed with the program.
- Continue to work through projects from 2018 disasters.
- With 2021 drought conditions in South Dakota, several roads came out of inundation. Getting applicants funding to repair infrastructure.
- Finished recordings for 15 video series.
    - Video topics range from what to do before a disaster occurs to documenting damage.
    - Trying to prepare applicants for success in 3- to 5-min segments.
- Finalizing contract to roll out new preliminary damage assessment software.

SD Dept. of Transportation

Kevin Marton, Bridge Hydraulic Engineer, SD Department of Transportation

- Identified areas on I-90 impacted by 2019 flooding.
  - Projects are in the works to mitigate flooding and keep the interstate open.
  - Time frames are variable. Some will occur as early as 2023, while some will occur as late as 2026 depending on the difficulty of the project.
- Interchange reconstruction project at Exit 63.
  - As part of the project, we will be completing a remapping effort in conjunction with the city and county.
  - Will submit a Letter of Map Revision to FEMA based on a 2-D modeling effort.

SD Bureau of Information and Telecom.

Mark Freund, State GIS Coordinator

- Updating all infrastructure for ArcGIS.
  - Major server updates are happening the first of the year.
  - ArcGIS pro development upgrades to be completed in the first quarter of 2022.
- Downloading the 2021 National Agricultural Imagery Program (NAIP) imagery.
  - True color and color infrared.
  - Will be the first year the department has color infrared available.

SD Dept. of Ag. and Natural Res.

Mark Rath, Natural Resources Engineer, SD Dept of Ag and Natural Resources

- No updates.

State Climatologist

Laura Edwards, State Climatologist, South Dakota State University Extension

- Work with Mesonet (weather station network) supported by USACE and NOAA.
  - Installing upgrades to equipment.
  - Handful of reactivated stations online.
  - Adding all weather precipitation gauges.
  - Many stations now have cameras. https://climate.sdstate.edu/. Look for the camera icon for stations that have live camera images.

SD Dept. of Game, Fish and Parks

Jason Jungwirth, Aquatic Habitat and Access Coordinator, SD Department of Game, Fish & Parks

- No updates.

SD Dept. of Health

Jesseca Mundahl, Assistant Administrator, SD Department of Health

- No updates.

SD Dept. of Public Safety

- No updates.

SD Dept. of Risk Management

Leon Ellis, State Risk Manager, Bureau of Administration

- No updates

SD Dept. of Tribal Relations

Nicole Schneider, Senior Policy Analyst, SD Dept of Tribal Relations

- No updates.

Governor's Office

Travis Dovre, Director of Administration, Governor's Office of Economic Development

- No updates.

Governor's Office of Economic Dev.

- No updates.

State Historical Preservation Office

- No updates.

USGS

- No updates.

NWS

Mike Gillispie, Sr. Service Hydrologist, NWS Sioux Falls

- Watching drought conditions.
    - Conditions are improving and getting closer to normal in eastern South Dakota.
- Spring Flood Outlook dates are February 10, 24 and March 10.

BOR

- No updates.

USACE

Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District; Tony Krause, Hydraulic Engineer, USACE

Lower Brule Projects

- Stabilizing and environmental restriction along shoreline.
- Part is in construction.
- Next phase is about to be in construction.
- Started feasibility study for next 3 miles upstream.

Big Sioux River Project

- Request from the Flandreau Santee Sioux Tribe for a project on the Big Sioux River.
- Looking to see how they can use natural floodplain wetland habitat features to develop flood risk management, drought resiliency and water quality improvements.

- Meeting scheduled in January with the Tribe.
- Upfront technical work may align well with the Silver Jackets Tribal Partnership Program.

Upper Missouri River Study

- Study will identify potential project areas.
- 50/50 cost-share.
- Met with state contacts in November 2021 to discuss ideas.
- Jen Gitt will send notes from the November meeting to Jason Bauder and Mark Macy for continued discussion on ideas and how best to fit them into the program and next steps.

Lewis and Clark Lake Sediment Management Plan

- Economic analysis study is mostly complete.
- Project is underway.

National Inventory of Dams (NID)

- Inundation areas are publicly available along with risk information.
- Will conduct outreach and education to inform communities and residents about the data.
- NID now includes inundation downstream of dams.
    - Large inundation boundary in South Dakota.
    - High consequence inundation, but low probability of occurrence.
    - Concern about how information will be received by the public.

Lower Missouri River GI Study/ Flow Frequency Update

- Developed updated flow frequency from Gavins to St. Louis.
- Regulation performance of reservoirs is a driver of the study.
    - Unable to determine without knowing flow frequency upstream.
    - This study is providing answers downstream.
- In future would like to integrate climate change. Would love to find a way to take tools being developed for downstream areas and make them beneficial for upstream areas as well.

Dam Q&A

- Steve Hardegen noted that another program that got super charged with the Infrastructure Bill was the High Hazard Dam Program. Of the $3 billion received, $900 million must be used for dam removal. It would be interesting to see how we could work with that inundation data if we are seeing structural impacts. Is the inundation data (NID) only looking at USACE regulated dams or is it looking at all dams?
- Tony Krause responded stating, the NID is a National Inventory of Dams, so its intent is to be a national inventory. When we get to the state level, I believe they also have inundation boundaries based on state criteria. What's out there now in those inundation boundaries is the Corps'. My understanding is that the Bureau of Reclamation and other DOI-owned dams are on the website; however, the inundation boundaries are not being presented for all based on individual agency decision processes.
- Steve Hardegen clarified the program is for non-federal-owned dams and facilities.
- Jen Gitt added that one of the FY 2023 Silver Jackets projects is doing a structure inventory downstream of dams. This will contribute to updating inundation areas.

- Steve Hardegen stated the goal is to partner with other federal grants and FEMA programs to get the big bang.

Mead County Mapping Project (Silver Jacket Project)

Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District

- Sturgis is growing very quickly and developing outside of the current floodplain mapping.
- To make informed development projects, this project is important.
- Project Partner Kickoff Meeting held on 12/15/21.
    - Great feedback from the city and county regarding the extent of mapping.
- Update the hydrology and 2-D modeling to obtain information about inundation areas and timing of flows.
    - Expanding the area further than the initial proposal to capture the campground area outside of the city. This will help with life safety improvements.
- LIDAR is ready to go.
- Will be completing a site visit in January to collect data and meet in person with the city and county.
- Large developments are popping up around Sturgis. New 800 lot project. Additional studies are extremely important.

Planning Assistance to State Study

Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District

- Planning Assistance for the State Study with the Department of Game, Fish and Parks.
- Study on fish loss through dams.
- Now in the scoping phase; likely to start in February 2022.

Fort Pier Study

Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District

- Study is starting in Fort Pier. Planning Assistance occurring with State Section 22.
- Producing an Emergency Action Plan for high-water events and exploring alternatives for mitigation projects to increase the city's flood resiliency.
- First team meeting is scheduled in January 2022.

Hydrology and Hydraulics Update Project

Jen Gitt, Project Manager and SD Silver Jackets Coordinator, USACE Omaha District

- Working with the Cheyenne River Sioux Tribe on the Lower Moreau River.
- Currently working to collect LIDAR data.
- Project will update H&H and will map the historic channel.
- The Tribe also requested two streambank stabilization projects on the Moreau River along BIA Route 2 and Thunder Butte.
- Millet County is looking at erosion along the Little White River at the intersection of HWY 44 and Ring Thunder Road.

Update on Silver Jackets & Projects

SJ Team Updates

Silver Jackets Workshop

- No Silver Jackets workshop scheduled for 2022 due to COVID protocol.
- Will likely conduct smaller trainings in lieu of a workshop.

Silver Jackets Team Charter

- Signed in 2011.
- Update considerations:
    - Examine member agencies and expand to include other offices or agencies that fit in with the mission.
    - Consider USDA Rural Development Funds and Opportunities.
    - Engage tribal representatives.
    - Update Department of Ag and Natural Resources section.
- Jen Gitt to send Charter to Silver Jackets members.
- Will set aside time at the next quarterly meeting to identify sections to update.

Flood Risk Management Newsletter

- Will send newsletter acknowledging the 50th anniversary of the Black Hills floods and highlighting Silver Jackets projects done in the aftermath.
- Will be drafting an article and reaching out to team members for support.
- Margaret Doherty indicated that FEMA R8 is doing an alluvial fan study in Summerset/Meade County that could be included in the summer newsletter.

Project Updates

1. Rapid Creek Inundation Map Library and Outreach
    a. Complete.
    b. Final product distribution estimated at the end of 2022.
2. Missouri River Inundation Maps for Online Viewer
    a. Team is editing and running scenarios.
    b. Inundation mapping from Gavins Point Dam downstream.
    c. Maps will be incorporated into the Big Sioux River flood information system.
    d. First 9,000 CSS run is done.
    e. Anticipated Spring 2022 completion.
3. Sturgis Hydrology, Hydraulics and Outreach
    a. See Round Table section above.

FY23 Proposals

- Due end of March.
- Intent is to set up meetings in January to start shaping proposals.
- Potential proposals:
    - Dam structure inventory and inundation project.
    - Need for H&H update on the Big Sioux river in Castlewood, Bruce, Baltic and Trent.
    - Jen will send out a Doodle Poll with potential meeting dates.

Outlook

a. Outreach, training or presentation opportunities.
   a. Fifth National Climate Assessment in progress.
      i. Federally mandated report assessing climate change.
      ii. FEMA is a co-author on the report.
      iii. Emphasis on the end user.
      iv. January 24. Reviewing key issues and priorities for the Northern Great Plains Chapter. This includes South Dakota and several other states.
         1. Opportunity to see if the assessment is on target and if it is covering the sectors that are of importance to you.
   b. Public Engagement Workshops for the National Climate Assessment are all listed here: https://www.globalchange.gov/nca5
b. Next South Dakota SJ meeting in March 2021 with NWS spring flood outlook.
   a. Thursday, March 17 - SJ meeting date
      i. Jen will send out a meeting placeholder.
      ii. In-person meeting in Pierre, South Dakota.
   b. March 17 is also the monthly and seasonal climate outlook release for NOAA; it's a good day for an update.
   c. If drought conditions change, may be beneficial to move SJ meeting sooner.

Action Items and Next Steps

- If available, provide FEMA with the Rural Electric Cooperative loss avoidance studies.
- HMP Planning Team is seeking additional information about critical assets: facility type, who maintains/operates, and value. Leon Ellis will provide list to Jeff Brislawn.
- Leverage partnership with the Silver Jackets Tribal Partnership Program to advance the Big Sioux River project.
- Spring Flood Outlook dates are February 10, 24 and March 10.
- Jen Gitt to send Charter to Silver Jackets members and will set aside time at next quarterly meeting to identify sections to update.
- Jen to send out Poll with potential meeting dates to discuss FY23 Silver Jacket proposals.
- Fifth National Climate Assessment engagement opportunities in January and February. Review of key issues and priorities for the Northern Great Plains Chapter on January 24.
- Next Silver Jackets meeting is Thursday, March 17.

Adjourn: 11:00 a.m. MST / 12:00 p.m. CST

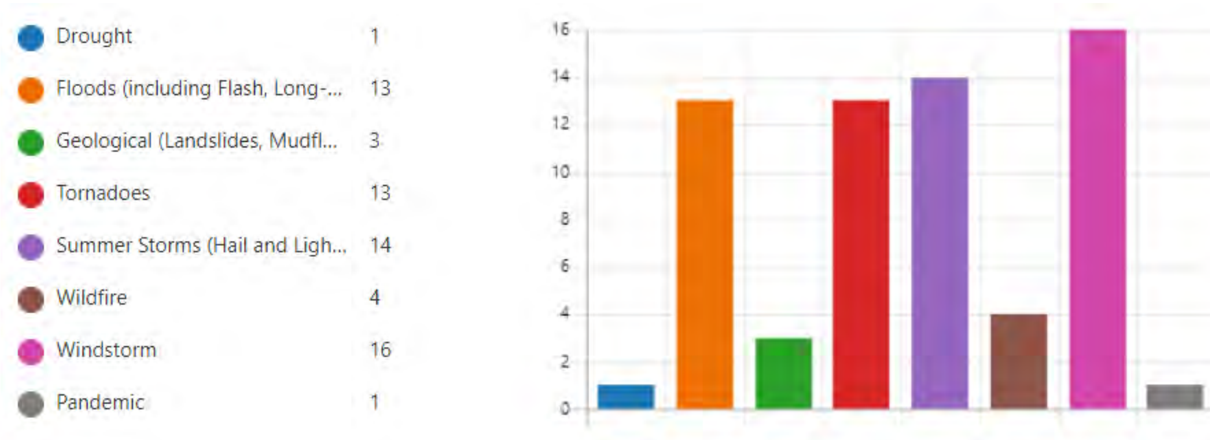
Appendix G

South Dakota Rural Electric Cooperatives Survey Results

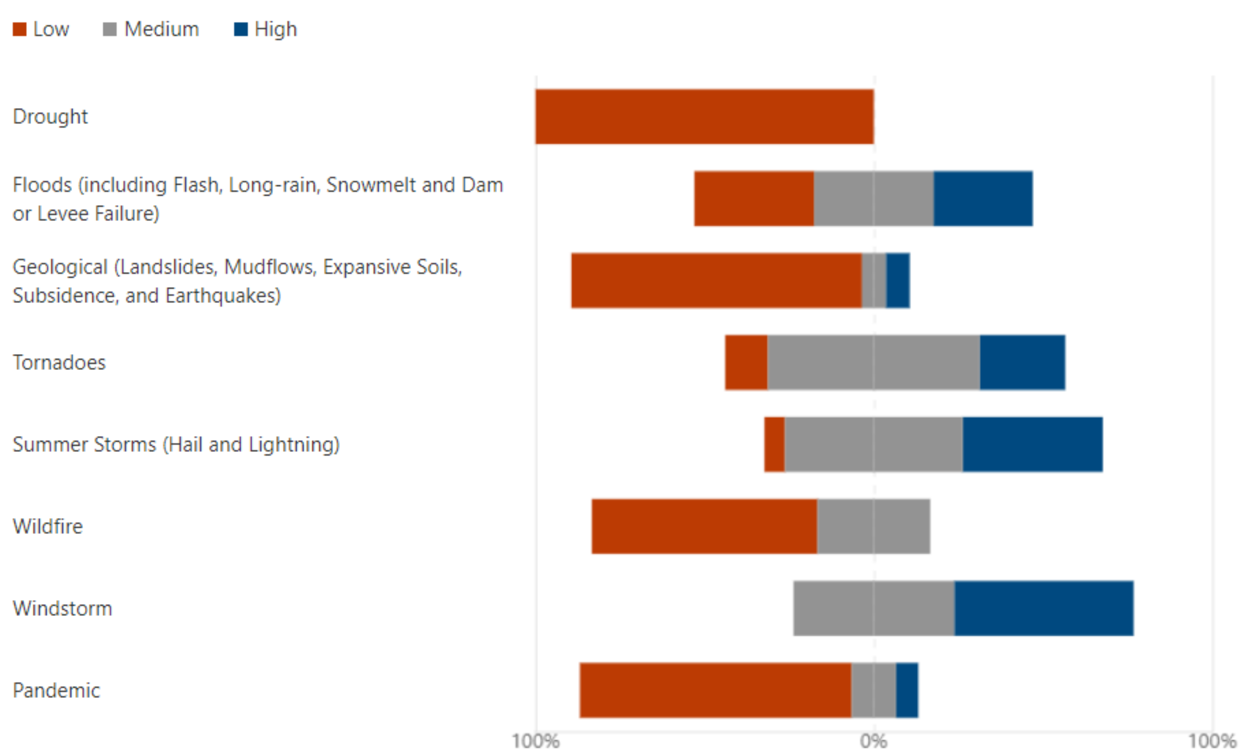
REC Survey Results

The State of South Dakota is in the process of updating the Hazard Identification and Risk Assessment (HIRA) section of the South Dakota Hazard Mitigation Plan. The State HMP allows Rural Electric Cooperatives to be eligible for certain FEMA hazard mitigation funds that can be used to increase resiliency of critical infrastructure and lifelines. Please complete a 12 question survey regarding natural hazard risk and vulnerability; the summary level information will be used to inform the HIRA update as it relates to Rural Electric Cooperatives. Please complete this survey by November 12, 2021.

1. Which of the following natural hazards have adversely affected/damaged critical electric infrastructure in the cooperative service territory in the past? (Choose all that apply)

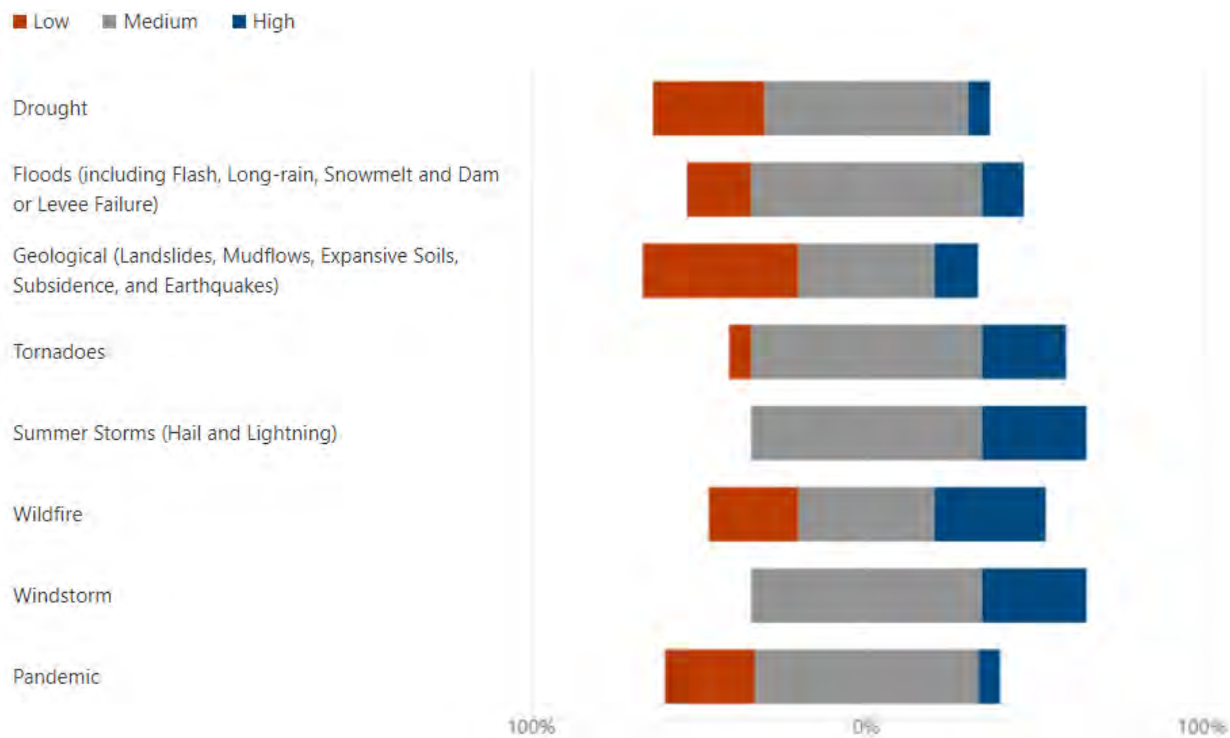


2. What natural hazards have the potential to impact critical electric infrastructure in the cooperative service territory in the future? (Low, Medium or High)



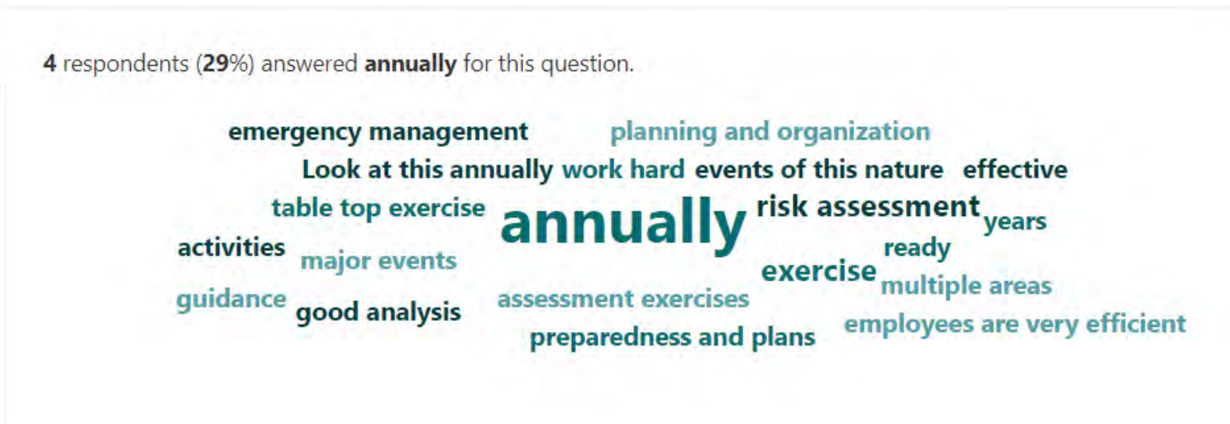
3. How concerned are you about the possibility of the rural electric cooperative critical electric infrastructure being impacted by a natural hazard?

4. What level of local capability exists to contend with the hazard in your cooperative service territory? (Low, Medium or High)

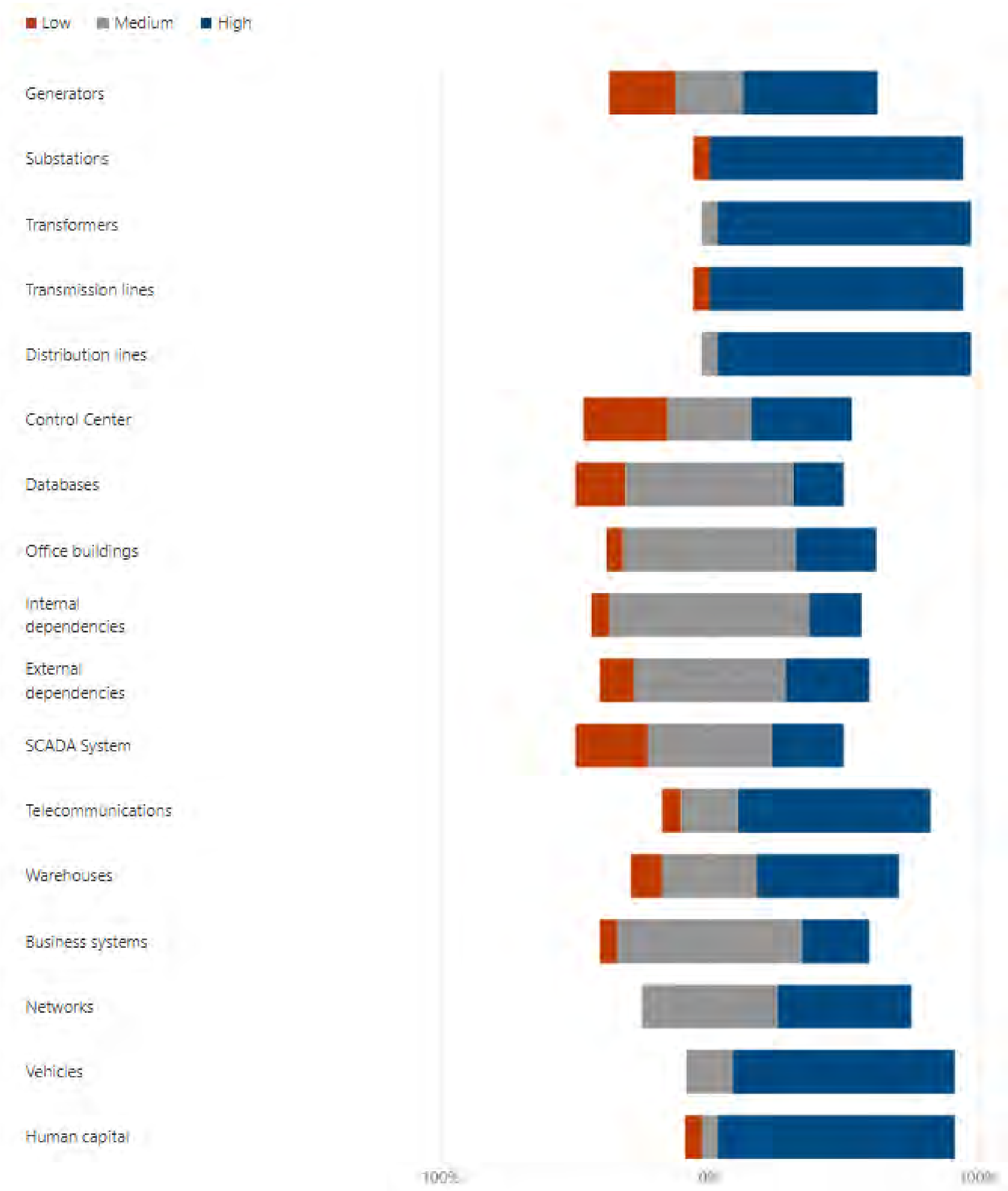


5. Has the rural electric cooperative conducted a hazard analysis and risk assessment? (If yes, please indicate how recently?)

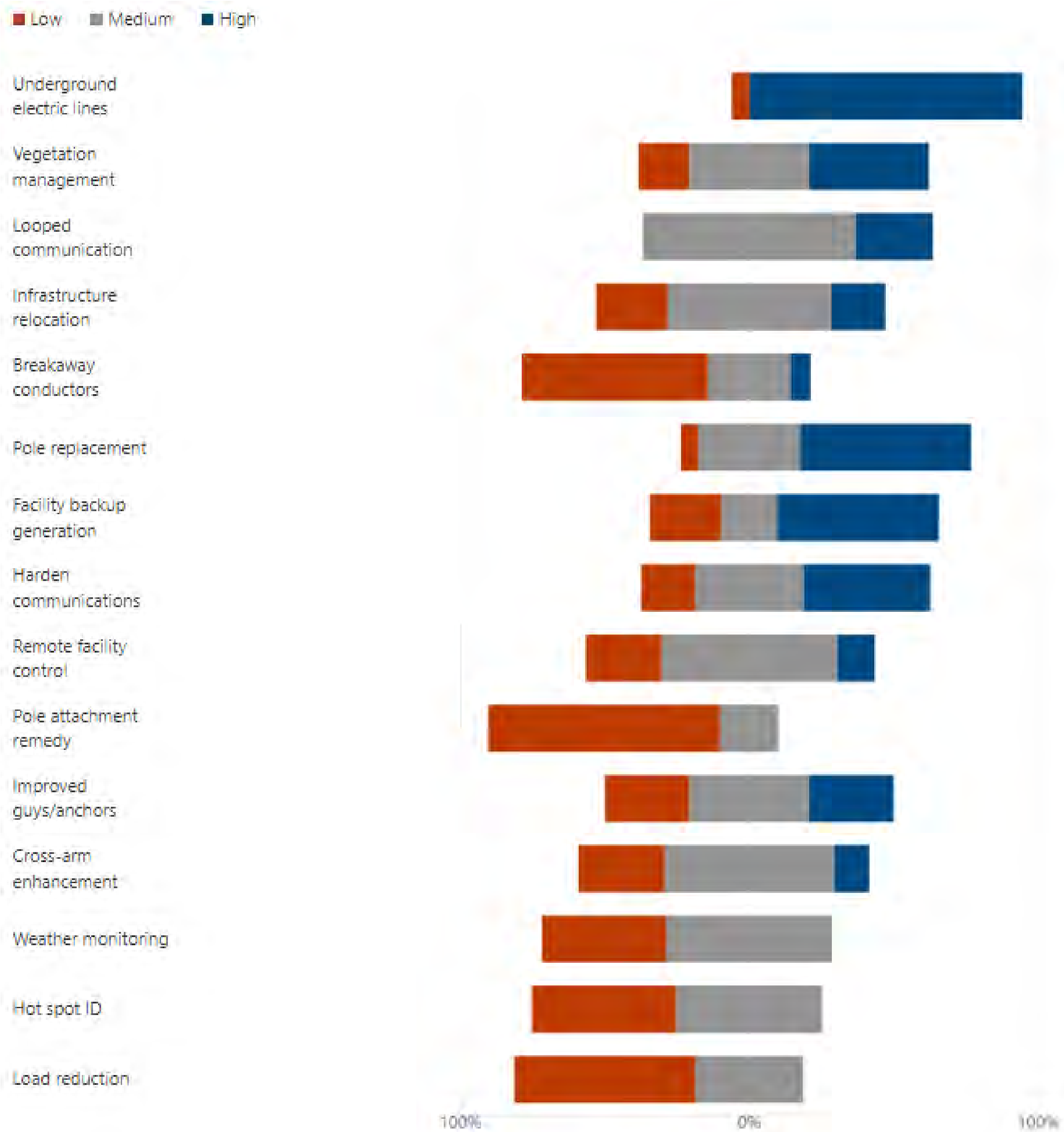
- 14 responses Total to this question
  - No
  - NA
  - Not Sure
  - We update our bi-annually
  - 2010
  - We annually do a table top exercise and a risk assessment to determine our preparedness and plans for events of this nature. With those activities we work hard to be ready for major events and our employees are very efficient and effective in emergency management, planning and organization.
  - No
  - I think in the last 5 years.
  - We have not but might be good. Could use guidance on what a good analysis might look like
  - No
  - No
  - Annually
  - Yes we have had risk assessment exercises is multiple areas. Look at this annually.
  - No



6. Please review the following list of potential critical assets to the electric infrastructure. Please rate (Low, Medium, High) the criticality of each type of infrastructure to the overall system.

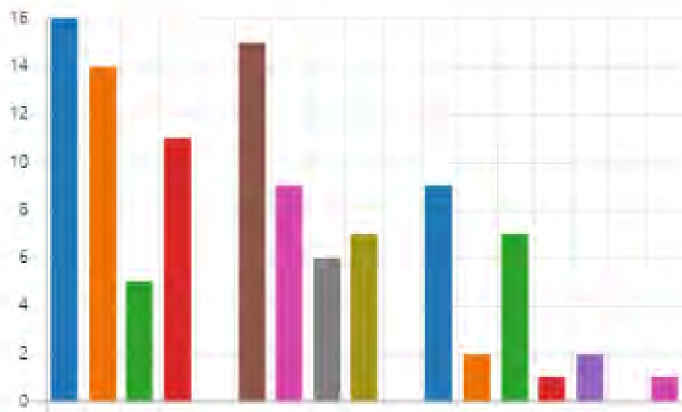


7. Please review the potential mitigation actions for rural electric cooperatives to reduce impacts of natural hazards on service or critical infrastructure. Please prioritize the importance of each (Low, Medium, High)



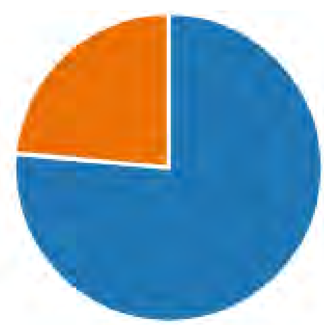
8. Please indicate mitigation actions your rural electric cooperative has taken to make critical electric infrastructure more resistant to natural hazards. (If "other" please indicate what that is)

Underground electric lines	16
Vegetation management	14
Looped communication	5
Infrastructure relocation	11
Breakaway conductors	0
Pole replacement	15
Facility backup generation	9
Harden communications	6
Remote facility control	7
Pole attachment remedy	0
Improved guys/anchors	9
Cross-arm enhancement	2
Weather monitoring	7
Hot spot ID	1
Load reduction	2
None	0
Other	1

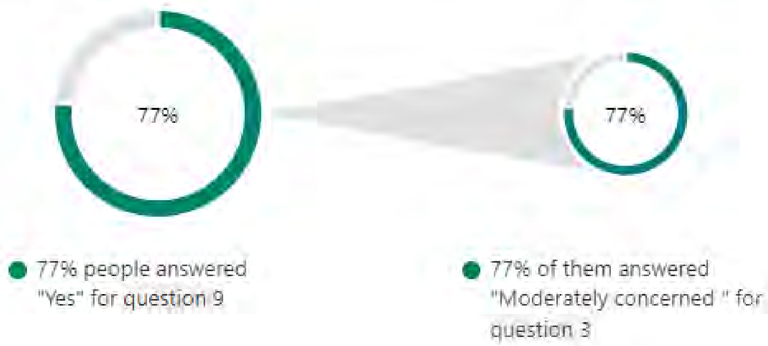


9. Has your organization received FEMA grant funding to strengthen infrastructure?

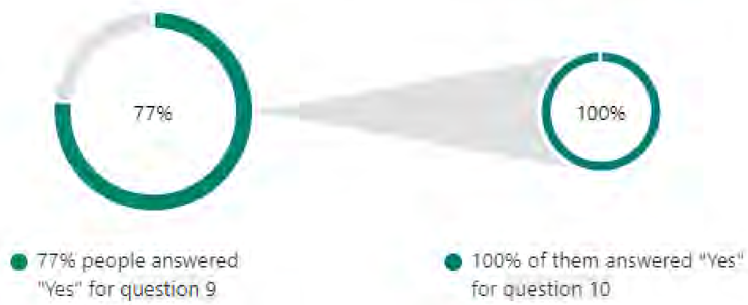
Yes	13
No	4



77% of people answered **Yes** for this question, and the majority answered "**Moderately concerned** " for Question 3.

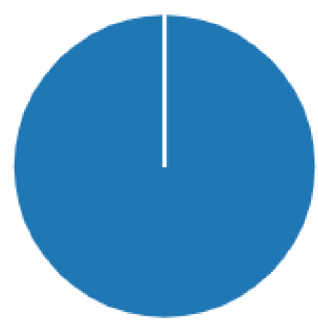


77% of people answered **Yes** for this question, and the majority answered "**Yes**" for Question 10.



10. Would your organization be interested in leveraging FEMA grant funding for strengthening infrastructure?

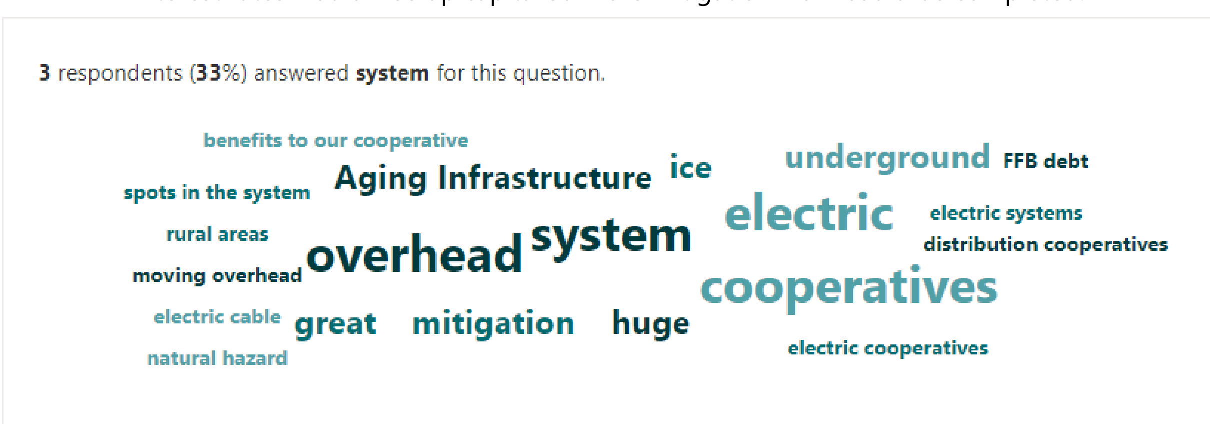
Yes	16
No	0



11. Has your organization conducted any loss avoidance studies to quantify or demonstrate the value of infrastructure mitigation efforts?

12. Are there any other issues regarding the reduction of risk and loss associated with natural hazards and rural electric cooperatives that you think are important, such as aging infrastructure or climate trends?

- 9 total responses
  - No
  - Aging Infrastructure
  - One of the main hazards that you did not mention is ice/winter storms which are a major natural hazard that hits rural electric systems very hard due to the huge amount of overhead line exposure we have as a result of serving the vast sparsely populated rural areas.
  - No, encourage co-op's to bury electric cable if feasible.
  - Would be great to have a way to expand the program to include more moving overhead to underground
  - Most SD distribution cooperatives face the same challenge to replace an aging system. Climate in the Dakotas remains unchanged as weather cycles have been consistently horrible out on the Great Plains. However, it's never so bad that it cannot get worse.
  - Aging infrastructure and utilities failure to utilize mitigation money to improve system and avoid continuous weak spots in the system.
  - We are in a area with high icing tendencies. Overhead to underground conversion has had huge benefits to our cooperative.
  - Federal legislation to allow electric cooperatives to refinance FFB debt at today's lower interest rates would free up capital so more mitigation work could be completed.



Appendix H

Rollup of Local and Tribal Hazard Mitigation Plans

Electronic Attachment [LHMP Rollup.xlsx]

Appendix I

Additional Information on High Hazard Potential Dams in South Dakota

Electronic Attachment
[SD Dams.xlsx]