Wisconsin Flood Resilience Scorecard

A guided conversation for local officials to improve flood-related health outcomes in their community

Module 3

WISCONSIN DEPARTMENT of HEALTH SERVICES

Sea Grant University of Wisconsin

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Introduction

Welcome to the Wisconsin Flood Resilience Scorecard (FRS). By completing this guide, local governments will be able to:

- Gather valuable information about flood vulnerability in their community;
- Identify potential sources of vulnerability; and
- Consider recommendations for improvement on a variety of scales.

The FRS can support communities in preparing for flooding events, such as the 2008 flooding experienced in southern Wisconsin. This guide is not designed to address catastrophic events such as a 500-year flood.

This guide is intended for use by Wisconsin public officials in local government. This guide will refer to counties and municipalities collectively as "communities". It is intended to be comprehensive, encompassing three categories of vulnerability:

Module 1: Environmental - Physical and natural landscape characteristics such as soil and slope

Module 2: Institutional - Government and infrastructural capacity and content of existing policies and community plans

Module 3: Social - Cultural and socioeconomic sources of vulnerability and the potential for community partnerships

Public officials benefit from completing all three modules; however, each can be considered independently if only certain portions are of interest. While flooding intensity and the severity of outcomes are influenced by a variety of factors, this guide focuses specifically on reducing the quantity of floodwater.

Ultimately, this guide will help decision makers prioritize projects for improving flood resilience. The benefits of flood resilience are many: limiting the adverse impacts of excess runoff into streams, reducing the financial burden of replacing damaged infrastructure and homes, and limiting negative public health outcomes.

Flooding in Wisconsin

Wisconsin has an abundance of water features, including 15,000 lakes and 84,000 miles of river (Wisconsin Department of Natural Resources, 2020), which provide livelihoods and recreation for its residents. While this water contributes to rich agriculture, fishing and boating, and ample clean drinking water, it also presents a challenge as detrimental flooding events become increasingly common across the state.

According to the Pew Charitable Trusts, flooding is the costliest and most common natural disaster in the United States (The Pew Charitable Trusts, 2019). In 2013 Americans spent approximately $400 per household in an average year on such extreme weather events but expenses have likely increased with increasing frequency of natural disasters (Weiss & Weidman, 2013). Flooding was a principal cause of damage in 32 of 46 presidential disaster declarations and one of six presidential emergency declarations in Wisconsin from 1971 through June 2016 (Wisconsin Emergency Management & State of Wisconsin Homeland Security Council, 2017).

As an example, unprecedented amounts of rain tore through southern Wisconsin in August 2018, resulting in more than $200 million of dollars in damage (Kirwan & The Associated Press, 2018), as well as a statewide state of emergency declaration from Governor Scott Walker (Federal Emergency Management Agency, 2018). While average precipitation in the city of Madison for the month of August is 4.27 inches (National Oceanic and Atmospheric Administration, 2010), the storm hitting August 20th -21st of 2018 brought 11 inches in a 24-hour period (National Weather Service & National Oceanic and Atmospheric Administration, 2018b, 2018a). The official all-time Wisconsin 24-hour rainfall record is 11.72 inches from 1946, but during the August 2018 storm unofficial measurements reached up to 15 inches west of Madison in the Cross Plains area (Burt, 2019). Exacerbating these issues are the predictions that these extreme flooding events are only anticipated to increase in the coming years.

Recent climate modeling predicts that high-intensity storms and subsequent flood events are likely to increase throughout the Upper Midwest, including Wisconsin (Wisconsin Initiative on Climate Change Impacts, 2020) . While temperatures have been increasing throughout the state over the past century, precipitation patterns are more difficult to predict (Wisconsin Initiative on Climate Change Impacts, 2020). Over the past 70 years, annual precipitation has increased approximately 15%, or on average 4.5 inches throughout the state (Wisconsin Initiative on Climate Change Impacts, 2020). However, these trends are not uniform, with western and south-central Wisconsin seeing the wettest conditions and the north experiencing a drying trend (Wisconsin Initiative on Climate Change Impacts, 2020). Some of Wisconsin's most populous cities can be found in these wettest areas. Wisconsin public officials will need to consider these conditions when creating emergency preparedness, hazard mitigation and management plans, and developing policies.

Creating policies, retrofitting existing structures, and developing green infrastructure solutions comes at a cost, but these steps are essential if communities hope to withstand the natural hazards of the future. Ultimately, investing in solutions earlier will minimize the much greater costs that result from damage after an event has already occurred.

Public Health Effects of Flooding

Not only does flooding damage physical infrastructure, it can contribute to adverse health impacts for some of the state's most vulnerable populations. Flooding is the one of the greatest causes of death associated with natural disasters in the United States (Greenough et al., 2001). This includes both direct and immediate effects as well as indirect, long-term consequences. Direct effects may include drowning, electrical injuries associated with standing water, blunt trauma from objects caught in a storm surge and hypothermia (Greenough et al., 2001). People seeking medical care may also have difficulty accessing care during a flood event (Du et al., 2010), and the effects of flooding can continue to plague individuals for days, months, or even years. Floods can damage critical facilities such as hospitals and nursing homes, which makes routine care for patients with chronic diseases exceedingly difficult. Health facilities, overwhelmed by flood victims and physical damage, may lose medical records or have very limited resources to treat patients while also conducting surveillance on exposures to toxic materials or waterborne diseases (Du et al., 2010).

While contact with floodwaters alone may not pose health risks, sewage overflows may contaminate the water with pathogens such as Escherichia coli, Salmonella, and the hepatitis A virus (Du et al., 2010). Floodwaters can also flow through industrial sites and spread chemicals and other hazardous materials (Du et al., 2010). Overcrowded conditions and lack of sanitary facilities contribute to spread of communicable diseases, and stagnant water allows for the breeding of many disease vectors such as mosquitoes (Du et al., 2010). Finally, if cleanup is not conducted shortly after the flood event (a challenge for financially limited communities), mold is able to grow in damaged buildings. This results in the exacerbation of respiratory conditions such as asthma (Du et al., 2010).

There is also growing interest in the mental health impacts of flooding. Those who experience flood events report higher levels of depression, anxiety, and post-traumatic stress disorder (Waite et al. 2017). If a flooded individual also experiences utility disruptions, their poor mental health outcomes are even greater (Waite et al. 2017). People who are displaced from their homes due to flooding also report higher depression, anxiety, and post-traumatic stress disorder (Munro et al. 2018). French et al. (2019) also found that repeat flood victims may experience slightly higher levels of reported poor mental health. This may be important in considering health equity, as individuals who lack the means to relocate may be more susceptible to repeat flood events.

It is in the best interests of community members, local government and public health officials to minimize these adverse effects by putting preventative measures in place before events occur.

What to Expect from this Guide

Each module of this guide contains the following:

- A “Before you Begin” section explaining why to use this module, who should complete it and what that person or persons will need in order to complete it;
- Definitions and acronyms that will be used throughout the module;
- The module itself;
- A series of recommendations;
- And additional resources.

It is our intention that upon completion of this guide, a community will be able to choose from a variety of solutions and tailor them to be most appropriate for their financial and administrative capacity. The results can also be used to build support from regional partners and to apply for state and federal grant opportunities. Each community may find it appropriate for different staff members to complete the guide — we have provided a partial list of potentially suitable officials at the top of each module. Because this guide was designed to be comprehensive, it is possible that certain portions are not applicable to every community or that certain portions have already been thoroughly examined by a community in the recent past. Each community can customize this guide as is sensible for their needs.

Who Should Participate

The Scorecard was designed for use by public officials and local government staff. It is up to those leading the process to recruit a team of people with the backgrounds and experiences necessary to complete this Scorecard. The Scorecard requires knowledge of the technicalities of infrastructure, zoning, and policy as well as knowledge of community inner workings and relationships. Those on your staff with water resources, engineering, planning, zoning, emergency management and/or community organizing experience are recommended. Other community members, e.g., those who lead health programs and long-time residents, may also be important contributors to this process because of their first-hand experiences living and working in the community.

While every community is encouraged to use the Flood Resilience Scorecard, we recognize some limitations in the usability of the FRS for tribal nations of Wisconsin. Wisconsin has an important population of Indigenous people among 11 federally recognized tribes that have faced severe flood events exacerbated by systemic inequities. The FRS relies on a significant amount of mapping and, in its current form, is tailored for Wisconsin's incorporated municipalities and counties. This inherently leaves some circumstances and institutional conditions of tribal nations unaddressed.

For example, many tribes are geographically dispersed. A reservation can include many other jurisdictions, making it difficult to assess vulnerabilities or makes changes within jurisdictional lines. Similarly, tribal nations have had a historically strained relationship with FEMA, limiting available mapping technologies of floodplains in reservations. Equally important to note is the historical reality of trauma and miscommunication tribes have experienced. Tribal communities' possible mistrust, particularly for government agencies and their work, is levied through centuries of violence, abuse, and mistreatment, often a result of state and federal governments impending on tribes' sovereignty. While the FRS may not be perfectly applicable, it can still serve as a resource to tribes. One benefit of this tool is how it is rooted in the individual community. By using local knowledge and experts who know your community best, it gives a sense of control and agency in flood resilience.

Tribes are encouraged to participate and can contact Maggie Thelen at Margaret.thelen@dhs.wisconsin.gov if interested in exploring how this document can be adapted to a specific tribe.

Scoring

Questions are equally weighted within the guide. It does not result in a numeric score, instead, if a community does not reach a particular threshold of favorably answered questions, they will be redirected to the appropriate recommendations section. For example, if a community has scored poorly on the "Resource Inventory and Monitoring" section of the Institutional module, the corresponding "Resource Inventory and Monitoring" section of recommendations should be consulted. Some strategies are relatively inexpensive, whereas others require a greater amount of money, staff, and technological capacity. It is possible to increase flood resilience with a variety of tools and strategies.

There are dozens of resources to be found online that can provide more information than is contained in this guide alone. Many of these tools and data, including from the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), the Wisconsin Department of Natural Resources (DNR) and many other authorities can be found in the Recommendations section.

The causes and effects of floods are complex and interconnected; it can be difficult to anticipate where and when flooding will occur and what strategies can ensure community resilience. However, this guide provides a foundation of concepts that are appropriate for communities both unfamiliar and well-versed in flood hazard mitigation.

Flood Resilience Scorecard Data Companion

Many of the questions in this guide request data that is publicly available but often difficult to obtain, analyze or interpret. To make these data more accessible to the users of the Flood Resilience Scorecard, the developers of this guide created the Flood Resilience Scorecard Data Companion.

The Data Companion is a separate document that contains 32 data points that serve as answers to questions in this guide. The Data Companion is specific to your community, with a unique document for all 72 counties and more than 600 cities and villages in the state. If you would like to access your Data Companion, contact Margaret Thelen, Climate and Health Program Coordinator at the Wisconsin Department of Health Services, at Margaret.Thelen@dhs.wisconsin.gov.

The 32 data points provided in the Data Companion are coded to align with the question number in this guide. For example, question E-B3 in this guide related to steep slopes can be answered with the information found in the Data Companion listed as E-B3. Questions in this guide that refer to information that can be found in the Data Companion will be noted with the symbol found to the right.

The Data Companion is currently only available for incorporated municipalities (cities and villages) and counties in Wisconsin. Other jurisdictions such as towns or watersheds, are encouraged to use the Flood Resilience Scorecard using the Data Instruction Manual described below.

Flood Resilience Scorecard Data Instruction Manual

Although the Flood Resilience Scorecard Data Companion is only available for municipalities and counties in Wisconsin, other communities and jurisdictions such as towns and watersheds are encouraged to participate. In absence of the Data Companion, we created the Flood Reslience Scorecard Data Instruction Manual.

The Data Instruction Manual details how to access the data required in a step-by-step walkthrough. For each question in this guide that contains the Data Companion logo shown above, you may also use the Data Instruction Manual to access the data for yourself. The Data Instruction Manual is for users both with and without access to Geographic Information Systems (GIS).

Acknowledgments

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- The University of Wisconsin Sea Grant Institute.

Many thanks are in order to these individuals and organizations for their insight in developing this guide. For questions or comments concerning this guide, please contact Margaret Thelen, Climate and Health Program Coordinator, at Margaret.Thelen@dhs.wisconsin.gov.

Module Three: Social

Overview

The socioeconomic and cultural sources of vulnerability affect a community's ability to withstand and recover from flood damage. Understanding flooding's effects on health can also help a community develop a more holistic and equitable approach to resiliency. Many social factors related to flood vulnerability are correlated and interconnected. We have chosen a few select topics for which data can be accessed by the public; however, knowledge of local conditions is essential for creating a full picture of your community's social vulnerability.

The social parameters to be assessed in this portion of the Scorecard include:

Sociodemographic Characteristics

- Assessing the social vulnerabilities of your community is essential to understanding the community's overall flood vulnerability.
- The most vulnerable groups in your community are the least likely to be able to access resources to prepare for or recover from a flooding emergency.

Transportation & Housing

- Members of your community, especially the most vulnerable, will need transportation to emergency facilities and/or access to emergency supplies in the case of a flood.
- The overall state of housing may influence how much damage could occur in the case of a flood. Usually, older houses are less structurally sound and were not built with intense precipitation events in mind.

Health Indicators

- Flooding can have both short-term and long-term health consequences and has the potential to affect all aspects of a person's health; therefore, access to medical care determines overall emergency flood preparedness and response.
- Knowing the capacity of your health care providers in emergency situations is crucial to determining if you will need to coordinate support for your health facilities and/or transportation to health facilities outside of your community.

Community Partnerships

- Engaging at-risk populations through local committees or advisory groups helps ensure more equitable and holistic community planning and emergency response.
- Having supportive resources available to community members can help keep them safe, financially support them, and help rebuild during and after a flood.

Education & Outreach

- Having shared language around flooding and ensuring access to the best information and educational materials available opens doors for community members to engage in flood preparedness efforts.
- Providing these spaces for community members to share their flood concerns will inform which kinds of information and support to make available to them.

Health Impacts of Flooding (Du et al., 2010)

Immediate Consequences

- Drowning
- Electrocution
- Hypothermia
- Lack of access to medical records prescription drugs or electric medical equipment (e.g., respirators)
- Contact with sewage-related pathogens
- Contact with waterborne vectors (e.g., mosquitoes)

Long-term Consequences

- Mold induced asthma
- Injuries while making repairs to flood damage
- Spread of communicable diseases in shelters
- Financial burden of recovery—strains resources for healthy food and routine healthcare
- Physiological effects
- Mental health and post-traumatic stress

Who Should Complete this Assessment?

One or more of the following groups may be appropriate to conduct this assessment:

- Urban planners
- Local public health officials
- Emergency management
- Community development staff
- Community organizers
- Representatives from community partnerships or non-profits

What Will you Need to Complete this Assessment?

- The Flood Resilience Scorecard Data Companion for your community or the Data Instruction Manual.
- The Center for Disease Control's Social Vulnerability Index (SVI) rankings for your community
- Census data or the most recent demographic data for your community. Ideally, the most recent American Community Survey or decennial census data should be used when possible. This can be found at data.census.gov
- Maps showing or local knowledge of the distribution of priority populations within your community
- Local knowledge of community partnerships, collaborations and outreach occurring that may support your community in the event of a flood

Definitions

Ambulatory care sensitive condition: Conditions for which good outpatient care can potentially prevent the need for hospitalization, or for which early intervention can prevent complications or more severe disease (Agency for Healthcare Research and Quality, 2001).

Composite index: Formed when individual indicators, such as poverty and minority status, among others, are compiled into a single index on the basis of an underlying model. The composite index should ideally measure multidimensional concepts that cannot be captured by a single indicator (Organisation for Economic Co-Operation and Development, 2013). The CDC's Social Vulnerability Index is an example of a composite index.

Cost burdened: According to the US Department of Housing and Urban Development, a household is cost burdened when over 30% of income is dedicated to housing costs. However, this measure has been contested and may not be appropriate for your community (PD&R Edge, 2014).

Culturally significant landmarks: Structures or buildings that contribute to the sense of community, history or tradition within your community. Examples may include monuments, historical buildings, or museums.

Priority populations: Populations that may be at higher risk for adverse flood outcomes based on sociodemographic features and should therefore be prioritized for financial and technical assistance. Examples include older adults, low-income individuals, and communities of color.

Social vulnerability: The sociodemographic characteristics of a person or community, such as access to a vehicle or English language proficiency, that affect their capacity to anticipate, confront, repair and recover from the effects of a disaster.

Sociodemographic: A combination of socioeconomic and demographic characteristics

S-A) Sociodemographic Characteristics

For this section, you will be using the Center for Disease Control's SVI. This is an interactive, online tool that can assess the vulnerability of your census tract or county in five different ways: 1) overall vulnerability, 2) socioeconomic theme, 3) household composition/disability theme, 4) minority status/language theme and 5) housing/transportation theme. The Flood Resilience Scorecard Data Companion contains the data for your community, but you may want to familiarize yourself with this online tool to better understand social vulnerability in your community.

This tool is intended to provide a broad view of social vulnerability at a population level. For a more specific understanding of your vulnerable communities and how they are spatially distributed, you may choose to download the SVI data from svi.cdc.gov and conduct a GIS analysis to isolate variables of interest as well as estimated counts for individual variables constituting each theme.

This section uses the socioeconomic theme, household composition/disability theme and minority status/language themes specifically.

For questions 1 and 2, check "socioeconomic theme" on the legend, making sure all other categories are unchecked. For questions 3 and 4, check "household composition/disability theme," making sure all other categories are unchecked. For questions 5 and 6, check "minority status/language theme," making sure all other categories are unchecked.

The maps will show all four SVI themes, which should correspond to the four categories of questions in the Scorecard. Here, you will be able to see how vulnerable your community is as compared to others in Wisconsin. If your community encompasses multiple census tracts, you may have to take the average for the purposes of this assessment.

How to Access the CDC SVI

- Go to svi.cdc.gov.
- Click on the "interactive map" icon.
- Enter your community's name in the search bar in the upper right-hand corner of the map.
- Click on the Legend tab in the upper right corner and select "Socioeconomic Theme - Tracts"

This tool only provides a broad understanding of social vulnerability. To complete this section, you will also need a map or local knowledge of the spatial distribution of priority populations. For a more specific understanding of your vulnerable populations and how they are spatially distributed, you may choose to download the SVI data from svi.cdc.gov and conduct a GIS analysis to isolate variables of interest.

Socioeconomic Features

In the CDC's SVI map, the variables included in the socioeconomic theme are persons below poverty line, persons unemployed, persons over 25 with no high school diploma and per capita income. These variables will be aggregated together into one composite value.

S-A1. Using the CDC's SVI map, what is your community's socioeconomic vulnerability?

A. 0.00 - 0.249

B. 0.25 - 0.499

C. 0.50 - 0.749

D. 0.74 - 1.00

S-A2. Has your community determined how these priority populations (those who are unemployed or of low income/education attainment) are spatially distributed?

A. Yes, the community has quantitatively identified where priority populations are concentrated in our community using mapping technology

B. No, but the community has anecdotal evidence or local knowledge about where these populations may be concentrated

C. No, the community has not determined where these populations are spatially distributed

S-A3. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, have efforts been made to expand services in those areas? Services could include employment trainings, assistance for low-income individuals, or outreach for social services programs.

A. Yes, the community has expanded resources and services in areas of greatest risk

B. The community is in contact with leaders and residents in high-risk areas but has not provided additional resources or services

C. No, the community has not made special efforts to expand services in priority population communities

S-A4. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, has your community engaged in education and outreach, created neighborhood emergency procedures, and/or secured additional supplies (i.e. generators, sandbags)?

A. Yes, we do all of the above for neighborhoods in which we have quantitatively determined these risk factors are concentrated

B. Yes, we do some of the above in areas we believe require more resources and supplies

C. We engage in the measures listed above, but for the community as a whole and not specific at-risk neighborhoods

D. No, areas where risk factors are concentrated do not have emergency procedures and/or additional supplies

Household Demographics

In the CDC's SVI map, the variables included in the household composition/disability theme are persons aged 65 or older, persons aged 17 or younger, non-institutionalized civilians with disability and single-parent households. These variables are aggregated together into one value.

S-A5. Using the CDC's SVI map, what is your community's household composition/disability vulnerability?

A. 0.00 - 0.249

B. 0.25 - 0.499

C. 0.50 - 0.749

D. 0.74 - 1.00

S-A6. Has your community determined how these priority populations (elderly, youth, those with disabilities) are spatially distributed?

A. Yes, the community has quantitatively identified where priority populations are concentrated in our community using mapping technology

B. No, but the community has anecdotal evidence or local knowledge about where these populations may be concentrated

C. No, the community has not determined where these populations are spatially distributed

S-A7. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, have efforts been made to expand services such as medical care in those areas?

A. Yes, the community has expanded resources and services in areas of greatest risk

B. The community is in contact with leaders and residents in high-risk areas but has not provided additional resources or services

C. No, the community has not made special efforts to expand services in priority population communities

S-A8. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, has your community engaged in education and outreach, created neighborhood emergency procedures, and/or secured additional supplies (i.e. generators, sandbags)?

A. Yes, we do all of the above for neighborhoods in which we have quantitatively determined these risk factors are concentrated

B. Yes, we do some of the above in areas we believe require more resources and supplies

C. We engage in the measures listed above, but for the community as a whole and not specific at-risk neighborhoods

D. No, areas where risk factors are concentrated do not have emergency procedures and/or additional supplies

Minority Status & Language

In the CDC's SVI map, the variables included in the minority status and language theme are minorities (all persons except white, non-Hispanic) and persons aged 5+ who speak English "less than well." These variables will be aggregated together into one value.

S-A9. Using the CDC's SVI map, what is your community's minority status and language vulnerability?

A. 0.00 - 0.249

B. 0.25 - 0.499

C. 0.50 - 0.749

D. 0.74 - 1.00

S-A10. Has your community determined how these priority populations (minority populations, those who speak English "less than well") are spatially distributed?

A. Yes, the community has quantitatively identified where priority populations are concentrated in our community using mapping technology

B. No, but the community has anecdotal evidence or local knowledge about where these populations may be concentrated

C. No, the community has not determined where these populations are spatially distributed

S-A11. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, have efforts been made to expand services in those areas? Services could include translated documents or a publicized list of contacts for resources available to non-English or minority populations.

A. Yes, the community has expanded resources and services in areas of greatest risk

B. The community is in contact with leaders and residents in high-risk areas but has not provided additional resources or services

C. No, the community has not made special efforts to expand services in priority population communities

S-A12. If your community has found particular neighborhoods or communities in which these risk factors are concentrated, has your community engaged in education and outreach, created neighborhood emergency procedures, and/or secured additional supplies (i.e. generators, sandbags)?

A. Yes, we do all of the above for neighborhoods in which we have quantitatively determined these risk factors are concentrated

B. Yes, we do some of the above in areas we believe require more resources and supplies

C. We engage in the measures listed above, but for the community as a whole and not specific at-risk neighborhoods

D. No, areas where risk factors are concentrated do not have emergency procedures and/or additional supplies

Scoring Sociodemographic Characteristics

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c” or "d" to four or more questions, please refer to the Sociodemographic Characteristics recommendations section on page 80.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

S-B) Transportation & Housing

For this section, you will be using the CDC's SVI. This is an interactive, online tool that can assess the vulnerability of your census tract or county in five different ways: 1) overall vulnerability, 2) socioeconomic theme, 3) household composition/disability theme, 4) minority status/language theme, and 5) housing/transportation theme. This section uses the housing/transportation theme specifically. The Flood Resilience Scorecard Data Companion contains the data for your community, but you may want to familiarize yourself with this online tool to better understand social vulnerability in your community.

Here, you will be able to see how vulnerable your community is as compared to others in Wisconsin. If your community encompasses multiple census tracts, you may have to take the average for the purposes of this assessment.

In the CDC's SVI map, the variables included in the housing/transportation theme are multi-unit structures, mobile homes, crowding, no access to a vehicle and group quarters. These variables will be aggregated together into one value.

How to Access the CDC SVI

- Go to svi.cdc.gov.
- Click on the "interactive map" icon.
- Enter your community's name in the search bar in the upper right-hand corner of the map.
- Click on the Legend tab in the upper right corner and select "Housing/Transportation - Tracts"

S-B1. Using the CDC's SVI map, what is your community's housing/transportation vulnerability?

A. 0.00 - 0.249

B. 0.25 - 0.499

C. 0.50 - 0.749

D. 0.74 - 1.00

S-B2. Has your community determined how these priority populations (poor housing quality, limited transportation options and connectivity) are spatially distributed?

A. Yes, the community has quantitatively identified where priority populations are concentrated in our community using mapping technology

B. No, but the community has anecdotal evidence or local knowledge about where these populations may be concentrated

C. No, the community has not determined where these populations are spatially distributed

S-B3. If yes, has your community made plans to expand transportation and housing options for these communities?

A. Yes, the community has expanded public transit options, improved pedestrian mobility, or built new housing to accommodate this need

B. Yes, community plans call for expanded transit, pedestrian mobility, and/or new housing specifically in these neighborhoods

C. Community plans generally call for expanded transit, pedestrian mobility, and/or new housing, but not specifically for these neighborhoods

D. No, the community has not taken action on this issue

S-B4. If yes, has your community secured emergency supplies and created procedures for transportation in these neighborhoods?

A. Yes, neighborhood emergency procedures and supplies have been secured for all of these areas, and these resources were developed in coordination with residents of the area

B. Yes, the community has general emergency procedures for all neighborhoods, but they are not tailored to individual community needs

C. Yes, some neighborhoods have their own emergency procedures, but not all

D. No, neighborhoods have not made these plans themselves and the community also has not provided them

S-B5. What is the pedestrian connectivity score for your community? If you do not have a Data Companion for your community, visit walkscore.com and search for your community. Divide the walkscore by 100 and use that value to answer this question.

A. Greater than 0.50 (high connectivity)

B. 0.25 - 0.499

C. 0.10 - 0.249

D. Less than 0.10 (low connectivity)

S-B6. What percentage of homes in your community were built before 1970?

A. Less than 25%

B. Between 25 – 50%

C. Between 50-75%

D. More than 75%

Scoring Transportation & Housing

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c” or "d" to three or more questions, please refer to the Transportation & Housing recommendations section on page 80.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

S-C) Health Indicators

American Community Survey Questions

All responses to these questions can be found in the Flood Resilience Scorecard Data Companion. If you do not have access to the Flood Resilience Scorecard Data Companion for your community, use the Data Instruction Manual to learn how to access the data.

S-C1. What is the percentage of persons without health insurance in your community?

(For reference: The Wisconsin state average in 2015 was 5.7%, according to the Wisconsin Council on Children and Families)

A. 0-4%

B. 4.1-6%

C. 6.1%-10%

D. Over 10%

Flood Resilience Scorecard Data Companion

S-C2. What is the percent of persons under 65 years with a disability?

(For reference: state average in 2015 was 7.4%, according to American Community Survey data)

A. 0-4%

B. 4.1-6%

C. 6.1%-10%

D. Over 10%

Flood Resilience Scorecard Data Companion

County Health Rankings

All responses to these questions can be found in the Flood Resilience Scorecard Data Companion. If you do not have access to the Flood Resilience Scorecard Data Companion for your community, use the Data Instruction Manual to learn how to access the data.

Keep in mind this data is at a broader scale than individual communities. If you have local knowledge, please supplement this analysis with it. Not all communities within one county may have the same conditions.

S-C3. What is the ratio of population to primary care physicians in your county?

A. 500 or fewer: 1
B. Between 501 and 1000: 1
C. Between 1001 and 3000: 1
D. Between 3001 and 6000: 1
E. Over 6000: 1
F. Missing data

S-C4. What is the ratio of population to mental health providers in your county?

A. 500 or fewer: 1
B. Between 501 and 1000: 1
C. Between 1001 and 3000: 1
D. Between 3001 and 6000: 1
E. More than 6000: 1
F. Missing data

S-C5. What is the number of hospital stays for ambulatory care sensitive conditions per 100,000 Medicare enrollees in your county?

A. Fewer than 4,000
B. Between 4,001 and 5,500
C. Between 5,501 and 7,000
D. More than 7,000
E. Missing data

Local Knowledge

For this section, because publicly accessible data may not be available, you should rely on local knowledge of health facilities within your community to determine these particular vulnerabilities, using either precise values or your best educated guess. An additional resource that may be helpful is the Centers for Disease Control and Prevention (CDC). Review the resources listed in the "Recommendations" section for more information.

S-C6. Are there hospitals or community medical facilities within your community?

A. Yes, there are several, and they are distributed well throughout the community

B. Yes, there are several, but some parts of the community may have trouble accessing them

C. There are one or two such facilities in our community, but they may have limited resources or accessibility

D. The community relies on medical facilities in another community entirely

S-C7. What is the average drive time to a hospital or a medical facility from the community's most populous residential areas?

A. The average resident is within walking distance of a medical facility

B. Medical facilities are within 10 minutes of driving or less for the average resident

C. Medical facilities are within 30 minutes of driving or less for the average resident

D. Medical facilities are more than 30 minutes for the average resident

S-C8. Are there assisted living facilities or nursing homes within your community?

A. Yes

B. No

S-C9. If yes, are assisted living facilities or nursing homes equipped with emergency supplies and generators to maintain care in the event of a flood?

A. Yes, the community funds ample food, potable water and generators so that care is not disrupted during flood events

B. Yes, facilities have access to some of these amenities, but through their own means of funding

C. We have not coordinated with these facilities or assessed their emergency supplies

D. No, facilities are lacking in either food, potable water, generators or multiple of these

Scoring Health Indicators

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c”, "d", "e" or "f" to five or more questions, please refer to the Health Indicators recommendations section on page 80.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

Number of “e” answers: _____

Number of “f” answers: _____

S-D) Community Partnerships

For this section, you should use local knowledge and experts to answer questions about community partnerships and collaborations with populations that may experience greater flood vulnerability.

S-D1. Are any culturally significant landmarks found within floodplain boundaries?

A. No, no such structures or landmarks are within floodplain boundaries

B. One such structure/landmark is within floodplain boundaries

C. Multiple culturally significant structures/landmarks are within floodplain boundaries

Does your community maintain regular committees/advisory groups that represent these groups?

Population	A. The community regularly meets with representatives from this population	B. The community does not meet with this population regularly, but we work closely with another group that does	C. This population is able to participate in standard public procedures	N/A: This group does not exist in our community
S-D2. African American community				
S-D3. Hmong community				
S-D4. Hispanic community				
S-D5. Native American/tribal community				
S-D6. Older adults (aged 65 and older)				
S-D7. Individuals with disability				

S-D8. Do you have neighborhood plans with flood-relevant information?

A. Yes, all neighborhoods have their own plans including development regulations and other flood-relevant information

B. Yes, some neighborhoods have plans with flood-relevant information

C. We have neighborhood plans but they do not have flood-relevant information

D. No, our community has one plan that is generalized for all neighborhoods to use

S-D9. Are all plans in your community (including emergency evacuation) made available in multiple languages?

A. Yes, plans are translated into all languages identified in our community

B. Yes, plans are translated into some, but not all of the languages identified in our community

C. No, plans are only available in English

S-D10. Does your community partner with local charities or nonprofits to support flood-damage victims?

A. Yes, we provide financial and technical support

B. Yes, but these partners are responsible for their own financial and technical needs

C. No, the community does not have local partners for flood recovery or support

S-D11. Has your community formally identified local shelters, schools or churches that can provide temporary housing for flood-damage victims?

A. Yes, we have formally identified multiple shelters that provide temporary housing for flood-damage victims and they are sited in areas of greatest need

B. Yes, we have formally identified one shelter, but it may or may not be sited in an area close to priority populations

C. We have not formally identified shelters, but we generally know what facilities can serve this purpose

D. No, there are no such shelters in our community

Scoring Community Partnerships

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c” or "d" to seven or more questions, please refer to the Community Partnerships recommendations section on page 80.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

S-E) Education & Outreach

For this section, you will use local knowledge about education and public outreach in your community. This information may be described in policies and plans or is known by staff members.

S-E1. Does your community have dedicated funding for water education or staff members whose duties include outreach and programming on water-related issues?

A. Yes, the community has dedicated staff responsible for water education and has secured funding for these efforts

B. No, the community has no permanent staff or funding, but it has temporary/seasonal positions dedicated to outreach and education or relies on regional or county scale programs

C. No, the community does not have any staff members responsible for water education

S-E2. Does your community have and publicize a list of contacts that the public can reach out to about water and stormwater questions?

A. The community both has and publicizes a list of contacts for public use

B. The community has a list of contacts, but it is not publicized

C. The community does not have a list of contacts for public use

S-E3. Does your community host any events/workshops to educate the public on stormwater issues or green infrastructure?

A. Yes, the community regularly hosts events that are well advertised for the public

B. Yes, the community has had events in the past

C. No, but the community publicizes events/workshops organized by other organizations

D. No, the community has not had such events

S-E4. Does your community host an annual water-focused community educational event, like a Lake Day or River Day, that incorporates flood information?

A. The community organizes, promotes and sponsors such an event each year

B. The community publicizes and supports efforts for such an event each year

C. The community had such an event, but it did not incorporate flood information

D. The community does not have such an event

S-E5. Does your community host public participation events at which members of the community can express their concerns about or desires for flood planning?

A. Yes, the community regularly hosts public participation events that include flood topics

B. Yes, the community occasionally hosts public participation events that include flood topics

C. Yes, the community hosts such events after a flood event has already occurred

D. No, we do not host public participation events related to flooding

S-E6. Has your community created any brochures, signs, posters, websites or videos to educate the public on stormwater issues?

A. Yes, the community has created multiple types of outreach materials and made them publicly available

B. Yes, the community has created some outreach materials and made them publicly available

C. No, but the community has outreach materials developed by another organization to suit this purpose

D. No, the community has no stormwater outreach materials for public use

S-E7. Has your community posted signs designating the boundaries of watersheds, floodplains or bodies of water on roadways, trails and public spaces?

A. The community has posted signs on all major streams, lakes and boundaries of watersheds and floodplains

B. The community has posted some signs of this nature

C. The community has no such signs

S-E8. Does your community distribute information to waterfront property owners about shoreline management and flood protection?

A. The community does not have any waterfront property owners

B. Yes, the community regularly reaches out to waterfront property owners to provide information on best practices

C. Yes, the community reaches out to waterfront property owners when they first move into their homes with some information

D. No, but there is information on our website that a resident could find if they sought it out

E. No, there is no information for waterfront property owners on our website or elsewhere

S-E9. Are Flood Insurance Rate Maps easily accessible to the public?

A. Yes, maps are available online and include a description of how they should be interpreted and understood

B. Yes, maps are available online but have no information as to how they should be interpreted and understood

C. Yes, maps are available, but only by request during business hours

D. No, maps are not easily accessible to the public

Scoring Education & Outreach

Review your responses to the questions in this section and sum the number of times you responded with each letter. Provide that number in the appropriate row to the right.

If you answered “c”, "d", "e", "f" to six or more questions, please refer to the Education & Outreach recommendations section on page 81.

Number of “a” answers: _____

Number of “b” answers: _____

Number of “c” answers: _____

Number of “d” answers: _____

Number of “e” answers: _____

Number of “f” answers: _____

Recommendations

In this section, you will find recommendations, resources and contacts to learn more about how to improve your community's resilience to flooding. Recommendations are grouped into the same sections as the guide itself. Keep in mind that you may benefit from recommendations in a variety of sections, not just those that you were suggested for you based on your scoring during the assessment. It may be valuable to review all or many suggestions below before choosing the best course of action. Please note that this list of recommendations is not exhaustive and does not represent the full spectrum of possibilities for your community.

Module 3: Social

Sociodemographic Characteristics

- Evaluate, using GIS, where priority populations are concentrated.
    - » Once such an evaluation is conducted, prioritize emergency supply and shelter locations to be sited near these populations.

Housing & Transportation

- Evaluate, using GIS, where priority populations are concentrated.
    - » Use this to inform where public transit stops need to exist and to prioritize emergency supply and shelter locations.
- Ensure that all new housing meets building standards beyond those required by state standards.
    - » For more information about building requirements, see the Uniform Dwelling Code for Wisconsin.

Health Indicators

- Provide educational materials to local public health officials.
    - » Provide these in all languages spoken by residents.
- Create an emergency plan for medical facilities and nursing homes to be in place before an emergency takes place.
- If possible, determine potential sites for new medical facilities closer to identified priority populations.
    - » If not possible, determine a location in which basic medical supplies can be stored in case of emergency.

Community Partnerships

- Create and publicize a list of community organizations that may provide assistance to their neighbors during and after flood events.
- Create an advisory committee representing priority populations.
    - » Allow this committee to review all flood-relevant community plans to ensure that their needs are met.
    - » Create neighborhood-scale evacuation and emergency action plans that are appropriate for these populations' needs.
    - » Determine a regular schedule to meet and reevaluate these plans or other flood-relevant needs this group may have.
    - » Advisory committee members can serve as points of contact for their neighborhoods to disseminate information.

Education & Outreach

To determine which groups may be important to engage with, and what messaging strategies could be useful, consult the CDC's Planning for an Emergency: Strategies for Identifying and Engaging At-Risk Groups.

- Designate at least one full-time staff member whose duties include water education.
    - » Hire an intern or provide college credit to a student to perform these duties.
- Publicize, both electronically and in printed copies, a list of contacts that the public can reach out to about stormwater related questions.
- Plan an annual water-focused community educational event to spread the word about how individuals can better plan for flooding.
- Create a communication plan to be used during hazardous events.
    - » The Wisconsin DHS also includes messaging guidance in their Flood Toolkit.
- Host public participation events to learn what questions and concerns exist in the community concerning flooding (these might be well attended following a storm event).
- Have open houses where your community's flood maps are available and residents can attend and receive professional guidance on how to interpret them.
- Participate in StormReady, a National Weather Service program to guide communities on how to communicate with their residents and strengthen safety programs.
- Create brochures, signs, posters, websites or videos to educate the public on stormwater issues.
    - » You may be able to adapt existing materials.

Education & Outreach (cont.)

- Post signs designating the boundaries of floodplains and watersheds to raise public awareness about hazard-prone areas and improve the connection between people and their watershed.
    - » You can find more information on these types of signage at the North American Lake Management Society website.
    - » The Wisconsin Department of Transportation regulations on informational watershed signage is available at their website.
- Work with local schools to build flood-relevant curricula and projects.
- Provide incentive programs for homeowners to install green infrastructure or to conduct stormwater runoff audits.
    - » Consider identifying one neighborhood as a pilot community before creating a municipal-wide project.
- Redesign your municipal website to be public friendly, with clear and obvious links to flood-relevant resources, incentive programs, flood hazard maps and water resource management plans.

Funding Resources

Federal

Federal Emergency Management Agency (FEMA)

Hazard Mitigation Assistance Grants: Provides funding for eligible mitigation measures that reduce disaster losses.

Flood Mitigation Assistance Grants: Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program.

Building Resilient Infrastructure And Community (BRIC): Support states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards.

Department of Housing and Urban Development (HUD)

Community Development Block Grants (CDBG): Provides grants to states, cities, and counties to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons.

National Park Service (NPS)

Land and Water Conservation Fund: This grant program helps urban communities address outdoor recreation deficits by supporting projects in cities and urbanized areas that create new outdoor recreation spaces, reinvigorate already existing parks, and form connections between people and the outdoors.

Rivers, Trails And Conservation Assistance Program: Partners with community groups, nonprofits, tribes, and state and local governments to design trails and parks, conserve and improve access to rivers, protect special places, and create recreation opportunities.

Department of Agriculture (USDA)

Community Facilities Direct Loan & Grant Program: Provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area.

Water And Waste Disposal Loan And Grant Program: Provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.

Conservation Innovation Grants (CIG): Supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations.

Special Evaluation Assistance For Rural Communities And Households (SEARCH): Helps very small, financially distressed rural communities with predevelopment feasibility studies, design and technical assistance on proposed water and waste disposal projects.

Environmental Protection Agency (EPA)

Recreation Economy For Rural Communities: Planning assistance program to help communities develop strategies and an action plan to revitalize their Main Streets through outdoor recreation.

Urban Waters Small Grants Program: Help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization.

Greening America's Communities: Help cities and towns develop an implementable vision of environmentally friendly neighborhoods that incorporate innovative green infrastructure and other sustainable design strategies.

Environmental Justice Collaborative Problem-Solving Cooperative Agreement Program: Provides financial assistance to eligible organizations working on or planning to work on projects to address local environmental and/or public health issues in their communities.

Economic Development Administration (EDA)

Public Works And Economic Adjustment Assistance Program: Support work in Opportunity Zones by leading to the creation and retention of jobs and increased private investment, advancing innovation, enhancing the manufacturing capacities of regions, providing workforce development opportunities, and growing ecosystems that attract foreign direct investment.

Fish and Wildlife Service

North American Wetlands Standard/Small Grant: Supports public-private partnerships carrying out projects in the United States that further the goals of the North American Wetlands Conservation Act. These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats for the benefit of all wetlands-associated migratory birds.

National Urban And Community Forestry Challenge Cost-Share Grant Program: Supports critical management of existing and future urban and community forests to promote disaster risk reduction and community resilience and better prepare communities for the increasingly destructive impacts of climate change.

State

Municipal Flood Control Grant Program (DNR): Assists cities, villages, towns and metropolitan sewerage districts concerned with municipal flood control management.

Clean Water Fund Program (DNR): Provides affordable financial assistance to municipalities for publicly-owned wastewater and water-quality-related storm water infrastructure projects that are needed to achieve or maintain compliance with federal and state regulations.

Safe Drinking Water Loan Program (DNR): provides affordable financial assistance to municipalities for publicly-owned drinking water infrastructure projects that are needed to protect public health and achieve or maintain compliance with federal and state regulations relating to water supply.

Urban Forestry Grants (DNR): Provides regular, startup, or catastrophic storm grants that support the creation or further development of urban forestry programs and help recover from storms.

Producer-Led Watershed Protection Grants (DATCP): Provides funding to producer-led groups that focus on nonpoint source pollution abatement activities.

Cited Resources

Agency for Healthcare Research and Quality. (2001). Guide to Prevention Quality Indicators: Vol. No. 02-R02. https://doi.org/10.1136/bmj.4.5941.418-a

Arendt, R. (1992). “Open Space” Zoning: What it is and Why it Works. Planning Commisioners Journal, 5, 4–8. http://plannersweb.com/wp-content/uploads/2012/08/590.pdf

Brantly, S. (2013). Rotational Grazing. Natural Resources Conservation Service Kentucky. https://www.nrcs.usda.gov//wps/portal/nrcs/detail/ky/newsroom/factsheets/?cid=stelprdb1101721

Burt, C. C. (2019). A Summary of U.S. State Historical Precipitation Extremes. Weather Underground. https://www.wunderground.com/cat6/Summary-US-State-Historical-Precipitation-Extremes

Department of Agriculture. (2020). Farm and Ranch Lands Protection Program. In Federal Code of Regulations. https://www.ecfr.gov/cgi-bin/text-idx?node=pt7.10.1491&rgn=div5#se7.10.1491_13

Department of Homeland Security. (2020). Critical Infrastructure. Department of Health Services - Science and Technology. https://www.dhs.gov/science-and-technology/critical-infrastructure

Du, W., Fitzgerald, G. J., Clark, M., & Hou, X. Y. (2010). Health impacts of floods. Prehospital and Disaster Medicine, 25(3), 265–272. https://doi.org/10.1017/S1049023X00008141

Federal Emergency Management Agency. (2018). Wisconsin: Major Disaster Declaration (Vol. 83, Issue 2018). https://www.wpr.org/wisconsin-storm-damage-tops-233m#:~:text=Published%3A,18%2C 2018%2C 12%3A30pm

FEMA. (2020a). Base Flood Elevation. FEMA. https://www.fema.gov/node/404233#:~:text=The elevation of surface water,level in any given year.

FEMA. (2020b). Flood Insurance Rate Maps. https://www.fema.gov/glossary/flood-insurance-rate-map-firm

French, C.E.., Waite. T.D., Armstrong, B., Rubin, G.J., Beck, C., Oliver, I., Impact of repeat flooding on mental health and health-related quality of life: a cross-sectional analysis of the English National Study of Flooding and Health BMJ Open 2019;9:e031562. doi: 10.1136/bmjopen-2019-031562

Greenough, G., McGeehin, M., Bernard, S. M., Trtanj, J., Riad, J., & Engelberg, D. (2001). The potential impacts of climate variability and change on health impacts of extreme weather events in the United States. Environmental Health Perspectives, 109(suppl 2), 191–198. https://doi.org/10.1289/ehp.109-1240666

Kirwan, H., & The Associated Press. (2018, September 18). Wisconsin Storm Damage Tops $223M.pdf. Wisconsin Public Radio, 3. https://www.wpr.org/wisconsin-storm-damage-tops-233m#:~:text=Published%3A,18%2C 2018%2C 12%3A30pm

Missouri Department of Elementary and Secondary Education. (2008). Soils Interpretation Help Sheet. https://dese.mo.gov/sites/default/files/ffa-ag-soils-interpretation_11.pdf

Munro, A., Kovats, R.S., Rubin,G.J., Waite, T.D., Bone, A., Armstrong, B., Beck, C.R., Amlôt, R., Leonardi, G., Oliver, I., Effect of evacuation and displacement on the association between flooding and mental health outcomes: a cross-sectional analysis of UK survey data, The Lancet Planetary Health, Volume 1, Issue 4, 2017,Pages e134-e141, ISSN 2542-5196, https://doi.org/10.1016/S2542-5196(17)30047-5.

National Oceanic and Atmospheric Administration. (2010). August Daily Normals For The Period 1981-2010, Madison, Wisconsin. Unique Local Climate Data. https://www.weather.gov/media/mkx/climate/msn-aug-norm.pdf

National Weather Service. (n.d.). Ice Jams and Flooding. National Weather Service. https://www.weather.gov/media/dmx/Hydro/DMX_InfoSht_IceJamsAndFlooding.pdf

North Carolina Forest Service. (2006). Appx 13 - Glossary of Select Terms (pp. 275–277). North Carolina Forest Service. gov/publications/WQ0107/BMP_cover_TOC_Howto

North Carolina State Extension. (2017). Agricultural Riparian Buffers. NC State Extension. https://content.ces.ncsu.edu/agricultural-riparian-buffers

Organisation for Economic Co-Operation and Development. (2013). Handbook on Constructing Composite Indicators: Methodolgy and User Guide. In Journal of the American Geriatrics Society. Secretary-General OECD. https://www.oecd.org/sdd/42495745.pdf

PD&R Edge. (2014, September). Rental Burdens: Rethinking Affordability Measures. PD&R Edge, 1–5. https://www.huduser.gov/portal/pdredge/pdr_edge_featd_article_092214.html

Soil Science Society of America. (2008). Alphabetical List of Soil Terms A-Z. Glossary of Soil Science Terms pp. 1-75.

Southeastern Wisconsin Regional Planning Commission. (2000). Environmental Corridors. https://www.sewrpc.org/SEWRPC/LandUse/EnvironmentalCorridors.htm

Wisconsin State Statutes, Pub. L. No. 23.32 (1) (2019). https://docs.legis.wisconsin.gov/statutes/statutes/23/32/1

The Pew Charitable Trusts. (2019). Federally Funded Infrastructure Must Be Flood Ready (Issue April).

United States Geological Survey. (2020). Land Subsidence. USGS: Water Resources. https://www.usgs.gov/mission-areas/water-resources/science/land-subsidence?qt-science_center_objects=0#qt-science_center_objects

University of Wisconsin. (1995). What Is A Farm Nutrient Management Plan? http://corn.agronomy.wisc.edu/Management/pdfs/L025_What_is_NMP.pdf

US EPA. (2020). Combined Sewer Overflows. National Pollutant Discharge Elimination System (NPDES). https://www.epa.gov/npdes/combined-sewer-overflows-csos

Waite, T.D., Chaintarli, K., Beck, C.R., Bone, A., Amlot, R., Kovats, S., Reacher, M., Armstrong, B., Leonardi, G., Rubin, G.J., Oliver, I., The English national cohort study of flooding and health: cross-sectional analysis of mental health outcomes at year one. BMC Public Health 17, 129 (2017). https://doi.org/10.1186/s12889-016-4000-2

Weiss, D. J., & Weidman, J. (2013). Disastrous Spending : Federal Disaster-Relief Expenditures Rise amid More Extreme Weather. 10. https://www.americanprogress.org/wp-content/uploads/2013/04/WeissDisasterSpending-1.pdf

Wisconsin Department of Natural Resources. (n.d.). Floodplain Development Basics. Wisconsin Department of Natural Resources.

Wisconsin Department of Natural Resources. (2020). Wisconsin DNR River Facts and Resources. River Facts and Resources. https://dnr.wisconsin.gov/topic/Rivers/FactsResources.html

Wisconsin Emergency Management, & State of Wisconsin Homeland Security Council. (2017). 2016 THIRA & SPR. In State of Wisconsin (Issue January). https://doi.org/10.1002/9780470925805.ch3

Wisconsin Initiative on Climate Change Impacts. (2020). Report to the Governor ' s Task Force on Climate Change: Strategies to Improve Wisconsin's Climate Resilience and Readiness. https://wicci.wisc.edu/wp-content/uploads/wicci-report-to-governors-task-force.pdf