

5.1 Plan Requirements

“The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs Local Mitigation Plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a Local Mitigation Plan lead to and support the mitigation strategy. The mitigation strategy includes the development of goals and prioritized hazard mitigation actions. Goals are long-term policy statements and global visions that support the mitigation strategy. A critical step in the development of specific hazard mitigation actions and projects is assessing the community’s existing authorities, policies, programs, and resources and its capability to use or modify local tools to reduce losses and vulnerability from profiled hazards.

In the plan update, goals and actions are either reaffirmed or updated based on current conditions, including the completion of hazard mitigation initiatives, an updated or new risk assessment, or changes in State or local priorities.”¹

Requirement	Description
44CFR 201.6 (c)(3)	[The plan shall include the following:] A mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
44CFR 201.6 (c)(3)(i)	[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
44CFR 201.6 (c)(3)(ii)	[The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction’s participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
44CFR 201.6 (c)(3)(ii)	[The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
44CFR 201.6 (c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
44CFR 201.6 (c)(4)(ii)	[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.

5.2 Capability Assessment

Dane County has the regulatory authority and non-regulatory capability to implement the mitigation strategy identified in this plan. Wisconsin counties are general purpose units of local government and

¹ FEMA, *Local Mitigation Plan Review Guide*, October 1, 2011

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administrative arms of the state. Dane County provides services through 2,300 elected and civil service employees. Dane County is governed by a county executive and a county board of supervisors. As the policy-making body of county government, the Board of Supervisors enacts county ordinances, levies taxes, and appropriates money for services. The County Executive is a chief executive officer of the county, directing the activities of 18 departments. The Department of Emergency Management is the lead agency on this plan development and implementation. The Department has a staff of nine, with the department head appointed by the County Executive.

Dane County's 2017 budget authorizes \$587.1 million in expenditures for operations, which is financed by \$357.2 million of program revenues, \$57.1 million of county sales taxes, and \$169.9 million of county property tax levy funds. The separate Capital Budget is \$50.6 million, which is financed by borrowing proceeds.

5.2.1 Regulatory Authority

Regulatory tools include floodplain and shoreland zoning ordinances and a comprehensive erosion control and stormwater management ordinance. Local governments within the county have similar authorities and ordinances. County and local shoreland and floodplain zoning authorities are determined by state statute. Through the Lakes and Watershed Commission, Dane County has unique authority to establish standards for local regulations and ordinances to protect water resources that apply within cities and villages as well as the unincorporated areas of the County. For example, the provisions of the County erosion control and stormwater management ordinance apply to the entire geographical area of Dane County. In addition, many communities have established local stormwater utilities to set standards for design and maintenance of facilities.

Additionally, the Land Suitability section of the County's Land Division and Subdivision Regulations gives the Zoning and Natural Resources Team of the County Board the authority to restrict division or subdivision of land that is unsuitable for development due to flooding or potential flooding, soil limitations, inadequate drainage, or other conditions likely to be harmful to the health, safety or welfare of future residents or users of the area, or harmful to the community or the County.

County ordinances relevant to natural hazards management include:

- Chapter 11 of the Dane County Code of Ordinances is the County's Shoreland, Shoreland-Wetland and Inland-Wetland ordinance
- Chapter 14 is Dane County's Manure Management, Erosion Control, and Stormwater Management ordinance
- Chapter 17 is Dane County's Floodplain Zoning Ordinance
- Chapter 75 is the County's Land Division and Subdivision ordinance.

Note: Building codes are established by the State of Wisconsin, through Wisconsin Administrative Code and the Wisconsin Department of Safety and Professional Services (SPS). The Uniform Dwelling Code is contained in SPS 320-325. Commercial Building Codes are described in SPS 361-366.

5.2.2 Non-Regulatory Actions

Managing natural hazards risk also involves a wide range of non-regulatory actions. Dane County has the long-standing partnerships with stakeholders necessary to implement every step in this process, from data collection and assessment to implementation. The County has well-established relationships with citizens, local governments and elected officials, the National Weather Service, climate scientists and researchers, local meteorologists, builders, realtors, economic development organizations, and numerous watershed associations friends groups and other natural resources groups that are acting to protect and improve water resources in Dane County.

5.3 Natural Hazard Mitigation Goals and Objectives

Dane County's hazard mitigation planning team prepared the goals, objectives and mitigation strategies included in this plan. The countywide planning team made up of county staff and all 37 participating jurisdictions also had input in the process of developing these strategies. The goals and mitigation actions were developed based on the experience of team and staff members, presentations and discussions about the natural hazards that impact the County, information from the risk assessment, and review and discussion of previous mitigation planning and activities. The goals in this plan are also consistent with statewide goals identified in the *State of Wisconsin Hazard Mitigation Plan*.

5.3.1 Mitigation Strategy

There are some basic themes that make up the County's strategy to mitigate the natural hazards risks identified in this plan. These concepts are integrated into the goals, policies, and objectives described in this section. The County's mitigation strategy was reviewed, but not changed in this plan update. Principles that make up the County's basic mitigation strategy are:

- *County government should work toward a sustainable future where loss of life, personal injury, and property damage caused by natural hazards are not made worse by unwise or short-term decision-making.*
- *County government should employ regulatory and non-regulatory actions in a comprehensive and balanced approach to reducing natural hazards risks.*
- *Government at all levels, businesses, community service agencies, and residents all have a stake in reducing our vulnerability to natural hazards. This effort can only be successful if these groups work together toward this common goal.*

5.3.2 Mitigation Goals

The following six goals provide the direction for reducing future hazard-related losses within Dane County. The County's mitigation strategy was reviewed and one additional goal (#6) was added to the goals identified in the previous version of the plan. The goals are listed below:

1. Minimize human, economic, and environmental disruption from natural hazards.

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2. Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.
3. Encourage hazard mitigation planning and incorporate that planning into other related plans.
4. Facilitate and coordinate solutions to multi-jurisdictional issues that involve government, citizens, stakeholders, and policy-makers at all levels.
5. Improve the disaster resilience of existing buildings, structures, critical facilities, as well as infrastructure whether new construction, expansion, or renovation.
6. Utilize existing science and technology to better understand and address changing risk to natural hazards in a changing climate.

5.3.3 Mitigation Objectives

Table 5.3.1 on the next pages describes the recommended mitigation objectives identified by the planning team. The table is organized in accordance with the Goals listed in the previous section. The objectives are sorted first by the primary hazard they are intended to address and second by priority. The table also identifies a lead agency for each objective and provides the status of actions that are either new or are carried over from the 2010 version of the plan. Each objective is also accompanied by a brief narrative of the rationale behind the objective. This is also the tie-in to the risk assessment for each hazard.

Additional detail on these alternatives are described in *Section 5.4 Mitigation Alternatives* which follows the table of objectives. Progress on mitigation actions identified in previous versions of the plan are described in Section 5.5, beginning on page 5-42.

Prioritization Considerations

The objectives recommended above were initially prioritized by the planning team and by County staff in accordance with input that has been received throughout the planning process. Hazard characteristics, the vulnerability analysis, the hazard ranking, and personal experience as well as several criteria guided the prioritization of the objectives. Criteria considered in the prioritization included:

- Objective requires no more technology or technical expertise than what is currently available.
- Objective requires no more staff or governmental resources than what is already available.
- Objective is expected to have wide political support.
- Objective can be legally implemented by the lead jurisdiction or agency.
- Objective is cost-effective. There is no other effective, cheaper alternative, and there is no other objective that pursues the same specific result.
- Objective makes progress toward sustainability in mitigating impacts of natural hazards.
- Objective makes significant progress toward mitigating natural hazards.
- Objective considers the cost of taking no action.
- Objective correlates with vulnerability analysis and problem statements.

These objectives were also discussed during the public meetings held in 2016 and 2017.

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Table 5.3.1

Goal 1: Minimize human, economic, and environmental disruption from natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
1	Support the WDNR hazard classification of dams in the County.	N/A	Dam Failure	As of the 2010 version of the plan, there were a number of dams in Dane County that were not classified. The dam classification has been completed.	Completed
2	Encourage the use of road materials and designs that are more resilient to temperature and precipitation extremes.	Moderate	Extreme Heat	Dane County Public Works, Highway and Transportation. Action is needed to reduce bucking of roadways in periods of extreme heat.	New
3	Consider tree coverage requirements for new subdivisions, parking lots, and other developments.	Moderate	Extreme Heat	Dane County Tree Board/ Shade trees can help mitigate the urban heat island effect during periods of extreme heat.	New
4	Support and maintain heat and cold shelter network throughout County.	Moderate	Extreme Cold Extreme Heat	Dane County Human Services/ Cooling and warming centers are essential tools in mitigating vulnerability reducing mortality during periods of extreme heat or cold.	New
5	Continue to implement sound floodplain management practices through continued compliance with the National Flood Insurance Program, to include floodplain ordinance enforcement and periodic review, promoting the benefits of flood insurance, and continued staff training and development in floodplain management. Continue to enforce the SI/SD requirements after a flood.	High	Flood	Dane County Planning and Development This is a continuous, on-going activity. The County recognizes the importance of the availability of flood insurance to its citizens. Dane County will make every effort to remain in good standing with the NFIP.	Continuing
6	Inventory public and private wells in the floodplain.	High	Flood	Public Health, Madison and Dane County/ Drinking water wells are vulnerable to contamination during and after floods. A comprehensive database of sites with potential for contamination is not currently available. Developing this data would provide a baseline starting point to better understand this risk.	New

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Goal 1: Minimize human, economic, and environmental disruption from natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
7	Identify, conserve, restore, and utilize land of potential flood mitigation value. Lands of potential flood mitigation value are wetlands, floodplain corridors, upland storage, internally drained basins, and areas of high infiltration potential.	High	Flood	Dane County Land and Water Resources and Dane County Planning and Development/ This is part of on-going effort. Preserving floodplains, wetlands, and natural water storage areas helps maintain existing stormwater storage capacities. This is an important step in assuring that existing run off problems do not worsen.	Continuing
8	Identify and map areas in the County that have potential flood mitigation value.	High	Flood	Dane County Land and Water Resources and Dane County Planning and Development/ This is part of on-going effort to identify, conserve, and restore land of potential flood mitigation value, such as wetlands, floodplain corridors, upland storage areas, internally drained areas, and areas of high infiltration value.	Continuing
9	Establish flood mitigation as a criterion for land acquisition and environmental restoration where it would aid in the achievement of flood-reduction goals and conserve and restore land that meets the criteria.	High	Flood	Dane County Land and Water Resources/ This is an on-going, continuous effort and the County routinely purchases land for this purpose. Most recently, Dane County reached an agreement to purchase 130 acres in the Town of Westport in the floodplain of the Yahara River.	Continuing
10	Facilitate programs that encourage stormwater volume control to reduce flow into storage areas.	High	Flood	Dane County Lakes and Watershed Commission and the Capital Area Regional Planning Commission established a Stormwater Technical Advisory Team to evaluate the County's stormwater management strategies and make recommendations regarding flood risk reduction.	Continuing

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Goal 1: Minimize human, economic, and environmental disruption from natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
11	Facilitate programs to maintain drainage channels to decrease storm flooding.	High	Flood	Dane County Public Works, Highway and Transportation/Dane County Land and Water Resources/ Undersized channels, siltation, and debris in streams and ditches is often cited as a significant contributor to localized flood problems. This is an on-going effort. Dane County recently implemented a capital improvement project to upgrade culverts along County highways to increase conveyance.	Continuing
12	Further refine the County's flood risk assessment to include an analysis of cost savings from implementation of floodplain management.	Moderate	Flood	Departments of Emergency Management and Planning and Development/ As indicated in the 2008 flood damage assessment, additional information is needed to fully understand where flood damages occur and the extent to which those losses can be prevented.	Continuing
13	Develop an education program for highway and town workers to identify and encourage native plants and to identify and eradicate noxious, invasive species.	High	Invasive Species	Dane County Public Works, Highway and Transportation/ There is a growing awareness that certain invasive species, such as wild parsnip, can pose a significant risk to unsuspecting workers and others exposed to the plant. This is one step in the process to address this problem.	New
14	Develop an inventory and monitoring system for invasive vegetation control. Consider a citizen monitoring system utilizing digital technologies, such as a mobile application, for identifying and reporting invasive species patches.	Moderate	Invasive Species	Dane County Public Works, Highway and Transportation/ There is a growing awareness that certain invasive species, such as wild parsnip, can pose a significant risk to unsuspecting workers and others exposed to the plant. This is one step in the process to address this problem.	New

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Goal 1: Minimize human, economic, and environmental disruption from natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
15	Explore existing invasive species targeting and best management practices and develop a public outreach campaign around these techniques.	Moderate	Invasive Species	Dane County Highway and Transportation/ There is a growing awareness that certain invasive species, such as wild parsnip, can pose a significant risk to unsuspecting workers and others exposed to the plant. This is one step in the process to address this problem.	New
16	Adopt a lobbying position for increased ability to modify building codes to protect lives and property from changing risk of natural hazards. This includes ability to exceed state uniform building codes in areas of elevated risk.	Moderate	Multi-hazard	Dane County Executive’s Office/ There are numerous, low-cost construction methods that would reduce risk if implemented. The State of Wisconsin administers building codes; County and local governments have little authority if code changes are needed.	New – Created from merging several 2010 objectives
17	Encourage local units of government within the County to employ hazard mitigation concepts when forming, reviewing, and updating local ordinances. Create local understanding of changing levels of vulnerability and risk due to climate change.	Moderate	Multi-hazard	Dane County Emergency Management/ The County can assist local governments in managing natural hazards in a variety of ways. Local ordinances can be used to reduce vulnerability. While the County has little or no direct authority in these areas, the County can encourage local governments to employ mitigation concepts when forming, reviewing, and updating local ordinances.	Continuing
18	Broaden existing partnerships with community support groups and service providers to better prepare for and respond to the needs of vulnerable populations in a disaster.	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Human Services/ Partnerships are essential to achieve the goals of this plan. Many partnerships between the County and community support groups already exist. Disaster planning is an area where County coordination could greatly benefit clients to reduce their overall vulnerability to natural hazards. This is part of an on-going, continuous effort.	Continuing

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Goal 1: Minimize human, economic, and environmental disruption from natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
19	If not already in place, encourage local governments to require that mobile home parks have storm shelters with enough capacity to adequately protect all residents of the development.	High	Tornado Wind	Dane County Emergency Management/ Manufactured homes are particularly vulnerable to damage from high wind and tornadoes, leading to a disproportionate number of residents that are injured or killed. Internal safe rooms can reduce injury and loss of life. Community storm shelters are a cost effective means of protecting residents of mobile home parks.	Continuing
20	Decrease the vulnerability of County park users to natural hazards through education and better shelter design. Assist local governments in applying for pre-disaster mitigation funds to construct storm shelters in vulnerable public facilities, such as parks and fairgrounds, and in mobile home parks.	High	Tornado Wind	Dane County Emergency Management/ Areas where large numbers of people gather outside are particularly vulnerable to tornadoes.	Continuing
21	Assist eligible manufactured home owners, not within mobile home parks, by applying for federal hazard mitigation grant funds as they become available to retrofit homes with a safe room.	Moderate	Tornado Wind	Dane County Emergency Management/ Manufactured homes are particularly vulnerable to damage from high wind and tornadoes, leading to a disproportionate number of residents that are injured or killed. Internal safe rooms can reduce injury and loss of life.	Continuing
22	Encourage local governments to provide adequate tornado shelters for employees and members of the public who may be present at their facilities.	Low	Tornado Wind	Dane County Emergency Management/ Tornado shelters are essential for life-safety.	Continuing
23	Assess and document the current state of tornado shelters at businesses. Facilitate the provision of technical assistance and incentives, when available, for business owners to provide adequate tornado shelter for employees, customers, and members of the public present at their facilities.	Moderate	Tornado Wind	Dane County Emergency Management/ The Department is routinely requested to make assessments and recommendations regarding shelter locations within buildings. This recommendation is to create a systematic program to address these issues.	Continuing with New Aspect

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Item	Mitigation Objective Title	Priority	Primary Hazard	Lead Agency/ Background Information	Plan Update Status
24	Support the bulk purchase of weather alert radios for at-cost redistribution to local residents.	Moderate	Tornado	Dane County partnered with local jurisdictions over a five year period to make weather radios available, at-cost to residents of Dane County. Over 18,000 weather radios were provided to people during this time period.	Completed
25	Where feasible, retrofit existing or install new structures in County-owned buildings to ensure adequate shelter from tornadoes.	Low	Tornado Wind	Dane County Emergency Management/ Tornado shelters are essential for life-safety.	Continuing
26	Encourage and, where necessary, install natural barriers beside highways and other roads, and re-grade roadsides to decrease snow on roads focusing on residential developments with limited road access. Especially consider new projects and road rebuilding projects.	Low	Winter Storm	Dane County Public Works, Highway and Transportation/ Focus on rural areas with limited road access. Snow blowing and drifting over roads is a significant hazard that can be effectively managed through road design and planning of natural barriers as snow fences. The recommended actions are typically incorporated into highway design considerations when rebuilding or improving roadways.	Continuing
27	Continue to enhance anti-icing practices for roads within Dane County.	Moderate	Winter Storm	Dane County Public Works, Highway and Transportation/ Effective de-icing of roadways is a direct means of reducing the impact of winter storms on travelers in the County.	New

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Goal 2: Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
1	Work with stormwater utilities to create public outreach campaign to educate public on benefits of stormwater volume control techniques and water conservation. Highlight property owner opportunities to contribute to increased volume control such as rain gardens and rain barrels or cisterns.	High	Flood	Dane County Emergency Management and Dane County Lakes and Watershed Commission Partnerships are essential to the success of this plan. Many local stormwater utilities already promote private homeowner actions to reduce stormwater volume control and water conservation. This objective builds on those activities.	New
2	Create a dry basements program for eligible housing to mitigate the risk of harmful mold outbreaks.	High	Flood	Public Health, Madison and Dane County and Dane County Emergency Management/ Mold growth in basements after a flood event can lead to on-going health concerns long after the flood waters have receded. This is particularly problematic in low income areas where residents may lack the resources to effectively clean-up basements and take the necessary action to prevent the problem from recurring.	New
3	Improve citizen and local elected officials understanding of floodplain maps, floodplain regulations, flood proofing options, development and stormwater management considerations, and other information to assist in good decision-making.	Moderate	Flood	Dane County Emergency Management and Dane County Planning and Development/ Factors leading to increasing flood risk are complex and are not readily understood by significant numbers of people. Improved tools are needed for informing people of the risks and options available for reducing or eliminating that risk. This is an on-going effort.	Continuing

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Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
4	Develop and use a flood risk map based on hydric soils, wetlands, and areas of past damage. Consider incorporating a buffer area of 1 foot in elevation above the mapped 100-year floodplain on FIRM maps as an advisory tool. Use the map as an educational tool, and also share with real estate agents and local units of government. Utilize FEMA's Risk Map concept as a model.	Moderate	Flood	Dane County Emergency Management and Dane County Planning and Development/ Factors leading to increasing flood risk are complex and are not readily understood by significant numbers of people. This is particularly true of FIRMs. Improved tools are needed for informing people of the risks and options available for reducing or eliminating that risk. This would also be a means to illustrate changing flood risk in light of climate change, with a focus on education rather than regulation.	Continuing
5	Create and distribute educational materials for landlords and residents regarding negative long-term health effects and options for addressing damp and moldy conditions following a flood event.	Moderate	Flood	Public Health, Madison and Dane County and Dane County Emergency Management/ Mold growth in basements after a flood event can lead to on-going health concerns long after the flood waters have receded. This is particularly problematic in low income areas where residents may lack the resources to effectively clean-up basements and take the necessary action to prevent the problem from recurring.	New

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Goal 2: Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
6	Provide an opportunity for homeowners to take advantage of state and federal flood mitigation funding to decrease their risk to flooding.	Moderate	Flood	Dane County Emergency Management/ There are a variety of protective measures available to homeowners. All of these options have advantages and disadvantages that have to be weighed against the risks and cost of undertaking the effort. The property owner would normally implement these protective measures, although in many cases, government agencies can provide technical and financial assistance. Dane County's role in this process is as a facilitating and coordinating entity. The County can assist in identifying and prioritizing structures at risk, recommending appropriate protective actions, identifying potential funding sources, and coordinating grant applications.	Continuing
7	Facilitate the use of existing tools and develop new educational tools to inform local officials, developers, property owners, and other stakeholders about preventing, mitigating, and responding to floods; taking advantage of flood events as an opportunity to get the word out.	Low	Flood	Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project. Information and education, pilot projects, and incentives are all tools that can be used to encourage homeowners to choose methods that will provide future resistance to the effects of flooding. People are often most receptive to making these changes immediately following an event, particularly one that causes damage in the immediate area.	Continuing
8	Compile and disseminate mitigation information to help citizens decrease their vulnerability to natural hazards.	High	Multi-hazard	Dane County Emergency Management/ There are many state and federal assistance programs available to help property owners become more resistant to the effects of natural hazards.	Continuing

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Goal 2: Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
9	Create a web-based resiliency guide for citizens to better understand their vulnerabilities and personal actions that can be taken by the property owner to reduce risk. Include flood zone maps, climate change information, and mitigation strategies by hazard.	High	Multi-hazard	Dane County Emergency Management/ Factors leading to increasing natural hazards risk are complex and are not readily understood by significant numbers of people. Improved tools are needed for informing people of the risks and options available for reducing or eliminating that risk. This would also be a means to illustrate changing risk in light of climate change, with a focus on education rather than regulation.	New
10	Work with partners to develop and publicize an information clearinghouse on sustainable and disaster resistant construction methods and local resources and use it in a public outreach campaign to encourage property owners to consider hazard mitigation and sustainability when building or remodeling. This should be included on resilience web-based publication.	Moderate	Multi-hazard	Dane County Emergency Management/ Partnerships are essential to achieve the goals of this plan. Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project. Partnerships with designers, contractors, and suppliers can provide information to homeowners at key points when they are making decisions regarding selection of materials and construction methods. Information and education, pilot projects, and incentives are all tools that can be used to encourage homeowners to choose methods that will provide future resistance to the effects of natural hazards.	Continuing
11	Work with partners to provide technical assistance to private property owners for planting, pruning, maintaining, removing, and replacing trees. Also include information on tree care, debris clean up, recognizing and dealing with hazardous trees.	Moderate	Multi-hazard	Dane County Tree Board/ Falling trees and tree limbs are a major source of debris that must be cleaned up after a storm and also a major cause of downed power lines and power outages. Proper care of trees on private property could reduce this problem.	Continuing

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Goal 2: Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
12	Provide information on sources of funding and technical assistance to help individuals take actions to decrease their vulnerability to all natural hazards.	Moderate	Multi-hazard	Dane County Emergency Management/ There are many programs available to help property owners become more resistant to the effects of natural hazards. These programs can only be effective if people know about them.	Continuing
13	Sponsor public education workshop demonstrating mitigation actions people can take on their own property to become more resilient.	Moderate	Multi-hazard	Dane County Emergency Management/ Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project. Partnerships with designers, contractors, and suppliers can provide information to homeowners at key points when they are making decisions regarding selection of materials and construction methods. Information and education, pilot projects, and incentives are all tools that can be used to encourage homeowners to choose methods that will provide future resistance to the effects of natural hazards.	Continuing
14	Work with partners to encourage agricultural producers to plan for power outages and install back-up power generation.	Low	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Agricultural operations and dairies are particularly vulnerable to losses in a sustained power outage. Renewable energy sources such as photo-voltaic cells would further reduce the vulnerability.	Continuing
15	Publish and distribute a continuity of operations guide to critical facilities and businesses. Guide should outline potential natural hazard impacts and associated mitigation strategies that can aid in minimizing or preventing downtime during a natural disaster.	Low	Multi-hazard	Dane County Emergency Management/ Effective response plans can minimize business down-time after an event occurs.	New

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Goal 2: Educate and encourage property owners to take action to decrease their vulnerability to the impacts of natural hazards.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
16	Educate building professionals on the importance of wind-mitigation techniques.	Low	Tornado Wind	Dane County Emergency Management/ There are simple, cost effective techniques available for reducing damages caused by tornados and high winds. The County does not have jurisdiction over building codes, so these actions are best achieved through education and partnership with builders.	New
17	Monitor mosquito and tick populations and develop vector breeding habitat control model ordinance. Develop public education materials regarding mosquito control techniques.	High	Vector-borne Illness	Public Health, Madison and Dane County/ Public understanding and control of breeding habitats is an effective means of minimizing mosquito and tick populations and reducing the incidence of transmitted illnesses.	New

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Goal 3: Encourage hazard mitigation planning and incorporate that planning into other related plans.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
1	Support and expand the Municipal, County and Citizen Water Quality Monitoring System.	High	Algal Blooms	Public Health, Madison and Dane County/ Public Health Madison and Dane County (PHMDC) maintains a routine surveillance and sampling schedule of area lakes, streams, primary and secondary outfalls, and point and non-point source run-off to ground surface, wetlands, and surface waters. Monitoring is essential as water conditions change quickly and testing results do not always represent the current conditions of the water quality. This is an on-going effort.	New
2	Support the watershed adaptive management program Yahara WINS to reduce nutrient loading in the Yahara watershed from non-point source pollution sources.	High	Algal Blooms	Harmful algal blooms are a consequence of the interplay of a range contributing water quality factors. Yahara WINS is a partnership program led by Madison Metropolitan Sewerage District intended to reduce phosphorous loads. The efforts of the Yahara WINS partnership can have an impact in reducing the incidence of algal blooms and other water quality related hazards.	New
3	Develop a County drought plan that takes into consideration meteorological, hydrological, agricultural, and socioeconomic drought.	High	Drought	Dane County Planning and Development/ The impacts and vulnerability to drought in Dane County are highly complex and are interrelated with many other aspects of life in the County. This complexity cannot be effectively managed within the scope of this multi-hazard plan.	Continuing
4	Address flooding as a significant component of the Dane County Comprehensive Plan.	High	Flood	Dane County Planning and Development/ Coordination of these planning efforts is essential to the success of both programs. Hazard risk reduction should be an on-going discussion in the comprehensive planning process.	Continuing

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Goal 3: Encourage hazard mitigation planning and incorporate that planning into other related plans.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
5	Evaluate methods such as modification of bridge constrictions, aquatic plant removal, dredging, and channel modifications to increase flow conveyance, while respecting in-stream natural and cultural resources.	Low	Flood	Dane County Land and Water Resources and Dane County Public Works, Highway, and Transportation/ Obstruction to the flow of water, from a wide variety of causes, has been identified as a significant contributing factor to flood impacts. Water conveyance can be improved, but must be utilized in conjunction with a range of other techniques, recognizing the function and limitations of the entire system. This is an on-going activity.	Continuing
6	Encourage communities to use best urban and rural forestry management practices. Supply information regarding benefits of urban forestry on urban heat island effects. Develop model policy for addressing invasive species and pest outbreaks as they relate to trees.	Moderate	Invasive Species	Dane County Tree Board and Dane County Land and Water Resources/ Shade trees can help mitigate the urban heat island effect during periods of extreme heat. This builds on current efforts to manage trees harmed by the emerald ash borer.	New
7	Utilize information gathered by 2013 Dane County Climate Action Plan in planning natural hazard mitigation policies and strategies.	High	Multi-hazard	Information from the 2013 Dane County Climate Action Plan is fully incorporated into this plan.	Completed
8	Assist local governments in developing hazard mitigation plans that will meet the DMA2000 requirements, address specific local needs, and are consistent with County goals.	High	Multi-hazard	Dane County Emergency Management/ The County can assist local governments in managing natural hazards in a variety of ways. Assisting with development of hazard mitigation plans is an effective means to coordinate these efforts.	Continuing

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Goal 3: Encourage hazard mitigation planning and incorporate that planning into other related plans.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
9	Assist local units of government in developing plans and model ordinances for managing trees or other vegetation, before, during, and after natural hazard events including flooding, tornadoes, drought, wildfires, and ice storms. Plans should reflect changing risk to flooding, ice storms, and excessive heat.	Low	Multi-hazard	Dane County Emergency Management/ The County can assist local governments in managing natural hazards in a variety of ways. Local ordinances can be used to reduce vulnerability. While the County has little or no direct authority in these areas, the County can encourage local governments to employ mitigation concepts when forming, reviewing, and updating local ordinances.	Continuing

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Goal 4: Facilitate and coordinate solutions to multi-jurisdictional issues that involve government, citizens, stakeholders, and policy-makers at all levels.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
1	Ensure local communities have extreme heat and cold contingency plans for vulnerable populations.	High	Extreme Heat, Extreme Cold	Dane County Human Services and Dane County Emergency Management/ Cooling and warming centers are essential tools in mitigating vulnerability reducing mortality during periods of extreme heat or cold. In most cases these centers are set up and operated by local jurisdictions. This process requires partnership and coordination with service agencies and local jurisdictions in order to be successful. While this is a new objective in the plan, this is an on-going effort.	New
2	Identify flood hot spots or high priority projects involving multiple jurisdictions where watershed level solutions could be applied.	High	Flood	All Departments/ The County is uniquely situated to coordinate and facilitate projects on a watershed level. In fact, facilitating multi-jurisdictional efforts was identified in the public input process as one of the primary roles of the County.	Continuing
3	Coordinate funding opportunities to carry out the objectives of the natural hazard mitigation plan including, but not limited to, mitigation, land acquisition, regional projects, and flood response activities.	High	Flood	Dane County Emergency Management/ There is wide range of funding opportunities available to advance the objectives of this plan. Inter-department and Inter-governmental coordination is important to assure that information is shared, opportunities are not missed, and efforts are not duplicated.	Continuing
4	Manage the Yahara River and Chain of Lakes, and other watersheds as integrated systems to minimize flood risk.	High	Flood	Dane County Land and Water Resources/ Dane County is a drainage area. With a few exceptions, Dane County contains the headwaters of the rivers and streams flowing out of the County. These waterbodies should managed as integrated systems, considering the function of the entire watershed.	Continuing

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Goal 4: Facilitate and coordinate solutions to multi-jurisdictional issues that involve government, citizens, stakeholders, and policy-makers at all levels.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
5	Ensure that the Department of Natural Resources affords flood risk as high priority when evaluating the public interest in the lake level orders for the Yahara chain of lakes.	Moderate	Flood	Dane County Land and Water Resources/ The Department of Natural Resources (DNR) created the Yahara Lakes Water Level Advisory Group (YLAG2) in 2011 to make recommendations regarding the water levels on the Yahara Lakes, including Mendota, Monona, Waubesa, Kegonsa and the Stoughton millpond. This was a stakeholder and public input driven process. Flood risk was considered along with numerous other issues and ultimately, the lake level orders were not changed.	Continuing
6	Develop a coordinated management strategy and a unified plan of operation and maintenance for all control structures on the Yahara River from Tenney Dam to the Stoughton Dam. Assure that the responsible agency has the technical expertise and resources to operate and maintain the control structures within the parameters of the plan.	Moderate	Flood	Dane County Land and Water Resources/ <i>The Dane County Lake Level Management Guide for the Yahara Chain of Lakes</i> was prepared in 2010. This guide has been implemented. Management of the Yahara River and Lakes as an integrated system is an on-going effort of continuous improvement.	Continuing
7	Maintain the levels of the Yahara lakes at the lower limit of the DNR's set operating range as part of a comprehensive strategy that addresses flood risk and the needs of fisheries, recreational interests, agricultural interests, and lakeshore property owners.	Moderate	Flood	Dane County Land and Water Resources/ <i>The Dane County Lake Level Management Guide for the Yahara Chain of Lakes</i> was prepared in 2010. This guide has been implemented. Management of the Yahara River and Lakes as an integrated system is an on-going effort of continuous improvement. The Management Guide does seek to balance these interests but does not recommend management of the system at the lower level of the DNR's set operating range – other factors are considered as well	Continuing with Modification

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Goal 4: Facilitate and coordinate solutions to multi-jurisdictional issues that involve government, citizens, stakeholders, and policy-makers at all levels.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
8	Improve monitoring and modeling of the Yahara River and chain of lakes to develop a better understanding of how the system can be more effectively managed.	Moderate	Flood	Dane County Land and Water Resources/ The Yahara system is a complicated, mostly man-made system with its four dams, channel constrictions, and irregular channel geometries. There is a need to spatially evaluate the Yahara Lakes through numerical modeling to further understand the complex system. Land and Water Resources has developed and continues to improve the Yahara Integrated Nowcast/Forecast Operation System (INFOS) to better understand and manage the Yahara River as an integrated system. This is an on-going effort that includes both water quality and water quantity concerns.	Continuing
9	Launch and update when necessary an educational program to provide local units of government with important flood-fighting information.	Moderate	Flood	Dane County Emergency Management/ There are a range of flood fighting options available to communities in addition to traditional sandbagging operations. This effort would include alternative options and resources available to assist local jurisdictions. This is an on-going effort.	Continuing
10	Facilitate multi-jurisdictional, high priority flood project activities involving stakeholders, and incorporated and unincorporated units of government where they are consistent with the goals and policies of this plan.	Moderate	Flood	The County is uniquely situated to coordinate and facilitate projects on a watershed level. In fact, facilitating multi-jurisdictional efforts was identified in the public input process as one of the primary roles of the County.	Continuing
11	Evaluate stormwater volume control policies, such as a 100% pre-development run-off control ordinance and fee-in-lieu-of program and assess for feasibility both County-wide and in closed watersheds only.	Moderate	Flood	Dane County Lakes and Watershed Commission and the Capital Area Regional Planning Commission established a Stormwater Technical Advisory Team in 2016-2017 to evaluate the County's stormwater management strategies and make recommendations regarding flood risk reduction.	New

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Goal 4: Facilitate and coordinate solutions to multi-jurisdictional issues that involve government, citizens, stakeholders, and policy-makers at all levels.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
12	Improve the flood-fighting response capabilities of Dane County and local units of government.	Low	Flood	Dane County Emergency Management/ There are a great number of actions that communities can take to reduce damages when flooding occurs, but these efforts must be coordinated and well planned to be effective. This is an on-going effort.	Continuing
13	Install a grounding and surge protection system to protect the electrical circuits that are critical to the methane blower system at the Verona Landfill.	High	Lightning	Dane County Public Works, Highway and Transportation/ This structure has been damaged by lightning in the past. Improved grounding and surge protection is needed.	New
14	Assess and document the extent to which critical facilities have back-up power systems in place. Work with partners to develop plans to deploy back-up power sources at critical facilities	High	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Partnerships are essential to achieve the goals of this plan. Many critical facilities and the populations they serve are particularly vulnerable in a sustained power outage. Renewable energy sources such as photo-voltaic cells would further reduce the vulnerability. The function of these critical facilities is vulnerable to loss of electrical power.	Continuing
15	Develop procedures to establish communication channels and mechanisms for identifying and providing services to vulnerable populations during hazard events. Generate and utilize existing vulnerability maps and link surveillance data to risk factors.	Moderate	Multi-hazard	Dane County Human Services and Dane County Emergency Management. Vulnerability to the effects of natural hazards can be mitigated through organized welfare checks as well “social capital” programs that build on informal relationships between friends, family members, and neighbors. People in Dane County are generally well connected to service agencies and other people in their communities.	New

Goal 5: Improve the disaster resilience of existing buildings, structures, critical facilities, as well as infrastructure whether new construction, expansion, or renovation.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
1	Reduce flood damage to roadways and drainage structures and maintain emergency vehicle access to all residences.	High	Flood	Dane County Public Works, Highway and Transportation/ Flood impact on County and local roads is a common problem in Dane County. Most State and Federal assistance to local governments following a flood is to assist with roadway and roadway drainage structure repair. This is an ongoing effort.	Continuing
2	Employ hazard mitigation concepts and support on-going sustainability concepts when building, remodeling, or otherwise improving County facilities or infrastructure.	High	Multi-hazard	Dane County Administration/ Structural mitigation is often cost-effective only when incorporated into the construction of a new building or a major remodeling project. The same concepts regarding construction methods and materials selection when building and remodeling apply to County facilities as well as private residences, businesses, and local government buildings. This is a successful on-going activity.	Continuing
3	Review the County's Green Building Policy and consider revisions to include hazard mitigation and sustainability features of new County building and remodeling projects.	Low	Multi-hazard	Dane County Administration/ Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project. This is a successful on-going activity.	Continuing
4	Encourage local units of government to apply structural hazard mitigation and sustainability concepts when building or remodeling their facilities.	Low	Multi-hazard	Dane County Emergency Management/ Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project.	Continuing

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Goal 5: Improve the disaster resilience of existing buildings, structures, critical facilities, as well as infrastructure whether new construction, expansion, or renovation.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
5	Encourage critical facilities to employ hazard mitigation and sustainability concepts when building or remodeling their facilities.	Moderate	Multi-hazard	Dane County Emergency Management/ The same concepts regarding construction methods and materials selection when building and remodeling apply to critical facilities as well as private residences. Partnerships are essential to achieve the goals of this plan.	Continuing
6	Facilitate the establishment of public/private partnerships with the local insurance industry, building industry, planners, architects, utilities, urban foresters, and their related associations to better inform and provide technical assistance to individuals about sustainable construction methods and hazard mitigation practices, and create incentives for action	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Partnerships are essential to achieve the goals of this plan. Structural mitigation is often cost-effective when only when incorporated into the construction of a new building or a major remodeling project. Partnerships with designers, contractors, and suppliers can provide information to home-owners at key points when they are making decisions regarding selection of materials and construction methods. Information and education, pilot projects, and incentives are all tools that can be used to encourage homeowners to choose methods that will provide future resistance to the effects of natural hazards.	Continuing
7	Assist in establishing public/private partnerships with local power, water, and wastewater utilities to further fortify their systems and reduce power outages and related losses caused by natural hazards.	Moderate	Multi-hazard	Dane County Emergency Management/ Partnerships are essential to achieve the goals of this plan. The function of these critical facilities is vulnerable to loss of electrical power. Partnerships are essential to achieve the goals of this plan. This is a on-going effort to prepare for potential impacts of an extended power outage.	Continuing

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Goal 5: Improve the disaster resilience of existing buildings, structures, critical facilities, as well as infrastructure whether new construction, expansion, or renovation.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
8	Encourage local businesses to apply structural hazard mitigation and sustainability concepts when building or remodeling their facilities and when constructing residential and commercial buildings for others.	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ The same concepts regarding construction methods and materials selection when building and remodeling apply to business facilities as well as private residences.	Continuing

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Goal 6: Utilize existing science and technology to better understand and address changing risk to natural hazards in a changing climate.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
1	Include a study of the likelihood and potential impact of a significant weather event to cause Lake Mendota to rise over the top of Tenney Dam.	Moderate	Flood	A storm-transposition study using the 2008 Baraboo Storm that resulted in over 14 inches of rain in some areas and caused the failure of the Lake Delton Dam was completed by UW-Madison researchers. The researchers have shared their finding with the Natural Hazard Mitigation Steering Team and are currently working with County engineers to better understand the impacts such a storm may have.	Completed
2	Encourage all natural hazard mitigation goals, objectives, strategies, and objectives to be understood in the context of a changing climate.	High	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Considering potential changes in future conditions is essential when developing mitigation strategies that will be adaptable and effective in reducing future disaster losses.	Continuing
3	Use all available information to assess and manage natural hazard mitigation risk. Risk analyses should utilize both historical data and, where possible, projections of future conditions.	High	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Considering potential changes in future conditions is essential when developing mitigation strategies that will be adaptable and effective in reducing future disaster losses. Most risk assessments rely on the frequency and magnitude of past occurrences to make predictions about future conditions. In the context of changing climate, however, past occurrences are no longer a valid predictor of the likelihood and scale of future hazard events.	Continuing

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Goal 6: Utilize existing science and technology to better understand and address changing risk to natural hazards in a changing climate.					
Item	Mitigation Objective Title	Priority	Primary Hazard	Background Information	Plan Update Status
4	Engage in planning and data gathering efforts that make progress toward achieving sustainability and resiliency through increasing efforts in hazard mitigation.	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Considering potential changes in future conditions is essential when developing mitigation strategies that will be adaptable and effective in reducing future disaster losses.	Continuing
5	Continue and strengthen collaboration with non-County organizations and agencies that have natural hazard mitigation functions. Collaborate with University of Wisconsin to improve prediction capability for extreme weather events and health outcomes. Work with climate experts at partner organizations to improve County staff and resident understanding of climate change impacts.	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Considering potential changes in future conditions is essential when developing mitigation strategies that will be adaptable and effective in reducing future disaster losses. Partnerships are essential to achieve the goals of this plan.	New
6	Facilitate working relationships with existing partners and climate experts to encourage County staff understanding of climate change and its potential impacts.	Moderate	Multi-hazard	Dane County Emergency Management and Dane County Office on Energy and Climate Change/ Considering potential changes in future conditions is essential when developing mitigation strategies that will be adaptable and effective in reducing future disaster losses. Partnerships are essential to achieve the goals of this plan.	Continuing

5.4 Mitigation Alternatives

This contains background and reference information on mitigation strategies, and the common alternatives that could be used in Dane County. This section also contains additional reference material for the mitigation options to the various hazards in Dane County.

5.4.1 Residential Property Protection Measures

There are many things that residential property owners can do to protect their homes and buildings from the effects of natural hazards, from simple inspections and maintenance to fully integrating hazard resistance into the design of new construction. All of these options have benefits and limitations that have to be weighed against the risks and cost of the effort. The individual property owner would normally implement these protective measures, although, in many cases, government agencies can provide technical and financial assistance. Dane County's role in this process is as a facilitating and coordinating entity. The County can assist by establishing public-private partnerships, providing information to property owners, and applying for grants where appropriate.

Incorporating hazard-resistant features into a new home is typically easier and more cost effective than retrofitting an existing home. In general, the time to invest in a stronger, more resistant home is when it is being built. Other opportunities are during major remodeling projects or when repairing a previously damaged building. Central to the County's mitigation strategy is to use these "windows of opportunity" to encourage property owners to incorporate hazard mitigation measures into the design of new homes or the rebuilding or remodeling of existing homes.

Protecting Homes from Wind Damage

Of the natural hazards affecting Dane County, tornadoes and high winds have the greatest potential to cause major building damage. Winds usually cause damage to homes and other buildings in one of two ways. Damage typically occurs when structural or non-structural elements of the building cannot resist the forces of the wind or when flying debris impacts the building. Types of wind damage most typically encountered include:

- *Roof covering and decking.* Roof covering damage can occur anywhere along the surface of the roof where the shingles are not adequately fastened to the decking or where the decking is not adequately fastened to the roof trusses.
- *Overhangs and porch roofs.* High winds can exert extreme forces on the underside of an overhanging roof. In general, overhanging roofs are not designed to handle these forces and fail due to uplift. These failures typically occur when the roof overhang is unsupported or when the porch columns are not adequately connected to the roof beams and anchored to the deck.
- *Gable end roofs.* Gable end roofs are those with two sloped roof surfaces and a vertical wall at each end. Gable end roofs are usually supported by a series of parallel roof trusses or parallel rafters. Gable end roof failures typically occur at the end walls where the trusses do not have enough support to keep them from blowing inward or being sucked outward from the building.

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- *Roof frame connections to walls.* Tornadoes or high straight-line winds can and often do completely blow off the entire roof of buildings. This occurs because of an inadequate connection of the roof framing to the exterior load-bearing walls. In many cases where roofs are entirely blown off, the roof frame was connected to the walls by “toe-nails.” Toe nailing alone is not sufficient to withstand the up-lifting force of a high wind event.
- *Wall frame connection to the foundation.* Wall frames typically connected to the foundation at the bottom stud of the wall frame, which is connected to the sill plate and then to the foundation wall or concrete slab. Failures can occur where the wall frame is connected to the sill plate by toe-nails. Failures can also occur if the sill plate is not adequately bolted to the foundation or slab.
- *Garages.* Garage doors are another weak point in a typical building design. Garage doors can be damaged when the force of the wind blows the door inward or when the tracks supporting the door fail. Failure of the garage door can lead to an increased wind pressure inside the garage, resulting in severe damage or destruction of the garage itself and to the building it is attached to.
- *Windows.* Windows are typically damaged by high wind pressure or impact by wind-borne debris.
- *Siding.* Siding can be damaged by wind-borne debris or it can fail where it is not adequately connected to the walls. Siding failure usually occurs at a corner or edge where wind pressures can take hold and peel off the panels.

Mitigation measures to address these problems focus on the concept of a “continuous load path.” A load path is a series of structural components and connections that resists any type of force on the building. A continuous load path is one that transfers the forces or loads from structural component to structural component until they are transferred to the ground. If the load path remains continuous while the load is applied, no structural damage will occur. If there is a break in the load path, damage will occur. The connections between the structural components are typically the weakest link in the path and are where most failures occur. Wind hazard mitigation measures, therefore, are likely to be most effective when focused on reinforcing the connections between the structural components of the building.

Structural mitigation measures for wind hazards include:

- Secure roof sheathing to trusses using screws and properly secure shingles.
- Increase the strength of the roof to wall connections by using mechanical fasteners or “hurricane clips” to anchor the roof trusses to the load-bearing walls.
- Increase the strength of the roof to wall connections by extending the wall sheathing to the top plate and nailing the sheathing to the top plate and wall studs.
- Brace the roof framing of gable end roofs.

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- Increase the strength of the foundation to wall connections by using mechanical fasteners to connect the wall framing to the sill plate and the sill plate to the foundation.
- Increase the strength of the foundation to wall connections by extending the wall sheathing to the sill plate and nailing the sheathing to both the wall studs and the sill plate.
- Anchor overhanging and porch roofs to the building with mechanical fasteners, connecting the roof truss to the columns and the columns to the floor deck or foundation.
- Replace or reinforce garage doors.

These measures are intended to strengthen residential buildings to resist the high winds associated with severe thunderstorms and the periphery of tornadoes. These measures, even if properly implemented, will not make a building capable of withstanding a direct hit from a tornado. A homeowner with basic construction skills can implement some of these techniques. Others require the expertise of skilled tradesmen, architects, and structural engineers. Furthermore, it is essential that the local building inspector approves all mitigation measures and that they be in compliance with building codes and ordinances.

Protecting Homes from Flooding

Actions and strategies for the Hazard Mitigation Plan have been continually evaluated and revised through public and professional input. Some of the variables that shaped the development and refinement of the goals and objectives were: implementation feasibility, citizen priorities and input, role of the County in the plan, political acceptability, grant requirements, scope of the plan, and current data about hydrologic systems. This section describes alternative actions that were considered in the process of refining final recommendations. The most effective elements within the alternatives were carried forth based upon the analysis of the action within the framework of the aforementioned variables.

- *Building Acquisition and/or Relocation.* Removing a home from a high-risk area is the surest way to protect it from flooding. In areas subject to flash flooding or deep floodwaters, removing homes from harms way is far and away the safest approach. There are two ways that this can be done; the homeowner can relocate the home to a more appropriate location or the home can be acquired by the local government and demolished. In either case, provisions should be made for the property to revert to open space or some other use that will not be harmed when flooding occurs. Building acquisition can be an expensive option and may not be attractive to local governments or homeowners. However, removing structures from floodplains is a high priority of several federal and state programs and funding assistance is available. Public interest in these programs is likely to increase when flooding is occurring or in the immediate aftermath of a significant flood.
- *Building Elevation.* Raising a home above flood level is the next best protective measure when removal is not an option. When a building has been elevated, water flows under the building, causing little or no damage to the building or its contents. Raising buildings above flood level can be a complicated and expensive process, however it is often cheaper than acquisition and is less disruptive to the neighborhood. This may be a viable option for property owners who are

unwilling to relocate. Many federal and state programs can also be applied to building elevation projects.

- *Flood Barriers.* Flood barriers can be built around homes or neighborhoods to keep floodwaters from reaching the buildings. Barriers built of soil are called berms. Barriers built of concrete or steel are called floodwalls. Barriers are a less secure flood protection measure than building elevation because the protected homes may be effectively below the level of the floodwater. Also, when floodwaters are present for more than a few hours, water will seep under the barrier. Pumps are needed to handle seepage and leaks. Barriers must be placed so that they do not create flooding or drainage problems on neighboring properties and they cannot be constructed in the floodway. State and federal programs may be available to offset some of the costs of building barriers, but this type of project is not a priority in those programs.
- *Floodproofing.* There are several different techniques available for floodproofing buildings. Dry floodproofing refers to any one of several methods of sealing a building to ensure that floodwater cannot get inside. Wet floodproofing means letting the water in and removing everything that could be damaged by the water.
 - Dry floodproofing is appropriate only for homes on a concrete slab with no basement. All areas below the flood level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting and windows and doors are closed and sealed permanently or with removable shields or sandbags.
 - Wet floodproofing is an effective means of protecting belongings and mechanical equipment located in the basement. It is really nothing more than moving things in the basement to an elevation where they will not be damaged. Structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls can be used instead of wood studs and gypsum drywall. The furnace, water heater, and laundry are permanently moved to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms. Light, moveable items that are stored in the basement can be moved if there is enough warning time. Wet floodproofing is one of the least expensive options available to a homeowner. Significant damages can be prevented simply by moving furniture and mechanical equipment out of the basement.
- *Sewer Back-flow Prevention.* Cross connections between the sanitary and storm sewers and infiltration and inflow can overload the sanitary sewers during a storm. Buildings that have downspouts, footing drain tile, and/or a sump pump connected to the sanitary sewer service may be flooded inside during heavy local rains and may be contributing to sanitary sewer back-up problems at other buildings. These cross connections should be disconnected. Rainwater and surface water should be directed out onto the ground where it will flow away from the building.

A number of other approaches may be used to protect a structure against sewer backup. These approaches should receive increased emphasis for all buildings that have experienced previous sewer back-up problems.

- Floor drain plugs
- Floor drain stand-pipes

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- Overhead sewers
 - Backflow protection valves
 - Sanitary sewer pumps for below grade building areas (basements)
- *Warning Systems.* Advance warning of flood conditions is essential for an effective response. A warning system has three basic components, threat detection, communications links, and emergency management. In an effective warning system, no one of these components is any more or less important than any other; they must be integrated into one system. Threats must be detected, that information must be communicated to those who must assess it and decisions must be made on how best to manage the situation.

There are areas on small rivers in the County that are subject to flash flood or near flash flood conditions. These areas have no specialized flood warning system in place. On larger rivers, this service is provided by the National Weather Service in conjunction with USGS monitoring stations. On smaller rivers, such as Black Earth Creek and its tributaries, locally established rainfall and river gages are needed to establish a flood threat recognition system. In the absence of a gaging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding. Communications links and flood management procedures must also be established.

- *Flood Insurance.* Flood Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. Although most homeowners' insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program (NFIP).

Flood insurance is required for properties with federally-backed mortgages that are in a regional floodplain, as shown on the adopted Flood Insurance Rate Map (FIRM). Flood insurance is optional for properties that are in moderate- or low-risk areas as shown on the adopted FIRM. Historically, flood damage has occurred throughout Dane County, not just in the mapped floodplains. Homeowners may wish to carry flood insurance even if their property is not in a high-risk area on the FIRM. Typically, insurance premiums in low-risk or moderate-risk areas are steeply discounted.

Flood insurance coverage is provided for insurable buildings and their contents damaged by a "general condition of surface flooding" in the area. Building coverage is for the structure. This includes all things that typically stay with the building when it changes ownership, including:

- Utility equipment, such as a furnace or water heater
- Wall-to-wall carpeting
- Built-in appliances
- Wallpaper and paneling

Contents coverage is also for the removable items inside an insurable building. A renter can take out a policy with contents coverage, even if there is no structural coverage.

Flood insurance is available through the NFIP if a local unit of government is in good standing with the program. Dane County, representing the unincorporated areas of the County, is currently participating and is in good standing with the program.

- *Response Planning.* There are a great number of actions that communities can take to reduce damages when flooding occurs, but these efforts must be coordinated and well planned to be effective.

Typical components of a flood response plan include:

- Activating an emergency operations center
- Closing streets or bridges
- Shutting off power to threatened areas
- Filling and placing sandbags or other flood barriers
- Monitoring water levels
- Providing security and other protection measures
- Assisting cleanup and recovery
- Providing information to the public

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans should be developed in coordination with the agencies or offices that are given various responsibilities.

Emergency response plans should be updated annually to keep contact names and telephone numbers current and to make sure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner.

Finally, individual citizens also have a role to play in responding to flooding and protecting their property. In order to do this, people need a straightforward way to get response information and guidance and request assistance if needed. Open lines of communication are needed between the County, local units of government, and individual citizens. In past flood events, communications processes did exist, but they were often ad hoc, not well publicized, and cumbersome to users.

These lines of communication should be two-way. Devising effective solutions to flooding requires an understanding of the constantly changing flooding conditions in the County. Providing better avenues for communication will allow the County and local governments to respond quickly to flooding, and over time, understand more completely the flooding patterns in the County and how they are evolving over time. Citizens are a valuable source for this information. Analysis of the information gathered during flood events could be used to prevent future damages and to inform citizens of the types of flooding problems in their vicinity, with a forecast of approximate future risk coupled with specific recommendations to decrease their risk.

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Protecting Homes from Hail Damage

The roof of a home is typically the area that is most vulnerable to hail damage. When large hail occurs, it can shred shingles and lead to water damage inside the home. Hail damage to roof materials can be mitigated through the selection and use of impact resistant materials. This is a cost effective measure only in new construction or when re-roofing an existing building.

The Underwriters Laboratory (UL) rates roofing materials for impact resistance under the 2218 standard. The standard provides a classification rating from Class 1 being the least resistant to damage and Class 4 having the highest resistance. The Institute for Business and Home Safety (IBHS) recommends use of Class 3 or Class 4 impact resistant materials to protect against hail damage.

Lightning Protection

Electrical surges from lightning can damage or destroy household electronic devices. Appliances and electronic equipment such as computers, TV's, VCR's, and DVD players are especially vulnerable. Power surges can enter the home through a number of different paths, including the cable TV or satellite dish cable, the incoming telephone lines, or the incoming electrical service line. Lightning and electrical surges can also cause a shock hazard or fire hazard if protective steps are not taken.

Surge protection devices can prevent the damages from most power surges. There are two basic types:

- Service entrance surge protection devices which are mounted at or near the incoming electrical service box and protect from surges coming through the incoming electrical power line, incoming telephone line, and cable TV or satellite dish cable.
- Point-of-use surge protection devices, which are used to directly protect specific appliances and include the types that plug into a wall outlet (computer power strips). These should be used to protect expensive electronics such as computers, TV's and stereos.

These measures will protect from most in-coming power surges. There is, however, no device that will protect against all power surges. A direct lightning strike to the home's electrical system will very likely be too great for the surge protector to handle.

When building a new home or remodeling, properly organizing the electrical circuits can reduce the exposure of power surges to sensitive equipment. Circuits intended for use by sensitive electronic should be isolated from those used for powering large appliances. When remodeling, it is also important to upgrade the electrical system to assure that the overall system and all outlets are properly grounded. Plug-in type surge protectors will not work if the outlet is not properly grounded. Surge protectors at the service entrance will not work if the overall system is not properly grounded.

Protecting Manufactured Homes

Manufactured homes are relatively lightweight compared to conventional residential construction and often have flat sides and ends, making them particularly vulnerable to high winds. However, there are steps that can be taken to protect property and people.

- *Tie-downs and anchors.* Manufactured homes are not usually installed with permanent foundations, but instead sit on short piers. Wind can get under a manufactured home and lift it

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up. In addition, winds passing over the top of the home can also create an uplift force. Tie-downs and anchors are needed to resist these forces. Tie-downs are straps or cables that are either secured to the building's steel frame or are placed over the top of the building and secured at either end. Some types of manufactured home use both methods to secure the building. Ground anchors are plates or augers imbedded in the soil to which the tie-down cables are secured. Properly applied, these systems are a cost-effective way to limit structural failure.

- *Storm shelters.* Even though a manufactured home may be well anchored, residents should have shelter available to protect them from severe thunderstorm winds and tornadoes. Accessible community shelters should be available in manufactured home communities (mobile home parks). Residents of isolated manufactured homes not located in developments should consider investing in a smaller, personal storm shelter. Storm shelters are available commercially or they can be custom designed and built on-site. FEMA's published standards and performance criteria provide guidance for selecting or designing a shelter.

5.4.2 Commercial Property Protection Measures

According to the Institute for Business and Home Safety, at least one-fourth of all businesses that close because of a disaster never reopen. Small businesses are especially vulnerable, because few of them have the resources or knowledge to assess disaster risks and develop comprehensive mitigation and recovery plans. Business losses can come in many forms, from direct physical losses and building damage to loss of vital records and computer files to indirect losses due to the unavailability of vital supplies.

As with residential properties, there are many things that business owners can do to protect their business investment, employees, and customers from the impacts of a disaster. Many of the hazard mitigation concepts described for residential properties also apply to commercial structures. There are differences in some cases, however due to the relative size and construction methods of commercial buildings and facilities.

Protecting Commercial Buildings from Wind

The concepts of wind resistance and structural mitigation described for protecting homes from wind damage also generally apply to business facilities. Commercial buildings, however, are usually built using different construction methods from residential buildings. FEMA provides the following recommendations for strengthening commercial buildings:

- *When re-roofing, assure that contractors adhere to the Factory Mutual Research Corporation's FM 4470 Class 1 performance standard for commercial roofs.* This standard includes performance tests for impact resistance, wind uplift, fire, water leakage, weathering, and corrosion.
- *Reinforce double entry doors.* Many commercial buildings are equipped with double entry doors. These are convenient because they span a wider opening than a single door, but they are usually not as strong as a single door and are therefore susceptible to wind damage.

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- *Secure metal siding and metal roofing.* The metal roofing and siding of pole barn type buildings are vulnerable to damage either when wind pulls of panels due to weak fasteners or when windborne debris punctures the panel.
- *Secure built-up and single-ply roofs.* Built-up and single-ply roofs are common on commercial buildings. Built-up roofs consist of multiple layers of felt and asphalt; single-ply roofs consist of one waterproof membrane. These roofs are often damaged when high winds tear away the metal edge flashing or coping around the perimeter of the roof. Once the flashing or coping is gone, the wind can peel back the roofing material and expose the interior of the building to the elements.
- *Avoid aggregate ballast roof coverings.* This roof type is most vulnerable to wind damage and the ballast materials can become windborne, further damaging nearby structures. To mitigate the vulnerability of displaced ballast, the roof can be covered with a membrane that secures all of the ballast to the roof.
- *Maintain EIFS Walls.* For buildings with Exterior Insulation Finishing System (EIFS) walls, a type of wall often used for commercial buildings, one example of wind protection is inspecting and maintaining the walls. An EIFS wall typically consists of several layers of materials sandwiched together into a single panel, which is attached to a substrate mounted on the wall studs. The exterior of an EIFS wall is water-resistant, but the wall can be weakened by moisture that becomes trapped behind the wall. The source of this moisture is usually leaks around doors and windows and where the wall joins the roof. Once an EIFS wall has been weakened in this way, it is more likely to be torn off or penetrated by high winds and windborne debris. If wind enters a building, the likelihood of severe structural damage increases, and the contents of the building will be exposed to the elements.
- *Reinforce Concrete Masonry Unit (CMU) walls.* Concrete masonry unit load bearing walls (CMU) are a common construction type in commercial buildings that are only a few stories high. The structures may be constructed without reinforcing steel, or with reinforcing steel within the walls. Most buildings constructed with CMU exterior walls prior to the 1980s are not likely to have reinforcing in the walls. Similarly, many buildings constructed after the 1980s may have only horizontal joint reinforcing, with no vertical reinforcing placed within the cells of the CMU. As a result, a continuous load path does not exist in these buildings and they are vulnerable to damage from strong winds capable of exerting lateral and uplift forces on the buildings. Typical failures are due to wind forces that push the wall into the building, pull the CMU wall out of the building, or pull the wall apart along the mortar joints. If the weight of the building and roof system is not adequate to resist the wind forces, the CMU block walls fail along their joints and fall apart. This leads to the progressive collapse of roofs, adjacent walls, and other building elements. Additionally, the connections between the roof system and the supporting walls are often incapable of resisting uplift forces.
- *Reinforce brick masonry walls.* Brick masonry buildings are typically constructed without reinforcing steel in the walls and have un-reinforced brick masonry walls along the perimeter of the building. Roof and floor systems either span from exterior wall to exterior wall, or are supported by interior load bearing wood frame walls. Typical brick wall failures are very similar to CMU wall failures and damages tend to be similar.

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- *Secure roof mounted mechanical units and vents.* Roof top equipment units can be either damaged in place by windborne debris or were dislodged from their anchorages (if any) by wind forces. Although it is not practical to protect these units from damage associated with windborne debris, it is practical to design and anchor the units to resist wind forces. Damaged roof top mechanical units are a hazard during high wind events for several reasons. First, when mechanical units are displaced, an opening on the roof is created, which exposes the building interior to wind forces, windborne debris, and rain. Second, displaced units can damage the roof covering and/or the roof deck. Finally, if units are completely removed from their roof location, they may fall and injure individuals adjacent the building.

It is important to note that these measures are intended to strengthen commercial and public buildings to resist high winds associated with thunderstorms, downbursts, and the straight-line winds that are on the periphery of a tornado. The measures are presented as guidelines for mitigation or as examples of successful mitigation. Commercial design and construction requires the involvement of a design professional, such as an architect and/or a structural engineer, and thus these mitigation strategies are intended to guide the design professional and they are not intended to dictate or imply that there is only one acceptable solution. These mitigation measures, if implemented, will help a building resist high winds, but additional mitigation is required if the building is meant to function as a storm shelter capable of preventing loss of life.

Furthermore, it is of utmost importance that the local building inspector approves all mitigation measures.

Backup Electrical Power

Many of the critical facilities and much of essential infrastructure identified in the vulnerability assessment are commercial operations. In many cases, the primary concern is not necessarily storm damage to the facility itself, but rather loss of the essential function and community services provided by the facility. As has been stated, power outages following natural hazard events are common and can last for days or even weeks. As a result, even businesses and other critical facilities that are not severely damaged can suffer losses because of the interruption in the power supply. Organizations that install backup or emergency power sources can minimize these losses. Essential operations in this setting include:

- Heating, ventilation, and air conditioning systems.
- Industrial equipment and major appliances such as freezers and refrigerators.
- Lights, computers, and office equipment.
- Pumps including sump pumps, sprinkler system pumps, well water pumps.
- Alarm systems.
- Pumping systems at public utilities such as wastewater lift stations and water wells.
- Water supply and milking operations on dairy farms.

The same basic concepts apply to both residential and commercial applications, with the main distinction being the scale and increased generation capacity of the system.

Electric Power Utilities

Many power outages occur because of damage or downed power lines. Burying power lines is one way to reduce the number of power outages in the County. Utilities do bury lines for new development, though there still remain many overhead power lines. There are many issues that have to be addressed, both for the utility company and for the local customers for burying power lines to be a cost effective option.

Business Recovery Planning

Developing a business recovery plan is one of the most important actions a business owner can take to minimize disruption. Business recovery planning is often thought of in terms of information technology and backup, off-site storage, and recovery of critical computer data. A comprehensive business recovery plan, however, is much more than that. Business recovery planning is a process that should be integrated into the overall business plans of the organization. There are many different ways to approach business recovery planning, but a basic plan should include at least the following elements:

- *Risk assessment.* An assessment of the potential risks to the business that could result from disasters or emergency situations is the basis of the planning effort. It is necessary to consider all the possible incidents and the impact each may have on the organization's ability to continue to deliver its normal business services.
- *Emergency preparations.* Many organizations have a wide range of existing procedures for dealing with various types of unusual situations. The plan should contain a brief summary of each of the procedures that are already in place, including the issues that are relevant in the event of handling an emergency disaster situation. These would probably include: IT data protection, security, and recovery procedures, property security, emergency contact information, emergency evacuation and sheltering procedures, fire regulations and procedures, and other health and safety considerations.
- *Backup strategies.* The plan should identify the back-up and preventive strategies that would be appropriate for each aspect of the business activities. This section should include: IT systems and data, personnel, critical vendors and suppliers, and documents and vital records.
- *Emergency response.* The plan should identify actions that will be taken to interface with public sector emergency services, assess and report damages, assess potential business impacts.
- *Business recovery actions.* The business recovery actions involve the restoration of normal business operations after an emergency or disaster. The efficiency and effectiveness of the procedures contained within this section could have a direct bearing on the organization's ability to survive the emergency. Considerations include: power and utilities, buildings and facilities, communications systems, IT systems, production and other equipment, warehouse stock, sales and customer service, and human resources.

5.4.3 Stormwater Management Strategies

While they are closely related, stormwater management and flood management are not the same. Flood management means dealing with or preventing the problems presented when streamflows

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exceed stream capacities and floodwaters move out of the stream channel and lake banks due to excessive volume. Stormwater management deals with the ability of stormwater runoff to reach the stream channels of the watershed without local ponding and street, yard, and basement flooding due to increased flow rate.

To prevent exacerbating flood problems, stormwater management systems must be coordinated within the watershed. This is important because the flood elevations along the major stream channels will determine the configuration, sizing, and performance of the local drainage systems. Coordination is needed to reduce the cumulative downstream impacts of numerous drainage systems.

On the community level, the combination of new stormwater control standards for new developments and actions by individual property owners can transform stormwater from a hazard to a resource.

Options for individual property owners include:

- *Rain gardens.* Rain gardens are shallow depressions (3-4 inches to two feet) planted with native wildflowers and other plants that soak up rainwater or melted snow from your rooftop, driveway and lawn. The gardens allow water to infiltrate into the soil rather than becoming runoff. A rain garden can soak up to 30% more water than a traditional lawn. This helps to protect the quality of water downstream by preventing runoff from getting to the storm drains and helps reduce the chances for local flooding.
- *Cisterns and rain barrels.* Another option is to collect roof runoff by directing the roof downspout to a cistern or rain barrel. Cisterns and rain barrels are intended to collect and store rainwater rather than channeling it to nearby rivers and streams. Cisterns are typically large storage tanks. Rain barrels are smaller, designed to collect water from a residential roof and can often be installed by individual homeowners. Rainwater collected in these containers can be later used to water lawns and gardens, flush toilets, or wash cars. The collected water can also be released slowly for infiltration between rains.

Commercial Stormwater Management Strategies

Water quality concerns have intensified, and stormwater management practices have come under scrutiny, as development occurs on an increasing percentage of the available land area in the County. With more stringent design requirements, costs for traditional conveyance systems have risen sharply. Due to their size and scale, many new commercial construction projects are subject to the County's Erosion Control and stormwater Management Ordinance. The Dane County Land and water Resources Department maintains the *Dane County Erosion Control and Stormwater Practices Manual*, to assist landowners, developers, and consultants to meet the requirements of the ordinance. The manual is available on line.

As a mitigation strategy, stormwater management practices that allow natural infiltration to occur as close as possible to the original area of rainfall are preferable to traditional conveyance systems. By engineering terrain, vegetation, and soil features to perform this function, costly conveyance systems can be avoided, and the landscape can retain more of its natural hydrological function. There are a variety of methods for handling runoff in order to reduce the volume of runoff and decentralize water flows. This is usually best accomplished by creating a series of smaller retention or detention areas that allow localized filtration rather than carrying runoff to a remote collection area. In addition to cisterns

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and rain gardens described previously, some common structural and non-structural methods that may be applied to commercial developments include:

- *Grass swales.* Grass swales can provide an alternative to curb and gutter systems by using grasses or other vegetation to reduce runoff velocity and allow filtration, while high volume flows are channeled away safely. In areas where salts are commonly used for winter de-icing, careful attention must be paid to selecting plant species which are salt tolerant.
- *Filter strips.* Filter strips can be incorporated within parking lots or other areas to collect flow from large impervious surfaces. They may direct water into vegetated detention areas or sand filters that capture pollutants and gradually discharge water over a period of time.
- *Disconnected impervious areas.* Disconnected impervious areas direct water flows from structures, driveways, or street sections, into separate localized detention cells rather than combining them in drainpipes with other runoff. Disconnecting the flow limits the velocity and overall amount of conveyed water that must be handled by end-of-pipe facilities.
- *Rooftop gardens.* Rooftop gardens or green roofs can provide a service similar to rain gardens, absorbing rainwater rather than directing it to the traditional stormwater infrastructure. Green roofs allow the cultivation of plants over much of a roof surface. This coverage, and the numerous underlying layers needed to sustain the plants and protect the building, shields the underlying roof structure from the elements. In most cases, considerable strengthening and modification to the underlying roof is needed in order to support the soil medium and plants.

Not all sites can effectively utilize these options. Soil permeability, slope, and water table characteristics may limit the potential for local infiltration. Also, in urban areas, and areas with existing high contaminant levels, use of infiltration techniques may be not be appropriate. When considering use of the alternatives it is important to keep in mind that they often require more precise engineering for soil characteristics, filtration rates, water tables, native vegetation, and other site features than do traditional stormwater management techniques. Participation of environmental consultants and planners is critical from the beginning of the project.

5.4.4 Flood Impact on Roads

Flood impact on roadways is a common problem in Dane County. Forty percent of sites reported by survey respondents indicated that flooding in their jurisdiction included flooding of roadways. Following Presidential disaster declarations for flooding, a high percentage of Public Assistance funding made available to local jurisdictions was for repair and rebuilding of flood-damaged roads.

There are two primary impacts associated with town road and County highway flooding. Repairing washed out roads costs local governments money. And flooded roads present a hazard to public safety. Water over roads is dangerous to motorists and if it is deep enough can cause areas to become isolated and inaccessible to emergency response vehicles.

Problems with roads are just one symptom of a systematic problem. In some cases, elevating a road to protect it from flooding can cause water to dam up behind it, exacerbating the upstream problem. In other cases, installing larger culverts can cause increased flow, which if unmitigated, can exacerbate downstream problems. Other contributing factors to these problems include the lack of systematic ditch

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maintenance policies and funding, roads located in low lying or inherently wet areas, improperly sized culverts, and inconsistent coordination with planners and developers when designing water conveyance structures across or next to rural roads. Mitigation strategies include:

- Reduce the flow of floodwaters over roads by evaluating road elevation and culvert sizing standards for construction and upgrade for all County roads, but especially for roads in low lying or flood prone areas.
- Develop road shoulder, ditch, and bridge maintenance and upgrade standards to prevent floodwater and stormwater from damaging or washing-out roads and making them impassible.
- Formalize a process for considering water flow along and under roadways as one component of the overall water conveyance system.

5.4.5 Other Water Management Strategies

Integral the County's water management and flood management strategy is the idea that the County and local jurisdictions should take any action possible to "minimize the potential for increasing flooding and flood-related problems within Dane County and in areas affected by Dane County drainage." This goal was identified in the initial version of the County's *Flood Mitigation Plan (2004)*. While the flood mitigation plan has been incorporated into this, more broad "all-hazards" plan, this goal remains a guiding principle.

Many aspects of flooding and flood management are interconnected and cannot be addressed as though they exist in a vacuum. There are links with groundwater issues, water quality issues, habitat protection, land use, economic development, recreational use, disaster preparedness, and stormwater management. Flood management has to be considered as an integral component of the County's approach to living with and cooperating with its environment. This would keep flood losses to a minimum and maintain our water resources for generations to come.

The County should better integrate flood management and overall water management considerations into the land use and development plans. Comprehensive plans should consider the entire watershed and address multiple community issues and concerns. Included in this effort should be the development and adoption of better methods of quantifying the economic benefits of natural and cultural resources.

- *Land Conservation.* Keeping the floodplain open and free from development is the best approach to preventing flood damage. Preserving open space is beneficial to the public in many ways. Preserving floodplains, wetlands, and natural water storage areas helps maintain the existing stormwater storage capacities of an area. These sites can also serve as recreational areas, greenway corridors, provide habitat for local flora and fauna, and protect water quality.

Open space preservation should not be limited to floodplains, as some upland areas within a watershed may be key to limiting runoff that will worsen flooding problems in adjacent or downstream lowlands. A significant increase in runoff from surrounding uplands will raise the base flood elevation and enlarge the floodplain boundary. Therefore, the amount of land maintained as open space will directly affect the level of flood hazard.

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- *Maintenance of Conveyance Channels.* By modifying channel conveyance, more water is carried away at a faster rate. Modifications generally include making a channel wider, deeper, smoother or straighter. Siltation and debris in streams and ditches was cited as a significant problem in the flood mitigation plan survey. Options available include:
 - Dredging to remove silt and other debris.
 - Stream straightening or widening.
 - Constructing diversion channels that send floodwaters to a different location.
 - Cleaning out streams to remove debris such as undesirable vegetation, garbage and downed trees.

Each of these options has advantages and disadvantages that have to be weighed against the flood risk and the impact on the environment. Because modifications of this kind convey water faster to other locations, they are appropriate only for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water.

To minimize the downstream impacts, channel modifications should be utilized in conjunction with a range of other techniques, recognizing the function of the entire system. A combination of restored wetland detention, vegetated swales, infiltration trenches and management practices that increase infiltration (reducing runoff), and improve water quality can be implemented in conjunction with stormwater system improvements. These types of projects can have multiple benefits

- *Project and Program Coordination.* In any planning process, boundaries have to be drawn to define the scope of the effort. Conceivably, planning for flood management and stormwater management could be based on areas defined by new subdivisions, governmental jurisdictions, or watersheds. There are important reasons for watershed level planning where possible:
 - A watershed is a natural description of the area of land that drains into a lake, stream, or other body of water. The term describes an interconnected system of water conveyance. Municipal borders or other political jurisdictions may coincide with some of these natural features, but their boundaries are artificial. The flow of water does not respect these boundaries.
 - Flood management and stormwater management should form a single integrated system over the entire watershed. The streams and waterways of a watershed must be capable of carrying present and future runoff loads generated by all of the existing and future planned development patterns within the watershed. Development patterns and land use are not controlled by watershed factors, but can and do have major effects on watershed problems. Land use changes and water management practices upstream can have significant impacts on downstream areas. In many cases part of the solution to a downstream problem may be found in changes to the way water is managed upstream.
 - Many “Friends” or constituency groups or other associations are organized on a watershed basis. There is a potential to partner on projects with these groups if the effort is designed to benefit the entire watershed.

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The County is uniquely situated to coordinate and facilitate projects on a watershed level. In fact, facilitating multi-jurisdictional efforts was identified in the public input process as one of the primary roles of the County. Many of the ideas expressed in other recommendations of this plan assume the role of the County as a facilitating agent. This policy makes that assumption explicit.

There are two distinct components identified in this plan, inter-departmental coordination, inter-governmental coordination.

- *Inter-Departmental Coordination.* The purpose of inter-departmental coordination is to tap into the experience and expertise of professionals in multiple departments in order to avoid redundancy of effort and capitalize on on-going efforts.
- *Inter-Governmental Coordination.* Through the planning process it became clear that multi-jurisdictional flooding problems are pervasive throughout the County. Flooding does not respect municipal boundaries and many of the most severe flooding problems are cross-boundary ones. The purpose of this coordination is to address these problems as specific projects.

Though the County has limited authority in cities and villages, their participation in the plan is crucial to its success. Furthermore, the Hazard Mitigation Planning Team is in a position to facilitate coordination activities between units of government, including funding for projects. This plan offers the opportunity for all units of government to engage in the plan by their designing specific multi-jurisdictional projects that are consistent with the recommendations of the Plan. Coordination at the project level will help Dane County avoid the site specific, individualized actions that have been marginally successful in the past. Additionally, by combining projects under the auspices of a single plan, projects may be able to obtain funding without having to compete against other municipalities within the County. Involving different levels of government also allows for the pooling of resources, thereby increasing the chance of project completion and success.

5.4.6 Urban Heat Island Mitigation

The implementation of green roofs and parking lots is a cost-effective way to manage increased temperatures in urban areas known as the Urban Heat Island effect. By constructing these projects in high-impact areas or incentivizing their construction through grants to municipalities, Dane County can build long-term resilience to climate change.²

By painting roofs white, incentivizing rooftop gardens, or installing green parking lots, ambient air temperatures can be reduced by two to four degrees, which reduces heat-induced mortality. Maintaining urban tree canopies can also be an effective means of mitigating the urban heat island effect.

² County-Level Emission Reduction and Adaptation Policy Alternatives, 2017. Complete this citation.

5.4.7 Information and Education

Effective hazards management can only be achieved if people are well educated on the issues and how they are related. Members of the public, political leaders, professionals, developers, etc. have to understand the implications of the decisions they are making. Good decision-making implies that people have good, accurate information on which to base those decisions.

5.5 Samples of Success

Dane County and the local jurisdictions within the County have a long history of taking action to reduce vulnerabilities to natural hazards and adapt to changing conditions. The following is a list of some of those accomplishments. *This is only a snapshot and is by no means a complete list.*

- Dane County, in partnership with all 61 local jurisdictions has distributed over 18,000 NOAA All-hazard radios to jurisdictions at cost.
- Dane County has established a pilot buyout program for repetitive flood loss properties.
- The Village of Oregon completed a buyout of 7 homes that had repetitive flooding, utilizing FEMA and CDGB funds.
- The City of Monona received FEMA grant to install a stormwater pumping system.
- The City of Monona received FEMA funding to do a detailed flood risk assessment of the Belle Isle area.
- The County created a comprehensive website developed to provide private property owners and local government with information on flood hazard mitigation.
- The County worked with the National Weather Service to install an automated gage at Black Earth Creek at Mazomanie.
- The Town of Dunn built a tornado shelter in Bayview Heights, a manufactured home development.
- The City of Madison built a tornado shelter in Highland Manor, a manufactured home development.
- Flood mitigation and flood risk reduction objectives were included in the most recent update of the County's Comprehensive Plan.
- The Town of Roxbury improved and raised a number of flood prone roads near Fish Lake and Crystal Lake.
- Numerous flood prone homes were elevated in the Town of Albion along Lake Koshkonong
- The County acquired a number of flood prone homes in the Town of Roxbury along Fish Lake and Rice Lake in the Town of Albion.
- The County and Wisconsin DNR organized two iterations of the Yahara Lakes Advisory Group to make recommendations on management strategies.
- The Land and Water Resources Department developed the Yahara INFOS system to model and better manage the Yahara River and Chain of Lakes as an integrated system.
- The Madison Metropolitan Sewerage district organized the Yahara WINs system in an effort to reduce phosphorus and improve water quality.
- This City of Monona received grant funding to elevate a number of homes in the Belle Isle area.
- The Town of Vienna received grant funds and implemented a project to improve drainage and reduce flood impact to Town and County roads.
- Dane County received grant funds and implemented a project to improve grounding and lightning protection on outdoor warning sirens.

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- The City of Sun Prairie received grant funds and implemented a project to install sanitary sewer backflow prevention devices.
- The Village of DeForest received grant funds and implemented a project to update sanitary sewer systems and install storm water detention ponds.
- The Hamlet of Morrisonville received grant funds to update sanitary sewer infrastructure to alleviate long standing sewer backflow problems.
- Dane County routinely purchases land for conservation purposes that are consistent with the flood mitigation objectives in this plan. Most recently this includes 130 acres along the Yahara River in the Town of Westport, north of Madison.
- Dane County captures natural gas emissions from its landfill. The captured bio-natural gas is in turn used to power compressed natural gas vehicles and used to produce enough renewable electricity to power 4,000 homes.
- The County created the Office of Climate Energy and Climate Change and the Dane County Council on Climate Change.
- Dane County owns the two largest municipal solar arrays in the State of Wisconsin.
- Over two years, Dane County replaced 56 aging outdoor sirens with new units and improved siren coverage in areas having significant numbers of people with low to moderate income.
- Dane County implemented a project to upgrade culverts under County highways to improve stormwater conveyance and reduce damage to roadways.
- The Lakes and Watershed Commission and the Capital Area Regional Planning Commission established a Stormwater Technical Advisory Team to evaluate the County's stormwater management strategies and make recommendations regarding flood risk reduction.

5.6 Implementation

Even the casual reader of this plan will notice that almost nowhere in the recommendations is there a discussion of feasibility or project cost. This is not an oversight. Rather, this is a result of the scope and scale of this plan. This was a broad planning effort and this document is intended to provide a comprehensive view of the general issues associated with natural hazards in Dane County. Through Countywide analysis, the mitigation plan presents a multi-faceted solution to a multi-faceted problem. The plan does not make any attempt to present a specific solution to a specific problem or a specific area. This is not possible given the scale of this planning effort. Rather, the plan describes a wide range of possible methods and projects and provides general guidelines for assigning priorities.

That being said, the plan does provide a framework, in the form of objectives, for implementing the various recommendations. In that sense, each of these recommendations is a point for further study and planning. This also is a function of the Countywide scale of plan. The plan is the first step in laying-out, in broad terms, what needs to be done to minimize the occurrence and impact of natural hazards in the County. The engineering studies, implementation costs, and benefit-cost analysis of specific projects will come at future points in the process.

5.6.1 Project Feasibility and Cost Effectiveness

The plan describes a wide range of possible methods and projects and provides general guidelines for assigning priorities. As solutions and projects are identified, each must be subjected to an analysis of feasibility and cost effectiveness. This is a necessary condition for obtaining FEMA or other federal or state funding assistance. FEMA has a strict set of requirements for mitigation project funding:

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- Projects must be technically feasible and ready to implement.
- Structural projects must include engineering studies with the project application so the FEMA can independently evaluate the effectiveness and feasibility of the proposed project.
- All projects must be cost effective and substantially reduce the risk of future damage, hardship, loss, or suffering. All projects must have a benefit-cost ratio of 1.0 or greater in FEMA's Benefit-Cost Analysis (BCA).
- All projects must be in conformance with the current natural hazard of flood mitigation plan.
- All flood-related projects must be located in a community that is participating and in good standing with the National Flood Insurance Program.

Technical assistance on completing the analysis and submitting project grant applications is available from FEMA. These considerations must be included in the on-going project analysis that will take place as this plan is implemented.

Even without the FEMA project requirements, and evaluation of cost effectiveness and technical feasibility is necessary to assure the success of the project. These are very basic considerations, but a 1.0 or greater BCA result is not the only measure of the value of a project. Nor is it the only measure of the potential for success or failure of a project. These issues also exist within a social and political context. There are other questions besides cost and technical feasibility that must be answered, or at least addressed, when evaluating options:

- How should scarce public resources, both financial and staff time, be allocated in a way that is fair?
- What are the constraints beyond technical and financial? Are there legal constraints or time constraints? Is there staff available to initiate and manage the project?
- Are there special interest groups that will impose restrictions on (or assist in implementing) the project?
- Who should benefit from the project?
- How will priorities be assigned when evaluating alternatives?
- By what measure do intangibles such as environmental quality or recreational potential factor into the discussion?
- How will these decisions be made?

These factors make it essential that this effort be a publicly open process involving as many stakeholder groups as possible.

5.6.2 Continued Public Involvement

The effort that produced this plan was an open process and the implementation must be as well. It's success depends on it. Full implementation of many of the objectives would require a range of possible actions on the part of county government, including:

- Stakeholder partnerships
- County Board and County Executive policy changes
- Ordinance amendment
- Capital expenditure
- Operating budget expenditure
- Staff time dedication
- Project grant application and acceptance

These activities *all* have public input and review built into the process. This plan was prepared with the idea that the citizens served by the entities developing the plan should have a voice in determining the priorities identified in the plan. The notion that every citizen has a right to participate in the process of making local government decisions is part of culture in Dane County government. Significant financial, time, and energy investments will be required to complete the planning effort. Given these investments, Dane County regards broad public participation in the process as an essential strategy for implementing actions that are supported by the public. Routinely used tools for gathering public and stakeholder input include:

- Stakeholder workgroups and partnerships
- Public meetings
- Websites
- Surveys
- Open houses
- Public comment period prior to open meetings
- Personal contact

Any or all of these methods will be employed as specific objectives in the plan are implemented.

5.6.3 Funding Assistance

There are numerous options available to Dane County for the financing of a flood mitigation program. The identification of potential funding sources, including sources other than those at the local level is an integral part of the implementation of a successful mitigation plan. However, funding programs and opportunities are constantly changing. The following list of existing programs and funding sources includes those that appear to be potentially applicable to Dane County directly or to municipalities within Dane County.

Federal Emergency Management Agency (FEMA) Unified Hazard Mitigation Assistance (HMA) Grant Programs

FEMA has recently unified its guidance for the various grant programs that fund mitigation projects. These programs include the Flood Mitigation Assistance, Hazard Mitigation Grant Program, Pre-Disaster

Mitigation, Severe Repetitive Loss and Repetitive Flood Claims grants. More information on these programs can be referenced on the FEMA.gov website and in the text that follows.

- *Hazard Mitigation Grant Program.* The Hazard Mitigation Grant Program (HMGP) is authorized by section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP assists state and local communities in implementing long-term hazard mitigation measures following a Presidential Major Disaster Declaration.

The HMGP is administered by Wisconsin Emergency Management and provides grant funds to local governments to implement cost effective and environmentally sound mitigation measures. The amount of federal funding for the HMGP is based on 15% of the total Stafford Act funds spent on Public and Individual Assistance Programs for the declared disaster. The HMGP will provide up to 75 percent of the project costs, with the balance of the costs shared by the State of Wisconsin (12.5 percent) and the local project grantee (12.5 percent). Communities in Wisconsin can only apply for HMGP funds after a Presidential disaster declaration is issued. Wisconsin Emergency Management is responsible for receiving local applications and prioritizing projects.

The HMGP can be used to fund projects to protect either public or private property. Examples of these projects include acquisition and relocation of structures from flood-prone areas, retrofitting such as flood proofing to protect structures from future damages, structural hazard control, such as debris basins or flood walls, and development of local standards to protect new or substantially improved structures from disaster damage. Projects must have a beneficial impact and solve a problem independently or constitute a functional portion of a solution where the project as a whole will be completed. The HMGP gives priority to FEMA identified repetitive loss properties.

- *Flood Mitigation Assistance Program.* The Flood Mitigation Assistance (FMA) provides pre-disaster financial assistance to states and local communities for flood mitigation and planning activities. The FMA program will provide funds for activities that will reduce the risk of flood damage to structures insurable under the National Flood insurance Program (NFIP). FMA is a state-administered, cost share program. Grants provided to local governments are 75 percent federally funded with the remaining 25 percent the responsibility of the local applicant. Each state receives an annual allocation based on the number of flood insurance policies in force and the number of repetitive loss structures within that state.

In order to receive an FMA grant, a community must be a participant and in good standing with the NFIP. To be eligible for a Project Grant, the community must have a FEMA approved flood mitigation plan. Only those mitigation activities that are specified in the approved mitigation plan are eligible for FMA Project Grant funding.

Projects must be an eligible type of activity that reduces the risk of flood damage to structures insurable under the NFIP. Eligible projects include acquisition and relocation, elevation and flood proofing, or demolition of NFIP insured structures. Minor structural projects that reduce localized flooding and protect NFIP insurable structures are also eligible. Projects must also be cost effective, technically feasible, and conform to the approved flood mitigation plan.

- *Pre-Disaster Mitigation Program.* The Pre-Disaster Mitigation (PDM) Program was authorized by §203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 USC, as amended by §102 of the Disaster Mitigation Act of 2000. Funding for the program is provided through the National Pre-Disaster Mitigation Fund to assist States and local governments (to include Indian Tribal governments) in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program. All applicants must be participating in the National Flood Insurance Program (NFIP) if they have been identified through the NFIP as having a Special Flood Hazard Area (a Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM) has been issued). In addition, the community must not be suspended or on probation from the NFIP.

44 CFR Part 201, Hazard Mitigation Planning, establishes criteria for State and local hazard mitigation planning authorized by §322 of the Stafford Act, as amended by §104 of the DMA. After November 1, 2003, local governments and Indian Tribal governments applying for PDM funds through the States will have to have an approved local mitigation plan prior to the approval of local mitigation project grants. States will also be required to have an approved Standard State mitigation plan in order to receive PDM funds for State or local mitigation projects after November 1, 2004. Therefore, the development of State and local multi-hazard mitigation plans is key to maintaining eligibility for future PDM funding.

Federal Emergency Management Agency (FEMA) – Public Assistance Program

The Public Assistance Program can provide limited assistance for hazard mitigation projects. Funding under this program is provided for repair of public infrastructure damaged during an event that results in a Presidential Major Disaster Declaration. The Public Assistance Program is authorized under the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The Public Assistance Program will provide up to 75 percent of the project costs, with the balance of the costs shared by the State of Wisconsin (12.5 percent) and the local project grantee (12.5 percent).

Eligible categories for public assistance include costs incurred for emergency work such as debris removal and emergency protective measures or permanent work of a restorative nature such as repairing damage to roads and bridges, water treatment and control systems, or publicly owned buildings or utilities. Mitigation measures are eligible if the work to restore public infrastructure is done in such a way as to improve the facility in order to prevent or minimize future damages.

U.S. Department of Housing and Urban Development – Community Development Block Grants

The Wisconsin Community Development Block Grant (CDBG) program is funded by HUD and administered by Wisconsin Departments of Administration and Commerce. The CDBG program can provide funding for a variety of flood mitigation activities, including disaster relief and acquisition and relocation of structures. CDBG housing grants are awarded annually through a competitive process. Eligible projects must have sustained damage and must benefit low- and moderate-income persons. In addition, CDBG emergency assistance grants may be provided for mitigation activities following a local disaster, even if a Presidential Major Disaster has not been declared. Most Dane County communities are eligible for CDBG funds, based on priorities established in a Consolidated Plan approved by the Dane County Board of Supervisors and HUD.

Wisconsin DNR Municipal Flood Control Grant Program

This program provides 70% cost sharing grants to cities, villages, towns and metropolitan sewerage districts to acquire or flood proof structures, purchase easements, restore riparian areas, or construct flood control structures. Applications would be ranked based on avoided flood damages, restoration or protection of natural and beneficial functions of water bodies, use of natural flood storage techniques or environmentally sensitive detention ponds and enhanced recreational opportunities. Eligible activities, in priority order include:

- Acquisition and removal of structures that, due to zoning restrictions, can not be rebuilt or repaired.
- Acquisition and removal of structures in the 100 year floodplain.
- Acquisition and removal of repetitive loss or substantially damaged structures.
- Acquisition and removal of other flood damaged structures.
- floodproofing and elevation of structures.
- Riparian restoration projects, including removal of dams and other artificial obstructions.
- Restoration of fish and native plant habitat, erosion control and streambank restoration projects.
- Acquisition of vacant land, or perpetual conservation or flowage easements to provide additional flood storage or to facilitate natural or more efficient flood flows.
- Construction of structures for the collection, detention, retention, storage, and transmission of stormwater and groundwater for flood control and riparian restoration projects.
- Preparation of flood insurance studies and other flood mapping projects.