# Montgomery County, Maryland

# Hazard Mitigation Plan

**September 2018**

Office of Emergency Management & Homeland Security

***This Plan was developed in cooperation with:***

## *Montgomery County*

***CITIES OF:***
*Gaithersburg*
*Rockville*
*Takoma Park*

***TOWNS OF:***
*Barnesville*
*Brookeville*
*Chevy Chase*
*Chevy Chase View*
*Chevy Chase Village*
*Garrett Park*
*Glen Echo*
*Kensington*
*Laytonsville*
*Poolesville*
*Somerset*
*Washington Grove*

***VILLAGES OF:***
*Chevy Chase, Section 3*
*Chevy Chase, Section 5*
*Martin's Additions*
*North Chevy Chase*

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# CERTIFICATION OF ANNUAL MEETINGS

The Montgomery County Mitigation Planning Committee has reviewed this Multi-Jurisdictional Hazard Mitigation Plan. See Chapter 6, Implementation and Maintenance section of this Plan for further details regarding the following table. The Director of the Montgomery County Office of Emergency Management and Homeland Security, hereby certifies this review.

| YEAR | DATE | PUBLIC OUTREACH ADDRESSED | SIGNATURE |
|---|---|---|---|
| **2020** | | | |
| **2021** | | | |
| **2022** | | | |
| **2023** | | | |
| **2024** | | | |

# EXECUTIVE SUMMARY

***Efficiently use County resources to minimize the loss of life and property from natural hazards and protect County assets, infrastructure, and critical facilities.***

Hazard mitigation is commonly defined as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. A hazard mitigation plan states the aspirations and specific courses of action that a community intends to follow to reduce vulnerability and exposure to future hazard events.

The intention of this Plan update is to serve as a blueprint for coordinating and implementing hazard mitigation policies, programs, and projects. It provides a list of mitigation goals, objectives, and related actions that may assist Montgomery County in reducing risk and preventing loss from future natural hazard events. The impacts of hazards can be lessened and sometimes avoided altogether if appropriate actions are taken before hazardous events occur. By avoiding unnecessary exposure to known hazard risks, communities will save lives and property and minimize the social, economic, and environmental disruptions that commonly follow hazard events. Montgomery County and its municipalities agree that hazard mitigation makes sense. Through the identification of vulnerable areas and the implementation of measures aimed at minimizing exposure, the negative impacts of natural hazards may be reduced for Montgomery County.

Communities face significant challenges during post-disaster redevelopment in balancing the driving need for rapid recovery with implementing long-term hazard mitigation. The necessity to meet basic needs and resettle displaced populations immediately following a disaster often overshadows the more abstract, longer-term sustainability considerations. Once full-scale reconstruction is initiated, it is difficult to modify projects in progress to meet sustainability objectives. This trend highlights the need for pre-disaster mitigation planning that incorporates principles of sustainable development within the context of reconstruction, so that communities can more easily rebuild in a manner that will make them less vulnerable to future hazard events while improving the quality of life.

It is essential that local decision makers become and stay involved in this planning process to provide new ideas and insight for future updates to the Hazard Mitigation Plan for Montgomery County. It will remain a challenge and a goal for Montgomery County to provide necessary updates as mitigation techniques are implemented. It will remain imperative that all local agencies, units of government, non-profit organizations, businesses and industries, and private citizens continue their involvement and dedication to hazard mitigation.

This update serves as a multi-jurisdictional hazard mitigation plan that represents a combined County and local commitment to reduce risks from natural hazards. The intent of this update is to produce a document that local officials can refer to in their day-to-day activities and in decisions regarding land use and planning decisions, regulation and ordinance creation and enforcement, granting permits, capital improvement investments, disaster planning and other community initiatives. Additionally, the update

to this hazard mitigation plan serves as the basis for FEMA and States to prioritize future grant funding as it becomes available.

The *2018 Montgomery County Plan Update* will continue to be a useful tool for all community stakeholders by increasing public awareness about local hazards and risks and by providing information about options and resources available to reduce those risks. Educating the public about potential hazards will help each jurisdiction protect itself against the effects of future hazards and will enable informed decision-making regarding where to live, purchase property, or locate business.

The Montgomery County Hazard Mitigation Plan was developed by members of a Mitigation Planning Committee (MPC) that consisted of County agencies, regional partners, and the following local jurisdictions:

| |
|---|
| Barnesville |
| Brookeville |
| Chevy Chase |
| Chevy Chase View |
| Chevy Chase Village |
| Chevy Chase Village Section 3 |
| Chevy Chase Village Section 5 |
| Gaithersburg |
| Garrett Park |
| Glen Echo |
| Kensington |
| Laytonsville |
| Martin's Additions |
| The Village of North Chevy Chase |
| Poolesville |
| Rockville |
| Somerset |
| Takoma Park |
| Washington Grove |

Hazards were ranked by the MPC and reevaluated during the planning process to determine the hazards with the largest impact on the County and its communities. The following table summarizes the results of the hazard identification, which are further explained in Chapter 3 of this plan.

| HAZARD | RANK |
|---|---|
| Severe Storm | High Rank |
| Winter Storm | Medium Rank |
| Extreme Heat | Medium Rank |
| Flooding | Medium Rank |
| Hurricane/Tropical Storm | Medium Rank |
| Fire | Medium Rank |
| Water Shortage/Drought | Medium Rank |

| HAZARD | RANK |
|---|---|
| Tornado | Medium Rank |
| Earthquake | Medium Rank |
| Land Subsidence/Karst | Low Rank |

The MPC members used the results of the Hazard Identification and Risk Assessment (HIRA) as well as the Capability Assessment to develop goals and inform updated strategies, actions, and projects for the County and its independent jurisdictions. The new 2018 mitigation strategy was re-organized to better correspond with both County agencies as well as local jurisdictions, programs, and plans.

The MPC members reviewed the 12 goals that were presented in the 2013 plan and re-worked them to include one overarching goal with seven distinctive objectives. The 2018 updated plan goals and objects are as follows:

**Goal:**

Efficiently use County resources to minimize the loss of life and property from natural hazards and protect County assets, infrastructure, and critical facilities.

**Objectives:**

1. Encourage building and land use regulations that increase safety and resiliency and reduce risks posed by natural disasters.
2. Protect public health, safety, and welfare by increasing public awareness of existing natural hazards and by fostering individual and public responsibility in mitigating risks caused by those hazards.
3. Ensure that infrastructure is adequate and properly maintained to provide continued functionality of all critical services necessary to protect residents and property.
4. Improve communications and increase natural hazard awareness through education and citizen participation.
5. Enhance the capabilities of local jurisdictions to identify and mitigate natural hazards.
6. Participate and comply with the National Flood Insurance Program through floodplain identification and mapping and floodplain management.
7. Promote actions that protect historic and cultural resources, while enhancing hazard mitigation and community resiliency.

Montgomery Office of Emergency Management and Homeland Security staff conducted in-person interviews with each community to discuss the status of action items that were identified in the 2013 strategy and to develop new actions for the 2018 strategy. These actions were compiled and prioritized

for each jurisdiction. Communities shared common strategies and developed community-specific actions that varied somewhat from jurisdiction to jurisdiction.

As part of the in-person interview, Montgomery County staff also conducted a survey to evaluate each jurisdiction's capability. This assessment evaluated the current capacity of each jurisdiction to mitigate the effects of the natural hazards identified in the HIRA. By providing a summary of each jurisdiction's existing capabilities, the Capability Assessment serves as the foundation for designing an effective hazard mitigation strategy.

The *2018 Montgomery County Mitigation Plan Update* embodies the continued commitment and dedication of the local jurisdictions and community members of the County to enhance the safety of residents and businesses by taking action before a disaster strikes. While nothing can be done to prevent natural hazard events from occurring, the region is poised to minimize the disruption and devastation that so often accompany these disasters.

The plan update is organized as follows, with detailed table and figure lists provided, by chapters, in the Table of Contents.

The Executive Summary provides the plan update context of the County and its local jurisdictions. The County MPC is described, along with the planning process, HIRA outcome, refreshed mitigation plan goals and a summary of updated mitigation action organization and plan implementation.

Planning Process summarizes the planning history behind the Disaster Mitigation Act of 2000, its regulatory requirements, the plan planning process used by the Montgomery County during the plan update process, and a description of stakeholder involvement and outreach.

Community Profile and Coordination provides a physical and demographic profile of the County, examining characteristics such as geography, hydrography, development, people, and land uses. This section additionally reviews land use planning authority for the County and multi-jurisdictional planning and participation.

Hazard Identification and Risk Assessment evaluates the natural hazards likely to affect or impact the County, quantifying whom, what, where, and how the area might be affected by natural hazards.

Hazard Mitigation Goals, Objectives, and Strategy addresses local and regional hazard-related issues and concerns by establishing a revised framework for mitigation activities and policies. The strategy includes a range of updated mitigation strategies, actions, and projects to support achievement of the plans goal and objectives.

Capability Assessment, Implementation and Plan Maintenance Procedures describes available programs and resources that can support plan implementation. This section describes how the plan will be monitored, evaluated, and updated, including a process for continuing stakeholder involvement after the plan is completed. A list Appendices are included at the end of the plan and contain supplemental reference materials and more detailed calculations and methodologies used in the planning process.

# INTRODUCTION

Emergency Management is the discipline of identifying, managing, avoiding, and responding to risks. It is a discipline that involves preparing for a disaster before it occurs, supporting those affected by the disaster, and rebuilding after the disaster. Emergency Management is an ever-changing process by which all individuals, groups, and communities attempt to manage hazards in an effort to avoid or reduce the impact of disasters. One method to attempt to prevent hazards from developing into disasters all together is hazard mitigation planning. Hazard mitigation planning is a process to identify policies, capabilities, activities, and tools necessary to implement successful and sustainable mitigation actions.

Mitigation planning is described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that pre-disaster investments will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Mitigation practices will build resilience and enable local residents, businesses, and industries to re-establish themselves in a post disaster environment.

The benefits of mitigation planning go beyond reducing hazard vulnerability to achieve additional community goals, such as preserving open space, improving water quality, maintaining environmental health, and enhancing recreational opportunities. For this reason, it is important that any local mitigation planning process be integrated with other concurrent local planning efforts.

A Hazard Mitigation Plan is the physical representation of a jurisdiction's commitment to reduce risks from natural hazards. Local officials can refer to the plan in their day-to-day activities and in decisions regarding regulations and ordinances, granting permits, and funding of capital improvements. Local Hazard Mitigation Plans also serve as the basis for FEMA and States to prioritize future grant funding as it becomes available.

Montgomery County completed its initial Hazard Mitigation Plan in January 2007 (approved February 2, 2007) and updated the plan in 2013 (adopted February 10, 2014). Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks and determining how to best minimize or manage those risks. This process results in a Hazard Mitigation Plan that identifies specific mitigation actions, each designed to achieve both short term planning objectives and a long-term community vision. To ensure the functionality of each mitigation action, responsibility is assigned to a specific individual, department, or agency along with a schedule for its implementation. Plan maintenance procedures are established to implement, as well as to evaluate and enhance the Plan as necessary. Developing clear plan maintenance procedures ensures that Montgomery County's Hazard Mitigation Plan remains a current, dynamic, and effective planning document over time.

As an incentive for State and local governments to develop Hazard Mitigation Plans, the Federal Government requires mitigation planning as a component of eligibility for hazard mitigation project funding. The 2015 FEMA Hazard Mitigation Assistance Guidance states that mitigation plans are the foundation for effective hazard mitigation. As such, local jurisdictions must have a FEMA-approved local Hazard Mitigation Plan at the time of obligation of grant funds in order to be eligible for grant funding

under the unified Hazard Mitigation Assistance (HMA) programs. This requirement reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

This Plan update has been prepared to meet requirements set forth by FEMA and the Maryland Emergency Management Agency (MEMA) in order for Montgomery County to be eligible for funding and technical assistance from State and Federal hazard mitigation programs. On April 8, 2019, Montgomery County adopted the update to the Montgomery County Hazard Mitigation Plan in accordance with the authority granted to counties by the State of Maryland. This Plan was updated in accordance with current State and Federal rules and regulations governing local Hazard Mitigation Plans. The Plan shall be monitored and updated on a routine basis to maintain compliance with the following legislation and guidance:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C 5121, Section 322, Mitigation Planning, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390) and by FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at Section 44 Code of Federal Regulations (CFR) Part 201. The Disaster Mitigation Act of 2000 added a new section to the law, Section 322, Mitigation Planning that requires local governments to prepare and adopt jurisdiction-wide Hazard Mitigation Plans for disasters declared after November 1, 2004, as a condition of receiving Hazard Mitigation Grant Program project grants and other non-disaster related mitigation grant assistance programs. Local governments must review and, if necessary, update their mitigation plans every five years from the original date of the plans in order to continue HMA program eligibility.
- The requirements for local mitigation plans are found in Section 44 CFR Section 201.6. FEMA's "*Local Multi-Hazard Mitigation* Planning Guidance" issued on October 1, 2011, provides updated FEMA interpretation and explanation of local plan mitigation regulations and FEMA's expectations for mitigation plan updates. In addition, MEMA and FEMA now use the 2013 *Local Mitigation Plan Review Tool* to ensure that a plan meets FEMA's regulatory requirements as well as additional requirements identified by the State of Maryland.
- The Maryland Code. The Emergency Management Policy was updated in July 2016 through Executive Order 01.01.1991.02 State of Maryland Emergency Management Policy. This policy authorizes the Maryland Emergency Management Agency (MEMA) as the state agency with the primary responsibility for the planning and execution of disaster and emergency preparedness, response, and recovery including the coordination and development of hazard mitigation planning activities.

# 1. PLANNING PROCESS

*A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? 44 CFR 201.6(c)(1)*
*A2. Does the Plan document an opportunity for neighboring communities and local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? 44 CFR 201.6(b)(2)*
*A3. Does the Plan document how the public was involved in the planning process during the drafting stage? 44 CFR 201.6(b)(1) and 201.6(c)(1)*

The Montgomery County Hazard Mitigation Plan provides the County with a roadmap to evaluating hazards, identifying resources and capabilities, selecting appropriate actions, and implementing mitigation measures to eliminate or reduce future damage from those hazards.

The process was developed to meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) §201.6.1. and the requirements laid out in the Federal Emergency Management Agency (FEMA) Local Mitigation Plan Review Guide. Additional guidance documents consulted during the planning process include, but are not limited to, the State of Maryland Local Hazard Mitigation Plan Guidance (2015), FEMA's Local Hazard Mitigation handbook (2013), Plan Integration: Linking Local Planning Efforts (2015), and FEMA's Mitigation Activities.

The Montgomery County Office of Emergency Management and Homeland Security (OEMHS) Planning Team worked closely with the Mitigation Planning Committee (MPC) to develop and review each section of the Mitigation Plan. The planning team conducted project meetings and MPC meetings throughout the process. Meeting agendas, meeting minutes, and sign in sheets were developed and maintained for each meeting and are detailed in Appendix B of this plan.

This section of the Plan describes the mitigation planning process that was undertaken by Montgomery County and participating municipalities in the preparation of the 2018 Hazard Mitigation Plan update. This section consists of the following subsections:

- LOCAL METHODOLOGY AND UPDATE PROCESS
- THE PLANNING TEAM AND THE MITIGATION PLANNING COMMITTEE
- PLANNING MEETINGS AND DOCUMENTATION
- PUBLIC PARTICIPATION

## LOCAL METHODOLOGY AND UPDATE PROCESS

This updated Plan contains a narrative description of the process followed to prepare it. All municipalities were notified in November 2017 of the requirement concerning the MPC and process. Subsequent meetings were held to ensure that all information is correct, and that all agencies, organizations and the public's input were included as presented. In all, the plan update process was conducted over the course of ten months, from December 2017 to September 2018. Throughout the

planning update process, the County MPC was involved with the review and update of each section of the Plan.

The first Montgomery County Multi-Hazard Mitigation Plan was adopted on February 6, 2007. In 2006, the Montgomery County MPC started preparing the Plan to fulfill the requirements of Disaster Mitigation Act of 2000. Development of the plan was a concerted effort on the part of Montgomery County and its municipalities. The Montgomery County OEMHS Director invited directors and staff from public agencies, private businesses and organizations, and community representatives to participate in this recent planning committee. The 2007 Montgomery County Multi-Hazard Mitigation Plan and the current State of Maryland Hazard Mitigation Plan were reviewed for incorporation into the 2013 Montgomery County Hazard Mitigation Plan.

The 2007 Plan addressed ten natural hazards and two technological hazards. Most of those hazards were assessed by previous occurrences, vulnerability and exposure to County and municipal assets, and potential loss estimates (if applicable). In addition, the 2007 Plan defined those hazards that were considered to have the highest probability of occurrence. An update to the 2007 Plan was initiated in November 2011 with funding support from MEMA and FEMA. Training Outreach and Michael Baker Jr., Inc. provided planning support and guidance to Montgomery County throughout that plan update process.

The planning process used for the 2018 Hazard Mitigation Plan update was based on Section 322 of the Disaster Mitigation Act of 2000 and supporting guidance developed by FEMA. The planning process followed these steps:

- Conduct kickoff meeting and reestablish the MPC/Team
- Conduct a five-year Plan review
- Review and update the local hazard, risk, and vulnerability summary
- Determine capability for the County and each municipality
- Update the mitigation strategy
- Update the Plan maintenance procedures
- Complete a draft plan for review by Montgomery County
- Advertise opportunity for comment on final draft
- Provide final draft to MEMA for review
- Provide final draft to FEMA for review
- Present Plan to Montgomery County for adoption
- Present Plan to municipalities for adoption

Each of the planning steps described above resulted in key products and outcomes that collectively make up the Hazard Mitigation Plan. These work elements are further discussed below for introductory purposes.

The *Community Profile*, located later in Chapter 2, describes the general makeup of Montgomery County and its municipalities, including prevalent geographic, demographic, and economic characteristics. This baseline information provides a snapshot of the countywide planning area and thereby assists

participating officials in recognizing those social, environmental, and economic factors that ultimately play a role in determining community vulnerability to natural hazards.

The *Hazard Identification and Risk Assessment* (*HIRA*), found in Chapter 3, is presented as three different elements: *Hazard Identification/Profile*, *Hazard Analysis,* and a *Vulnerability Assessment*. Together, these elements serve to identify, analyze, and assess Montgomery County's overall risk to natural hazards. The HIRA builds on available historical data from previous occurrences, establishes hazard-by-hazard profiles, and culminates in a hazard risk priority or ranking based on conclusions about the frequency of occurrence, potential impact, spatial extent, warning time, and duration of each hazard. FEMA's Hazus-MH loss estimation methodology was also used in evaluating known flood risks according to their relative long-term cost, measured in expected damages. The HIRA is designed to assist communities in seeking the most appropriate mitigation actions to pursue and implement by focusing their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s).

The *Community Profile and HIRA* collectively serve as a basis for updating goals for this Plan update, each contributing to the development, adoption, and implementation of a meaningful *Mitigation Strategy* update that is based on accurate background information.

The *Mitigation Strategy*, found in Chapter 4, presents the plan goal and objectives as well as specific mitigation actions for each jurisdiction participating in the planning process. This updated strategy provides the foundation for *Mitigation Action Plans* that link jurisdictionally specific mitigation actions to locally assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan more strategic and functional through the identification of both long-term goals and near-term actions that will guide day-to-day decision-making and project implementation.

In addition to the identification and prioritization of possible mitigation projects, emphasis is placed on the use of program and policy alternatives to help make Montgomery County and participating municipalities less vulnerable to the damaging forces of nature while improving the economic, social, and environmental health of the community. The concept of multi-objective planning is emphasized throughout this Plan update, identifying ways to link hazard mitigation policies and programs with complimentary community goals that may be related to housing, economic development, community revitalization, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety. This Hazard Mitigation Plan update is a proactive document that represents a concerted effort to make Montgomery County and participating jurisdictions more livable communities.

The *Plan Maintenance Procedures*, found in Chapter 5, includes the measures Montgomery County and participating jurisdictions will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly monitored, reported upon, evaluated, and updated to remain a current and meaningful planning document.

Over the course of ten months and three meetings, the MPC reviewed the current plan for consistency, provided new information that needed to be included in the Plan update, and incorporated it as required by State and Federal guidelines. The MPC was also tasked with collecting all accurate data from plan participants and provided outreach to the public and business stakeholders to ensure that all relevant information is included in this Plan update.

# THE PLANNING TEAM AND MITIGATION PLANNING COMMITTEE

The 2018 Montgomery County Hazard Mitigation Plan update was led by the planning team that provided guidance and leadership for the overall project. The planning team assisted the MPC through the planning process and dissemination of information and administrative tasks. Table 1-1**,** Mitigation Planning Team, outlines the individuals that comprised this team.

**Table 1-1: 2018 Mitigation Planning Team**

| NAME | TITLE & DEPARTMENT |
|---|---|
| Earl Stoddard | Director, Montgomery Co., OEMHS |
| Marianne Souders | Planning Division Chief, Montgomery Co., OEMHS |
| Michael Boldosser | Emergency Management Specialist, Montgomery Co., OEMHS |
| Laura Johnson | President, Training Outreach |
| Mark James | Project Manager, Michael Baker International |
| Desirae Williams | Environmental Planner, Michael Baker International |

The planning team developed a diverse list of potential committee members that would contribute to the development of this Plan update. Invitations were delivered to the prospective members with a description of the duties and responsibilities needed to serve on the MPC. Montgomery County engaged past MPC members, local government officials, stakeholders, and the general public in local meetings and planning workshops to discuss and complete tasks associated with preparing the Plan update. Members that participated in the 2013 Hazard Mitigation Plan were highly encouraged to join the 2018 team, and the following agencies, departments, and organizations were invited to participate in the MPC: County Council members, The Maryland-National Capital Park and Planning Commission, County Police, County Department of General Services, County Permitting Services, County Department of Transportation, County Recreation, Technology Services, County Health and Human Services, County Department of Environment, County Office of Community Partnership, County Park Police, County Public Schools, County Department of Agriculture, County Attorney's Office, American Red Cross, Potomac Electric Power Company, Washington Suburban Sanitary Commission, and Baltimore Gas and Electric. The invitations for membership of the MPC were disseminated by the Montgomery County Office of Emergency Management and Homeland Security utilizing letters, email, and telephone calls. The planning team worked with members of the MPC throughout the process to plan and hold meetings, collect information and conduct public outreach efforts. A complete list of the MPC members (contact information) who were invited to participate in the plan update is in Appendix B

The stakeholders listed in Table 1-2, Mitigation Planning Committee involvement in 2018 Planning Process, actively participated in the planning process by attending meetings and by completing assessments, surveys, and worksheets and/or submitting comments.

**Table 1-2: 2018 Mitigation Planning Committee Involvement in 2018 Planning Process**

| NAME | JURISDICTION, AGENCY | KICKOFF MEETING | RISK ASSESSMENT MEETING | STRATEGY MEETING |
|---|---|---|---|---|
| Ron Hardy | Takoma Park | X | | X |
| Jackie Parker | Chevy Chase Village | X | | X |
| Lennox Jones | Red Cross | X | | |

**Table 1-2: 2018 Mitigation Planning Committee Involvement in 2018 Planning Process**

| NAME | JURISDICTION, AGENCY | KICKOFF MEETING | RISK ASSESSMENT MEETING | STRATEGY MEETING |
|---|---|---|---|---|
| Ed Daniel | MC PD | X | X | X |
| David Borchardt | DDS FCC | X | | |
| Cat Lee | MC DEP | X | X | X |
| Rick Merck | DPS FCC | X | | |
| Hemal Mustafa | DPS FCC | X | | X |
| Ruben Rosario | MC PD | X | | |
| Luis Solis | MC DGS | X | | X |
| Jan Seilhamer | RC PD | X | X | X |
| Trudy Schwarz | City of Gaithersburg | X | | |
| Andrew Benjamin | City of Gaithersburg | X | | |
| Isami Aygla | MC DGS | X | | |
| Chuck Crisostomo | OEMHS | X | | |
| Jim McClelland | OEMHS | X | | |
| Tina Laboy | OEMHS | X | | |
| Christine McGrew | MNCPPC | X | X | X |
| Patty Bubar | MC DEP | X | | |
| Keith Levchenko | MC Council - Central | X | | |
| Marianne Souders | OEMHS | X | X | X |
| Skip Lanham | City of Gaithersburg | X | X | X |
| Dave McDonough | WSSC | X | | |
| Michael Boldosser | OEMHS | X | X | X |
| Wade Yos | Poolesville | | X | |
| Charlie Challstrom | Washington Grove | | X | X |
| Arnold Ramsammy | MNCPPC | | X | X |
| Michael Moxley | MNCPPC | | X | X |
| Sean ODonnell | DHHS | | X | |
| Bob Hellmuth | MCPS | | | |
| David Cosson | Washington Grove | | X | X |
| Clark Beil | DHHS | | | X |
| Lt. Patrick Lau | MNCPP | | | X |
| Hadi Manjouri | DPS | | | |
| Chris Henry | City of Rockville | | | |
| Jalessa Tate | MEMA | | X | X |

# PLANNING MEETINGS AND DOCUMENTATION

The preparation of the Plan update required a series of meetings and workshops intended to facilitate discussion and initiate data collection efforts with local community officials. More importantly, the meetings and workshops prompted continuous input and feedback from local officials throughout the update process.

Below is a summary of the key meetings and workshops conducted by the Montgomery County MPC:

## INTERNAL KICKOFF MEETING

Between August 2017 and November 2017, Montgomery County secured a private firm to assist in the update of the plan. On November 9, 2017, the County and the contractor met for an internal project kickoff meeting. During this meeting a five-year plan review was conducted. Also discussed was data

requested from the county, the details of standing up the project website, an overview of the HIRA process, and project logistics.

### KICKOFF MEETING AND FIVE-YEAR PLAN REVIEW MEETING

This meeting was held and advertised as an open/public forum on December 14, 2017, during which the mitigation planning update project was introduced to County officials, representatives of participating jurisdictions, stakeholders, and the general public. The intent of this meeting was to educate local officials, stakeholders, and the general public on the mitigation planning process being sponsored by Montgomery County, as well as to explain the Disaster Mitigation Act of 2000 multi-jurisdictional planning requirements and the individual roles required of planning committee members. The meeting also served to collect data for the HIRA.

The meeting began with introductions and a detailed presentation on the mitigation planning process. Specific data collection needs were thoroughly explained, including the need for accurate GIS data as well as any unique local hazard risk data available for specific areas of concern. During the presentation, the project team from Training Outreach/Michael Baker International conducted an exercise to identify natural and/or technological hazards that should be addressed in the HIRA, and subsequently those that participating jurisdictions would possibly focus their mitigation efforts on throughout the next five years of the Plan's cycle.

An assessment was then conducted for ranking the top hazards affecting Montgomery County. The findings and details on each hazard can be found in Chapter 2: HIRA of this Plan. Following the presentation on the planning process, the project team explained the need to assess existing County and jurisdictional capabilities. A survey inventorying existing planning and regulatory tools and analyzing the capacity to carry them out was provided to each attendee to complete and return to the planning team by the next committee meeting. This assessment process helped identify existing gaps, conflicts, and/or weaknesses that may need to be addressed through future mitigation planning goals and actions. It will also highlight the measures in place or already being performed that should continue to be supported and enhanced through future mitigation efforts. Materials that were used for conducting this meeting, including agenda, presentations, exercises (results), photos, and notes, can be found in APPENDIX B.

### RISK ASSESSMENT REVIEW PLANNING COMMITTEE MEETING

The next meeting was conducted on February 6, 2018 and was also advertised as an open/public forum. This meeting focused on the results of the HIRA exercise that was distributed at the end of the kickoff meeting. The planning committee members were given an opportunity to review and comment on the decisions that were made and the hazards that were selected. The planning committee also agreed at this time to pull technological and manmade hazards out of the assessment and address these hazards as a separate pull out analysis that will be conducted at a later date using an appropriate funding source. A description of each hazard was presented with illustrations and supporting data, and the planning committee members completed an exercise that ranked each hazard. A summary of the risk assessment evaluation can be found in Chapter 3 of this Plan. During this meeting, the MPC also reviewed current goals and objectives and evaluated whether they had been completed or whether they should be deferred into the 2018 Plan, deleted, or changed. During this meeting a unanimous agreement was reached to change the goal and objectives of the Hazard Mitigation Plan. Materials that were used for

conducting this meeting, including agenda, presentations, exercises (results), photos, and notes, can be found in APPENDIX B.

## LOCAL COORDINATION MEETING WITH ALL MUNICIPALITIES

Between March 1st and 29th 2018, the Montgomery County OEMHS staff traveled to and coordinated individual meetings with all municipalities in the county. The purpose of these meetings was to introduce the project and stress the importance of municipal involvement. Topics covered included introduction and purpose of the Hazard Mitigation Plan update, discussion of the mitigation process, review of County and local jurisdiction strategies, and discussion of potential mitigation projects. These meetings proved to be very helpful in building relations and developing a sense of trust between County and local jurisdictions. Materials that were used for conducting the local coordination meetings can be found in APPENDIX D. A summary of the findings is included in the strategy and capabilities sections of the plan. A list of participating jurisdictions and their point of contact is listed in Table 1-3. Please note that all jurisdictions except Chevy Chase View, North Chevy Chase and Laytonsville participated in the survey.

**Table 1-3 : Summary of Meetings and Outreach Efforts**

| DATE | PLACE | PURPOSE | TARGET AUDIENCE | ATTENDEES | COMPOSITION | MATERIAL | INPUT |
|---|---|---|---|---|---|---|---|
| 11/9/17 | Montgomery County OEMHS | Internal Kickoff Meeting | Mitigation Planning Team | 6 | Montgomery Co. OEMHS and contractor staff | Plan Schedule/ Requested Information | Finalized Schedule and Task Assignment |
| 12/14/17 | Montgomery County Public Library | Plan Kick off Meeting | Mitigation Planning Committee and General Public | 21 | Regional Planning, County police, OEMHS, and local Officials | Hazard Identification Exercise and | Identified Hazards in Plan |
| 2/6/18 | Montgomery County Public Library | Risk Assessment Review | Mitigation Planning Committee and General Public | 14 | Regional Planning, County police, OEMHS, and local Officials | Risk Assessment Exercise | Hazard Ranking |
| 4/16/18 | Montgomery County Public Library | Mitigation Solutions Workshop | Mitigation Planning Committee and General Public | 16 | Regional Planning, County police, OEMHS, and local Officials | Mitigation Action Review and Development Exercise | Updated Mitigation Actions |
| 9/4/18 | Montgomery County Public Library | Public Question and Review Period | Mitigation Planning Committee and General Public | 8 | Regional Planning, County OEMHS, and local Officials | Plan Summary and Findings | General Questions on plan schedule, objectives and purpose |
| 3/1/18 – 3/29/18 | Local Jurisdiction Offices | Local Jurisdiction Coordination and Input | Local Jurisdictions | 17 | Local Emergency Management POC | Mitigation Action and Capabilities Discussion | Local actions and capability |

| Table 1-4: Municipality Meeting List and Summary of Scheduled Visits | | | | |
|---|---|---|---|---|
| MUNICIPALITY | POINT OF CONTACT | E-MAIL | MEETING REQUEST SENT | MEETING DATE |
| Barnesville | Mildred Callear | Mildred.callear@gmail.com | 23-Feb | 3/5 1900 |
| Brookeville | Sue Daley | clerk@townofbrookevillemd.org | 3/7 2018 | 3/20 1900 |
| Chevy Chase | Todd Hoffman | thoffman@townofchevychase.org | 23-Feb | 3/1 1300 |
| Chevy Chase View | Jana Coe | janascoe@gmail.com | 23-Feb | Not included |
| Chevy Chase Village | Jackie Parker | Jacqueline.parker@montgomerycountymd.gov | 23-Feb | 3/20/1030 |
| Chevy Chase Village Section 3 | Andy Leon Harney | villagemanager@chevychasesection3.org | 2/23/2018 Second request sent 3/9 | Phone call 3/12 |
| Chevy Chase Village Section 5 | Ashley Kavanaugh | manager@chevychasesection5.org | 23-Feb | 3/5 1300 |
| Gaithersburg | Skip Lanham | Skip.Lanham@gaithersburgmd.gov | 2/23/2018 Second request sent 3/9 | 3/27 1300 |
| Garrett Park | Gene Swearingen | managergene@garrettparkmd.gov | 23-Feb | 3/13 1400 |
| Glen Echo | Willem Polak | glenechomayor@gmail.com | 23-Feb | 3/15 1100 |
| Kensington | Tracey Furman | Mayor.Tracey@tok.md.gov | 23-Feb | 3/1 1000 |
| Laytonsville | Jim Ruspi | laytonsvillemayor@comcast.net | 2/23/2018 Second request sent 3/9 | Not included |
| Martins Additions | Matt Trollinger | manager@martinsadditions.org | 2/23/2018 Second request sent 3/9 | 3/20 1300 |
| The Village of North Chevy Chase | Robert Weesner | nccvm@comcast.net | 2/23/2018 Second request sent 3/9 | Phone call 3/12. |
| Poolesville | Wade Yost | wyost@comcast.net | 23-Feb | 3/8 1000 |
| Rockville | Lt. Jan Seilhamer | jseilhamer@rockvillemd.gov | 23-Feb | 3/7 1300 |
| Somerset | Rich Charnovich | manager@townofsomerset.com | 2/23/2018 Second request sent 3/8 | 3/20 1500 |
| Takoma Park | Ron Hardy | ronh@takomaparkmd.gov | | 3/29 1000 |
| Washington Grove | Joli A. McCathran | JMcCathranWGMD@gmail.com | 23-Feb | 3/28 1400 |

## MITIGATION SOLUTIONS WORKSHOP

This MPC workshop was also advertised an open/public forum and was held on April, 16 2018. The workshop concentrated on the review of existing mitigation actions and the conception of new actions. The results of the local coordination meetings were presented to the committee for comment. Handouts were distributed for workshop participants to use in identifying new mitigation actions to be incorporated into the plan. An in-depth evaluation of the current (2013 plan) mitigation actions was also conducted to determine if the actions have been completed, were incomplete and needed to be

deferred to the 2018 plan, changed, or deleted from the plan altogether. Participants were instructed to complete these templates during the workshop or returned to the planning team within a one-week period. Materials that were used for conducting this meeting, including agenda, presentations, exercises (results), photos, and notes, can be found in APPENDIX B.

Mitigation Action Templates, along with a variety of planning tools and reference documents (FEMA Mitigation Ideas), were used for considering and evaluating new mitigation action.

## PUBLIC PARTICIPATION

An important component of Montgomery County's community-based mitigation planning process involves public, stakeholder, and jurisdiction participation. Individual citizen involvement provides the MPC with a greater understanding of local concerns and ensures a higher degree of mitigation success by developing community "buy-in" from those directly affected by the planning decisions of public officials.

Public input was sought by advertising open public meetings on the Montgomery County OEMHS project website during the planning process. The updated Plan was also available for review and comment at the Montgomery County OEMHS project website prior to adoption. In 2013 Montgomery County utilized a local newspaper, the Montgomery County Gazette to provide public outreach and to advertise meetings. In June 2015 The *Gazette* ceased publication leaving the County to resort to alternative and electronic media sources for conducting public outreach.

Meeting minutes photos and presentations from the December 14, February 6 and April 16 meetings are located in APPENDIX B. Further, a county-level public meeting on September 4, 2018 was scheduled to present the completion of the draft Plan to the general public. The intent of this meeting was to inform citizens about the importance of hazard mitigation, describe the mitigation planning process, and present methods to implement the plan over the next five years. The September 4, 2018, county-level public meeting was advertised on the Montgomery County OEMHS website, Facebook page, and Nextdoor. Advertisements and material from this meeting including minutes photos and presentations are located in APPENDIX B.

In addition to the public notice, upon completion of the final draft Plan, the document was posted on the Montgomery County OEMHS project website for general public review and comment. The Plan was also made available for review at OEMHS. This provided citizens with several opportunities to review the content of each of the Plan's sections, to ask questions, and to suggest possible final revisions.

# 2. COMMUNITY PROFILE AND COORDINATION

*A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? 44 CFR 201.6(b)(3)*

*D1. Was the plan revised to reflect changes in development? 44 CFR 201.6(d)(3)*

This section of the Plan describes the mitigation planning process that was undertaken by Montgomery County and participating municipalities in the preparation of the 2018 Hazard Mitigation Plan update. This section consists of the following subsections:

- COMMUNITY PROFILE, LAND USE, AND DEVELOPMENT TRENDS
- MULTI-JURISDICTIONAL PLANNING AND PARTICIPATION

## COMMUNITY PROFILE AND LAND USE AND DEVELOPMENT TRENDS

Various factors and circumstances of Montgomery County's profile demonstrate the challenges and complexities for implementing mitigation measures. These factors were accounted for throughout the hazard identification, risk analysis, and vulnerability analysis process.

Since Montgomery County is a partner to the National Capital Region, and is the location for several important federal agencies, the consequences and impacts of a hazardous event have the potential for crippling operations not only to the county, but throughout the region and the nation. As such, it is important that all community profile factors are analyzed and factored in throughout the mitigation process as well as in aligning mitigation measures to local jurisdictions.

This chapter will provide a summary of the county's geography and physical environment, demographics, housing characteristics, relationship between its municipalities, and its relationship to other jurisdictions.

### GEOGRAPHY AND PHYSICAL ENVIRONMENT

Montgomery County Maryland is a part of the Washington-Baltimore Metropolitan Area and covers 507 square miles. The total area is 97.7 percent land and 2.3 percent water. Montgomery County lies in the Piedmont Plateau Province of the United States.

### CLIMATE

Since the County lies midway between the mild climate of the South and the more severe climate of the North, the County experiences a continental type of climate and has four distinct seasons. According to the Maryland State Office of Climatology, Montgomery County experiences its coldest temperatures in the month of January and its warmest temperatures in July. The area has an average annual rainfall of

41.13 inches and an average annual snowfall of 18.71 inches[1]. The County received its largest daily rainfall amount of 7.9 inches on June 22, 1972, when Hurricane Agnes hit the area. The County received a record snowfall of more than 40 inches during back-to-back storms on February 5 and 6, 2010 and on February 9 and 10, 2010.

## TOPOGRAPHY

The County's topography is composed of small rolling hills. The elevation of the County ranges from 52 feet above sea level near the Washington D.C. line to 850 feet above sea level in the northern part of the County near the town of Damascus.

## OPEN SPACE

As seen in Figure 2-1, one-third of the County is open space, including farmland and approximately 35,000 acres of parkland and green space. Five large regional parks complement more than 416 different parks, including one state park, two national parks, and numerous local and neighborhood parks featuring a combined 636 acres of lakes[2]. The County has a land-use policy, that promotes open spaces and agricultural preservation in coordination with controlled growth in designated "wedges and corridors." This promotes planning for more efficient water, sewer, and public facilities.

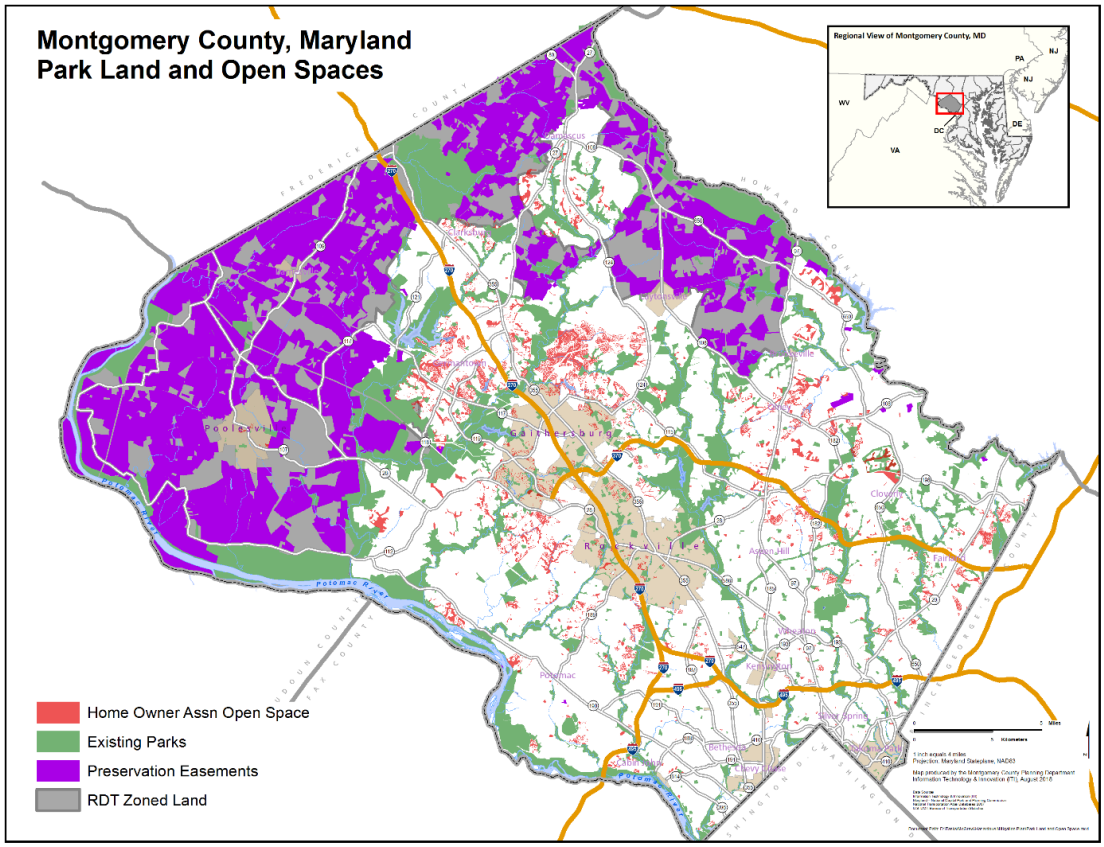



**Figure 2-1: Montgomery County Park Land and Open Spaces**

[1] http://www.usa.com/montgomery-county-md-weather.htm
[2] http://conservationmontgomery.org/issues/

## DEMOGRAPHICS

Montgomery County's estimated population of 1,058,810 in July 2017 ranks second behind Fairfax, Virginia in the Washington, D.C. region, and 42nd in population nationwide. Reigning as the most populous county in Maryland since 1990, Montgomery County crossed another demographic milestone reaching over one million residents in 2012. It is one of only two counties in the region—Fairfax being the other—and part of less than two percent of all counties across the nation, with a million-plus population. Over the next 30 years, no other jurisdiction in the Washington, D.C. region is expected to break the one million-mark to join Fairfax and Montgomery Counties.

In 2016, there were an estimated 1,978 residents per square mile in Montgomery County. The population density ranges from over 30,000 people per square mile in the Somerset and downtown Silver Spring areas to the least populated areas with population densities of 63 and 98 people per square mile, respectively, Barnesville and Poolesville in the northwestern part of the county. As shown in Figure 2-2, the concentration of the County's population along the traffic corridors and inside the I-495 beltway, follows the residential development concepts of "Wedges" and "Corridors" originating from the 1964 Montgomery County General Plan.

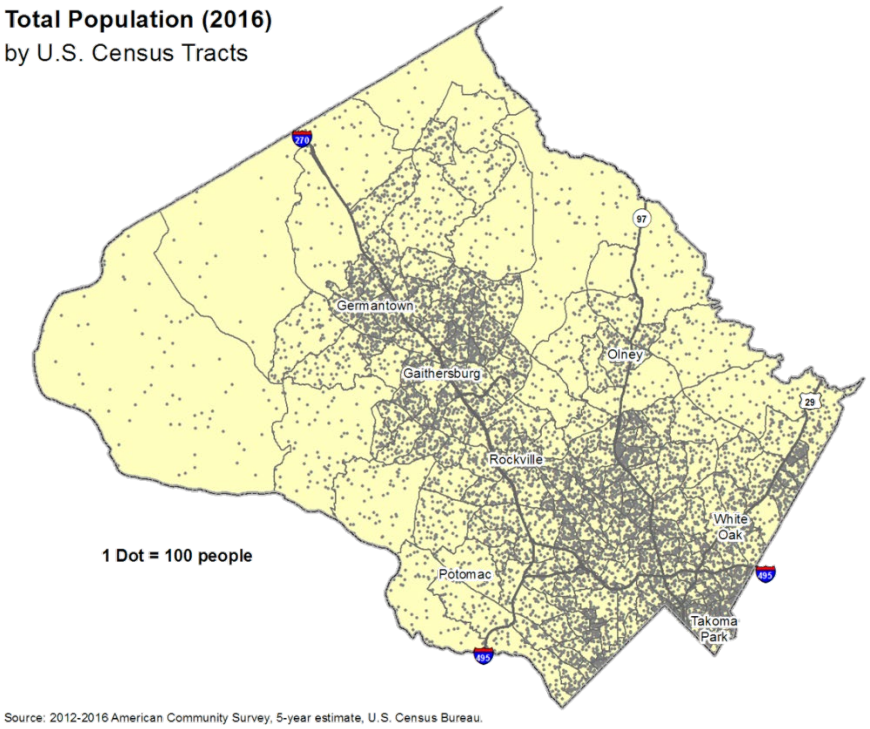



**Figure 2-2: Distribution of Population**

Table 2-1 shows the 2017 estimated population of each of Montgomery County's incorporated municipalities. Overall, Montgomery County's incorporated municipalities make up 16.6 percent of the County's total population.

**Table 2-1: 2017 Total Municipal Population**

| MUNICIPALITY | POPULATION | % OF COUNTY POP |
|---|---|---|
| Barnesville | 184 | 0.02% |

| Table 2-1: 2017 Total Municipal Population | | |
|---|---|---|
| MUNICIPALITY | POPULATION | % OF COUNTY POP |
| Brookeville | 139 | 0.01% |
| Chevy Chase | 3,014 | 0.28% |
| Chevy Chase Section 5 | 797 | 0.08% |
| Chevy Chase Section 3 | 717 | 0.07% |
| Chevy Chase View | 994 | 0.09% |
| Chevy Chase Village | 2,076 | 0.20% |
| Gaithersburg | 68,710 | 6.49% |
| Garrett Park | 1,055 | 0.10% |
| Glen Echo | 273 | 0.03% |
| Kensington | 2,394 | 0.23% |
| Laytonsville | 380 | 0.04% |
| Martin's Additions | 1,004 | 0.09% |
| North Chevy Chase | 593 | 0.06% |
| Poolesville | 5,269 | 0.50% |
| Rockville | 68,401 | 6.46% |
| Somerset | 1,285 | 0.12% |
| Takoma Park | 17,885 | 1.69% |
| Washington Grove | 565 | 0.05% |
| Montgomery County Total | 1,058,810 | 16.60% |

Montgomery County is noted for its high concentration of well-educated residents where 59 percent (423,600) of adults age 25 and older earned at least a bachelor's degree compared to 50 percent in the Washington, D.C. region, and 31 percent nationally in 2016. Almost one-third (231,300) of adults hold a master's, doctorate or professional degree ranking Montgomery County 5th among all counties in the nation in 2016.

### Population Growth

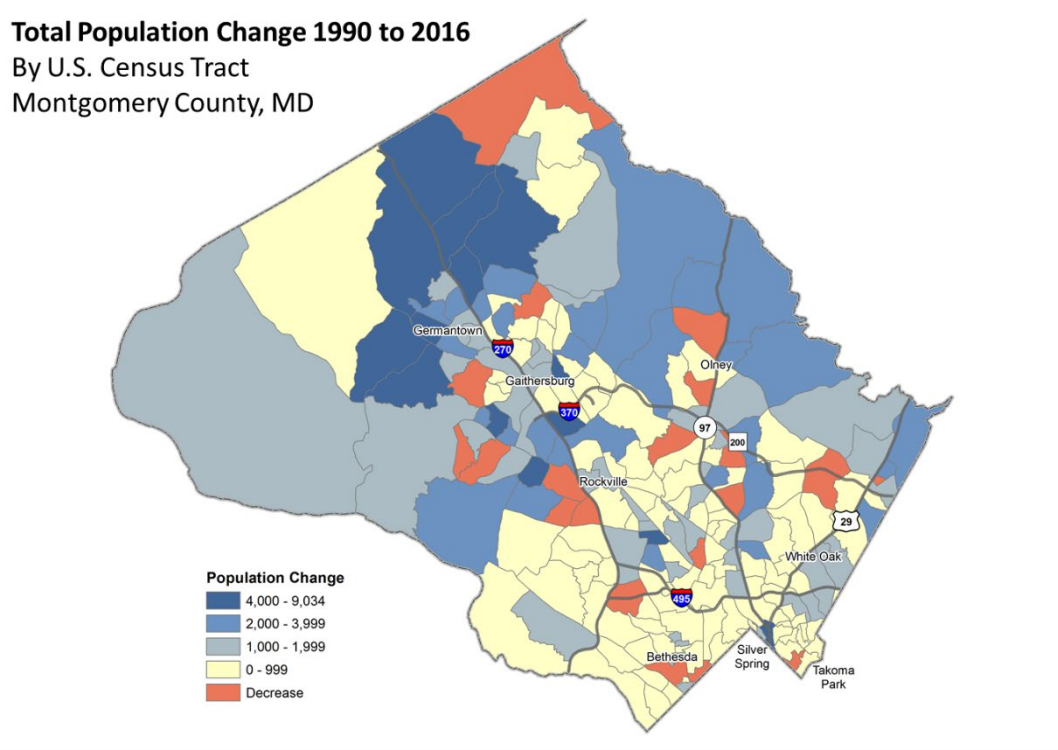
Montgomery County's population grew from 976,140 people in 2010 to an estimated 1,058,810 people in 2017, a change of 8.5 percent. The County's growing population is largely attributed to the population's natural increase with a wide margin of births exceeding deaths, and gains from international migration. Between 1990 and 2017, the County's population increased by 38 percent, gaining 293,334 people. Over this span of 27 years, the County's growth accounted for almost one-quarter of the total population increase across Maryland (Table 2-2). More recently, the population increased 8.5 percent gaining 82,670 people between 2010 and 2017. So far, Montgomery County contributed a larger share, 31 percent in this decade, to the State's overall population increase compared to 22 percent in the 1990s and 21 percent in the 2000s.

| Table 2-2: Share of Maryland's Population Growth[3] | | | | |
|---|---|---|---|---|
| YEAR | POPULATION | GAINS | % INCREASE | % OF STATE'S GROWTH |
| 1990 | 765,476 | | | |
| 2000 | 877,478 | 112,002 | 14.6% | 22% |
| 2010 | 976,140 | 98,662 | 11.2% | 21% |
| 2017 | 1,058,810 | 82,670 | 8.5% | 31% |

[3] Source: Annual July Population Estimates Program, U.S. Census Bureau; Research & Special Projects, Montgomery Planning Department.

| Table 2-2: Share of Maryland's Population Growth[3] | | | | |
|---|---|---|---|---|
| YEAR | POPULATION | GAINS | % INCREASE | % OF STATE'S GROWTH |
| 1990-2017 | | 293,334 | 38.3% | 23% |

Figure 2-3 displays the change in Montgomery County's population from 1990 to 2016 at the U.S. Census tract level. The tracts with the greatest gains in population since 1990 are located at the northern end of I-270 near Clarksburg and Germantown and north of Olney heading toward Howard County. Most tracts gained less than 1,000 people or had slight decreases in population.




Source: 1990 U.S. Census, 2012-2016 American Community Survey, 5-year estimate, U.S. Census Bureau.
Research & Special Projects, Montgomery County Planning Department, M-NCPPC.

**Figure 2-3: Montgomery County Population Change, 1990-2016 by Census Tract**

The most recent population estimates of incorporated places in Montgomery County and the change in the number of residents between 2010 and 2017 are shown in Table 2-3. The Cities of Gaithersburg and Rockville, with estimated populations just under 70,000 people in 2017, are the largest incorporated places in the County and respectively, rank 3rd and 4th in the State. These jurisdictions are also the fastest growing among the local municipalities; Gaithersburg gained 8,805 people, a 14.7 percent increase and Rockville grew by 11.7 percent, adding 7,151 residents. The City of Takoma Park gained 1,163 people, a seven percent increase since 2010.

**Table 2-3: Population of Incorporated Places[4]**

| MUNICIPALITY | JULY 2010 POPULATION* | JULY 2017 POPULATION | CHANGE 2010-2017 | % CHANGE 2010-2017 |
|---|---|---|---|---|
| Barnesville | 174 | 184 | 11 | 6.4% |
| Brookeville | 129 | 139 | 11 | 8.6% |
| Chevy Chase | 2,833 | 3,014 | 190 | 6.7% |
| Chevy Chase Section 5 | 753 | 797 | 47 | 6.3% |
| Chevy Chase Section 3 | 676 | 717 | 44 | 6.5% |
| Chevy Chase View | 932 | 994 | 66 | 7.1% |
| Chevy Chase Village | 1,957 | 2,076 | 125 | 6.4% |
| Gaithersburg | 60,183 | 68,710 | 8,805 | 14.7% |
| Garrett Park | 991 | 1,055 | 68 | 6.9% |
| Glen Echo | 256 | 273 | 18 | 7.1% |
| Kensington | 2,246 | 2,394 | 155 | 6.9% |
| Laytonsville | 356 | 380 | 26 | 7.3% |
| Martin's Additions | 945 | 1,004 | 63 | 6.7% |
| North Chevy Chase | 553 | 593 | 42 | 7.6% |
| Poolesville | 4,875 | 5,269 | 415 | 8.5% |
| Rockville | 61,492 | 68,401 | 7,151 | 11.7% |
| Somerset | 1,205 | 1,285 | 85 | 7.1% |
| Takoma Park | 16,783 | 17,885 | 1,163 | 7% |
| Washington Grove | 531 | 565 | 36 | 6.8% |
| Montgomery County Total | 976,140 | 1,058,810 | 86,858 | 8.9% |

*The July 1, 2010 number reflects modifications to the Census 2010 population as documented in the Count Resolution Program, the Boundary and Annexation Survey, and geographic program revisions.

With over one million people, Montgomery County settled into a slower growth phase as dwindling supplies of developable land and transportation capacity no longer sustained rapid growth. Forecasts of Montgomery County's population, households and employment are prepared by the Research and Special Projects staff of the Montgomery Planning Department participating in a regional cooperative process organized by the Metropolitan Washington Council of Governments. The County's annual growth rate of one percent is projected to slow even further over the next 30 years. In the latest cooperative forecast, Round 9.1, the County's population is projected to grow from just over one million people in 2015 to 1.2 million by 2045 (Figure 2-4). This is an increase of about 208,000 people, or 21% gain over 30 years. In the near term, the County is forecasted to gain 72,000 people at a rate of 20 people per day to reach 1,087,000 people in 2025.

[4] Source: U.S. Census Bureau, Population Division, Population Estimate Program. Release date: May 24, 2018; Research & Special Projects, Montgomery County Planning Department, M-NCPPC (5/24/2018).

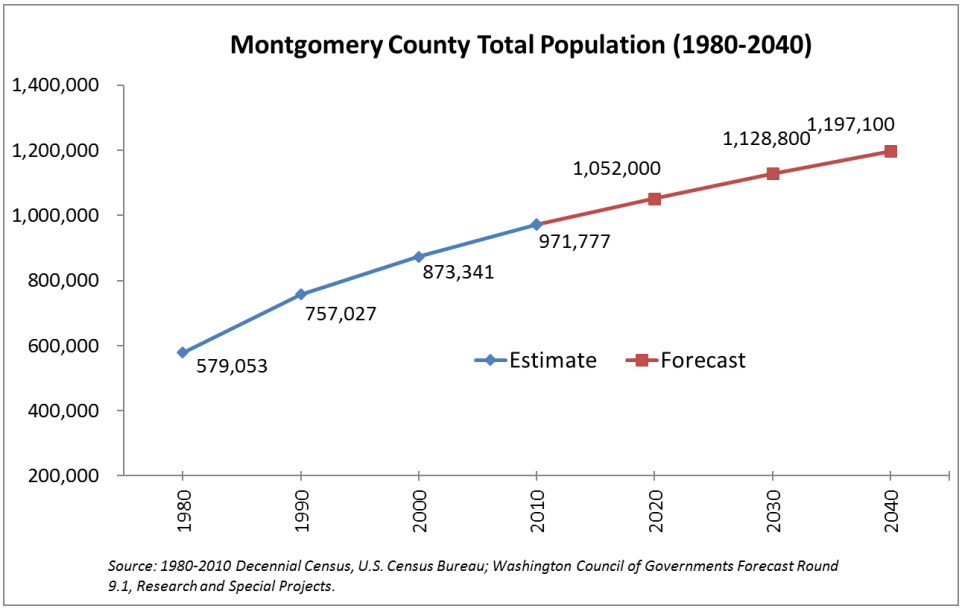



**Figure 2-4: Montgomery County Estimated and Forecasted Population, 1980-2040**

Over the previous decade, many long-term demographic shifts toward suburban and exurban growth have continued to impact land uses in Montgomery County. Previously, natural hazards in sparsely populated areas did not pose as significant a risk to the community. However, as populations increase, the potential for greater loss of life and property damage from natural hazards also increases. For this reason, FEMA requires that state and local plans evaluate land use and development trends so that mitigation options can be considered in future land use decisions. In addition, highly dense population areas are factored into the risk analysis process for prioritizing current mitigation strategies.

## CHANGES IN DEVELOPMENT

Growth-related changes in development patterns in Montgomery County are changes in land use, zoning, transportation capacity improvements (primarily bridge repair and renovations), new subdivisions, new schools or school additions, or changes to water and sewer service areas. Under Chapter 50, regulated land uses and zoning, changes in development patterns for Montgomery County are consistent with one another under the General Plan, area master plans, and functional plans adopted by the County Council. Subdivision approvals, septic tiers, and any zoning changes all support the preservation of agricultural land and open space, the protection of established neighborhoods, and the promotion of development/redevelopment in priority funding areas.

Figure 2-5 and Figure 2-6[5] below show approved and constructed commercial and residential projects from 2012-2017 in Montgomery County. Growth is evident throughout the County, with more residential projects than commercial, particularly in the southeast corner.

[5] Source: 2017 Annual Land Use Report for Montgomery County to the Maryland State Department of Planning. June 8, 2018. http://montgomeryplanningboard.org/wp-content/uploads/2018/05/MPD-Local-Jurisdiction-Annual-Report_Final.pdf

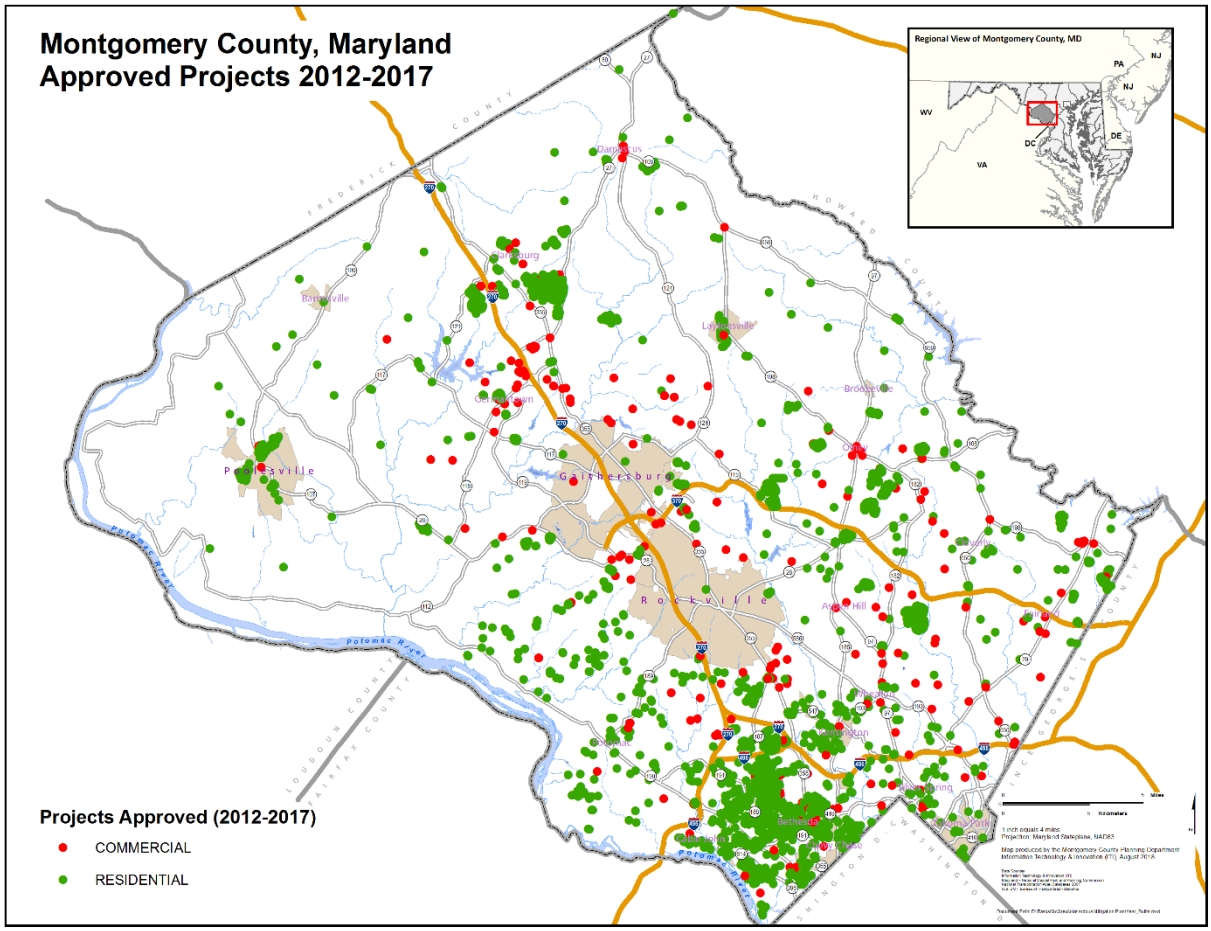



**Figure 2-5: Approved Projects, 2012-2017**

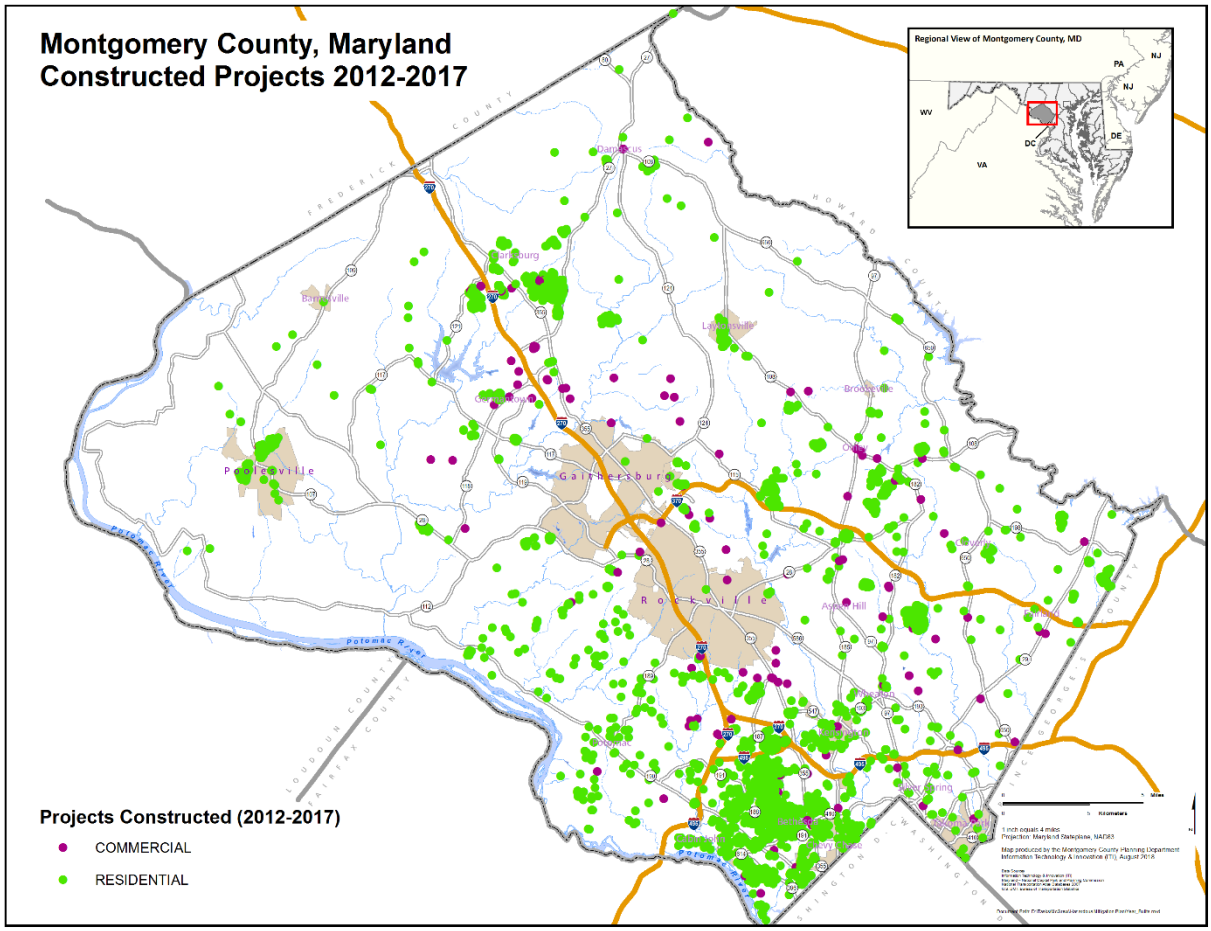



**Figure 2-6: Constructed Projects, 2012-2017**

## RELATIONSHIP BETWEEN COUNTY AND MUNICIPALITIES

For more than 200 years, Montgomery County has a strong history of local community. This reflects the origins of the county as a series of rural communities surrounding the national capital. The municipalities, towns, and neighborhoods consistently work together to better themselves and each contributes to making Montgomery County a great place to live, work, and play.

Every community in Montgomery County is distinctive, although many share similar characteristics. Bethesda, Silver Spring, Kensington and Wheaton offer the advantages that come with urban settings. Olney, Poolesville, and Laytonsville offer small town appeal in a rural setting. Brookeville, Barnesville, and Washington Grove have significant properties designated in the historic district. Rockville, as the seat of the County, has an attractive residential historic district that merges well into the growing business district. Similarly, Gaithersburg has both an attractive residential historic district and museums in the commercial district.

## LAND USE PLANNING AUTHORITY

Montgomery County's new zoning code, effective on October 30, 2014, applies to the entire County with the exception of municipalities that control their own zoning. Seven municipalities have their own zoning authority: Barnesville, Brookeville, Gaithersburg, Laytonsville, Poolesville, Rockville, and

Washington Grove. The cities of Gaithersburg and Rockville have permitting authority for building permits where the County Code, Chapter 8, does not apply.

Meanwhile, the following municipalities issue building permits: Chevy Chase Village; Chevy Chase, Village of, Section 3; Chevy Chase, Village of, Section 5; Village of Martins Addition; North Chevy Chase; and the Towns of Glen Echo, Garrett Park, Kensington, Somerset, Chevy Chase, and Chevy Chase View, and Washington Grove.

Montgomery County also has several land use regulations that limit development in hazard areas. County land use and administrative regulations are described and present in Chapter 50 and COMCOR 50.00.01. Information related to development in hazard areas is described below.

- Purpose of Chapter 50 (Subdivision Regulations) of the Montgomery County Code: Chapter 50 provides for the legal division and subsequent transfer of land. It requires the coordination of new transportation facilities with other existing and planned facilities, a determination of adequate public facilities, and land for public use. The intent of this Chapter is to protect natural resources and sensitive environmental features; promote the health, safety, and welfare of the present and future inhabitants of the Maryland-Washington Regional District within Montgomery County under the General Plan; and any other purpose enumerated in the Land Use Article.
- COMCOR 50.00.01 Administrative Procedures for Subdivision Plan Review: On March 2, 2017, the Planning Board approved release of proposed administrative regulations for the recently enacted rewrite of Chapter 50. The proposed regulations replace the previously adopted 2007 "Manual of Development Review Procedures" that contains Planning Department practices related to the review and processing of development applications that are acted upon by the Planning Board or Planning Director under Chapter 50 and Chapter 59 of the County Code. When Chapter 59 was rewritten in 2014, these practices were changed and codified as part of new provisions for Administration and Procedures (Article 59-7). Similar updates were needed as part of the recent rewrite of Chapter 50. The purpose of the original manual and the proposed regulations continues are to:
    - Clearly explain the Planning Department's overall regulatory review process for applicants, staff, residents and other interested parties.
    - Clarify standards and procedures for submission of timely and relevant information by applicants.
    - Provide for timely participation by public agencies in the review of applications.
    - Provide for participation by interested parties so their views can be known by staff and the Planning Board before action is taken.

## INCORPORATION WITH MUNICIPALITIES HAZARD MITIGATION GOALS

In accordance with Section 201.6(a) (4) of the federal regulation governing hazard mitigation plan standards, local jurisdictions with land use authority must be included in the multi-jurisdiction plan. Language from referenced planning documents from municipalities is indicated below with website

addresses. These planning documents are referred to and are incorporated by reference, rather than including these lengthy documents into this Plan.

## MULTI-JURISDICTIONAL PLANNING AND PARTICIPATION

The 2018 Montgomery County Hazard Mitigation Plan is multi-jurisdictional and includes the participation of County officials and the following municipalities:

- Gaithersburg
- Rockville
- Takoma Park
- Barnesville
- Brookeville
- Chevy Chase
- Chevy Chase View
- Chevy Chase Village
- Garrett Park
- Glen Echo
- Kensington
- Laytonsville
- Poolesville
- Somerset
- Washington Grove
- Chevy Chase, Section 3
- Chevy Chase, Section 5
- Martin's Additions
- North Chevy Chase

To satisfy multi-jurisdictional participation requirements, each jurisdiction was required to perform the following tasks:

(1) Designate a representative to serve on the Montgomery County Mitigation Planning Committee;
(2) Participate in Plan update meetings and workshops;
(3) Provide best available data as required for the update to the local hazard, risk, and vulnerability summary section of the Plan;
(4) Determine capability and provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan;
(5) Support the updating of the current Countywide mitigation strategy, including the update, evaluation, design and adoption of general goal statements for all jurisdictions to pursue;
(6) Review and provide timely comments on all draft components of the Plan update;
(7) Adopt the 2018 Montgomery County Mitigation Plan, including the local mitigation action plan specific to their jurisdiction.

Through the completion of these tasks, all municipalities participated with Montgomery County in updating this Plan. Further, through the preparation of their own local mitigation action plans, the municipalities were responsible for addressing their most significant hazard concerns. This component of the Plan provides the opportunity for the jurisdiction to monitor and update their specific action plan implementation responsibilities without necessarily having to meet with the Countywide Mitigation Planning Committee. It also enables each jurisdiction to be solely responsible and accountable for those actions that apply to their jurisdiction.

**Table 2-4: 2006, 2013, and 2018 Multi-Jurisdictional Participation**

| JURISDICTION | 2006 PARTICIPATION | 2013 PARTICIPATION | 2018 PARTICIPATION | ADOPTION DATE |
|---|---|---|---|---|
| Barnesville | • | • | • | INSERT |
| Brookeville | • | • | • | INSERT |
| Chevy Chase | • | • | • | INSERT |
| Chevy Chase View | • | • | • | INSERT |
| Chevy Chase Village | • | • | • | INSERT |
| Chevy Chase Village Section 3 | • | • | • | INSERT |
| Chevy Chase Village Section 5 | • | • | • | INSERT |
| Gaithersburg | • | • | • | INSERT |
| Garrett Park | • | • | • | INSERT |
| Glen Echo | • | • | • | INSERT |
| Kensington | • | • | • | INSERT |
| Laytonsville | • | • | • | INSERT |
| Martin's Additions | • | • | • | INSERT |
| North Chevy Chase | • | • | • | INSERT |
| Poolesville | • | • | • | INSERT |
| Rockville | • | • | • | INSERT |
| Somerset | • | • | • | INSERT |
| Takoma Park | • | • | • | INSERT |
| Washington Grove | • | • | • | INSERT |

All jurisdictions participated in the Plan update, as well as reviewed and provided timely comments on all draft components of the Plan.

## EXISTING PLANNING MECHANISMS

There are numerous existing regulatory and planning mechanisms in place at the state, County, and municipal levels of government which support hazard mitigation planning efforts. These tools include the State of Maryland Hazard Mitigation Plan, local floodplain management ordinances, the Montgomery County Emergency Operation Plans, and local ordinances. These mechanisms were discussed at planning meetings and the Montgomery County Mitigation Planning Committee reviewed all available technical information provided within these planning mechanisms and have incorporated them into this Plan update. This plan will also serve as a source document and be incorporated into local plans as they are updated or developed. These planning mechanisms enhance the County's mitigation strategy and are therefore incorporated into several of the mitigation actions identified in this Plan.

## LOCAL JURISDICTION PLANNING MECHANISMS:

### Chevy Chase Village

The Chevy Chase Village is a self-governing municipality located in Montgomery County. As such, the Village has the authority to regulate certain activities within its boundaries. The ordinances controlling building within the incorporated boundaries of the Village appear in Chapter 8 of the Municipal Code. County laws also apply in the Village for fire, electrical and plumbing codes, private water systems, air quality, erosion, housing, solid waste, and unsafe buildings; see list of ordinances on website (www.chevychasevillagemd.gov). Chevy Chase Village is a dual permitting zone requiring both a Village and County permit for new construction, additions, fences, or walls. A Village permit is not required for interior remodeling; however, the County may require a permit. A portion of the Village is also designated historic by the Historic Preservation Commission of Montgomery County and is subject to its permitting requirements.

### City of Rockville

The Mayor and City Council of Rockville adopted a Comprehensive Master Plan for the City on November 12, 2002. It is currently under revision. An updated plan is scheduled for Planning Commission, Mayor, and Council approval in 2018. The Master Plan articulates a broad vision for Rockville's future and directs all development activities. It also guides the City's capital improvement projects. By reference, this Plan acknowledges the City of Rockville Master Plan proposals, which relate to natural hazard mitigation strategies found in the City's Master Plan. Chapters 1-12 of the City's Master Plan include specific items on land use, urban growth, transportation, environment, recreation, parks and open spaces, community facilities, historic preservation, community appearance and design, housing, residential neighborhood planning areas, and economic development. More detailed information is available on the City of Rockville's website at www.rockvillemd.gov/government.

### City of Gaithersburg

The Mayor and City Council of Gaithersburg adopted their City's 2009 Comprehensive Master Plan in phases throughout 2010 and 2011 covering Process and Overview, Water Resources, Transportation Element and Land Use Element. The Master Plan articulates a broad vision for Gaithersburg's future and directs all development activities. It also guides the City's capital improvement projects. The Comprehensive Master Plan describes general land use and zoning categories for public and private properties and makes recommendations for future use. The Plan also describes the extensive public input involved in the planning process. The Mayor and City Council recently adopted the first element, Historic Preservation, of the 2018 Master Plan. Other elements will be updated in the next couple of years.

In accordance with Section 201.6(a)(4) of Federal Regulation, by reference, the County's Hazard Mitigation Plan acknowledges the City of Gaithersburg's Comprehensive Master Plan, which relates to natural hazard mitigation strategies. In the Master Plan regarding land use, language has been incorporated, where appropriate, for specific parcels to preserve stream valley buffers, floodplain areas, and wetlands. Specific language related to land use, urban growth, transportation, environment, recreation, parks and open spaces, historic preservation and housing are included.

### City of Takoma Park

The Mayor and City Council of Takoma Park jointly issued the City Master Plan with the Maryland National Capital Park and Planning Commission. The Master Plan articulates a broad vision for Takoma Park and its Central Business District with Silver Spring. It highlights Takoma Park's future development activities. It also guides the City's capital improvement projects. The Master Plan includes the City's future Land Use Plan, which makes recommendations for future use. Additional information is available from the City's website at www.takomaparkmd.gov. The City of Takoma Park Master Plan identifies stormwater management as a major environmental concern in the Central Business District. Urban renewal areas are covered by the Adopted Urban Renewal Plan.

### Town of Barnesville

The Town of Barnesville has its own zoning authority but it relies upon County government to regulate building codes. At this time the Town has not adopted a master plan separate from the County's Master Plan.

### Town of Brookeville

The Town of Brookeville has its own zoning authority, but it relies upon County government to regulate building codes. The Town of Brookeville has adopted its own Comprehensive Plan, as amended. The Town of Brookeville's Comprehensive Plan states that it is committed to maintaining the historical character of the community. They will continue to administer the requirement that all telephone lines for new construction must be installed underground by permit. They will also continue to administer the requirement for addressing historic preservation.

### Town of Chevy Chase

The Town of Chevy Chase is a self-governing municipality located in Montgomery County. As such, the Town has the authority to regulate certain activities within its boundaries. The ordinances controlling building within the incorporated boundaries of the Town appear in Chapter 4 of the Municipal Code. County laws also apply in the town for fire, electrical and plumbing codes, private water systems, air quality, erosion, housing, solid waste, and unsafe buildings; see list of ordinances on website (www.townofchevychase.org). The Town of Chevy Chase is a dual permitting zone requiring both Town and County permit for new construction, additions, fences, or walls. A Town permit is not required for interior remodeling; however, the County may require a permit.

### Town of Laytonsville

The Town of Laytonsville was incorporated in 1892 and is located in the northern portion of the County. In 1989, the Mayor and Council approved a Comprehensive Plan that specified an effective road system for the future and defined a Historic District in the residential and commercial zones. The Town of Laytonsville has its own zoning, building, and subdivision authority.

### Town of Poolesville

The Town of Poolesville updated its Comprehensive Plan in 2011 and includes Vision Statements that identify the characteristics that make Poolesville unique while ensuring those traits are preserved and strengthened in the future. Other components of the Plan include a Land Use Element, Municipal Growth Element, and Water Resource Element. This small yet independent community is located in

Montgomery County's 100,000-acre Agricultural Reserve and has its own zoning authority, water supply system, and wastewater treatment facility.

### Town of Somerset

The Town of Somerset has permitting authority for buildings and modifies the County Code Chapter 8. The Townwill be integrating its natural hazard mitigation planning efforts by reference to the County's Multi-Hazard Mitigation Plan. By reference, this Plan acknowledges the Town of Somerset Long Range Planning Report developed with public hearings for those proposals which relate to natural hazard mitigation strategies found in the report. Recommendations in the Long Range Planning Report include specific items on land use, urban growth, transportation, environment, recreation, parks and open spaces, community facilities, historic preservation, community appearance and design, and economic development. More information is available at www.townofsomerset.com.

### Washington Grove

The Town of Washington Grove has authority to adopt its own zoning and building ordinances. Washington Grove adopted a Master Plan in 1995. The plan was updated and revised in 2009. By reference, this Plan acknowledges the Master Plan of the Town of Washington Grove. Recognizing that most of the Town's privately owned parcels are already developed, the goals and objectives of the 2009 plan were to:

- *Preserve the integrity of the Town and its way of life by providing guidance for protection of the original pattern and character of the community;*
- *Enhance the Town's destiny by preserving historic resources through thoughtful adaptation of housing stock and conservation of the natural landscape;*
- *Protect and improve the economic value of both the privately owned property and the property and resources held in common;*
- *Create an awareness of Washington Grove in adjacent jurisdictions and support planning requirements throughout the State*

# 3. HAZARD IDENTIFICATION & RISK ASSESSMENT

*B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? 44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)*
*B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? 44 CFR 201.6(c)(2)(i)*
*B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? 44 CFR 201.6(c)(2)(ii)*
*B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? 44 CFR 201.6(c)(2)(ii)*

This section of the Plan describes the Local Hazard Identification & Risk Assessment summary undertaken by Montgomery County and participating municipalities in the preparation of this Hazard Mitigation Plan Update.

## INTRODUCTION AND UPDATE SUMMARY

The Local Hazard Identification and Risk Assessment (HIRA) summary is a process or application of a methodology for evaluating risk as defined by probability and frequency of occurrence of a hazard event, exposure to people and property to the hazard, and consequences of that exposure. Different methodologies exist for assessing the risk of hazard events, ranging from qualitative to quantitative.

Montgomery County and its communities are vulnerable to a wide range of natural hazards that threaten life and property. The hazards identified by the Montgomery County Mitigation Planning Committee for inclusion in this HIRA summary are those determined to be of actual potential threat to Montgomery County and its municipalities and are consistent with the hazards identified by the State of Maryland and the Federal Emergency Management Agency for this part of the State and this region of the country. The hazards for this 2018 Plan update include:

NATURAL HAZARDS:

- SEVERE STORM
- WINTER STORM
- EXTREME HEAT
- WILDFIRE
- FLOODING
- HURRICANE/TROPICAL STORM
- WATER SHORTAGE/DROUGHT
- TORNADO
- EARTHQUAKE

- LAND SUBSIDENCE/KARST

Some of these hazards can be interrelated (for example, thunderstorms can produce high wind/tornado activity and can cause flooding), and thus discussion of these hazards may overlap where necessary throughout the HIRA.

Of the eight (8) hazards profiled in the State of Maryland's 2016 Hazard Mitigation Plan, seven (7) are addressed in this Plan.

**Table 3-1: State/Local Plan Hazards Matrix**

| STATE OF MARYLAND HAZARD MITIGATION PLAN 2016 | INCLUDED IN MONTGOMERY COUNTY MITIGATION PLAN 2013 | RATIONALE FOR EXCLUSION |
|---|---|---|
| COASTAL HAZARDS | | |
| FLOODS | ✓ | |
| WINTER STORM | ✓ | |
| TORNADO | ✓ | |
| WIND | ✓ | Hazards combined as SEVERE STORM |
| THUNDERSTORM | ✓ | |
| WILDFIRE | ✓ | |
| DROUGHT | ✓ | |

Table 3-2 documents the review by the Montgomery County Mitigation Planning Committee as it relates to those hazards that were to be re-evaluated and/or identified, analyzed, and addressed through the updating of the Countywide HIRA summary. Hazards were either *deferred*, *deleted*, *changed*, or *new* hazards were identified.

**Table 3-2: Evaluation of Hazards for Inclusion in 2013 HIRA Summary**

| 2013 HAZARD | STATUS | NOTES | 2018 HAZARD |
|---|---|---|---|
| Thunderstorms | Integrated | Included in Severe Storm | |
| Severe Storm | Carried Forward | No change | Severe Storm |
| Winter Storm | Carried Forward | No change | Winter Storm |
| Extreme Heat | Carried Forward | No change | Extreme Heat |
| Flooding | Carried Forward | No change | Flooding |
| Hurricane /Tropical Storm | Carried Forward | No change | Hurricane /Tropical Storm |
| Wildfire | Carried Forward | No change | Fire |
| Water Shortage/Drought | Carried Forward | No change | Water Shortage/Drought |
| Tornado | Carried Forward | No change | Tornado |
| Earthquakes | Carried Forward | No change | Earthquakes |
| Land Subsidence/Karst | Carried Forward | No change | Land Subsidence/Karst |
| Hazardous Material | Excluded | Now a separate profile included in addendum | |
| Dams | Excluded | Now a separate profile included in addendum | |

The "Thunderstorm" hazard was separated for the 2013 Plan update due to the nature of the hazard being ranked as high risk. In the previous plan, "Thunderstorm" was profiled under the "Tornado" hazard.

Once the hazards were identified and evaluated for inclusion into the 2018 Plan update, the Mitigation Planning Committee then ranked these based on a Risk Factor (RF) approach. To further focus on the list of identified hazards for this Plan, Table 3-3 presents a list of all federal disaster and emergency declarations that have occurred in Montgomery County since 1964, according to the Federal Emergency Management Agency. This list presents the foundation for identifying what hazards pose the greatest risk within Montgomery County.

**Table 3-3: Presidential Disaster and Emergency Declarations in Montgomery County**

| DECLARATION # | DATE | EVENT DETAILS |
|---|---|---|
| FEMA-EM-3335 | 8/27/2011 | Hurricane Irene |
| FEMA-DR-1910 | 5/6/2010 | Winter Storm |
| FEMA-DR-1875 | 2/19/2010 | Winter Storm |
| FEMA-DR-1652 | 7/2/2006 | Flooding/Tornadoes |
| FEMA-EM-3251 | 9/13/2005 | Hurricane Katrina |
| FEMA-DR-1492 | 9/13/2003 | Hurricane Isabel |
| FEMA-EM-3179 | 3/14/2003 | Snow Storm |
| FEMA-DR-1324 | 4/10/2000 | Winter Storm |
| FEMA-DR-1081 | 1/11/1996 | Blizzard |
| FEMA-EM-3100 | 3/16/1993 | Winter Storm |
| FEMA-DR-839 | 8/28/1989 | Severe Storms/High Wind |
| FEMA-DR-524 | 1/26/1977 | Ice conditions |
| FEMA-DR-489 | 10/4/1975 | Flooding |
| FEMA-DR-341 | 6/23/1972 | Tropical Storm Agnes |
| FEMA-DR-309 | 8/17/1971 | Flooding |
| FEMA-DR-127 | 3/9/1962 | Severe Storms, High Tides, Flooding |

Hazards were ranked in order to provide structure and prioritize the mitigation goals and actions discussed in this plan. Ranking was both quantitative and qualitative. First, the quantitative analysis considered all the GIS and Hazus data available. Then, a qualitative approach, the Risk Factor (RF) approach, was used to provide additional insights on the specific risks associated with each hazard. This process can also be a valuable cross-check or validation of the quantitative analysis performed.

The RF approach combines historical data, local knowledge, and consensus opinions to produce numerical values that allow identified hazards to be ranked against one another. During the planning process, the Montgomery County Mitigation Planning Committee compared the results of the hazard profile against their local knowledge to generate a set of ranking criteria. These criteria were used to evaluate hazards and identify the highest risk hazard.

RF values are obtained by assigning varying degrees of risk to five categories for each hazard: *probability, impact, spatial extent, warning time*, and *duration*. Each degree of risk is assigned a value ranging from 1 to 4 and a weighing factor for each category was agreed upon by the Mitigation Planning Committee. Based upon any unique concerns for the planning area, the Mitigation Planning Committee may also adjust the RF weighting scheme. To calculate the RF value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation below:

**RF Value = [(Probability x .30) + (Impact x .30) +**
**(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]**

**Table 3-4: Risk Factor Criteria**

| RISK ASSESSMENT CATEGORY | LEVEL | DEGREE OF RISK LEVEL | INDEX | WEIGHT |
|---|---|---|---|---|
| **PROBABILITY**<br>**What is the likelihood of a hazard event occurring in a given year?** | **UNLIKELY** | LESS THAN 1% ANNUAL PROBABILITY | **1** | **30%** |
| | **POSSIBLE** | BETWEEN 1 & 10% ANNUAL PROBABILITY | **2** | |
| | **LIKELY** | BETWEEN 10 &100% ANNUAL PROBABILITY | **3** | |
| | **HIGHLY LIKELY** | 100% ANNUAL PROBABILTY | **4** | |
| **IMPACT**<br>***In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*** | **MINOR** | VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION OF QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES. | **1** | **30%** |
| | **LIMITED** | MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY. | **2** | |
| | **CRITICAL** | MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK. | **3** | |
| | **CATASTROPHIC** | HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE. | **4** | |
| **SPATIAL EXTENT**<br>***How large of an area could be impacted by a hazard event? Are impacts localized or regional?*** | **NEGLIGIBLE** | LESS THAN 1% OF AREA AFFECTED | **1** | **20%** |
| | **SMALL** | BETWEEN 1 & 10% OF AREA AFFECTED | **2** | |
| | **MODERATE** | BETWEEN 10 & 50% OF AREA AFFECTED | **3** | |
| | **LARGE** | BETWEEN 50 & 100% OF AREA AFFECTED | **4** | |
| **WARNING TIME**<br>***Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*** | **MORE THAN 24 HRS** | SELF DEFINED | **1** | **10%** |
| | **12 TO 24 HRS** | SELF DEFINED | **2** | |
| | **6 TO 12 HRS** | SELF DEFINED | **3** | |
| | **LESS THAN 6 HRS** | SELF DEFINED | **4** | |
| **DURATION**<br>***How long does the hazard event usually last?*** | **LESS THAN 6 HRS** | SELF DEFINED | **1** | **10%** |
| | **LESS THAN 24 HRS** | SELF DEFINED | **2** | |
| | **LESS THAN 1 WEEK** | SELF DEFINED | **3** | |
| | **MORE THAN 1 WEEK** | SELF DEFINED | **4** | |

According to the default weighting scheme applied, the highest possible RF value is 4.0. The methodology illustrated above lists categories that are used to calculate the variables for the RF value.

## RANKING RESULTS

**Table 3-5: Risk Factor Results for Montgomery County and Participating Jurisdictions**

| # | NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|---|
| **1** | Severe Storm | 1.14 | 0.66 | 0.62 | 0.24 | 0.31 | 2.97 |
| **2** | Winter Storm | 0.99 | 0.69 | 0.78 | 0.1 | 0.31 | 2.86 |
| **3** | Extreme Heat | 1.11 | 0.42 | 0.8 | 0.1 | 0.32 | 2.75 |
| **4** | Flooding | 0.93 | 0.54 | 0.44 | 0.24 | 0.26 | 2.41 |
| **5** | Hurricane/Tropical Storm | 0.75 | 0.54 | 0.74 | 0.1 | 0.32 | 2.60 |
| **6** | Fire | 0.72 | 0.39 | 0.38 | 0.4 | 0.16 | 2.05 |
| **7** | Water Shortage/Drought | 0.75 | 0.53 | 0.68 | 0.1 | 0.4 | 2.47 |
| **8** | Tornado | 0.74 | 0.63 | 0.42 | 0.4 | 0.23 | 2.43 |
| **9** | Earthquake | 0.63 | 0.39 | 0.78 | 0.4 | 0.12 | 2.32 |
| **10** | Land Subsidence/Karst | 0.45 | 0.39 | 0.32 | 0.37 | 0.2 | 1.73 |

Based on the RF analysis all hazards but Land Subsidence / Karst were rated between 2.0 and 2.9 and have a moderate risk ranking. The conclusions drawn from the qualitative and quantitative assessments, combined with final determinations from the Montgomery County Mitigation Planning Committee, were fit into three categories for a final summary of hazard risk for Montgomery County based on High, Moderate or Low risk designations and are presented in Table 3-6 below. A summary table for each hazard is presented in the introduction of the risk assessment for each hazard.

**Table 3-6: Conclusions on Hazard Risk for Montgomery County and Participating Jurisdictions**

| | |
|---|---|
| **HIGH RISK (3.0 or higher)** | |
| **MODERATE RISK (2.0 – 2.9)** | **Severe Storm, Winter Storm, Extreme Heat, Flooding, Hurricane/Tropical Storm, Fire, Water Shortage/ Drought, Tornado, Earthquake** |
| **LOW RISK (0.1 – 1.9)** | **Land Subsidence/Karst** |

# SEVERE STORM

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| SEVERE STORM | 1.14 | 0.66 | 0.62 | 0.24 | 0.31 | 2.97 |
| **HIGH RISK HAZARD (3.0 – 4.0)** | | | | | | |

## HAZARD IDENTIFICATION

Extreme weather conditions can exist during any season throughout Maryland. Thunderstorms, associated with strong winds, heavy precipitation, and lightning strikes can all be hazardous under the right conditions and locations. Strong winds and tornadoes can take down trees, damage structures, tip high profile vehicles, and create high velocity flying debris. Large hail can damage crops, dent vehicles, break windows, and injure or kill livestock, pets, and people. Coastal storms, which include hurricanes, tropical storms, and Nor'easters, are among the most devastating naturally occurring hazards in the United States and its territories. Past events reveal the magnitude of damage that is possible. In 2005, Hurricane Katrina resulted in the highest total damage of any natural disaster in U.S. history, an estimated $90 billion, eclipsing many times the damage wrought by Hurricane Andrew in 1992.

**Thunderstorms & High Winds:** There are basic two types of damaging wind events other than tropical systems that affect Maryland: synoptic-scale winds and thunderstorm winds. Synoptic-scale winds are large scale high winds that occur typically with cold frontal passages or Nor'easters. Thunderstorms on the other hand affect relatively small areas but, despite their size, are very dangerous. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. When thunderstorm winds are over 58 mph, the thunderstorm is considered severe and a warning is issued. "Downbursts" cause the high winds in a thunderstorm. Downburst winds result from the sudden descent of cool or cold air toward the ground. As the air hits the ground, it spreads outward, creating a fast-moving surge of high winds. Of the estimated 100,000 thunderstorms that occur each year in the United States, about 10 percent are classified as severe. The National Weather Service considers a thunderstorm severe if it produces hail at least 3/4 inch in diameter, winds of 58 MPH or stronger, or a tornado. Every thunderstorm needs three basic components: (1) moisture to form clouds and rain (2) unstable air which is warm air that rises rapidly and (3) lift, which is a cold or warm front capable of lifting air to help form thunderstorms. The effects can include blowing debris, interruptions in elevated power and communications utilities and intensified effects of winter weather.

**Lightning**, although not considered severe by the National Weather Service definition, can accompany heavy rain during thunderstorms. Lightning develops when ice particles in a cloud move around, colliding with other particles. These collisions cause a separation of electrical charges. Positively charged ice particles rise to the top of the cloud and negatively charged ones fall to the middle and lower sections of the cloud. The negative charges at the base of the cloud attract positive charges at the surface of the Earth. Invisible to the human eye, the negatively charged area of the cloud sends a charge called a stepped leader toward the ground. Once it gets close enough, a channel develops between the cloud and the ground. Lightning is the electrical transfer through this channel. The channel rapidly heats to 50,000 degrees Fahrenheit and contains approximately 100 million electrical volts. The rapid expansion of the heated air causes thunder.

**Hail** develops when a super cooled droplet collects a layer of ice and continues to grow, sustained by the updraft. Once the hail stone cannot be held up any longer by the updraft, it falls to the ground. Nationally, hailstorms cause nearly $1 billion in property and crop damage annually, as peak activity coincides with peak agricultural seasons. Severe hailstorms also cause considerable damage to buildings and automobiles, but rarely result in loss of life.

**Table 3-7: Size Reference Chart for Hail**

| COMMON OBJECT | SIZE IN DIAMETER |
|---|---|
| Pea | 0.25 Inch |
| Penny or Dime | 0.75 Inch |
| Quarter | 1.00 Inch |
| Half Dollar | 1.25 Inch |
| Golf Ball | 1.75 Inch |
| Tennis Ball | 2.50 Inch |
| Baseball | 2.75 Inch |
| Grapefruit | 4.00 Inch |

## HAZARD PROFILE

Dangerous and damaging aspects of a severe storm are tornadoes, hail, lightning strikes, flash flooding, and winds associated with straight-line winds, downbursts and microbursts. Reported severe weather events over the past 57 years provide an acceptable framework for determining the magnitude of such storms that can be expected and planned for accordingly. FEMA places this region in Zone II (155 MPH) for structural wind design (Federal Emergency Management Agency, 2008).

### Hail

Large hail can damage structures, break windows, dent vehicles, ruin crops, and kill or injure people and livestock. Based on past occurrences, hail sizes greater than 2 inches in diameter are possible and should be accounted for in future planning activities. Non-tornadic, thunderstorm and non-thunderstorm winds over 100 mph should also be considered in future planning initiatives. These types of winds can remove roofs, move mobile homes, topple trees, take down utility lines, and destroy poorly-built or weak structures.

Figure 3-1 on the next page shows the geographic extent and size of hail that has occurred in Montgomery County since 1950.

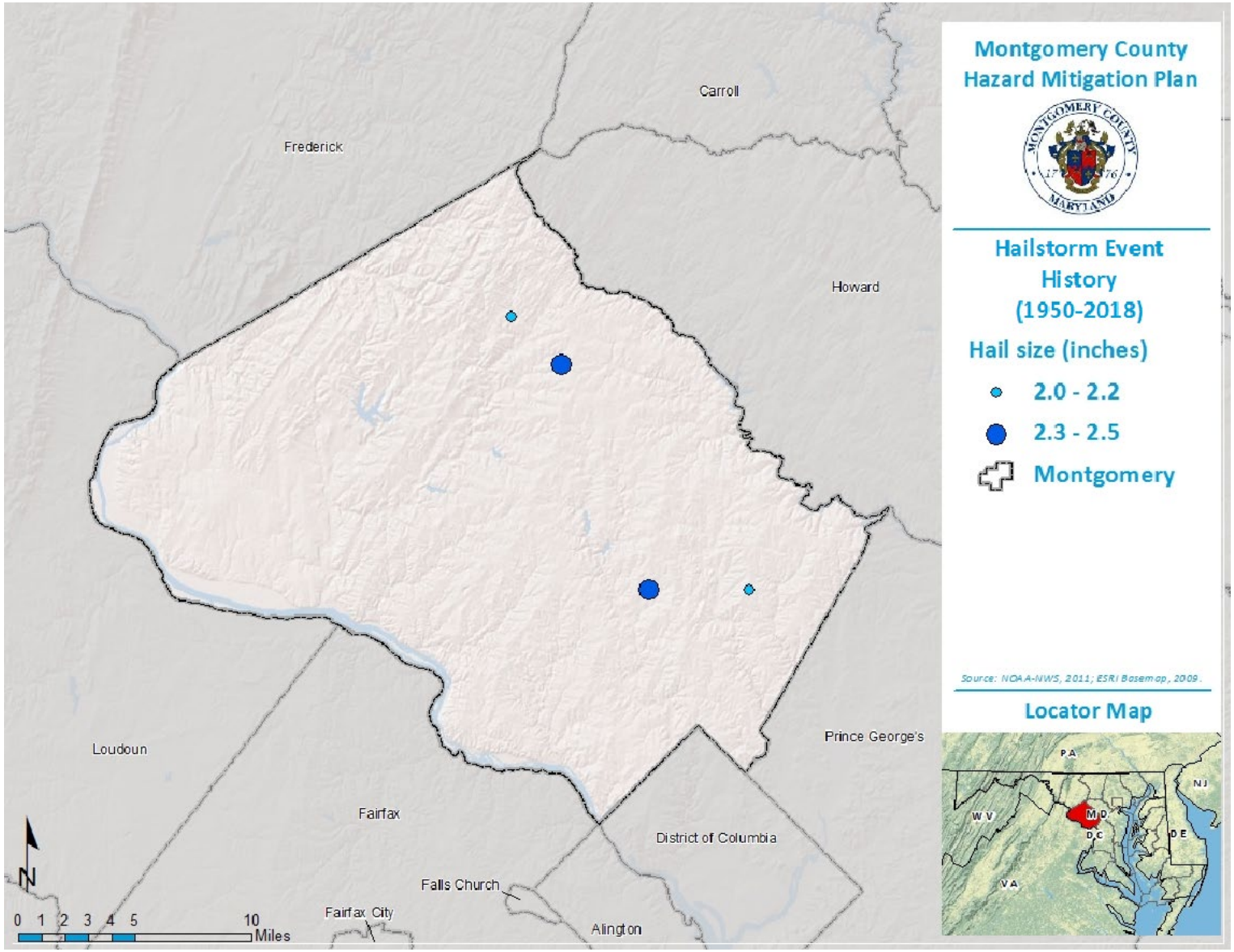



**Figure 3-1: Hailstorm Event History, 1950-2018**

There have been 34 recorded hail events associated with thunderstorms that have either directly or indirectly impacted Montgomery County and its municipalities since 1950.

**Table 3-8: : Hail Events in Montgomery County Since 1960**

| LOCATION | DATE | TYPE | MAGNITUDE | DEATH | INJURY | PROPERTY & CROP DAMAGE |
|---|---|---|---|---|---|---|
| Countywide | 1950-2018 | Hail | 0.1”-2.5” | 1 | 0 | $1,194,191 |
| | | | **TOTALS:** | **0** | **0** | **$1,194,191** |

Reported hail events over the past 68 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipality experiencing a hail event associated with damages or injury can be difficult to quantify, but based on historical record of 37 hail events since 1950 that have either caused damages to buildings and infrastructure or resulted in an injury or death, it can reasonably be assumed that this type of event has occurred once every 1.8 years from 1950 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 1950] = 68 Years on Record*

*[(Years on Record) 68] divided by [(Number of Historical Events) 37] = 1.83*

Furthermore, the historic frequency calculates that there is a 55% chance of this type of event occurring each year.

### Thunderstorm Wind

There have been 147 recorded severe wind events associated with thunderstorms that have either directly or indirectly impacted Montgomery County since 1950.

**Table 3-9 High Wind Events Associated with Thunderstorms in Montgomery County since 1956**

| LOCATION | DATE | TYPE | MAGNITUDE | DEATH | INJURY | PROPERTY DAMAGE | CROP DAMAGE |
|---|---|---|---|---|---|---|---|
| Countywide | 1950-2018 | Wind | kts | 0 | 12 | $16,330,792 | $0 |

Reported thunderstorm winds over the past 68 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipality experiencing thunderstorm winds associated with damages or injury can be difficult to quantify, but based on historical record of 159 thunderstorm wind events since 1950 that have either caused damages to buildings and infrastructure or resulted in an injury or death, it can reasonably be assumed that this type of event has occurred once every .42 years from 1950 through 2018.

*(Current Year) 2018] subtracted by [(Historical Year) 1950] =68 Years on Record*

*[(Years on Record) 68] divided by [(Number of Historical Events) 159] = .42*

Furthermore, the historic frequency calculates that there is a 100% chance of this type of event occurring each year.

## Lightning

Except in cases where significant forest or range fires are ignited, lightning generally does not result in disasters. For the period of 1993 to 2018, NOAA reported four injuries, and one fatality along with several damage reports in Montgomery County (as shown in the table below). The greatest impact due to a lightning strike in Montgomery County occurred on July 25, 2010 according to the National Weather Service. A lightning strike in Rockville killed a man while he was attending a celebration outdoors. An article from Maryland's Gazette explained that he was riding a bicycle to a community picnic when the lightning struck.

A house caught on fire due to a lightning strike in Bethesda in June 2008 according to Maryland's Gazette. Several fires started throughout the County during the same storm in Germanton, Damascus, Colesville, and Laytonsville. The cause of at least one of the fires may have been lightning striking the gas meter of a home.

Another severe storm occurred on August 15, 2011. Two houses were struck by lightning in the County, causing some damage. That evening over 10,000 residents were without power according to the Washington Post.

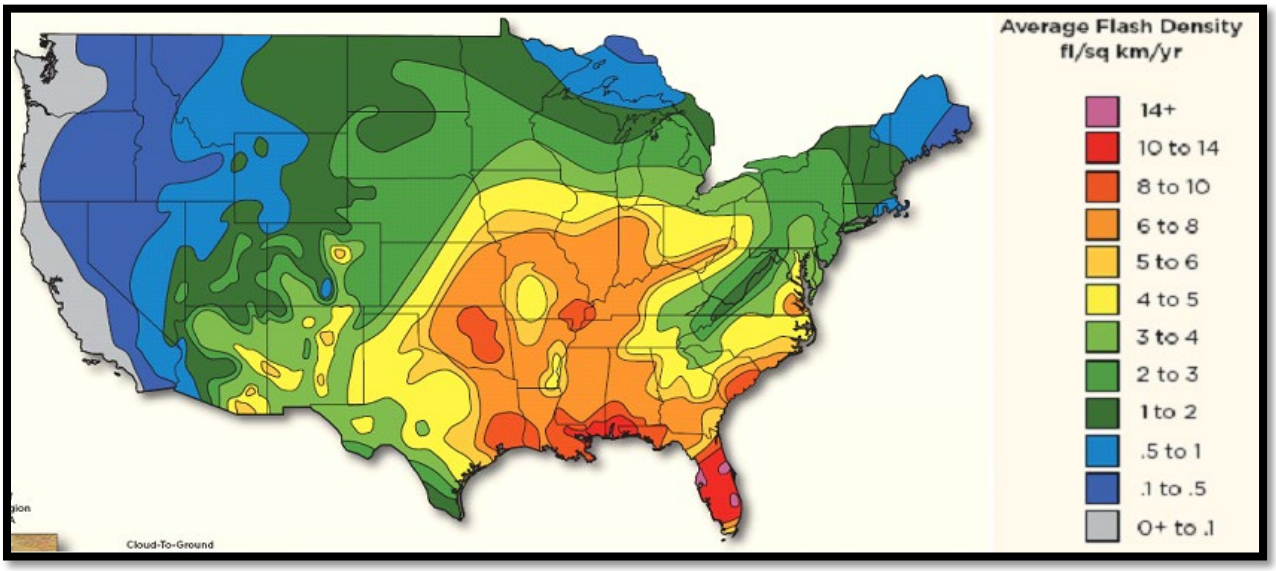



**Figure 3-2: Average Flash Density**[6]

**Table 3-10: Lightning Strikes in Montgomery County Since 1993**

| JURISDICTION AFFECTED | DATE OF EVENTS | # OF FATALITIES | # OF INJURIES | RECORDED PROPERTY DAMAGES |
|---|---|---|---|---|
| Countywide | 11/28/1993 | 0 | 0 | 50,000 |
| Countywide | 5/24/1994 | 0 | 0 | 1,000,000 |
| Countywide | 6/10/1996 | 0 | 0 | 2,000 |
| Countywide | 6/26/1997 | 0 | 0 | 30,000 |
| Countywide | 8/17/1997 | 0 | 0 | 265,000 |
| Countywide | 7/21/1998 | 0 | 1 | 0 |

[6] www.lightningsafety.noaa.gov (NOAA)

| Table 3-10: Lightning Strikes in Montgomery County Since 1993 | | | | |
|---|---|---|---|---|
| JURISDICTION AFFECTED | DATE OF EVENTS | # OF FATALITIES | # OF INJURIES | RECORDED PROPERTY DAMAGES |
| Countywide | 4/9/1999 | 0 | 0 | 1,000 |
| Countywide | 6/14/1999 | 0 | 1 | 0 |
| Countywide | 8/14/1999 | 0 | 0 | 2,500 |
| Countywide | 8/27/2000 | 0 | 0 | 95,000 |
| Countywide | 6/20/2001 | 0 | 0 | 2,000,000 |
| Countywide | 6/22/2001 | 0 | 0 | 120,000 |
| Countywide | 7/1/2001 | 0 | 0 | 80,000 |
| Countywide | 8/22/2001 | 0 | 0 | 120,000 |
| Countywide | 4/21/2002 | 0 | 0 | 250,000 |
| Countywide | 7/23/2002 | 0 | 0 | 45,000 |
| Countywide | 8/26/2003 | 0 | 0 | 100,000 |
| Countywide | 5/17/2004 | 0 | 0 | 400,000 |
| Countywide | 5/17/2004 | 0 | 0 | 75,000 |
| Countywide | 5/17/2004 | 0 | 0 | 25,000 |
| Countywide | 5/18/2004 | 0 | 0 | 75,000 |
| Countywide | 5/18/2004 | 0 | 0 | 15,000 |
| Countywide | 5/25/2004 | 0 | 0 | 1,300,000 |
| Countywide | 6/6/2005 | 0 | 0 | 475,000 |
| Countywide | 6/1/2006 | 0 | 0 | 500,000 |
| Countywide | 6/4/2008 | 0 | 0 | 10,000 |
| Countywide | 6/4/2008 | 0 | 0 | 3,000 |
| Countywide | 7/27/2008 | 0 | 0 | 105,000 |
| Countywide | 7/27/2008 | 0 | 1 | 0 |
| Countywide | 7/23/2009 | 0 | 1 | 0 |
| Countywide | 7/25/2010 | 1 | 0 | 0 |
| | **TOTAL** | **1** | **4** | **$7,143,500** |

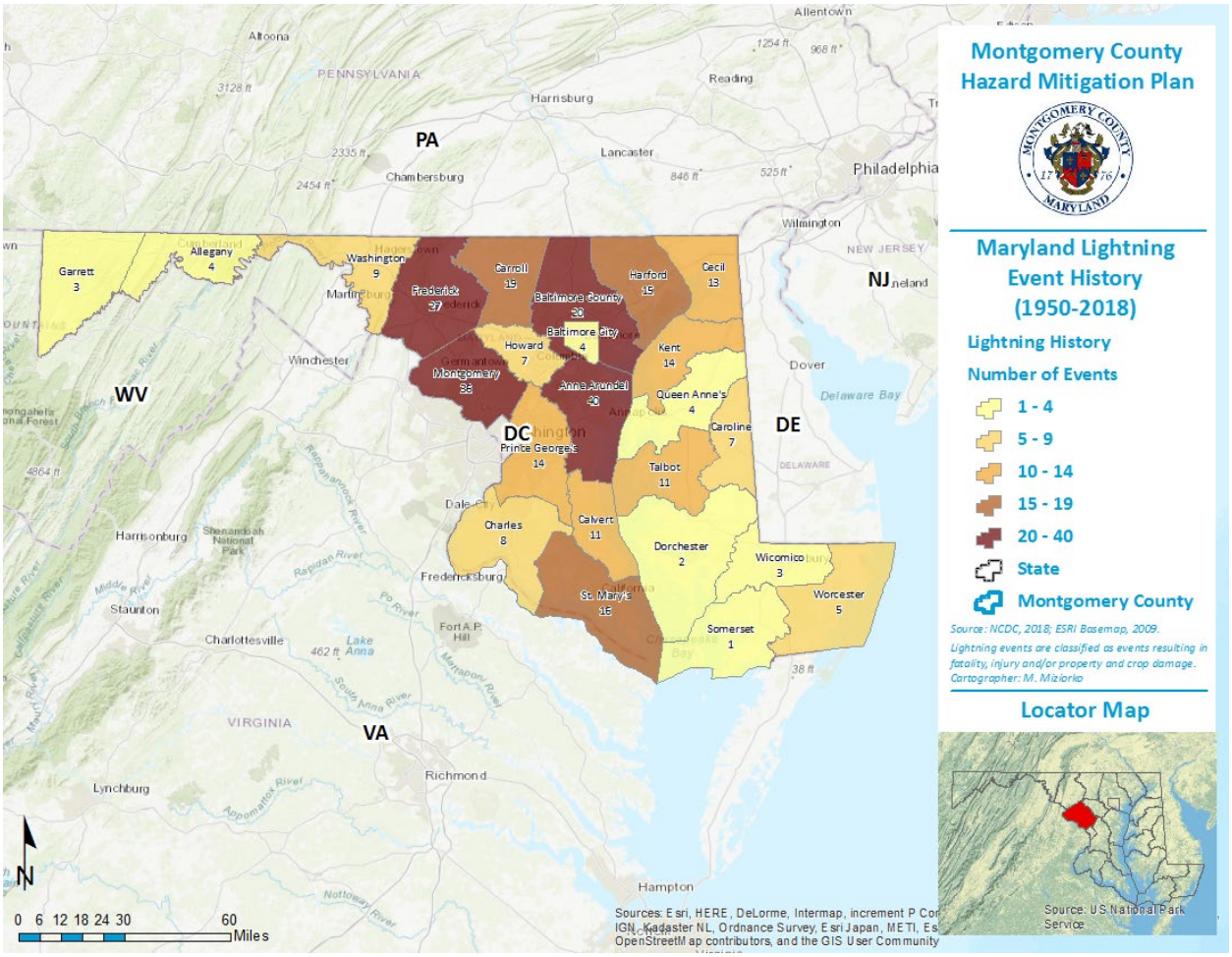



**Figure 3-3: Maryland Lightning Event History, 1950-2018**

Reported lightning strikes over the past 68 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipalities experiencing a lightning strike associated with damages or injury can be difficult to quantify, but based on historical record of 36 lightning strikes since 1950 that have either caused damages to buildings and infrastructure or resulted in an injury or death, it can reasonably be assumed that this type of event has occurred once every 0.61 years from 1950 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 1950] = 68 Years on Record*

*[(Years on Record) 68] divided by [(Number of Historical Events) 36] = 1.8*

## INVENTORY ASSETS EXPOSED TO HAZARD

All assets located in Montgomery County were considered for this assessment. This includes all of the County's buildings and infrastructure. Damages resulting from severe storms primarily occur as a result of high winds, lightning strikes, hail, and flooding. Most structures, including the county's critical facilities, should be able to provide adequate protection from hail but the structures could suffer broken windows and dented exteriors. Those facilities with back-up generators are better equipped to handle a severe weather situation should the power go out.

## POTENTIAL LOSSES

A timely forecast may not be able to mitigate the property loss, but could reduce the casualties and associated injury. It appears possible to forecast these extreme events with some skill, but further research needs to be done to test the existing hypothesis about the interaction between the convective storm and its environment that produces the extensive swath of high winds. Thunderstorms will remain a highly likely occurrence for Montgomery County. Lightning, hail and tornadoes may also be experienced in the area due to such storms. Climate change may exacerbate more intense storms and Montgomery County acknowledges the likelihood of the increasing risks and vulnerability from natural hazards. Through the development and implementation of the 2018 Hazard Mitigation Plan, planning consideration for both today and tomorrow are evidenced.

## LAND USE & DEVELOPMENT TRENDS

All future structures built in Montgomery County will likely be exposed to severe thunderstorm damage. Since the previous statement is assumed to be uniform countywide, the location of development does not increase or reduce the risk necessarily. Montgomery County and its jurisdictions need to adhere to building codes, and therefore, new development can be built to current standards to account for strong winds associated with severe storms. Additionally, as homes go up in more remote parts of the county, accessing those rural residents may become impossible should sheltering or emergency services be needed in an extreme event.

## MULTI-JURISDICTIONAL DIFFERENCES

Each municipality in the County has an equal susceptibility to severe weather as profiled in this section. Predictability again causes a great problem when discussing the probability of damage from these events. There is really no way to pinpoint exactly where, when, and to what extent a thunderstorm or other severe weather event will cause damage. However, we know that thunderstorm events, with high wind and dangerous lightning, are highly possible in the county. These storms are prominent in the early spring and continue through late fall. If located in a densely populated area of the county, it is easy to estimate damages in the millions of dollars from these events.

In the case of lightning strikes, population and building density has a correlation with hazard vulnerability and loss. In particular, the urban and suburban areas have higher population and structure density as well as taller buildings that can act as lightning rods; therefore, they naturally have experienced greater vulnerability and loss during past lightning events. Loss of power resulting from fallen trees that were struck by lightning or uprooted from high winds has proven to be a significant problem in Montgomery County in the past 10 years. The environmental impacts most often associated with lightning strikes include damage or death to trees and ignition of wildfires. Jurisdictions that are heavily forested and that have, in the past, experienced wildfires that start because of a lightning strike are also vulnerable to losses due to lightning. In addition, older homes that are in deteriorating condition and aluminum-clad mobile homes are also more susceptible to severe storms that generate high winds.

## SEVERE STORM HIRA SUMMARY

Montgomery County is subject to severe thunderstorms which have the potential to cause flash flooding, tornadoes, downbursts, and debris. The severe storms profile is primarily concerned with past and future damages from high winds, lightning, heavy precipitation, and subsequent flooding.

Mitigation of building damage has been most successful where strict building codes for high-wind influence areas and designated special flood hazard areas have been adopted and enforced by local governments, and complied with by builders. Proven techniques are available to reduce lightning damage by grounding techniques for buildings.

Critical Facilities, such as fire/police stations, water and wastewater treatment facilities, community health care and schools that were built prior to 1965 may be more susceptible to wind damage. As part of the plan implantation process these facilities should be evaluated for wind load and vulnerability, and retrofitted to mitigate potential wind damage. Facilities include: public shelters, water filtration and pump stations, police and fire stations, schools and general use government buildings.

High wind speeds impact infrastructure, specifically communications and utilities. Mass power outages seriously affect the operation of County facilities and utility companies. The interruptions in services and impaired transportation network from downed power lines and trees can lead to lost services and access in and out of communities for extensive periods. Power outages, debris cleanup, and repairs to damaged power lines may take days, if not weeks. The faster a community can recover following a disaster event, the better. Continuity planning for both public and private sectors is integral to mitigating long periods of interruption, which results in a more resilient community.

# WINTER STORM

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| WINTER STORM | 0.99 | 0.69 | 0.78 | 0.10 | 0.30 | 2.86 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

Winter storms (including severe winter weather and extreme cold) have significantly impacted Montgomery County in the past. Winter storms are regional events that can cause hazardous driving conditions, communications and electrical power failure, community isolation and can adversely affect business continuity. This type of severe weather may include one or more of the following winter factors:

**Blizzards**, as defined by the National Weather Service, are a combination of sustained winds or frequent gusts of 35 mph or greater and visibilities of less than a quarter mile from falling or blowing snow for 3 hours or more. A blizzard, by definition, does not indicate heavy amounts of snow, although they can happen together. The falling or blowing snow usually creates large drifts from the strong winds. The reduced visibilities make travel, even on foot, particularly treacherous. The strong winds may also support dangerous wind chills. Ground blizzards can develop when strong winds lift snow off the ground and severely reduce visibilities.

**Heavy snow**, in large quantities, may fall during winter storms. Six inches or more in 12 hours or eight inches or more in 24 hours constitutes conditions that may significantly hamper travel or create hazardous conditions. The National Weather Service issues warnings for such events. Smaller amounts can also make travel hazardous, but in most cases, only results in minor inconveniences. Heavy wet snow before the leaves fall from the trees in the fall or after the trees have leafed out in the spring may cause problems with broken tree branches and power outages.

**Ice storms** develop when a layer of warm (above freezing), moist air aloft coincides with a shallow cold (below freezing) pool of air at the surface. As snow falls into the warm layer of air, it melts to rain, and then freezes on contact when hitting the frozen ground or cold objects at the surface, creating a smooth layer of ice. This phenomenon is called freezing rain. Similarly, sleet occurs when the rain in the warm layer subsequently freezes into pellets while falling through a cold layer of air at or near the Earth's surface. The U.S. National Weather Service defines an ice storm as a storm which results in the accumulation of at least .25 inch of ice on exposed surfaces. Extended periods of freezing rain can lead to accumulations of ice on roadways, walkways, power lines, trees, and buildings. Almost any accumulation can make driving and walking hazardous. Ice accumulations can lead to downed trees, utility poles and communication towers. Ice can disrupt communications and power while utility companies repair significant damage. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces.

**Extreme Cold**, in extended periods, could occur throughout the winter months in Montgomery County. Heating systems compensate for the cold outside. Most people limit their time outside during extreme

cold conditions, but common complaints usually include pipes freezing and cars unable to start. When cold temperatures and wind combine, dangerous wind chills can develop.

Wind chill is how cold it "feels" and is based on the rate of heat loss on exposed skin from wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature, and eventually, internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature. For example, if the temperature is 0°F and the wind is blowing at 15 mph, the wind chill is -19°F. At this wind chill, exposed skin can freeze in 30 minutes. Wind chill does not affect inanimate objects. (National Weather Service)

Maryland's greatest winter storms are the Nor'easters. For Nor'easters to occur in Maryland, an arctic air mass would be in place. While high pressure builds over New England, cold arctic air flows south from the high-pressure area. The dense cold air is unable to move west over the Appalachian Mountains; therefore, it funnels south down the valleys and along the Coastal Plain. Winds around the Nor'easter's center can become intense. The strong northeast winds that rack the East Coast and inland areas give the storm its name. The wind builds large waves that batter the coastline and sometimes pile water inland, causing major coastal flooding and severe beach erosion. Unlike hurricanes, which usually come and go within one tide cycle, the Nor'easter can linger through several tides, each one piling more and more water on shore and into the bays while dragging more sand away from the beaches.

## HAZARD PROFILE

Winter Storms have an extensive history in Montgomery County; of the 17 Disaster Declarations in Montgomery County, seven have been winter storm disasters. The National Weather Service reports that average annual snowfall in Montgomery County is expected to range from 20 inches in the southern half of the County to 30 inches its northernmost reaches.

Winter storms have been a recent threat to Montgomery County. In January of 2016, a blizzard produced historic snowfall of 24 – 38" of snow in the county. December 2010 and February 2011, back-to-back blizzards dropped more than 40 inches of snow on the County, leaving more than 80,000 households and businesses without power. Hundreds of trees and tree limbs fell, exacerbating the utility outages and preventing swift response time. Other significant winter storms occurred in January 1996, when a blizzard crippled all of Maryland west of the Chesapeake Bay, and January 1999, when a major ice storm caused ice accumulations of 0.25 to 1 inch and resulted in 30 Montgomery County school buses slipping off the road, among other roadway accidents.

According to the Special Hazard Event and Losses Database for the United States (SHELDUS), there have been a total of 72 winter weather events from 1960-2018. These events are summarized in the table below.

**Table 3-11: Severe Winter Storms from 1960-2018**

| NATURAL HAZARD | # OF EVENTS | # OF INJURIES | # OF FATALITIES | RECORDED PROPERTY DAMAGES | RECORDED CROP DAMAGES |
|---|---|---|---|---|---|
| Winter Storm/Heavy Snow/Ice | 72 | 69.15 | 8.07 | $3,634,043 | $812 |

*Please note that injuries and fatalities are reported with decimal places when damages were reported for multiple counties; the total amount of loss is divided by the number of counties included in each event to estimate local loss.*

Due to the nature of winter storms, it is extremely difficult to predict, but through identifying various indicators of weather systems, and tracking these indicators, it provides us with a crucial means of monitoring severe winter weather. Understanding the historical frequency, duration, and spatial extent of severe winter weather assists in determining the likelihood and potential severity of future occurrences. The characteristics of past severe winter events provide benchmarks for projecting similar conditions into the future. The probability of Montgomery County and its municipalities experiencing a severe winter storm event can be difficult to quantify but based on historical record of 72 events since 1960, it can reasonably be assumed that this type of event has occurred once every .80 years from 1960 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 1960] = 58 Years on Record*

*[(Years on Record) 58] divided by [(Number of Historical Events) 72] = .80*

Furthermore, the historic frequency calculates that there is a 100% chance of this type of event occurring each year.

### Extreme Cold

Extreme Cold can also be a hazard in any given year. Threats such as hypothermia and frostbite can lead to loss of fingers and toes or cause permanent kidney, pancreas and liver injury and even death. While the average minimum temperature in Montgomery County ranges from 21-26 $^{o}$ F (Figure 3-4), above the extreme cold threat levels, major winter storms can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall and cold temperatures that induce cold-related injuries. Fifty percent of cold-related injuries happen to people over sixty years of age. More than seventy-five percent happen to males, and almost twenty percent occur within the home.

The dangers associated with extreme cold include frostbite and hypothermia. Frostbite is damage to body tissue caused by that tissue being frozen. Frostbite causes a loss of feeling in extremities, such as fingers, toes, ear lobes, or the tip of the nose. Hypothermia, or low body temperature can lead to uncontrollable shivering, memory loss, disorientation, slurred speech, drowsiness, and apparent exhaustion.

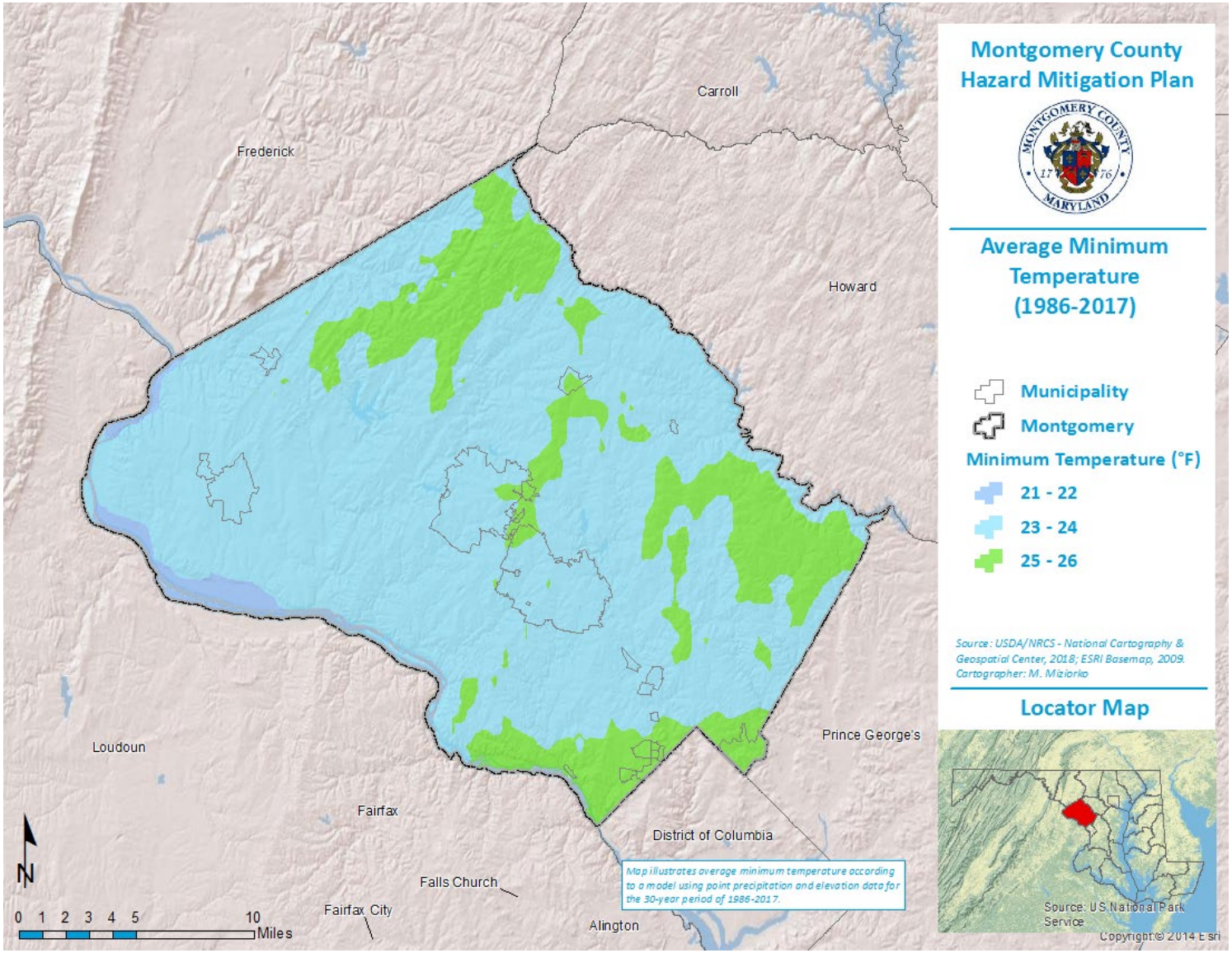



**Figure 3-4: Montgomery County Average Minimum Temperature, 1986-2017**

| Table 3-12: Cold Temperatures and Associated Threat Level | |
|---|---|
| **COLD TEMPERATURES THREAT LEVEL** | **DESCRIPTION** |
| **Extreme** | **"An Extreme Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -35° F or below for 3 hours or more. Or, lowest air temperature less than or equal to -20° F. |
| **High** | **"A High Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -28° F to -35 ° F for 3 hours or more. Or, lowest air temperature -15° to -20° F. |
| **Moderate** | **"A Moderate Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -20° F to -28 ° F or below for 3 hours or more. Or, lowest air temperature -10° to -15° F. |
| **Low** | **"A Low Threat to Life and Property from Excessive Cold."** It is likely that wind chill values will drop to -15° F to -20 ° F or below for 3 hours or more. Or, lowest air temperature -5° to -10° F. |
| **Very Low** | **"A Very Low Threat to Life and Property from Excessive Cold."** It is likely that that wind chill values will drop to -10° F to -15 ° F or below for 3 hours or more. Or, lowest air temperature zero to -5° F. |
| **Non-Threatening** | **"No Discernible Threat to Life and Property from Excessive Cold."** Cold season weather conditions are non-threatening. |

According to SHELDUS, since 1960 Montgomery County has experienced ten events related to extremely cold temperatures. These events are listed in Table 3-13 below.

| Table 3-13: Severe Winter Storms Since 1960 as reported to SHELDUS | | | | | |
|---|---|---|---|---|---|
| **EVENT TYPE** | **DATE** | **# OF INJURIES** | **# OF FATALITIES** | **RECORDED PROPERTY DAMAGES** | **RECORDED CROP DAMAGES** |
| Low Temperatures | 1/8/1970 | 0 | 0 | $1,041.67 | $0 |
| Wind, Cold | 1/28/1977 | 0 | 0 | $20 | $0 |
| Rapid Temperature/ Pressure Change | 3/21/1978 | 0 | 0 | $500 | $0 |
| Cold | 1/9/1982 | 0.68 | 0 | $200 | $0 |
| Cold | 1/16/1982 | 0.46 | 0 | $0 | $0 |
| Extreme Cold | 12/24/1983 | 0.4 | 0.16 | $20,000 | $0 |
| Extreme Cold | 1/19/1994 | 0 | 0 | $20,833.33 | $208,333.33 |
| Unseasonably Cold | 3/11/1998 | 0 | 0 | $0 | $1,346.15 |
| Extreme Cold | 1/2/2014 | 0 | 0 | $0 | $0 |
| Extreme Cold | 2/2/2015 | 0 | 0 | $0 | $0 |
| | **TOTAL** | 1.54 | 0.16 | $42,595 | $209,679.48 |
| *Please note that injuries and fatalities are reported with decimal places when damages were reported for multiple counties; the total amount of loss is divided by the number of counties included in each event to estimate local loss.* | | | | | |

Reported extreme cold temperatures over the past 58 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipalities experiencing an extreme cold event can be difficult to quantify, but based on historical record of 10 winter storm events since 1960, it can reasonably be assumed that this type of event has occurred every 5.8 years from 1960 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 1960] = 58 Years on Record*

*[(Years on Record) 58] divided by [(Number of Historical Events) 10] = 5.8*

## INVENTORY ASSETS EXPOSED TO HAZARD

All assets in Montgomery County can be considered at risk from winter storms. This includes 100% of the population, buildings, and infrastructure located within the county. However, elderly populations are relatively more vulnerable to the impacts of winter storms. Damages due to winter storms primarily occur as a result of cold temperatures, heavy snow or ice, and sometimes high winds. Because winter storms occur regularly in Montgomery County, these storms are considered hazards only when they result in damage to structures or cause disruption to traffic, communication, power, and utilities.

A winter storm can adversely affect roadways, utilities, business activities, and can cause loss of life, frostbite and freezing conditions. They can result in the closing of secondary roads, particularly in more rural locations, loss of utility services and depletion of oil heating supplies. Most structures, including the county's critical facilities, should be able to provide adequate protection, but structures could suffer damage from snow load on rooftops and large deposits of ice. Those facilities with back-up generators are better equipped to handle a severe weather situation should the power go out. Older structures that have not been well maintained are more at risk to damage due to winter storms.

The use of auxiliary heat and electricity supplies such as wood burning stoves, kerosene heaters and gasoline power generators reduces the vulnerability of humans to extreme cold temperatures commonly associated with winter storms. People residing in structures lacking adequate equipment to protect against cold temperatures or significant snow and ice are more vulnerable to winter storm events. Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large number of traffic accidents, strand motorists due to snow drifts, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems.

Environmental impacts of winter storms often include damage to shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds which can break limbs or even bring down large trees.

## POTENTIAL LOSSES

Based on the information available, all communities in Montgomery County are essentially equally vulnerable to the direct impacts of winter storms, so exact losses are difficult to calculate. Potential loss estimates based on past events indicate that the average property damage caused by a winter storm is approximately $47,000, while crop damages average $5,000. Injuries are generally more common than fatalities; in the fifty years of data on record, there have been 71 injuries and 8 fatalities.

## LAND USE & DEVELOPMENT TRENDS

All future structures built in Montgomery County will likely be exposed to winter storm damage. Since the previous statement is assumed to be uniform countywide, the location of development does not increase or reduce the risk necessarily. Montgomery County and its jurisdictions need to adhere to building codes, and therefore, new development can be built to current or above standards to account for heavy snow loads. Additionally, as homes go up in more remote parts of the County where ingress and egress routes are limited, accessing rural residents may become impossible should sheltering or emergency services be needed in an extreme event.

## MULTI-JURISDICTIONAL DIFFERENCES

Because of the regional nature of winter storms, all of Montgomery County is equally likely to experience winter storms and extreme cold events, but their magnitude will generally increase the farther north and west the jurisdiction is in the County. A number of factors also correlate with increased jurisdictional risk, including higher proportions of elderly residents, higher building densities, and higher proportions of aging building stock.

## WINTER STORM HIRA SUMMARY

Montgomery County is subject to severe winter storms which have the potential to be a hazard as a result of cold temperatures, heavy snow or ice and sometimes strong winds. Severe winter storm hazards can cause a range of damage to structures that will depend on the magnitude and duration of storm events. Losses may be as small as lost productivity and wages when workers are unable to travel or as large as sustained roof damage or building collapse. The severe winter storms profile is primarily concerned with past and future damages from cold temperatures, heavy snow or ice and sometimes strong winds.

# EXTREME HEAT

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| EXTREME HEAT | 1.11 | 0.42 | 0.80 | 0.10 | 0.32 | 2.75 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

**Extreme Heat** is the number one weather-related killer in the United States, resulting in hundreds of fatalities each year. On average, excessive heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined. While there is no universal definition for extreme heat, NOAA does release the following watch, warning, and advisory products when extremely high temperatures are likely or expected:

- **Excessive Heat Outlook**, issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- **Excessive Heat Watches,** are issued when the conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat mitigation plans.
- **Excessive Heat Warnings/Advisories,** are issued when an excessive heat event is expected within the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

In the Mid-Atlantic, summers tend to combine both high temperature and high humidity. Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When the body heats too quickly to cool itself safely, or when too much fluid is lost through dehydration or sweating, the body temperature rises, and heat-related illnesses may develop.

The major human risk associated with extreme heat is heatstroke, heat exhaustion, heat syncope, and heat cramps.

- **Heatstroke**, considered a medical emergency, is often fatal. It occurs when perspiration and the vasomotor, hemodynamic, and adaptive behavior responses to heat stress are insufficient to prevent a substantial rise in core body temperature.
- **Heat Exhaustion** is much less severe than heatstroke. Victims may complain of dizziness, weakness, or fatigue. Body temperature may be normal or slightly or moderately elevated.
- **Heat Syncope.** Usually refers to sudden loss of consciousness.

- **Heat Cramps** occur when people unaccustomed to heat exercise outdoors. The cramps are thought to be due to mild fluid and electrolyte imbalances.

Extreme temperatures can result in elevated utility costs to consumers and also can cause human risks. Extremely high temperatures cause heat stress which can be divided into four categories. Each category is defined by apparent temperature which is associated with a heat index value that captures the combined effects of dry air temperature and relative humidity on humans and animals. Major human risks for these temperatures include heat cramps, heat syncope, heat exhaustion, heatstroke, and death. Note that while the temperatures in Table 3-14 serve as a guide for various danger categories, the impacts of high temperatures will vary from person to person based on individual age, health, and other factors.

Figure 3-5 on the following page shows the average maximum temperatures for Maryland and Montgomery County.

Figure 3-6 shows the average maximum temperature for Montgomery County only.

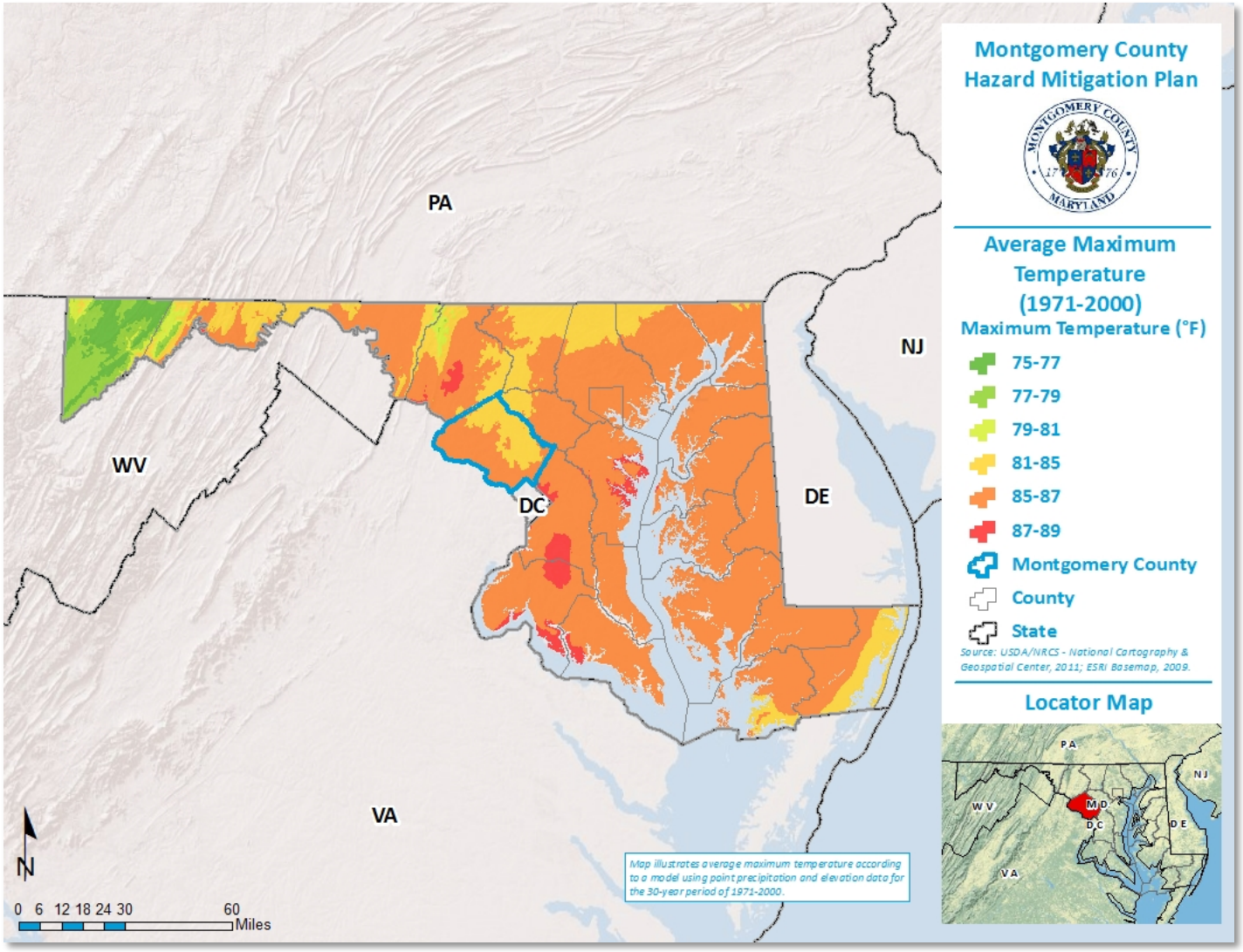



**Figure 3-5: Average Maximum Temperature, 1971-2000**

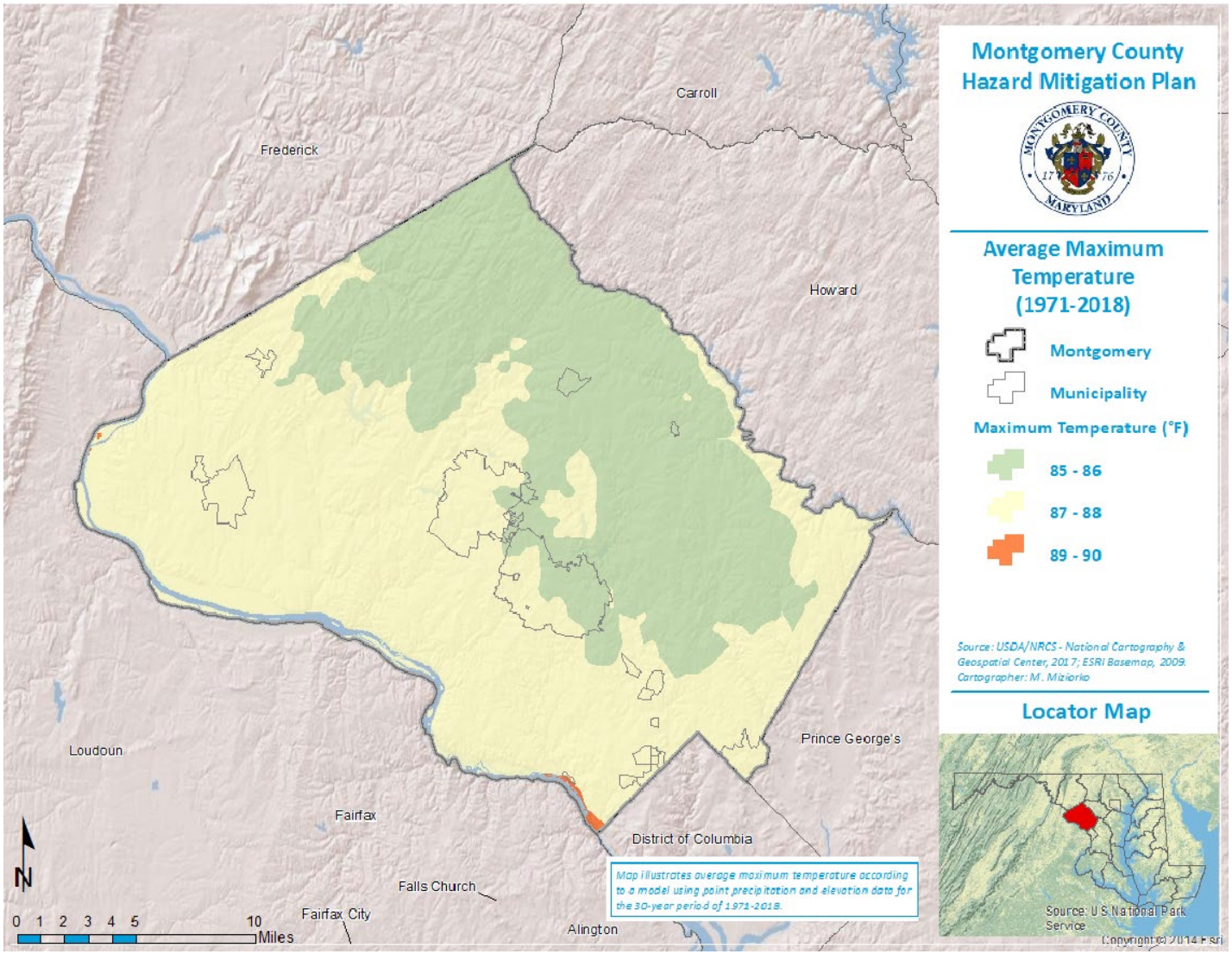



**Figure 3-6: Montgomery County Average Maximum Temperature, 1971-2018**

## HAZARD PROFILE

Temperature advisories, watches and warnings are issued by the National Weather Service relating the above impacts to the range of temperatures typically experienced in Maryland. Exact thresholds vary across the State including Montgomery County, but in general *Heat Advisories* are issued when the heat index will be equal to or greater than 100°F, but less than 105°F, *Excessive Heat Warnings* are issued when heat indices will attain or exceed 105°F, and *Excessive Heat Watches*, are issued when there is a possibility that excessive heat warning criteria may be experienced within twelve to forty-eight hours

**Table 3-14: Four Categories of Heat Stress (FEMA, 1997)**

| DANGER CATEGORY | HEAT DISORDERS | APPARENT TEMPERATURE (°F) |
|---|---|---|
| I (Caution) | Fatigue possible with prolonged exposure and physical activity. | 80 to 90 |
| II (Extreme Caution) | Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity. | 90 to 105 |
| III (Danger) | Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity. | 105 to 130 |
| IV (Extreme Danger) | Heatstroke or sunstroke imminent. | >130 |

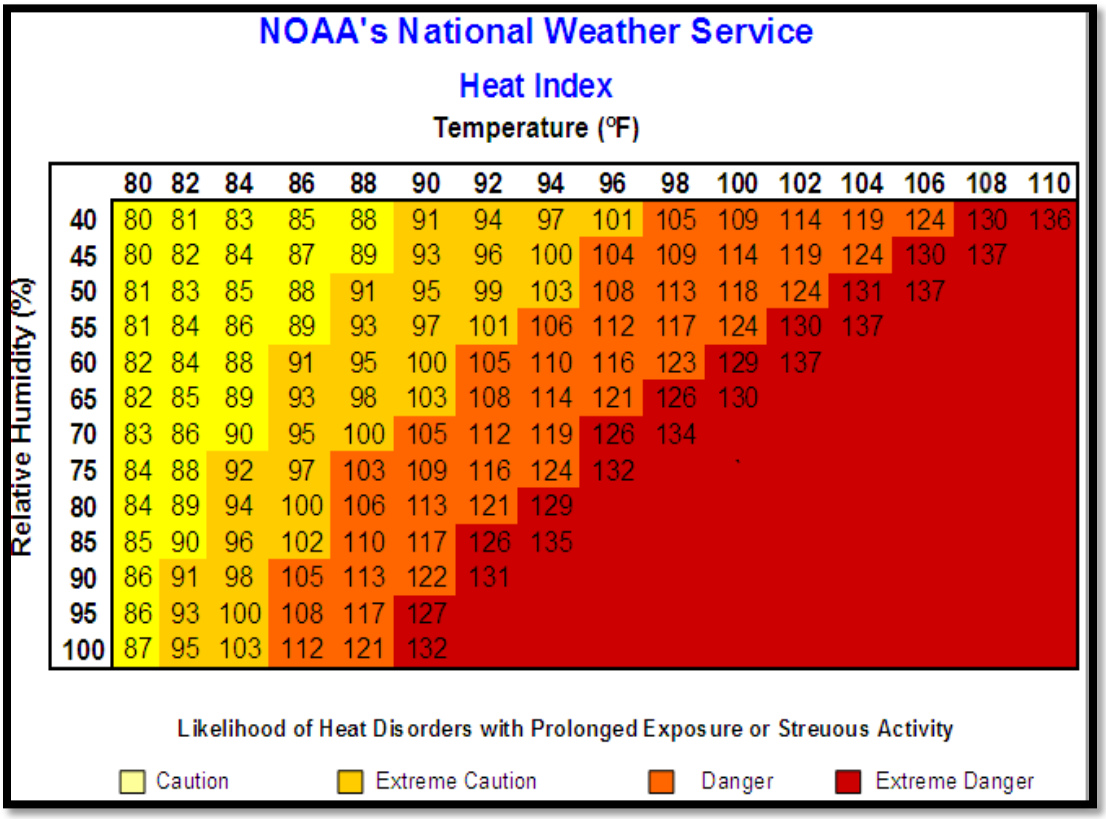



**Figure 3-7: NOAA's National Weather Service Heat Index**

Extreme heat can be associated with severe weather associated with summer storms. For temperature extremes, Montgomery County has experienced only 13 events according to SHELDUS since 1983. A summary is provided in the table below.

**Table 3-15: Temperature Extremes Since 2005**

| NATURAL HAZARD | # OF EVENTS | # OF INJURIES | # OF FATALITIES | RECORDED PROPERTY & CROP DAMAGES |
|---|---|---|---|---|
| Extreme Heat | 13 | N/A | 13 | N/A |

Reported high heat events over the past 7 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipalities experiencing a high heat event can be difficult to quantify, but based on historical record of 13 heat events since 2005, it can reasonably be assumed that this type of event has occurred once every 1.32 years from 1983 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 2005] = 13 Years on Record*

*[(Years on Record) 13] divided by [(Number of Historical Events) 13] = 1*

The summer of 1999 was characterized by both extreme heat and drought. According to NCDC, the number of days the temperature was at or above 90 was significantly greater than previous years. From July 4th through the 7th of that year, many residents reported injury and at least one reported fatality occurred in Montgomery County. Excessive heat caused the most damage in Montgomery County on July 17, 1987 with about $2,200 in both crop and property damages according to SHELDUS. The most recent heat related death in Montgomery County occurred on June 24th, 2010. According to the Baltimore Sun, the victim had no major health concerns and was not a senior citizen.

## INVENTORY ASSETS EXPOSED TO HAZARD

Vulnerability for extreme heat was classified as areas having a maximum average temperature over 85 degrees, according to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) study. This range falls within the upper limits of FEMA's heat stress index, Caution Category 1. Extreme heat does not generally impact buildings; instead, they primarily impact people. Nonetheless, facilities need to be maintained to ensure that they operate in appropriate conditions for people.

## POTENTIAL LOSSES

It is evident from past events that extreme heat is dangerous and can cause human related illnesses and death. As temperature goes up so do the number of people hospitalized for heat related illnesses. Therefore, it is important to understand how many people are exposed to such conditions, and how many buildings exist, where potential problems could arise should power be lost. Additionally, extreme heat can cause damage to buildings or contents by overheating HVAC or air conditioning systems, contributing to jurisdictional losses. It is unlikely that an entire building would be impacted in an extreme heat event, though.

## LAND USE & DEVELOPMENT TRENDS

The elderly just like small children are more susceptible to temperature extremes. Additionally, buildings of significant age may be more susceptible to temperature extremes. It is important to identify building stock and special needs populations so that those who have to respond to an emergency will be better prepared.

The Maryland Department of Health and Mental Hygiene developed a Heat Emergency Plan for the State of Maryland in 2011 laying out specific actions and preparation that can help mitigate the impacts of extreme heat. During the summer of 2011, cooling centers were established to provide residents of Rockville refuge from the heat. That same year, sites were set up across the County to distribute fans to residents without sufficient cooling in their homes and who were exposed to extreme heat.

The Montgomery County Government through the Montgomery County Department of Health and Human Services (DHHS), and with the guidance and assistance of the Montgomery County Office of Emergency Management and Homeland Security (OEMHS), will activate the Montgomery County Extreme Temperature Plan when a cold or heat emergency occurs. The purpose of the Extreme Temperature Plan is to minimize the effects of extreme cold or hot weather to all residents, workers, and visitors.

In addition to notifying the public via Alert Montgomery, the County's Mass Notification System, the plan outlines steps to be taken by County Departments and Agencies to prepare for and respond to extreme temperature events.

## MULTI-JURISDICTIONAL DIFFERENCES

During the summertime the Northern portion of the County has temperatures of 85-86 °F whereas the Southern portion of the County has average temperatures of 87-88 °F. A small part in the Southern portion of the County has average temperatures closer to 89-90°F.

Temperature extremes generally do not impact buildings; instead they primarily impact people. The Center for Disease Control and Prevention (CDC) sites those at greatest risk for temperature (hot and cold)-related illness include infants and children up to four years of age, people 65 years of age and older, people who are overweight, and people who are ill or on certain medications. Based on the 2010 Census, Maryland District 7 (Chevy Chase Section 3, Chevy Chase Section 5, Chevy Chase Village, Glen Echo, Martins Addition, North Chevy Chase, Somerset, and Town of Chevy Chase) currently has 23% of its population under the age of 18 and 18% of its population over the age of 65. Montgomery County as a whole currently has 24% of its population under the age of 18 and 12% of its population over the age of 65.

## EXTREME HEAT HIRA SUMMARY

Montgomery County is subject to temperature extremes. The affect temperature extremes will have on the County will vary due to population density, age of population, and the age of structures. Nonetheless, facilities need to be maintained to ensure that they operate in appropriate conditions for people. Temporary periods of extreme hot temperatures typically do not have significant environmental impact. However, prolonged periods of hot temperatures may be associated with drought conditions and can damage or destroy vegetation, dry up rivers and streams, and reduce water

quality. Those that are most prone to temperature extremes are jurisdictions with the highest populations, buildings, and building costs.

# FLOODING

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| FLOODING | 0.93 | 0.54 | 0.44 | 0.24 | 0.26 | 2.41 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

A flood is a natural event for rivers and streams and occurs when a normally dry area is inundated with water. Excess water from snowmelt or rainfall accumulates and overflows onto the stream banks and adjacent floodplains. As illustrated in the figure below, floodplains are lowlands, adjacent to rivers, streams and creeks that are subject to recurring floods. Flash floods, usually resulting from heavy rains or rapid snowmelt, can flood areas not typically subject to flooding, including urban areas. Extreme cold temperatures can cause streams and rivers to freeze, causing ice jams and creating flood conditions.

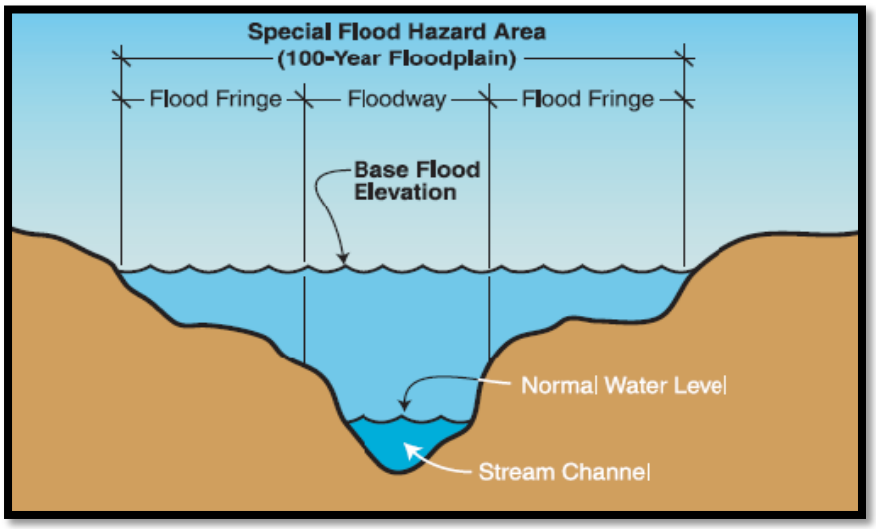



**Figure 3-8: Floodplain Terminology**

Floods are considered hazards when people and property are affected. Nationwide, hundreds of floods occur each year, making it one of the most common hazards in all 50 states and U.S. territories. In Maryland, flooding occurs commonly and can occur during any season of the year from a variety of sources. Most injuries and deaths from flooding happen when people are swept away by flood currents and most property damage results from inundation by sediment-filled water. Fast-moving water can wash buildings off their foundations and sweep vehicles downstream. Pipelines, bridges, and other infrastructure can be damaged when high water combines with flood debris. Basement flooding can cause extensive damage. Flooding can cause extensive damage to crop lands and bring about the loss of livestock. Several factors determine the severity of floods, including rainfall intensity and duration, topography and ground cover.

**Riverine flooding** originates from a body of water, typically a river, creek, or stream, as water levels rise onto normally dry land. Water from snowmelt, rainfall, freezing streams, ice flows, or a combination thereof, causes the river or stream to overflow its banks into adjacent floodplains. Winter flooding

usually occurs when ice in the rivers creates dams or streams freeze from the bottom up during extreme cold spells. Spring flooding is usually the direct result of melting winter snow packs, heavy spring rains, or a combination of the two.

**Flash floods** can occur anywhere when a large volume of water flows or melts over a short time period, usually from slow moving thunderstorms or rapid snowmelt. Because of the localized nature of flash floods, clear definitions of hazard areas do not exist. These types of floods often occur rapidly with significant impacts. Rapidly moving water, only a few inches deep, can lift people off their feet, and only a depth of a foot or two, is needed to sweep cars away. Most flood deaths result from flash floods.

**Urban flooding** is the result of development and the ground's decreased ability to absorb excess water without adequate drainage systems in place. Typically, this type of flooding occurs when land uses change from fields or woodlands to roads and parking lots. Urbanization can increase runoff two to six times more than natural terrain. (National Oceanic and Atmospheric Administration, 1992) The flooding of developed areas may occur when the amount of water generated from rainfall and runoff exceeds a storm water system's capability to remove it.

**Stream Bank Erosion** is measured as the rate of the change in the position or horizontal displacement of a stream bank over a period of time. It is generally associated with riverine flooding and discharge, and may be exacerbated by human activities such as bank hardening and dredging.

**Ice Jams** are stationary accumulations of ice that restrict flow. Ice jams can cause considerable increases in upstream water levels, while at the same time, downstream water levels may drop. Types of ice jams include freeze up jams, breakup jams, or combinations of both. When an ice jam releases, the effects downstream can be similar to that of a flash flood or dam failure. Ice jam flooding generally occurs in the late winter or spring.

Montgomery County and its 19 political subdivisions, which consist of cities, towns, and villages, continue to work together to enforce the local floodplain management ordinance requirements set forth by the National Flood Insurance Program (NFIP).

**Table 3-16: FEMA Community Status in the NFIP**

| CID | COMMUNITY NAME | STATUS | INITIAL FIRM IDENTIFIED | CURRENT EFFECTIVE MAP DATE |
|---|---|---|---|---|
| 240049# | Montgomery County (Unincorporated) | Participating | 7/02/79 | 9/29/06 |
| 240094# | Barnesville | Participating | 8/10/79 | 9/29/06 |
| 240166# | Brookeville | Participating | 6/19/89 | 9/29/06 |
| 240122# | Chevy Chase – NSFHA, all Zone X | Participating | 9/29/06 | 9/29/06 |
| 240132# | Chevy Chase View - NSFHA, all Zone X | Participating | 9/29/06 | NSFHA |
| 240047# | Chevy Chase Village – NSFHA, all Zone X | Participating | 9/29/06 | 9/29/06 |
| 240136# | Chevy Chase Village Section 3 | Sanctioned - 9/29/07 | 09/29/06 | NSFHA |
| 240137# | Chevy Chase Village Section 5 | Participating | 9/29/06 | NSFHA |
| 240128# | Friendship Heights | Non-Participating | 9/29/06 | 9/29/06 |
| 540050# | Gaithersburg | Participating | 12/01/82 | 9/29/06 |
| 240150# | Garrett Park | Participating | 9/29/06 | 9/29/06 |
| 240142# | Glen Echo | Participating | 9/29/06 | 9/29/06 |
| 240119# | Kensington – "All Zone C and X no SFHA" | Participating | 9/29/06 | 9/29/06 |
| 240055# | Laytonsville | Sanctioned – 9/29/07 | 9/29/06 | 9/29/06 |
| 240113# | Martin's Addition | Participating | 9/29/06 | 9/29/06 |
| 240129# | North Chevy Chase | Sanctioned – 9/29/07 | 9/29/06 | 9/29/06 |
| 240118# | Poolesville | Participating | 10/15/82 | 9/29/06 |
| 240051# | Rockville | Participating | 1/05/78 | 9/29/06 |
| 240134# | Somerset | Participating | 9/29/06 | 9/29/06 |
| 240126# | Takoma Park | Participating | 9/29/06 | 9/29/06 |
| 240135# | Washington Grove | Participating | 9/29/06 | 9/29/06 |

## HAZARD PROFILE

The severity of flooding in Montgomery County is determined by a number of local factors, including river basin topography, precipitation patterns, recent soil moisture conditions, and groundcover/vegetative state. Montgomery County and its municipalities have many streams and small tributaries that are highly susceptible to flooding. The County is bounded by the Potomac River along the southwest. As illustrated in Figure 3-10 there are 3 major (Patapsco, Potomac, and Patuxent) and 49 sub-watersheds in the County and each area is subject to flash flooding. The properties in and near the identified floodplains of Montgomery County are subject to flooding events on an almost annual basis.

Large floods have occurred along the major streams in the basin during all seasons of the year. However, the most devastating floods have occurred between the months of March and June. The maximum flood of record occurred along the Potomac River in March 1936. Along small tributaries, flood stages can rise from normal flow to extreme flood peaks, with accompanying high velocities, in a

relatively short period. Along the Potomac River, floods rise to their crest over a longer period and remain out of banks for a more extended length of time.

Considering the available records of all known floods in the basin, it is probable that the five (5) largest floods in Montgomery County occurred in 1936, 1937, 1942, 1972, and 1996. Historical Crests for the five largest floods of record for the Potomac River at Little Falls are shown below.

**Table 3-17: Discharge Values for Largest Floods along the Potomac River at Little Falls, Montgomery County**

| DATE OF CREST | FEET |
|---|---|
| 03/19/1936 | 28.10 |
| 10/17/1942 | 26.88 |
| 04/28/1937 | 23.30 |
| 06/24/1972 | 22.03 |
| 01/21/1996 | 19.29 |

Information on historical floods in Montgomery County along the main stem of the Potomac River and was obtained from stream gauging stations maintained by the USGS at several locations within the drainage basin.

**Table 3-18: Flood Categories for Potomac River near Little Falls (USGS)**

| FLOOD CATEGORIES | FEET |
|---|---|
| MAJOR FLOOD STAGE | 14′ |
| MODERATE FLOOD STAGE | 12′ |
| FLOOD STAGE | 10′ |
| ACTION STAGE | 5′ |

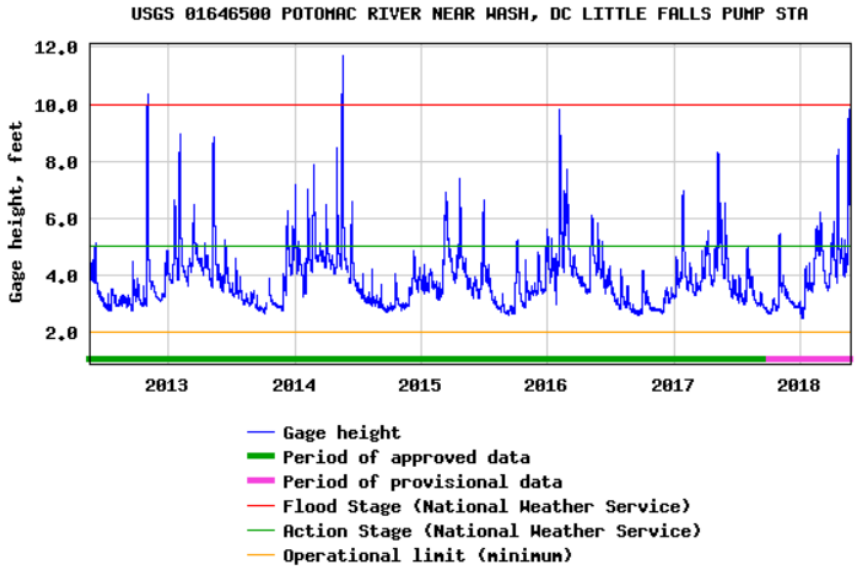



**Figure 3-9: Potomac River Little Falls Pump Station Gage Height**

Over the course of the past five years this section of the Potomac River reached flood stage during two separate events. October 30, 2013, and May 17, 2014. The Mid-Atlantic United States flood of 2006 was a significant flood that affected much of the Mid-Atlantic region of the eastern United States. The flooding was very widespread, affecting numerous rivers, lakes and communities from upstate New York

to North Carolina. It was widely considered to be the worst flooding in the region since Hurricane David in 1979. It was also one of the worst flood events in the United States since Hurricane Katrina in August 2005. At least 16 deaths regionally were related to the flooding.

The most severe flooding took place in and around Montgomery County. A total of 50 roads were closed at one time in the county, and 30 people were rescued from vehicles, outbuildings and stream trails by during the afternoon of the afternoon of June 27. Over 2,200 people were ordered to evacuate from the area south of Lake Needwood in Rockville due to concerns of a failure at Lake Needwood dam. If the dam were to break, communities downstream could be under as much as 22 feet (6.7 m) of flood water. Approximately 400 people were ultimately placed in a shelter over the next 36 hours. The dam did not break, however, and the evacuations ended on the evening of June 29. It was the largest evacuation and shelter operation in the history of the county.

According to the National Climatic Data Center Montgomery County has been impacted by 234 flood events since 1964 (21 days with damages and 1 day with damage to crops).

**Table 3-19: : Flood Events affecting Montgomery County**

| LOCATION | DATE | TYPE | DEATH | INJURY | PROPERTY DAMAGE | AGRICULTURAL DAMAGE |
|---|---|---|---|---|---|---|
| COMUS | 06/10/1996 | Flash Flood | 0 | 0 | 40,000 | 0 |
| CENTRAL PORTION | 06/11/1996 | Flash Flood | 0 | 0 | 2,000 | 0 |
| EXTREME NW PORTION | 06/17/1996 | Flash Flood | 0 | 0 | 10,000 | 0 |
| CENTRAL PORTION | 06/18/1996 | Flash Flood | 0 | 0 | 30,000 | 0 |
| NW PORTION | 06/19/1996 | Flash Flood | 0 | 0 | 30,000 | 0 |
| N PORTION | 06/19/1996 | Flash Flood | 0 | 0 | 40,000 | 0 |
| GLEN ECHO | 06/20/1996 | Flash Flood | 0 | 0 | 15,000 | 0 |
| COUNTYWIDE | 09/06/1996 | Flash Flood | 0 | 0 | 25,000 | 5,000 |
| COUNTYWIDE | 12/13/1996 | Flash Flood | 0 | 0 | 3,000 | 0 |
| GAITHERSBURG | 04/22/2006 | Flash Flood | 0 | 0 | 50,000 | 0 |
| COUNTYWIDE | 06/25/2006 | Flash Flood | 0 | 0 | 1,600,000 | 0 |
| COUNTYWIDE | 06/26/2006 | Flash Flood | 0 | 0 | 100,000 | 0 |
| ROCKVILLE | 06/27/2006 | Flash Flood | 0 | 0 | 100,000 | 0 |
| GERMANTOWN | 11/16/2006 | Flood | 0 | 0 | 50,000 | 0 |
| GARRETT PK ESTATES | 05/02/2016 | Flash Flood | 0 | 0 | 25,000 | 0 |
| POTOMAC | 05/02/2016 | Flash Flood | 0 | 0 | 25,000 | 0 |
| GLEN ECHO | 05/02/2016 | Flash Flood | 0 | 0 | 25,000 | 0 |
| CARDEROCK | 05/02/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| BROOKEVILLE | 06/21/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| GLEN ECHO | 07/19/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| CLARKSBURG | 07/30/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| DAVIS ARPT | 07/30/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| LAYTONSVILLE | 07/30/2016 | Flash Flood | 0 | 0 | 15,000 | 0 |
| BROOKEVILLE | 07/30/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| UNITY | 07/30/2016 | Flash Flood | 0 | 0 | 5,000 | 0 |
| BROOKEVILLE | 05/25/2017 | Flash Flood | 0 | 0 | 5,000 | 0 |
| GOSHEN | 07/17/2017 | Flash Flood | 0 | 0 | 500 | 0 |
| **TOTAL:** | | | **0** | **0** | **2,225,500** | **5,000** |

Reported flood events over the past 54 years provide an acceptable framework for determining the future occurrence in terms of frequency for such events. The probability of the County and its municipalities experiencing a flood event can be difficult to quantify, but based on historical record of 74 flood events since 1964, it can reasonably be assumed that this type of event has occurred once every 0.23 years from 1964 through 2018.

*[(Current Year) 2018] subtracted by [(Historical Year) 1964] = 54 Years on Record*

*[(Years on Record) 54] divided by [(Number of Historical Events) 234] = 0.23*

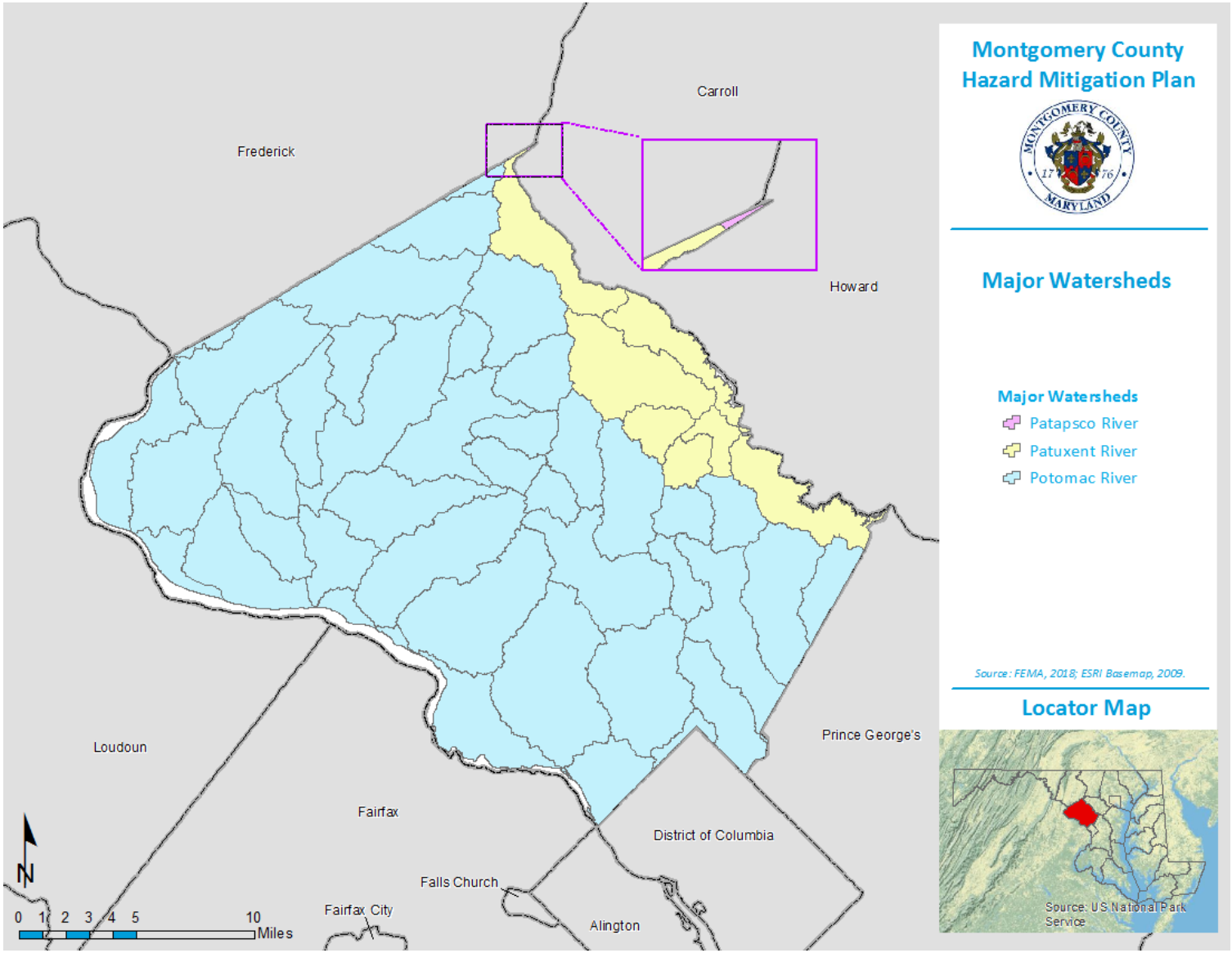



**Figure 3-10: Montgomery County Watersheds**

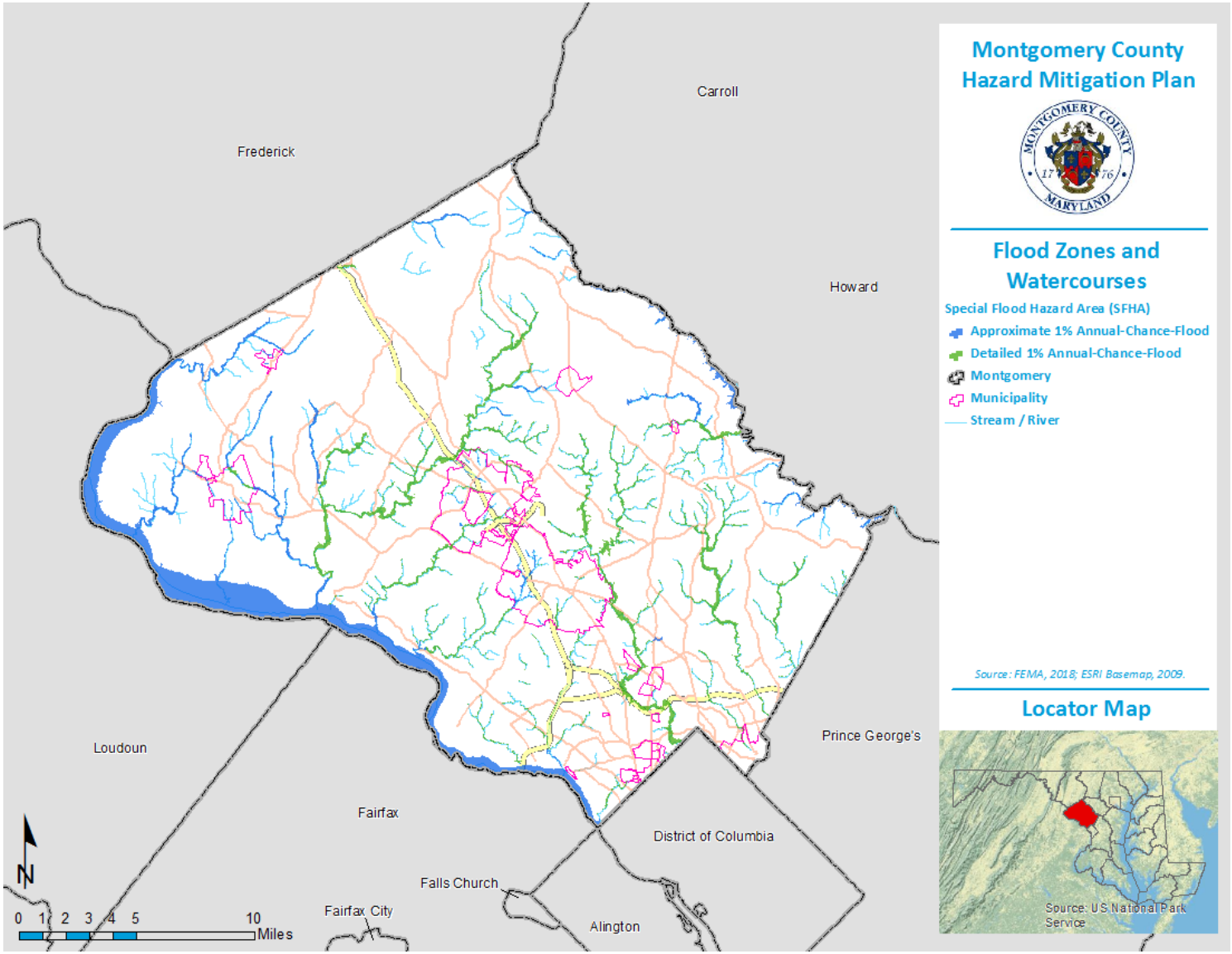



**Figure 3-11: Montgomery County Floodplain**

## INVENTORY ASSETS EXPOSED TO HAZARD

The method used in determining the types and numbers of potential assets exposed to flooding was conducted using a loss estimation model called Hazus-MH. Hazus-MH is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Buildings Sciences (NIBS). For this Plan update, a 100-year flood scenario was modeled and the results are presented below.

### Hazus-MH 100-Year Flood Scenario

Hazus estimates that approximately 1,797 buildings will be at least moderately damaged which is over 25% of the total number of buildings in the scenario. There are an estimated 140 buildings that will be completely destroyed. The tables below summarize the expected damage by general occupancy for the buildings and the expected building damage by building type in the study region.

| | 1-10 | | 11-20 | | 21-30 | | 31-40 | | 41-50 | | Substantially | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Occupancy | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Agriculture | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1 | 100.00 | 0 | 0.00 |
| Commercial | 0 | 0.00 | 1 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Education | 0 | 0.00 | 1 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Government | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Religion | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Residential | 0 | 0.00 | 53 | 2.95 | 547 | 30.49 | 318 | 17.73 | 736 | 41.03 | 140 | 7.80 |
| Total | 0 | | 55 | | 547 | | 318 | | 737 | | 140 | |

**Expected Building Damage by Occupancy (Hazus Flood Scenario)**

| Building Type | 1-10 | | 11-20 | | 21-30 | | 31-40 | | 41-50 | | Substantially | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| Concrete | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| ManufHousing | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 11 | 100.00 |
| Masonry | 0 | 0.00 | 16 | 3.31 | 151 | 31.26 | 77 | 15.94 | 206 | 42.65 | 33 | 6.83 |
| Steel | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Wood | 0 | 0.00 | 37 | 2.86 | 395 | 30.53 | 241 | 18.62 | 525 | 40.57 | 96 | 7.42 |

**Expected Building Damage by Building Type (Hazus Flood Scenario)**

As presented in Table 3-20 only 1 critical facility (School in Gaithersburg) in the county will experience moderate damage by a 500-year flood event. Critical facilities are essential to the health and welfare of the whole population and are especially important following hazard events. Hazus indicates that there are approximately 397 critical facilities that are floodprone. Please note that Hazus refers to these buildings as “essential” and the County refers to these as “critical.” Also, what the County defines as critical may also differ from what Hazus refers to as essential facilities. Please refer to the map on the next page to see the location of County deemed critical facilities.

| Table 3-20: Hazus Determined Critical Facilities that are Flood Prone | | |
|---|---|---|
| CRITICAL FACILITIES | # OF FLOODPRONE STRUCTURES | LOSS OF USE |
| FIRE | 0/40 | 0 |
| POLICE | 0/7 | 0 |
| HOSPITALS | 0/11 | 0 |
| SCHOOLS | 1/318 (Gaithersburg) | 0 |
| **TOTAL STRUCTURES** | **1/376** | **0** |

### Debris Generation

Hazus estimates the amount of debris that will be generated by the 100-year flood. The model breaks the debris into three general categories: a) Finishes (dry wall, insulation), b) Structural (wood, brick), and c) Foundations (concrete, slab, block, rebar). This distinction is made because of the different types of materials handling equipment required to handle the debris.

The model estimates that a total of 31,306 tons of debris will be generated due to the flood. Of the total amount, finishes comprises 48% of the total, structural comprises of 28% of the total, with the remainder being foundations. If the building tonnage is converted to an estimated number of truckloads, it will require 1,252 truckloads (@25 tons/truck) to remove the debris generated by the flood.

### Displacement and Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,701 households to be displaced due to the flood. Of these, 9,700 persons will seek temporary shelter in public shelters.

Critical facilities are essential to the health and welfare of the whole population and are especially important following hazard events. The following figure illustrates critical facilities located in the flood hazard areas followed by a table providing further data.

## POTENTIAL LOSSES

2017 census data estimates indicate that Montgomery County has over 390, 000 residential buildings with an approximate replacement value (excluding contents) of $180 billion. Though the majority of this property is not in the floodplain, a significant amount is. All assets are considered at risk from flooding; however, losses may vary widely depending on the type and factors contributing to the flood. To examine the potential losses from a flood, Montgomery County modeled a 100-year flood in Montgomery County using FEMA's loss estimation tool: Hazus-MH.

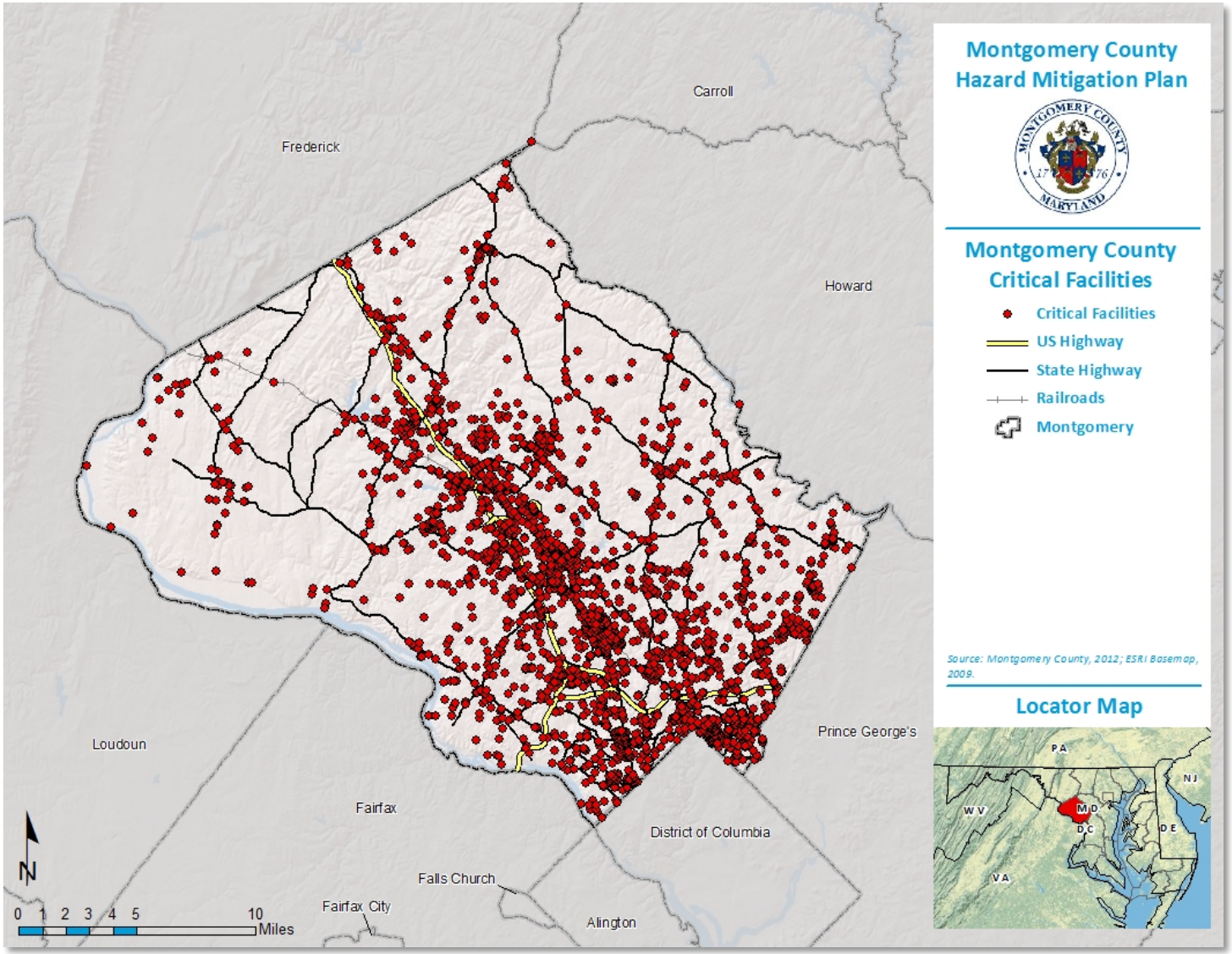



**Figure 3-12: Montgomery County Critical Facilities**

### Hazus-MH 100-Year Flood Scenario Losses

The total economic loss estimated for the flood is $454 million, which represents 6.38% of the total replacement value of the scenario buildings. The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were $453 million. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 78% of the total loss. The table below provides a summary of the losses associated with the building damage.

(Millions of dollars)

| Category | Area | Residential | Commercial | Industrial | Others | Total |
|---|---|---|---|---|---|---|
| Building Loss | | | | | | |
| | Building | 221.88 | 20.77 | 3.60 | 3.51 | 249.76 |
| | Content | 135.57 | 45.65 | 6.36 | 14.18 | 201.76 |
| | Inventory | 0.00 | 0.74 | 1.04 | 0.46 | 2.24 |
| | **Subtotal** | **357.45** | **67.15** | **11.00** | **18.16** | **453.76** |
| Business Interruption | | | | | | |
| | Income | 0.00 | 0.16 | 0.00 | 0.01 | 0.17 |
| | Relocation | 0.36 | 0.02 | 0.00 | 0.00 | 0.38 |
| | Rental Income | 0.07 | 0.01 | 0.00 | 0.00 | 0.08 |
| | Wage | 0.01 | 0.12 | 0.00 | 0.25 | 0.38 |
| | **Subtotal** | **0.44** | **0.30** | **0.00** | **0.27** | **1.01** |
| ALL | **Total** | **357.89** | **67.46** | **11.00** | **18.42** | **454.77** |

**Figure 3-13: Building-Related Economic Losses Estimates (Hazus Flood Scenario)**

The map on the next page depicts where Hazus estimated most loss would occur throughout Montgomery County.

The number and value of structures within the 100-year floodplain is considerable, as shown by the above map and Table 3-20. A flooding event could occur in a highly developed area such as Gaithersburg, Rockville, and Takoma Park and cause substantial infrastructure damage resulting in high dollar losses. While flooding could certainly affect many critical facilities in the county, many measures have been taken to lessen the probability of flooding in the municipal areas, which is where many of the county's critical facilities are located. Many residential structures may be affected by flooding outside of the municipalities. However, with the exception of repetitive loss properties (see discussion below); these structures are not directly located in floodplains.

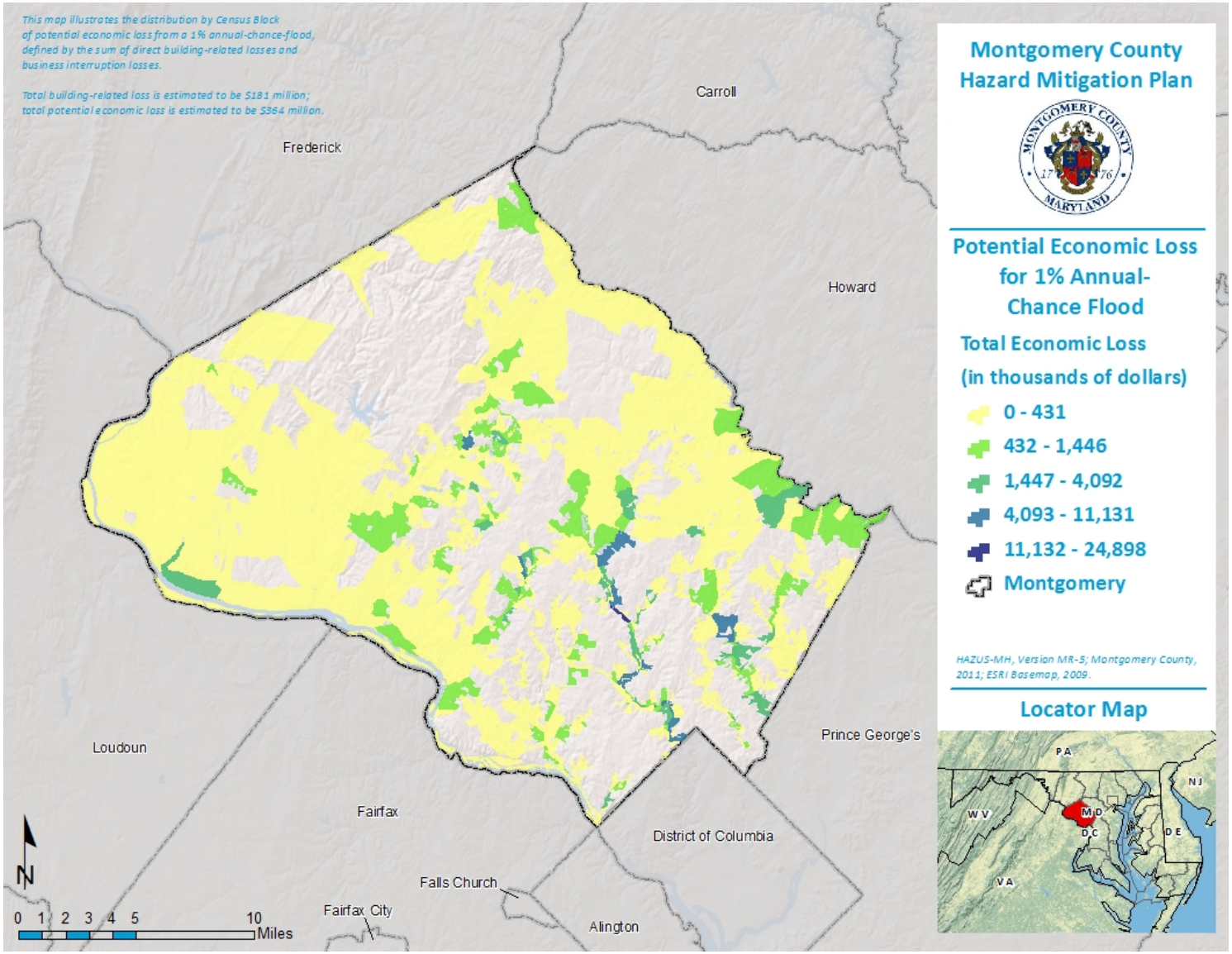



**Figure 3-14: Potential Economic Loss for 1% Annual Chance Flood**

Repetitive loss properties are those for which two or more losses of at $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. The following table details the known repetitive loss properties in Montgomery County by location, number of losses, and structure type. As of 2018, there are 40 repetitive loss properties located in Montgomery County.

**Table 3-21: Repetitive Flood Claim Properties in Montgomery County**

| LOCATION | # PROPERTIES | CLAIMS | TYPE | NFIP INSURED |
|---|---|---|---|---|
| Montgomery County | 30 | 63 | Single Family | 20 |
| Montgomery County | 6 | 19 | Non-Residential | 2 |
| Montgomery County | 4 | 10 | Multi-Family (Condo) | 3 |
| **TOTALS** | **40** | **92** | **N/A** | **25** |

## LAND USE & DEVELOPMENT TRENDS

Besides the localized flooding, there is also the great amount of property, both private and public that is at risk from flooding. As development grows within the county, there is added risk and probability for damage. It is essential that zoning and land use plans consider not only the dollar amount of damage that buildings near waterways could incur, but also the added risk of flood debris and narrowing the floodplains by building close to the rivers.

## MULTI-JURISDICTIONAL DIFFERENCES

As stated previously, a flooding event could occur in a built-up area such as Gaithersburg, Rockville, and Takoma Park and cause substantial structure damage resulting in high dollar losses. While flooding could certainly affect many facilities in the county, including critical facilities, it is safe to say that few critical facilities in the County are directly located in floodplains. The County as a whole should anticipate that there is an overall likelihood of being exposed to a flood annually.

## FLOODING HIRA SUMMARY

Severe flooding has the potential to inflict significant damage in Montgomery County. Assessing flood damage requires the communities throughout the County to remain alert and notify local officials of potential flood prone areas near infrastructure such as roads, bridges, and buildings. While flooding remains a highly likely occurrence throughout the identified flood hazard areas of Montgomery County, smaller floods caused by heavy rains and inadequate drainage capacity will be more frequent, but not as costly as the large-scale floods which may occur at much less frequent intervals. While the potential for flood is always present, Montgomery County does have policies and regulations for development that should help lessen potential damage due to floods.

# HURRICANE/TROPICAL STORM

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| Hurricane/Tropical Storm | 0.75 | 0.69 | 0.74 | 0.10 | 0.32 | 2.60 |
| **MODERATE RISK (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

Coastal hazards take many forms ranging from storm systems like tropical storms, hurricanes and Nor'easters that can cause storm surge inundation, heavy precipitation that may lead to flash flooding, and exacerbation of shoreline erosion to longer term hazards such as sea level rise.

Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as —cyclones due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage.

There are three categories of tropical cyclones:

1. Tropical Depression: maximum sustained surface wind speed is less than39 mph.
2. Tropical Storm: maximum sustained surface wind speed from 39-73 mph.
3. Hurricane: maximum sustained surface wind speed exceeds 73 mph.

Once a tropical cyclone no longer has tropical characteristics it is then classified as an extratropical system. Most Atlantic tropical cyclones begin as atmospheric —easterly waves that propagate off the coast of Africa and cross the tropical North Atlantic and Caribbean Sea. When a storm starts to move toward the north, it begins to leave the area where the easterly trade winds prevail, and enters the temperate latitudes where the westerly winds dominate. This produces the eastward curving pattern of most tropical storms that pass through the Mid-Atlantic region. When the westerly steering winds are strong, it is easier to predict where a hurricane will go. When the steering winds become weak, the storm follows an erratic path that makes forecasting very difficult.

**Hurricanes** are categorized according to the Saffir/Simpson scale with ratings determined by wind speed and central barometric pressure. Hurricane categories range from One through Five, with Category Five being the strongest (winds greater than 155 mph). A hurricane watch is issued when hurricane conditions could occur within the next 36 hours. A hurricane warning indicates that sustained winds of at least 74 mph are expected within 24 hours or less. The National Weather Service (NWS) National Hurricane Center defines June 1 through November 30 as the Atlantic hurricane season. September is typically the most active month for tropical cyclones in Maryland.

Tropical storms and hurricanes are accompanied by a storm surge, an abnormal local rise in sea level. The storm surge is caused by the difference in wind and barometric pressure between a tropical system and the environment outside the system. The end result is that water is pushed onto a coastline. The height of the surge is measured as the deviation from mean sea level and can reach over 25 feet in

extreme circumstances. The most devastating storm surges occur just to the right of the eye of a land falling hurricane. For coastal areas, the storm surge is typically the most dangerous and damaging aspect of the storm.

Howling winds associated with Nor'easters also have the potential to produce significant storm surge, similar to that of a Category One hurricane. In addition, these types of storms can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall. The wintry impacts of Nor'easters are discussed in greater detail in Severe Winter Storms.

The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model is used to evaluate the potential impact of storm surge. Emergency managers use data from SLOSH to identify at-risk populations and determine evacuation areas. Storm surges also affect tidal rivers and creeks, potentially increasing evacuation areas. The Saffir/Simpson scale was developed in 1971 by Herbert Saffir and Dr. Robert Simpson as a way to classify hurricanes. The scale rates the intensity of hurricanes based on wind speed and barometric pressure measurements. The scale gives an indication of the potential flooding and wind damages associated with each hurricane category. While major hurricanes comprise only 20% of all tropical cyclones making landfall, they account for over 70% of the damage in the United States.

**Table 3-22: Saffir-Simpson Scale Categories with Associated Wind Speeds and Damages (NHC, 2009)**

| STORM CATEGORY | WIND SPEED (mph) | DESCRIPTION OF DAMAGES |
|---|---|---|
| 1 | 74-95 | *MINIMAL*: Damage is limited primarily to shrubbery and trees, unanchored mobile homes and signs. No significant structural damage. |
| 2 | 96-110 | *MODERATE*: Some trees are toppled, some roof coverings are damaged and major damage occurs to mobile homes. Some roofing material, door and window damage. |
| 3 | 111-130 | *EXTENSIVE*: Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Large trees are toppled. Terrain may be flooded well inland. |
| 4 | 131-155 | *EXTREME*: Extensive damage to roofs, windows and doors; roof systems on small buildings completely fail. More extensive curtain wall failures. Terrain may be flooded well inland. |
| 5 | >155 | *CATASTROPHIC*: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Massive evacuation of residential areas may be required. |

## HAZARD PROFILE

All of Montgomery County could be affected by a hurricane or a tropical storm. Since they can disrupt power and inundate roads, tropical storms can cause havoc on the entire community. The county's proximity to the Potomac River indicates potential for flooding during heavy rains and high winds.

Figure 3-15 depicts the wind zone for Montgomery County. The wind zones were established by the American Society of Civil Engineers based on information which includes 40 years of tornado history and over 100 years of hurricane history. Montgomery County falls into within Zone II. Shelters and critical

facilities should be able to withstand a 3-second gust of up to 160 mph, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm event.

In September 1979, Hurricane David reduced to a Tropical Storm and struck Montgomery County, resulting in property damage of over $2 million and crop damage of over $20,000 according to SHELDUS. Power outages, road closures, and damage to homes occurred across the county. On 16 September 1999, Hurricane Floyd hit Maryland and resulted in property damage worth approximately $200 million. Hurricane Floyd made landfall just east of Cape Fear, North Carolina, in the early morning hours of the 16th and moved north-northeast across extreme southeast Virginia to near Ocean City, Maryland. The Maryland Eastern Shore was declared a disaster area as damages totaled near $3.5 million. Tidal flooding was reported along the Chesapeake Bay.

On September 18, 2003, Montgomery County was struck by Hurricane Isabel. Initially Isabel was identified as a Category 2 hurricane that turned into a tropical storm by the time it struck Montgomery County. Power outages impacted hospitals, nursing homes, and traffic signals. Downed trees, wires, and flooding led to numerous road closures.

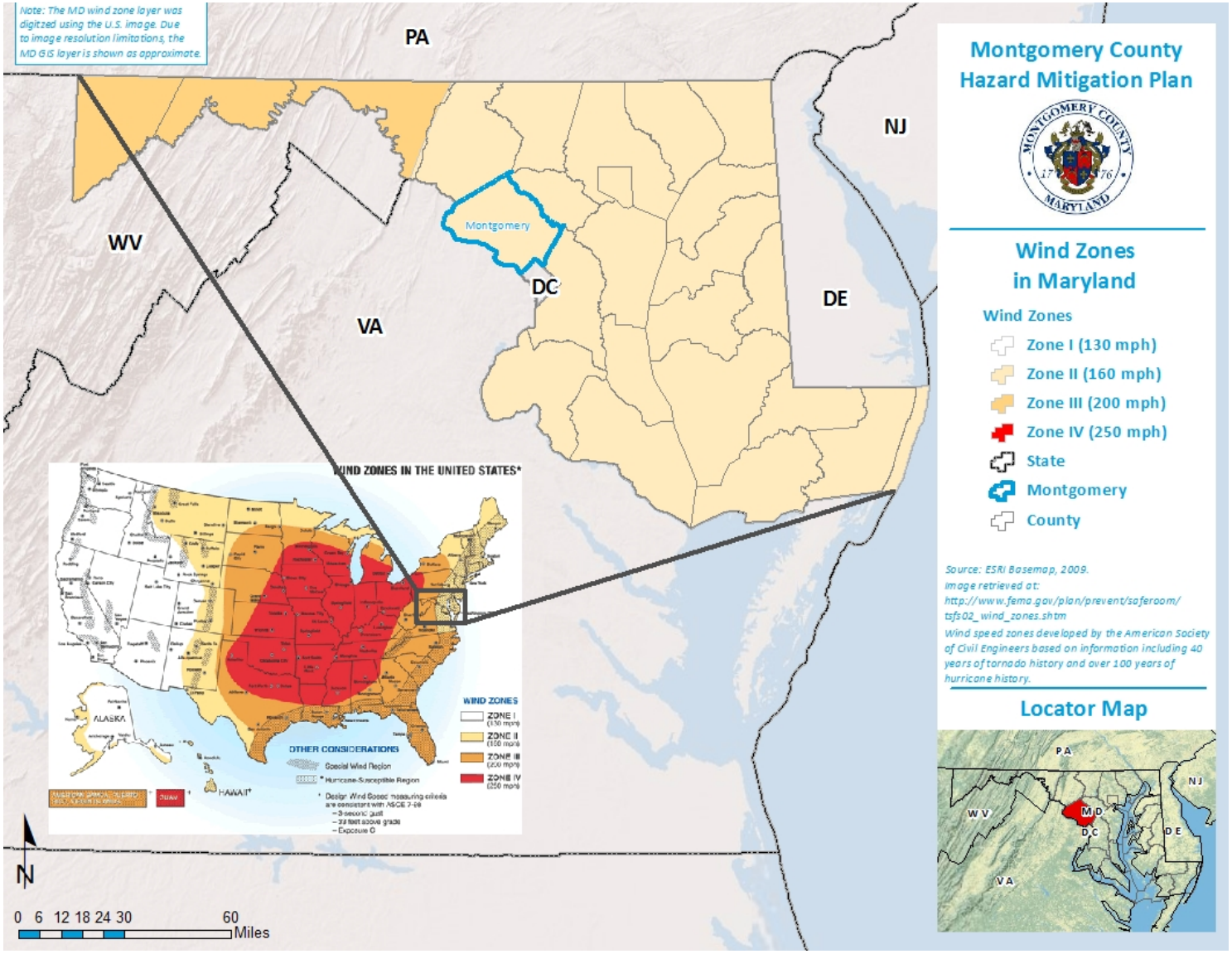



**Figure 3-15: Wind Zones in Maryland**

SHELDUS only lists Tropical Storm David for Montgomery County; however the County may have been impacted by other hurricane and tropical storm events that have affected the State of Maryland. Figure 3-19 shows hurricane tracks and Figure 3-20 shows the tropical storms that have crossed Montgomery County. These additional events are listed below:

- **August 12 and 18, 1955: Hurricanes Connie and Diane**
  Hurricanes Connie and Diane both passed over Maryland as tropical storms within several days of each other, on Aug. 12 and 18, respectively. The rains from Connie set the stage for the devastating floods caused by Diane, which poured 10-20 inches of rain on the already-soaked region. Major flooding occurred in central Maryland, particularly along the Potomac River. Strong gales from Connie sunk the tour schooner Levin J. Marvel, about 20 miles south of its home port of Annapolis. Fourteen passengers drowned.
- **June 21-23, 1972: Hurricane Agnes**
  Hurricane Agnes moved through the Atlantic past Maryland as a tropical storm on June 21-23. Widespread and in some places record flooding wrought one of the state's most destructive natural disasters. In the tributaries on the north side of the Potomac River, from the Conococheague Creek at Fairview, Maryland down to Rock Creek at Washington, DC, floods in excess of the 100-year frequency level were observed. Many roads were closed, particularly in central Maryland, and thousands of evacuations occurred. Montgomery County along with several surrounding jurisdictions was declared a federal disaster area. The event proved to be an ecological calamity for the Chesapeake Bay. The damage in Maryland was in excess of $110 million (in 1972 dollars), and there were 19 deaths.
- **July 13, 1996: Hurricane Bertha**
  Hurricane Bertha moved across the Lower Maryland Eastern Shore on July 13th. The highest sustained wind speed recorded was 23 mph at Salisbury, with gusts up to 63 mph at Ocean City. One confirmed tornado was spawned by the hurricane near Madison in Dorchester County. Numerous trees and power lines were blown down and resulted in scattered property damage and power outages. Rainfall amounts generally ranged from to 5.0 inches and caused some street flooding. Property damages of $100,000 and crop damages of $15,000 occurred.
- **September 6, 1996: Tropical Storm Fran**
  Spiral bands associated with Hurricane Fran affected the Lower Maryland Eastern Shore during Friday, September 6th. The highest sustained wind speed recorded was 22 mph at Salisbury with gusts of 35 mph. A storm surge of 4 to 6 feet inundated portions of the communities of Taylors Island, Hoopers Island, and Madison in Dorchester County along the Chesapeake Bay. Many roads were flooded with some homes receiving water damage at the time of high tide. Dorchester, Wicomico, Somerset, and Worcester counties were affected, and property damages reached $1 million. Storm winds channeled water up the Chesapeake Bay and its main tributaries, which became a small-scale storm surge, causing $1.6 million in property damages and $5,000 in crop damages in central Maryland.
- **October 8, 1996: Tropical Storm Josephine**

Remnants of Tropical Storm Josephine moved quickly up the East Coast during Tuesday, October 8th, affecting the Lower Maryland Eastern Shore. The storm produced 1.5 to 3.5 inches of rain resulting in flooding of several roads. The storm caused $100,000 in damages.

- **September 16, 1999: Hurricane Floyd**
  Hurricane Floyd moved north-northeast across extreme southeast Virginia and reached Maryland near Ocean City by evening on the 16th. Hurricane Floyd was a Category 1 hurricane as it crossed the Wakefield WFO County warning area. The storm surge caused tides two to three feet above normal throughout central Maryland. Tropical storm force wind gusts occurred in the northwest quadrant of the storm over portions of the Lower Maryland Eastern Shore. Property damages of over $1 million and crop damages of $575,000 occurred.
- **September 18, 2003: Hurricane Isabel**
  Hurricane Isabel had been downgraded to a tropical storm by the time it reached Maryland, but it still caused significant damage in the state. Isabel's eye tracked well west of the bay, but the storm's 40 to 50 mph sustained winds pushed a bulge of water northward up the bay and its tributaries producing a record storm surge. The Maryland western shore counties of the Chesapeake Bay and along the tidal tributaries of the Potomac, Patuxent, Patapsco and other smaller rivers experienced a storm surge that reached 5 to 9 feet above normal tides. Over 2000 people were evacuated from their homes. Many buildings were destroyed and the Lower Maryland East Shore suffered the worst power outages in history. The storm caused one fatality, 200 injuries, $530 million in property damages, and $190,000 in crop damages. Montgomery County was one of several jurisdictions with significant damages, road closures, and flooding.
- **September 1, 2006: Tropical Storm Ernesto**
  Moderate coastal flooding occurred due to the storm surge from the remnants of Tropical Storm Ernesto. The tide crest at Annapolis was 3.56 MLLW late Friday.
- **September 6, 2008: Tropical Storm Hanna**
  Tropical Storm Hanna brought heavy rain, strong winds and some tidal flooding to the Eastern Shore during the day and into the evening of the 6th. Maximum sustained winds reached 50 mph. Tree damage was sustained throughout much of the state, and many roads were closed due to trees down.
- **August 27, 2011: Hurricane Irene**
  Hurricane Irene, a Category One hurricane brought rain and heavy winds to Maryland. Sustained winds speed measured at nearly 85 mph. Tree damage, power outages, and road closures were sustained as were several deaths throughout Maryland and neighboring Virginia. Because of the recent occurrence of this event, damages and event details are still being assessed.
- **September 6, 2011: Tropical Storm Lee**
  Remnants from Tropical Storm Lee impacted over 400 residents in the state at an estimated cost of over $23 million in public assistance. This prompted the Governor to request a major disaster declaration for seven counties. Though several areas within Montgomery County were affected by the storm, the declaration was not extended to include the county.

- **Tropical Storm Sandy Oct 28, 2012** Tropical Cyclone Sandy moving northward well off the Mid Atlantic Coast then northwest into extreme southern New Jersey produced very strong northeast winds followed by very strong west or northwest winds. The very strong winds caused moderate to severe coastal flooding across portions of the Lower Maryland Eastern Shore. Water levels reached 3.0 feet to 4.5 feet above normal adjacent to the Atlantic Ocean resulting in moderate to severe coastal flooding.

The figure on the following page shows the Hurricane Tracks for the State of Maryland that have Impacted Montgomery County.

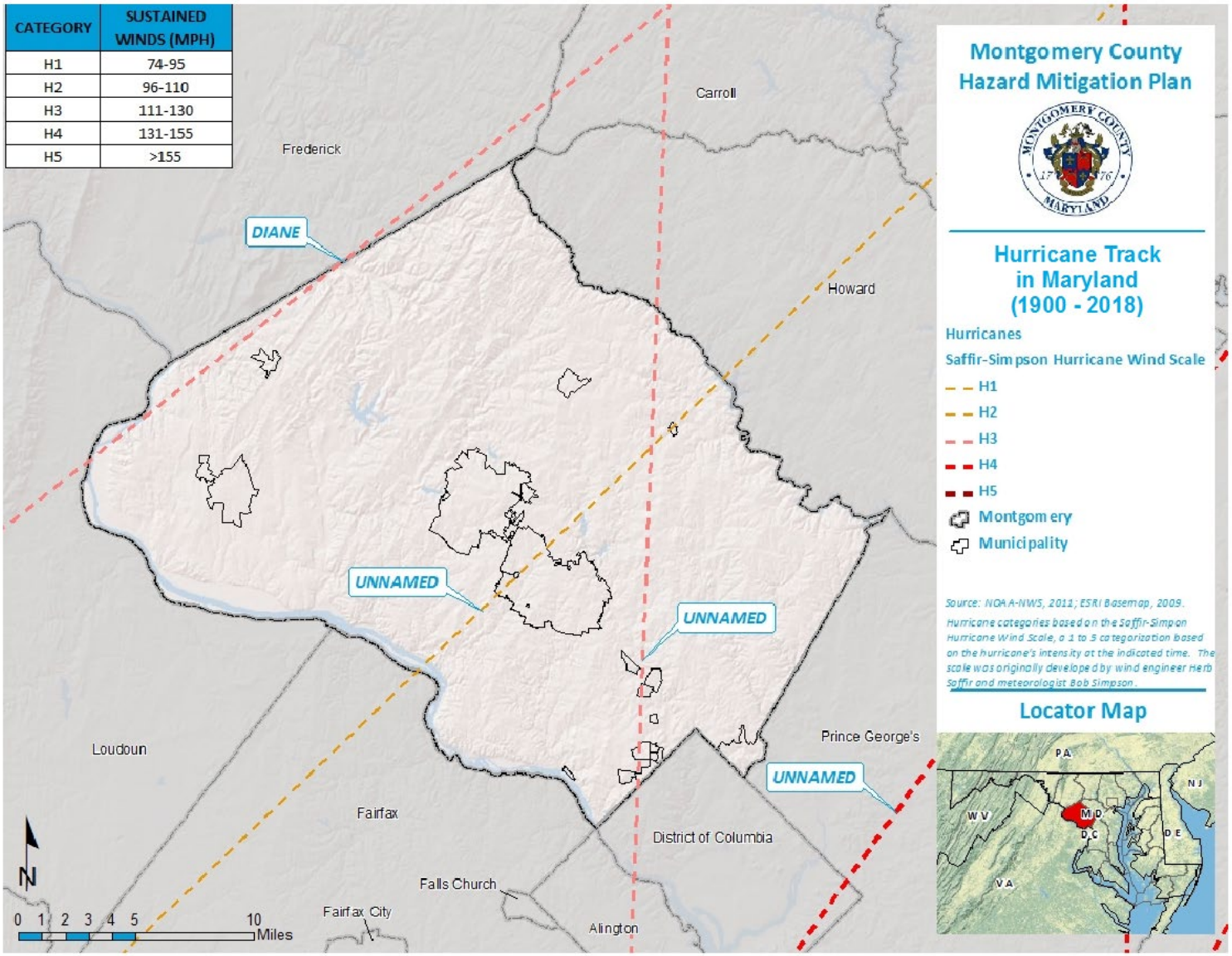



**Figure 3-16: Hurricane Tracks in Maryland, 1900-2018**

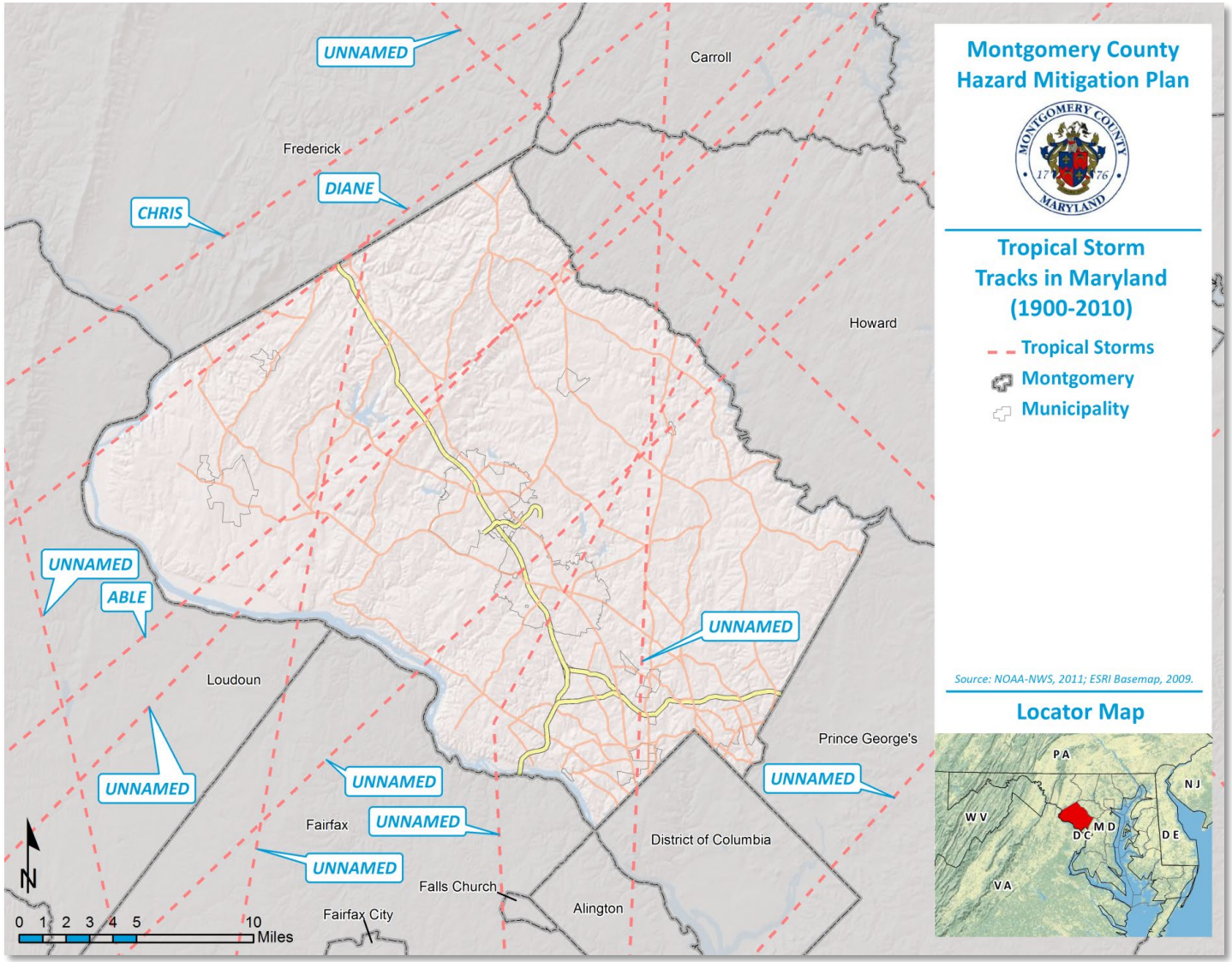



**Figure 3-17: Tropical Storm Tracks in Maryland, 1900-2010**

## INVENTORY ASSETS EXPOSED TO HAZARD

The 2016 Maryland State Hazard Mitigation plan indicated that Montgomery County has not had any injuries or deaths related to coastal storms. The State plan also does not list any property damage or crop damage associated with this hazard, although SHELDUS data did indicate damage from Tropical Storm David in 1979.

All assets located in Montgomery County can be considered at risk from tropical storms. This includes all of the County's population and all buildings and infrastructure within the County. Damages primarily occur as a result of high winds, heavy rains, and flooding.

## POTENTIAL LOSSES

Also completed as part of the 2016 State Hazard Mitigation Plan was a Hazus-MH for hurricane wind in order to determine potential losses due to winds associated with tropical storm and hurricanes. The total amount of annualized losses for Montgomery County is just over $2.2 million. The table below lists the occupancy type and expected loss based on the Hazus analysis.

**Table 3-23: Annualized Loss Estimates by Occupancy in Thousands of Dollars**

| Agricultural | Commercial | Educational | Government | Industrial | Religion-Non Profit | Residential | Total |
|---|---|---|---|---|---|---|---|
| 4 | 181 | 8 | 10 | 24 | 16 | 1977 | 2220 |

The table below lists the building construction types and expected loss based on Hazus analysis.

**Table 3-24: Hazus-MH MR5 Annualized Loss Estimates by Building Type in Thousands of Dollars**

| Wood | Masonry | Concrete | Steel | Manufactured Homes | Total |
|---|---|---|---|---|---|
| 1358 | 715 | 28 | 103 | 1 | 2205 |

Montgomery County is not within a high coastal hazard area, but is still at risk of impacts from coastal storms (Maryland State HMP, 2016).

**Table 3-25: Annual Probability of Tropical Storm and Hurricane Strength Wind Speeds for Montgomery County (FEMA, 2000)**

| WIND SPEED (mph) | CORRESPONDING SAFFIR-SIMPSON TROPICAL STORM/HURRICANE CATEGORIES | ANNUAL PROBABILITY OF OCCURRENCE (%) |
|---|---|---|
| 39-74 | Tropical Storms | 91.59 |
| 74-95 | Category 1 to 2 Hurricanes | 8.32 |
| 96-110 | Category 3 to 4 Hurricanes | 0.0766 |
| 111-130 | Category 4 to 5 Hurricanes | 0.0086 |
| 131-155 | Category 5 Hurricanes | 0.00054 |
| >155 | Category 5 Hurricanes | 0.00001 |

## LAND USE & DEVELOPMENT TRENDS

The type and age of construction plays a role in vulnerability of facilities to coastal hazard winds. In general, concrete, brick and steel-framed structures tend to fare better than older, wood-framed

structures or manufactured homes. Vulnerability to storm surge is determined by facility location in relation to storm surge inundation zones. Finally, not all critical facilities have redundant power sources and may not even be wired to accept a generator.

### MULTI-JURISDICTIONAL DIFFERENCES

All of Montgomery County could be affected by a hurricane or a tropical storm. Since they can disrupt power and inundate roads, tropical storms can cause havoc on the entire community. The county's proximity to the Potomac River exposes it to significant potential for flooding.

### HURRICANE / TROPICAL STORM HIRA SUMMARY

Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage. It is important to ensure that all development is built to code to withstand impacts from flooding and severe wind associate with hurricanes and other tropical storms.

# WILDFIRE

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| WILDFIRE | 0.72 | 0.39 | 0.38 | 0.40 | 0.16 | 2.05 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

Wildfire is an unplanned ignition of vegetation including unauthorized human-caused fires, in a wilderness area. Other names such as brush fire, bushfire, forest fire, grass fire, and vegetation fire, may be used to describe the same phenomenon depending on the type of vegetation being burned. A wildfire differs from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to change direction unexpectedly, and its ability to jump gaps such as roads, rivers and fire breaks.

During a very intense wildfire or "conflagration" a significant movement of air and combustion occurs. Conflagrations occur mostly in a building fire however, in forests or other wilderness areas they are known as a "firestorm". A firestorm is a conflagration which attains such intensity that it creates and sustains its own wind system which further fuels the fire. Firestorms are most commonly created during some of the largest of bushfires, forest fires, and wildfires.

## HAZARD PROFILE

Wildfire hazard is a significant and recurrent threat in Montgomery County and has the potential to harm people, destroy buildings and cause damage to vital infrastructure. Wildfire season in Montgomery County commences in early spring through late fall every year during the hotter, dryer months. Topography, weather, and vegetation provide the ingredients for destructive wildfires that can spread rapidly throughout the county.

In Montgomery County, development activities within wildfire hazard areas have exacerbated the problem by placing more development into more rural and vegetated area. In recent years, more and more people have built houses in or near the forest. Over 650 wildfires burn over 3,500 acres every year in Maryland alone. Since humans cause 98% of these fires, a zone has been created where homes intermingle with wildland fuels and the risk of wildland fire ignitions is increased. This zone is called the Wildland-Urban Interface (WUI). The WUI is an area where homes and lives are at high risk of the dangers associated with wildfires. In these areas development has pushed an increasing number of people and buildings at risk.

In Montgomery County, wildfire has been a continuous threat for rural areas with large fuel loads. In the county, a total of 23 wildfires have ignited across most of the County from 2005-2010. As indicated is the Table 3-26 the majority of fires (32%) are caused by arson. There have been no death or injuries related to wildfire over the five-year reporting period.

**Table 3-26: Past Wildfire Occurrences**

| NO. | YEAR | FIRE NAME | CAUSE | ACRES BURNED |
|---|---|---|---|---|
| 1078 | 2005 | N/A | Debris Burning | 4.0 |

**Table 3-26: Past Wildfire Occurrences**

| NO. | YEAR | FIRE NAME | CAUSE | ACRES BURNED |
|---|---|---|---|---|
| 1091 | 2005 | N/A | Smoking | 1.0 |
| 1687 | 2006 | Needwood Golf Course | Arson | 5.0 |
| 1689 | 2006 | Lake Needwood Park | Arson | 1.0 |
| 1793 | 2006 | Snouffer School Road | Arson | 3.5 |
| 1795 | 2006 | Brown Church Road | Smoking | 2.5 |
| 1833 | 2006 | N/A | Smoking | 0.5 |
| 1844 | 2006 | N/A | Miscellaneous, Spontaneous combustion | 0.2 |
| 1910 | 2006 | N/A | Miscellaneous, Spontaneous Combustion | 0.2 |
| 1917 | 2006 | N/A | Arson | 0.2 |
| 1975 | 2006 | Needwood 3 | Arson | 0.3 |
| 1995 | 2006 | N/A | Arson | 0.4 |
| 2057 | 2006 | N/A | Arson | 0.1 |
| 2144 (Rockville) | 2006 | N/A | Lightning | 0.1 |
| 2395 | 2007 | N/A | Railroad | 6.0 |
| 2422 | 2007 | N/A | Smoking | 0.1 |
| 2520 (Takoma Park) | 2007 | N/A | Children | 0.1 |
| 3037 | 2008 | Indian Spring | Smoking | 5.2 |
| 3203 | 2008 | N/A | Campfire | 0.1 |
| 3564 | 2009 | Peach Tree Road | Miscellaneous, Downed power line | 8.7 |
| 3735 | 2009 | Glendevon | Children | 1.1 |
| 4062 | 2010 | Barnes Road Fire | Equipment | 7.0 |
| | 2011 | Darnestown Fire | Undetermined | 460.0 |

Throughout Maryland, communities are increasingly concerned about wildfire safety as increased development in forested areas and subsequent fire control practices have affected the natural cycle of the ecosystem. As indicated in Figure 3-19, where there is human access to wildland areas, such as the areas more populated near southern Montgomery County, the risk of fire increases due to a greater chance for human carelessness. Within the County, the area starting near the District of Colombia and extending west and northwest through the center of the County is most prone to wildfire due to its terrain and vegetation.

Only 2 wildfires on record have started in or traversed into a municipality in Montgomery County. wildfire record no. 2520 in Takoma Park and wildfire record No. 2144 in Rockville. Analysis in GIS shows that all other wildfires between 2005 – 2018 originated and remained in unincorporated areas of the county.

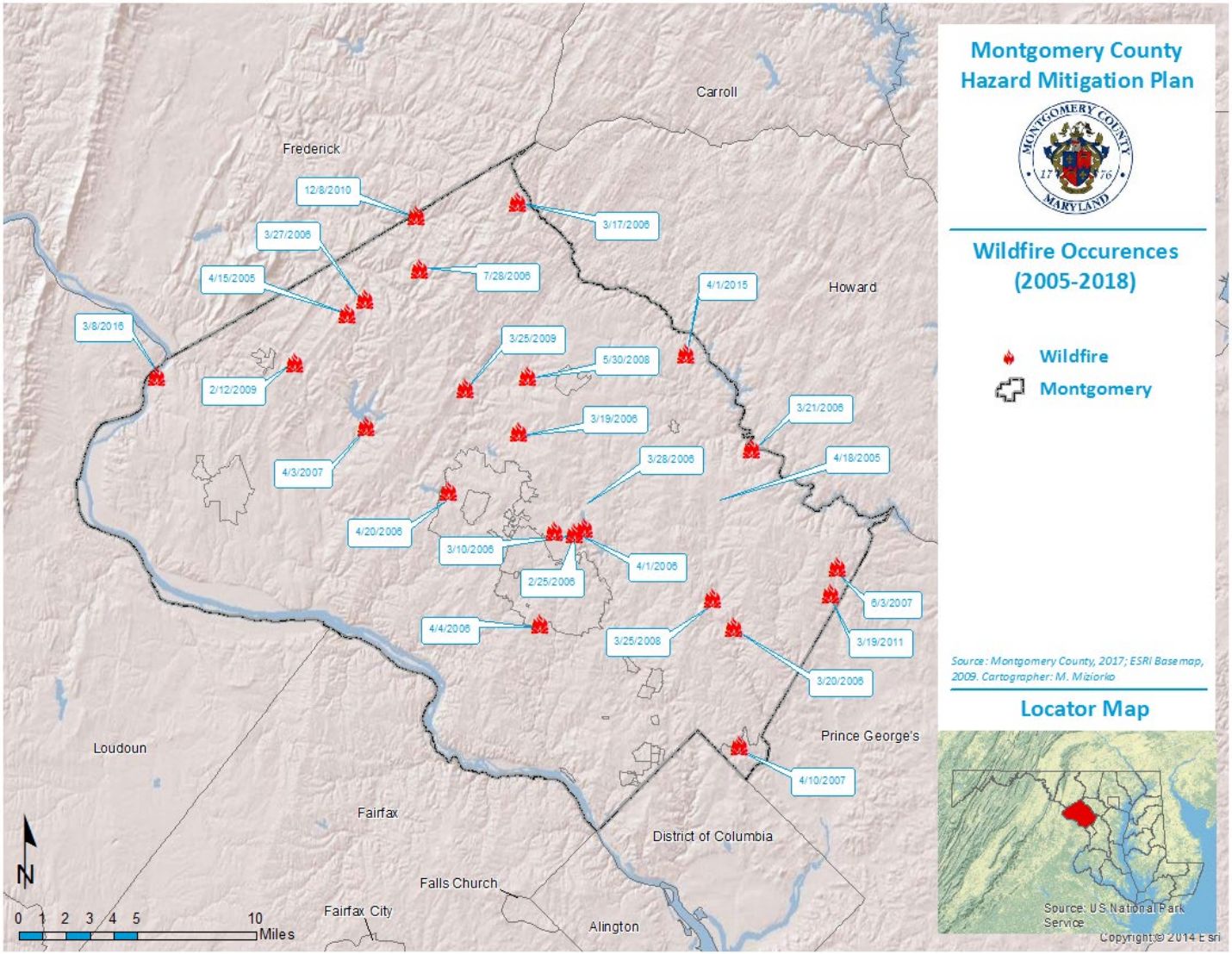



**Figure 3-18: Wildfire Occurrences, 2005-2018**

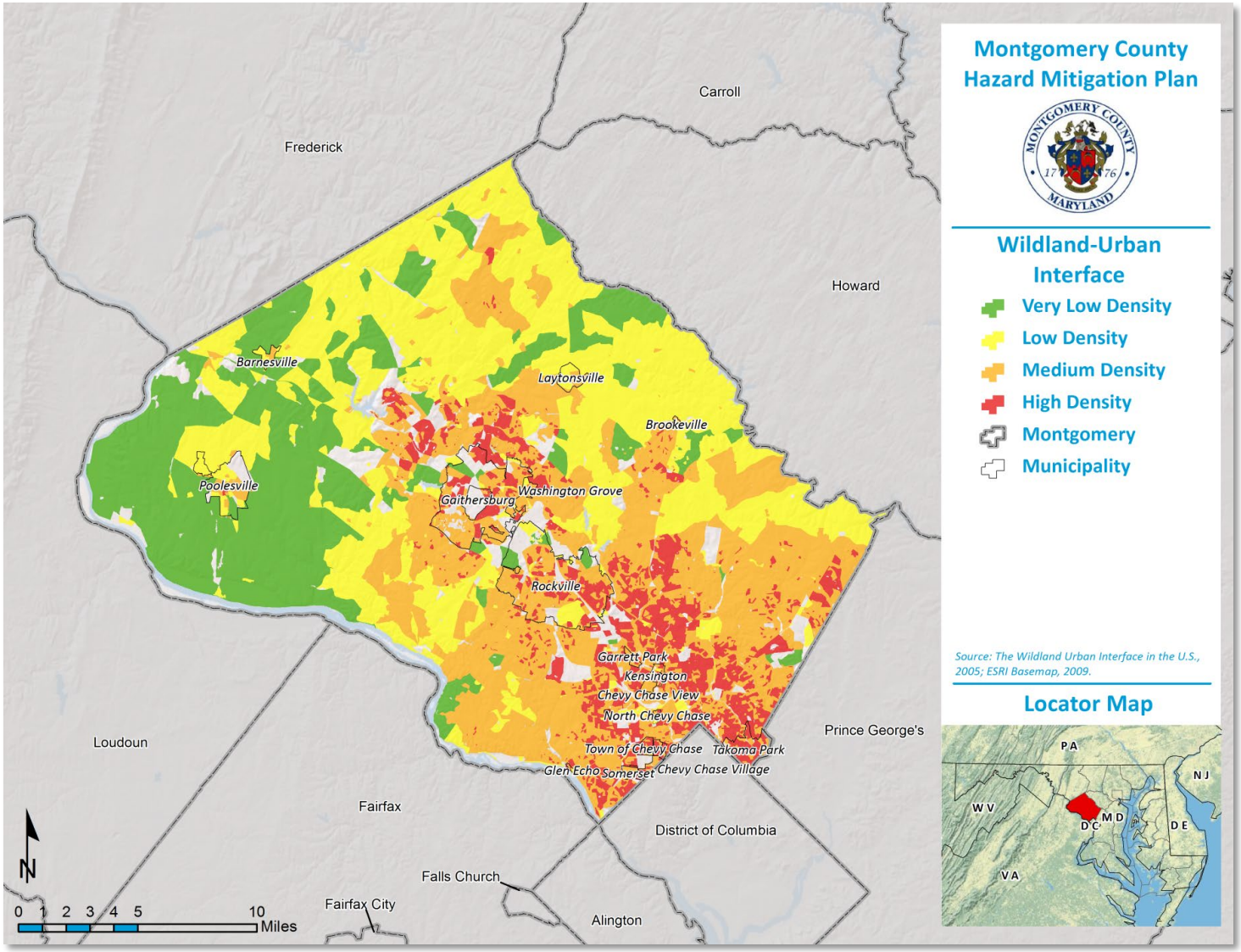



**Figure 3-19: Wildland-Urban Interface in Montgomery County**

Generally, there are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather.

- Fuel – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also to be considered as a fuel source are manmade structures, such as homes and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that is under human control.
- Topography – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.
- Weather – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread and the more intense it will be.

Factors contributing to the wildfire risk in Montgomery County include:

- Overstocked forests
- Lack of defensible space around structures
- Excessive vegetation along roadsides and hanging over roads
- Fire engine access, and evacuation routes
- Drought and overstocked forests
- Increasing population density leading to more ignitions

## INVENTORY ASSETS EXPOSED

Montgomery County has had 0 injuries in relation to forest fires from 1998-2018. Total damage for wildfires from 1998 to 2018 was $3,689. The 2016 State of Maryland Hazard Mitigation Plan indicated that there are approximately 76 critical facilities (State and County) within a high wildfire area for Montgomery County. The total content value that was assessed for those 76 critical facilities was $4,359,053. Information was pulled from the 2016 Maryland State Hazard Mitigation Plan as best available information.

## POTENTIAL LOSSES

Fires can extensively impact the economy of an affected area. Major direct costs associated with forest fires or wildfires include the salvage and removal of downed timber and debris and the restoration of the burned area. If burned-out woodlands and grasslands are not replanted quickly to prevent widespread soil erosion, then landslides, mudflows, and floods could result, compounding the damage.

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Factors contributing to the wildfire risk in Montgomery County include

- Overstocked forests,
- lack of defensible space around structures;
- Excessive vegetation along roadsides and hanging over roads,
- fire engine access, and evacuation routes;
- Drought and overstocked forests;
- Increasing population density leading to more ignitions.

## LAND USE AND DEVELOPMENT TRENDS

Wildfires can occur at any time of day and during any month of the year, and the season length and peak months may vary appreciably from year to year. Land use, vegetation, amount of combustible materials present, and weather conditions such as wind, low humidity, and lack of precipitation are the chief factors determining the number of fires and acreage burned. Generally, fires are more likely when vegetation is dry from a winter with little snow and/or a spring and summer with sparse rainfall. Forest fires and wildfires are capable of causing significant injury, death, and damage to property. The potential for property damage from fire increases each year as more recreational properties are developed on wooded land and increased numbers of people use these areas.

## MULTI-JURISDICTIONAL DIFFERENCES

Wildfires can occur at any time of day and during any month of the year, and the season length and peak months may vary appreciably from year to year.

## WILDFIRE HIRA SUMMARY

Wildfires and brush fires in Maryland from 1988 to 2018 have forced school closings, disrupted telephone services by burning fiber optic cables, damaged railroads and other infrastructure, and adversely affected tourism, outdoor recreation, and hunting. The likelihood of one of those fires attaining significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response. Weather conditions, particularly drought events, increase the likelihood of wildfires occurring. It is important to note that 98% of wildfires are human-caused. Nonetheless, the critical inference to draw from this statistic is the fact that the occurrence of future wildfire events will strongly depend on patterns of human activity. Events are more likely to occur in wildfire-prone areas experiencing new or additional development.

# WATER SHORTAGE/DROUGHT

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| WATER SHORTAGE/DROUGHT | 0.75 | 0.54 | 0.68 | 0.10 | 0.40 | **2.6** |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

Drought is a normal part of virtually all climates, including areas with high and low average rainfall. It is caused by a deficiency of precipitation and can be aggravated by other factors such as high temperatures, high winds, and low relative humidity.

Droughts can be grouped as meteorological, hydrologic, agricultural, and socioeconomic. Representative definitions commonly used to describe the types of drought are summarized below.

**Meteorological** drought is defined solely on the degrees of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.

**Hydrologic** drought is related to the effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.

**Agricultural** drought is defined principally in terms of soil moisture deficiencies relative to water demands of plant life, usually crops.

**Socioeconomic** drought associates the supply and demand of economic goods or services with elements of meteorological, hydrologic, and agricultural drought. Socioeconomic drought occurs when the demand for water exceeds the supply as a result of a weather-related supply shortfall. The incidence of this type of drought can increase because of a change in the amount of rainfall, a change in societal demands for water (or vulnerability to water shortages), or both.

The Maryland Department of the Environment uses the U.S. Army Corp of Engineers' definition of drought, which states, "droughts are periods of time when natural or managed water systems do not provide enough water to meet established human and environmental uses because of natural shortfalls in precipitation or stream flow." As a result, the State monitors precipitation levels, stream flows, groundwater levels, and reservoir storage to manage water supplies to meet the needs of humans, the environment, and wildlife.

**The Standardized Precipitation Index (SPI)** is a drought index based on the probability of an observed precipitation deficit occurring over a given prior time period. The assessment periods considered range from 1 to 36 months. The variable time scale allows the SPI to describe drought conditions important for a range of meteorological, agricultural, and hydrological applications. For example, soil moisture conditions respond to precipitation deficits occurring on a relatively short time scale, whereas groundwater, stream flow, and reservoir storage respond to precipitation deficits arising over many months.

**The Palmer Drought Severity Index (PDSI)** was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. It has become the semi-official

drought index. The Palmer Index is most effective in determining long term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought.

**Table 3-27: Drought Severity Classification**[7]

| DROUGHT SEVERITY | RETURN PERIOD (YEARS) | DESCRIPTION OF POSSIBLE IMPACTS | DROUGHT MONITORING INDICES | | |
|---|---|---|---|---|---|
| | | | Standardized Precipitation Index (SPI) | NDMC* Drought Category | Palmer Drought Index |
| Minor Drought | 3 to 4 | Going into drought; short-term dryness slowing growth of crops or pastures; fire risk above average. Coming out of drought; some lingering water deficits; pastures or crops not fully recovered. | -0.5 to -0.7 | D0 | -1.0 to -1.9 |
| Moderate Drought | 5 to 9 | Some damage to crops or pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested. | -0.8 to -1.2 | D1 | -2.0 to -2.9 |
| Severe Drought | 10 to 17 | Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed | -1.3 to -1.5 | D2 | -3.0 to -3.9 |
| Extreme Drought | 18 to 43 | Major crop and pasture losses; extreme fire danger; widespread water shortages or restrictions | -1.6 to -1.9 | D3 | -4.0 to -4.9 |
| Exceptional Drought | 44 + | Exceptional and widespread crop and pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells creating water emergencies | Less than -2 | D4 | -5.0 or less |

## HAZARD PROFILE

There is no commonly accepted approach for assessing risk associated with droughts given the varying types and indices. Drought risk is based on a combination of the frequency, severity, and spatial extent (the physical nature of drought) and the degree to which a population or activity is vulnerable to the effects of drought. The degree of Montgomery County's vulnerability to drought depends on the environmental and social characteristics of the region and is measured by its ability to anticipate, cope with, resist, and recover from drought.

Because drought is usually considered a regional hazard, it is not enhanced or analyzed by County-level mapping. All jurisdictions are assumed to have the same risk level within Montgomery County. Mapping of the current drought status is published by the National Integrated Drought Information System (NIDIS): U.S. Drought Portal which can be found online at: www.drought.gov.

The 2016 Maryland State Hazard Mitigation Plan identifies historical drought occurrences for the State. According to the National Climate Data Center's U.S. Storm Events Database, there were 16 drought events between August 7, 1995 and November 1, 2016. Crop damages from these events totaled $7.36

[7] Source: National Drought Mitigation Center

million for an average damage assessment of $460,000 per event. Table 3-28 below provides information for some of the more significant drought events in Montgomery County.

**Table 3-28: Significant Drought Events in Montgomery County[8]**

| EVENT | COMMENTS |
|---|---|
| 1930-1932 | Probably the most severe agricultural drought ever recorded in Maryland and the District of Columbia. Rainfall was about 40 percent less than average, and crop losses for 1930 alone were estimated at $40 million. |
| 1953-1956 | Affected almost all of Maryland and the District of Columbia. Drought recurrence intervals exceeded 25 years for those areas of Maryland west of Baltimore. For the remaining parts of Maryland and the District of Columbia, the drought had recurrence intervals of 10-25 years, except for the area north and east of Baltimore where recurrence intervals were less than 10 years. |
| 1958-1971 | This drought lasted the longest of any drought since 1930 and was the most severe in terms of annual departure from average stream flow. Rainfall was sufficient to prevent major agricultural losses. Stream flow in the Potomac declined to record lows, with withdrawals accounting for 80 percent of the available water flow. |
| 1980-1983 | Affected all but the westernmost part of Maryland. Recurrence interval of the drought was about 10 to 25 years throughout the affected area. The extent to which stream flow decreased during this drought is similar to that during the 1958-71 drought. No major agricultural drought developed, and water supplies were adequate for public supply use. |
| Fall 1984 - Summer 1988 | This drought affected Maryland east and south of Frederick and Washington D.C. Many counties were declared disaster areas because of large agricultural losses. These losses for 1986-1988 were estimated at $302 million. Water supplies for municipalities did not become critically low, although water use was restricted in several areas during summers. Crop damages for Montgomery County amounted to over $2.0 million. No injuries, fatalities, or properties were lost or damaged. |
| August - September, 1995 | Dry weather, combined with periods of excessive heat, caused substantial damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. Montgomery County crop damages amounted to $100. No injuries, fatalities, or properties were lost or damaged. |
| July 1, 1997 | A very dry month, containing one 7-day heat wave, exacerbated drought-like conditions across much of the fertile farmland of Maryland. The weather in July proved to be the death knell for much of the crop yield, including corn, hay, alfalfa, and soybeans. Agricultural states of emergency were declared in many areas west of the Chesapeake Bay. Hardest-hit counties included Carroll, Frederick, Howard, Montgomery, and Washington. Total crop damages were estimated at $43.7 million for the State; crop damages for |

[8] Source: 2016 Maryland State Hazard Mitigation Plan; Spatial Hazard Events and Losses Database for the United States (SHELDUS), Hazards & Vulnerability Research Institute, University of South Carolina, December 2008; US Small Business Administration Disaster Declarations (http://archive.sba.gov/disasternotices/md.html).
Note: Damages are presented in actual costs documented at the time of the event.

| Table 3-28: Significant Drought Events in Montgomery County[8] | |
|---|---|
| **EVENT** | **COMMENTS** |
| | Montgomery County amounted to $4.6 million. No injuries, fatalities, or properties were lost or damaged. |
| September 1998 | Crop damages for Montgomery County amounted to over $1.4 million. No injuries, fatalities, or properties were lost or damaged. |
| November 1998 | Crop damages for Montgomery County amounted to over $1.8 million. No injuries, fatalities, or properties were lost or damaged. |
| August 1999 | High pressure was the dominant weather feature across Maryland through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which plagued the area. By the third week of August the Palmer Drought Index, a measure of long term drought conditions, indicated Maryland was in an extreme drought. Washington County reported the lowest groundwater levels in history on the 4th. Nineteen Maryland counties were declared federal drought disaster areas on the 11th. The agricultural drought in Maryland continued to devastate farmers, who suffered crop damages of $30 million. An official drought declaration was declared by the Governor of Maryland. Montgomery County crop damage resulting from this drought event amounted to over $2.3 million. The County approved $1.0 million to distribute to 94 farmers covering 35,590 acres. No injuries, fatalities, or properties were lost or damaged. |
| September 2001 - September 2002 | These months were the driest on record since record keeping began in 1871. Groundwater levels, reservoirs, and stream levels fell below record lows. Much of the state was under mandatory water-use restrictions, and wildfires were abundant. Precipitation amounts during this time were only about 57 percent of normal levels. An official drought declaration was declared by the Governor of Maryland. |
| August 22, 2007 | The U.S. Department of Agriculture Secretary declared a drought disaster for the entire State of Maryland. County losses were projected to exceed $13 million. The County approved $1.5 million for distribution to impacted farmers. |
| November 2008 | This was the fifth month in a row that drought conditions were seen across Central and Northern Maryland. Persistent high pressure over the Southeast U.S. forced most rain producing low pressure systems to steer north of the region. The 5-month rainfall total at BWI Airport was only 5.79 inches, compared to the normal of over 17 inches. The drought contributed to a six-fold increase in the amount of brush fires seen across Maryland this November. The agricultural community continued to be hard hit by the persistent drought. By November 20th, 80 percent of topsoil moisture across the state was rated short or very short. The persistent drought contributed $40 million in damage to the fall harvest. |
| June 2010 – August 2010 | Drought/Excessive Hear Economic Injury Disaster (#12386) declared by US Small Business Administration in Maryland, including Montgomery County. |

There is no commonly accepted return period or non-exceedance probability for defining the risk from drought (such as the 100-year or 1% annual chance of flood). The magnitude of drought is usually measured in time and the severity of the hydrologic deficit. There are several resources available to evaluate drought status and even project very near future expected conditions. The National Integrated Drought Information System (NIDIS) Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning (NIDIS, 2007). The NIDIS maintains the U.S. Drought Portal22, which is a centralized, web-based access point to several drought-related resources including the U.S. Drought Monitor (USDM) and the U.S. Seasonal Drought Outlook (USSDO). The USDM September 11, 2018, shown in Figure 3-20, depicts the current weekly status of drought in Maryland and is developed/maintained by the National Drought Mitigation Center. The USSDO for August through November 2018, shown in Figure 3-21, projects potential drought conditions developed by the National Weather Service's Climate Prediction Center.

A number of indices measure how much precipitation for a given period of time has deviated from historically established norms. The Palmer Drought Severity Index (PDSI) is widely used by the US Department of Agriculture to determine when to grant emergency drought assistance. The PDSI is a commonly used index that measures the severity of drought for agriculture and water resource management. It is calculated from observed temperature and precipitation values and estimates soil moisture. The PDSI is most effective in determining long-term drought (a matter of several months), but is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought. The average annual PDSI value for Montgomery County from 1895 to 2010 was -0.32, denotes near normal moisture conditions.

Future droughts can also be expected due to more frequent extreme heat events as a result of a warming climate. Long-term climate forecast models suggest that a warming planet will lead to changes in precipitation distribution and more frequent and severe drought in some parts of the country. In spite of projections of moderate increases in annual precipitation in Maryland, increases in temperatures in climate models lead to decreases in soil moisture throughout the year. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report indicates that it is very likely that hot extremes and heat waves will become more frequent as the Earth warms. In Maryland, the number of days above 90F is projected to more than double under a lower greenhouse gas emissions scenario and roughly triple under a higher emissions scenario by the end of the century. Extended heat waves (temperatures above 90F for at least three consecutive days) are expected to be much more frequent and longer lasting, particularly under higher emissions scenarios.

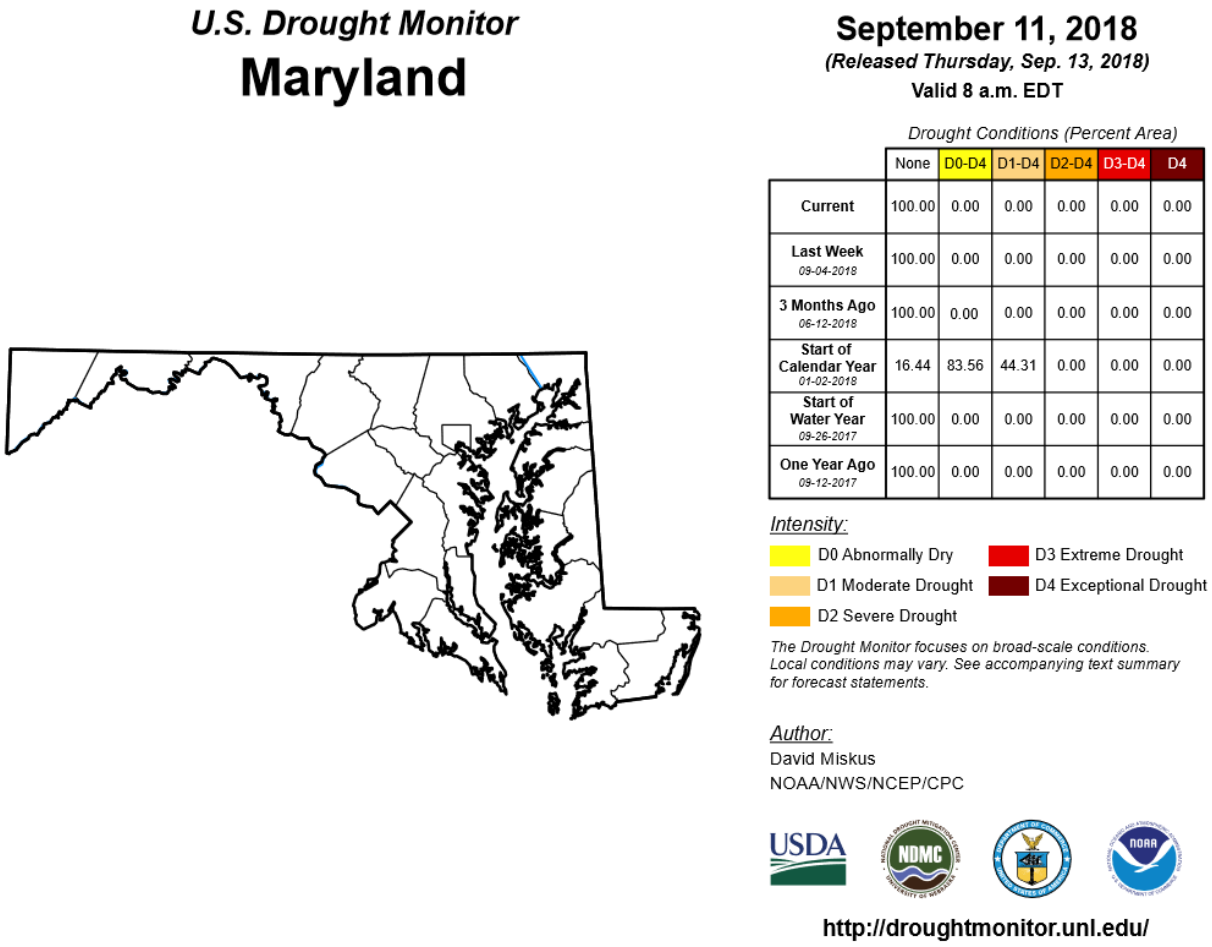


**Figure 3-20: U.S. Drought Monitor for Northeast, September 2018**

Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this "natural" hazard. Droughts may cause a shortage of water for human and industrial consumption, hydroelectric power, recreation, and navigation. Water quality may also decline and the number and severity of wildfires may increase. Severe droughts may result in the loss of agricultural crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

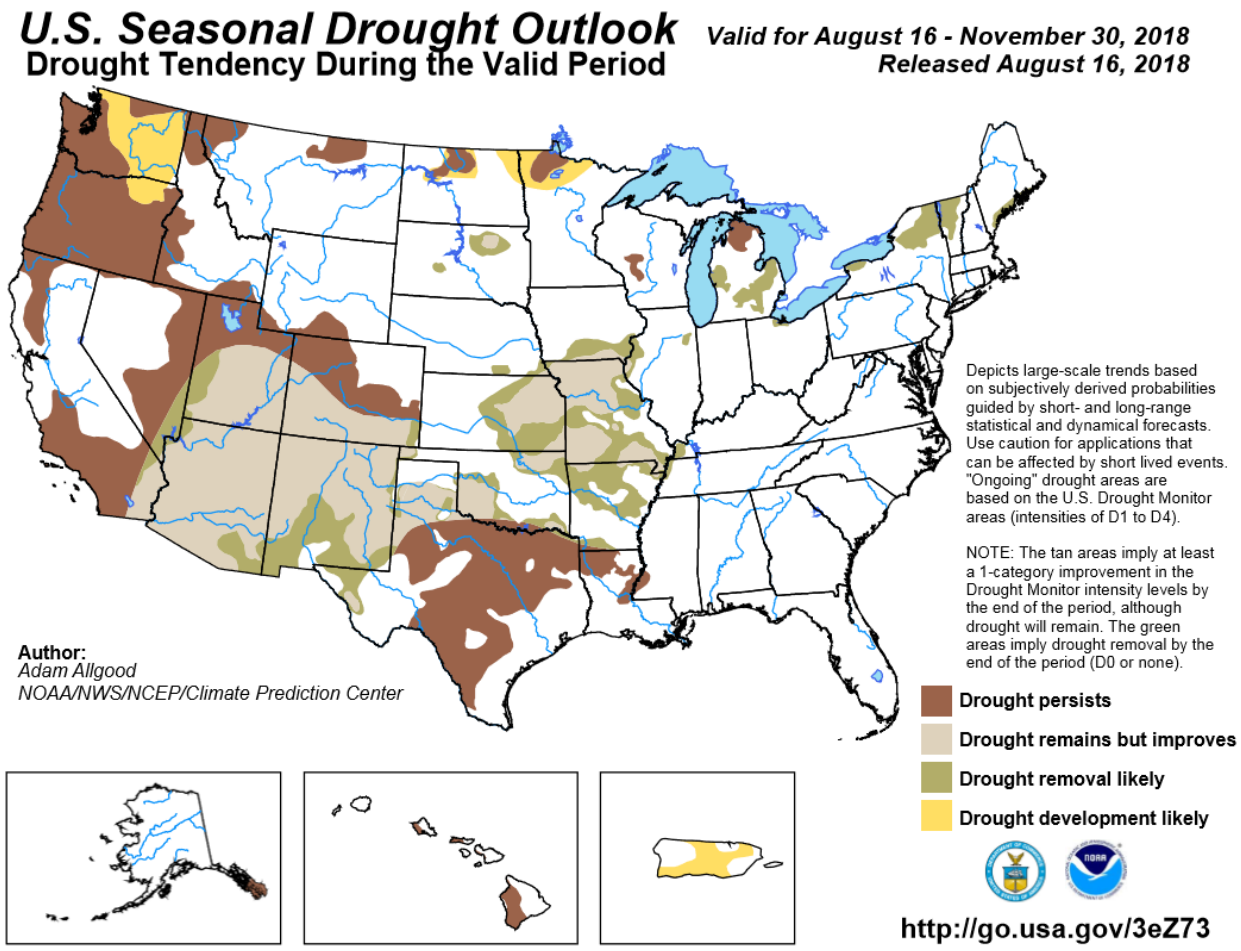


**Figure 3-21: U.S. Seasonal Drought Outlook, August 2018**[9]

Impacts are commonly referred to as direct or indirect. The most significant impacts associated with drought include agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. A reduction of electric power generation and water quality deterioration are also potential problems. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. Drought impacts increase with the length of a drought, as carry-over supplies in reservoirs are depleted and water levels in groundwater basins decline. These are just a few examples of direct impacts. The consequences of these impacts illustrate indirect impacts. For example, a reduction in crop, rangeland, and forest productivity may result in reduced income for farmers and agribusiness, increased prices for food and timber, unemployment, reduced tax revenues because of reduced expenditures, increased crime, foreclosures on bank loans to farmers and businesses, migration, and disaster relief programs. Direct or primary impacts are usually biophysical. Conceptually speaking, the more removed the impact from the cause, the more complex the link to the cause. In fact, the web of impacts becomes so diffuse that it is very difficult to come up with financial estimates of damages. The impacts of drought can be categorized as economic, environmental, or social.

[9] Source: http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

Many economic impacts occur in agriculture and related sectors, including forestry and fisheries, because of the reliance of these sectors on surface and subsurface water supplies. In addition to obvious losses in yields in both crop and livestock production, drought is associated with increases in insect infestations, plant disease, and wind erosion. Droughts also bring increased problems with insects and diseases to forests and reduce growth. The incidence of forest and range fires increases substantially during extended droughts, which in turn places both human and wildlife populations, as well as buildings, infrastructure, and critical facilities, at higher levels of risk. However, drought conditions by itself are not anticipated to impact general building stock, critical facilities, and infrastructure.

Income loss is another indicator used in assessing the impacts of drought because so many sectors are affected. Reduced income for farmers has a ripple effect. Retailers and others who provide goods and services to farmers face reduced business. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue for local, state, and federal government. Less discretionary income affects the recreation and tourism industries. Prices for food, energy, and other products increase as supplies are reduced. In some cases, local shortages of certain goods result in the need to import these goods from outside the stricken region. Reduced water supply impairs the navigability of rivers and results in increased transportation costs because products must be transported by rail or truck. Hydropower production may also be curtailed significantly.

Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality; forest and range fires; degradation of landscape quality; loss of biodiversity; and soil erosion. Some of the effects are short-term and conditions quickly return to normal following the end of the drought. Other environmental effects linger for some time or may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species will eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity of the landscape. Although environmental losses are difficult to quantify, growing public awareness and concern for environmental quality has forced public officials to focus greater attention and resources on these effects.

## INVENTORY ASSETS EXPOSED AND POTENTIAL LOSS TO HAZARD

Drought typically does not have a direct impact on critical facilities or structures. However, possible losses/impacts to critical facilities include the loss of critical function due to low water supplies. Severe droughts can negatively affect drinking water supplies. Should a public water system be affected, the losses could total into the millions of dollars if outside water is shipped in. Private springs/wells could also dry up. The 2016 Maryland State Hazard Mitigation Plan identified critical facility exposure to drought, shown in Table 3-29.

**Table 3-29: Hazus-MH MR5 Annualized Loss Estimates by Building Type in Thousands of Dollars[10]**

| FACILITY TYPE | EXPOSURE TO DROUGHT |
|---|---|
| Police Facilities | 19 |
| Fire Facilities | 40 |
| Health Facilities | 49 |
| Educational Facilities | 367 |

[10] Source: 2016 Maryland State HMP

| Table 3-29: Hazus-MH MR5 Annualized Loss Estimates by Building Type in Thousands of Dollars[10] | |
|---|---|
| **FACILITY TYPE** | **EXPOSURE TO DROUGHT** |
| TOTAL Number of All Types | 6,992 |
| Building Values of All Types | $2,073,052,250 |
| Content Values of All Types | $691,017,417 |
| **TOTAL Values of All Types (Building and Content)** | **$2,764,069,667** |

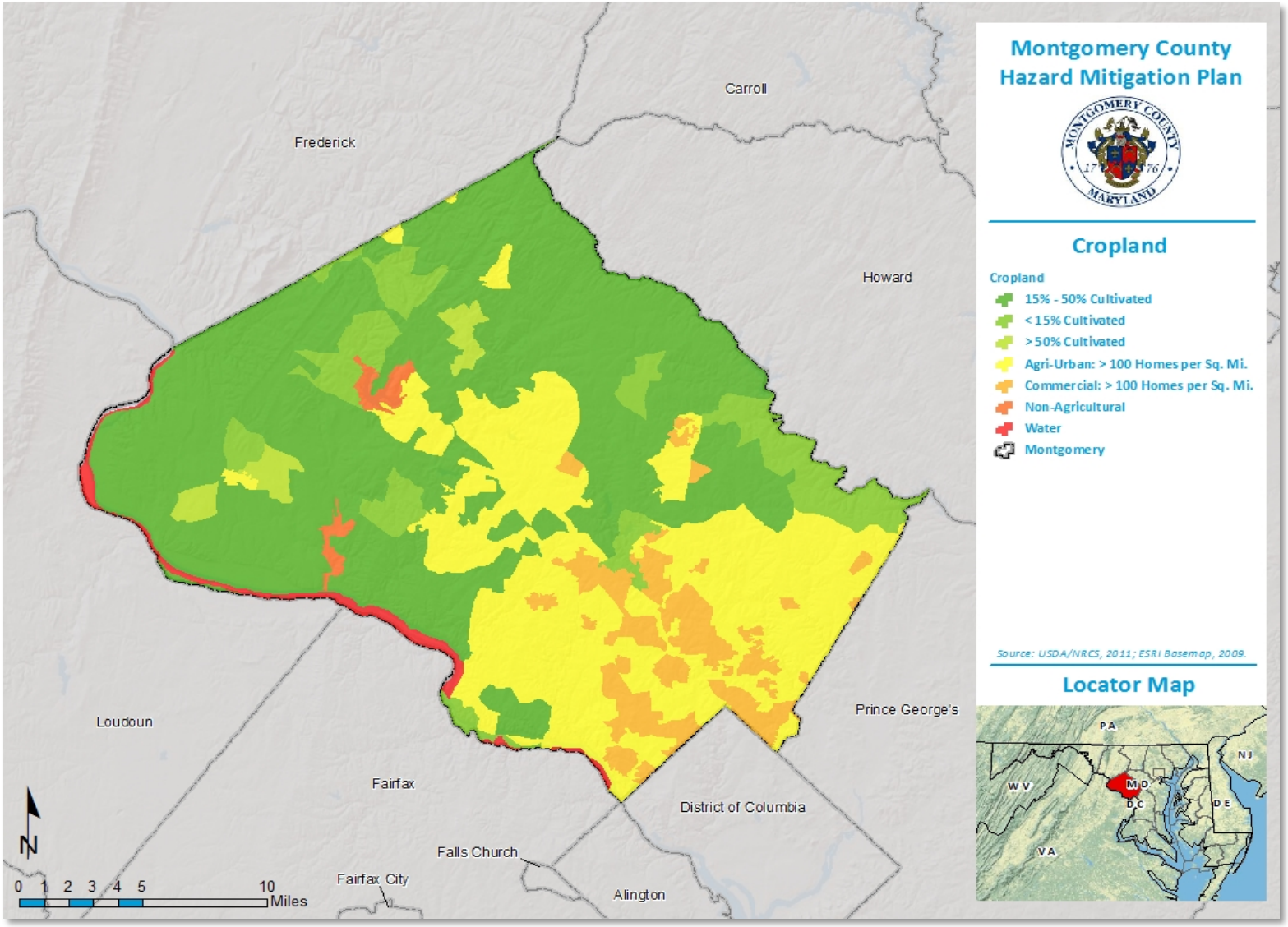


**Figure 3-22: Montgomery County Cropland**

Direct costs such as increased pumping costs due to lowering of groundwater levels and costs to expand water infrastructure to compensate for reduced yields or to develop alternative water sources, are a significant factor but very difficult to estimate due to a lack of documentation. There are also the intangible costs associated with lost tourism revenues and impacts to wildlife habitat and animals. Typically, these impacts are translated into the general economy in the form of higher food and agricultural goods prices and increase utility costs.

## LAND USE & DEVELOPMENT TRENDS

Society's vulnerability to drought is affected by (among other things) population growth and shifts, urbanization, demographic characteristics, technology, water use trends, government policy, social behavior, and environmental awareness. These factors are continually changing, and society's vulnerability to drought may rise or fall in response to these changes. For example, increasing and shifting populations put increasing pressure on water and other natural resources—more people need more water.

According to the 2017 Statistical Abstract (2017 estimates) conducted by the U.S. Census Bureau, Maryland's current residential population is estimated at just over 6 million people. Considering the data available between 2010 and 2017, Maryland's residential population has grown an average of 4.8%. Considering these factors and timeline, Maryland's residential population has consistently ranked 19$^{th}$ among the United States of America. The U.S. Census Bureau projects Maryland's population will increase between 30% and 40% between 2010 and 2030. Considering these projections were developed for each of the 50 states, it is estimated that Maryland's residential population ranking will be 16$^{th}$ in by the year 2030.

Future development's greatest impact on the drought hazard would possibly be to ground water resources. New water and sewer systems or significant well and septic sites could use up more of the water available, particularly during periods of drought. Public water systems are monitored, but individual wells and septic systems are not as strictly regulated. Therefore, future development could have an impact on drought vulnerabilities.

## MULTI-JURISDICTIONAL DIFFERENCES

Due to the nature of drought, all jurisdictions within Montgomery County are expected to be impacted equally due to drought conditions.

## WATER SHORTAGE AND DROUGHT HIRA SUMMARY

Drought is extremely difficult to predict. However, identifying and tracking a number of established indicators for drought provides a crucial means of monitoring conditions that result in drought. As identified, Montgomery County has been affected severely by periods of drought, which seem to be occurring more frequently and last longer in recent years resulting in water shortages which will impact domestic, agricultural and fire response needs.

The Montgomery County Department of Environmental Protection, Metropolitan Washington Council of Governments, and the Washington Suburban Sanitary Commission have worked together to develop the Metropolitan Washington Water Supply and Drought Awareness Response Plan: Potomac River System, updated May 2015[11], to address potential drought conditions. Additionally, water conservation

[11] http://www1.mwcog.org/environment/water/downloads/CAO%20Primer%20May%202015.pdf

campaigns and literature have been developed to increase awareness. Several mitigation measures will be reviewed and considered by Montgomery County for incorporation into this Plan that will build upon these current efforts, including:

- Decreasing emphasis on the natural event (precipitation deficiencies)
- Increasing emphasis on water/natural hazard resource management
- Assessment programs
- Water supply augmentation and development of new supplies
- Public awareness and education programs
- Technical assistance on water conservation
- Reduction and water conservation programs
- Emergency response programs
- Drought contingency plans

Some of these actions can have long-term impacts; such as contingency plan development, and the development of water conservation and public awareness programs. As Montgomery County gains more experience assessing and responding to drought, future actions will undoubtedly become more timely, effective, and less reactive.

Possible losses to infrastructure include the loss of potable water, but a drought evolves slowly over time and the population typically has ample time to prepare for its effects. Should a drought affect the water available for public water systems or individual wells, the availability of clean drinking water could be compromised. This situation would require emergency actions and could possibly overwhelm the local government and financial resources.

# TORNADO

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| Tornadoes | 0.75 | 0.63 | 0.42 | 0.40 | 0.23 | 2.43 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

A tornado is a violently rotating funnel-shaped column of air that extends from a thunderstorm cloud toward the ground. Tornadoes can touch the ground with winds of over 300 mph. While relatively short-lived, tornadoes are intensely focused and are one of nature's most violent storms. Tornadoes can occur at any point in the day or night, but are most frequent during the late afternoon into early evening, the warmest hours of the day, and most likely occur during the spring and early summer months of March through June.

Service definitions of a tornado and associated terms:

- **Tornado** - A violently rotating column of air that is touching the ground.
- **Funnel cloud** - A rapidly rotating column of air that does not touch the ground.
- **Downburst** - A strong downdraft, initiated by a thunderstorm, which induces an outburst of straight-line winds on or near the ground. They may last anywhere from a few minutes in small-scale microbursts to periods of up to 20 minutes in larger, longer macro-bursts. Wind speeds in downbursts can reach 150 mph and, therefore, can result in damages similar to tornado damages.

Tornadoes usually form from one of three types of thunderstorms: 1) squall-lines; 2) multicells; and 3) supercells. Supercell thunderstorms are rotating storms containing what is known as a mesocyclone, or a rotating updraft (column of air) from which tornadoes sometimes form. Supercell thunderstorms have a greater potential than other thunderstorms for producing severe weather, including tornadoes. Tornadoes can range from just several yards to over two miles in width. Although tornadoes normally travel on the ground for short distances, tornado tracks of 200 miles or more have been reported. Tornadoes can destroy almost everything in their path; the damage is a result of high wind velocities, wind-blown debris, and the frequent appearance of lightning or large hail. The destruction caused by tornadoes depends on the intensity, size, and duration of the storm, but typically tornadoes inflict the most damage on structures with light construction such as mobile homes and trailers.

Previously, tornado damage was measured on the Fujita Scale, also called the F-Scale, named for Dr. Tetsuya Theodore Fujita. The operational Fujita scale ranges from an F0 to an F5. The strongest tornadoes observed to date have been F5 (winds between 261-318 mph). An Enhanced Fujita Scale (EF-Scale) was developed and implemented operationally by the National Weather Service (NWS) in 2007. The EF-Scale was developed to better align tornado wind speeds with associated damages; it classifies tornadoes into six intensity categories based upon the maximum wind occurring within the wind vortex.

The table below illustrates summarizes the EF scale and associated damages that are based upon estimated maximum winds occurring within the wind vortex. The EF-Scale has become the definitive

metric for estimating wind speeds within tornadoes based upon the damage done to buildings and structures since it was implemented through the National Weather Service in 2007.

**Table 3-30: Enhanced Fujita Scale and Associated Damage**

| EF-SCALE NUMBER | WIND SPEED (MPH) | TYPE OF DAMAGE POSSIBLE |
|---|---|---|
| EFO | 65-85 | **Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0. |
| EF1 | 86-110 | **Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken. |
| EF2 | 111-135 | **Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground. |
| EF3 | 136-165 | **Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance. |
| EF4 | 166-200 | **Devastating damage**: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated. |
| EF5 | >200 | **Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation. |

The Storm Prediction Center has developed damage indicators to be used with the Enhanced Fujita Scale for different types of buildings but can be also be used to classify any high wind event. Some of the indicators for different building types are shown in tables below[12].

**Table 3-31: Institutional Buildings**

| DAMAGE DESCRIPTION | WIND SPEED RANGE (Expected in Parentheses) |
|---|---|
| Threshold of visible damage | 59-88 MPH (72 MPH) |
| Loss of roof covering (<20%) | 72-109 MPH (86 MPH) |
| Damage to penthouse roof & walls, loss of rooftop HVAC equipment | 75-111 MPH (92 MPH) |
| Broken glass in windows or doors | 78-115 MPH (95 MPH) |
| Uplift of lightweight roof deck & insulation, significant loss of roofing material (>20%) | 95-136 MPH (114 MPH) |
| Façade components torn from structure | 97-140 MPH (118 MPH) |
| Damage to curtain walls or other wall cladding | 110-152 MPH (131 MPH) |
| Uplift of pre-cast concrete roof slabs | 119-163 MPH (142 MPH) |
| Uplift of metal deck with concrete fill slab | 118-170 MPH (146 MPH) |
| Collapse of some top building envelope | 127-172 MPH (148 MPH) |
| Significant damage to building envelope | 178-268 MPH (210 MPH) |

**Table 3-32: Educational Institutions (Elementary Schools, High Schools)**

[12] Source: Storm Prediction Center, 2009

| DAMAGE DESCRIPTION | WIND SPEED RANGE (Expected in Parentheses) |
|---|---|
| Threshold of visible damage | 55-83 MPH (68 MPH) |
| Loss of roof covering (<20%) | 66-99 MPH (79 MPH) |
| Broken windows | 71-106 MPH (87 MPH) |
| Exterior door failures | 83-121 MPH (101 MPH) |
| Uplift of metal roof decking; significant loss of roofing material (>20%); loss of rooftop HVAC | 85-119 MPH (101 MPH) |
| Damage to or loss of wall cladding | 92-127 MPH (108 MPH) |
| Collapse of tall masonry walls at gym, cafeteria, or auditorium | 94-136 MPH (114 MPH) |
| Uplift or collapse of light steel roof structure | 108-148 MPH (125 MPH) |
| Collapse of exterior walls in top floor | 121-153 MPH (139 MPH) |
| Most interior walls of top floor collapsed | 133-186 MPH (158 MPH) |
| Total destruction of a large section of building envelope | 163-224 MPH (192 MPH) |

**Table 3-33: Metal Building Systems**

| DAMAGE DESCRIPTION | WIND SPEED RANGE (Expected in Parentheses) |
|---|---|
| Threshold of visible damage | 54-83 MPH (67 MPH) |
| Inward or outward collapsed of overhead doors | 75-108 MPH (89 MPH) |
| Metal roof or wall panels pulled from the building | 78-120 MPH (95 MPH) |
| Column anchorage failed | 96-135 MPH (117 MPH) |
| Buckling of roof purlins | 95-138 MPH (118 MPH) |
| Failure of X-braces in the lateral load resisting system | 118-158 MPH (138 MPH) |
| Progressive collapse of rigid frames | 120-168 MPH (143 MPH) |
| Total destruction of building | 132-178 MPH (155 MPH) |

**Table 3-34: Electric Transmission Lines**

| DAMAGE DESCRIPTION | WIND SPEED RANGE (Expected in Parentheses) |
|---|---|
| Threshold of visible damage | 70-98 MPH (83 MPH) |
| Broken wood cross member | 80-114 MPH (99 MPH) |
| Wood poles leaning | 85-130 MPH (108 MPH) |
| Broken wood poles | 98-142 MPH (118 MPH) |

Strong winds can also occur outside of tornadoes, severe thunderstorms, and winter storms. These winds typically develop with strong pressure gradients and gusty frontal passages. The closer and stronger two systems (one high pressure, one low pressure) are, the stronger the pressure gradient, and therefore, the stronger the winds are.

**Downburst** winds, which can cause more widespread damage than a tornado, occur when air is carried into a storm's updraft, cools rapidly, and comes rushing to the ground. Cold air is denser than warm air, and therefore, wants to fall to the surface. On warm summer days, when the cold air can no longer be supported up by the storm's updraft, or an exceptional downdraft develops, the air crashes to the ground in the form of strong winds. These winds are forced horizontally when they reach the ground and can cause significant damage. These types of strong winds can also be referred to as straight-line winds. Downbursts with a diameter of less than 2.5 miles are called microbursts and those with a diameter of 2.5 miles or greater are called macrobursts. A derecho, or bow echo, is a series of

downbursts associated with a line of thunderstorms. This type of phenomenon can extend for hundreds of miles and contain wind speeds in excess of 100 mph.

## HAZARD PROFILE

Nearly 70 percent of the deaths from tornadoes happen to people located in residential structures. Of these, over 40 percent are located in mobile homes, which are easily overturned and destroyed due to the low wind resistance of the structure. Table below indicates events that have occurred in Montgomery County since 1920; events occurring prior to 2007 have magnitudes assigned according to the old F-Scale while those after 2007 are reported in the EF-Scale. Montgomery County reported a total of 17 tornadoes to NOAA since 1950. One of the most damaging occurred on October 18, 1990. During this event, a number of tornadoes spawned from a supercell, and an F1 tornado struck Kensington. This storm had a damage path 1 mile long and 100 yards wide, causing an estimated $500,000 in damage and one injury. Trees were uprooted and many snapped, landing on cars and homes.

**Table 3-35: Tornado History for Montgomery County from 1950 – 2010**

| LOCATION | DATE | MAGNITUDE | DEATH | INJURY | PROPERTY DAMAGE |
|---|---|---|---|---|---|
| Montgomery County | 05/02/1929 | Unknown | 4 | 4 | $75,000 |
| Montgomery County | 8/31/1952 | F1 | 0 | 0 | $5,000-$50,000 |
| Montgomery County | 7/1/1959 | F1 | 0 | 0 | $500-$5000 |
| Montgomery County, MD and Loudon County, VA | 8/26/1967 | F1 | 0 | 0 | $5,000-$50,000 |
| Montgomery County, Poolesville | 9/5/1979 | F2 | 0 | 0 | $50,000-$500,000 |
| Montgomery County | 5/12/1974 | F1 | 0 | 0 | $500-$5000 |
| Montgomery County | 10/18/1990 | F1 | 0 | 1 | $500,000 |
| Montgomery County | 8/20/1991 | F1 | 0 | 0 | $5,000-$50,000 |
| Montgomery County | 9/27/1993 | F1 | 0 | 0 | $50-$500 |
| Montgomery County, Gaitherburg | 9/22/1995 | F1 | 0 | 0 | $5,000-$50,000 |
| Montgomery County | 7/19/1996 | F1 | 0 | 0 | - |
| Montgomery County, MD and Loudon County, VA | 7/19/1996 | F0 | 0 | 0 | - |
| Montgomery County | 6/21/2000 | F1 | 0 | 0 | $250,000 |
| Montgomery County | 5/27/2001 | F1 | 0 | 0 | $500,000 |
| Montgomery County, MD and Loudon County, VA | 11/5/2003 | F0 | 0 | 0 | $1,000 |
| Montgomery County | 11/5/2003 | F1 | 0 | 0 | $200,000 |
| Montgomery County | 11/5/2003 | F1 | 0 | 0 | $1,000,000 |
| Montgomery County | 9/17/2004 | F1 | 0 | 0 | $120,000 |
| Montgomery County | 6/4/2008 | EFO | 0 | 0 | $2,000 |
| Montgomery, Rockville | 6/13/2013 | EFO | 0 | 0 | $500,000 |
| Montgomery, Poolesville | 11/5/2013 | EFO | 0 | 0 | $100,000 |

A tornado path averages 4 miles in length, but may reach up to 300 miles. Widths average 300 to 400 yards, but severe tornadoes have cut swaths a mile or more in width, or have formed groups of two or

three funnels traveling together. On the average, tornadoes move between 25 and 45 miles per hour, but speeds over land of up to 70 mph have been reported. Tornadoes rarely last more than a couple of minutes over a spot or more than 15 to 20 minutes in a 10-mile area, but their short periods of existence do not limit their devastation of an area. The destructive power of a tornado results primarily from its high wind velocities and sudden changes in pressure. Damages from tornadoes result from extreme wind pressure and windborne debris. Since tornadoes are generally associated with severe storm systems, they are often accompanied by hail, torrential rain and intense lightning. Depending on their intensity, tornadoes can uproot trees, bring down power lines and destroy buildings. Flying debris is the main cause of serious injury and death. Downbursts are characterized by straight-line winds. Downburst damage is often highly localized and resembles that of tornadoes. There are significant interactions between tornadoes and downbursts; a tornado's path can also be affected by downbursts. Because of this, the path of a tornado can be very unpredictable, including veering right, left or even taking a U-turn.

Due to the nature of storms, it is extremely difficult to predict, but through identifying various indicators of weather systems, and tracking these indicators, it provides us with a crucial means of monitoring extreme weather. Understanding the historical frequency, duration, and spatial extent of high wind events assists in determining the likelihood and potential severity of future occurrences. The characteristics of past severe wind events provide benchmarks for projecting similar conditions into the future. The probability of Montgomery County and its municipalities experiencing a tornado can be difficult to quantify, but based on historical record of 17 events since 1950, it can reasonably be assumed that this type of event has occurred once every 4 years from 1950 through 2018.

*[(Last Reporting Year) 2018] subtracted by [(Historical Year) 1950] = 68 Years on Record*

*[(Years on Record) 68] divided by [(Number of Historical Events) 17] = 4*

Furthermore, the historic frequency calculates that there is a 25% chance of this type of event occurring each year. The figure on the next page shows where tornadoes have occurred in Montgomery County, MD.

## NVENTORY ASSETS EXPOSED AND POTENTIAL LOSSES FROM TORNADO EVENTS

Any given tornado can cause damage along its specific track, including causing losses to above-ground structures and infrastructure. These losses are typically covered by insurance, but there are indirect losses related to time, maintenance, and contents. Because it is so difficult to predict the path of a tornado, potential loss estimates must rely on historic events. Montgomery County has experienced between $2.6 and $7.3 million in cumulative tornado-related damages since 1950; individual events have ranged in damages from $50 to $500,000.

## LAND USE & DEVELOPMENT TRENDS

All future structures built in Montgomery County will likely be exposed to high winds over their lifetime, regardless of the land use or development trends. However, Montgomery County's residential and commercial construction design parameters include provisions for structures to withstand 160 mph wind speeds. Additionally, accessory buildings and sheds constructed must be anchored to resist wind loads of 15 lbs. per square foot of lateral load. Implementation of these design standards may lessen the impact of tornado events for future construction across Montgomery County.

## MULTI-JURISDICTIONAL DIFFERENCES

Due to the nature of high winds, all jurisdictions in Montgomery County are expected to be equally susceptible to tornadoes. However, damages may be higher in the denser areas following the I-270 and I-495 corridors in the communities of Gaithersburg, Rockville, Garrett Park, Kensington, Bethesda, Chevy Chase, Silver Spring, and Tacoma Park.

## TORNADO HIRA SUMMARY

Tornadoes often occur in conjunction with other hazards such as thunderstorms, hail, and lightning and can occur year-round, though they are more common from March-June. Tornado events can disrupt transportation, power transmission and even communications. Mitigation measures may include enhanced building codes, planned deployment of resources, underground utility lines for critical facilities, and increased tree trimming along utilities. Weather data is limited by the observations reported; many events are never reported or recorded with the National Weather Service or other archiving agencies.

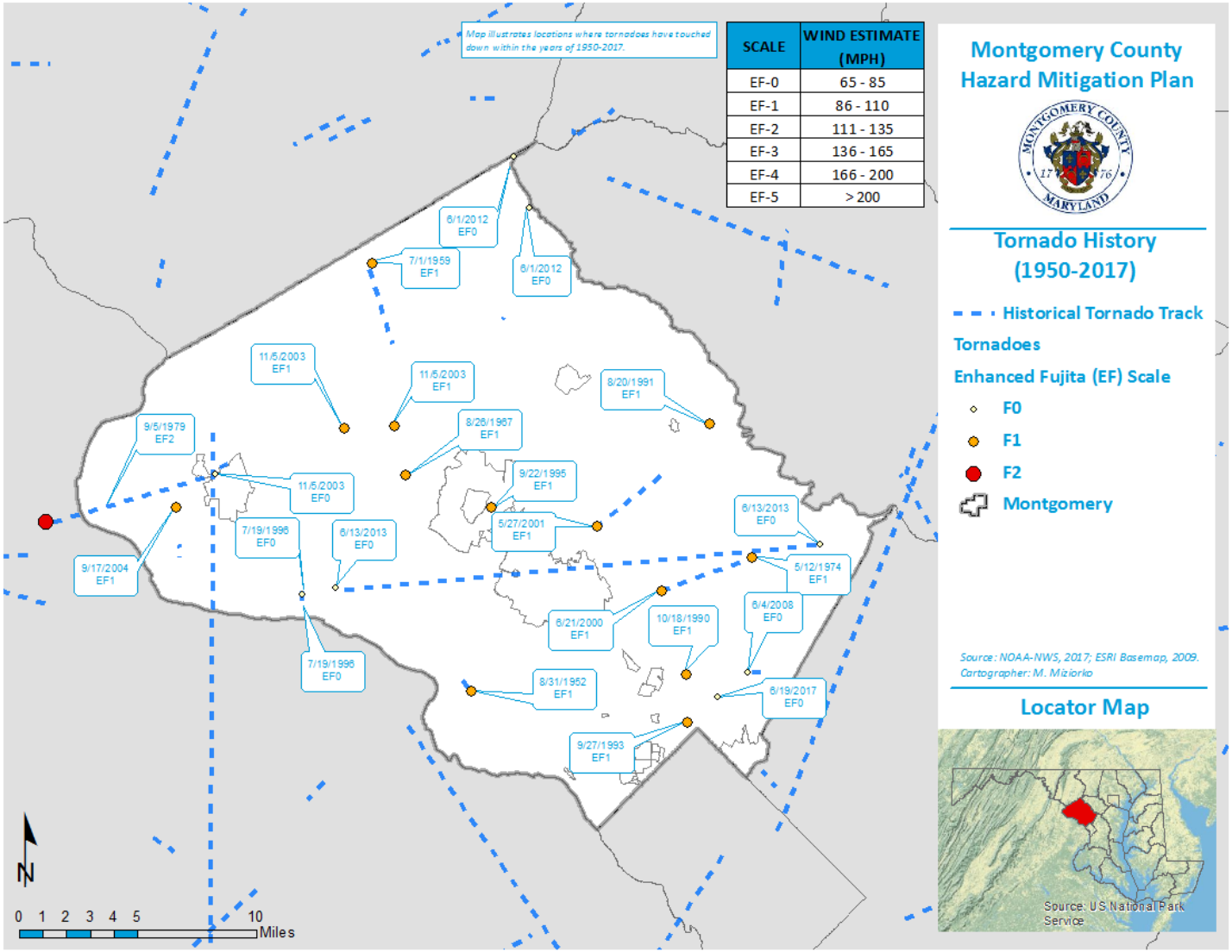


**Figure 3-23: Montgomery County Tornado History, 1950-2018**

# EARTHQUAKE

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING |
|---|---|---|---|---|---|---|
| Earthquake | 0.63 | 0.39 | 0.78 | 0.40 | 0.12 | 2.32 |
| **MODERATE RISK HAZARD (2.0 – 2.9)** | | | | | | |

## HAZARD IDENTIFICATION

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10 – 20 miles of the Earth's crust. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake (FEMA, 1997).

### Earthquake Mechanics

Regardless of the source of the earthquake, the associated energy travels in waves radiating outward from the point of release. When these waves travel along the surface, the ground shakes and rolls, fractures form, and water waves may be generated. Earthquakes generally last a matter of seconds but the waves may travel for long distances and cause damage well after the initial shaking at the point of origin has subsided.

Breaks in the crust associated with seismic activity are known as "faults" and are classified as either active or inactive. Faults may be expressed on the surface by sharp cliffs or scarps or may be buried below surface deposits.

"Foreshocks," minor releases of pressure or slippage, may occur months or minutes before the actual onset of the earthquake. "Aftershocks," which range from minor to major, may occur for months after the main earthquake. In some cases, strong aftershocks may cause significant additional damage, especially if the initial earthquake impacted emergency management and response functions or weakened structures.

### Factors Contributing to Damage

The damage associated with each earthquake is subject to four primary variables:

- The nature of the seismic activity
- The composition of the underlying geology and soils
- The level and quality of development of the area struck by the earthquake
- The time of day

***Seismic Activity:*** The properties of earthquakes vary greatly from event to event. Some seismic activity is localized (a small point of energy release), while other activity is widespread (e.g., a major fault letting loose all at once). Earthquakes can be very brief (only a few seconds) or last for a minute or more. The depth of release and type of seismic waves generated also play roles in the nature and location of

damage; shallow quakes will hit the area close to the epicenter harder, but tend to be felt across a smaller region than deep earthquakes.

***Geology and Soils:*** The surface geology and soils of an area influence the propagation (conduction) of seismic waves and how strongly the energy is felt. Generally, stable areas (e.g., solid bedrock) experience less destructive shaking than unstable areas (e.g., fill soils). The siting of a community or even individual buildings plays a strong role in the nature and extent of damage from an event**.**

***Development:*** An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that has no direct impact. Large magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

***Time of Day:*** The time of day of an event controls the distribution of the population of an affected area. On work days, the majority of the community will transition between work or school, home, and the commute between the two. The relative seismic vulnerability of each location can strongly influence the loss of life and injury resulting from an event.

### Types of Damage

While damage can occur by movement at the fault, most damage from earthquake events is the result of shaking. Shaking also produces a number of phenomena that can generate additional damage:

- Ground displacement
- Landslides and avalanches
- Liquefaction and subsidence
- Seiches

***Shaking:*** In minor events, objects fall from shelves and dishes are rattled. In major events, large structures may be torn apart by the forces of the seismic waves. Structural damage is generally limited to older structures that are poorly maintained, constructed, or designed in all but the largest quakes. Un-reinforced masonry buildings and wood frame homes not anchored to their foundations are typical victims.

Loose or poorly secured objects also pose a significant hazard when they are loosened or dropped by shaking. These “non-structural falling hazard” objects include bookcases, heavy wall hangings, and building facades. Home water heaters pose a special risk due to their tendency to start fires when they topple over and rupture gas lines. Crumbling chimneys may also be responsible for injuries and property damage.

Dam and bridge failures are significant risks during stronger earthquake events, and due to the consequences of such failures, may result in considerable property damage and loss of life. In areas of severe seismic shaking hazard, Intensity VII or higher can be experienced even on solid bedrock. In these areas, older buildings especially are at significant risk.

***Ground Displacement:*** Often, the most dramatic evidence of an earthquake results from displacement of the ground along a fault line.

***Landslides and Avalanches:*** Even small earthquake events can cause landslides. Rock falls are common as unstable material on steep slopes is shaken loose, but significant landslides or even debris flows can

be generated if conditions are ripe. Roads may be blocked by landslide activity, hampering response and recovery operations. Avalanches are possible when the snowpack is sufficient.

***Liquefaction and Subsidence:*** Soils may liquefy and/or subside when impacted by the seismic waves. Fill and previously saturated soils are especially at risk. The failure of the soils can lead to possibly widespread structural damage. The oscillation and failure of the soils may result in increased water flow and/or failure of wells as the subsurface flows are disrupted and sometimes permanently altered. Increased flows may be dramatic, resulting in geyser-like water spouts and/or flash floods. Similarly, septic systems may be damaged creating both inconvenience and health concerns.

***Seiches:*** Seismic waves may rock an enclosed body of water (e.g., lake or reservoir), creating an oscillating wave referred to as a "seiche." Although not a common cause of damage in earthquakes, there is a potential for large, forceful waves similar to tsunami ("tidal waves") to be generated on the large lakes of the state. Such a wave would be a hazard to shoreline development and pose a significant risk on dam-created reservoirs. A seiche could either overtop or damage a dam leading to downstream flash flooding.

## HAZARD PROFILE

Earthquake magnitude is often measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. Table 3-36 summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas.

**Table 3-36: Richter Scale Magnitudes and Associated Earthquake Size Effects**

| RICHTER MAGNITUDES | EARTHQUAKE EFFECTS |
|---|---|
| **Less than 3.5** | Generally not felt, but recorded. |
| **3.5-5.4** | Often felt, but rarely causes damage. |
| **5.4- 6.0** | At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions. |
| **6.1-6.9** | Can be destructive up to about 100 kilometers from epicenter. |
| **7.0-7.9** | Major earthquake; can cause serious damage over large areas. |
| **8.0 or greater** | Great earthquake; can cause serious damage in areas several hundred kilometers across. |

The impact an earthquake event has on an area is typically measured in terms of earthquake intensity. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. A detailed description of the Modified Mercalli Intensity Scale is shown in Table below.

**Table 3-37: Modified Mercalli Intensity**

| SCALE | INTENSITY | DESCRIPTION OF EFFECTS | CORRESPONDING RICHTER SCALE MAGNITUDE |
|---|---|---|---|
| I | Instrumental | Detected only on seismographs | <4.2 |
| II | Feeble | Some people feel it | |
| III | Slight | Felt by people resting; like a truck rumbling by | |
| IV | Moderate | Felt by people walking | |
| V | Slightly Strong | Sleepers awake; church bells ring | <4.8 |
| VI | Strong | Trees sway; suspended objects swing; objects fall off shelves | <5.4 |
| VII | Very Strong | Mild alarm, walls crack, plaster falls | <6.1 |
| VIII | Destructive | Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged | <6.9 |
| IX | Ruinous | Some houses collapse, ground cracks, pipes break open | |
| X | Disastrous | Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread | <7.3 |
| XI | Very Disastrous | Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards | <8.1 |
| XII | Catastrophic | Total destruction, trees fall, ground rises and falls in waves | >8.1 |

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak ground acceleration (PGA) measures the strength of ground movements in this manner. PGA represents the rate in change of motion of the earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity.

The lack of noticeable activity in Montgomery County can be partly attributed to the PGA. PGA is partly determined by what soils and bedrocks are present in the area. In regards to Montgomery County, the PGA is relatively low. As shown in the figure below, Montgomery County is in the area of 0.06 PGA.

The earliest recorded earthquake in Maryland was located in Annapolis on April 24, 1758 and measured between 3.5 and 3.7 on the Richter Scale. The last recorded earthquake event in Montgomery County was recorded on August 23, 2011 and measured 5.8 on the Richter Scale. The epicenter was in Louisa County, VA. Even though it was felt hundreds of miles away, there were no reports of significant damage in Montgomery County. Minor impacts included closure of some public facilities in Montgomery County and damage to the National Cathedral, which is only a few miles from the County line. Maryland has recorded 68 earthquakes since 1758. None of these earthquakes were reported to

cause major damage or loss of life. Most sources in the geology science predict that the largest magnitude earthquake that might occur in the state of Maryland would register between 4 and 4.5. Maryland has a very low probability of experiencing a destructive earthquake in a 50-year period.

When the peak acceleration nears .1g, damage may be caused to poorly constructed buildings while acceleration nearing .2 would create loss of balance and greater damage to lesser quality structures. As mentioned previously, Montgomery County has peak acceleration much below that number, thus providing a buffer from most seismic activity. On a local basis, community members within Montgomery County have made reports of ground shakings. With this in mind, seismic activity will be a lessened priority in this plan. Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts are considered. Some examples are shown below, but are unlikely to occur in Montgomery County:

- Induced flooding and landslides;
- Poor water quality;
- Damage to vegetation; and
- Breakage in sewage or toxic material containments

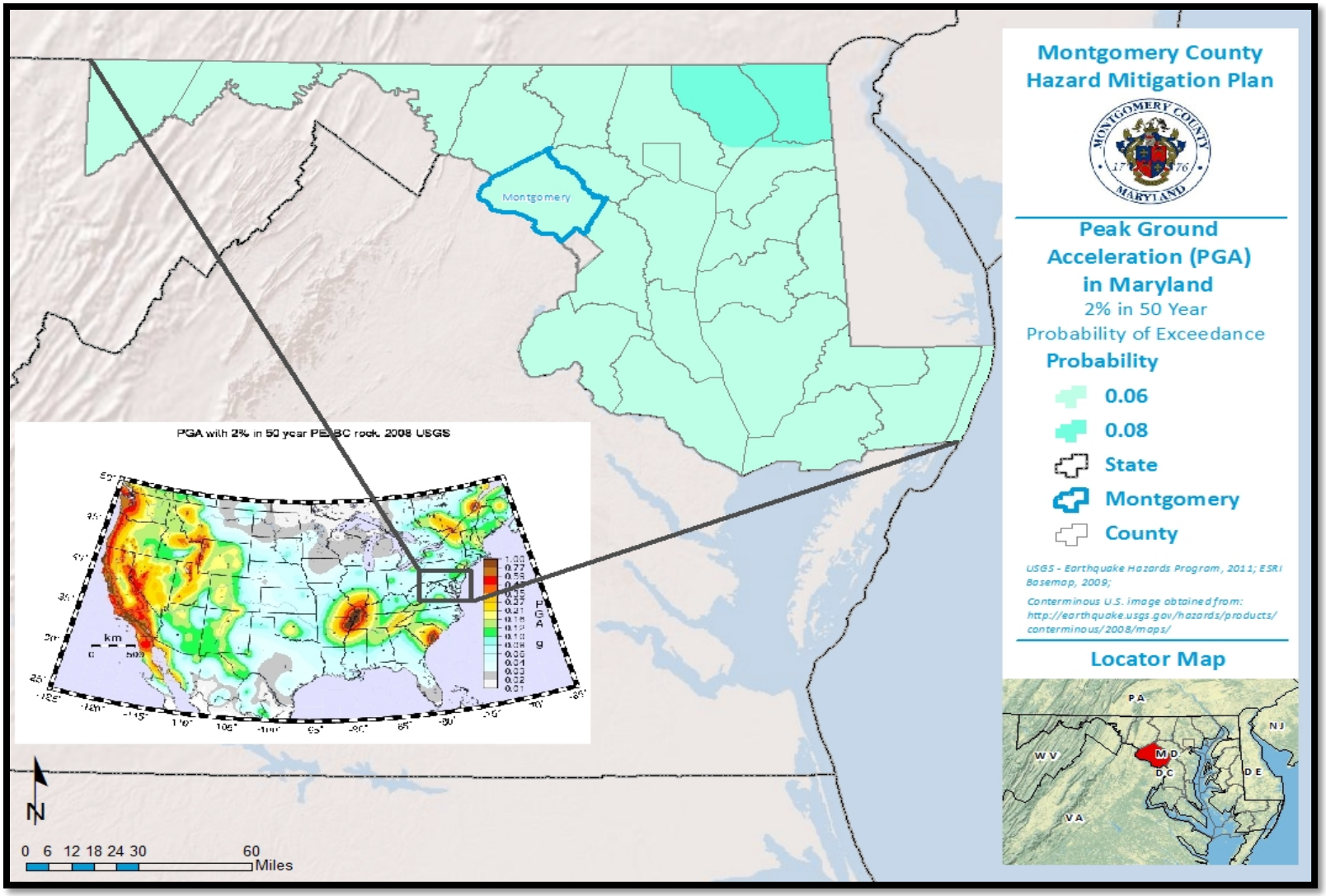


**Figure 3-24: PGA in Maryland**

The likelihood of a hazard event happening is usually expressed in terms of frequency. It is critically important to establish a probability of occurrence so that community officials can make informed decisions about the sustainability of future development and determine the feasibility of proposed mitigation projects. The exact probability of an earthquake is very site-specific, and no one map will illustrate the probability, but USGS has spatial data illustrating seismic hazard nationwide, expressed in terms of peak ground acceleration (percent of gravity) with a 2, 5, or 10% probability of exceedance in 50 years. The figure on the previous page shows the 2% probability of exceedance in 50 years. Damage starts to occur at around 10-15% g (percent of gravities). Maryland falls in the 4-10% g range which could mean an expected magnitude earthquake of 4.0-4.5. The higher the Peak Ground Acceleration (PGA), the higher the probability of future earthquake events. Since predicting future hazard events is not an exact science, it is also acceptable to base the prediction of future hazard occurrences on past history - for example, dividing the number of events by the number of years' data exists to calculate the number of events per year. The more historical data you can obtain, the more accurate your calculated probability of future occurrence will be for a given hazard.

## INVENTORY ASSETS EXPOSED TO HAZARD

Earthquakes are low probability, high-consequence events. Although earthquakes may occur infrequently they can have devastating impacts. Ground shaking can lead to the collapse of buildings and bridges; disrupt gas, life lines, electric, and phone service. Deaths, injuries, and extensive property damage are possible vulnerabilities from this hazard. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failure. Moderate and even very large earthquakes are inevitable, although very infrequent, in areas of normally low seismic activity. Consequently, buildings in these regions are seldom designed to deal with an earthquake threat; therefore, they are extremely vulnerable.

Most property damage and earthquake-related injuries and deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses shear strength and the ability to support foundation loads. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

A mitigation action will be created to develop a countywide inventory of existing structures and infrastructure susceptible to Earthquake/Seismic Activity in order to address this specific plan element in the next Plan update.

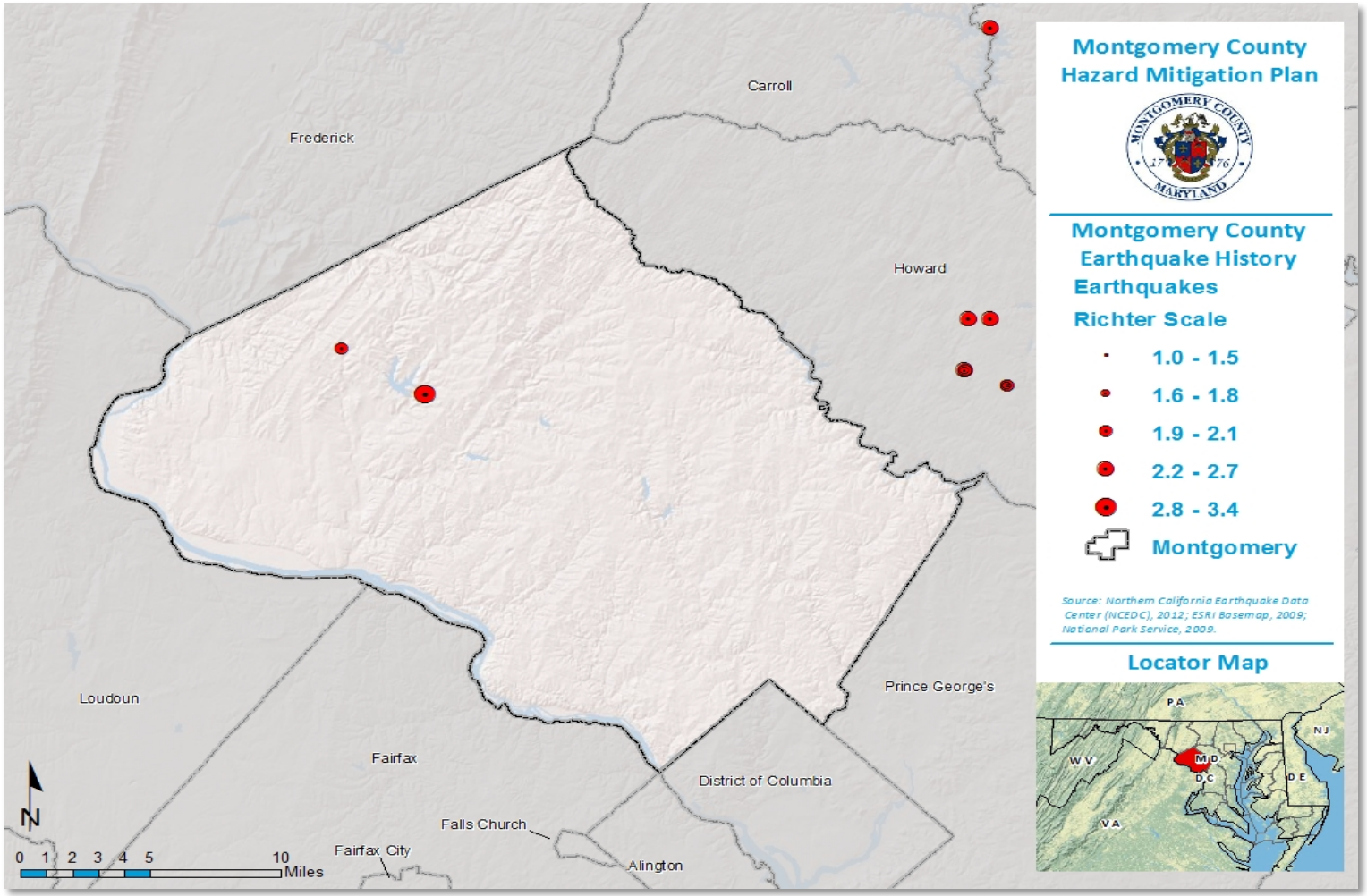


**Figure 3-25: Montgomery County Earthquake History**

## POTENTIAL LOSSES

In the event of an earthquake, the magnitude and location in the County would determine the possible loss of life and infrastructure affected.

## LAND USE & DEVELOPMENT TRENDS

The effects of an earthquake (if the hazard exists) could potentially be anything from detected only on seismographs to ground water wells collapsing to total destruction, trees falling, ground rises and falls in waves. Continued enforcement of the unified construction code should mitigate this vulnerability.

## MULTI-JURISDICTIONAL DIFFERENCES

As stated previously, the probability for a seismic event in Montgomery County is low. However, if for some reason an event was to occur with the epicenter near the county, there is no way to comprehend the amount of damage that could be sustained by the county.

## EARTHQUAKE/SEISMIC ACTIVITY HIRA SUMMARY

Earthquakes give little to no warning. They are capable of having a large impact on an area. The impacts of an earthquake can be similar to that of a tornado. After-effects from an earthquake can include impacted roadways, downed power and communication lines, and damages to structures (especially poorly built, or those already in disrepair). Earthquakes are not a seasonal hazard, and thus can be experienced year-round. This can present its own set of issues.

# LAND SUBSIDENCE/KARST

| NATURAL HAZARDS | PROBABILITY | IMPACT | SPATIAL EXTENT | WARNING TIME | DURATION | RF RATING (PRIORITY) |
|---|---|---|---|---|---|---|
| Land Subsidence | 0.45 | 0.39 | 0.32 | 0.37 | 0.20 | 1.73 |
| **LOW RISK (0.1 – 1.9)** | | | | | | |

## HAZARD IDENTIFICATION

Land subsidence is the sinking or settling movement of the earth's surface, the result of this movement is commonly referred to as a sinkhole. There are several common causes of subsidence in Maryland, each of which can cause subsidence or sinkholes in different areas of Montgomery County. The 2016 Maryland State Hazard Mitigation plan lists the causes as follows: 1) drainage of organic soils, 2) mining, 3) hydrocompaction, 4) aquifer system compaction, 5) natural compaction, 6) sinkholes, and 7) thawing permafrost. The State Plan further describes that water-related subsidence is typically caused by dissolution and collapse of susceptible rocks, drainage of soils, and the compaction of aquifer systems. Subsidence can occur quickly or gradually and cover varying amounts of land area.

Water passing through naturally occurring fractures, joints, and bedding planes dissolves bedrock and leaves voids below the surface. Eventually, overburden on top of the voids collapses, leaving surface depressions resulting in karst topography. Characteristic structures associated with karst topography include sinkholes, linear depressions and caves. In Maryland, limestone, dolostone, and marble, or carbonate rock underlie most Karst topography, according to the State Plan. Often, sub-surface solution of limestone will not result in the immediate formation of karst features. Collapse sometimes occurs only after a large amount of activity, or when a heavy burden is placed on the overlying material.

Maryland is part of six distinct physiographic provinces: 1) the Atlantic Continental Shelf, 2) the Coastal Plain, 3) the Piedmont Plateau, 4) the Blue Ridge, 5) the Ridge and Valley, and 6) the Appalachian Plateaus Provinces. Montgomery County lies principally within the Upland Section of the Piedmont Plateau Province, according to the Maryland Geological Survey. Though the majority of Montgomery County has limestone formations, the only areas of karst topography are in the western portion of the County, as shown in the figure below. There are no municipalities impacted by karst topography.

Karst formations develop in specific ways that are influenced by unique local conditions. Sinkholes can be induced through natural or human causes. Sinkholes that occur naturally usually form by the slow downward dissolution of carbonate rock though bedrock collapse in areas that overlie caverns. Human induced sinkholes can be triggered by simple alteration in the local hydrology. Inadequate drainage along highways and increased runoff from pavements can also be sources of sinkhole development. The Maryland Geological Survey describes that in the past, many minerals such as iron ore, gold and slate were mined throughout the Piedmont Plateau Province. Currently, crushed stone is extracted from the province for use in cement, lime and aggregate, but other mining activity has stopped. As mining activity has declined in the region, so has the risk of subsidence from mining.

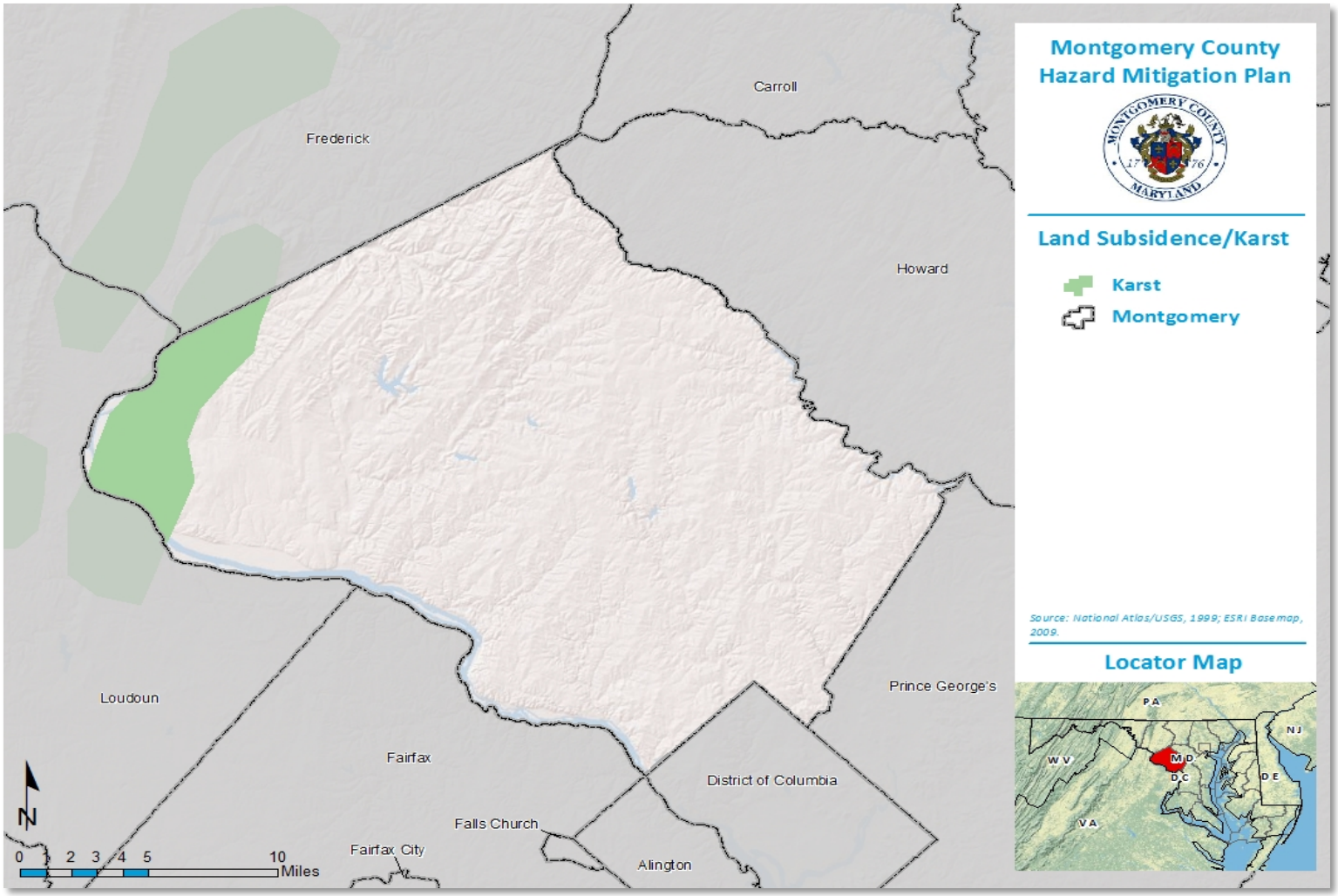


**Figure 3-26: Land Subsidence/Karst in Montgomery County**

The figure on the previous page illustrates where land subsidence/karst topography exists in Montgomery County. There is no land subsidence/karst topography documented in any municipalities.

## HAZARD PROFILE

Montgomery County is located in an area of low susceptibility and incidence based on the USGS Landslide Overview Map of the Conterminous United States. However, there are several past occurrences of sinkholes and subsidence in the county. There is no established database for recording or researching land subsidence and sinkhole incidents in the state of Maryland, but many news articles and technical reports document most occurrences.

A 1996 water resources study on the Patuxent River by the U.S. Army Corps of Engineers indicated that increased withdrawals of groundwater may be causing land subsidence as well as salt water intrusion in the Patuxent watershed area.

A sinkhole formed underneath a historic statue in Bethesda Maryland in 2004. According to the Gazette, a water main break was the cause of the sinkhole, which led to the temporary relocation of the Madonna of the Trail statue to a nearby school in Rockville. Two years later, heavy rain in June led to sinkholes developing along the side of Woodcrest Drive in Rockville Maryland.

A large sinkhole developed near the bridge on Randolph Road over Rock Creek in February 2007, causing road delays to allow for repairs. In December of 2010, a Chevy Chase resident lost his car when a sinkhole formed below the vehicle, collapsing his parking spot into the hole. The hole developed due to a local water main break prior to the incident.

On July 22 a metal pipe in the median of Father Hurley Boulevard, between Crystal Rock Drive and Middlebrook Road near Waters Landing Drive designed to drain water into an adjacent creek rusted and collapsed. This allowed runoff from heavy rains to erode the berm underneath the road causing a 20’ X 20” sinkhole.

## INVENTORY ASSETS EXPOSED TO HAZARD

Buildings, ground water, and residents in the western portion of the County with Karst topography may be more vulnerable to subsidence, but sinkholes and subsidence can occur in any part of Montgomery County. Land subsidence primarily impacts infrastructure and groundwater, but can endanger buildings, people, and utility lines as well.

## POTENTIAL LOSSES

The most important environmental issues with respect to karst are the sensitivity of karst aquifers to groundwater contamination and foundation engineering problems. Groundwater contamination is universal among all karst regions in the United States that underlie populated areas.

Typical foundation engineering problems include differential compaction and settling, subsurface erosion, and collapse sinkholes, according to the Maryland Geological Survey. Potential effects are the collapse of a building or pavement, the slow sinking of a building or pavement, or cracks developing in building or structure foundations.

## LAND USE & DEVELOPMENT TRENDS

Develop of land for building and roadway construction should avoid filling wetlands or streams to reduce vulnerability to land subsidence. All building projects should require detailed engineering design to avoid or plan for subsidence.

## MULTI-JURISDICTIONAL DIFFERENCES

All of Montgomery County could be affected by land subsidence. Subsidence can damage roadways, buildings, and utilities and lead to groundwater contamination, thus it can greatly inconvenience or endanger any community within Montgomery County.

## LAND SUBSIDENCE/KARST HIRA SUMMARY

Land subsidence may occur due to natural or manmade causes. Impacts can include sinkhole collapses, differential foundation settlement, and groundwater contamination. Due to its geology, Montgomery County is not at great risk from land subsidence, but the hazard will sometimes occur. It is important to ensure that all development is built to code to withstand impacts from land subsidence and that sinkhole collapse will be better documented in the future in order to increase understanding of this hazard.

# 4. HAZARD MITIGATION GOALS, OBJECTIVES, AND STRATEGY

*C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs? 44 CFR 201.6(c)(3)*
*C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? 44 CFR 201.6(c)(3)(ii)*
*C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? 44 CFR 201.6(c)(3)(i)*
*C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? 44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv)*
*C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? 44 CFR 201.6(c)(3)(iii) and 44 CFR (c)(3)(iv)*
*C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? 44 CFR 201.6(c)(4)(ii)*
*D2. Was the plan revised to reflect progress in local mitigation efforts? 44 CFR 201.6(d)(3)*
*D3. Was the plan revised to reflect changes in priorities? 44 CFR 201.6(d)(3)*

After completion of the Hazard Identification and Risk Assessment, the Planning Team developed the Mitigation Strategy for Montgomery County and its participating jurisdictions. The Strategy will serve as a guide for future hazard mitigation policy, project development, and administration. It also includes a list of proposed actions intended to reduce the impact of natural hazards upon the county. For each action, the responsible department, anticipated cost, potential funding sources, and timeframe have been provided.

This section of the Plan provides the "blueprint" for Montgomery County and participating municipalities to become less vulnerable to natural hazards. It is based on the general consensus of the Montgomery County Mitigation Planning Committee along with the findings of the Hazard Identification and Risk Assessment. This section consists of the following subsections:

- INTRODUCTION
- CHANGES FROM 2013
- 2018 MONTGOMERY COUNTY MITIGATION GOALS AND OBJECTIVES
- COMMUNITY VALUES, HISTORIC AND SPECIAL CONSIDERATIONS

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# INTRODUCTION

## MITIGATION STRATEGY

The intent of the Mitigation Strategy is to provide Montgomery County and participating municipalities with the goals that will serve as the guiding principles for future mitigation policy and project administration, along with a list of proposed actions deemed necessary to meet those goals and reduce the impact of natural hazards. It is designed to be comprehensive and strategic in nature. The development of the strategy included a thorough review of natural hazards and identified policies and projects intended to not only reduce the future impacts of hazards, but also to help Montgomery County and participating municipalities achieve compatible economic, environmental, and social goals. The development of this section is also intended to be strategic, in that all policies and projects are linked to establish priorities assigned to specific departments or individuals responsible for their implementation and assigned target completion deadlines. Funding sources are identified that can be used to assist in project implementation.

- *Mitigation goals* are general guidelines that explain what the County wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results.
- *Mitigation objectives* describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date.
- *Mitigation Actions* provide more detailed descriptions of specific work tasks to help the County and its municipalities achieve prescribed goals and objectives.

### 2018 Mitigation Strategy Planning Process

Following the risk assessment meeting, a mitigation strategy and solutions meeting was held on April 16, 2018, where jurisdictions gathered to update the 2018 Mitigation Strategy. The results of the hazard rankings were summarized to help inform the creation of mitigation actions. A meeting with each jurisdiction was conducted and a survey was administered with the goal of ensuring every community in the County had an opportunity to participate in the planning process and benefit from the outcome of the Plan. The survey contained questions to evaluate how risk has changed in the communities since

the 2013 Plan, and what opportunities, limitations, and challenges the communities face. The survey also allowed each jurisdiction to complete a consequence analysis to better understand their capability to recover after a natural hazard. Additionally, during the mitigation strategy and solutions meeting, resources and guidance were provided to include historic properties and resource preservation into hazard mitigation planning.

The survey resulted in some common trends across the county. Jurisdictions responded that their hazard risk has changed over the past 5 years due to more frequent and severe storms and increased drought and water shortage concerns. However, no recent development has occurred in the county, aside from in Gaithersburg. In terms of resources, many jurisdictions are reliant on the county, have a limited part-time or full-time town manager, or are contract dependent to implement mitigation actions. Some obstacles to implementing mitigation actions include funding and time constraints, an "out of sight out of mind" mentality, lack of a front-end loader for snow removal, and stormwater management response time. On the other hand, some opportunities for mitigation action implementation include a tree survey determining the health of trees, a gap analysis and education on mitigation actions, a need for a County liaison, support from neighboring communities, and an impervious surface plan.

Next, two exercises were performed. The first allowed each jurisdiction to report on the status of mitigation actions from the 2013 Plan, and whether they recommend keeping the action in the 2018 Plan or deleting it. The second allowed each jurisdiction to create new mitigation actions for the 2018 Plan. The survey results have been incorporated into the 2018 Mitigation Strategy. The full completed surveys are included in APPENDIX B.

Based on the participation from the Montgomery County Mitigation Planning Committee and participating jurisdictions, the mitigation strategy was modified and updated. Objectives were clarified to better document roles and responsibilities. Completed actions were noted and deleted. New actions have been added to address particular hazards facing Montgomery County and the consensus achieved in how to address those actions.

### Mitigation Action Plan

The last step in updating the Mitigation Strategy is the creation of jurisdictionally specific Mitigation Action Plans (MAPs). The MAPs represent the key outcome of the mitigation planning process. MAPs include a prioritized list of proposed hazard mitigation actions (policies and projects) for Montgomery County and its municipalities, including accompanying information such as the agencies or individuals assigned responsibility for their implementation, potential funding sources, estimated target date for completion, and a current status. The MAPs provide those individuals or agencies responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring progress over time. The collection of actions listed in each jurisdiction's MAP also serves as an easily understood synopsis of activities for local decision makers.

## STAPLEE

In preparing their own MAP, each jurisdiction considered their overall hazard risk and capability to mitigate identified hazards, in addition to meeting the adopted countywide mitigation goals. Prioritizing mitigation actions for each jurisdiction was completed using FEMA's STAPLEE methodology.

The STAPLEE approach allows for a careful review of the feasibility of mitigation actions by using seven criteria. The criteria are described below:

- *S - Social*
- *T - Technical*
- *A - Administrative*
- *P - Political*
- *L - Legal*
- *E - Economic*
- *E - Environmental*

FEMA mitigation planning requirements indicate that any prioritization system used shall include a special emphasis on the extent to which benefits are maximized according to a cost-benefit review of the proposed projects. To do this in an efficient manner that is consistent with FEMA's guidance on using cost-benefit review in mitigation planning, the STAPLEE method was adapted to include a higher weighting for two elements of the economic feasibility factor – Benefits of Action and Costs of Action. This method incorporates concepts similar to those described in Method C of FEMA 386-5: Using Benefit Cost Review in Mitigation Planning (FEMA, 2007).

For the individual action plans, a STAPLEE score was calculated based on the number of favorable considerations that can be found on the STAPLEE document. Up to 23 considerations can be used to prioritize each action using this evaluation methodology.

## Mitigation Categories

To ensure that a broad range of mitigation actions was considered, the Montgomery County Mitigation Planning Committee analyzed a comprehensive range of specific mitigation actions for each hazard after it had completed the risk assessment. This helped to ensure that there was sufficient span and creativity in the mitigation actions considered.

There are six categories of mitigation actions which Montgomery County considered in developing its mitigation action plan. Those categories include:

- **Prevention**: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning, zoning, building codes, subdivision regulations, hazard-specific regulations (such as floodplain regulations), capital improvement programs, and open space preservation and stormwater regulations.
    - Planning and zoning

  - Building codes
  - Open space preservation
  - Floodplain regulations
  - Stormwater management regulations
  - Drainage system maintenance
  - Capital improvement programming
  - Riverine setbacks
- **Property Protection**: Actions that involve modifying or removing existing buildings or infrastructure to protect them from a hazard. Examples include the acquisition, elevation, and relocation of structures, structural retrofits, floodproofing, storm shutters, and shatter-resistant glass. This category also includes insurance.
  - Acquisition
  - Relocation
  - Building elevation
  - Critical facilities protection
  - Retrofitting (e.g., windproofing, floodproofing, etc.)
  - Safe rooms, shutters, shatter-resistant glass
  - Insurance
- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include hazard mapping, outreach projects, library materials dissemination, real estate disclosures, the creation of hazard information centers, and school age / adult education programs.
  - Outreach projects
  - Speaker series/demonstration events
  - Hazard mapping
  - Real estate disclosure
  - Library materials
  - School children educational programs
  - Hazard expositions
  - Inter-governmental coordination
- **Natural Resource Protection**: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, forest and vegetation management, wetlands restoration or preservation, slope stabilization, and historic property and archeological site preservation.
  - Land acquisition
  - Floodplain protection
  - Watershed management
  - Riparian buffers
  - Forest and vegetative management

  - Erosion and sediment control
  - Wetland preservation and restoration
  - Habitat preservation
  - Slope stabilization
  - Historic properties and archaeological site preservation
- **Structural Project Implementation**: Mitigation projects intended to lessen the impact of a hazard by using structures to modify the environment. Structures include stormwater controls (culverts); dams, dikes, and levees; and safe rooms.
  - Reservoirs
  - Dams/levees/dikes/floodwalls
  - Diversions/detention/retention
  - Channel modification
  - Storm sewers
- **Emergency Services**: Actions that typically are not considered mitigation techniques but reduce the impacts of a hazard event on people and property. These actions are often taken prior to, during, or in response to an emergency or disaster. Examples include warning systems, evacuation planning and management, emergency response training and exercises, and emergency flood protection procedures.
  - Warning systems
  - Evacuation planning and management
  - Emergency response training and exercises
  - Sandbagging for flood protection
  - Installing temporary shutters for wind protection

## CHANGES FROM 2013

The Mitigation Planning Committee reviewed the current plan, identified new information that needed to be included in the Plan update, and incorporated it as required by State and Federal guidelines. The planning committee was also tasked with collecting all accurate data from plan participants and provided outreach to the public and business stakeholders to ensure that everyone's information is included in this Plan update.

Based on these efforts, several changes from the 2013 Mitigation Strategy have been incorporated into this Plan. For the 2018 Plan, it was decided to simplify the goals and objectives to better represent the goals of Montgomery County. The goals and objectives for each hazard from the 2013 Plan were consolidated into one over-arching hazard mitigation goal with seven associated objectives. The goals and objectives from the 2013 Plan are shown in Table 4-1 below. The 2018 goal and objectives are further described in the 2018 Montgomery County Mitigation Goals and Objectives section below. The 2018 Mitigation Strategy is still organized by hazard but has been updated to match the changes in identified hazards since 2013.

| Table 4-1: 2013-2017 Goals and Objectives | |
|---|---|
| **Goal** | **Objective** |
| To minimize the losses of life and property due to thunderstorms in Montgomery County | **Objective 1.1:** To minimize the effects of electrical storms to public and private property in Montgomery County<br>**Objective 1.2:** To minimize the effects of high winds on public and private property in Montgomery County |
| To minimize the losses of life and property due to winter storms in Montgomery County | **Objective 2.1:** To minimize the impact of winter storm events on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to extreme heat in Montgomery County | **Objective 3.1:** To minimize the impact of extreme heat on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to fire in Montgomery County | **Objective 4.1:** To protect both people and property against the devastating effects of wildfire |
| To minimize the losses of life and property due to flooding in Montgomery County | **Objective 5.1:** To minimize the impact of flooding on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure<br>**Objective 5.2:** To reduce the impact of flooding through education and outreach of flood mitigation techniques<br>**Objective 5.3:** Pursue flood mitigation projects in repetitive flood areas to improve stormwater management |
| To minimize the losses of life and property due to hurricanes and tropical storms in Montgomery County | **Objective 6.1:** To minimize the wind and flooding effects of hurricanes and tropical storms on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to water shortage and drought in Montgomery County | **Objective 7.1:** To educate the citizens of Montgomery County on methods to reduce the effects of drought<br>**Objective 7.2:** Minimize the effects of drought through education and outreach on water saving techniques |
| To minimize the losses of life and property due to tornadoes in Montgomery County | **Objective 8.1:** To minimize the effects of high winds on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to earthquake in Montgomery County | **Objective 9.1:** To minimize the effects of seismic activity on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to land subsidence and karst in Montgomery County | **Objective 10.1:** To minimize the effects of land subsidence and karst to include buildings, infrastructure, critical facilities, and critical infrastructure |
| To minimize the losses of life and property due to hazardous materials in Montgomery County | **Objective 11.1:** To continue to provide enhanced trainings, equipment, and plans for hazardous materials emergency response and mitigation in Montgomery County |

| Table 4-1: 2013-2017 Goals and Objectives | |
|---|---|
| **Goal** | **Objective** |
| To minimize the losses of life and property due to dam failure in Montgomery County | **Objective 12.1:** To minimize the impact of dam failure on life and property to include buildings, infrastructure, critical facilities, and critical infrastructure<br>**Objective 12.2:** To continue to provide education and outreach to Montgomery County citizens and business owners on dam failure inundation areas |
| To minimize the losses of life and property due to natural, technological, and/or threat induced hazards to include buildings, infrastructure, critical facilities, and critical infrastructure | **Objective 13.1:** To minimize the impact of natural, technological, and/or threat-induced hazards to include buildings, infrastructure, critical facilities, and critical infrastructure |

In the 2013 Plan, the individual mitigation actions were given a responsible jurisdiction. During the mitigation strategy planning for the 2018 Plan, it was recognized that other jurisdictions may have started or completed an action or would like an action to expand to their community, so the mitigation action tables were modified to capture all jurisdictions' progress on each mitigation action with the following changes:

1. The "Jurisdiction" row was changed to "Responsible Jurisdiction," which is the original jurisdiction assigned to the action.
2. The "Additional Jurisdictions" row was added to include other jurisdictions that noted during the mitigation strategy planning process that they had made progress or completed an action that was not originally assigned to them, or who would like a particular mitigation action expanded to include their community.

Additionally, in the 2013 Plan the term "deferred" was used for mitigation actions that were carried over from the 2007 Plan. In this 2018 Plan update, to better clarify which actions are from previous versions of the Plan, the term "carried over" is used rather than "deferred." Lastly, mitigation action summary tables were updated for each hazard to include actions from the 2013 Plan, changes for the action in the 2018 Plan, the status of each action, and any notes or comments associated with the action.

## 2018 MONTGOMERY COUNTY MITIGATION GOALS AND OBJECTIVES

The 2018 Montgomery County mitigation goals and objectives have been updated since the 2013 Plan to consolidate goals for each hazard into one, over-arching goal for the county. The goal is supported by seven measurable objectives for a clearer path to achieve the goal. The 2018 goal and objectives are listed below.

**Goal:** Efficiently use County resources to minimize the losses of life and property from natural hazards and protection of County assets, infrastructure, and critical facilities.

**Objectives:**

1. Encourage building and land use regulations that increase safety and resiliency and reduce risks posed by natural disasters.
2. Protect public health, safety, and welfare by increasing public awareness of existing natural hazards and by fostering individual and public responsibility in mitigating risks caused by those hazards.
3. Ensure that infrastructure is adequate and properly maintained to provide continued functionality of all critical services necessary to protect residents and property.
4. Improve communications and increase natural hazard awareness through education and citizen participation.
5. Enhance the capabilities of local jurisdictions to identify and mitigate natural hazards.
6. Participate and comply with the National Flood Insurance Program (NFIP) through floodplain identification, mapping, and management.
7. Promote actions that protect historic and cultural resources, while enhancing hazard mitigation and community resiliency.

## COMMUNITY VALUES, HISTORIC AND SPECIAL CONSIDERATIONS

Historic resources include landmark buildings, historic structures and sites, commercial and residential districts, historic rural resources, archaeological and cultural sites, and the historic environment in which they exist. Historic resources serve as visual reminders of a community's past, providing a link to its cultural heritage and a better understanding of the people and events that shaped the patterns of its development. Preservation of these important resources makes it possible for them to continue to play an integral, vital role in the community.

Before European immigration, the land now known as Montgomery County was covered in a vast swath of forest crossed by the creeks and small streams that feed the Potomac and Patuxent rivers. A few small villages of the Piscataway, members of the Algonquian people, were scattered across the southern portions of the county. North of the Great Falls of the Potomac, there were few permanent settlements, and the Piscataway shared hunting camps and foot paths with members of rival peoples like the Susquehannocks and the Senecas. Early European settlers were tobacco planters from the Chesapeake and wheat farmers from Pennsylvania. During the Civil War, residents were divided in their loyalties, with those in the western County with Virginia family ties sympathizing with the South, while Sandy Spring Quakers and northern-born residents aligned with the North. Currently the County has 76 properties listed on the National Register of Historic Places.

Depending on the number of historic resources within a community, it can be unrealistic to assume that all of the necessary mitigation activities can be done at once to protect these resources. The work must be done in a manner that retains the character-defining features of a historic property and can be costly. Therefore, it makes sense to set priorities in terms of which resources and mitigation projects should be the point of focus. Montgomery County recognizes that the preservation and maintenance of archaeological sites and historic structures contribute to the cultural heritage of the County and are in the long-term best interest of the county.

# SEVERE STORMS MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Severe Storms Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Mitigation of building damage has been most successful where strict building codes for high-wind influence areas and designated Special Flood Hazard Areas (SFHAs) have been adopted and enforced by local governments and complied with by builders. County and municipal construction and zoning ordinances are applicable within their respective jurisdictions.

## NEW BUILDINGS AND INFRASTRUCTURE

Attention to the type of structure used in tornado-prone areas may yield benefits, particularly by avoiding highly susceptible manufactured or mobile homes. The greatest protection is afforded by quality construction and reinforcement of walls, floors, and ceilings. Properly anchoring walls to foundations and roofs to walls is essential for a building to withstand certain wind speeds. Code adoption by local jurisdictions, compliance by builders, and local government inspection of new homes could reduce the risk of destruction in high wind-prone areas.

## EXISTING BUILDINGS AND INFRASTRUCTURE

Existing manufactured or mobile homes are most exposed to damage from severe thunderstorms. Even if anchored, mobile homes do not withstand high wind speeds as well as some permanent, site-built structures. Existing structures can be retrofitted to withstand higher winds and safe rooms may be constructed in existing buildings or as standalone facilities. Safe room construction includes very specific design and engineering standards set forth by FEMA for structures to withstand tornado force winds. Retrofitting existing structures to meet safe room criteria involves making improvements to walls, roofs, window, and doors, among other structural elements of the building.

## MITIGATION ACTION PLAN

| **Mitigation Action 1.1.1** | |
|---|---|
| **INSTALL UNINTERRUPTIBLE POWER SUPPLIES ON CRITICAL ELECTRONIC EQUIPMENT IN COUNTY AND MUNICIPAL FACILITIES** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | $500-$1,000 PER FACILITY |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, FEMA HMA GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE SECTION 3, CITY OF ROCKVILLE, WASHINGTON GROVE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.1.2 | |
|---|---|
| **COORDINATE WITH THE MD STATE HIGHWAY ADMINISTRATION TO PROVIDE BACK-UP POWER/GENERATORS FOR ALL MAJOR STATE ROADS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS & DOT |
| ANTICIPATED COST | $15,000 PER UNIT ($150,000 TOTAL) |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, FEMA DHS GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.1.3 | |
|---|---|
| **INSTALL BACKUP GENERATORS FOR THE POTOMAC WATER TREATMENT FACILITY – A WASHINGTON SUBURBAN SANITARY COMMISSION FACILITY** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | WSSC FUNDS/FEMA HMA GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY/WSSC |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARREID OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.1.4 | |
|---|---|
| **EDUCATE THE PUBLIC ON HOW TO PROTECT PROPERTY AND RESIDENTIAL ELECTRICAL SYSTEMS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | $250,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, FEMA HMA GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.1.6 | |
|---|---|
| **PURCHASE EMERGENCY GENERATORS FOR CRITICAL FACILITIES** | |
| RESPONSIBLE DEPARTMENT | WASHINGTON GROVE |
| ANTICIPATED COST | $15,000 - $20,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS, FEMA DHS GRANTS |
| RESPONSIBLE JURISDICTION | WASHINGTON GROVE |
| ADDITIONAL JURISDICTIONS | BARNESVILLE, BROOKEVILLE, CHEVY CHASE, CHEVY CHASE VILLAGE, CITY OF ROCKVILLE, GAITHERSBURG, GARRETT PARK, GLEN ECHO, MARTIN'S ADDITION, MONTGOMERY COUNTY, POOLESVILLE, SOMERSET, TAKOMA PARK |
| TIMEFRAME | 1 YEAR |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.2.1 | |
|---|---|
| **TREE BRANCH/BRUSH CLEARANCE AND LIMIT HOW CLOSE VEGETATION CAN BE PLANTED NEAR/BENEATH POWER LINES** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DOT, GARRETT PARK |
| ANTICIPATED COST | $2,000,000 (COUNTY), $10,000-$100,000 (MUNICIPAL) |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, GARRETT PARK |
| ADDITIONAL JURISDICTIONS | CITY OF ROCKVILLE, WASHINGTON GROVE |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.2.2 | |
|---|---|
| **DEVELOP PUBLIC AWARENESS CAMPAIGN INFORMING RESIDENTS OF THE POTENTIAL IMPACT OF HIGH WINDS DUE TO SEVERE THUNDERSTORMS** | |
| RESPONSIBLE DEPARTMENT | CHEVY CHASE, SECTION 5 |
| ANTICIPATED COST | $1,500 |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS, FEMA HMA FUNDS |
| RESPONSIBLE JURISDICTION | CHEVY CHASE, SECTION 5 |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE, SECTION 3, MONTGOMERY COUNTY |
| TIMEFRAME | 1 YEAR |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.2.3 | |
|---|---|
| **PUBLIC OUTREACH FOR THE USE OF THE ALERT MONTGOMERY SYSTEM** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | $5,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE, SECTION 3, CITY OF ROCKVILLE, WASHINGTON GROVE |

| Mitigation Action 1.2.3 | |
|---|---|
| **PUBLIC OUTREACH FOR THE USE OF THE ALERT MONTGOMERY SYSTEM** | |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 1.2.4 | |
|---|---|
| **COORDINATE WITH STATE HIGHWAY ADMINISTRATION AND LOCAL OFFICIALS TO ENSURE EMERGENCY ROUTES AND MAJOR ROADS ARE CLEARED OF DEBRIS AND DOWNED WIRES** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| New Mitigation Action 1.2.5 | |
|---|---|
| **REPLACEMENT OF EMERGENCY POWER GENERATOR FOR ROCKVILLE MAINTENANCE AND EMERGENCY OPERATIONS COMPLEX** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA HMA, CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 1.2.6 | |
|---|---|
| **INSTALL EMERGENCY POWER GENERATOR AT GLENVIEW** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA HMA, CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

## COMPLETED, CARRIED OVER, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-2: Updated Actions for Montgomery County – Severe Storms**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Install uninterruptible power supplies on critical electronic equipment in County and municipal facilities | Carried Over | Ongoing | Maintenance facilities, HQ, and Satellite facilities to protect resources and provide communication capabilities<br>Washington Grove has installed uninterruptable power supplies on most electronic equipment, few items left to address |
| Coordinate with the MD State Highway Administration to provide back-up power/ generators for all major State roads | Carried Over | Ongoing | |
| Install back-up generators for the Potomac Water Treatment facility – A Washington Suburban Sanitary Commission Facility | Carried Over | Ongoing | |
| Educate the public on how to protect property and residential electrical systems | Carried Over | Ongoing | Can be supported through outreach from power companies |
| Purchase an early warning system to alert the public to take shelter | Delete | Complete | Alert Montgomery |
| Purchase emergency generators for critical facilities | Carried Over | Ongoing | Needed to maintain capability for equipment repair;<br>Washington Grove recently procured backup emergency generator for Town Hall; generator delivered and awaiting installation |
| Tree branch/brush clearance and limit how close vegetation can be planted near/beneath power lines | Carried Over | Ongoing | Washington Grove constantly evaluates new plantings relative to power lines; excellent cooperation with Pepco (and their contractor) regarding trimming and removing vegetation threatening power lines |
| Develop a public awareness campaign informing residents of the potential impact of high winds due to severe thunderstorms | Carried Over | Ongoing | |
| Public outreach for the use of the Alert Montgomery System | Carried Over | Ongoing | Refresh the communication plan;<br>Washington Grove continues outreach to Town residents regarding Alert Montgomery while exploring improvements to Grove Alert. |
| Coordinate with State Highway Administration and local officials to | Carried Over | Ongoing | Washington Grove has procured additional equipment for use by Town Maintenance to help ensure internal roadways are cleared of |

| Table 4-2: Updated Actions for Montgomery County – Severe Storms | | | |
|---|---|---|---|
| **2013 ACTION** | **2018 UPDATE ACTION** | **STATUS** | **NOTES** |
| ensure emergency routes and major roads are cleared of debris and downed wires | | | snow, ice, and debris during winter storms and severe storms |
| N/A | Replacement of emergency power generator for Rockville Maintenance and Emergency Operations Complex | New | |
| N/A | Install emergency power generator at Glenview | New | |

# WINTER STORMS MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Winter Storms Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Standard building codes can provide Montgomery County with reasonable guidance for development throughout the unincorporated and incorporated areas. However, contractors and builders should be aware of winter hazards such as extreme cold, high winds, and snow loads that can result from winter weather.

## NEW BUILDINGS AND INFRASTRUCTURE

As development grows in the County and its municipalities, it will be a priority to improve the roads, utilities, and stormwater management systems in the area. Any structures and infrastructure built should be considered vulnerable to severe winter weather. New structures and infrastructure built in Montgomery County should take into account snow loads when constructed, and it may be a case of going above and beyond what current codes require.

Montgomery County Code, Chapter 8, Buildings, adopts the ICC International Building Code (IBC) as the county's basic building code. The IBC regulates construction materials and methods for all structures except one- and two-family dwellings. These buildings are covered by the International Residential Code (IRC). The IBC and IRC are kept current through an Executive Regulation process. These codes establish building criteria that resists damage to natural hazards. Pre-existing buildings do not have to meet new requirements except for new additions and complete rebuilds. This leaves older buildings less resistant to damage from natural hazards.

## EXISTING BUILDINGS AND INFRASTRUCTURE

The county's entire structural inventory is vulnerable to winter storms. Winter storms in Montgomery County cause widespread impacts, with the greatest threat to public safety occurring on the major roads and highways. Power outages caused by snow, ice, and wind accompanied by cold temperatures create needs for additional shelter. Montgomery County's priority is to continue operation of existing buildings and infrastructure, especially critical facilities and services like emergency services and hospitals in times of severe winter weather and winter storms.

## MITIGATION ACTION PLAN

| Mitigation Action 2.1.1* | |
|---|---|
| CONTINUE TO RESEARCH AND PROVIDE ALTERNATIVE MEASURES TO NOTIFY INDIVIDUALS WITH DISABILITIES OF WINTER EMERGENCIES | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE, SECTION 3, CITY OF ROCKVILLE, TAKOMA PARK |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 2.1.2 | |
|---|---|
| PROVIDE SHELTERS FOR BOTH RESIDENTS AND ANIMALS DURING SEVERE WINTER WEATHER | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CITY OF ROCKVILLE |
| TIMEFRAME | CONTINOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 2.1.3 | |
|---|---|
| PROVIDE 4WD VEHICLES FOR LAW ENFORCEMENT PERSONNEL DURING HEAVY SNOW ACTIVITY | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DOT/POLICE |
| ANTICIPATED COST | SIX UNITS AT $25,000 EACH |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE, SECTION 3 |
| TIMEFRAME | TWO UNITS PER YEAR FOR 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-3: Updated Actions for Montgomery County - Winter Storms**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Continue to research and provide alternative measures to notify individuals with disabilities of winter emergencies* | Carried Over | Ongoing | |
| Provide shelters for both residents and animals during severe winter weather | Carried Over | Ongoing | Assess capacity of sheltering across the county, is it adequate? Use of other agency spaces? |
| Provide 4WD vehicles for law enforcement personnel during heavy snow activity | Carried Over | Ongoing | Is fleet coverage adequate? |

*Action originally from 2007 Plan

# EXTREME HEAT MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Extreme Heat Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Although damage to buildings can occur, more commonly people themselves are impacted by temperature extreme events. The effect temperature extremes have on the County will vary due to population density, age of the population, and the age of structures. Facilities need to be maintained to ensure that they operate in appropriate conditions for people. Temperature advisories, watches, and warnings relating the impacts associated with extreme temperatures are issued by the National Weather Service. The County can assist with lessening the impact by ensuring that those residents in more remote areas are being notified about temperature extremes and what to do during an event.

The County has a "Shelter Task Force" that can open shelters as needed for the general population. In addition, the County has shelters for cooling purposes for homeless residents.

## NEW BUILDINGS AND INFRASTRUCTURE

Encouraging residents to purchase energy efficient appliances and ensuring properties are built to code and in proper working order can help mitigate a possible electrical overload.

## EXISTING BUILDINGS AND INFRASTRUCTURE

It is unlikely that an entire building would be impacted by an extreme heat event. Extreme heat events can cause damage to buildings or contents by overheating HVAC systems. Extreme heat events can also result in elevated utility costs. Encouraging residents to purchase energy efficient appliances and ensuring properties are built to code and in proper working order can help mitigate a possible electrical overload.

## MITIGATION ACTION PLAN

| **Mitigation Action 3.1.1** | |
|---|---|
| **PROVIDE RELIEF FOR THOSE HIGHLY IMPACTED BY HEAT BY OPENING COOLING CENTERS THAT ALSO ACCOUNT FOR SPECIAL NEEDS POPULATIONS AND CONDUCT EDUCATION AND OUTREACH REGARDING SPECIAL NEEDS POPULATIONS.** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | $10,000 - $20,000 PER CENTER |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTION | CITY OF ROCKVILLE |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, MODIFIED, OR DELETED ACTION STEPS FROM THE 2013 PLAN

**Table 4-4: Updated Actions for Montgomery County - Extreme Heat**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Provide relief for those highly impacted by heat by opening cooling centers that also account for special needs populations and conduct education and outreach regarding special needs populations. | Carried Over | Ongoing | Ensure the capacity of sheltering is adequate in urban, suburban, and rural areas |

# WILDFIRE MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Wildfire Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Montgomery County is experiencing a rapid population growth and because of this there has been a substantial change in land use as well as the wildland urban interface over the years, bringing a diverse range of challenges. Therefore, Montgomery County adheres to a comprehensive list of policies and regulations including the National Fire Protection Association Codes, International Fire Code, and County ordinances. It is also a County priority to address the primary concern regarding protection of existing and future development in the wildland urban interface areas within the county.

## NEW BUILDINGS AND INFRASTRUCTURE

As residential developments expand into wildland areas, people and property are increasingly at risk from wildfire. A cleared safety zone of at least 30 feet (100 feet in pine forests) should be maintained between structures and combustible vegetation, and fire-resistant ground cover, shrubs, and trees should be used for landscaping (for example, hardwood trees are less flammable than pines, evergreens, eucalyptus, or firs). Only fire-resistant or non-combustible materials should be used on roofs and exterior surfaces. Roofs and gutters should be regularly cleaned, and chimneys should be equipped with spark arrestors. Vents, louvers, and other openings should be covered with wire mesh to prevent embers and flaming debris from entering. Overhangs, eaves, porches, and balconies can trap heat and embers and should also be avoided or minimized and protected with wire mesh. Windows allow radiated heat to pass through and ignite combustible materials inside, but dual- or triple-pane thermal glass, fire-resistant shutters or drapes, and noncombustible awnings can help reduce this risk.

The term fireproof does not necessarily mean that an item cannot ever burn: It relates to measured performance under specific conditions of testing and evaluation. Fireproofing does not allow treated items to be entirely unaffected by any fire, as conventional materials are not immune to the effects of fire at a sufficient intensity and/or duration.

As stated above, safety zones can be created around structures by reducing or eliminating brush, trees, and vegetation around a home or facility. FEMA recommends using a 30-foot safety zone, including keeping grass below 2 feet tall and clearing all fallen leaves and branches promptly.

Firebreaks are areas of inflammable materials that create a fuel break and reduce the ability for fires to spread and roads and pathways can be planned and designed to serve as breaks. The use of GIS-based wildfire hazard assessment tools for use by Montgomery County should be considered for future planning and mitigation efforts.

Increased public education on fire safety is critical in Montgomery County due to its rapidly growing population, especially when many of the areas being developed are larger lots scattered throughout wildland fuels.

## EXISTING BUILDINGS AND INFRASTRUCTURE

Wildfire mitigation in the urban/wildland interface has primarily been the responsibility of property owners who choose to build and live in vulnerable zones. In practice, successful wildfire strategies can be quite involved. The most important aspect of successful suppression is disruption of the continuity of fuels, achieved by creating breaks or defensible areas. For interface fires, where homes and other structures fill the space, fuel reduction is best accomplished before the fires begin.

The Maryland Forest Service provides several services that help reduce wildfire risk. These include community outreach and education, fuels management, development review, hazardous activity permitting, fire danger monitoring, operational support, burn bans and restrictions, grant administration, and a volunteer program. This rigorous mitigation strategy shares responsibilities amongst agencies and promotes safer communities in the process.

## MITIGATION ACTION PLAN

| Mitigation Action 6.1.1 | |
|---|---|
| **DEVELOP A PUBLIC AWARENESS CAMPAIGN TO HEIGHTEN AWARENESS ABOUT BRUSH FIRES AND PREVENTATIVE MAINTENANCE FOR HOMEOWNERS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTION | WASHINGTON GROVE |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-5: Updated Actions for Montgomery County – Fire**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Develop a public awareness campaign to heighten awareness about brush fires and preventative maintenance for homeowners | Carried Over | Ongoing | Washington Grove continues outreach to Town residents regarding hazards and mitigation strategies, including proximity to risk of wildfire in East Woods and West Woods. Work continues on the Town Master Plan to incorporate risk reduction and hazard mitigation strategies. County fire suppression capability needed; Town fire lane maintenance being discussed. Concern for East Woods and West Woods. |

# FLOOD MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Flood Mitigation Strategy.

With sufficient warning of a flood, a community and its residents can take protective measures such as moving personal property, cars, and people out of harm's way. New radar technologies, improved river forecast models, computer visualization, automated data transmission, and improved data collection techniques hold significant promise for improving the timeliness and accuracy of flood forecasts and warnings.

A comprehensive education and outreach program is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when a warning is issued.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Floodplain management ordinances are intended to minimize flood damage to new and substantial home improvement projects as well as address zoning and subdivision ordinances and State regulations. With that said, Montgomery County joined the NFIP on July 18, 1975 and continues to participate and support floodplain management. Floodplain management is required under the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. There are approximately 2,000 flood insured properties in Montgomery County. As of 2018, all incorporated municipalities within Montgomery County participate in the NFIP with the exception of Laytonsville and North Chevy Chase.

Montgomery County's zoning laws are reflected in the ordinances of local jurisdictions with the land-use control authority. The Maryland-National Capital Park and Planning Commission's Montgomery County Planning Department developed a general plan in 1964 to guide development in Montgomery County. This plan has been updated several times and specifically states that protecting lives and property is the basis for regulations that limit or prohibit development in the floodplain.

Montgomery County's Department of Permitting Service has responsibility for enforcing countywide codes by restricting development in areas through a site planning approval process. Some of the incorporated jurisdictions located in the County have enforcement authority for their own ordinances. Floodplain estimates are based on the 100-year estimates of fully developed land and require large-scale impoundments such as Lake Frank and Lake Needwood.

Montgomery County Code, Chapter 8: Buildings, prohibits building in any 100-year floodplain or stream or drainage course (riverine and flash flood mitigation). These sections of the code also prohibit building in any area that is subject to flooding, erosion, or destabilized slope or fill within the danger reach of a high-hazard dam. The County has a 1-foot freeboard requirement contained in their floodplain ordinance plus commercial and industrial development may utilize wet or dry flood-proofing measures in the floodplain provided the building is designed to resist the effects of flooding and made of appropriate materials. Montgomery County has inspection staff to identify any illegal construction. Violations of the floodplain ordinance or regulations are required to correct such violations. For more

information on the Montgomery County floodplain management program consult APPENDIX D for a copy of the NFIP Survey.

## NEW BUILDINGS AND INFRASTRUCTURE

The greatest protection is afforded by quality construction and compliance with local ordinances that exceed NFIP requirements. Code adoption by local jurisdictions, compliance by builders, and local government inspection of new homes can reduce the risk of flooding. Montgomery County will continue to support monitoring, analysis, modeling, and the development of decision support systems and geographic information applications for floodplain activities.

## EXISTING BUILDINGS AND INFRASTRUCTURE

In addition to land use planning, zoning, and codes applicable to new development, flood mitigation measures include structural and non-structural measures to address susceptibility of existing structures. Flood mitigation measures such as acquisition, relocation, elevation-in-place, wet/dry floodproofing, and enhanced storm drainage systems all have the potential to effectively reduce the impact of floods in Montgomery County.

## MITIGATION ACTION PLAN

| **Mitigation Action 5.1.1*** | |
|---|---|
| **CONTINUE ONGOING LAND USE POLICIES THAT PROHIBIT NEW DEVELOPMENT IN THE SFHA** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY AND ALL JURISDICTIONS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS |
| RESPONSBILE JURISDICTION | MONTGOMERY COUNTY, ALL JURISDICTIONS |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |
| **CONTINUED COMPLIANCE WITH NFIP** | **YES** |

*Action originally from 2007 Plan

| Mitigation Action 5.1.2* | |
|---|---|
| **EXPLORE MITIGATION SOLUTIONS FOR ALL OCCUPIED PROPERTIES AND HISTORIC RESOURCES LOCATED IN THE SFHA** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY AND ALL JURISDICTIONS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS, FEMA HMA GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL JURISDICTIONS |
| ADDITIONAL JURISDICITONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 5.1.3* | |
|---|---|
| **CONTINUE TO SURVEY MUNICIPAL-OWNED OR LEASED PROPERTY, TO INCLUDE HISTORIC PROPERTIES AND RESOURCES, FOR POTENTIAL FLOODING PROBLEMS AND IDENTIFY FLOOD MITIGATION STRATEGIES FOR STRENGTHENING FLOOD RESILIENCE** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY AND ALL JURISDICTIONS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS, FEMA HMA GRANTS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL JURISDICTIONS |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 5.1.4 | |
|---|---|
| **AMEND ZONING REQUIREMENTS TO INCLUDE FLOODPLAIN LANGUAGE INTO CONSERVATION EASEMENTS** | |
| RESPONSIBLE DEPARTMENT | POOLESVILLE |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | POOLESVILLE |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE, SECTION 3, ROCKVILLE, KENSINGTON |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.2.1* | |
|---|---|
| **ESTABLISH COMMUNITY OUTREACH REGARDING THE NFIP AND APPLY FOR THE COMMUNITY RATING SYSTEM; ENCOURAGE ALL MUNICIPALITIES TO PARTICIPATE** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY AND ALL JURISDICTIONS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL JURISDICTIONS |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |
| **CONTINUED COMPLIANCE WITH NFIP** | **YES** |

*Action originally from 2007 Plan

| Mitigation Action 5.3.1* | |
|---|---|
| **EXPLORE MITIGATION PROJECTS IN AREAS THAT FREQUENTLY FLOOD, INCLUDING STORMWATER MANAGEMENT IMPROVEMENTS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY AND ALL JURISDICTIONS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL JURISDICTIONS |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 5.3.2* | |
|---|---|
| **COORDINATE WITH DOT TO CONTINUE TO CLEAR AND MAINTAIN STORM DRAINS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | ROCKVILLE |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 5.3.3 | |
|---|---|
| **DEVELOP A STORM DRAIN EVALUATION PROGRAM DESIGNED FOR FUTURE IMPROVEMENTS AND HAZARD MITIGATION** | |
| RESPONSIBLE DEPARTMENT | GARRETT PARK |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | GARRETT PARK |

| Mitigation Action 5.3.3 | |
|---|---|
| **DEVELOP A STORM DRAIN EVALUATION PROGRAM DESIGNED FOR FUTURE IMPROVEMENTS AND HAZARD MITIGATION** | |
| ADDITIONAL JURISDICTIONS | ROCKVILLE |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.3.4 | |
|---|---|
| **RECONSTRUCT UNDERSIZED STORM DRAINS THROUGHOUT GARRETT PARK** | |
| RESPONSIBLE DEPARTMENT | GARRETT PARK |
| ANTICIPATED COST | |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | GARRETT PARK |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.3.5 | |
|---|---|
| **MAINTAIN AND UPGRADE STORMWATER DRAINAGE WHERE UNDERSIZED INFRASTRUCTURE EXISTS** | |
| RESPONSIBLE DEPARTMENT | POOLESVILLE |
| ANTICIPATED COST | |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | POOLESVILLE |
| ADDITIONAL JURISDICITONS | BARNESVILLE, BROOKEVILLE, CHEVY CHASE SECTION 3, CITY OF ROCKVILLE, POOLESVILLE, WASHINGTON GROVE |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.3.6 | |
|---|---|
| **EVALUATE UNDERSIZED STORMWATER INFRASTRUCTURE AND PRIORITIZE HAZARD MITIGATION PROJECTS** | |
| RESPONSIBLE DEPARTMENT | ROCKVILLE |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | ROCKVILLE |
| ADDITIONAL JURISDICTIONS | BROOKEVILLE, CHEVY CHASE SECTION 3, GARRETT PARK |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.3.7 | |
|---|---|
| **DEVELOP AND IMPLEMENT A STORM DRAIN EVALUATION PROGRAM TO IDENTIFY UNDERSIZED INFRASTRUCTURE** | |
| RESPONSIBLE DEPARTMENT | COUNTYWIDE |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | BROOKEVILLE, CHEVY CHASE SECTION 3, GARRETT PARK, ROCKVILLE, KENSINGTON, WASHINGTON GROVE |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 5.3.8 | |
|---|---|
| **CONDUCT A STORMWATER IMPROVEMENT PROJECT ON SILVER CREEK WITHIN THE TOWN OF KENSINGTON** | |
| RESPONSIBLE DEPARTMENT | TOWN OF KENSINGTON |
| ANTICIPATED COST | |
| EXISTING & POTENTIAL FUNDING SOURCES | HMGP OR PDM GRANT FUNDS |
| RESPONSIBLE JURISDICTION | TOWN OF KENSINGTON |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| New Mitigation Action 5.3.9 | |
|---|---|
| **INSTALL STORM DRAINAGE INFRASTRUCTURE IN THOSE AREAS THAT CURRENTLY DON'T HAVE ANY AND UPGRADE EXISTING INFRASTRUCTURE WHERE NEEDED IN CHEVY CHASE VILLAGE** | |
| RESPONSIBLE DEPARTMENT | CHEVY CHASE VILLAGE |
| ANTICIPATED COST | $265,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | EXPLORING PRIVATE AND PUBLIC-SECTOR FUNDING/GRANT SOURCES AT THIS TIME |
| RESPONSIBLE JURISDICTION | CHEVY CHASE VILLAGE |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | PLANNING PHASE: FY 2019; IMPLEMENTATION BY END OF FY2023 |
| STAPLEE PRIORITY | LOW |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.10 | |
|---|---|
| **RESTORE AND UPGRADE STORMWATER DRAINAGE UNDER RAILROAD STREET IN WASHINGTON GROVE** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DOT |
| ANTICIPATED COST | LOW |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY STORMWATER FACILITY AND/OR ROAD MAINTENANCE FUNDS |
| RESPONSIBLE JURISDICTION | WASHINGTON GROVE |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | SHORT TERM – PIPE REPLACEMENT UNDER RAILROAD STREET |

| New Mitigation Action 5.3.10 | |
|---|---|
| **RESTORE AND UPGRADE STORMWATER DRAINAGE UNDER RAILROAD STREET IN WASHINGTON GROVE** | |
| | ONGOING – CLEANING OF PIPE UNDER CSX RAILROAD TRACKS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.11 | |
|---|---|
| **UPDATE EXISTING FLOOD MITIGATION PLAN AND CONTINUE TO CARRY OUT ACTIONS FROM THE PLAN** | |
| RESPONSIBLE DEPARTMENT | TAKOMA PARK |
| ANTICIPATED COST | |
| EXISTING & POTENTIAL FUNDING SOURCES | MULTIPLE |
| RESPONSIBLE JURISDICTION | TAKOMA PARK |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | ONGOING |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.12 | |
|---|---|
| **FLOOD AND EROSION MITIGATION AT THE HYATTSTOWN WASTEWATER STATION** | |
| RESPONSIBLE DEPARTMENT | WSSC |
| ANTICIPATED COST | 500,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA - FMA |
| RESPONSIBLE JURISDICTION | WSSC |
| ADDITIONAL JURISDICTIONS | |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.13 | |
|---|---|
| **TWINBROOK PARK CULVERT REPAIR** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA HMA, CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.14 | |
|---|---|
| **WATER TREATMENT PLANT RAW WATER INFRASTRUCTURE PROTECTION** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | $360,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA HMA, CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |

| | |
|---|---|
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 5.3.15 | |
|---|---|
| **SANDY LANDING ROAD – MAJOR ROADWAY REPAIR** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | $2,000,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | FEMA HMA, CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | NEW |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-6: Updated Actions for Montgomery County – Flood**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Create a flood risk public awareness campaign for the residents of Chevy Chase, Section 5 | Deleted | Incomplete | |
| Develop a storm drain evaluation program designed for future improvements and hazard mitigation | Carried Over | Ongoing | Chevy Chase Section 3 has completed this action |
| Reconstruct undersized storm drains throughout Garrett Park | Carried Over | Ongoing | |
| Amend zoning requirements to include floodplain language into conservation easements | Carried Over | Ongoing | Barnesville has completed this action |
| Maintain and upgrade stormwater drainage where undersized infrastructure exists | Carried Over | Ongoing | |
| Evaluate undersized stormwater infrastructure and prioritize hazard mitigation projects | Carried Over | Ongoing | |
| Develop and implement a storm drain evaluation program to identify undersized infrastructure | Carried Over | Ongoing | Chevy Chase Section 5 has completed this action<br>Comment from Garrett Park: This is a capital budget for storm drain issues. They will need financial help |

| Table 4-6: Updated Actions for Montgomery County – Flood | | | |
|---|---|---|---|
| **2013 ACTION** | **2018 UPDATE ACTION** | **STATUS** | **NOTES** |
| Conduct a stormwater improvement project on Silver Creek within the Town of Kensington | Carried Over | Ongoing | |
| Continue to survey municipal-owned or leased property, to include historic properties and resources, for potential flooding problems and identify flood mitigation strategies for strengthening flood resilience* | Carried Over | Ongoing | This action was modified to include historic properties and resources |
| Establish community outreach regarding the NFIP, apply for the CRS, and encourage all municipalities to participate* | Carried Over | Ongoing | |
| Continue ongoing land use policies that prohibit new development in the SFHA* | Carried Over | Ongoing | |
| Explore mitigation solutions for all occupied properties and historic resources located in the SFHA* | Carried Over | Ongoing | Action updated to include historic resources (may or may not be occupied) |
| Explore mitigation projects in areas that frequently flood, including stormwater management improvements* | Carried Over | Ongoing | |
| Coordinate with DOT to continue to clear and maintain storm drains* | Carried Over | Ongoing | Plan for seasonal and post-weather events |
| N/A | Install storm drainage infrastructure in those areas that currently don't have any and upgrade existing infrastructure where needed in Chevy Chase Village | New | |
| N/A | Restore and upgrade stormwater drainage under railroad street in Washington Grove | New | |
| N/A | Update existing flood mitigation plan and continue to carry out actions from the Plan | New | |
| N/A | Flood and erosion mitigation at the Hyattstown wastewater station | New | |

| Table 4-6: Updated Actions for Montgomery County – Flood | | | |
|---|---|---|---|
| **2013 ACTION** | **2018 UPDATE ACTION** | **STATUS** | **NOTES** |
| N/A | Twinbrook Park Culvert Repai | New | |
| N/A | Water Treatment Plant Raw Water Infrastructure Protection | New | |
| N/A | Sandy Landing Road - major roadway repair | New | |

*Action originally from 2007 Plan

# HURRICANE/TROPICAL STORMS MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Hurricane Mitigation Strategy.

With sufficient warning of a hurricane, a community and its residents can take protective measures such as moving personal property, cars, and people out of harm's way. New radar technologies, improved forecast models, computer visualization, automated data transmission, and improved data collection techniques hold significant promise for improving the timeliness and accuracy of hurricane forecasts and warnings.

A comprehensive education and outreach program is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when a warning is issued.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Maryland's building codes, enforcement officials, and contractor licensing system ranks in the middle of the pack among States subject to hurricanes, according to the above referenced study. Montgomery County is susceptible to hurricanes and the current Emergency Operations Plan for Montgomery County, dated October 2017, takes this into consideration when planning for potential evacuation events. The County is prepared to evacuate out of the jurisdiction and to receive evacuees from other jurisdictions, as necessary, in the case of a major hurricane event.

Prior to the beginning of hurricane season (June 1 through November 30 for the Atlantic coast), Montgomery County's Office of Emergency Management and Homeland Security, in collaboration with the county's Public Information Office, issues a press release on hurricane emergency preparedness. Montgomery County also participates in a multi-jurisdictional hurricane exercise on or around June 1 of each year. The County includes interested jurisdictions and utilities in these exercises.

The County has the capacity to use text messaging and mass voice technology (ALERT MONTGOMERY) to notify citizens of emergencies stemming from hurricanes and other events. The County also has a procedure for tracking hurricane damage through windshield assessment surveys. The data collected from these surveys after a hurricane event is input into a GIS and used to help County managers and PEPCO staff in their prioritization and post-event decision-making process. The county's Traffic Management Center operates a traffic signal control system with the ability to monitor and adjust signal operations in response to events.

## NEW BUILDINGS AND INFRASTRUCTURE

The State of Maryland does very well with regard to building regulations for hurricanes when compared to the rest of the Nation's coastal States according to a January 12, 2013, study by the Institute for Business and Home Safety, because they adopted the 2009 IRC, including the fire sprinkler requirement, with very few amendments. However, Maryland allows local jurisdictions to make amendments to the code, which makes the code not uniform and weakens wind protections, especially in vulnerable coastal areas.

The greatest protection is afforded by quality construction and compliance with local ordinances that exceed NFIP requirements. Code adoption by local jurisdictions, compliance by builders, and local government inspection of new homes can reduce the risk of damage from hurricanes. Montgomery County prohibits development in regions through restrictive zoning and subdivision requirements. New construction is prohibited within the floodplains of the major waterways of the Northwest Branch, Paint Branch, Rock Creek, and Sligo Creek. These waterways, which flow through the most heavily populated areas of the county, are protected.

## EXISTING BUILDINGS AND INFRASTRUCTURE

In addition to land use planning, zoning, and codes applicable to new development, flood mitigation measures include structural and non-structural measures to address the susceptibility of existing structures. Flood mitigation measures such as acquisition, relocation, elevation-in-place, wet/dry floodproofing, and enhanced storm drainage systems all have the potential to effectively reduce the impact of hurricane damage in Montgomery County.

## MITIGATION ACTION PLAN

| Mitigation Action 6.1.1* | |
|---|---|
| **DEVELOP A PLAN TO ADDRESS THAT EMERGENCY ROUTES ARE CLEARED OF DEBRIS AND DOWNED POWER LINES POST EVENT** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | GAITHERSBURG, ROCKVILLE |
| TIMEFRAME | 2 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-7: Updated Actions for Montgomery County – Hurricane/Tropical Storm**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Develop a plan to address that emergency routes are cleared of debris and downed power lines post event* | Carried Over | Ongoing | Gaithersburg has completed this action. MNCPPC comment: Reassess emergency routes? Are they effective in growth areas of the urban, suburban areas? |

*Action originally from 2007 Plan

# WATER SHORTAGE/DROUGHT MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Water Shortage and Drought Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

As Montgomery County continues to grow, it will consider practical guidelines for determining the impacts of water shortage and drought, such as measuring the economic value of water in alternative uses and objective methods for quantifying non-market impacts of drought on those uses.

The county's Fire and Rescue Service (MCFRS) has certified drafting sites for water (certified drafting sites must have reliable water levels, even during a drought). In addition, MCFRS now has six tankers, each with a capacity to hold 3,000 to 3,500 gallons. The county's Department of Environmental Protection is responsible for protecting both the public and private drinking water supply for the county, the water quality of streams, and the wildlife dependent on those systems. The County has protocols for "drought emergency stages" based on the State of Maryland's Drought Monitoring and Response Plan (dated November 2000), and the Metropolitan Washington Water Supply and Drought Awareness Response Plan – Potomac River System, created June 2000 and updated May 2015. The former pertains to citizens using wells and the latter to those who receive water from a municipality or water authority.

Drought emergency stages are:

- ✓ *Stage One - Normal Condition*
- ✓ *Stage Two - Drought Watch*
- ✓ *Stage Three - Drought Warning*
- ✓ *Stage Four - Drought Emergency*

At each stage, appropriate measures are initiated to ensure an adequate and safe drinking water supply. For more information, see the Montgomery County Emergency Operations Plan, dated October 2017: ESF #17 Damage Assessment. The County is a member of the Metropolitan Washington Council of Governments and participates in the following plans and agreements:

- ✓ Metropolitan Washington Water Supply and Drought Awareness Response Plan (June 2000): This document provides a plan of action that would be implemented during drought conditions for the purpose of a coordinated regional response. The Plan consists of two interrelated components: (1) a year-round plan emphasizing wise water use and conservation; and (2) a water supply and drought awareness and response plan. The year-round wise water use program applies to the entire region and is under development; what is presented is the basic framework and initial key messages. The Water Supply and Drought Awareness Plan contains four stages and is primarily designed for those customers who use the Potomac River for their drinking water supply. The Plan will eventually be expanded to incorporate all water supply systems throughout the region.

- ✓ Metropolitan Washington Water Supply Emergency Plan (Updated 2009): The 2009 Water Supply Emergency Plan replaces the 2004 Water Supply Emergency Plan (originally drafted in 1994). The new plan provides regional coordination and communication guidance in the event of a disruption, outage, or threat to regional water supplies and as those supplies might relate to wastewater operations. Such events would or could potentially disrupt fire protection, sanitation, and potable water services within the Metropolitan Washington region. In general, the plan addresses all incidents and emergencies that involve water treatment and/or its conveyance systems within the metropolitan Washington region. This plan is designed to coordinate the actions to be taken by local, State, and Federal government agencies and water supply utilities in the Washington region in the event of a regional water emergency.
- ✓ Metropolitan Washington Water Supply Emergency Agreement (1979): Adopted in 1979 to create coordinated area-wide water conservation as well as curtail water use during periods when available water supplies were insufficient to meet the water supply demands of the utilities due to drought or water outages. It provides inter-jurisdictional assistance and coordination to conserve water and provide for the necessary curtailment of water use during critical water supply situations. Signatories to the agreement include 15 metropolitan Washington local government jurisdictions, including Montgomery County, as well as the Fairfax County Water Authority, Loudoun County Sanitation Authority, Washington Suburban Sanitary Commission, and the Metropolitan Washington Council of Governments.
- ✓ Low Flow Allocation Agreement (2017 Reviewed): Originally signed in 1978 and modified in 1982, this agreement, which is administered by the U.S. Army Corps of Engineers (USACE), defined the severity of a water supply shortage in stages and established the allowable withdrawal of water from the Potomac River during low flow. Signatories to the agreement include the Commonwealth of Virginia, State of Maryland, District of Columbia, USACE – Washington Aqueduct Division, Washington Suburban Sanitary Commission, and the Fairfax County Water Authority.
- ✓ Statewide Water Conservation Plan: Since May 2001, the State of Maryland has had a comprehensive water conservation plan. State facility water conservation was phased-in, beginning with a usage reduction goal of 7 percent by 2003; 8 percent by 2005; 9 percent by 2007, and achieving 10 percent by 2010. In Maryland, 1.4 billion gallons of water are used every day, with the average home using about 250 gallons a day. If all Maryland residents reduced their water usage by 10 percent, the water conserved would be enough to provide additional water for 440,000 homes daily.
- ✓ Montgomery County Comprehensive Water Supply and Sewerage Systems Plan 2018-2027: The Montgomery County government addresses this responsibility through the 10-Year Comprehensive Water Supply and Sewerage Systems Plan (Water and Sewer Plan), which ensures that existing and future water supply and wastewater disposal needs are coordinated in a manner that is timely and cost-effective; well integrated with land use planning efforts; protects the health, safety, and welfare of residents, businesses, and institutions; protects the quality of the environmental resources of the county, the State, and the Chesapeake Bay region;

and improves the quality of the environmental resources of the county, State, and region. The Water and Sewer Plan is a functional master plan for providing water and sewer services throughout Montgomery County. As such, it provides an important link between the county's land use and development planning and the actual construction of the water supply and sewerage systems needed to implement that planning effort.

## NEW BUILDINGS AND INFRASTRUCTURE

New water and sewer systems or significant well and septic sites could use up more of the water available, particularly during periods of drought. Public water systems are monitored, but individual wells and septic systems are not as strictly regulated. Therefore, future development could have an impact on the drought vulnerabilities to new buildings and infrastructure.

## EXISTING BUILDINGS AND INFRASTRUCTURE

Although drought conditions rarely affect existing buildings, infrastructure, and critical infrastructure, the economic livelihood could be negatively impacted due to crop loss, timberland damage, water shortages, and wildfires as a result of drought. Possible losses/impacts to critical facilities include the loss of critical function due to low water supplies.

## MITIGATION ACTION PLAN

| Mitigation Action 7.1.1 | |
|---|---|
| **DEVELOP A WATER SOURCE ALTERNATE INTERCONNECTION PLAN AND IMPLEMENT DESIGN** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DEP |
| ANTICIPATED COST | $100,000 (PLAN), $12,000,000 (CONSTRUCTION) |
| EXISTING & POTENTIAL FUNDING SOURCES | MUNICIPAL FUNDS, STATE/FEDERAL GRANTS (TBD) |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 7.1.2 | |
|---|---|
| **CONTINUE TO DEVELOP INCENTIVES FOR WATER CONSERVATION DURING DROUGHT CONDITIONS*** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DEP |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARREID OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 7.1.3* | |
|---|---|
| CONTINUE TO COORDINATE WITH WSSC, ROCKVILLE, AND POOLESVILLE REGARDING WATER SUPPLY CAPACITY DURING DROUGHT CONDITIONS | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DEP, ROCKVILLE, POOLESVILLE |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY/MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ROCKVILLE, POOLESVILLE |
| ADDITIONAL JURISDICTION | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 7.1.4* | |
|---|---|
| PURCHASE ADDITIONAL WATER QUALITY MONITORING EQUIPMENT AND INSTRUMENTS | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DEP |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS AND STATE GRANTS (TBD) |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTION | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

| Mitigation Action 7.1.5 | |
|---|---|
| UPDATE STORM DRAINAGE INVENTORY USING GIS | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY DEP |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS |
| RESPONSBILE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-8: Updated Actions for Montgomery County - Drought/Water Shortage**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Develop a water source alternate interconnection plan and implement design | Carried over and revised | Ongoing | Changed responsible jurisdiction from Poolesville to Montgomery County |

| Table 4-8: Updated Actions for Montgomery County - Drought/Water Shortage | | | |
|---|---|---|---|
| **2013 ACTION** | **2018 UPDATE ACTION** | **STATUS** | **NOTES** |
| Continue to develop incentives for water conservation during drought conditions* | Carried Over | Ongoing | |
| Purchase additional water quality monitoring equipment and instruments* | Carried Over | Ongoing | |
| Update storm drainage inventory using GIS | Carried Over | Ongoing | |
| Continue to coordinate with WSSC, Rockville, and Poolesville regarding water supply capacity during drought conditions* | Carried Over | Ongoing | Rockville comment: Continue to make water treatment plants more resilient<br>MNCPPC comment: Assess the changes in housing developments which impact water consumption |

*Action originally from 2007 Plan

# TORNADO MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Tornado Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Mitigation of building damage has been most successful where strict building codes for high-wind influence areas and designated SFHAs have been adopted and enforced by local governments and complied with by builders. County and municipal construction and zoning ordinances are applicable within their respective jurisdictions.

## NEW BUILDINGS AND INFRASTRUCTURE

Mitigation opportunities for tornadoes are similar to mitigation measures for general high wind hazards. Attention to the type of structure used in, for example hurricane-prone areas may yield benefits, particularly by avoiding highly susceptible manufactured or mobile homes.

The greatest protection is afforded by quality construction and reinforcement of walls, floors, and ceilings. Properly anchoring walls to foundations and roofs to walls is essential for a building to withstand certain wind speeds. Code adoption by local jurisdictions, compliance by builders, and local government inspection of new homes could reduce the risk of destruction in tornado prone areas.

Construction of safe rooms has also shown great success in protecting life and reducing injuries during severe storm events. These are typically areas within an existing structure that are reinforced to serve as temporary shelters for the duration of an event. Walls and other structural components are heavily reinforced with concrete and rebar to provide an area designed to withstand high wind speeds and protect occupants from windborne debris. Safe rooms can be constructed not only in critical facilities such as police stations and hospitals, but also in residential and commercial buildings. They can be built into any new structure during the construction phase, which often proves to be the most cost beneficial time to do such an activity. Montgomery County and its municipalities will consider incorporating safe room areas into all new construction projects as well as retrofitting existing facilities to include safe room areas. All projects should be designed to meet FEMA 320 standards or beyond.

## EXISTING BUILDINGS AND INFRASTRUCTURE

High wind and tornadoes affect the entire planning area, including all above ground structures and utilities. Due to the erratic movement of tornadoes, destruction is often random. Buildings constructed prior to adoption of buildings codes remain more susceptible to damage. Some retrofit projects, such as specially designed shutters and windows for public schools and retrofitted saferooms, are expected to reduce future damage and loss of life and injury. Modification of existing buildings to incorporate wind-resistant measures may come about slowly as buildings are substantially improved. Post-disaster mitigation efforts include retrofits and the construction of saferooms.

## MITIGATION ACTION PLAN

| Mitigation Action 8.1.1 | |
|---|---|
| **PROMOTE ENHANCED ANCHORING OF MANUFACTURED HOMES** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUND |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE SECTION 3 |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| Mitigation Action 8.1.2 | |
|---|---|
| **PUBLIC EDUCATION AND OUTREACH CONCERNING THE DANGERS OF TORNADOES AND HIGH WINDS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS |
| ANTICIPATED COST | $500 |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY GENERAL FUND |
| RESPONSBILE JURISDICTION | MONTGOMERY COUNTY |
| ADDITIONAL JURISDICTIONS | CHEVY CHASE SECTION 5 |
| TIMEFRAME | 3 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-9: Updated Actions for Montgomery County – Tornado**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Evaluate the feasibility for constructing a community saferoom | Deleted | Determined to be Unfeasible | |
| Promote enhanced anchoring of manufactured homes | Carried Over | Ongoing | |
| Public education and outreach concerning the dangers of tornadoes and high winds | Carried Over | Ongoing | |

# EARTHQUAKE MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Earthquake Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Standard building codes can provide Montgomery County with reasonable guidance for development throughout unincorporated and incorporated areas. However, contractors and builders should be aware of applicable codes and regulations designed to reduce losses sustained by new and existing construction due to seismic hazards.

## NEW BUILDINGS AND INFRASTRUCTURE

The light weight of wood frame buildings results in less force from inertia. Less force means less damage. Wood's natural flexibility also is an advantage when seismic forces are brought to bear and the nailed joints in wood frame buildings dissipate energy and motion.

But wood's inherent earthquake resistance must be accompanied by design and construction techniques that take advantage of those characteristics. Structural wood panels nailed to wall framing add rigid bracing, help resist lateral loads, and tie framing members together. Bolted connections at the sill plate/foundation joint help keep the structure in one spot. Securely connected wall, floor, and roof framing also help tie a structure together and make it a single, solid, structural unit. Proper connections will do more to hold a house together during an earthquake than any other single seismic design element.

As development grows in the County and its municipalities, it will be important for citizens to consult with local building codes as modern building codes generally require seismic design elements for new construction.

## EXISTING BUILDINGS AND INFRASTRUCTURE

The county's entire structural inventory is vulnerable to earthquake. An earthquake occurring in Montgomery County could cause widespread impacts, with the greatest threat to the public safety occurring on major roads and highways. Power outages caused by downed power lines could impact critical facilities such as fire protection, law enforcement, and hospitals. Montgomery County's priority is to continue operation of existing buildings and infrastructure, especially critical facilities and infrastructure, after an earthquake has occurred.

## MITIGATION ACTION PLAN

| Mitigation Action 9.1.1* | |
|---|---|
| **CONTINUE TO PROMOTE EARTHQUAKE PREPAREDNESS THROUGH PUBLIC OUTREACH** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY, ALL MUNICIPALITIES |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, MUNICIPAL FUNDS |
| RESPONSBILE JURISDICTION | MONTGOMERY COUNTY, ALL MUNICIPALITIES |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | LOW |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

*Action originally from 2007 Plan

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-10: Updated Actions for Montgomery County - Earthquake**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Continue to promote earthquake preparedness through public outreach* | | Deferred | This action had a low response rate recommended to carry over |

*Action originally from 2007 Plan

# LAND SUBSIDENCE/KARST MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the Land Subsidence/Karst Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE

Restricting the use of land and establishing minimum standards for avoiding areas prone to landslide, erosion, and mine subsidence is one approach that Montgomery County is aware of and it will continue to remain proactive in future planning endeavors.

## NEW BUILDINGS AND INFRASTRUCTURE

As development grows in the County and its municipalities, it will be a priority to cross-check these at-risk areas with new development. Further, there is a high potential for soil piping and/or erosion caused by leakage from drainage pipes, culverts, etc. and it should also be taken into account for both new and existing infrastructure.

Areas that are generally prone to landslide hazards include previous landslide areas; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past; relatively flat-lying areas away from sudden changes in slope; and areas at the top or along ridges, set back from the tops of slopes.

## EXISTING BUILDINGS AND INFRASTRUCTURE

It should be considered that minor landslide events are possible for buildings and infrastructure located in localized, steep-slope areas during extremely wet conditions. If an existing building and/or infrastructure are in a mine subsidence area, mitigation action can and should be taken to avoid further risk and potential losses.

## MITIGATION ACTION PLAN

| **Mitigation Action 10.1.1** | |
|---|---|
| **ENCOURAGE COUNTY AND MUNICIPAL OFFICES TO REVIEW REGULATIONS PERTAINING TO THEIR JURISDICTION TO ENSURE THAT ADEQUATE LOCAL REGULATIONS ARE IN PLACE TO REDUCE FUTURE DEVELOPMENT IN HIGH-HAZARD AREAS** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS, ALL MUNICIPALITIES |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUND, MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL MUNICIPALITIES |
| ADDITIONAL JURISDICTIONS | N/A |
| TIMEFRAME | CONTINUOUS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-11: Updated Actions for Montgomery County - Land Subsidence/Karst**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Encourage County and municipal offices to review regulations pertaining to their jurisdiction to ensure that adequate local regulations are in place to reduce future development in high-hazard areas | Carried over | Ongoing | |

# ALL HAZARDS MITIGATION STRATEGY

## IDENTIFICATION AND ANALYSIS OF RANGE OF MITIGATION OPTIONS

The Montgomery County Mitigation Planning Committee considered a range of mitigation options for the All Hazards Mitigation Strategy.

## EXISTING POLICIES, REGULATIONS, ORDINANCES, AND LAND USE / NEW BUILDINGS AND INFRASTRUCTURE

Regulations, codes, standards, and best practices will guide the design of buildings to resist natural hazards. For new buildings, code requirements serve to define the minimum mitigation requirements, but compliance with regulations in building design is not sufficient to guarantee that a facility will perform adequately when impacted by the forces for which it was designed. Indeed, individual evaluation of the costs and benefits of specific hazard mitigation alternatives can lead to effective strategies that will exceed the minimum requirements. Additionally, special mitigation requirements may be imposed on projects in response to locale-specific hazards. When a change in use or occupancy occurs, the designer must determine whether this change triggers other mitigation requirements and must understand how to evaluate alternatives for meeting those requirements.

## EXISTING BUILDINGS AND INFRASTRUCTURE

Buildings in any geographic location are subject to a wide variety of natural phenomena such as windstorms, floods, wildfire, and other hazards. While the occurrence of these incidents cannot be precisely predicted, their impacts are well understood and may be reduced through a comprehensive program of hazard mitigation planning.

A variety of techniques is available to mitigate the effects of natural hazards on the built environment. Depending on the hazards identified, the location and construction type of a proposed building or facility, and the specific performance requirements for the building, the structure can be designed to resist hazard effects such as induced loads. Later in the building's life cycle, additional opportunities to further reduce the risk from natural hazards may exist when renovation projects and repairs of the existing structure are undertaken. When incorporating disaster reduction measures into building design, some or all of the issues outlined below should be considered in order to protect lives, properties, and operations from damages caused by natural hazards.

## MITIGATION ACTION PLAN

| Mitigation Action 13.1.1 | |
|---|---|
| **CONDUCT PUBLIC EDUCATION AND OUTREACH ON ALL NATURAL, TECHNOLOGICAL, AND THREAT-INDUCED HAZARDS FOR THE CITIZENS OF MONTGOMERY COUNTY** | |
| RESPONSIBLE DEPARTMENT | MONTGOMERY COUNTY OEMHS, ALL MUNICIPALITIES |
| ANTICIPATED COST | STAFF TIME AND RESOURCES |
| EXISTING & POTENTIAL FUNDING SOURCES | COUNTY FUNDS, MUNICIPAL FUNDS |
| RESPONSIBLE JURISDICTION | MONTGOMERY COUNTY, ALL MUNICIPALITIES |
| ADDITIONAL JURISDICTIONS | ROCKVILLE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | CARRIED OVER |

| New Mitigation Action 13.1.2 | |
|---|---|
| **PLANNING, DESIGNING AND HARDENING AND/OR PROVIDING BACKUP POWER TO THE POTOMAC WATER FILTRATION PLANT** | |
| RESPONSIBLE DEPARTMENT | WSSC |
| ANTICIPATED COST | 800,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | EPA or HMA |
| RESPONSIBLE JURISDICTION | WSSC |
| ADDITIONAL JURISDICTIONS | |
| TIMEFRAME | 4 Years |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 13.1.3 | |
|---|---|
| **PROVIDING BACKUP POWER TO THE TWO WSSC MAINTENANCE DEPOTS FOR MONTGOMERY COUNTY IN LYTTONSVILLE AND GAITHERSBURG TO ENSURE CONTINUITY OF EMERGENCY RESPONSE/MAINTENANCE SERVICE REGARDLESS OF POWER AVAILABILITY** | |
| RESPONSIBLE DEPARTMENT | WSSC |
| ANTICIPATED COST | 800,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | EPA or HMA |
| RESPONSIBLE JURISDICTION | WSSC |
| ADDITIONAL JURISDICTIONS | |
| TIMEFRAME | 4 Years |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 13.1.4 | |
|---|---|
| **PLANNING, DESIGNING AND HARDENING AND/OR PROVIDING BACKUP POWER TO SENECA WATER RESOURCE RECOVERY FACILITY (WASTEWATER) WHICH DOES NOT CURRENTLY HAVE SUFFICIENT BACKUP POWER GENERATION FOR THE COMPLETE WATER RECOVERY PROCESS** | |
| RESPONSIBLE DEPARTMENT | WSSC |
| ANTICIPATED COST | 500,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | EPA or HMA |
| RESPONSIBLE JURISDICTION | WSSC |
| ADDITIONAL JURISDICTIONS | |
| TIMEFRAME | 4 Years |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 13.1.5 | |
|---|---|
| **ROCKVILLE MAINTENANCE AND EMERGENCY OPERATIONS FACILITY IMPROVEMENTS** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | TBD |
| EXISTING & POTENTIAL FUNDING SOURCES | CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | MEDIUM |
| STATUS (CARRIED OVER OR NEW) | NEW |

| New Mitigation Action 13.1.6 | |
|---|---|
| **PURCHASE NEW EMERGENCY BORADCAST RADIO SYSTEM TO ENABLE CITY-WIDE CONNECTIVITY FOR ROCKVILLE AND ADJACENT MUNICIPALITIES** | |
| RESPONSIBLE DEPARTMENT | CITY OF ROCKVILLE, DEPARTMENT OF PUBLIC WORKS |
| ANTICIPATED COST | $75,000 |
| EXISTING & POTENTIAL FUNDING SOURCES | CAPITAL BUDGET |
| RESPONSIBLE JURISDICTION | CITY OF ROCKVILLE AND ADJACENT COMMUNITIES |
| ADDITIONAL JURISDICTIONS | NONE |
| TIMEFRAME | 5 YEARS |
| STAPLEE PRIORITY | HIGH |
| STATUS (CARRIED OVER OR NEW) | NEW |

## COMPLETED, DEFERRED, DELETED, OR NEW ACTION STEPS FROM THE 2013 PLAN

**Table 4-12: Updated Actions for Montgomery County - All Hazards**

| 2013 ACTION | 2018 UPDATE ACTION | STATUS | NOTES |
|---|---|---|---|
| Conduct public education and outreach on all natural, technological, and threat-induced hazards for the | Carried over | Ongoing | |

| | | | |
|---|---|---|---|
| citizens of Montgomery County | | | |
| N/A | Planning, designing and hardening and/or providing backup power to the Potomac water filtration plant | New | |
| N/A | Providing backup power to the two WSSC maintenance depots for Montgomery county in Lyttonsville and Gaithersburg to ensure continuity of emergency response/maintenance service regardless of power availability | New | |
| N/A | Planning, designing and hardening and/or providing backup power to Seneca water resource recovery facility (wastewater) which does not currently have sufficient backup power generation for the complete water recovery process | New | |
| N/A | Rockville Maintenance and Emergency Operations Facility Improvements | New | |
| N/A | Purchase new radio system to enable city-wide connectivity for Rockville and adjacent municipalities | New | |

# 5. CAPABILITY ASSESSMENT, IMPLEMENTATION, AND PLAN MAINTENANCE PROCEDURES

*A5. Is there discussion on how the communities will continue public participation in the plan maintenance process? 44 CFR 201.6(c)(4)(iii)*
*A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? 44 CFR 201.6(c)(4)(i)*
*E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? 44 CR 201.6(c)(5)*
*E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? 44 CFR 201.6(c)(5)*

## CAPABILITY ASSESSMENT

This portion of the Plan assesses the current capacity of the communities of Montgomery County to mitigate the effects of the natural hazards identified in the Hazard Identification and Risk Assessment section of the Plan. This assessment includes a comprehensive examination of the following local government capabilities:

- *Administrative Capability* – describes the forms of government in the County, including the departments that may be involved in hazard mitigation.
- *Technical Capability* – addresses the technical expertise of local government staff.
- *Fiscal Capability* – examines budgets and currently used funding mechanisms.
- *Policy and Program Capability* – describes past, present, and future mitigation projects in the County and examines existing plans (e.g., emergency operations plan, comprehensive plan).
- *Legal Authority* – describes how jurisdictions in the region use the four broad government powers (i.e., regulation, acquisition, taxation, and spending) to influence hazard mitigation activities.

The purpose of conducting the capability assessment is to assess methods that Montgomery County local governments have available to implement successful mitigation programs. Through careful analysis, any existing gaps, shortfalls, or weaknesses within existing governmental activities that could exacerbate a community's vulnerability were identified. The assessment also highlights the positive measures underway at the local level that will continue to be supported and enhanced through future mitigation efforts.

# CHAPTER 5 CAPABILITY ASSESSMENT, IMPLEMENTATION, AND PLAN MAINTENANCE PROCEDURES

The capability assessment serves as the foundation for designing an effective hazard mitigation strategy. It not only helps inform plan goals to be both achievable but aspirational to reduce the County's exposure to natural hazards. To inform this capability assessment, each jurisdiction completed a worksheet that reviewed their current administrative, technical, fiscal, programmatic, and legal capabilities. Additionally, each jurisdiction completed a survey to qualitatively review their current hazard mitigation capabilities. Overall trends noted in the jurisdiction surveys related to hazard mitigation capabilities include a generally good impression and well supported, County reliance, the limited capabilities of the National Park Service for funding support, and that emergency support staff and funds are needed across the County. The following sections go into further detail of the results, and the full surveys are included in APPENDIX D.

Table 5-1 summarizes those jurisdictions that perform key administration functions. For the most part, jurisdiction self-evaluations determined that jurisdictions are well covered by emergency services, law enforcement, and fire departments. Please note that all jurisdictions except Chevy Chase View, North Chevy Chase and Laytonsville participated in the survey. Numerous attempts were made to contact the communities however, multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase. A list of participating jurisdictions and the point of contact is listed in Table 1-3 (planning Process)

**Table 5-1: Jurisdiction Administrative Capabilities**

| JURISDICTION | BUILDING / PLANNING / ZONING | EMERGENCY SERVICES (Consolidated at County Level) | LAW ENFORCEMENT (Consolidated at County Level- Exceptions: Rockville, Gaithersburg, and Takoma Park ) | FIRE DEPARTMENT |
|---|---|---|---|---|
| Barnesville | x | x | x | x |
| Brookeville | x | x | x | x |
| Chevy Chase Section 3 | | x | x | x |
| Chevy Chase Section 5 | | x | x | x |
| Chevy Chase | x | x | x | x |
| Chevy Chase View* | | | | |
| Chevy Chase Village | x | x | x | x |
| Rockville | x | x | X | x |
| Gaithersburg | x | x | X | x |
| Garrett Park | x | x | x | x |
| Glen Echo | | x | x | x |
| Kensington | x | x | x | x |
| Laytonsville* | | | | |
| Martin's Addition | x (contracted) | x | x | x |
| North Chevy Chase* | | | | |
| Poolesville | x | x | x | x |
| Somerset | | x | x | x |
| Takoma Park | x | x | X | x |
| Washington Grove | x | x | x | x |

| | | | | |
|---|---|---|---|---|
| Montgomery County | x | x | x | x |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

## TECHNICAL CAPABILITY

Mitigation is multi-disciplinary. For a successful mitigation program, it is necessary to have a broad range of people involved who can inform and contribute to holistic mitigation programs through diverse backgrounds and experience. Mitigation process participant diversity can further include additional local planners, engineers, building inspectors, emergency managers, floodplain managers, Geographic Information Systems (GIS) analysts and grant writers.

GIS systems include the hardware, software and technicians that collect, manage, analyze and display spatially-referenced data. Many local governments are now incorporating GIS systems into their existing planning and management operations. GIS is invaluable in identifying areas vulnerable to hazards. Improved online archived technical information has greatly improved update processes and quality of emergency operations plans, continuity of operations plans, hazard mitigation plans and emergency management, resiliency and mitigation messaging. This increases community resiliency, especially outreach efforts using social media.

Table 5-2 summarizes the technical capabilities of the jurisdictions per their self-rated assessment.

As demonstrated in Table 5-2, with the exception of Gaithersburg, many jurisdictions in Montgomery County either contract out many hazard mitigation related positions, or rely on the County.

**Table 5-2: Jurisdiction Technical Capabilities**

| Jurisdiction | Land Use/ Development Zoning/ | Building Inspector | Engineering | Emergency Manager | Floodplain Manager | GIS | Grants | Comments |
|---|---|---|---|---|---|---|---|---|
| Barnesville | | | | | | | | Contracted |
| Brookeville | | | | | | | | Contract with either County or State |
| Chevy Chase Section 3 | | | | | | | | Rely on County |
| Chevy Chase Section 5 | | | | | | | | |
| Chevy Chase | | | Contract | | | | | Rely on County |
| Chevy Chase View* | | | | | | | | |
| Chevy Chase Village | | | Contract | x | | Have ESRI but need training on how to use it. | | |
| Gaithersburg | x | x | x | x | x | x | x | |

**Table 5-2: Jurisdiction Technical Capabilities**

| Jurisdiction | Land Use/ Development Zoning/ | Building Inspector | Engineering | Emergency Manager | Floodplain Manager | GIS | Grants | Comments |
|---|---|---|---|---|---|---|---|---|
| Garrett Park | x | | Contract | x | | | | |
| Glen Echo | | | | | | | | Rely on County |
| Kensington | x | x | Contract | | | | | |
| Laytonsville* | | | | | | | | |
| Martin's Addition | | x | Contract | | | Contract | | |
| North Chevy Chase* | | | | | | | | |
| Poolesville | x | | x | x | x | | | |
| Rockville | x | x | x | x | x | x | x | |
| Somerset | | Contract | Contract | | | | x | |
| Takoma Park | | | x | x | | x | x | |
| Washington Grove | x | | x | | | | | |
| Montgomery County | x | x | x | x | x | x | x | x |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

## FISCAL CAPABILITY

For Fiscal Year 2018, the budgets of the participating jurisdictions vary widely, ranging from about $100,000 (Barnesville) to $9 million (Gaithersburg). Revenues which support local budgets come from property taxes, State and local sales taxes, local service fees, and through restricted intergovernmental contributions (federal and state pass through dollars). Mitigation projects have been funded through FEMA's post-disaster Hazard Mitigation Grant Program (HMGP). Considering current budget challenges combined with trends in reduced federal support to state and local governments, funding for future mitigation work could be a challenge.

FY 2018 budgets provided by local jurisdiction representatives are shown in Table 5-3.

**Table 5-3: Jurisdiction Fiscal Capability**

| Jurisdiction | Total FY 2018 Budget | Public Safety FY 2018 Budget |
|---|---|---|
| Barnesville | $102,000 | $20,000 |
| Brookeville | N/A | N/A |
| Chevy Chase Section 3 | | |
| Chevy Chase Section 5 | $425,000 | Roughly $30,000 |
| Chevy Chase | $2,600,000 | $340,000 to pay for off duty policing patrol. |
| Chevy Chase View* | | |
| Chevy Chase Village | | |

| Table 5-3: Jurisdiction Fiscal Capability | | |
|---|---|---|
| Jurisdiction | Total FY 2018 Budget | Public Safety FY 2018 Budget |
| Gaithersburg | $9,210,085 | |
| Garrett Park | 0 | 0 |
| Glen Echo | $302,000 | 0 |
| Kensington | $2,900,000 | $233,836 |
| Laytonsville* | | |
| Martin's Addition | $1,000,000 | |
| North Chevy Chase* | | |
| Poolesville | $3,478,478 | All services provided by the County |
| Rockville | $130,300,000 | $11,529,590 |
| Somerset | | |
| Takoma Park | | |
| Washington Grove | $635,432 | $29,500 |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

## POLICY AND PROGRAM CAPABILITY

Local officials generally felt that their government capacity, through staffing, technical expertise and programs was at least moderate in most areas. However, some jurisdictions, such as Brookeville, Garrett Park, Martin's Addition, Somerset, and Kensington, are reliant on the County for their policy and programs capabilities. Table 5-4 provides a summary of public services that are offered by local jurisdictions. The gaps in this table represent areas were capabilities are limited in local jurisdictions. All jurisdictions are lacking in evacuation plans, Firewise and storm ready capabilities. All jurisdictions have adopted the 2013 Montgomery County's Hazard Mitigation Plan through local resolution.

| Table 5-4: Jurisdiction Policy and Program Capabilities | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jurisdiction | Hazard Mitigation Plan | Emergency Operations Plan | Evacuation Plan | Continuity of Operations Plan | Floodplain Management Ordinance | Comprehensive Land Use Plan (or General, Master, or Growth Management Plan) | Stormwater Management Plan | Natural Resource Protection Plan | Capital Improvement Plan | Firewise Community | Storm Ready |
| Barnesville | x | | | | | x | | x | | | |
| Brookeville | x | | | | | x | | | | | |
| Chevy Chase Section 3 | x | | | | | | | | | | |
| Chevy Chase Section 5 | x | | | | | | | | | | |
| Chevy Chase | x | | | x | | | | | | | |
| Chevy Chase View* | | | | | | | | | | | |

**Table 5-4: Jurisdiction Policy and Program Capabilities**

| Jurisdiction | Hazard Mitigation Plan | Emergency Operations Plan | Evacuation Plan | Continuity of Operations Plan | Floodplain Management Ordinance | Comprehensive Land Use Plan (or General, Master, or Growth Management Plan) | Stormwater Management Plan | Natural Resource Protection Plan | Capital Improvement Plan | Firewise Community | Storm Ready |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Chevy Chase Village | x | x | | x | x | | x | | x | | |
| Gaithersburg | x | x | | x | x | x | x | x | x | x | |
| Garrett Park | x | | | | | | | x | x | | |
| Glen Echo | x | | | | | | | | IP | | |
| Kensington | x | | | | | | | | x | | |
| Laytonsville* | | | | | | | | | | | |
| Martin's Addition | x | | | | | | | | | | |
| North Chevy Chase* | | | | | | | | | | | |
| Poolesville | x | | | | | | | | | | |
| Rockville | x | x | | x | x | x | x | | x | | |
| Somerset | x | | | | | | | | x | | |
| Takoma Park | x | | | | | | | | | | |
| Washington Grove | x | | | | | x | x | | x | | |
| Montgomery County | x | x | | x | x | x | x | x | x | | |
| Rockville | x | x | | x | x | | | | x | | |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

IP = In progress

### Emergency Operations Plan

The Montgomery County Emergency Operations Plan (EOP) is a multi-discipline, all-hazards plan that establishes a single, comprehensive framework for the management of major emergencies and disasters within the county. The plan is implemented by the Emergency Management Group (EMG) when it becomes necessary to mobilize the resources identified herein in order to save lives, and protect property and infrastructure. The EOP incorporates the National Incident Management System (NIMS) as the County standard for incident management and reflects other changes resulting from the adoption of the National Response Framework in 2008. The plan also has been developed in compliance with the Emergency Management Accreditation Program (EMAP) standards.

The EOP assigns roles and responsibilities to County departments, offices, and municipalities mobilized as the EMG for use during pre-planned events and in response to disasters and emergencies. The EOP is

not intended as a standalone document but rather establishes the basis for more detailed planning by the individual departments and offices. The EOP is intended to be used in conjunction with more detailed department/office plans and operating procedures. Section Two contains the 17 separate Emergency Support Functions (ESF). Each ESF is broken out by the Primary Agency, Support Agencies, and Cooperating Agencies and spells out the responsibilities for each agency.

The successful implementation of the plan is contingent upon a collaborative approach with a wide range of cooperating organizations that provide crucial and critical support as the EMG during emergency operations. The plan recognizes the significant role cooperating organizations perform during times of emergencies and disasters and their roles and responsibilities are also included in the plan. Separate memoranda of understanding will be established and maintained with each of these organizations.

The EOP is organized into two sections. Section One is the Base Plan and includes the federal, state, and County authorities and other references that provide the basis for this plan. This section establishes the planning assumptions for the plan and defines the emergency management roles and responsibilities for County Executive (CE), the County Council, the Chief Administrative Officer (CAO), departments, offices, and cooperating organizations. Section One also contains background information on Montgomery County including demographic data, a description of the County, a summary of the County's Hazard Identification and Risk Assessment (HIRA), and a summary of major transportation features.

### Comprehensive Land Use Planning

Regulatory powers granted by the state to local governments are the most basic manner in which a local government can control the use of land within its jurisdiction. Through various land use regulatory powers, a local government can control the amount, timing, density, quality, and location of new development. All these characteristics of growth can determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, and to enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls. Each local community possesses great power to prevent unsuitable development in hazard-prone areas.

According to State Statutes, local governments in Montgomery County may create or designate a planning agency. The planning agency may perform a number of duties, including:

- Make studies of the area;
- Determine objectives;
- Prepare and adopt plans for achieving those objectives;
- Develop and recommend policies, ordinances, and administrative means to implement plans;
- Perform other related duties.

The M-NCPPC Montgomery County Planning Department is responsible for developing master plans, reviewing applications for development and analyzing various types of information to help public officials plan for Montgomery County's future. Each community within Montgomery County has a master plan that creates a comprehensive view of land use trends and future development.

Plans recommend land uses, zoning, transportation, schools, parks, libraries, and fire and police stations as well as address housing, historic preservation, pedestrian and trail systems and environmental issues.

Montgomery Planning has two (2) tree programs in place: 1) Leaves for Neighborhoods and 2) Shades of Green. The latter is a new program to encourage tree plantings by property owners in urban areas. Both programs, implemented after the 2013 Hazard Mitigation Plan, focus on areas that are in addition to our other County forestation efforts in conservation areas.

- Leaves for Neighborhoods: The Planning Department provides a subsidy to participating nurseries for the planting of new native trees anywhere in Montgomery County.
- Shades of Green: The Planning Department will plant FREE trees on private land within the Central Business Districts of Montgomery County.

### Natural Resource Protection

The M-NCPPC's Montgomery County Planning Board, through its extensive system of parks and its planning and regulatory activities, protects Montgomery County's natural resources as it balances the competing needs of the larger community.

As a planning and regulatory agency as well as a land owner, the M-NCPPC safeguards the County's environment through natural resources planning, development planning, and review of development projects, as well as land acquisition and conservation of County parklands. Staff carry out a comprehensive program for the planning and management of County-wide natural resources (on private lands) and resources on lands under the stewardship of the M-NCPPC (public parklands).

M-NCPPC responsibilities are mandated by Article 28 of the Annotated Code of Maryland and more recent environmental law and policy, including the County's General Plan and amendments (i.e, area and functional master plans, including the Park Recreation and Open Space (PROS) Plan), forest conservation and wetland legislation, federal National Pollution Discharge Elimination System (NPDES) requirements for park maintenance facilities, and the Maryland Economic Growth, Resource Protection, and Planning Act of 1992.

M-NCPPC collect and analyze natural resources data needed for effective land use and land management decision-making from both the biological and planning aspects for best natural resources management. M-NCPPC's four-fold functions of inventory, planning, management, and research allow us to serve our customers including private citizens, the business community, other planning divisions, park managers, and federal, state, regional, and County government agencies.

Resource mapping; resource planning; support in development of area master plans, functional master plans, and park master plans; environmental review of development proposals, including management of the County forest conservation program; stewardship and enhancement of forest, aquatic, and wildlife ecology; and special projects. In addition, the document, "White Tail Deer in Montgomery County, Maryland", explains the County's deer management strategies.

This organization balances healthy community development with effective natural resources protection and enhancement for the benefit of current and future generations of Montgomery County residents and visitors.

Programs for the enjoyment of the County's natural, historical, and archaeological resources are offered through the park system's nature centers, historic sites and interpretive programs.

### Capital Improvements Plan

Hazard mitigation principles can be made a routine element of all spending decisions made by local governments, including during adoption of annual budgets and the Capital Improvement Plan (CIP) for protection of critical facilities.

A CIP is a schedule for provision of town or County services over a specified period of time. By tentatively committing itself to a timetable for the provision of capital to extend services, a community can control growth in areas where the provision of on-site sewage disposal and water supply are unusually expensive.

In addition to forming a timetable for provision of services, a local community can regulate the extension of and access to services. A CIP that is coordinated with extension and access policies can provide a significant degree of control over the location and timing of growth. These tools also can influence the cost of growth. If the CIP is effective in directing growth away from environmentally sensitive or high hazard areas, for example, it can reduce environmental costs.

The Montgomery County Charter (Section 302) requires the County Executive to submit a comprehensive six-year program for capital improvements, called the Capital Improvements Program (CIP), not later than January 15 of each even-numbered calendar year. The Charter requires that the annual capital budget be consistent with the six-year program. In odd-numbered calendar years, the approved CIP, together with any amendments, continues to guide capital investment.

The CIP includes all capital projects for all agencies for which the County sets tax rates or approves budgets or programs. The CIP includes:

- a statement of the objectives of capital programs;
- the relationship of capital programs to the County's long-range development plans;
- recommendations for capital projects and their construction schedules; and
- estimates of costs, anticipated revenue sources, and impacts of the capital program on County revenues and the operating budget.

The County Charter (Section 302) also provides that the CIP may be amended at any time. In practice, amendments to the CIP are limited to conform to the requirement for a biennial, or every other year, CIP. Criteria for amendments generally include: use of funds from external sources; projects which address significant health or safety requirements; and economic development opportunities.

Planning for capital improvements is tied to the County's continuing development and growth in population, numbers of households, and businesses. Land use master plans and sector plans for the County's geographic planning areas anticipate needs for roads, schools, and other facilities required by new or changing population. The County continues its efforts to improve the linkages between County planning activities, the CIP and the Operating Budget.

### Climate Action Plan

Montgomery County, Maryland has been a national leader in addressing climate change. From the early adoption of climate protection objectives to the implementation of ground-breaking programs designed to expand the use of clean energy, increase the energy efficiency of buildings, or develop new transportation initiatives, the County has sought effective and innovative solutions to reducing the County's climate footprint. This 2009 Climate Protection Plan represents the next major step in the County's efforts. The Plan contains 58 specific recommendations across a broad spectrum of activities to ensure that Montgomery County remains at the forefront of local governments addressing climate change.

The Sustainability Working Group (SWG) consists of 26 representatives, 15 from the County government, County agencies or regional organizations, and 11 from the public. To help with the development of the Plan, the SWG established committees to look more closely at issues in seven distinct areas:

- Renewable Energy
- Residential Building Energy Efficiency
- Commercial/Multi-Family/Public Building Energy Efficiency
- Transportation
- Forestry & Agriculture
- Long-Term Planning (including Land Use Planning)
- Education & Outreach

### Watershed Restoration Implementation Strategy

Local floodplain management programs are supported by Maryland's National Floodplain Management Program Coordinator and assigned staff. Technical assistance is provided by in-person Community Assistance Visits (CAVs), check in phone interviews called Community Assistance Contacts (CACs) which consists of a program "check-in" or address specific technical issues or situations. CAVs are performed on a two to three year rotation. All Montgomery County communities are in good standing with the National Flood Insurance Program (NFIP) and the state NFIP Coordinator's office, continuing property owner and renter eligibility for flood insurance purchase and FEMA HMA grant program participation.

Recognizing the potential risks associated with projected changes in climate, Montgomery County has already begun to establish initiatives to reduce impacts on the environment and increase resiliency to hazardous events. The Department of Environmental Protection (DEP) is the lead agency in Montgomery County dedicated to improving stream health and water quality by fostering strong partnerships with communities to improve water quality and restore natural ecosystems through innovative watershed planning and design. The following is a list of activities and that make up the DEPs Watershed Restoration program.

Tree Montgomery **https://treemontgomery.org/**

Tree Montgomery is a FREE program to plant shade trees across the County. The goal is simple – to plant shade trees and increase the tree canopy to provide a wide array of benefits for residents, businesses and the County.

Leaves for Neighborhoods http://montgomeryplanning.org/planning/environment/forest-conservation-and-trees/leaves-for-neighborhoods/

The Planning Department provides a subsidy to participating nurseries for the planting of new native trees anywhere in Montgomery County.

Shades of Green http://montgomeryplanning.org/planning/environment/forest-conservation-and-trees/shades-of-green/

The Planning Department will plant FREE trees on private land within the Central Business Districts of Montgomery County. Shades of Green is a new program to encourage tree plantings by property owners in urban areas.

Both programs implemented after the 2013 Hazard Mitigation Plan and assist in areas that are in addition to our forestation efforts in conservation areas.

Green Streets **https://www.montgomerycountymd.gov/water/restoration/green-streets.html**

Green Streets are roadway landscaping designs that reduce and filter stormwater runoff. Green Streets are part of a County initiative to capture stormwater runoff in neighborhoods with minimal stormwater controls and not enough open space for larger stormwater practices. They use Low Impact Development (LID) and are constructed within the street right-of-ways. When the County considers installing a Green Street, they take into account factors like utilities, existing drainage patterns, soils, tree impacts, the amount of runoff volume, and many other considerations.

RainScapes **https://www.montgomerycountymd.gov/water/rainscapes/index.html**

A RainScape is a landscape or design technique that helps reduce stormwater runoff from individual properties. They include: Rain Gardens, Conservation Landscapes, Green Roofs, Rain Barrels, Permeable Pavement, Pavement Removal

RainScapes can be installed on any kind of property, but those on private residential, institutional, and/or commercial properties may be eligible for financial assistance: RainScapes Rewards Rebates. The RainScapes program also offers technical and financial assistance to encourage property owners to implement RainScapes techniques on their property.

Stormwater Regulation **https://www.montgomerycountymd.gov/water/stormwater/ms4.html**

For most urban areas like Montgomery County, what goes into our storm drains (stormwater) makes its way into our local streams. Those streams are part of larger watersheds that lead to major rivers, like the Potomac River, and eventually the Chesapeake Bay. Because our waters are interconnected and not defined by County or state lines, the federal government regulates everything that goes through storm drain systems.

The federal government regulates storm drains through a permit process called the Municipal Separate Storm Sewer System Permit Program (MS4 Permit Program). The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Montgomery County has mandates the County to meet certain water quality standards.

Montgomery County Coordinated Implementation Strategy
**https://www.montgomerycountymd.gov/DEP/Resources/Files/ReportsandPublications/Water/Countywide%20Implementation%20Strategy/Countywide-coordinated-implemented-strategy-12.pdf**

The County is currently in a consent decree with MDE and will complete all work under this expired permit by the end of CY2018. The Strategy identifies the following general priorities:

- Implement watershed restoration projects
- Focus on Environmental Site Design projects in urban areas on public and private properties
- Implement key initiatives in the Public Education and Outreach Workplan
- Implement only the most cost efficient individual watershed strategies

Water Quality Protection Charge **https://www.montgomerycountymd.gov/water/wqpc/index.html**

The Water Quality Protection Charge (WQPC) is a part of Montgomery County property tax bills. The WQPC funds are used to improve the water quality of our streams and reduce the impacts of stormwater runoff.

The WQPC is calculated based on the potential for a property to contribute to stormwater runoff. Typically, a larger, more developed property produces more runoff, and therefore, receives a higher charge.

Stormwater Management Facilities
**https://www.montgomerycountymd.gov/water/stormwater/practices.html**

Stormwater management facilities come in many shapes and sizes, from large regional ponds to small backyard measures. There are also many underground structures beneath parking lots and roadways that no one ever sees.

Stormwater management facilities help maintain the ecological integrity, quantity and quality of our water resources. These facilities control stormwater and thereby reduce the harmful effects of uncontrolled stormwater, such as flooding and poor water quality. They control stormwater by releasing stormwater slowly and/or by reducing the amount of stormwater.

While all stormwater management facilities play a role in improving water quality, some facilities are more desirable by virtue of their benefit to the environment and level of stormwater treatment. The more desirable practices such as small-scale practices (e.g. rain gardens and cisterns) or wetlands, preserve the natural hydrologic conditions and/or use plants and infiltration to treat stormwater. The County provides various incentives for the installation and maintenance of these types of facilities.

Stormwater Facility Maintenance Program
**https://www.montgomerycountymd.gov/water/stormwater/maintenance.html**

The Stormwater Facility Maintenance Program is responsible for inspecting and ensuring maintenance of all public and private stormwater management facilities within Montgomery County (excluding the municipalities of City of Rockville, Gaithersburg and Takoma Park).

DEP is responsible for more than 12,000 facilities. It is vital that these structures be maintained in working order so they function as intended, providing protection and stormwater management for our parks, schools, and businesses.

Montgomery County's Department of Environmental Protection (DEP) watershed restoration programs are restoring stream valleys, improving water quality and addressing historical damage caused by urban stormwater pollution. Watershed restoration is a regulatory requirement of the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit.

This Countywide Coordinated Implementation Strategy (the Strategy) document presents the restoration strategies that are needed to meet the watershed-specific restoration goals and water quality standards as specified in the current MS4 permit. Specifically, the Strategy will provide the planning basis for the County to:

- Meet Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) approved by EPA.
- Provide additional stormwater runoff management on impervious acres equal to 20% of the impervious area for which runoff is not currently managed to the maximum extent practicable (MEP).
- Meet commitments in the Trash Free Potomac Watershed Initiative 2006 Action Agreement which include support for regional strategies and collaborations aimed at reducing trash, increasing recycling, and increasing education and awareness of trash issues throughout the Potomac Watershed.
- Educate and involve residents, businesses, and stakeholder groups in achieving measurable water quality improvements.
- Establish a reporting framework that will be used for annual reporting as required in the County's NPDES MS4 Permit.
- Identify necessary organizational infrastructure changes needed to implement the Strategy.

## LEGAL AUTHORITY CAPABILITIES BY JURISDICTION

The importance of the planning powers of local governments is illustrated by the requirement that zoning regulations be made in accordance with a comprehensive plan. While the ordinance itself may provide evidence that zoning is being conducted "in accordance with a plan," the existence of a separate planning document ensures that the government is developing regulations and ordinances that are consistent with the overall goals of the community.

Zoning is the traditional and most common tool available to local governments to control the use of land. Broad enabling authority is granted for municipalities and counties in Maryland to engage in zoning. Land ''uses" controlled by zoning include the type of use (e.g., residential, commercial, and industrial) as well as minimum specifications that control height and bulk such as lot size, building height and setbacks, and density of population. Local governments are authorized to divide their territorial

jurisdiction into districts, and to regulate and restrict the erection, construction, reconstruction, alteration, repair or use of buildings, structures, or land within those districts. Districts may include general use districts, overlay districts, and special use or conditional use districts. Zoning ordinances consist of maps and written text.

Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision regulations are included in the floodplain management ordinance, requiring developers to install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. They also may prohibit the subdivision of land subject to flooding unless flood hazards are mitigated through filling or other measures, and they prohibit filling of floodway areas.

Table 5-5 summarizes each jurisdiction's legal capabilities related to hazard mitigation planning. Zoning regulations have the highest number of jurisdictions with legal authority, followed by building code, subdivision regulations, and floodplain ordinances. It is evident from the table that jurisdictions rely on the County for many legal authorities.

**Table 5-5: Legal Authority Capabilities by Jurisdiction**

| JURISDICTION | FLOODPLAIN MANAGEMENT ORDINANCE | ZONING REGULATIONS | SUBDIVISION REGULATIONS | BUILDING CODE |
|---|---|---|---|---|
| Barnesville | | x | x | |
| Brookeville | | x | | |
| Chevy Chase Section 3 | | | | |
| Chevy Chase Section 5 | | | | |
| Chevy Chase | | | | x |
| Chevy Chase View* | | | | |
| Chevy Chase Village | x | x | | x |
| Gaithersburg | x | x | x | x |
| Garrett Park | | | | |
| Glen Echo | | x | | |
| Kensington | | | | |
| Laytonsville* | | | | |
| Martin's Addition | | | | x |
| North Chevy Chase* | | | | |
| Poolesville | | | | |
| Rockville | x | x | | x |
| Somerset | | | | |
| Takoma Park | | | | |
| Washington Grove | | x | x | x |
| Montgomery County | x | x | x | x |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

## JURISDICTION CAPABILITIES SUMMARY

After reviewing individual jurisdictional administrative, technical, fiscal, programmatic, and legal capabilities, each jurisdiction rated their capabilities as limited, moderate, or high, as summarized in the table below. There was not a lot of consistencies across jurisdictions. For each category of hazard mitigation capabilities, there were a variety of limited, moderate, and high responses. The administrative and technical capability and planning and regulatory capability had the most jurisdictions respond that their capabilities are limited. The community political capability had the most jurisdictions respond that their capabilities are high.

**Table 5-6: Jurisdiction Capabilities Summary**

| JURISDICTION | ADMINISTRATIVE AND TECHNICAL CAPABILITY | FISCAL CAPABILITY | PLANNING AND REGULATORY CAPABILITY | COMMUNITY LEGAL CAPABILITY |
|---|---|---|---|---|
| Barnesville | Limited | Limited | Limited | Limited |
| Brookeville | Limited | Limited | Limited | Limited |
| Chevy Chase Section 3 | Limited | Moderate | Limited | Moderate |
| Chevy Chase Section 5 | Moderate | Moderate | Moderate | Moderate |
| Chevy Chase | Limited | Moderate | Limited | Moderate |
| Chevy Chase View* | | | | |
| Chevy Chase Village | Limited | Moderate | Limited | Moderate |
| Gaithersburg | High | High | High | High |
| Garrett Park | High | High | High | High |
| Glen Echo | Moderate | Moderate | Moderate | Moderate |
| Laytonsville* | | | | |
| Martin's Addition | Moderate | High | Moderate | Moderate |
| North Chevy Chase* | | | | |
| Poolesville | High | High | High | High |
| Rockville | High | High | High | High |
| Somerset | Limited | High | Limited | High |
| Takoma Park | Moderate | Limited | Moderate | High |
| Kensington | Moderate | High | Moderate | High |
| Washington Grove | Moderate | Moderate | High | High |
| Montgomery County | High | High | High | High |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

## CONSEQUENCE ANALYSIS

In addition to measuring the jurisdictions' administrative, technical, fiscal, programmatic, and legal capabilities in regard to implementing hazard mitigation actions, a consequence analysis was completed by each jurisdiction to help determine their community's capability to recover after a natural hazard event. Each jurisdiction responded how different systems would be impacted by an event on a scale of zero to five, with zero being no impacts to the system and five being significantly impacted. The results are shown in the table below. Overall, Kensington reported the highest score across all systems which

indicates that the Town would be the most impacted after a natural hazard event. Across the different systems, impacts to the public received the highest average score across all towns, indicating it would be the most impacted system from a natural hazard event.

**Table 5-7: Consequence Analysis Results**

| Impacted System | Jurisdiction | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Barnesville | Brookeville | Chevy Chase | Chevy Chase View* | Chevy Chase Village | Chevy Chase Sec 3 | Chevy Chase Sec 5 | Gaithersburg | Garrett Park | Glen Echo | Kensington | Laytonsville* | Martins Addition | North Chevy Chase* | Poolesville | Rockville | Somerset | Takoma Park | Washington Grove | Impact Average |
| Public | 4 | 2 | No Specifics Given - Reliant on County | | 3 | No Specifics Given - Hazard Dependent | No Specifics Given - Reliant on County | 5 | 4 | 5 | 4 | | 2 | | 5 | 5 | No Specifics Given - Hazard Dependent | 2 | 3 | 3.2 |
| Responders | | | | | 5 | | | 5 | 3.5 | 4 | 4 | | | | 2 | 3.5 | | 2 | 3 | 2.7 |
| Continuity of operations/ Delivery of services | 0 | 0 | | | 5 | | | 3 | 2 | 4 | 4 | | 2 | | 2 | 2 | | 1 | 3 | 2.3 |
| Property, facilities, and infrastructure | 2 | 2 | | | 3 | | | 2 | 4 | 3 | 4 | | 3 | | 2 | 1 | | 1 | 3 | 2.3 |
| Environment | 0 | 4 | | | 5 | | | 0 | 3 | 3 | 3 | | 2 | | 1 | 1 | | 3 | 3 | 2.4 |
| Economic condition of the jurisdiction | 0 | 0 | | | 1 | | | 2 | 1 | 3 | 4 | | 1 | | 3 | 3 | | 2 | 3 | 1.7 |
| Public confidence in the jurisdiction's governance | 0 | 2 | | | 1 | | | 1 | 1 | 2 | 3 | | 4 | | 1 | 1 | | 1 | 0 | 1.6 |
| Total | 6 | 10 | | | 23 | | | 18 | 18.5 | 24 | 26 | | 14 | | 16 | 16.5 | | 12 | 1 | 16.2 |

* Multiple schedule conflicts and medical issues precluded meetings with Chevy Chase View, Laytonsville and the Village of North Chevy Chase during the planning phase.

# IMPLEMENTATION AND MAINTENANCE

This Plan is Montgomery County's road map for evaluating hazards, identifying resources and capabilities, selecting appropriate actions, and developing and implementing mitigation and resilience measures to eliminate or reduce future impacts from those hazards in order to protect the health, safety, and welfare of the residents in the community. Implementation of the plan is a critical component of strengthening the resilience of Montgomery County. An extensive listing of potential funding sources available to assist in the implementation of the identified mitigation and resilience actions has been included at the end of this chapter for reference.

This section discusses how the Mitigation Strategy will be implemented by participating jurisdictions and how the overall Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public and participating stakeholders will continue to be involved in the hazard mitigation planning process. This section consists of the following three subsections:

- IMPLEMENTATION ACTION PLAN
- EVALUATION, MONITORING, UPDATING
- PLAN UPDATE AND MAINTENANCE

## IMPLEMENTATION ACTION PLAN

### Administrative Actions

As with the 2013 Plan, the 2018 planning process was overseen by the staff of the Montgomery County OEMHS. The Montgomery County Council has authorized the submission of this Plan to both the Maryland Emergency Management Agency and the Federal Emergency Management Agency for their respective reviews and subsequent approvals. Upon state and federal approval, the Montgomery County Council will act to formally adopt this Plan. The adoption process will take several months, as significant coordination by the Mitigation Planning Committee with their governing bodies is required to:

1. Place the plan review and adoption on the appropriate meeting agendas in each jurisdiction;
2. Advertise the review process and provide copies in the County Council and local jurisdiction council members' adoption meeting packets;
3. Facilitate the actual adoption;
4. Collect the adoption resolutions; and
5. Incorporate the adopted resolutions into the final hazard mitigation plan.

Montgomery County appreciates the willingness that both Maryland Emergency Management Agency and FEMA Region III demonstrated by reviewing this and providing comments for revision prior to the adoption process.

## EVALUATION, MONITORING, AND UPDATING

Monitoring, evaluating, and updating this plan is critical to maintaining its value and success in Montgomery County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the

future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. While the methodology and schedule are similar to what is outlined in the 2013 Montgomery County Hazard Mitigation Plan, slight revisions were made based on the County's experience with actually maintaining the existing plan between 2013 and 2018.

The Montgomery County Mitigation Planning Committee established for this 2018 Plan update is designated to lead the plan maintenance processes of monitoring, evaluation and updating with support and representation from all participating municipalities. The Mitigation Planning Committee will coordinate maintenance efforts, but the input needed for effective periodic evaluations will come from community representatives, local emergency management coordinators and planners, the general public, and other important stakeholders. In addition, the committee will serve in an advisory capacity to the Montgomery County Council and the Montgomery County OEMHS.

Each municipality will designate a community representative to monitor implementation of mitigation activities and hazard events within their respective communities. This individual will be asked to work with the Montgomery County Mitigation Planning Committee to provide updates on applicable mitigation actions and feedback on changing hazard vulnerabilities within their community.

In addition, the municipal monitor will be responsible for reviewing the planning and land use regulatory element of the municipality's capability assessment to identify potential opportunities for incorporating appropriate elements of this Plan into local planning mechanisms and will also identify locally generated plans, information, reports, etc.

The Mitigation Planning Committee will oversee the progress made on the implementation of action items identified and modify actions, as needed, to reflect changing conditions. The Montgomery County Mitigation Planning Committee will meet annually to evaluate the plan and discuss specific coordination efforts that may be needed with participating jurisdictions and other stakeholders. The annual evaluation may include the participation of individual municipal monitors, or at least will include reports prepared by them.

The annual evaluation of the 2018 Hazard Mitigation Plan will not only include an investigation of whether mitigation actions were completed, but also an assessment of how effective those actions were in mitigating losses. A review of the qualitative and quantitative benefits (or avoided losses) of mitigation activities will support this assessment. Results of the evaluation will then be compared to the goals and objectives established in the plan and decisions will be made regarding whether actions should be discontinued or modified in any way in light of new developments in the community. Progress will be documented by the Mitigation Planning Committee for use in the next Hazard Mitigation Plan update and submitted to the Montgomery County OEMHS. Finally, the Mitigation Planning Committee will monitor and incorporate elements of this Plan into other planning mechanisms. The annual reviews will be led by the Director of the Montgomery County OEMHS.

This Plan will be updated by the FEMA approved five-year anniversary date, as required by the Disaster Mitigation Act of 2000, or following a disaster event. Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the

five-year review process, the following questions will be considered as criteria for assessing the effectiveness of the Montgomery County Hazard Mitigation Plan.

- Has the nature or magnitude of hazards affecting the County changed?
- Are there new hazards that have the potential to impact the County?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the plan?
- Should additional local resources be committed to address identified hazards?

Issues that arise during monitoring and evaluation which require changes to the local hazard, risk and vulnerability summary, mitigation strategy, and other components of the plan will be incorporated during future updates.

**Update process for plan prior to 5-year update**. Any interested party wishing for an update of this Plan sooner than the 5-year update will submit such a request to the Montgomery County OEMHS for consideration through the Director of the Montgomery County OEMHS and Chairman of the Montgomery County Mitigation Planning Committee. The request shall be accompanied by a detailed rationale. The Montgomery County OEMHS will evaluate all such requests and determine whether the update request should be acted upon. If the decision is in the affirmative, an assignment will be made for an individual to author the update. The draft updated section along with a detailed rationale will be submitted to the Montgomery County Mitigation Planning Committee. The committee will circulate the draft updated section to every jurisdiction participating in the plan for comment and after an appropriate period of time, the committee shall make a decision to update the plan at least partially based on the feedback received from the other jurisdiction. County and municipal adoptions will then occur.

## PLAN UPDATE AND MAINTENANCE

As was done during the development of both the 2007 and 2013 Hazard Mitigation Plans, the 2018 Montgomery County Mitigation Planning Committee will involve the public during the evaluation and update of this Plan through any workshops and meetings. The public will have access to the current Plan through their local municipal office and the Montgomery County OEMHS. Information on upcoming events related to this Plan or solicitation for comments will be announced via newsletters, newspapers, mailings, and the County website. The public is encouraged to submit comments on the Plan at any time. The Montgomery County Mitigation Planning Committee will review and determine relevant comments to include during the next update of the hazard mitigation plan. As a result of initiating the hazard mitigation planning process, Montgomery County officials have obtained a great deal of information and knowledge regarding the County's disaster history, the presence of natural hazards, the likelihood of each of these hazards occurring within the County, and the potential impacts, losses, and challenges these hazards present to the community.

The general planning process picked up from where the 2013 Plan left off and that is with the identification and re-evaluation of hazards that have occurred within Montgomery County throughout

the past. This was followed with data collection throughout the County and within its communities. Assessments were then made to determine the vulnerability of the community to various hazards, and to determine hazard-specific losses. After evaluation of potential losses within the community, mitigation goals, objectives, and related action items were then re-evaluated and prioritized using FEMA's STAPLEE method.

The planning process included the re-convening of the Montgomery County Mitigation Planning Committee which was formally tasked by the Montgomery County Council. Two public outreach measures were conducted, providing Montgomery County citizens with the opportunity to comment on and offer suggestions concerning disaster mitigation actions within the community both during the development and draft stages of the Plan update. The Plan will be updated every five years, as required by the Disaster Mitigation Act of 2000, or following a disaster. The Montgomery County OEMHS will oversee and facilitate the update of the Plan. The updated Plan will account for any new developments in the County or special circumstances (post-disaster). Issues that come up during monitoring and evaluation which require changes in mitigation strategies and projects should be incorporated in the Plan at this stage. The Montgomery County OEMHS will involve the public during the evaluation and update of the Plan through annual public education activities, public workshops, and public hearings. The County's website will serve as a means of communication by providing information about mitigation and resilience initiatives.

The mission of the Montgomery County Mitigation Planning Committee for this 2018 update remains the similar to that of 2013:

*To make the citizens of Montgomery County less vulnerable to the effects of natural hazards through a coordinated effort by identifying risks, community vulnerabilities, developing wise mitigation strategies, and seeking hazard mitigation grant funding to implement chosen strategies.*

The committee feels that this Plan update, when implemented, will help to make all of Montgomery County a safer place to live and work for all of its citizens.

The following is a list of Federal and State Grants that may assist in implementing local All Hazard Mitigation Plans. This information is subject to change at any time; contact the federal or state agency for current grant status. (Last Updated: March 2018)

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Federal Emergency Management Agency, Hazard Mitigation Grant Program (HMGP) | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21136 | All Hazards Mitigation Planning. Acquisition, relocation, elevation and flood-proofing of flood-prone insured properties, flood mitigation planning, wind retro0fit, stormwater improvements, education and awareness. | Federal - 75% State - 25% | Local government must be in compliance with the National Flood Insurance Program to be eligible. Projects must be cost effective, environmentally sound and solve a problem. Repetitive loss properties are a high priority. | After a Presidential Disaster Declaration |
| Federal Emergency Management Agency, Pre-Disaster Mitigation Grant Program (PDM) | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21136 | Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. | Federal - 75% Non-Federal - 25% | PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. | Annual Spring/Summer |
| Federal Emergency Management Agency, Flood Mitigation Assistance Program (FMA) | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21136 | Assist States and communities to implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program. | RL: Federal - 90% Non-Federal - 10% SRL: Federal - 100% Non-Federal - 0% | Available once a Flood Mitigation Plan has been developed and approved by FEMA. | Annual Spring/Summer |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| National Flood Insurance Program (NFIP) | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21136 | Provides financial protection by enabling persons to purchase insurance against floods, mudslide or flood related erosion. | Varies | Includes Federally backed insurance against flooding, available to individuals and businesses that participate in the NFIP. | Anytime |
| Increased Cost of Compliance | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21136 | ICC coverage provides payment to help cover the cost of mitigation activities that will reduce the risk of future flood damage to a building. If a Flood Insurance Policy Holder suffers a flood loss and is declared to be substantially or repetitively damaged, ICC will pay up to 30,000 to bring the building into compliance with State or community floodplain management laws or ordinances. Usually this means elevating or relocating the building so that it is above the base flood elevation (BFE). | Varies | Once the local jurisdiction determines the building is substantially or repetitively damaged, the policy holder can contact insurance agent to file an ICC claim. | Anytime |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| U.S. Economic Development Administration, Economic Adjustment Program | U.S. Department of Commerce Economic Development Administration Curtis Center, 601 Walnut Street, Ste 140 South Philadelphia, PA 19106-3323 215-597-4603 | Improvements and reconstruction of public facilities after a disaster or industry closing. Research studies designed to facilitate economic development. | Federal - 50%-70% Local- 30%-50% | Documenting economic distress, job impact and proposing a project that is consistent with a Comprehensive Economic Development Strategy are important funding selection criteria. | Anytime |
| U.S. Economic Development Administration, Public Works and Development Facilities | U.S. Department of Commerce Economic Development Administration Curtis Center, 601 Walnut Street, Ste 140 South Philadelphia, PA 19106-3323 215-597-4603 | Water and sewer, Industrial access roads, rail spurs, port improvements technological and related infrastructure | Federal - 50%-70% Local- 30%-50% | Documenting economic distress, job impact and projects that is consistency with a Comprehensive Economic Development Strategy are important funding selection criteria. | Quarterly Basis |
| Small Business Administration (SBA) Pre-disaster Mitigation Loan Program | James Rivera, Office of Disaster Assistance, Small Business Administration, 409 3rd Street, SW, STE 6050 Washington, DC 20416;202-205-6734 | Activities done for the purpose of protecting real and personal property against disaster related damage. | No information | The mitigation measures must protect property or contents from damage that may be caused by future disasters and must conform to the priorities and goals of the state or local government's mitigation plan. | |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Community Development Block Grants / States Program | U.S Department of Housing and Urban Development, Office of Block Grant Assistance, 451 7th Street SW., Washington, DC 20410-7000;202-708-1112 | Used for long-term recovery needs, such as: rehabilitation residential and commercial building; homeownership assistance, including down-payment assistance and interest rate subsidies; building new replacement housing; code enforcement; acquiring, construction, or reconstructing public facilities. | No information | Citizen participation procedures must be followed. At least 70 percent of funds must be used for activities that principally benefit persons of low and moderate income. Formula grants to States for non-entitlement communities. | After a Presidential Disaster Declaration |
| Fire Suppression Assistance Program | Infrastructure Division, Response and Recovery Directorate, FEMA, 500 C Street SW., Washington DC 20024; 202-646-2500. | Provides real-time assistance for the suppression of any fire on public (non-Federal) or privately-owned forest or grassland that threatens to become a major disaster. | Federal - 70% Local - 30% | The State must first meet annual floor cost (f percent of average fiscal year fire costs) on a single declared fire. After the State's out-of-pocket expenses exceed twice the average fiscal year costs, funds are made available for 100 percent of all costs for each declared fire. | Funds from President's Disaster Relief Fund for use in a designated emergency or major disaster area. |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Historic Preservation: Repair and Restoration of Disaster-Damaged Historic Properties | Infrastructure Division, Response and Recovery Directorate, FEMA, 500 C Street SW., Washington DC 20024; 202-646-4621. | To evaluate the effects of repairs to, restoration of, or mitigation hazards to disaster-damaged historic structures working in concert with the requirements of the Stafford Act. | Federal - 75% Local - 25% | Eligible to State and local governments, and any political subdivision of a State. Also, eligible are private non-profit organizations that operate educational, utility, emergency, or medical facilities. | After a Presidential Disaster Declaration |
| Transportation: Emergency Relief Program | Federal Transit Authority, FHWA, DOT, 1200 New Jersey Avenue Washington, DC 20590; 202-366-4043 | Provides aid for the repair of Federal-aid roads and roads on Federal lands. | Federal - 100% | Application is submitted by the State department of transportation for damages to Federal-aid highway routes, and by the applicable Federal agency for damages to roads on Federal lands. | After serious damage to Federal-aid roads or roads on Federal lands caused by a natural disaster or by catastrophic failure. |
| Animals: Emergency Haying and Grazing | Emergency and Non-insured Assistance Programs, FSA, USDA, 1400 Independence Ave, SW, Washington, DC 20013; 202-720-4053 | To help livestock producers in approved counties when the growth and yield of hay and pasture have been substantially reduced because of a widespread natural disaster. | No information | Assistance is provided by the Secretary of Agriculture to harvest hay or graze cropland or other commercial use of forage devoted to the Conservation Reserve Program (CRP0 in response to a drought or other similar emergency. | Anytime |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Emergency Watershed Protection Program | Natural Resources Conservation Service<br>1400 Independence Avenue, SW<br>Washington, DC 20250 | Implementing emergency recovery measures for runoff retardation and erosion prevention to relieve imminent hazards to life and property created by a natural disaster that causes a sudden impairment of a watershed. | Federal - 75%<br>Local - 25% | It cannot fund operation and maintenance work or repair private or public transportation facilities or utilities. The work cannot adversely affect downstream water rights and funds cannot be used to install measures not essential to the reduction of hazards. | TBD |
| Watershed Protection and Flood Prevention Program | Natural Resources Conservation Service<br>1400 Independence Avenue, SW<br>Washington, DC 20250 | To provide technical and financial assistance in carrying out works of improvement to protect, develop, and utilize the land and water resources in watersheds. | Varies due to project type. | Watershed area must not exceed 250,000 acres. Capacity of a single structure is limited to 25,000 acre-feet of total capacity and 12,500 acre-feet of floodwater detention capacity. | TBD |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Watershed Surveys and Planning | Natural Resources Conservation Service<br>1400 Independence Avenue, SW<br>Washington, DC 20250 | To provide planning assistance to Federal, State, and local agencies for the development of coordinated water and related programs in watersheds and river basins. Emphasis is on flood damage reduction, erosion control, water conservation, preservation of wetlands and water quality improvements. | No information | These watershed plans form the basis for installing needed works of improvement and include estimated benefits and costs, cost-sharing, operation and maintenance arrangements, and other information necessary to justify the need for Federal assistance in carrying out the plan. | Anytime |
| Emergency Advance Measures for Flood Prevention | USACE<br>441 G Street, NW, Washington DC 20314; 202-761-0011 | To perform activities prior to flooding or flood fight that would assist in protecting against loss of life and damages to property due to flooding. | No information | There must be an immediate threat of unusual flooding present before advance measures can be considered. Any work performed under this program will be temporary in nature and must have a favorable benefit cost ratio. | Governor of State must request assistance |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Emergency Streambank and Shoreline Protection | USACE<br>441 G Street, NW, Washington DC 20314; 202-761-0011 | Authorizes the construction of emergency streambank protection measures to prevent damage to highways, bridge approaches, municipal water supply systems, sewage disposal plants, and other essential public works facilities endangered by floods or storms due to bank erosion. | No information | Churches, hospitals, schools, and other non-profit service facilities may also be protected under this program. This authority does not apply to privately-owned property or structures. | TBD |
| Small Flood Control Projects | USACE<br>441 G Street, NW, Washington DC 20314; 202-761-0011 | Authorizes the construction of small flood control projects that have not already been specifically authorized by Congress. | No information | There are two general categories of projects: structural and nonstructural. Structural projects may include levees, floodwalls, diversion channels, pumping plants, and bridge modifications. Nonstructural projects have little or no effect on water surface elevations, and may include flood proofing, the relocation of structures, and flood warning systems. | TBD |
| Flood: Emergency Advance Measures for Flood Prevention | USACE<br>441 G Street, NW, Washington DC 20314; 202-761-0011 | To mitigate, before an event, the potential loss of life and damages to property due to floods. | No information | Assistance may consist of temporary levees, channel cleaning, preparation for abnormal snowpacks, etc. | Governor of State must request assistance |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Continuing Authorities Program (CAP) | USACE<br>441 G Street, NW, Washington DC 20314; 202-761-0011 | Initiates a short reconnaissance effort to determine Federal interest in proceeding. If there is interest, a feasibility study is performed. | Federal - 65%<br>Local- 35% | A local sponsor must identify the problem and request assistance. Small flood control projects are also available. | Anytime |
| Hazardous Materials: State Access to the Oil Spill Liability Trust Fund | Director, USCG National Pollution Funds Center, U.S. Coast Guard Stop 7605<br>2703 Martin Luther King Jr. Avenue, SE<br>Washington, DC 20593-7605<br>202-795-6000 | To encourage greater State participation in response to actual or threatened discharges of oil. | No information | Eligible to States and U.S. Trust Territories and possessions. | Anytime |
| Emergency Management Assistance (EMA) | Maryland Emergency Management Agency 5401Rue Saint Lo Drive Reisterstown, MD 21401 | Funds may be used for salaries, travel expenses, and other administrative cost essential to the day-to-day operations of State and Local emergency management agencies. Program also includes management processes that ensure coordinated planning, accountability for progress, and trained qualified staffing. | Federal - 50% | EMA funded activities may include specific mitigation management efforts not otherwise eligible for Federal funding. Management Assistance program funds may not be used for construction, repairs, equipment, materials or physical operations required for damage mitigation projects for public or private buildings, roads, bridges, or other facilities. | Anytime |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
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| Assistant to Firefighters Grant | Source: U.S. Fire Administration<br>CFDA Number: 97.044 | Vehicles, safety equipment, protective equipment, etc. | Federal Grant Funds match depended upon population served by Fire Departments and nonaffiliated EMS organizations | Provides assistance to local fire department to protect citizens and firefighters against the effects of fire and fire-related incidents. | Annually in September projects are due. |
| Maryland Program Open Space | Department of Natural Resources<br>580 Taylor Ave.<br>Annapolis, MD 21401<br>410-260-8445 | Local provides financial and technical assistance to local subdivisions for the planning, acquisition, and/or development of recreation land or open space areas. | A local governing body may use up to $25,000 annually from its 100% (Acquisition) money to fund planning projects that update the Local Land Preservation and Recreation Plans. | Acquires outdoor recreation and open space areas for public use. Administers funds made available to local communities for open and recreational space by the Outdoor Recreation Land Loan of 1969 and from the Land and Water Conservation Fund of the National Park Service, U.S. Department of the Interior. | July 1st |

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| Maryland Recreational Trails Program | Maryland Scenic Byways /Recreational Trails Program*<br>Office of Planning & Preliminary Engineering<br>State Highway Administration<br>707 N Calvert Street<br>Baltimore, MD 21201<br>(p) 410.545.8637<br>(f) 410.209-5012<br>tmaxwell@sha.state.md.us | Maintenance and restoration of existing recreational trail; Development and rehabilitation of trailside facilities and trail linkages; Purchase and lease of trail construction equipment; Construction of new trails; Acquisition of easements or property for recreational trails or recreational trail corridors; and Implementation of interpretive/educational programs to promote intrinsic qualities, safety, and environmental protection, as those objectives relate to the use of recreational trails. | Administered by the State Highway Administration (SHA), this program matches federal funds with local funds or in-kind contributions to implement trail projects. Projects can be sponsored by a County or municipal government, a private non-profit agency, a community group or an individual (non-governmental agencies must secure an appropriate government agency as a co-sponsor). Federal funds administered by the State Highway Administration are available for up to 80% of the | Projects must meet state and federal environmental regulatory requirements (NEPA, MEPA, Section 106, Section 4(f)). SHA will provide assistance to the project sponsor to acquire these approvals. | July 1st |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
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| | | | project cost, matched by at least 20% funding from the project sponsor. Matching funds must be committed and documented in the local jurisdiction's budget. | | |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| CoastSmart Communities Grant (CCG) Program | Maryland Department of Natural Resources Chesapeake and Coastal Service<br>(p) 410.260.8718<br>(f) 410.260.8739<br>sasha.land@maryland.gov | Municipalities and counties in the coastal zone are eligible to apply for and receive funds: Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, St. Mary's, Somerset, Talbot, Wicomico, and Worcester counties and Baltimore City.<br>Funding for a one-year project that contributes to understanding, planning for, or implementing planning and outreach measures to address coastal hazard issues. | Up to $75,000 annually | Track A can fund flood vulnerability and risk assessments, updates to planning documents (e.g. hazard mitigation plans, zoning ordinances, building codes, floodplain ordinances, comprehensive plans), education and outreach campaigns and materials, applications to FEMA's Community Rating System in concert with other task outcomes, support for adopting an updated plan and integrating the plan into day-to-day existing planning processes that reduce overall flood risk due to tidal events or stormwater and rain events. | TBD |

**Table 5-8: Federal and State Grants for Hazard Mitigation Planning**

| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
|---|---|---|---|---|---|
| Green Infrastructure Resiliency Grant Program | Maryland Department of Natural Resources Chesapeake and Coastal Service (p) 410.260.8799 (f) 410.260.8739 (e) megan.granato@maryland.gov | Municipalities and counties within the Maryland portion of the Chesapeake Bay watershed are eligible to apply for and receive funds. Please note that projects proposed in Cecil, Garrett and Worcester counties must be located within the portions of those counties that are within the watershed in order to be eligible.<br><br>Funding for one year for Phase 1 and Phase 2 projects and up to 2 years for Phase 3 projects that will assess stormwater management needs associated with localized flooding and design or construct targeted green infrastructure practices to address those needs. | Up to $100,000 per project | Track B can fund watershed assessments that focus on determining local flood risks and how green infrastructure can be used to address those risks, site or watershed-level green infrastructure implementation plans, and green infrastructure project designs. This track can also fund construction of green infrastructure projects. In order to apply for construction funding, all applicable permit preapplication meetings must be complete. | TBD |

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| Maryland Community Parks and Playgrounds Program | Department of Natural Resources<br>580 Taylor Ave.<br>Annapolis, MD 21401<br>410-260-8445 | 1) development of new parks<br>2) rehabilitation of existing parks<br>3) expansion or improvement of existing parks<br>4) purchase and installation of playground equipment<br>5) development of environmentally oriented parks and recreation projects<br>6) development of new trails or extension of existing trails<br>7) creation of access points to water recreation resources<br>8) acquisition of land to create new parks. | The source of funds for this program is primarily State General Obligation Bonds, which may be authorized on an annual basis. The Community Parks and Playgrounds Program provides funding to incorporated municipalities and Baltimore City. Grants may be for up to 100% of the project cost and are selected on a competitive basis. Each applicant will be limited to one (1) Grant Proposal List submission package, which may contain several prioritized | The Department of Natural Resources works to provide opportunities for Marylanders, especially our children, to experience nature. The Department has developed a website that provides information about Nature Play Spaces. Nature Play Spaces are one of the many types of public recreation projects eligible for consideration for Community Parks and Playgrounds grant funding. While land acquisition costs may be considered for project funding, the highest priority will be placed on capital costs associated with park development and improvement. | TBD |

| Table 5-8: Federal and State Grants for Hazard Mitigation Planning | | | | | |
|---|---|---|---|---|---|
| GRANT PROGRAM NAME | ADDRESS AND TELEPHONE CONTACT INFORMATION | ELIGIBLE ACTIVITIES | FEDERAL, STATE AND LOCAL COST SHARE REQUIREMENTS | OTHER PROGRAM CHARACTERISTICS | GRANT APPLICATION DUE DATE |
| | | | projects, per award cycle. | | |

# APPENDIX A: COUNTY AND MUNICIPAL RESOLUTIONS

Resolution No.: 19-70
Introduced: April 2, 2019
Adopted: April 8, 2019

**COUNTY COUNCIL**
**FOR MONTGOMERY COUNTY, MARYLAND**

Lead Sponsor: Council President at the Request of the County Executive

**SUBJECT:** The Montgomery County Hazard Mitigation Plan 2018

## Background

1. The Montgomery County Hazard Mitigation Plan was first approved by the County Council by Resolution 14-569 in June 2000. Updated Multi-Hazard Mitigation Plans were approved by Resolution 16-41 in February 2007 and Resolution 17-832 in July 2013. Upon adoption of this resolution, the Montgomery County Hazard Mitigation Plan 2018 supersedes all previous County mitigation plans.

2. On October 30, 2000, the federal Disaster Mitigation Act of 2000 (Public Law 106-390) was signed into law. To reduce the effects of disasters, the law encourages, among other initiatives, a planning process based on cooperation among state and local authorities, community partners, and the public at large. The law recognizes local and state pre-disaster planning and promotes "resiliency" as a major mitigation strategy. Under the regulations implementing this law, states and local governments must have an approved and adopted hazard mitigation plan in order to maintain eligibility for pre- and post-disaster mitigation grant funding. The Federal Emergency Management Agency (FEMA) is responsible for reviewing and approving state and local plans.

3. The Montgomery County Hazard Mitigation Plan 2018 is a major update to the 2013 Hazard Mitigation Plan and is in accordance with the following state and federal rules and regulations governing local hazard mitigation plans.

   - Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §5121 *et seq.*, Section 322 (*Mitigation Planning*) (42 U.S.C. §5165), as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390), and FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at 44 CFR Part 201.

   - Maryland Emergency Management Agency (MEMA) established under Section 14-103 in the Public Safety Article of the Maryland Code. The Emergency Management Policy was updated in 1991 through Executive Order 01.01.1991.02 State of Maryland Emergency Management Policy.

4. In developing this plan, a core planning team was assembled consisting of County agencies, municipalities, utility companies, and community and volunteer organizations. Three public hearings were held to solicit public input. Representatives from 18 local municipalities were conferred with directly to receive their inputs. The purpose of the Hazard Mitigation Plan is to identify policies, capabilities, activities and tools to help make Montgomery County more resilient in the face of future disasters.

5. In October 2018, the County submitted its initial draft of the Hazard Mitigation Plan to the Maryland Emergency Management Agency (MEMA) for review and incorporated all comments satisfactorily. In January 2019, the County forwarded its final Draft Hazard Mitigation Plan to the Federal Emergency Management Agency (FEMA) for review and approval. The partial government shutdown directly affected FEMA's review capabilities. Delaying County adoption of the Hazard Mitigation Plan until FEMA conducts its review could potentially put the County at risk of losing Federal Disaster Funds if the County suffers a declared disaster after our current plan expires.

6. The County Council's Transportation, Infrastructure, Energy & Environment Committee met on January 17, 2019 and recommended approval of the Montgomery County Hazard Mitigation Plan 2018 with some technical edits and corrections. The County Council approved the draft of the Hazard Mitigation Plan 2018 with these recommended changes on January 29, 2019.

7. The Federal Emergency Management Agency (FEMA) completed its review of the draft Hazard Mitigation Plan 2018. Minor changes required by FEMA have been incorporated into the latest version of the Plan. Adoption by the County Council of the latest version of the Plan is required for final FEMA approval.

**Action**

The County Council for Montgomery County, Maryland approves the following resolution:

The County Council approves and adopts the Montgomery County Hazard Mitigation Plan 2018.

This is a correct copy of Council action.

Megan Davey Limarzi, Esq.
Clerk of the Council

# APPENDIX B: PLANNING MEETINGS

# APPENDIX C: 2013 LOCAL MITIGATION PLAN REVIEW CROSSWALK / 2018 LOCAL MITIGATION PLAN REVIEW TOOL

# APPENDIX D: LOCAL JURISDICTION SURVEYS – STRATEGY AND CAPABILITIY ASSESSMENTS