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# Plan Structure

This Hazard Mitigation Plan contains four main components: background information, hazard specific information, allhazard mitigation measures, and information about the plan maintenance process.

The background information section includes an introduction to hazard mitigation planning, information about this project's background, a description of the planning process used to develop this document and a community profile.

Separate chapters then address each hazard for which the county or one of its municipalities is at risk. Each of these chapters includes an analysis of a specific hazard and an assessment of risks and potential damage from that hazard, as well as existing and potential mitigation strategies to address those risks.

Identified with the potential mitigation strategies is the agency most likely to take the lead on the project. Potential mitigation strategies are separated into high-priority projects and projects that are a lower priority now but will be considered in the future. Project prioritization affects what grant funding will be sought. The costs of a project will be weighed against the overall benefit to individual properties, as well as to the county as a whole. Projects with the greatest benefits compared to the associated costs will be given the first priority for mitigation grant funding requests.

The hazard-specific chapters are followed by a chapter enumerating mitigation measures that are relevant to all hazards, and a chapter that outlines the plan maintenance process.

A glossary of terms and acronyms used in the plan is included, as well as a list of references. Appendices A-D provide additional information relevant to the plan.

# **Chapter One:**

# Hazard Mitigation Planning - An Introduction

# Mitigation Planning as Part of the Larger Emergency Management Picture

Emergency activities are divided into four phases that require different types of organization and preparation.

In general, *mitigation* is the initial phase. It should take place long before an emergency occurs. It includes any activities aimed at eliminating or reducing the probability of occurrence of an emergency or disaster. It also includes activities designed to postpone, dissipate, or lessen the effects of a disaster or emergency. The goal of mitigation is to decrease the need for response.

*Preparedness* is an insurance policy against emergencies since we cannot anticipate every disaster. It is a critical component because mitigation activities alone cannot prevent emergencies. One goal of preparedness is to increase response capability. Preparedness includes planning to ensure the most effective, efficient response as well as efforts to minimize damage. Preparedness measures might include forecasting and warning systems or developing protocols to enable a rapid response, such as stockpiling supplies and readying facilities for fallout protection. *Response* is the first phase that occurs after the onset of a disaster. It is intended to provide emergency assistance for disaster victims. It includes search and rescue, providing emergency shelters and medical care, as well as anti-looting patrols, sandbagging against impending floodwaters, or any other measures that may enhance future recovery operations.

*Recovery* activities continue well beyond the initial response immediately following the disaster. Their purpose is to return all systems, both formal and informal, to normal. They can be broken down into short-term and long-term activities. Short-term activities attempt to return vital human systems to minimum operating standards and usually encompass approximately a two-week period. Long-term activities stabilize all systems. These include such functions as redevelopment loans and legal assistance as well as the actual rebuilding of community resources.

Experience shows that these phases are cyclical rather than linear. All activities and experiences lead individually and cumulatively back to the mitigation phase. We improve our efforts to prevent and diminish future emergencies by applying what we learn during past events. Fortunately, in many cases, these lessons can be learned by simulating an emergency situation and then analyzing the results of a planned mitigation or response. Regardless of which phase of the emergency

management cycle is being studied or developed, the crisis event is the catalyst which puts the process in motion.

# Minimizing Losses & Costs with Mitigation Planning

A *hazard* is an event or condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

*Mitigation*, as it relates to emergency management, is any action taken to reduce or eliminate risk to people and property from hazards and their effects.

Hazard mitigation measures are the collective steps taken by individuals, businesses, governments, or any other community stakeholders to prevent or reduce losses from any type of

emergency situation.

According to the Federal Emergency Management Agency's (FEMA) website, mitigation is defined as any sustained action taken to reduce or eliminate longterm risk to human life and property from a hazard event. The goal of mitigation is to decrease the need for response as opposed to simply According to nationwide analyses presented in a June, 2009 study, Andrew Healy and Neil Malhotra of the Loyola Marymount University and Stanford Graduate School of Business "estimate that the average dollar spent on disaster preparedness reduces future disaster damage by more than seven dollars in a single election cycle, and find that the total value of a dollar of preparedness spending in terms of the total reduction in all future damage is about fifteen dollars." (Healy and Malhotra, 2009). increasing the response capability. Mitigation can save lives and reduce property damage and is cost-effective and environmentally sound. This, in turn, can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities, reduce exposure to liability, and minimize community disruption.

Mitigation occurs at the local level. Local governments must recognize hazards and initiate mitigation actions. This can be accomplished by enacting and enforcing building codes, zoning ordinances, and other measures to protect life and property. In addition, governments can inform citizens of hazards as well as measures they can take to reduce risks and potential losses. At the federal, state, and local level, regulations are written to reduce disaster costs and preserve and protect natural, historic, and cultural resources. Mitigation can benefit a community by saving lives, reducing damage to buildings and properties, and lowering flood insurance rates. A local mitigation plan helps to identify specific hazard areas and risks while recommending specific projects which will help reduce or prevent impacts from those hazards.

The local mitigation plan demonstrates a jurisdiction's commitment to reduce risks from hazards. Further, it guides decision makers as they commit resources to reducing the effects of natural or man-made hazards. Local plans also serve as the basis for State-provided technical assistance and to prioritize project funding.

Mitigation planning to prevent disasters is similar for either natural or human-caused hazards. FEMA describes an effective planning process as:

- Identifying & organizing resources;
- Conducting risk or threat assessments & estimating losses;
- Identifying effective mitigation measures to address the hazards & developing a prioritized strategy to implement these measures
- Executing the measures, evaluating the results, and regularly updating the plan

# **Robert T. Stafford Disaster Relief and Emergency Assistance Act**

The Robert T. Stafford *Disaster Relief and Emergency Assistance Act*, Public Law 93-288, as amended (the Stafford Act) was enacted to support state and local governments and their citizens when disasters overwhelm them. This law establishes a process for requesting and obtaining a Presidential disaster declaration, defines the type and scope of assistance available under the Stafford Act, and sets the conditions for obtaining that assistance.

# **Declaration Process**

The Stafford Act (Sections 401 and 501) requires that "all requests for a declaration by the President that a major disaster or emergency exists shall be made by the Governor [chief executive] of the affected State." The Governor's request is made through the regional FEMA office. State, local, and federal officials conduct a preliminary damage assessment (PDA) to estimate the extent of the current disaster and its impact on individuals and public facilities. The information gathered during the PDA details the severity and magnitude of the event. Normally, the PDA is completed prior to the submission of the Governor's declaration request and is included to prove the claim. However, when a catastrophic event occurs, the Governor's request may be submitted prior to the PDA. Regardless of sequence, the Governor must still make the request and a PDA is still conducted.

As part of the request, the Governor must note that the State's emergency plan has been implemented. The situation must be of such severity and magnitude that the response is beyond State and local capability, and, therefore, Stafford Act assistance is necessary. The Governor details the nature and amount of State and local resources that have been or will be committed to alleviate the disaster, provides estimates of the extent of damage and the impacts on both the private and public sectors, and provides an assessment of the assistance required under the Stafford Act. The Governor must also certify that State and local government obligations and expenditures will comply with all applicable cost-sharing requirements. Typically, State payments or funding commitments represent a significant portion of the planned recovery costs.

Based on the details of Governor's request, the President may declare that a major disaster or emergency exists. This declaration activates an array of federal programs to assist in the response and recovery effort.

# **Hazard Mitigation Funds**

Not all programs are activated for every disaster. The determination of which programs are activated is based on the

needs found during the joint preliminary damage assessment and any subsequent information that may be discovered. Federal disaster assistance available under a major disaster declaration falls into three general categories:

- Individual Assistance aid to individuals, families, and business owners;
- Public Assistance aid to public (and certain private non-profit) entities for specific emergency services and the repair or replacement of disaster-damaged public facilities;
- Hazard Mitigation Assistance funding for measures designed to reduce future losses to public and private property.

Most major disaster declarations include some level of hazard mitigation funding. Depending on the resources impacted, disaster assistance funding may be provided to either individuals, public entities, or to both groups.

Sections 404 and 406 of the Stafford Act authorize two FEMA programs that can provide hazard mitigation funds when a Federal disaster has been declared.

Following a major disaster declaration, all counties within that state are eligible to apply for assistance under the Hazard Mitigation Grant Program (HMGP). The HMGP is authorized by Section 404 of the Act and provides technical and financial assistance to states and local governments for cost-effective, pre-disaster hazard mitigation activities. FEMA provides HMGP grants to states that, in turn, provide sub-grants to local governments for mitigation activities such as planning. Concrete mitigation strategies identified through this planning process can then be considered for HMGP funding in the future. HMGP funds become available to a state through a federal disaster declaration. Federal funding for HMGP projects can be up to 75 percent of the project's total eligible costs. The remaining 25 percent is the required local-match funding which can include cash and in-kind sources.

Funding provided through Section 406 is used to repair public facilities or infrastructure damaged as a result of a disaster; it is not intended for pre-disaster mitigation activities. It is possible for mitigation measures to be funded under both the HMGP and Section 406 programs, but duplication of funding between Section 404 and 406 is not allowed.

Eligible mitigation measures under the HMGP include:

- Acquisition or relocation of properties located in high-hazard areas;
- Elevation of flood-prone structures;
- Seismic and wind retrofitting of existing structures;
- Protecting existing structures against wildfire.

All HMGP projects must comply with all relevant environmental laws and Executive Orders. Projects should not be initiated prior to FEMA's completion of the environmental review and project approval. HMGP grants cannot be given for acquisition, elevation, or construction purposes if the site is located in a designated Special Flood Hazard Area (SFHA) or the community is not participating in the National Flood Insurance Program (NFIP).



To qualify for state public assistance mitigation funding, local governments are required to adhere to the guidance contained in FEMA's Local Mitigation Planning Handbook.

# **Disaster Mitigation Act of 2000**

The Disaster Mitigation Act of 2000 (DMA 2000) (Public Law 106-390), amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988. This new legislation reinforces the importance of pre-disaster planning to reduce losses by placing a new emphasis on local mitigation efforts. Its aim is primarily to control and streamline the administration of federal disaster relief and mitigation programs. Most significant to state and local governments are the amendments to Sections 203 (Pre-Disaster Hazard Mitigation) and 322 (Mitigation Planning) of the Stafford Act:

- Section 203 established a "National Pre-Disaster Mitigation Fund." These mitigation planning funds are distributed through the Pre-Disaster Mitigation (PDM) Grant Program. This fund provides "technical and financial assistance to States and local governments to assist in the implementation of pre-disaster hazard mitigation measures that are cost-effective and designed to reduce injuries, loss of life, and damage and destruction of property, including damage to critical services and facilities under the jurisdiction of the States or local governments."
- Section 322 places new emphasis on mitigation planning. It requires local governments to develop and submit mitigation plans as a condition of receiving Hazard Mitigation Grant Program (HMGP) project

grants. Section 322 provides a new and revitalized approach to mitigation planning by:

- Establishing a new requirement for local and tribal mitigation plans;
- Authorizing up to seven (7) percent of the Hazard Mitigation Grant Program (HMGP) funds available to a state to be used for development of state, local and tribal mitigation plans; state HMGP funds may be increased to twenty (20) percent for a major disaster where the state has in effect an approved mitigation plan under this section at the time of the disaster declaration.

# 44 Code of Federal Regulations (CFR), Part 201.6

The content requirements for local mitigation plans are contained in section 44 CFR and focus primarily on natural hazards. As with many other civic planning endeavors, opportunities for public involvement and comment are essential to developing a practical and useable document. Further, bona fide and documented public participation is required for plan approval. Every jurisdiction within the plan's geographic area is expected to actively join in drafting and adopting the document. The plan should include both currently developed areas as well as areas planned for future development. The plan should assess the impact of identified hazards for existing development as well as the potential for additional impacts from future development for each hazard.

# Chapter Two: Mitigation Plan Foundation

# Definitions

For this Hazard Mitigation Plan, the following definitions for the document's goals, objectives, and strategies are utilized:

- **Goals** are general guidelines, usually expressed as broad policy statements, which represent desired longterm results. They seek to address problems and situations identified during vulnerability and capability assessments.
- **Objectives** describe implementation steps to attain the identified goals. Objectives are more specific statements than goals. The steps described are usually measurable and can have a defined completion date.
- **Strategies** provide detailed descriptions of specific tasks that are required to be accomplished to achieve the goals and objectives. For each stated objective, there are alternative strategies for mitigation steps that must be evaluated to determine the best choices for each situation.

# **Countywide Hazard Mitigation Plan Goals**

# Prevention through...

# **Protection of Life and Property**

• Implement cost-effective and technically-feasible mitigation projects to protect lives by making homes, businesses, infrastructure, critical facilities, and other property more resistant to hazard events.

#### Objectives:

- Ensure that *critical facilities* are protected from effects of hazard events to the maximum extent possible
- Ensure that impacts from hazard events on *public infrastructure* are minimized
- Reduce the potential impact of natural and man-made disasters on the County's *historic and cultural treasures*
- Improve the *resistance of structures* against hazard events

# **Community Education**

- Protect public health, safety, and welfare by increasing public awareness of existing hazards and mitigation activities that reduce the risk to citizens, public agencies, private property owners, businesses, and schools
- Foster individual responsibility in mitigation risks due to hazard events

#### **Objectives:**

- Work with the Carroll County *Board of Education* to teach hazard mitigation topics; seek opportunities to integrate mitigation into the curriculum, including science, math, social studies/history, career and technology, or other subjects
- Educate property owners on the *individual* mitigation *measures* that can be taken before the next hazard event
- Identify, improve, and sustain collaborative programs focusing on the *real estate* industry, the *development community*, and public and private sector organizations to avoid activity that increases risk from hazards
- Identify mechanisms to educate the *business community* on minimizing the risk of hazard events and implementing mitigation projects

# Natural Resource Protection & Sustainable Development

• Promote growth in a sustainable manner

• Balance watershed planning, natural resource management, and land-use planning with hazard mitigation to protect life, property, and the environment

#### Objectives:

- Incorporate hazard mitigation into *long-range* comprehensive and functional *planning* activities
- Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities
- Protect the community's *water supply*
- Utilize *regulatory approaches* to prevent creation of future hazards to life and property and to minimize risk to environmentally-sensitive areas

# **Emergency Services**

• Improve and enhance the capability of emergency services to prevent or minimize impacts and risks from hazard events

#### Objective:

 Coordinate hazard mitigation activities with other emergency management activities

# Interjurisdictional & Community Partnerships

• Strengthen communication and coordinate participation among and within public agencies, citizens, non-profit

organizations, business, and industry to gain a vested interest in implementation and improving emergency operations

• Encourage leadership within public and private sector organizations to prioritize and implement municipal, county, and regional hazard mitigation activities

#### Objective:

 Develop *public and private partnerships* to foster hazard mitigation program coordination and collaboration in Carroll County

# Plan Monitoring, Maintenance, & Implementation

• Establish a process to monitor, evaluate, and update the hazard mitigation plan based on analysis of implemented prevention measures

#### **Objectives:**

- Enhance the County's ability to collect, maintain, and utilize *data* that could be useful for mitigation projects, preparedness, response, and/or recovery, as well as to conduct hazard *risk assessments* and *track mitigation* activities
- Establish a sustainable process for implementing, monitoring, and evaluating countywide mitigation activities

 Identify and pursue *funding opportunities* to develop and implement County and municipal mitigation activities and demonstrate *funding needs*

# **Benefits of the Plan**

Development of the Hazard Mitigation Plan will benefit the community in many ways, including:

- saving lives and property by reducing vulnerability to disaster events;
- receiving more post-disaster funding, more quickly;
- receiving more pre-disaster mitigation funding;
- saving money, as the costs of mitigation are usually less than the costs of recovery;
- improving existing county and city partnerships through sharing resources and developing a unified, countywide mitigation strategy;
- focusing combined resources on areas specifically identified as hazard-prone;
- making clear, well-thought out decisions in advance of a disaster; and
- improving Community Rating System (CRS) classifications by implementing prioritized mitigation initiatives, thereby lowering NFIP premiums

# Chapter Three:

**Planning Process & Content** 

# **Planning Team**

The CCHMP was drafted by County staff from the Office of Public Safety Support Services Emergency Management Division and the Bureau of Comprehensive Planning who jointly participated on the project planning team. Sample plans from across the country were reviewed to help guide the planning process as well as to identify needed plan content. Additional feedback was sought from members of the Department of Public Works and the Economic Development Department at the outset of the planning process to assist with the initial direction of the plan. Following this initial research, the team identified further needed information and data sources as well as additional community stakeholders who should participate in this joint planning effort. These added resources and stakeholders were incorporated into the CCHMP work plan.

# Work Plan

A work plan identifying the tasks required to develop the hazard mitigation plan was developed to guide the planning process. It included a timeline for completing each major task group as well as an estimated budget. Developing this guidance document required coordinating responsibilities between the lead agencies and stakeholder participants. Through discussions over edits and revisions, this guidance document aided in further detailing plan content, plan process, and team member responsibilities. With a clearer scope and approach to creating the CCHMP, participating municipalities were contacted and brought into the planning team.

# **Plan Development**

Development of the CCHMP began with initial research and individual meetings with key town staff which were held in July and August 2010 and an interagency meeting in September 2010. After these initial meetings were held, the text of the plan and various maps, charts and graphs were created and incorporated into the first draft.

The first draft of the plan was circulated among various stakeholders for review and input. Stakeholders included multiple county agencies and departments, all eight municipalities located within the county, the Carroll County University of Maryland Agricultural Extension Service, the Carroll County Soil Conservation Office, the Carroll County Citizen Corps Council, the Carroll County LEPC, the Carroll County Public School System, and additional various agencies and organizations.

After receiving comments and suggestions, an updated draft was created that incorporated the appropriate changes and an easier to read format. This draft was transmitted to the Maryland Emergency Management Agency for review and

subsequent transmittal to FEMA from which approval pending adoption status was requested.

Any changes that were required or recommended by FEMA were made, and the final draft of the plan was presented to each municipality's planning commission as well as the county planning and zoning commission – adoption by each municipality was requested. Copies of the adoption documentation from each jurisdiction are included in Appendix D.

# Hazard Identification and Analysis

Identifying the types of hazards which could likely affect a community is the first step in planning effective prevention measures. There are three general hazard categories typically considered in mitigation planning: natural, technological or civil. More specifically, these categories involve:

- Natural hazards generally result from weather-related conditions or other natural phenomena. They include hurricanes, winter storms, drought, various types of flooding, tornadoes, wildfires, and soil movements.
- Technological hazards include large-scale or catastrophic situations such as significant hazardous materials incidents; dam failures; nuclear or industrial accidents; or transportation incidents such as large-scale traffic collisions, train derailments, and the like

• Civil hazards typically result from intentional human activities such as acts of terrorism, school violence, large-scale riots, or other civil disturbances

Currently, FEMA only requires that natural hazards be addressed in an HMP. However, the HMP becomes an infinitely more valuable resource if it attempts to include all hazards that could potentially affect a community. This approach reflects nationwide trends for local plans to consider the multi-hazard approach.

The various types of hazards, the types of resources impacted, as well as the probability of occurrence associated with those hazards are important factors in determining how to mitigate their impacts. For this plan, hazards were defined by typical characteristics, potential effects in the community and extent of impacts, as well as by their occurrence regionally and within Carroll County. A preliminary survey helped to identify the natural, technological, and civil hazards which pose the greatest threats to the County and its municipalities. The CCHMP will address all hazards which were assessed to present a medium or higher level of risk within Carroll County.

With the exception of jurisdiction-specific data, much of the primary information on hazard identification in each chapter was taken from the 2011 Maryland State Hazard Mitigation Plan Update.

The sources of information to identify and describe the hazards include the following:

- 2011 Maryland State Hazard Mitigation Plan Update
- History, Knowledge, & Expertise of County Agencies

- History, Knowledge, & Expertise of Municipal Staff
- History, Knowledge, & Expertise of other Community Members
- Applicable USGS maps and publications
- National Weather Service (NWS)
- National Oceanic and Atmospheric Administration (NOAA)
- Spatial Hazards Events and Losses Database for the United States (SHELDUS)
- Flood Insurance Rate Maps
- U. S. Army Corps of Engineers National Dam Database
- Maryland Department of the Environment
- County GIS Data Layers
- Other relevant resources

Once the relevant hazards were identified by type and degree of risk, areas of greatest potential impact needed to be defined. For many hazards, the highest impact areas can be easily delineated by using boundaries already known from prior emergency planning efforts or existing data. Examples of previously defined hazard areas include FEMA-mapped floodplains or previously designated dam breach inundation areas as the hazard area for a dam failure. Examples of relevant emergency planning data include using the evacuation plan areas surrounding Superfund Amendments and Reauthorization Act (SARA), Title III, Section 302 facilities or mapping sites of operations required to submit a Toxic Release Inventory as the hazard areas for hazardous materials incidents. Some high risk areas may be defined by a series of locations or even a corridor. Situations such as a toxic material spill during shipment or damage to a critical infrastructure network are examples where multiple points may define the highest risk area for a particular type of hazard.

Determining how many people will be affected and in what ways is one of the most critical considerations in specifying hazard impact areas. Factors include defining existing population or occupation centers, areas planned for any type of future development, and locations of more vulnerable populations including anyone requiring additional assistance during a disaster due to issues including age, infirmity, disability, lack of transportation or language barriers.

Given that the primary goal of the CCHMP is the protection of lives and property, those portions of Carroll County with the highest concentrations of both population and built resources have been determined to be the highest impact areas for virtually all types of hazards. The exception was the risk presented by an extended drought. Impacts from a lack of water would be felt across the entire community due to lost water and drinking water supplies, lost crop production, and businesses or institutions whose operations would be curtailed.

Generally, the highest concentrations of population and buildings are found in the county's designated Growth Areas (GA). These GAs correspond to the planned future limits of all eight of the County's municipalities as well as un-incorporated areas which are long established community and population centers. Each of these areas has a standing community comprehensive plan. Each of these areas is also addressed in relevant functional plans such as county-wide plans for water and sewerage, mineral resources, environmental resources, or transportation. By utilizing these commonly understood planning areas, the task of planning for hazard mitigation can be more easily translated and incorporated into any existing plan. Maps are included on pages 33-50 which display the current *existing use of land* for each GA as well as for the

surrounding county; additional maps on those pages identify the types and locations of future development described as the *designated land use* as anticipated on the comprehensive plan map for the county and each GA.

Maps were also created that identified where and how hazards can affect the community. The maps show the areas most at risk for each hazard type; they are included at the end of each hazard specific chapter except for the chapter addressing drought. A drought would affect both public and private wells and nearly all categories of agricultural production throughout the county. Designation of hazard areas for purposes of this plan does not imply that there will be no impact to other areas of the county. This document seeks describe that these areas have the highest degree of risk and/or highest level of impact from the particular type of hazard event.

# **Risk Assessments**

A *risk assessment* is the process of measuring potential loss of life, personal injury, economic injury, and property damage resulting from hazard events.

*Vulnerable assets* are buildings, structures, facilities, resources, and population centers that will likely sustain the most damage or loss in a hazard event.

A risk assessment defines potential risks and vulnerabilities for each type of hazard which could affect a specific hazard area. Following the identification of hazard areas, assets are inventoried to determine what facilities and resources might be affected. Inventoried resources typically include public and quasi-public facilities, infrastructure, major employers, historic and cultural resources, and residences. Records from previous events and damages were also useful for developing estimates of potential losses. Risks were quantified by assigning potential dollar-loss estimates to vulnerable assets.

Potential injury or loss of lives is an important consideration in estimating vulnerability. Census data, locally-adopted comprehensive plans, tax assessment data, and Bureau of Comprehensive Planning demographic data were used to estimate population in each hazard area.

The Maryland Department of Assessment and Taxation database was queried and aerial photographs reviewed to identify the location and improved value of private assets/structures within each of the hazard areas, with the exception of drought. U.S. Census data was also consulted for housing value information. Valuations assumed current market assessment values for the impacted properties which may or may not reflect actual repair or replacement costs. Estimates of potential losses in defined hazard areas with a limited number of developed properties or structural assets were totaled to estimate maximum total loss or average valuations were used and multiplied by the number of properties. In some risk assessments, an entire growth area may be delineated as the hazard area, such as for winter storms and hurricanes. Here, the number of developed properties was totaled and then multiplied by an average value unique to that area. This valuation data was factored for the type and number of impacted sites to develop damage estimates for other unique or defined hazard areas. Details of calculation methods are explained in the each individual hazard chapters.

Critical facilities are those systems or structures that must function during emergency situations or afterwards to enable recovery efforts. They permit public safety officials to provide the continuity of operations expected by impacted populations. Critical facilities include schools, police and fire stations, emergency operations centers, hospitals, libraries, senior centers, colleges, bridges, banks, communication towers, town halls and county office building, fuel tank farms, county airport, and wastewater treatment plants. These are the facilities that would be essential to maintaining basic government functions or emergency response and recovery operations. Critical public and quasi-public facilities and infrastructure were identified through several methods.

The GIS data for At Risk and Critical Facilities in Maryland developed by Towson University Center for GIS for MEMA was used to identify and map critical facilities. Coordination with the appropriate County agencies and with the municipalities further clarified which facilities are critical to continuity of operations. The asset value of these facilities and infrastructure was also estimated and included where available or appropriate. A combination of assessment data and data from the County Department of Management and Budget was used to estimate values for critical facilities. These resources have been generally identified on the maps. However for security purposes, some detailed information is omitted from this plan. Some resource information is highly sensitive and should never be included in publicly available documents. Examples include vulnerability studies of critical infrastructure and data on security plans and systems. Any such material would be treated as an addendum to the HMP so that it is still part of the plan, but access to it can be controlled.

Coordination with the County Department of Economic Development as well as review of the Bureau of Comprehensive Planning's "existing use of land" data was used to identify major employers. Maryland Assessment and Taxation data, information from the County Departments of Economic Development and Management and Budget, and information from the Carroll County Local Emergency Planning Committee (LEPC) was used to estimate economic injury. The Planning Team also sought help from the local insurance industry, state insurance commission, and other appropriate local businesses to identify potential losses and the dollar figures associated with them.

The Maryland Inventory of Historic Properties was used to identify locations of historic structures. The "existing use of land" data and the planners for each geographic area in the county were consulted to identify cultural resources. Assessment data was used to estimate the tangible cost of damages and losses.

Where relevant, Carroll County Agricultural Land Preservation Program staff and the Agricultural specialist from the Department of Economic Development were consulted to identify assets and impacts to the agricultural industry in the county. Sources of information included the Agricultural Census, the Soil Conservation Service, and the local extension service, among others.

The information related to the risk assessment can be found in the relevant section of each hazard chapter.

# **Development of Mitigation Strategies**

Mitigation strategies were developed to provide a blueprint for reducing the potential losses identified in the risk assessment. These recommendations were based on legislated powers, existing operating policies or duties, programs, and available resources, as well as the assessed ability to expand on or improve these existing tools. The mitigation strategies strive for prevention under one of the following goal categories:

- protection of life and property
- community education
- natural resource protection and sustainable development
- interjurisdictional and community partnerships
- plan monitoring, maintenance, and implementation

Several subtasks were pursued to accomplish the overall development of these mitigation strategies:

- Mitigation goals were established.
- Existing mitigation measures, including mitigationrelated policies, programs, projects, and ordinances, were identified and described.
- A range of recommended specific mitigation actions and projects for each hazard were identified.
- Proposed mitigation measures were prioritized. The benefits and costs of each measure were considered to the extent possible.
- Implementation of the proposed mitigation measures was described and identification of the agencies

responsible for administering those measures took place.

The LEPC provided feedback and input on mitigation measures. Coordination with the municipalities provided information about mitigation measures already in place, further direction and input on identifying and prioritizing appropriate mitigation strategies.

# **Plan Monitoring and Maintenance**

This task required developing a methodology and schedule for monitoring, evaluating and updating the plan based on a fiveyear cycle. Beyond simply a schedule to review, amend, or update the HMP, procedures were established to monitor and evaluate the effectiveness of the plan and its implementation measures. Efforts to include HMP mitigation planning and implementation recommendations into existing and future comprehensive plans were also begun. The LEPC assisted the Planning Team in developing the monitoring, evaluating, and updating process. They continue to provide input and advice regarding plan updates and implementation efforts.

# **Plan Adoption**

Adopting the plan does not obligate communities to undertake particular actions. Rather, it demonstrates the community's commitment to mitigation. As a multi-jurisdictional plan, the

County and each participating municipality adopted the plan to qualify for grants. As part of the adoption process, a community information meeting and a public hearing were held prior to adoption of the plan. The community information meeting presented attendees a summary of the plan process and contents, as well as an opportunity to ask questions enabling them to make better informed comments during the public hearing. The Board of County Commissioners held the public hearing after approval of the plan was received from FEMA. Letters of intent to adopt the plan were included with the plan that was submitted to FEMA for approval. Written documentation of adoption by each jurisdiction was included as part of the adopted plan.

# **Public Involvement**

# Local Emergency Planning Committee (LEPC)

In 1986, Congress passed the Superfund Amendments and Reauthorization Act (SARA). Title III of this legislation requires each community to establish a Local Emergency Planning Committee (LEPC) to develop an emergency plan to prepare for and respond to chemical emergencies in the community. The plan must include:

- identification of local facilities and transportation routes where hazardous materials are present
- procedures for immediate response in case of an accident (this must include a community-wide evacuation plan)

- a plan for notifying the community that an incident has occurred
- the names of response coordinators at local facilities
- a plan for conducting exercises to test the plan

The plan is reviewed by the State Emergency Response Commission (SERC) and publicized throughout the community. The LEPC is required to review, test, and update



this plan every year.

Because of the experience and diverse knowledge base available within Carroll County's LEPC, the Planning Team felt it was the ideal conduit to draw in public input and participation while developing this plan. The CCHMP was introduced to LEPC at its September 2013 meeting. Members were briefed on the timeline and reviewed the identified hazards along with the accompanying risk assessments. Discussions with the LEPC also included a review of existing mitigation measures as well as feedback on additional mitigation measures to assess and include in the plan. The Carroll County LEPC includes representatives from the following:

- Carroll County Office of Public Safety Support Services Emergency Management Division
- Carroll County
  Volunteer Emergency
  Services Association
- Carroll County Office of
  Information &
  Communication Services
- Carroll County Board of Commissioners
- Maryland State Police, Barrack G
- Carroll County Sheriff's Office

- Carroll County Health Dept.
- Carroll Hospital Center
- Carroll County Public Works Dept.
- Carroll County Chamber of Commerce
- Carroll County Times
- Local Elected Officials (Municipalities)
- Local Businesses:
  - S. H. Tevis & Son
  - EVAPCO, Inc.
  - Colonial Pipeline Co.
  - C. J. Miller, Inc.
  - Highs of Baltimore LLC

# **Other Community Participation**

Public involvement was also sought following the initial identification of hazards, hazard areas, and risk assessments. This enabled residents without in-depth experience in emergency planning or preparedness to have sufficient information to offer additional information and insights. They were specifically invited to provide feedback on potential issues and remedies based on their local knowledge experiences as mitigation measures were developed.

A draft of the plan with potential mitigation strategies was posted on the County's web site and a comment page that provided citizens with the opportunity to ask questions or request more information was provided.

# Municipal Coordination

In addition to their role in the LEPC, input and data were incorporated from all of the participating municipalities. Coordination with each jurisdiction was essential for accurate hazard identification as well as the associated risk assessment. The municipalities participated in identifying mitigation measures as well. The County coordinated with the municipalities to establish and prioritize acceptable mitigation strategies, as well as to identify timelines, funding sources, and responsible agencies. A workshop was held for municipal staff members that provided them with an opportunity to learn about the plan, the types hazards addressed, the risk areas and assessments described and the mitigation measures outlined.

Carroll County and the participating Towns have a strong track record of interjurisdictional coordination on enforcement, planning, and many other issues. It is important to note that several of the mitigation strategies which specifically identify a County agency as the lead agency cannot be effectively accomplished without coordination with the towns. However, the named agency would be responsible to lead the activity for the County as well as to coordinate efforts with and between the towns for that project. The plan concludes with a description of what measures will be taken to maintain this plan and monitor the progress of its implementation.

The County Commissioners of Carroll County, Maryland, and participating municipalities support the implementation of the Carroll County Hazard Mitigation Plan. The resources necessary for Plan implementation and maintenance, including funding, manpower, and equipment, will be provided based on availability. The Carroll County Commissioners and

participating Towns reserve the right to prioritize use of County or Town resources in accordance with the sound fiscal policy of the relevant local government. In no event shall a failure by the County or Town to comply with any provision or aspect of this Plan constitute a material breach nor shall adoption of this Plan provide any rights to any third party for a cause of action. This Plan is established as a guide and nothing herein shall be deemed legally binding on the corporate authority of the County Commissioners or participating Mayors and Town Councils.

# Chapter Four: Community Profile

# **Carroll County Geography and Physical Environment**

Carroll County covers 456 square miles, or approximately 289,000 acres. Eight incorporated towns are located within the county, including Hampstead, Manchester, Mount Airy (partly in Frederick County, as well), New Windsor, Sykesville, Taneytown, Union Bridge, and Westminster. The County and

towns jointly plan for the areas considered growth areas around each municipality.

Carroll County is located in the Piedmont region of north-central Maryland. Parr's Ridge diagonally divides the county into two major drainage basins. Streams to the north and west drain into the Monocacy River and eventually the Potomac River. Streams to the south and east flow into the Patapsco and Gunpowder Rivers towards the Chesapeake Bay. These two major drainage basins contain nearly 1,380 miles of streams in Carroll County. Their uses range from recreational uses, such as fishing and canoeing, to agricultural uses such as irrigation. These streams eventually feed into the Chesapeake Bay and contribute to its water quality and ecological health. Virtually all of the land on the east side of Parr's Ridge drains into a public water supply reservoir.

Based on soil types, more than 54 percent of the county, or



about 157,000 acres, can be cultivated regularly. The remaining acreage is divided among those areas that can be cultivated occasionally or not at all, or is suitable for pasture.

Carroll County lies near the northernmost extents of the humid subtropical zone near the eastern boundary of the humid continental zone. Regionally, the general atmospheric flow is from west to east across North

America, with a continental type of climate and four welldefined seasons.

According to the Maryland State Office of Climatology, statistically the coldest period of the year is late January and early February; the warmest period is the last half of July. The highest recorded temperature is 105 degrees Fahrenheit at Taneytown on July 17, 1900, and the lowest is minus 23 degrees Fahrenheit at Bachman's Valley on February 11, 1899. Precipitation is fairly evenly distributed throughout the year; typically May is the wettest month. The heaviest precipitation is generally the result of low pressure systems moving northeastward along the Atlantic Coast. Rainfall averages 42 inches per year, and the county receives an average of 30 inches of snow per year. The greatest one-day precipitation is 11.55 inches of rain at Westminster on June 22, 1972, when the remnants of Hurricane Agnes swept through Maryland. Prevailing surface winds are from west northwest to northwest except during the months of May through September when they become more southerly. The average annual wind speed is about nine miles per hour.

# **Carroll County Demographics**

Due to its proximity to two major metropolitan areas, Carroll County has seen significant growth over the last several decades. The current population (as of April 2013) of Carroll County is estimated to be 169, 358. According to demographic data reported by the U. S. Census Bureau, the County's population increased 10.8 percent between 2000 and 2010. Most of this growth has occurred within the Designated Growth Areas (DGAs) of the county. In April 2010, the same time of the 2010 Census, population within the DGAs was

Population by Municipality Carroll County, MD April 2010			
Municipality	Population	% of County Population	
Hampstead	6,323	3.78	
Manchester	4,808	2.88	
Mt. Airy*	5,503	3.29	
New Windsor	1,396	0.84	
Sykesville	4,436	2.65	
Taneytown	6,728	4.03	
Union Bridge	975	0.58	
Westminster	18,590	11.12	
Unincorporated Areas	118,375	70.83	
County Total	167,134	100.00	
* Accounts for the Carroll County portion only			

Source: 2010 Census (U.S. Census Bureau)

estimated to be 106,510 (assuming a 4.2 percent vacancy rate), which makes up roughly 64 percent of the total population in the county. The DGAs include the county's eight incorporated municipalities and two un-incorporated villages. They will continue to see the majority of new growth within the county. The incorporated towns accounted for 29.2 percent of the total population in April 2010, compared to 25.5 percent the population in the two unincorporated DGAs of the county. The table entitled "Population by Municipality" shows the populations of the incorporated areas as well as the population of the unincorporated areas of the County based on 2010 Census data.

According to the 2010 Census, Carroll County had a total of 59,786 households. This represents an increase of 7,283 units since the 2000 Census. Over the past decade, the county has

Households by Municipality Carroll County, MD 2010			
Municipality	Total # of Households	Persons per Household	
Hampstead	2,415	2.62	
Manchester	1,632	2.98	
Mt. Airy	1,937	2.97	
New Windsor	526	2.65	
Sykesville	1,409	2.72	
Taneytown	2,434	2.74	
Union Bridge	394	2.47	
Westminster	7,161	2.39	
County	59,786	2.74	
Source: U.S. Census			

grown at a rate of approximately 540 new households per year, although construction has been heavily impacted by the economy during the past five years. In 2010, the average household size for Carroll County was 2.74 persons per

Home Value by Municipality Carroll County, MD 2009		
Municipality	Median Home Value	
Hampstead	\$248,200	
Manchester	\$280,000	
Mt. Airy	\$405,100	
New Windsor	\$323,100	
Sykesville	\$399,300	
Taneytown	\$262,300	
Union Bridge	\$218,100	
Westminster	\$237,800	
County	\$342,200	
Source: U.S. Census and CityData.com, 2013		

household. This was a slight decrease from the 2000 census average household size of 2.81 persons per household.

In 2010, 78.6 percent of occupied households were owner occupied and 17.2 percent renter occupied, with only 4.2 percent of the total households reported vacant. The majority of new housing units built in the county are single-family dwellings located in and around the incorporated towns. The table entitled "Households by Municipality" shows the total households within the incorporated areas versus the rest of the county.

In 2010, the median cost of a house in Carroll County was \$265,000, an increase of \$77,200 dollars from the 2000 value. The majority of low- to medium-priced housing is located in and around the incorporated areas of the county. As a result, the median values in most of the towns tend to be a little lower than the countywide median value. The table entitled "Home Value by Municipality" illustrates this difference.

According to the 2008-2010 American Community Survey (ACS), the majority (55.7%) of households in Carroll County had an income ranging between \$50,000 and \$149,999, with the median household income at \$79,703. Compared to the 2000 median household income of \$60,021, this was an increase of

Household Income by Municipality Carroll County, MD 2009		
Municipality	Average Income	
Hampstead	\$74,894	
Manchester	\$79,690	
Mt. Airy	\$99,901	
New Windsor	\$69,737	
Sykesville	\$87,084	
Taneytown	\$62,321	
Union Bridge	\$41,991	
Westminster	\$47,786	
County	\$79,703	
Source: U.S. Census and CityData.com, 2013		

\$19,082. Although a few of the incorporated towns have a higher median household income, most of them are below the countywide figure. This could be attributed to the fact that

these areas contain more low- to medium-priced housing options than the rest of the county. The table entitled "Household Income by Municipality" lists the incorporated towns' household income figures as well as the countywide figure.

The County has a strong tradition of cottage industries and small businesses, many of which center on the agricultural and manufacturing sectors. In recent years however, the retail trade and services sectors have increased in terms of the number of jobs they provide within the county while the number of manufacturing jobs has decreased. This trend is expected to continue as the county's demographics and the types of industries attracted to the county change.

In 2011, Carroll County businesses provided approximately 55,000 jobs. Private sector jobs accounted for 85.1 percent of the total employment for the County, while government jobs made up the remaining 14.9 percent. Jobs in the "service providing" industry group made up the largest percentage (67.8) of total employment. "Goods-producing" jobs comprised 17.3 percent of total employment.16

The table entitled "Selected Employers with Workforce over 100" is a list of the major employers located within Carroll County.

Selected Employers With Workforce Over 100			
Carroll County, MD			
	2013		
		Workforce	
Company Name	Product/Service Type	Total	RFT
Carroll County Public Schools	Education (K-12)	3,630	0
Carroll Hospital Center	Health Care	1,759	1,071
Springfield Hospital Center	Mental health services	833	810
Jos. A. Bank Clothiers	Corporate HQ/Distribution	778	747
Random House	Book warehousing & distribution	722	708
EMA/Fairhaven	Retirement/Assisted Living	700	0
McDaniel College	Higher Education (Private)	621	415
Carroll County Commissioners	Local Government	587	0
Carroll Community College	Higher Education (Public)	509	214
EVAPCO	Cooling equipment manufacturer	440	440
Carroll Lutheran Village	Retirement/Assisted Living	437	231
Northrop Grumman	Electronic Manufacturing/Testing	400	400
English American Tailoring	Clothing manufacturer	385	0
C. J. Miller, LLC	Contracting (paving & excavation)	334	334
Flowserve Corporation	Industrial Pumping Equipment	264	264
Knorr Brake	Railroad brake manufacturer	260	260
S. H. Tevis/Modern Comfort	Oil/fuel, heating & AC	232	168
PFG/Carroll County Foods	Wholesale foods/distribution	211	211
BB&T	Banking services	174	139
PNC Bank	Banking services	171	143
Long View Nursing Home	Nursing/assisted living	166	133
Lehigh Cement	Portland cement manufacturer	165	165
Solo Cup Company	Warehousing & distribution	150	150
Carroll County Times	Publishing	145	130
Black & Decker	Warehousing & distribution	130	130
Total		14,203	7,263
RFT = Regular Full-Time  0 = Number not available (numeric - allows calculation)			
Source: Carroll County Department of Economic Development, Last Updated: January 2013			

# **Relationship between County and Municipalities**

Carroll County and its municipalities have a long history of interjurisdictional coordination and cooperation. Since 1977, the County Commissioners have annually entered into an agreement with each municipality to share funds and coordinate planning and other governmental functions. The Town/County Agreements are formal documents enumerating the types of services the County provides to the towns. The agreements are tailored to the needs of each municipality and vary in complexity, depending on the extent of Town staff. County services range from simple liaison (i.e. notifying the Town of all future developments within one mile of its boundaries) to full staffing for most planning and zoning matters. The latter includes reviewing development plans and advising the appropriate municipal boards and commissions on the best course of action, as well as preparing community comprehensive plans. These agreements provide for cooperative referral by each jurisdiction to the other for review of subdivision plans, site plans, comprehensive plans or comprehensive plan amendments, annexation petitions, and rezoning petitions. This cooperative relationship has worked well. It ensures the open exchange of information regarding plans and development proposals. As a result, many issues are resolved at the staff level, reducing the possibility of problems later in the process. The County Commissioners also distribute funds annually to the municipalities upon execution of the Agreement.

The County and municipalities have had a history of cooperative planning that has included joint plan development

and adoption, or other steps to ensure consistency for future growth in the designated growth areas. Often the County works with a town to develop a community comprehensive plan. These documents identify future land-use designations and make a wide variety of planning decisions for the areas within the current corporate limits, as well as within the municipal growth areas. The entire area for which a plan is developed is called the Designated Growth Area (DGA), the limits of which are considered the Growth Area Boundary (GAB). The area within the Town's corporate limits and designated Municipal Growth Area becomes the officially adopted plan for the Town; however, the area within the corporate limits is the only area over which the Town has legal authority. The area of the plan outside of the corporate limits is the Municipal Growth Area portion of the overall DGA whose development needs, limitations, and opportunities are examined in detail in a legislatively-mandated Municipal Growth Element (MGE). The MGE is a required element of the community comprehensive plan. These MGE's are required to describe existing conditions and all kinds of future growth. They must also analyze adequacy of all manner of public facilities and infrastructure to accommodate planned growth regardless of which jurisdiction is responsible for providing these facilities and services.

As a provision of the Town/County Agreement, the County provides staff assistance to the towns on planning-related issues. The County planner acts as a liaison to the Towns' Planning Commissions. The County planner's duties may include assisting in obtaining grants, developing the community comprehensive plan, providing research support, reviewing development plans, conducting citizen participation activities, and handling annexations and rezoning requests,

among other things. This arrangement not only fosters cooperation between the jurisdictions, but aids in conflict prevention and development of compatible goals and regulations.

The County continues to encourage all municipalities to join the National Flood Insurance Program (NFIP). Currently Hampstead, Manchester, New Windsor, Sykesville, Union Bridge and Westminster all participate in the NFIP. Mount Airy is in the process of joining the program. FEMA is reviewing the Town's floodplain ordinance for compliance as part of the revised Flood Insurance Rate Map adoption process. Taneytown will also have the opportunity to join the NFIP during the adoption process.

To ensure safety and compliance, the County most recently reviewed and revised its floodplain ordinance in 2011. Most municipalities have adopted the same regulations and protections. Currently, the City of Westminster and the Town of Union Bridge have adopted separate floodplain ordinances and standards. The County does provide cooperative review for Westminster while Union Bridge utilizes its own consulting engineers. A FEMA review of all local floodplain ordinances will occur to ensure compliance with the updated FEMA floodplain mapping during the map adoption process..

Carroll County's fire and rescue and emergency medical services (EMS) are provided primarily by volunteers. The County also has a long-standing relationship with the Carroll County Volunteer Emergency Services Association (CCVESA) and other related groups. The County provides funds to the CCVESA for the provision of some full-time paid positions, primarily EMS personnel. Police services are primarily provided by the Carroll County Sheriff's Office. Maryland State Police (MSP) also provides law enforcement services, and five of the eight municipalities have their own police force to serve their populations. One municipality currently utilizes a cost-sharing agreement with MSP to provide police protection to its population.

# Relationship between Hazard Mitigation Planning and Comprehensive Planning

A clear connection exists between comprehensive planning to envision and enable the most appropriate land uses and the reduction of a community's vulnerability to all types of hazards. Communities that thoughtfully direct the locations, types, and standards for development to avoid hazard areas suffer much less disaster-related damage and impact than do communities that do not consider hazard risks.

Planners who think they are not familiar with hazard mitigation planning do not realize that they are already planning for hazard mitigation when they develop their comprehensive plans. Comprehensive/land use planning is not just about planning where develop *should* go; it is also about planning where development should *not* go. For example, most jurisdictions do not intentionally plan for concentrated future development to occur within a floodplain or other area known to be a hazard for life or property. Truly comprehensive planning also looks at the relationship between land-use planning and how impacts of development on the environment and reduced environmental sustainability can potentially

increase an area's vulnerability to certain hazards. From a hazard mitigation perspective, smart land-use planning results in less disruption to a community's economic, social, and physical structure; less impact on the community's tax base; less impact on the provision of essential services; and less financial impact in terms of local participation in disaster program cost-sharing. Hazard mitigation does not erect a barrier to growth but actually helps a community to continue to thrive. Comprehensive planning that includes hazard mitigation planning helps to create a sustainable community.

Community planners also provide a pivotal role in guiding recovery and rebuilding after disasters. Comprehensive plan documents have established guidance to help direct community building, regardless if it is due to post-disaster recovery and reconstruction or due to planned community growth. However, opportunities to strengthen the comprehensive plan as a recovery tool remain. Capitalizing on lessons learned during any recovery helps communities rebuild in ways which result in even greater resistance to future disasters. The incorporation of hazard mitigation planning as well as planning in a post-disaster recovery demonstrates a strong illustration of planning's roots in protecting the public health, safety, and welfare.

The following pages contain maps showing two types of information. The first group of maps indicates the land-use designations as depicted on the County Master Plan map and the individual community comprehensive plan maps. The second group of maps shows the use of land that actually exists on property located throughout the county and within the growth areas of the same individual communities for which a comprehensive plan has been adopted.
























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# Natural Hazards

# Chapter Five: Drought

# **Hazard Identification**

#### Hazard Characterization

A drought is any extended period of dry weather. There are three different intensities of drought conditions: meteorological drought, which is a period of abnormally dry weather lasting long enough to cause a water imbalance in the affected area; agricultural drought, which is a change in weather and climate patterns that causes conditions dry enough to adversely affect crop or livestock production; and hydrologic drought, which is "a period of below average water content in streams, reservoirs, groundwater aquifers, lakes, and soils as well as precipitation shortfalls that affect bodies of water or groundwater levels." (Yevjevich et al., 1977)

There are several indexes describing drought severity. The most frequently cited are the Crop Moisture Index and the Palmer Drought Severity Index (PDSI). Monthly PDSI values have been recorded for the eight Maryland climate divisions since 1895. For the PDSI, a monthly value below –2 indicates moderate drought, and a value below –3 indicates severe drought.

Droughts can cause damage not only to crops but also to wildlife and livestock. In addition, during times of prolonged

drought, jurisdictions, homeowners, and businesses can be affected when groundwater levels are low or wells run dry.

# **Regional & Historical Perspectives**

A 1997 FEMA analysis of historical mean stream flows indicates that Maryland, relative to other regions of the country, generally has average to higher-than-average stream flows. An analysis of Maryland drought conditions dating back to the early 20<sup>th</sup> Century indicates several significant drought periods. The worst statewide event occurred from December 1929 to February 1931. That was a full-fledged agricultural drought; crop losses were estimated at \$40 million in 1930 dollars (USGS, 2012). The worst drought on record for Carroll County was very recent, occurring between 1999 and 2002. Since the beginning of drought records, four other well-documented dry periods have occurred in Maryland: 1) 1953-1956, 2) 1958-1971, 3) 1980-1983, and 4) 1984-1988.

# **Risk Characterization**

In the 2011 Maryland State Hazard Mitigation Plan Update, Carroll County was determined to be at high risk for drought. Montgomery, Harford and Howard Counties are also considered to have a high drought risk (MEMA, 2011).

# Hazard High-Impact Areas

Droughts tend to have impacts other than sudden loss of lives and structures. In Carroll County, while a drought would impact the entire county, a prolonged drought would most significantly affect public and private water supplies as well as the County's valuable agricultural industry. The County has been able to withstand a single-season drought in the past. However, multi-season droughts have had significant impacts.

The most recent prolonged drought events have required operators of public water supply systems in the county to put in place strict water usage restrictions or to augment their water supplies. A longer-term drought also significantly impacts homes and businesses on private well water. During the 1999-2002 drought, many individual wells failed. This circumstance left homes and businesses without water or owners attempting to drill additional wells. Further, during that same event Carroll's agricultural industry was severely impacted by loss of crops and lack of water; many farmers had to purchase and truck in water to be able to care for their livestock.

As of 2008, over 181,000 acres within the County were used for agricultural purposes; the vast majority of those are income-generating farms.

Based on an inventory of existing use of land completed by the Carroll County Bureau of Comprehensive Planning during 2008, a total of approximately 184,691 acres were actually in agricultural use, which represents roughly 64 percent of the county's land area. The U.S. Department of Agriculture's 2007 Census of Agriculture counted 1,148 farms occupying 141,934 acres in the county. This discrepancy is probably due to differing inventory methodologies. The Bureau of Comprehensive Planning conducted a visual survey using satellite imaging and field verification to identify all lands in current agricultural use. The USDA utilized mail-in surveys from *income-producing* farms and then adjusted to account for non-response. The Bureau's inventory included small farms, fallow fields, and wooded parcels that the Census did not capture.

Regardless of inventory methodology, significant lands within Carroll County are devoted to active agricultural uses. Further, due to the County's long-standing commitment to retain its agricultural lands and agri-business economy, the County has been actively protecting productive lands. As of April 2010, 55,888 acres of farmland had been permanently preserved through agricultural land preservation easements. These properties do not have the ability to subdivide their property for residential development, and, therefore, have less financial opportunities available to them when impacted by extended drought.

Since the high-impact areas of the county don't lend themselves well to mapping, the hazard areas are simply defined in this text as public and private wells as well as agricultural crops and livestock.

# **Risk Assessment**

#### **Critical Facilities**

#### **Identification of Vulnerable Assets**

No significant impacts to the critical facilities identified by the State are anticipated as a result of a drought.

#### **Estimate of Damages & Losses**

No significant damages or losses to the critical facilities identified by the State are anticipated as a result of a drought.

#### Population, People, & Residences

#### **Identification of Vulnerable Assets**

Based on the 2010 Census, the population living within incorporated areas of the county represented 29 percent of the total Carroll County population of 167,134. As of April 2013, the estimated population living within incorporated areas of the county also represented approximately 29 percent of the total Carroll County population estimate of 169,358, which was based on a combination of US Census data and County-issued Use & Occupancy Permits. This data combination also showed an increase in the number of households to an estimated 61,245. As of April 2007, the eight public water supply systems in the county were providing water to 78,446 people. The 2007 *Carroll County Water and Sewerage Master Plan* projects that the number of people served by the public systems will reach 139,665 once development in the planned service area is completed. During that same period, residential demand for public water supply is projected to more than double from 5.177 million gallons daily (MGD) to 10.066 MGD. The table "Current and Future Population and Households Serviced by Public Water Supply Systems" identifies the current and projected population for each municipality that is served and/or planned to be served by public water service. The totals at the

<b>Current and Future Population &amp; Households</b>							
Served by Public Water Supply Systems							
	Car	roll County, M	1D				
2007							
		Projected					
		Population		Projected			
		to be		Households			
	•••=	Served by	••••	to be Served			
<b>D</b> 11	2007	Public	2007	by Public			
Public	Population	Water	Households	Water			
System	Served	Service	Served	Service			
Hampstead	6,283	11,287	1,892	3,400			
Manchester	4,358	6,458	1,345	1,993			
Mount Airy	8,631	16,615	2,561	4,930			
New							
Windsor	1,414	2,969	455	955			
Sykesville-							
Freedom	23,650	35,654	7,232	10,903			
Taneytown	6,200	14,225	2,793	6,408			
Union							
Bridge	1,049	5,256	337	1,690			
Westminster	26,861	47,201	8,807	15,476			
Totals	78,446	139,665	25,422	45,755			
Source: 2007	Carroll County	Water and Sewe	rage Master Pl	lan			

bottom represent the number of people countywide who would be impacted by a prolonged, severe drought if the public water supplies could not provide an adequate supply of water to their residential users.

In 2007, public wells accounted for only a few hundred of the estimated 40,000 to 50,000 wells in the county (Carroll County Health Department). Approximately 95 percent of the wells were for private, domestic water supply. Nearly 53 percent, or 32,156, of the county's households had a private well as their water source.

#### Estimate of Damages & Losses

Costs associated with drought for public systems are mainly the costs of purchasing additional or supplemental water supplies to serve the population on a short-term basis. When the groundwater table lowered during the 1999-2002 drought, the City of Westminster trucked in water to supplement dwindling supplies due to a severe reduction in reservoir capacity. For about two weeks, five to six trucks continuously hauled loads of 6,500 gallons each. For another two weeks,

Current and Future Population & Households Served by Community Water Supply Systems Carroll County, MD				
Public System	2007 Population Served	Projected Population to be Served by Public Water Service	2007 Households Served	Projected Households to be Served by Public Water Service
Bark Hill	312	319	114	116
Pleasant Valley	123	139	45	52
Source: 2007 Carroll County Water and Sewerage Master Plan				

two trucks continued hauling in water for about 16 hours per day. The total bill for one month was approximately \$120,000. The water source was located less than five miles from town. Factors such as hauling distance, inflation, and fuel costs could result in higher costs if a public water supply system were to truck in water in the future.

Costs associated with the drought for private domestic wells are mainly those that result if wells run dry. For the individual homeowner on a private well, the cost to drill a new well, if indeed water can be secured by establishing additional wells, varies depending on the number of attempts and the depth that must be drilled to hit water. While exact cost data were not available for the 1999-2002 drought because there are too many variables, local experts agreed that costs could start around \$1,500 and go up from there, with a typical cost falling around \$3,000.

Wells can fail at any time, but a drought increases the rate at which they fail. If a well does run dry, the property owner must apply with the Carroll County Health Department for a permit to drill a replacement well. The Health Department reports that during non-drought years permit requests range between zero and ten per month. When rainfall declines, there is a lag before the groundwater table drops below a level that causes wells to run dry. In the most recent drought, applications were submitted for 367 domestic-use replacement wells during the peak 12 months (September 2001 – August 2002). That averages to just fewer than 31 permit applications per month, but as many as 84 applications were submitted in one month. In other words, during normal periods between 0 and 0.025 percent of wells fail per month, but during the most recent drought the monthly failure rate more than tripled to

0.078 percent and in the worst month it spiked to 0.21 percent, or nearly ten times the normal rate. The number of applications averaged over the peak 12 months (31) was multiplied by the typical well replacement cost figure at the time (\$3,000) to estimate the average cost per month of \$93,000 during that severe drought. Using a current typical well replacement cost of \$6,000, the estimated cost per month for a comparable event would be \$186,000.

#### Agricultural & Natural Resources

#### **Identification of Vulnerable Assets**

Agriculture is the number one industry in Carroll County. According to the 2007 Census of Agriculture, there were 1,148 farms in the county producing products worth in excess of \$87.4 million. This survey reported that 141, 934 acres of ground were used in income-producing farming pursuits. Given the value of agricultural products sold, the multiplier effect of the agriculture industry (2.11) resulted in an economic impact exceeding \$184.5 million on the local economy.

As discussed earlier in this chapter, farms occupied between one-half and two-thirds of the land in the county. The most significant crops according to acres planted were corn, hay, and soybeans. Livestock, poultry, and poultry products, such as table eggs, accounted for 55 percent of the sales value of all agricultural products.

#### **Estimate of Damages & Losses**

The table below reports long-term agricultural losses resulting from the drought in 2002.

Production Losses									
	Crop Year 2002 (long-term drought effects)								
	Disaster	Year		Norn	nal Year	Estim	ated Losses <sup>1</sup>		
<b>Major Crops Planted</b>	# Acres	Acres Not			3-Year Avg		Percentage Of		
In The Disaster Year	Planted / #	Planted In			Price Used For	Revenue	Normal Harvest		
(Or Livestock	Units In The	<b>County Due To</b>	Disaster Year	Normal	Disaster &	Lost Due	Lost Due To		
Enterprise)	Disaster Year	The Disaster	Yield	Year Yield	Normal Year	To Disaster	Disaster		
Corn	35,400	6,700	71 bu/ac	118 bu/ac	\$2.14 / bu	5,252,416	49%		
Soybeans	20,332	1,000	23 bu/ac	35 bu/ac	\$4.40 / bu	1,227,530	37%		
Hay Crops	12,198	Unknown	1.32 tons/ac	2.4 tons/ac	\$121 / ton	1,594,035	45%		
Gr. Beans (proc)			2.02 tons/ac	3.11 tons/ac	\$208 / ton	400,229	48%		
Peas	2,104	500	1.35 tons/ac	2.07 tons/ac	\$329 / ton	419,455	47%		
Alfalfa	3,675	Unknown	2.34 tons/ac	4.23 tons/ac	\$134 / ton	930,731	45%		
Other Fruits and	363	Unknown	30% loss on			Unknown	30% loss on		
Vegetables (FAV's)			many FAV's				many FAV's		
1) Estimated losses were extrapolated from the data by Carroll County staff.					Total:				
					\$9,824,395				
Source: USDA									

Complete data across all sectors of the agriculture industry is not available to indicate losses incurred during droughts. However, the Farm Service Agency's disaster assistance program data provides a glimpse of the impact of a drought on certain types of farming. Under the disaster assistance program, farmers can apply for assistance for losses incurred in a drought. Carroll County's most recent drought occurred between 1999 and 2002. During the drought, impacts to agriculture increased in severity as the effects of years with insufficient water compounded. In 2002, farmers experienced three-year lows for production levels in most crops. The table entitled "Production Losses for Crop Year 2002" illustrates that the impacts of a drought are twofold – the farmer plants fewer acres to begin with, and, even in the acres that the farmer does plant, crop yields are as much as 49 percent lower than in a normal year. By extrapolating the decrease in production from the two types of loss and multiplying by the 3-year average price, we can estimate the difference in sales values between 2002 and a normal year for each type of crop in the table. Based on those extrapolations, we estimate losses greater than \$9 million for corn, soybeans, hay, green beans and peas, and alfalfa. The table also indicates that production levels were between 30 and 49 percent below normal-year levels for the crops listed. If yields had been 30 to 49 percent lower in 2007, the value of sales from crops (\$46,717,000) could have been \$14 to nearly \$23 million lower. Impacts to the \$40,689,000 in sales of cattle, calves, hogs, pigs, and their products would be harder to estimate.

Agricultural Production Statistics						
		Carroll Co	A crosse	Avorago	Total	
Сгор	Year	Unit	Harvested	Yield	Production	
Corn for Grain	2008	Bushels	24,500	118.0	2,900,000	
	2009		28,000	153.0	4,285,000	
	2010		31,000	107.4	3,330,000	
Corn for Silage	2008	Tons	9,200	12.0	110,000	
	2009		**	**	**	
	2010		**	**	**	
Soybeans	2008	Bushels	21,600	36.5	790,000	
	2009		23,000	43.0	985,000	
	2010		22,300	36.8	820,000	
Winter Wheat	2008	Bushels	9,000	73.5	660,000	
	2009		9,000	66.5	600,000	
	2010		8,300	66.3	550,000	
Other Hay	2008	Tons	20,000	3.0	60,000	
	2009		20,000	2.5	50,000	
	2010		*	*	*	
Barley	2008	Bushels	4,200	89.3	375,000	
	2009		5,500	70.0	385,000	
	2010		4,100	73.4	301,000	

Source: Census of Agriculture, NASS, USDA

\* Not published to avoid disclosure.

\*\* Corn silage no longer published at county level.

The table entitled "Agricultural Production Statistics" provides additional figures on harvests, yields, and production values for Carroll County based on more recent data.

# Major Employers

#### **Identification of Vulnerable Assets**

The risk to major employers during a drought would be twofold: lack of water for employee facilities and lack of water for business operations. If a major employer's water supply were not available, it would have to either curtail operations or truck in water from an outside source.

Most major employers in Carroll County rely on public water supply, as opposed to private wells. The workforces of some major employers, such as certain banks and contractors, cannot be easily apportioned based on type of water supply because much of the workforce is mobile or dispersed among numerous locations. Nevertheless, as of spring 2010, among companies that employed over 100 people at one location (see table on page 45), there were 20 that relied on public water systems. Collectively, these major employment facilities employed over 11,600 people.

Additionally, thirty-four public schools with over 100 employees and students, combined, and the administrative building are provided public water service. As of September 2012, these schools served 25,734 occupants.

Six major employers rely on private wells. These sites include three manufacturing operations, a paving contractor, and two distribution operations. Combined, these establishments employed just over 1,300 people.

Seven public schools rely on onsite wells. As of September 2012, these schools served 5,239 occupants.

#### **Estimate of Damages & Losses**

If a public water supply could not serve a major employer, costs to the employer would derive from obtaining water from an alternate source, or curtailing or shutting down operations. We do not have sufficient data to estimate what those costs would be. The logistics, and therefore the cost, of obtaining water would depend upon the use for the water. For example, drinking water could be obtained by purchasing bottled water whereas water used in a manufacturing process might require a makeshift storage and pumping system. The estimated daily cost of shutting down operations is sensitive information that businesses are unwilling to make public.

Estimated Cost to Truck in Water Supply during a Well Failure						
	Selected	l Major Ind	dustries			
	Carro	oll County,	MD			
			Cost to	Cost	Cost for	
	Demand	Demand	truck in	per	One	
Major Employer	$(\mathbf{MGD})^{\mathbf{I}}$	(KGD)	1KG <sup>2</sup>	Day	Month	
Black & Decker	0.0040	4.0	\$8.50	\$34.00	\$1,020.00	
Congoleum	0.0046	4.6	\$8.50	\$39.10	\$1,173.00	
Industries						
Finksburg Plaza	0.0100	10.0	\$8.50	\$85.00	\$2,550.00	
Development Co of	0.0106	10.6	\$8.50	\$90.10	\$2,703.00	
America						
Joseph A Banks	0.0063	6.3	\$8.50	\$53.55	\$1,606.50	
1) Common Common II Com		Dlan fan We	4 Q. C			

1) Source: Carroll County Master Plan for Water & Sewerage

2) Assumes truck costs and distance to water source are the same as for the City of Westminster in 2000

If a private industrial or commercial well runs dry, costs to the employer would derive from trucking in water, and/or drilling a replacement well. The table entitled *Estimated Cost to Truck* 

*in Water Supply during a Well Failure* uses costs from Westminster and water demand data to generate estimated costs, falling between \$1,000 - \$3,000 for one month hauling in supplemental water supply if the water does not need to be treated or is only hauled a short distance. Costs will be more if the water is treated first or needs to be hauled a long distance. In 2013, local experts report that costs to drill a replacement well can start around \$5000 and go up from there, with a typical cost falling around \$6,000.

#### Historic Resources

#### **Identification of Vulnerable Assets**

No major impacts anticipated.

#### **Estimate of Damages & Losses**

No significant costs for damages and losses anticipated.

# **Mitigation Measures**

# **Existing County Mitigation Measures**

- The Department of Public Works monitors water use and rainfall on a monthly basis in order to determine at what stage water restrictions will be emplaced at facilities which are owned and operated by the county.
- The County acquired the John Hyde Quarry Reservoir northwest of Westminster in September, 2007 as an emergency water supply.
- The City of Westminster and the County continue to partner on efforts to enhance the City's municipal water supply system to benefit both City and County residents and businesses.
- The County acquired the Harrison Property adjacent to the Town of Mount Airy and the future Gillis Falls Reservoir in June, 2009 for potential development of well fields and recharge areas
- Mandatory water conservation practices are put in place as necessary by the County and each municipality.
- The County has a designated drought coordinator as required by Maryland Department of Environment (MDE).
- The County's Bureau of Resource Management measures groundwater levels bi-weekly to monitor current status and trend of the resource.
- Operators of the County-owned water supply systems track daily water use to determine supply needs and potential problems.
- Water conservation devices and educational materials are distributed through the County's Bureau of Utilities.
- The County has adopted an Adequate Public Facilities and Concurrency Management Ordinance that would prevent new development from receiving approval if the demand created by that development would exceed the available capacity of the public water supply systems.

- The Health Department has exercised its authority when necessary to stop approval of development plans or building permits when adequate water supply is not available to serve the development.
- Projected or developable water supply is one of the customary criteria considered while developing land-use strategies for all comprehensive plans within Carroll County. The recently adopted County-wide comprehensive Water Resources Element (WRE) responds to State mandates requiring ever more specific analysis relative to water supply, wastewater capacity, and storm water management capacity. This unified plan addresses these issues on a watershed basis and governs each of Carroll's municipalities as well as the unincorporated areas of the County.
- Pamphlets on water conservation techniques and several newsletter articles about agricultural drought management strategies have been published and distributed by the County's Bureau of Utilities and the University of Maryland's Agricultural Extension Carroll County Office, respectively.
- An inventory of data has been conducted and collection networks established for the purpose of assessing drought risk.
- The Carroll Soil Conservation District, through the financial cooperation of the Farm Service Agency, augments water supply to vulnerable assets by providing pumps and pipes for distribution and provides technical and financial assistance for installation of livestock watering facilities.
- The Carroll Soil Conservation District has developed information resources for farmers to help with decisions on crop selection, cultivation methods, and water and moisture management.
- The Maryland Department of Agriculture has created low-interest loan and aid programs for the agricultural sector.
- The County Department of Economic Development has an Agriculture Development Specialist dedicated to providing assistance to the agribusiness community. The services offered include research and marketing assistance, promotional activities, aid with policies and programs, and help in acquiring ag-based small business resources.

# **Existing Municipal Mitigation Measures**

- Mandatory water conservation practices are put in place as necessary by each municipality.
- Operators of the community water supply systems track daily water use to determine supply needs and potential problems.
- The Bureau of Resource Management provides technical assistance to the municipalities in the county for evaluating water quantity and quality from potential new sources.
- City of Westminster has completed permitting, funding and construction of the Medford Quarry Pipeline; the system was completed in 2009.
- The Town of Mount Airy has continued needed field exploration for additional well sites and continues exploration of additional surface water supply resources.

- The City of Taneytown has developed agreements for locating an additional well (Well #17) on protected property within the community. The Baptist Church property has been annexed into the City and the well is under construction. It is anticipated that construction will be completed in July, 2013.
- Currently the Town of Hampstead has a 1-million-gallon water storage capacity on a gravity fed-system with opportunity for manual controls in the event of power failures.

#### High-Priority Proposed County Mitigation Strategies

High-Priority Drought Mitigation Strategies - County					
Stratogy	Responsible	Anticipated Timeline	Funding Source(s)		
Continue the planning process and land acquisition for the Gillis Falls and Union Mills Reservoirs should water demand, permitting and/or regulatory environment dictate implementing either or both of these facilities	Bureau of Resource Management (BRM)	Ongoing – currently monitoring water quality, acquiring land	County		

# High-Priority Proposed Municipal Mitigation Strategies

High-Priority Drought Mitigation Strategies - Municipalities				
Strategy	Municipality	Cooperating Stakeholders /Jurisdiction	Anticipated Timeline	Funding Sources(s)
Develop and bring	Town of	N/A	TBD	Town funded
Super Pump House	Hampstead			
and generators on-				
line				
Analyze needed	Town of	N/A	TBD	TBD
capacity and acquire	Hampstead			
emergency generators				
to allow individual				
well operations				

# Lower-Priority Proposed County Mitigation Strategies-Future Consideration

Lower-Priority Drought Mitigation Strategies - County				
Strategy	Responsible Agency/ies	Anticipated Timeline	Funding Source(s)	
Develop a reservoir				
operation plan for Piney Run				
Reservoir and pursue				
possible funding sources for				
developing the plan	BRM	TBD	County	
Deepen water wells to				
increase storage capacity for				
rural water supplies	BRM	TBD	County	
Work with the towns to				
improve water conveyance				
efficiencies through leak				
detection programs in the				
towns as well as within the				
County system	DPW	TBD	County	

Coordinate with hay and/or			
grain receiving areas to aid			
in the distribution of			
emergency feed stocks	DED	TBD	County
Limit or possibly eliminate			
irrigation practices on certain			
agricultural properties, golf			
courses, or areas where			
excessive water use is not			
practical or feasible during a			
severe drought	MDE	TBD	State

# Lower-Priority Proposed Municipal Mitigation Strategies-Future Consideration

Lower-Priority Drought Mitigation Strategies - Municipalities					
	Responsible				
	Town and	Anticipated			
Strategy	Agency/ies	Timeline	Funding Source(s)		
Investigate the use of quarry	New				
discharge waters from the	Windsor.				
Union Bridge and New	Union				
Windsor Lehigh Quarries for	Bridge,				
use during water shortages	& BRM	TBD	TBD		
Develop drought mitigation					
plans for public water					
supplies to include source	BRM &				
augmentation	Towns	TBD	County & Towns		
Inventory self-supplied					
industrial water users for					
possible use of their supplies					
for emergency public water	BRM &				
supplies	Towns	TBD	County & Towns		
Work with public water	DPW &	TBD	County & Towns		

systems and community	Towns	
water systems to adopt water		
conservation measures		

# Chapter Six: Flooding (Flash/Riverine)

# **Hazard Identification**

# Hazard Characterization

Flooding is the most common natural disaster nationally.

Nearly 9 out of 10 presidential disaster declarations result from natural phenomena, of which flooding is a major component. In terms of both loss of life and property/crop damage, it has been recorded that floods account for more losses than any other natural disaster in the country. The two types of flooding associated with rivers and streams are "flash" and "riverine."

Flash floods occur suddenly with tremendous force, usually as a result of torrential rainfall

over a short period of time. With little or no warning, a peaceful stream can become a raging torrent capable of carrying away large objects such as boulders, trees, houses, trailers, cars, and people. The potential for flash flooding increases dramatically if the ground already is saturated from previous rainfall. Flash floods also can occur from a sudden release of water from a dam failure or breakup of an ice jam. The 1889 Johnstown, Pennsylvania, flood that killed 2,200

sylvania, flood that killed 2,200 people is an example of flash flooding caused by failure of a dam.

> Riverine flooding is caused by a different set of conditions. Persistent moderate or heavy rain over one or more days, sometimes combined with snowmelt, can cause a river to slowly rise and overflow its banks. It may take several days to even weeks for rivers to rise over their banks, providing enough warning for people to move to higher ground.

However, river floods can last for weeks and can inundate very large areas or entire regions. The 1993 Upper Mississippi River Basin flood, affecting nine states with damages around \$14 billion, is a classic example of a river flood affecting a large region.



Little Pipe Creek Flooding in Union Bridge – December 4, 1993



# **Regional & Historical Perspectives**

Nationwide from 1993 through 2010, floods caused an average of more than \$10 billion and 80 fatalities per year. By comparison, Maryland averaged nearly \$7 million and less than one fatality per year over the same period. Although Maryland does experience some significant floods, annual damages rarely

approach the \$100 million level.

Maryland has a long history of significant floods. The greatest flooding from a one-river perspective occurred on the Potomac River in 1936. The flood was the result of a storm dropping heavy rain on soil already saturated from snowmelt and rainfall earlier in the month; it caused \$24 million in damage. The greatest riverine and stream flooding, in terms of geographic extent and duration, occurred in 1972 when the remnants of Hurricane Agnes

Little Pipe Creek Flooding along MD 75 – December 4, 1993

snowmelt. The second, in September, was caused by rainfall from the remnants of Hurricane Fran, but did not include Carroll County. Since 1996, however, there has not been a major flood event in the Maryland area.

#### **Risk Characterization**

Carroll County is among the jurisdictions in Maryland

considered at the highest risk for flash flooding. However, Carroll County is still identified in the 2011 MD State Hazard Mitigation Plan Update as being at medium risk for flooding overall. Flash flooding poses a higher risk for the county than riverine flooding because Carroll County is predominately a headwater stream area, not a river valley system that conveys flows from other counties and states.

Hazard High-Impact Areas

became nearly stationary over Pennsylvania and New York. Heavy rainfall from June 20 to June 25 caused flooding in excess of the 100-year frequency level in tributaries along the north side of the Potomac River from Conococheague Creek at Fairview, Maryland, down to Rock Creek at Washington, D.C.

Two events during 1996 resulted in Presidential Disaster Declarations for Maryland. Carroll County was included in the first Declaration, in January, which was caused by rapid The areas at the greatest risk of impact from flooding are those that fall within the one-percent-annual chance (100-year) floodplain. Since FEMA-mapped floodplains provide an already existing source of data, the effective Flood Insurance Rate Map (FIRM) for Carroll County was used to delineate the hazard areas for riverine and flash flooding. The FIRM is designed to serve FEMA's needs for disaster response

activities, risk assessment, and
floodplain management. The FIRM is
used for a variety of planning
applications, including
broad-based review for floodplain
management, land-use planning,
commercial site analysis, insurance
target marketing, natural
resource/environmental analyses, and
real estate development and targeting.
As of the writing of this plan, FEMA
is in the process of revising the
FIRMs for Carroll County, including
the incorporated towns. The revised
product will be a Digital Flood
Insurance Rate Map to be used with
Geographic Information Systems
(GIS) software. This map will
provide the first accurate digital
depiction of the flood risk within
Carroll County. The County hopes to
have updated and more precise maps
of the floodplains by the end of 2014.

Value of Critical Facilities Located within a 100-Year Floodplain					
Carroll County, MD					
Land Value	Value	Total Value			
n/a	n/a	n/a			
n/a	n/a	n/a			
n/a	n/a	n/a			
255,200		255,200			
1,364,000	4,995,200	6,359,200			
145,900	33,200	179,100			
13,798,400	2,639,100	16,437,500			
n/a	n/a	121,800,000			
n/a	n/a	121,000,000			
800	50,000	50,800			
1,000	200,000	201,000			
500	300,000	300,500			
14,000	400,000	414,000			
<ul> <li><sup>1</sup> Tax assessment data for the wastewater treatment plants were not available.</li> <li><sup>2</sup> Values are for entire property. All structures are not in floodplain.</li> <li><sup>3</sup> Replacement cost is reported under Total Value</li> <li><sup>4</sup> Estimated replacement value is reported under "Improvement Value"; "Total Value" is combination of land value (based on tax assessment data) and replacement value</li> </ul>					
Source: FEIVIA (100-Year Floodplains) 2013; CC Bureau of Comprehensive Planning, 2013					
	MD           Land Value           n/a           n/a           n/a           255,200           1,364,000           145,900           13,798,400           n/a           n/a           n/a           1000           500           14,000           e not available.           plain.           t Value"; "Total V           Comprehensive P	MD         Improvement           Land Value         Value           n/a         n/a           n/a         n/a           n/a         n/a           n/a         n/a           n/a         n/a           n/a         n/a           1,364,000         4,995,200           145,900         33,200           13,798,400         2,639,100           n/a         n/a           no         300			

facilities, and historic sites located in the floodplain. References to the 100-year floodplain throughout the rest of this plan are to the FEMA-mapped floodplains, unless otherwise noted.

Each sub-watershed is shown on a separate map. The maps entitled "Hazard High-Impact Area for Riverine/Flash Flooding" found on pages 77-84 show those areas of Carroll County by sub-watershed mapped by FEMA that are at risk for riverine and/or flash flooding and include the locations of structures and critical facilities within those areas. The overall county map shows the location within the county of each watershed, while individual maps of each watershed are also provided to display structures, major employers, critical

# **Risk Assessment**

#### **Critical Facilities**

#### **Identification of Vulnerable Assets**

The table entitled "Value of Critical Facilities Located within a 100-Year Floodplain" lists the various facilities located within a floodplain throughout the County. Most of the structures are public facilities such as wastewater treatment plants, stormwater management facilities, municipal buildings, and bridges. For the few privately owned properties, the structures area located outside the floodplain.

#### **Estimate of Damages and Losses**

Total values for the four stormwater management facilities, all located in the Town of Sykesville, vary from nearly \$51,000 to \$414,000. The total replacement cost for 115 County bridges is estimated at \$121,800,000 and for 47 State bridges, the estimated cost is \$121,000,000. Total values for the privately owned properties range from approximately \$179,000 to \$16,438,000.

Tax assessment data were not available for the wastewater treatment facilities.

#### People & Residences

#### **Identification of Vulnerable Assets**

"Repetitive loss structure" is a term that is usually associated with the National Flood Insurance Program (NFIP). For Flood Mitigation Assistance (FMA) program purposes, this is a structure, covered by a contract of flood insurance under the NFIP, that has suffered flood damage on two or more occasions over a 10-year period ending on the date when a second claim is made, in which the cost to repair the flood damage, on average, equals or exceeds 25 percent of the market-value of the structure at the time of each flood loss event. For the Community Rating System (CRS) of the NFIP, a repetitive loss property is any property for which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. A repetitive loss structure is important to the NFIP, since structures that flood frequently put a strain on the flood insurance fund.

The County's Office of Public Safety Support Services Emergency Management Division's building-point data were used to identify properties for which the structure itself on a parcel located either all or partially in the floodplain was also located in the floodplain. The data showed that, throughout the county, 1,043 residential structures are located within 100-year floodplain boundaries. Of these, an estimated two houses are considered repetitive loss structures. The vast majority (1,039) of the structures are detached, single-family homes. Of the others, three are residential condominiums, and one is a residential commercial operation where the primary use is residential. To estimate the number of people at risk of losing their homes in a worst-case scenario flood, the number of

structures was multiplied by the countywide occupancy rate of 95.8 percent to estimate that 999 of the residential structures have people living in them. That is, 999 households live within a 100-year floodplain. That equates to 2,737 people residing in the flood hazard area, based on the countywide average persons per household of 2.74.

#### **Estimate of Damages & Losses**

Based on data reported in the two tables relating to residential structures located within the 100-year floodplain, if every residential structure in the floodplain were destroyed, the value of the lost homes would total an estimated \$69,148,000, or an average of \$159,000 per structure. Those loss estimates assume that the value of the land underneath the structures would not be lost. They are based on the value of the buildings only. However, if a government agency determines that it is necessary to condemn repetitive loss structures, the land would lose all or nearly all of its value as well. The estimated total value of all residential properties (including the value of both land and improvements) inside 100-year floodplains is \$106,495,000.

Residential Structures Located within FEMA-Mapped Floodplains
by County (excluding Municipalities & Growth Areas)
Carroll County, MD

Area	# of Structures	Total Land Value of Parcels	Total Improvement Value on Parcels	Total Value
Carroll	208	13,128,478	30,247,199	43,375,577
County				
Avg. Values		63,117	145,419	208,536
Source: CC Bureau of Comprehensive Planning & MD Assessment and				
Taxation Data, 2013				

<b>Residential Structures Located within FEMA-Mapped</b>							
Floodplains							
by Growth Area							
Carroll County, MD							
	Total Total						
	# of	Land	Improvement				
	Structure	Value of	Value on	Total			
Growth Area	s	Parcels	Parcels	Value			
Hampstead	0						
Average Values							
Manchester	0						
Average Values							
Mount Airy	1	172,000	39,000	211,000			
Average Values		172,000	39,000	211,000			
New Windsor	9	908,300	1,042,200	1,950,500			
Average Values		100,922	115,800	216,722			
Freedom	104	10,918,200	23,935,400	34,853,600			
Average Values		104,983	230,148	335,131			
Taneytown	11	1,109,700	1,170,000	2,279,700			
Average Values		100,882	106,367	207,246			
Union Bridge	15	2,542,400	1,988,600	4,531,000			
Average Values		169,493	132,573	295,560			
Westminster	68	6,299,200	8,582,700	14,881,900			
Average Values		92,635	126,216	218,851			
Finksburg	20	2,268,800	2,143,200	4,412,000			
Average Values		113,440	107,160	220,600			
Totals	228	24,218,600	38,901,100	63,119,700			
Source: CC Bureau of Comprehensive Planning & MD Assessment and							
Taxation Data, 2013							

The table entitled "Residential Structures Located within the FEMA-Mapped Floodplains by Growth Area" shows the number of structures located in the floodplain by growth area. The table entitled "Residential Structures Located within FEMA-Mapped Floodplains by County" shows the number of structures located in the floodplain for the remainder of the county.



#### Agricultural & Natural Resources

#### **Identification of Vulnerable Assets**

Most of the land in floodplains is used for agriculture. In fact, farms account for 10,480 acres, or 61 percent, of all land in 100-year floodplains in the county. Farmers typically plant grasses within a 20- to 40-foot buffer of a stream, but the 100-year floodplain can be much wider and encompass many types of crop fields as well as pastures for livestock.

#### Estimate of Damages & Losses

Approximately 6.7 percent of all agricultural land in the county is located in a 100-year floodplain. No one type of agriculture predominates in the floodplains, so to estimate damages and losses we assume that a proportionate amount of each type of agriculture is present. Since flooding destroys crops, we estimate the losses to crop farming in a 100-year flood event by multiplying the value of all crop sales from the 2007 Census of Agriculture by the proportion of croplands that we assume to be in a 100-year floodplain (6.7 percent). In other words, crop losses from a 100-year flood would total approximately \$3,130,039.

Flooding does not necessarily destroy livestock, and, as a result, it is more difficult to estimate the losses to livestock farmers from a 100-year flood event. While is it possible for livestock to be removed from a floodplain, the process is not simple and can be costly. The 2007 Census of Agriculture reports the market value of certain livestock (cattle, calves,

hogs, and pigs) and their products (i.e., milk and other dairy products from cows) that were sold during the census year. For Carroll County, data for several animal categories (horses and ponies, poultry, sheep, and goats) and their products were withheld in the 2007 Census to avoid disclosing individual farm data. For the livestock data reported, the market value of livestock and their products sold was \$40,689,000. If we assume that 6.7 percent of these farms are in the 100-year floodplains, we can estimate that \$2,726,163 worth of potential sales product was based in a 100-year floodplain at the time of the 2007 Census of Agriculture. The portion that would be lost would depend on the extent of warning before the water levels rise, the cost to relocate the livestock, and the availability of substitute pasturelands.

# Major Employers

#### **Identification of Vulnerable Assets**

There are no major employers located within a 100-year floodplain in Carroll County.

#### **Estimate of Damages & Losses**

No significant damages or losses to major employers are anticipated as a result of flooding.

#### Historic Resources

Historic Sites Located within FEMA-Mapped Floodplains				
Carroll County, MD				
	# of			
	Historic	Total Property		
Growth Area	Sites	Value (\$)		
Hampstead	0	0		
Freedom- Sykesville	6	1,001,800		
Manchester	0	0		
Mount Airy*	1	923,000		
New Windsor	1	1,500,000		
Taneytown	1	801,000		
Union Bridge	3	2,366,500		
Westminster	3	1,402,700		
Totals	15	7,995,000		
<b>Remainder of County</b>				
Area Outside Growth Areas	86	55,309,200		
Total for County	101	63,304,200		
* Mount Airy numbers are for Carroll Co. portion of the municipality				
Sources: CC Bureau of Comprehensive Planning; MD Assessment				
and Taxation, 2013				

#### **Identification of Vulnerable Assets**

A total of 101 historic sites, those which are listed on the National Register of Historic Sites and/or on the Maryland Historical Trust Inventory of Historic Sites, are located within a hazard area for 100-year floods. Due to the fact that many historic sites are homes, the number and value of many of these structures have been included in the total number of structures indicated in the People, Population & Residences section of this chapter.

#### Estimate of Damages & Losses

The table entitled "Historic Sites Located within FEMA-Mapped Floodplains" identifies the number of historic sites found in the identified hazard area for floods for each of the county's growth areas. Total property values were queried from the assessment data to estimate damages and losses. The total value of the historic buildings in the hazard area for floods is estimated to be \$9,289,071. However, no real numerical value can be placed on sites that tell the history of the community and help to preserve its sense of place.

# **Mitigation Measures**

Guiding development in the 100-year flood inundation zone presents a straightforward method of preventing flood damage. If structures are properly sited or elevated to prevent flood damage, the amount of hazard risk decreases. Preventative activities attempt to keep flood problems from getting worse by addressing development collectively. Planning, land acquisition, and regulations help to guide the use and development of flood-prone areas. Building, planning, and/or code enforcement offices administer most preventative activities.

## **Existing County Mitigation Measures**

- The Floodplain Management Ordinance was adopted to protect human life and health, minimize property damage, encourage appropriate construction practices, and protect water supply, sanitary disposal, and natural drainage. Floodplain impacts are to be avoided and minimized. It also requires a setback area to be preserved in perpetuity with natural vegetation.
- Section 505 of the Development Handbook prohibits construction in floodplain and wetland areas for the purposes of reducing losses to life and property from flooding, and reducing the need for public expenditures and flood protection.
- The Conservation Zoning District of the Carroll County Zoning Ordinance is intended to help limit the damage floods cause by limiting the amount of development within floodplains. In addition to the general purpose of the district, all cluster subdivisions located in a Conservation Zoning District must be located 300 feet from the 100-year planned reservoir flood pool.
- The Stormwater Management Ordinance limits the impact of new development on flooding that can occur from 1-year and 10-year storms. This ordinance is in compliance with the Maryland Stormwater Manual and requires stormwater management plans to be consistent with the Flood Hazard Management Act of 1976.
- In 2004, the County adopted a new floodplain management ordinance that increases previous protections by prohibiting, except in very limited circumstances, new development in floodplains where the development would affect flood heights.
- The Building Code regulates development of existing lots in floodplains, prohibits activities affecting flood height, and prohibits new sewerage systems in floodplains.
- Mitigation Grant Programs
- Hazards Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance program
- Pre-Disaster Mitigation Program
- Mitigation Technical Assistance Programs
- The County participates in the National Flood Insurance Programs (NFIP).
  - The function of NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost, and to encourage the location of new development away from the floodplain. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through guidance of new development in floodplains.
  - Congress created the NFIP in 1968 to minimize response and recovery costs and to reduce the loss of life and damage to property caused by flooding. The Federal Emergency Management Agency (FEMA) administers the NFIP. The two fundamental objectives of NFIP are to:
    - Ensure that new buildings will be free from flood damage; and
    - Prevent new developments from increasing flood damage to existing properties.
  - The primary benefits of the NFIP are to:
    - Provide flood insurance coverage not generally available in the private market;
    - Stimulate local floodplain management to guide future development;
    - Emphasize less costly nonstructural flood control regulatory measures over structural measures; and
    - Reduce costs to the federal and state governments by shifting the burden from the general taxpayer to floodplain occupants.
  - Participation in this program by the County allows citizens to be eligible for flood insurance. The current Flood Insurance Rate Maps need to be updated, but they are available in various County agencies for viewing prior to construction.
- Flood Mitigation Assistance
  - The Flood Mitigation Assistance program (FMA) is a cost-share program (75% federal, 25% local match) through which communities can receive grants for the development of a comprehensive flood mitigation plan and the implementation of flood mitigation projects. Communities must belong to the National Flood Insurance Program (NFIP) to receive FMA funds.
  - The overall goal of FMA is to fund cost-effective measures that reduce or eliminate the long-term risk of flood damage to <u>NFIP-insured</u> buildings, manufactured homes, and other structures. Other goals are to: Reduce the number of repetitively or substantially damaged structures and the associated claims on the NFIP; encourage long-term, comprehensive mitigation planning; respond to the needs of communities participating in the NFIP; and complement other federal and state mitigation programs with similar goals.
  - There are two types of FMA grants available: planning grants and project grants. The funds allocated to the state are based on the number of flood insurance policies in place statewide as well as the number of identified repetitive loss

properties. A repetitive loss property is any insured structure that has two or more flood insurance claims of at least \$1,000 each.

- To receive a FMA project grant, a community must have an <u>approved</u> flood mitigation plan. Typically, funded FMA projects are for the acquisition and demolition of repetitively flooded structures insured by the National Flood Insurance Program (NFIP).
- Weather-alert radios are available in most government agencies with responsibility for response or action during a hazard event.
- Riparian vegetation, where absent in stream buffers, is restored to provide natural mitigation against storm-related hazards and soil movement, as well as to capture and slow the pace of stormwater. This is accomplished through the Forest Conservation ordinance and the Floodplain Management ordinance that was adopted in April 2004.
- Wetlands are currently being preserved in floodplains to protect the functioning of natural systems to mitigate flooding as new development occurs on individual properties.
- DPW routinely clears debris from the support bracing underneath low-lying bridges to decrease the likelihood that large objects carried by floodwaters will lodge against a bridge and subsequently dam the river course.
- The Bureau of Resource Management implements the Stormwater Management chapter of the Carroll County Code of Public Local Laws, which allows porous or open-grid pavement to be substituted for impervious pavement to limit the amount of stormwater runoff that contributes to localized flooding on a site-specific basis.
- The County floodplain ordinance was updated and revisions adopted in April 2004 to evaluate and update the requirements to meet or exceed the NFIP standards.
- County staff is participating in training on NFIP requirements to help improve the enforcement of existing floodplain regulations. The County has been delegated review and enforcement authority by the municipalities for the Floodplain Management Program.
- The new Floodplain Management Program and requirements put into place in April 2004 for the County require that flood-free access be provided to new developments.
- FEMA issued preliminary FIRM's on July 18, 2012. The 90-day appeal period ended October 15, 2012. The County is awaiting FEMA's appeal resolution and issuance of Letter of Final Determination (LFD). The revised FIRM's will become effective 6 months after issuance of the LFD.
- FEMA is reviewing the County's floodplain ordinance for compliance. Hampstead, Manchester, Mount Airy, New Windsor, Union Bridge and Sykesville have all adopted the County's ordinance. Westminster may need to revise their ordinance to remain compliant. FEMA is reviewing Mount Airy's floodplain ordinance for compliance. Taneytown will need to adopt an ordinance that meets FEMA's minimum requirements to join the NFIP.

# **Existing Municipal Mitigation Measures**

- The Town of Sykesville is working with the County on locating and mapping its 330 storm drains and developing an operation and maintenance plan for the storm drain network.
- Westminster is in the process of repairing and rebuilding some of its stormwater management facilities; the city has identified 4 areas to target for remediation.
- Since 2010, Westminster has been urging the adoption of the new FEMA floodplain maps to enable an additional tool to protect its flood-prone areas designated by the new mapping.
- The Town of Union Bridge has included within its subdivision plan approval of the Jackson Ridge development and pursuant public works agreement, stipulations requiring construction of new box culverts for the MD 75 Bridge over Little Pipe Creek, which will mitigate the flood risk in the eastern portion of the town.
- Union Bridge suggests that a study of the cumulative stormwater effects for the MD 75 and Bucher John Road corridors in the vicinity of Little Pipe Creek and Cherry Branch be made to aid development of appropriate flood management projects.

High-Priority Flood Mitigation Strategies - County				
Strategy	Responsible	Anticipated Timeline	Funding Source(s)	
	Agency/ies			
Work with FEMA and MEMA	Bureau of Resource	Ongoing	• County	
on the Map Modernization	Management	County is awaiting issuance of LFD by	• State	
Program to support the		FEMA		
development of digital FIRMS				
for the county and identify				
areas for possible re-study.				
Work with the municipalities	Bureau of Resource	Ongoing – as of May 2013, Union Bridge	• County	
to update all floodplain	Management &	and Westminster may need to revise their		
ordinances.	Towns	ordinance; FEMA is reviewing Mount		
		Airy's ordinance; Taneytown will need to		
		adopt an ordinance the meets FEMA		
		requirements		

### **Proposed High-Priority Mitigation Strategies**

	High-Priority Flood Mitigation Strategies - County					
Retrofit existing storm water management facilities that do not meet current requirements	Bureau of Resource Management	Ongoing	• County			
Identify owners of repetitive loss properties who are interested in participating in future property acquisition and relocation projects with assistance available through the federal Flood Mitigation Assistance (FMA) program, in addition to other flood protection measures.	Office of Public Safety Support Services Emergency Management Division	Continuous	• County • State • Federal			
Identify owners of properties with structures in the floodplain – other than identified repetitive loss properties who are interested in participating in future property acquisition and relocation projects.	Office of Public Safety Support Services Emergency Management Division	Continuous	• County • State • Federal			
Where relocation is not feasible, educate property owners with structures in the floodplain on elevating those structures to reduce flood damage through dry and wet flood-proofing techniques and the benefits of each. Dry flood- proofing techniques may be applied to non- residential properties only; residential structures must be elevated.	Office of Public Safety Support Services Emergency Management Division	Continuous	• County • State • Federal			

While the mitigation strategies in the plan can and should be implemented regardless of HMGP funding, it should be noted that, in addressing flood hazards, FEMA's primary emphasis under the HMGP is the implementation of non-structural measures. Non-structural measures include the acquisition and demolition, relocation, elevation, or dry flood-proofing (non-residential structures only) of flood damaged or flood-prone properties.

# Lower-Priority Mitigation Measures for Future Consideration-County and Municipal

- Preserve and restore floodplains to protect the functioning of natural systems to mitigate flooding on properties that do not go through the development process. (BRM & Towns)
- Raise low-lying bridges to decrease the likelihood that large objects carried by floodwaters will lodge against a bridge and subsequently dam the river course. (DPW & Towns)
- Identify bridges at risk from flood, identify enhancements, and implement projects needed to reduce the risks. (DPW & Towns)
- Support federal legislation limiting payments for repetitive losses. (OPS)
- Review and update building codes to accurately reflect requirements of the National Flood Insurance Program (BPI)
- Work with SHA to identify areas of frequent roadway flooding and develop mitigation strategies. (DPW)
- Provide additional means of access into existing neighborhoods in flood-prone areas to prevent residents from becoming trapped during a flood event. (DPW, BCP, & Towns)
- Construct, where possible, berms around flood-threatened water or wastewater treatment plants to avoid inundation of the local water or wastewater plant. (DPW & Towns)
- Relocate, where possible, flood-threatened water or wastewater treatment plants to avoid inundation of the local water or wastewater plant. (DPW & Towns)
- Install watertight covers or inflow guards on sewer manholes, and/or raise manhole openings that are not located within roadways onto concrete pillars to prevent floodwaters from infiltrating sewerage pipes and causing sewer overflow, pipe pressurization, and household surcharge of untreated wastewater. (DPW & Towns)

















# Chapter Seven: Hurricane

# **Hazard Identification**

# Hazard Characterization

A hurricane, also known as a tropical cyclone, is a tropical storm with winds that have reached a constant speed of 74 miles per hour or more. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane approaches, the skies will begin to darken, and winds will grow in strength. As a hurricane nears land, it can bring torrential rains, high winds, and storm surges. A single hurricane can last for more than two weeks over open waters and can run a path across the entire length of the eastern seaboard. August and September are peak months during the hurricane season that lasts from June 1 through November 30.

The center, or eye, of a hurricane is relatively calm. The most violent activity takes place in the area immediately around the eye, called the eye wall. At the top of the eye wall (about 50,000 feet), most of the air is propelled outward, increasing the air's upward motion. Some of the air, however, moves inward and sinks into the eye, creating a cloud-free area.

Coastlines often suffer the most from the impacts of a hurricane. However, areas well inland also can be significantly affected by tropical cyclones. Heavy rains sometimes cause severe flooding and gusty winds, and tornadoes can cause moderate to major structural damage and can down power lines and trees.

# **Regional & Historical Perspectives**

During the years 1886 to 1999, 72 tropical cyclones or their remnants passed within 60 miles of the Maryland State boundary. However, only one of these storms was classified as a land-falling hurricane. By comparison, 158 made landfall between Texas and Maine from 1990 to 1996. Although Maryland's risk of a land-falling hurricane is much lower than some other coastline states, such as Florida and North Carolina, it is still among the one-third of U.S. states that have such a risk.

Maryland typically is spared from land-falling hurricanes because of the orientation of the coastline at the State's latitude. When hurricanes reach the latitude of the Mid-Atlantic States, they are tracking (recurving) toward the north or northeast. Because the coastline protrudes outward in North Carolina, storms tend to make landfall there (or elsewhere in the southeast) or pass just short of Maryland's coastline. Most often, Maryland is affected by hurricanes that have been



downgraded to tropical storm or depression status after making landfall further south.

Some of the storms that have passed near or through Maryland are notable because of the flooding they produced. For example, Agnes (1972) and Fran (1996) resulted in some of the worst flooding ever recorded for western and central Maryland. However, neither storm was classified as a hurricane when it affected Maryland.

### **Risk Characterization**

The composite risk for coastal hazards, which includes risk from hurricanes, remnants of tropical storms, and storm surge, is shown as medium-low for Carroll County in the Maryland State Hazard Mitigation Plan 2011 Update. That is not to say that the county is not affected or at any risk, but that by comparison to the impacts experienced by some of the other counties, particularly the bay and coastal counties, Carroll County's risk is much lower. Carroll County is basically not affected by storm surge and therefore has a lower risk classification than those counties that are affected.

# Hazard High-Impact Areas

Of all the hazards associated with hurricanes, hurricane force winds cause the greatest property loss. Detached, one- to twostory houses are more susceptible to wind damage than other types of buildings because they are not built to the same engineering standards as taller and more load-bearing structures. When Hurricane Andrew struck Dade County, Florida, 90 percent of homes in the county had major roof damage. Hurricane Iniki damaged over 90 percent of all buildings in Kauai County (Ayscue, 1996).

When a hurricane strikes Carroll County, the entire county is at risk for some impact. However, the Growth Areas (GAs), which are the areas within the Growth Area Boundaries (GAB), are those areas which would be at risk for sustaining the most damage and losses, simply because population and the associated infrastructure, houses, and businesses are concentrated in these areas as part of the ongoing effort to promote efficient growth and preserve agricultural and natural resource land. While the probability of occurrence of a hurricane is not necessarily higher in these areas, the damages and losses that might be sustained within the GABs would be greater because of this concentration of people and structures. In addition, the people most at risk when a hurricane hits are also most likely to be located in a GA – people in automobiles; people who may not understand a warning due to a language barrier; the elderly and very young; and people with physical or mental disabilities. The GABs provide a logical delineation of areas which will likely incur the most damages.

Each of the eight GAs within the county has been identified on the map entitled "Hazard High-Impact Area for Hurricanes: Growth Areas" on page 95. Appendix B contains individual maps of each GA showing the location of all structures, major employers, critical facilities, and historic sites. These maps are titled "Hazard High-Impact Area for Winter Storms, Hurricanes, and Tornadoes" and are further identified by the name of the specific GA which it depicts.

# **Risk Assessment**

### **Critical Facilities**

#### **Identification of Vulnerable Assets**

According to the State critical facilities data, a total of approximately 199 critical facilities are located in the GAs. These facilities include many schools and Board of Education facilities as well as numerous facilities serving McDaniel College. Among these facilities are also several fire departments, municipal offices, County facilities, State facilities, and health-related facilities.

#### **Estimate of Damages & Losses**

Critical Facilities Most at Risk for Hurricane By Growth Area Carroll County, MD				
GA # of Critical Facilities Total Value (\$)				
Hampstead	18	71,451,100		
Manchester	8	76,469,800		
Mount Airy*	17	39,860,100		
New Windsor	11	19,740,300		
Sykesville-Freedom	41	283,958,500		
Taneytown	17	35,096,400		
Union Bridge	9	19,014,933		
Westminster	78	549,991,333		
Totals 199 \$1,095,582,466				
*Does not reflect Critical Facilities in Frederick County				
Source: CC Bureau of Comprehensive Planning, MD Assessment and				
Taxation Data, & MEN	MA, 2013			

The table entitled "Critical Facilities Most at Risk for Hurricane" breaks down the number of critical facilities by GA and provides the total value of critical facilities in each GA.

### Population, People, & Residences

#### **Identification of Vulnerable Assets**

Housing development within GA's is primarily at suburban and urban densities, that is two to four lots per acre. Housing development outside of the GA's is primarily at rural densities, that is lots of one acre and larger.

Carroll County is narrow enough (no two points in Carroll County are farther than 35 miles apart) that if a hurricane were to pass directly over the county, the eye wall, that is, the area of most violent storm activity, would be likely to hit every GA. As of April 2013, an estimated 89,702 people, or 53 percent of the county's population, lived in one of the eight GA's. The table entitled "Populations and Structures Most at Risk for Hurricane" shows the numbers of people, households, and structures within each GA. The estimates for the number of structures were derived by starting with the number of residential structures counted in the 2010 U.S. Census and adding the number of use and occupancy permits issued since 2010. By taking the number of structures and multiplying by the residential occupancy rates for each GA, the estimates for the number of households were

derived. Next, by taking the number of households and multiplying by the average persons per household figure for each GA, the population estimates were derived. The occupancy rates and persons per household figures came from 2010 U.S. Census data.

When discussing hurricanes, mobile homes deserve added attention because they are particularly vulnerable to damage from high winds. Of the 16 mobile home parks in Carroll County, four are located in the hazard area for hurricanes. Between them, there are 140 pads.

### Estimate of Damages & Losses

If we assume a similar damage rate to those experienced during Andrew and Iniki, over 25,000 homes in the GA's would be damaged. According to tax assessment data, the average value for residential structures in the eight GA's is \$151,758. By multiplying that average value by the projected number of damaged homes, it is estimated that the damage to homes in GA's could total \$3,793,950,000. The table entitled "Value of Residential Structures Most at Risk for Hurricane" gives the total land and improvement values by GA as well as the

Populations and Structures Most at Risk for Hurricane by Growth Area						
		Carr	oll County, MI	)		
		2013		Pr	ojected Build-	out
			# of			# of
		# of	Residential		# of	Residential
Growth Area	Population	Households	Structures	Population	Households	Structures
Hampstead	7,516	2,694	2,821	8,702	3,119	3,267
Freedom-	34,039	11,819	12,185	45,801	15,903	16,395
Sykesville						
Manchester	4,991	1,733	1,815	6,667	2,315	2,424
Mount Airy*	6,103	2,090	2,166	8,991	3,079	3,190
New Windsor	1,770	639	683	2,889	1,043	1,116
Taneytown	7,239	2,576	2,669	14,789	5,263	5,454
Union Bridge	1,191	460	508	4,268	1,648	1,821
Westminster	26,853	10,614	11,056	34,018	13,446	14,006
Totals	89,702	32,625	33,903	126,125	45,816	47,673
* Mount Airy n Source: Carroll	umbers are for County Bureau	Carroll County p	ortion of the mu	nicipality		

Value of Residential Structures Most at Risk for Hurricane							
	by Growth Area						
		Carrol	l County, MD				
			Total Impro	vement	Total La	nd &	
	Land Valu	ie (\$)	Value	(\$)	Improvement	Value (\$)	
Growth Area	Total	Average	Total	Average	Total	Average	
Hampstead	208,340,700	93,678	298,486,300	134,213	506,654,050	227,812	
Freedom-	1,534,238,200	144,576	2,051,438,000	193,313	3,585,676,200	337,889	
Sykesville							
Manchester	158,525,400	99,702	247,458,000	155,634	405,855,485	255,255	
Mount Airy*	25,535,600	127,742	389,662,100	194,929	645,018,400	322,670	
New Windsor	56,318,100	96,270	94,022,000	160,721	150,340,100	256,992	
Taneytown 175,955,500 72,739 286,465,400 118,423 461,664,477 190,84							
Union Bridge	27,865,000	78,493	33,808,300	95,235	61,506,554	173,258	
Westminster	811,290,300	97,828	1,283,892,900	154,817	2,085,661,492	251,497	
Totals (Ave) 2,998,068,800 (97,110) 4,685,233,000 (151,758) 7,902,376,758 (255,964)							
* Mount Airy numb	ers are for Carrol	l County po	rtion of the muni	cipality			
Sources: CC Bureau	u of Comprehens	ive Planning	g; MD Dept. of A	ssessments a	and Taxation, 201	.3	

average value of structures within each. The data for the table were derived using a query of residential address points, the property data layer, and the tax assessment data. The results from the query provided information by GA for totals and averages.

Mobile home parks would experience greater concentrations of damage during a hurricane. There are more homes per acre in mobile home parks than in residential subdivisions. The table entitled "Mobile Home Parks Located within the Hazard Area for Hurricanes" lists mobile home parks with pads for anywhere from 10 to 100 homes. If complete replacement were required after a hurricane, local experts state that the cost for a new doublewide trailer including hook-up fees would range from \$40,000 to \$80,000, with models at the lower end

1	Mobile Home Parks Located within the					
	Hazard Area for Hurricanes					
	by	Growth	Area			
	Carro	oll Coun	ty, MD			
			Typical	<b>Estimated Cost</b>		
Mobile Home		# of	Replacement	to Replace all		
Park	GA	Pads	Cost/Unit (\$)*	Units (\$)		
Keelei Trailer	Sykesville	10	40,000	400,000		
Court						
Pheasant Ridge	Mt. Airy	100	40,000	4,000,000		
Mobile Estates						
Twin Arch	Mt. Airy	20	40,000	800,000		
Mobile Park						
Wuthering	Westminster	10	40,000	400,000		
Heights Mobile						
Home Village						
Total		140	40,000	5,600,000		
Source: CC Bure	Source: CC Bureau of Comprehensive Planning, 2013					

\* Typical replacement cost is derived from interviews with local experts and includes the unit itself plus charges for hooking up plumbing and electricity for a double-wide mobile home.

of the spectrum being more popular. Multiplying the \$40,000 figure by the total number of homes from the table yields an estimated \$5,600,000 in damages in mobile home parks in the hazard area.

Human casualty rates depend largely on the extent to which people evacuate before a hurricane arrives. Death totals of 49, 41, and three were attributed to Hurricanes Hugo, Andrew, and Iniki, respectively. All were considered lower than what might have been had advanced warnings and evacuations not been as effective.

### **Agricultural & Natural Resources**

#### **Identification of Vulnerable Assets**

There are minimal agricultural operations located within the defined hazard area for hurricanes. Therefore, no significant impacts are anticipated.

### **Estimate of Damages & Losses**

No significant costs due to damages and losses to agriculture are anticipated within the hazard high impact area.

# Major Employers

### **Identification of Vulnerable Assets**

If a major employer is defined as an organization that employs, or is occupied by, 100 or more people at any one location, then the county's eight GA's are home to 21 major employers as

Board of Education Facilities with 100 or More Occupants and within the Hazard Area by Growth Area - Carroll County, MD					
Board of Education Facility	Occupants	Value of Buildings (\$)	GA		
Century High	1,302	31,306,600	Freedom		
Liberty High	1,247	27,733,700	Freedom		
Sykesville Middle	851	7,715,900	Freedom		
Oklahoma Middle	878	11,550,700	Freedom		
Linton Springs Elem	748	11,918,400	Freedom		
Carrolltowne Elem	646	10,331,800	Freedom		
Eldersburg Elem	553	6,357,000	Freedom		
Freedom District Elem	588	5,396,800	Freedom		
Piney Ridge Elem	668	10,619,200	Freedom		
North Carroll High	869	24,970,800	Hampstead		
Shiloh Middle	723	11,174,900	Hampstead		
Hampstead Elem	434	4,622,600	Hampstead		
Spring Garden Elem	601	7,910,600	Hampstead		
West Middle & William Winchester Elem	1,743	15,077,200	Westminster		
Winter's Mill High & Cranberry Station Elem	1,831	28,107,300	Westminster		
East Middle	806	8,343,700	Westminster		
Westminster High & Tech Ctr	2,527	37,713,800	Westminster		
Friendship Valley Elem	562	5,588,200	Westminster		
Robert Moton Elem	497	7,220,200	Westminster		
Westminster Elem	602	6,142,600	Westminster		
Carroll Springs	102	3,285,700	Westminster		
Administrative Building	387	7,728,600	Westminster		
Elmer Wolfe Elem	458	10,183,500	Union Bridge		
New Windsor Middle	422	8,034,300	New Windsor		
Taneytown Elem	540	7,374,500	Taneytown		
Northwest Middle	560	11,564,600	Taneytown		
Mount Airy Middle & Parr's Ridge Elem & Mount Airy Elem	1,793	23,702,900	Mount Airy		
North Carroll Middle	665	8,936,600	Manchester		
Manchester Elem	683	8,689,900	Manchester		
Manchester Valley Elem	866	46,251,700	Manchester		
Ebb Valley Elem	582	11,436,400	Manchester		
Total Occupants within Growth Areas			25,734		
All Board of Education Facility Occupants			30,973		
Percent of Total within Growth Areas			83%		
Sources: Carroll County Board of Education, 2013, and MD Assessment and Taxation Data, 2013					

Major Employment Facilities Employers with Over 100 Occupants Onsite Carroll County MD

Carroli County, MD			
Major Employer <sup>1</sup>	# of Employees at Largest Facility		
Carroll County Public Schools <sup>2</sup>	2,527		
Carroll Hospital Center <sup>2</sup>	1,893		
Random House	722		
Springfield Hospital Center <sup>2</sup>	1,073		
Carroll County Commissioners <sup>3</sup>	306		
EMA/Fairhaven <sup>2</sup>	1,094		
Northrop Grumman	400		
McDaniel College <sup>2</sup>	3,966		
English American Tailoring	385		
Jos. A. Bank Clothiers	675		
EVAPCO	350		
Carroll Lutheran Village <sup>2</sup>	1,316		
Black & Decker	130		
Carroll Community College <sup>2</sup>	14,458		
Flowserve Corporation	260		
Landmark Community Newspapers	145		
Lehigh Cement	165		
Knorr Brake	260		
Solo Cup Company [Div. Dart Container Corp.]	150		
Shelter Systems Limited	100		
PFG/Carroll County Foods	200		
Employment Facilities - Total Occupants	30.575		

<sup>1</sup> 100 or more occupants at one site. An employer with multiple sites counts if any one site has more than 100 occupants based there.

<sup>2</sup> Occupants include students or patients, as well as employees; data for remaining 14 sites are employees only.

<sup>3</sup> Multiple locations and some of workforce is mobile; 306 employees are primarily based at the County Office Building; an estimated 594 total employees.

Sources: Carroll County Department of Economic Development, Carroll County Department of Human Resources, Carroll County Board of Education, 2013 shown in the table entitled "Major Employment Facilities: Employers with Over 100 Occupants Onsite." The largest employer, the Carroll County Public Schools, has 100 or more occupants (students and staff) at thirty-five locations throughout the GA's. The table entitled "Carroll County Public Schools Facilities with 100 or More Occupants" lists the facilities that fit the criteria, including the administrative building and most of the schools in the system. The thirty-five locations are occupied by approximately 25,734 people, or 83 percent of the school system's total occupants.

With regard to the 21 major employers listed in the table entitled "Major Employment Facilities – Employers with Over 100 Occupants Onsite", as of spring 2013, over 30,000 people occupied one of the locations listed. Still other large employers, such as certain banks and contractors, cannot be apportioned based on the hazard area because employees are based at numerous locations or much of the workforce is mobile.

#### **Estimate of Damages & Losses**

For the purpose of estimating damages and losses to major employers located within the GAs, tax assessment data were reviewed for the locations of the 23 employers reported in the table entitled "Assessed Values of Major Employment Facilities". Where an employer owns property in multiple locations, those locations with fewer than 100 occupants were excluded. In many cases, what appears as one location is actually made up of multiple properties. Two buildings that appear to be part of the same facility may be on separate properties and assessed separately. Aerial photographs and tax

maps were used to identify the property or properties that make up what is, for all intents and purposes, one employment site for each major employer. In some instances, a campus of buildings comprised one employment site.

All told, more than 76 individual properties made up the principal sites of the 23 major employers. The total value of the buildings at the principal sites of these major employers was \$551,121,400.

Thirty-five school system facilities with 100 or more occupants are located in a GA. The average value of the buildings was over \$12 million per campus. The losses, should all of said school buildings be destroyed, would total \$426,990,700.

### Historic Resources

#### **Identification of Vulnerable Assets**

A total of 675 historic sites, those which are listed on the National Register of Historic Places and/or on the Maryland Historical Trust's Inventory of Historic Properties, are located within a hazard area for hurricanes. Historic sites can comprise numerous historic structures. These sites can be buildings such as houses, structures such as bridges, objects such as Mason-Dixon Line boundary markers, or sites such as entire farms. In addition to historic sites, the National Register and the Maryland Historical Trust also inventory historic districts. Historic district designations recognize collections of historic sites that contribute to a whole that is greater than the sum of its parts. A typical example in Carroll County would be a historic main street along which multiple historic sites

Assessed Values of Major Employment Facilities				
Carroll County, MD				
	Assessed Value			
Major Employer	of Buildings (\$)	GA		
Knorr Brake	28,000,000	Westminster		
Black & Decker	2,499,800	Hampstead		
Jos. A. Bank Clothiers	3,849,300	Hampstead		
PFG/Carroll County Foods	2,512,300	Westminster		
Carroll Hospital Center	106,864,000	Westminster		
Carroll Lutheran Village	53,044,500	Westminster		
Carroll Community College	55,331,200	Westminster		
Longview Nursing Home	5,609,000	Manchester		
EMA/Fairhaven	43,699,200	Freedom		
EVAPCO	8,436,400	Taneytown		
Flowserve Corporation	5,083,600	Taneytown		
Landmark Community Newspapers	1,653,400	Westminster		
Lehigh Cement	10,407,900	Union Bridge		
Northrop Grumman	4,098,100	Freedom		
Random House	21,907,900	Westminster		
Springfield Hospital Center	60,791,300	Freedom		
English American Tailoring	1,683,000	Westminster		
McDaniel College	70,837,400	Westminster		
Carroll County Commissioners	29,442,300	Westminster		
General Dynamics Robotic Systems	4,831,500	Westminster		
Solo Cup Company	28,915,900	Hampstead		
Taney Stair	1,387,000	Taneytown		
Van Sant Plumbing & Heating	236,400	Mount Airy		
Total Assessed Value	\$551,121,400			
Source: MD Assessment and Taxation Data, 2013				

collectively convey a sense of the town that existed there 100 to 200 years earlier. Five historic districts are within the hazard area for hurricanes.

#### Estimate of Damages & Losses

The table entitled "Historic Sites Located within the Hazard Area for Hurricanes by Growth Area" lists the number of historic sites found in the identified hazard area for hurricanes. Property values for individual properties and buildings were queried from the assessment data to estimate damages and losses. If all of the historic properties in the hazard area were destroyed in a hurricane, the quantifiable property losses would total \$598,291,094. However, no real numerical value can be

Historic Sites Located within the					
Hazard Area for Hurricanes					
	By Growth Are	ea a a a a a a a a a a a a a a a a a a			
	Carroll County, I	MD			
	# of Historic				
GA	Sites	<b>Total Property Value (\$)</b>			
Hampstead	61	27,779,317			
Manchester	15	14,329,400			
Mount Airy	12	28,620,500			
New Windsor	24	15,342,200			
Sykesville-Freedom	151	217,017,700			
Taneytown	20	5,978,200			
Union Bridge	15	13,479,500			
Westminster	377	275,744,277			
Totals 675 598,291,094					
Source: CC Bureau of Comprehensive Planning & MD Assessment and					
Taxation Data, 2013					

placed on the way the sites tell the history of the community and help to preserve its sense of place. The average value for buildings on a historic site is \$593,720. The average is high because large, expensive buildings at sites such as McDaniel College and Springfield State Hospital are included in the calculation.

The table entitled "Historic Districts on the National Register of Historic Places" lists the historic districts in Carroll County that are officially recognized by the National Park Service. Five of the 10 are located within a GA and are, therefore, part of the hazard area for hurricanes. The multiple buildings that make up any given historic district are also inventoried individually as historic sites. As a result, the losses that would result from destruction of property within a historic district are accounted for in the above estimate for historic sites. The losses in a historic district, however, would go beyond the damage to the individual properties. Depending on the extent of the damages, losses could also include whatever greater historic value the district as a whole represented.

Historic Districts on the National Register of Historic Places Carroll County, MD			
Historic District Name	GA Location		
Lineboro	None		
Linwood	None		
McKinstry's Mill	None		
Mount Airy	Mount Airy		
New Windsor	New Windsor		
Sykesville	Sykesville - Freedom		
Taneytown	Taneytown		
Union Mills Homestead	None		
Uniontown	None		
Westminster	Westminster		
Source: CC Bureau of Comprehensive Planning, 2004			

# **Mitigation Measures**

### **Existing Mitigation Measures**

- Hurricanes are tracked in the Emergency Operations Center (EOC) as they develop; government officials and the media are kept informed of the preparations of response forces. (OPS)
- The Bureau of Permits and Inspections currently augments the enforcement of the Maryland Building Performance Standards and related County ordinances by encouraging wind-resistant design techniques for new construction during the County's permit process. (BPI)
- Standard tie-downs of propane tanks are mandated to prevent tanks from being lifted by floodwaters or winds and becoming ballistic hazards. (BPI)
- Trees and branches in public areas at risk of breaking or falling in wind and heavy rain storms are monitored. Trees or branches that pose an immediate threat to property, utility lines, or other significant structures or critical facilities in the county are pruned and trimmed. (DPW & Towns)

### **Proposed High-Priority Mitigation Strategies**

Hurricane Mitigation High-Priority Strategies - County					
<b>Responsible</b> Anticipated Funding					
Strategy	Agency/ies	Timeline	Source(s)		
No additional strategies identified at this time					

### Lower-Priority Mitigation Measures for Future Consideration

• Mandate standard tie-downs of mobile homes to prevent mobile homes from being lifted by floodwaters or winds and becoming ballistic hazards. (BPI & Towns)



# Chapter Eight: Tornado

# **Hazard Identification**

### Hazard Characterization

A tornado is defined as a rotating column of air that comes out of a cloud and usually is accompanied by a downward extension of a funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity and wind-blown debris. Tornadoes can touch the ground with winds of over 300 mph. Tornado season is generally March through August, although tornadoes can occur at any time of year. They tend to occur in the afternoons and evenings: over 80 percent of all tornadoes strike between noon and midnight. While relatively short-lived, tornadoes are intensely focused and are characterized as one of nature's most violent storms.

Tornadoes have the ability to destroy almost everything in their path and can range from small in size (yards) to over two miles in width. Although tornadoes normally travel on the ground for short distances (yards – miles), tornado tracks of 200 miles have been reported.

Tornado damage is measured on the EF-Scale (Enhanced Fujita Scale), named after the most noted researcher of tornadoes, Dr. Fujita of the University of Chicago. The scale ranges from EF0 (weak) to EF5. However, the strongest tornadoes observed to date have been EF5 (200+ mph).

# **Regional & Historical Perspectives**

The risk of tornado occurrence is highest in the central region of the U.S. and, to a somewhat lesser extent, in the southeast region (FEMA, 1997). The two states with the highest risks are Texas and Oklahoma. The risks in the west and northeast

ENHANC	ENHANCED FUJITA SCALE				
EFO (Gale)	65-85 mph   3-second gusts				
EF1 (Weak)	86-110 mph   3-second gusts				
EF2 (Strong)	111-135 mph   3-second gusts				
EF3 (Severe)	136-165 mph   3-second gusts				
EF4 (Devastating)	166-200 mph  3-second gusts				
EF5 (Incredible) Source: FEMA, 2012	over 200 mph   3-second gusts				

(including Maryland) are comparatively low but not nonexistent.

According to the National Climatic Data Center (NCDC), between 1950 and 2010, 339 tornado touchdowns were recorded in Maryland for an average of 5.65 per year. Statewide these events caused \$463.3 million in property damages, seven deaths, and 314 injuries. The most intense tornado ever recorded in Maryland was an F4 that touched down in LaPlata in Charles County in April, 2002. It caused three deaths, 122 injuries, and more than \$115 million in damages. Its path was almost half a mile wide at its widest point and its speed was estimated at 58 mph.

Other events of note in Maryland include an F3 tornado that affected College Park in September 2001 and caused two deaths along with more than 50 injuries, an F4 tornado in Frostburg in 1998 which caused approximately \$5 million in damages and five injuries, an F2 in Baltimore County in 1990 that caused 59 injuries, and an F1 in Dorchester County in 1984 and another F1 in Garrett County in 1954.

According to NOAA and the Spatial Hazard Events and Losses Database for the United States (SHELDUS) at the University of South Carolina's Hazards and Vulnerability Research Institute, Carroll County has experienced nineteen recorded tornadoes between 1963 and 2012. All together these storms caused three injuries and an estimated total of \$5.9 million in property and crop damages. The intensity of all but two of them was recorded at F2 or less, with the remaining storms being F3 tornadoes. A strong F3 (almost F4) tornado that occurred just outside of Gamber in Bird Hill in July 1996 is the worst tornado to have occurred in the county. It caused a total of \$5 million in property damage, injured three people, and caused \$20,000 in crop damage. The other F3 tornado touched down in May 1983 in northeast Frederick County and traveled about two miles into northwest Carroll County. It caused \$2,500 in property damage but no injuries or fatalities.

# **Risk Characterization**

The 2011 Maryland State Hazard Mitigation Plan Update utilizes a risk prioritization method that takes into account several factors including: historical occurrence, vulnerability of the population, historical impact in terms of human lives and property and how local jurisdiction plans rank hazards. Using this methodology, in the overall ranking of hazards across the State of Maryland, the risk of tornadoes is considered medium. The composite tornado risk across Maryland is highest in Calvert, Charles, Frederick, and Garrett Counties, and Carroll County has a composite risk of medium-high.

# Hazard High-Impact Areas

While data are available to indicate when past tornado events have occurred in the county, most of the data do not provide accurate enough locational data to be able to map with any degree of reliability where these tornadoes occurred or where they are most likely to occur in the future.

The entire county is at risk for a tornado touchdown. However, the Growth Areas (GA), which are the areas within the Growth Area Boundaries (GAB), are those areas which would be at risk for sustaining the most damage and losses, simply because population and the associated infrastructure, houses, and

businesses are concentrated in these areas as part of the ongoing effort to promote efficient growth and preserve agricultural and natural resource land. While the probability of occurrence of a tornado is not necessarily higher in these areas, the damages and losses that might be sustained within the GABs would be greater because of this concentration of people and structures. In addition, the people most at risk when a tornado touches down are also most likely to be located in a GA – people in automobiles and mobile homes; people who may not understand a warning due to a language barrier; the elderly and very young; and people with physical or mental disabilities. The GABs provide a logical delineation of areas which will likely incur the most damages.

A tornado can, and most likely will, take a path that is less than the width of most of the GAs in the county. According to NOAA's data for historic tornado events in Carroll County, the median length of the path of tornadoes that have touched down in Carroll County is one mile and the median width is 50 yards. This width and distance is equal to approximately 37 acres of area likely to be impacted within a GA if a tornado touched down. Which 37 acres in a GA would be impacted is unknown.

Each of the eight GAs within the county has been identified on the map entitled "Hazard High-Impact Area for Tornadoes: Growth Areas" on page 104. Appendix A contains individual maps of each GA showing the location of all structures, major employers, critical facilities, and historic sites. These maps are titled "Hazard High-Impact Area for Winter Storms, Hurricanes, and Tornadoes" and are further identified by the name of the specific GA which it depicts.

# **Risk Assessment**

### **Critical Facilities**

#### **Identification of Vulnerable Assets**

According to the State critical facilities data, approximately 199 critical facilities are located in all the GAs. These facilities include many schools and Board of Education facilities, as well as numerous facilities serving McDaniel College. Among these facilities are also several fire departments, municipal offices, County facilities, State facilities, and health-related facilities.

Critical Facilities Most at Risk for Tornado						
by Growth Area						
Carroll County, MD						
GA	# of Critical Facilities	Total Value (\$)				
Hampstead	18	71,451,100				
Manchester	8	76,469,800				
Mount Airy*	17	39,860,100				
New Windsor	11	19,740,300				
Sykesville-Freedom	41	283,958,500				
Taneytown	17	35,096,400				
Union Bridge	9	19,014,933				
Westminster	78	549,991,333				
Totals	199	\$1,095,582,466				
* Does not reflect Critical Facilities in Frederick County Source: CC Bureau of Comprehensive Planning, MD Assessment and Taxation Data, & MEMA, 2013						

#### Estimate of Damages & Losses

The table entitled "Critical Facilities Most at Risk for Tornado by Growth Area" breaks down the number of critical facilities by GA and provides the total value of critical facilities in each GA.

### Population, People, & Residences

#### **Identification of Vulnerable Assets**

People and residences are more concentrated in the GAs. If a tornado were to touch down in a GA, the property damage and human casualty tolls would likely be higher than anything experienced during a tornado in Carroll County in the past. As of April 2013, the population density within GAs was 1.73 people per acre, more than five times the density outside of GAs. As another way of looking at it, although only 18 percent

of the land area in the county is in a GA, an estimated 89,702 people, or 53 percent of the population, lived in one of the eight GAs. This reflects a greater concentration of homes within the GAs.

When discussing tornadoes, mobile homes deserve added attention because they are particularly vulnerable to damage from high winds. Of the 16 mobile home parks in Carroll County, four are located in the hazard area for tornadoes. Between them, there are 140 pads.

#### **Estimate of Damages & Losses**

Tornadoes in Carroll County are reported in historical records to have resulted in one death, in 1929. Three people suffered injuries during the 1996 'Bird Hill' tornado outside of Gamber. If a tornado were to touch down in a densely populated area, the casualty toll would likely be higher. The table entitled "Households and Population in the Path of a Prototype

Residential Structures Most at Risk for Damage by a Hypothetical Tornado							
GA	Swath of Tornado (Acres)*	GA Area (Acres)	% of GA hit by Tornado	# of Residential Structures in GA	# of Residences hit by Tornado	Avg Value (\$) for Residential Improvements in GA's	Cost (\$) of Damage to Residential Structures
Hampstead	18	2,579	0.70	2,821	20	134,213	2,684,260
Manchester	18	1,585	1.14	1,815	21	193,313	4,059,573
Mount Airy	18	3,671	0.49	2,166	11	155,634	1,711,974
New Windsor	18	878	2.05	683	14	194,929	2,729,006
Sykesville- Freedom	18	27,353	0.07	12,185	8	160,721	1,285,768
Taneytown	18	3,354	0.54	2,669	14	118,423	1,657,922
Union Bridge	18	1,648	1.09	508	6	95,235	571,410
Westminster	18	10,835	0.17	11,056	18	154,817	2,786,706
Totals 51,903 33,903 112 \$17,486,619							
* Assumes a swath that is 50 yards wide by 1 mile long. Assumption based on historical tornado data for Carroll County Sources: Carroll County Bureau of Comprehensive Planning; Maryland Dept. of Assessments and Taxation, 2013							

Tornado" uses the acreage of the prototype tornado defined in the table "Residential Structures Most as Risk for Damage by a Hypothetical Tornado" to estimate the numbers of homes that would be

Households and Population in the Path of a Prototype Tornado									
	Swath of		% of GA	# of Residential	# of Residences	Residential		Persons per	Population
	Tornado	GA Area	Hit by	Structures in	Hit by	Occupancy	# of Households	Household	Hit by
GA	(Acres)*	(Acres)	Tornado	GA	Tornado	Rate	Hit by Tornado	by GA	Tornado
Hampstead	18	2,579	0.70	2,821	20	95.5	19	2.79	52
Manchester	18	1,585	1.14	1,815	21	95.5	20	2.88	57
Mount Airy	18	3,671	0.49	2,166	11	96.5	10	2.92	30
New Windsor	18	878	2.05	683	14	93.5	13	2.77	36
Sykesville-	18	27,353	0.07	12,185	8	97.0	8	2.88	22
Freedom									
Taneytown	18	3,354	0.54	2,669	14	96.5	14	2.81	39
Union Bridge	18	1,648	1.09	508	6	90.5	5	2.59	13
Westminster	18	10,835	0.17	11,056	18	96.0	18	2.53	45
Totals		51,903		33,903	112		107		294
* Assumes a swath that is 50 yards wide by 1 mile long. Assumption based on historical tornado data for Carroll County									
Source: Carroll County Bureau of Comprehensive Planning, 2013									

struck if the tornado were to touch down in one of the GAs. Based on the number of homes, the population affected if the tornado struck at a time when everyone was at home was extrapolated. The number of people impacted in each GA ranges from 13 to 57 depending on the density of the GA. Injuries and fatalities would depend on numerous factors, including how much warning could be provided and the amount of debris in the tornado.

The 'Bird Hill' tornado was a strong F3 (almost F4) that touched down in a rural subdivision, Bird Hill. The houses in Bird Hill and the surrounding area are situated on lots of one acre or larger. Approximately \$5 million in damage was reported. The table entitled "Residential Structures Most at Risk for Damage by a Hypothetical Tornado" uses the same prototype tornado used above. By multiplying the estimated number of residential buildings struck by the average assessed value for a residential building, the total cost of the damage if every home were destroyed was extrapolated. Total cost values vary by GA depending on the number of homes hit. Figures range from nearly \$600,000 to nearly \$2.8 million.

Worse damages are anticipated if a tornado were to strike a mobile home park. There are more homes per acre in mobile home parks than in residential subdivisions. In fact, estimates using aerial photography indicate that the prototypical tornado described above could directly impact up to 80 homes in a large mobile home park. If complete replacement were

required after a tornado, local experts state that the cost for a new doublewide trailer including hook-up fees would range from \$40,000 to \$80,000, with models at the lower end of the spectrum being more popular. Multiplying the \$40,000 figure by the maximum number of homes destroyed in the

Mobile Home Parks Located within the Hazard Area for Tornadoes by Growth Area Carroll County, MD							
Mobile# ofTypicalEstimated CostHome ParkGAPadsCost per Unit (\$)*Units (\$)							
Keelei Trailer Court	Sykesville	10	40,000	400,000			
Pheasant Ridge Mobile Estates	Mt. Airy	100	40,000	4,000,000			
Twin Arch Mobile Park	Mt. Airy	20	40,000	800,000			
Wuthering Heights Mobile Home Village	Westminster	10	40,000	400,000			
Total		140	40,000	5,600,000			

Source: CC Bureau of Comprehensive Planning, 2013

\* Typical replacement cost is derived from interviews with local experts and includes the unit itself plus charges for hooking up plumbing and electricity for a double-wide mobile home.

prototypical scenario yields \$5,600,000 in potential losses. The table entitled "Mobile Home Parks Located within the Hazard Area for Tornadoes" lists the number of pad sites at each mobile home park in the hazard area.

### Agricultural & Natural Resources

#### **Identification of Vulnerable Assets**

There are minimal agricultural operations located within the defined hazard area for tornadoes. Therefore, no significant impacts are anticipated.

### **Estimate of Damages & Losses**

No significant costs due to damages and losses to agriculture are anticipated within the hazard high impact area.

# Major Employers

### **Identification of Vulnerable Assets**

If a major employer is defined as an organization that employs, or is occupied by, 100 or more people at any one location, then the county's eight GA's are home to 21 major employers as shown in the table entitled "Major Employment Facilities: Employers With Over 100 Occupants Onsite." The largest employer, the Carroll County Public Schools, has 100 or more occupants at thirty-five locations throughout the GA's. The table entitled "Carroll County Public Schools Facilities with 100 or More Occupants" on page 90 lists the facilities that fit the criteria, including the administrative building and most of the schools in the system. The thirty-five locations are occupied by approximately 25,734 people or 83 percent of the school system's total occupants.

Major Employment Facilities Employers with Over 100 Occupants Onsite Carroll County MD

	# of Employees at			
Major Employer <sup>1</sup>	Largest Facility			
Carroll County Public Schools <sup>2</sup>	2,527			
Carroll Hospital Center <sup>2</sup>	1,893			
Random House	722			
Springfield Hospital Center <sup>2</sup>	1,073			
Carroll County Commissioners <sup>3</sup>	306			
EMA/Fairhaven <sup>2</sup>	1,094			
Northrop Grumman	400			
McDaniel College <sup>2</sup>	3,966			
English American Tailoring	385			
Jos. A. Bank Clothiers	675			
EVAPCO	350			
Carroll Lutheran Village <sup>2</sup>	1,316			
Black & Decker	130			
Carroll Community College <sup>2</sup>	14,458			
Flowserve Corporation	260			
Landmark Community Newspapers	145			
Lehigh Cement	165			
Knorr Brake	260			
Solo Cup Company [Div. Dart Container	150			
Corp.]				
Shelter Systems Limited	100			
PFG/Carroll County Foods	200			
Employment Facilities - Total Occupants	30,575			
<sup>1</sup> 100 or more employees at one site. An employer with multi	ple sites counts if any			
one site has more than 100 occupants based there.				
<sup>2</sup> Occupants include students or patients, as well as employees	; data for remaining			
14 sites are employees only.	,,			
<sup>-</sup> Multiple locations and some of workforce is mobile; 306 em	ployees are primarily			
Sources: Carroll County Department of Economic Day	alopmont Carroll			
County Department of Human Resources, Carroll County	ty Board of			
Education 2012	ty board of			
Education, 2015				

With regard to the 21 major employers listed in the table entitled "Major Employment Facilities – Employers with Over 100 Occupants Onsite", as of spring 2013, over 30,000 people occupied one of the locations listed. Still other large employers, such as certain banks and contractors, cannot be apportioned based on the hazard area because employees are based at numerous locations or much of the workforce is mobile.

#### **Estimate of Damages & Losses**

For the purpose of estimating damages and losses to major employers, tax assessment data were reviewed for the locations of the 23 employers reported in the table entitled "Assessed Values of Major Employment Facilities". Where an employer owns property in multiple locations, those locations with fewer than 100 occupants were excluded. In many cases, what appears as one location is actually made up of multiple properties. Two buildings that appear to be part of the same facility may be on separate properties and assessed separately. Aerial photographs and tax maps were used to identify the property or properties that make up what is, for all intents and purposes, one employment site for each major employer. In some instances a campus of buildings comprised on employment site.

All told, more than 76 individual properties made up the principal sites of the 23 major employers. The total value of the buildings at the principal sites of these major employers was \$551,121,400. In a few parts of the county, the same tornado could destroy the facilities of two or more major

Assessed Values of Major Employment Facilities						
Carroll Cou	Carroll County, MD					
Assessed Value						
Major Employer	of Buildings (\$)	GA				
Knorr Brake	28,000,000	Westminster				
Black & Decker	2,499,800	Hampstead				
Jos. A. Bank Clothiers	3,849,300	Hampstead				
PFG/Carroll County Foods	2,512,300	Westminster				
Carroll Hospital Center	106,864,000	Westminster				
Carroll Lutheran Village	53,044,500	Westminster				
Carroll Community College	55,331,200	Westminster				
Longview Nursing Home	5,609,000	Manchester				
EMA/Fairhaven	43,699,200	Freedom				
EVAPCO	8,436,400	Taneytown				
Flowserve Corporation	5,083,600	Taneytown				
Landmark Community Newspapers	1,653,400	Westminster				
Lehigh Cement	10,407,900	Union Bridge				
Northrop Grumman	4,098,100	Freedom				
Random House	21,907,900	Westminster				
Springfield Hospital Center	60,791,300	Freedom				
English American Tailoring	1,683,000	Westminster				
McDaniel College	70,837,400	Westminster				
Carroll County Commissioners	29,442,300	Westminster				
General Dynamics Robotic Systems	4,831,500	Westminster				
Solo Cup Company	28,915,900	Hampstead				
Taney Stair	1,387,000	Taneytown				
Van Sant Plumbing & Heating	236,400	Mount Airy				
Total Assessed Value	\$551,121,400					
Source: MD Assassment and Taxation Data 2013						

Source: MD Assessment and Taxation Data, 2013

employers with multiple buildings each. Under such a scenario, damages could exceed \$50 million.

Thirty-five school system facilities with 100 or more occupants are located in a GA. The average value of the buildings was over \$12 million per campus. As with the other major employers, clusters of schools exist in the county where one tornado could destroy two or more school sites. The damages in such a scenario could exceed \$30 million.

# Historic Resources

### **Identification of Vulnerable Assets**

A total of 675 historic sites, those which are listed on the National Register of Historic Places and/or on the Maryland Historical Trust's Inventory of Historic Properties, are located within a hazard area for tornados. Historic sites can comprise numerous historic structures. These sites can be buildings such as houses, structures such as bridges, objects such as Mason-Dixon Line boundary markers, or sites such as entire farms. In addition to historic sites, the National Register and the Maryland Historical Trust also inventory historic districts. Historic district designations recognize collections of historic sites that contribute to a whole that is greater than the sum of its parts. A typical example in Carroll County would be a historic main street along which multiple historic sites collectively convey a sense of the town that existed there 100 to 200 years earlier. Five historic districts are within the hazard area for tornados.

### **Estimate of Damages & Losses**

The table entitled "Historic Sites Located within the Hazard Area for Tornadoes" shows the number of sites and the total values within each GA (the GAs are the identified hazard areas for this hazard). Property values for individual properties and buildings were queried from the assessment data to estimate damages and losses.

Historic Sites Located within the Hazard Area for Tornadoes By Growth Area Carroll County, MD					
GA	# of Historic Sites	<b>Total Property Value (\$)</b>			
Hampstead	61	27,779,317			
Manchester	15	14,329,400			
Mount Airy	12	28,620,500			
New Windsor	24	15,342,200			
Sykesville-Freedom	151	217,017,700			
Taneytown	20	5,978,200			
Union Bridge	15	13,479,500			
Westminster	377	275,744,277			
Totals	675	\$598,291,094			
Source: CC Bureau of Comprehensive Planning & MD Assessment and					
Taxation Data, 2013					

Historic sites are dispersed to the extent that the prototypical tornado with its 18-acre swath could strike a GA and nevertheless, more often than not, avoid any historic sites. In terms of quantifiable damage to historic properties, the worstcase scenario would occur if a tornado were to strike a cluster of high-value historic buildings sites, such as at McDaniel College or Springfield State Hospital. For example, if a tornado destroyed the buildings at Springfield State Hospital, losses would total approximately \$34 million. In terms of hard-to-quantify historical value, the greatest losses would occur where a tornado could damage or destroy multiple historic sites in proximity to one another. The historic district designation applies to many such concentrations of historic sites.

The table entitled "Historic Districts on the National Register of Historic Places" lists the historic districts in Carroll County that are on the National Register of Historic Places. Five of the 10 are located within a GA and are, therefore, within the hazard area for tornados. The losses in a historic district would go beyond the damage to the individual properties to also include whatever greater historic value the district as a whole represented.

Historic Districts on the				
National Register of Historic Places				
Carroll County, MD				
Historic District GA Location				
Name				
Lineboro	None			
Linwood	None			
McKinstry's Mill	None			
Mount Airy Mount Airy				
New Windsor	New Windsor			
Sykesville	Sykesville - Freedom			
Taneytown	Taneytown			
Union Mills	None			
Homestead				
Uniontown	None			
Westminster	Westminster			
Source: CC Bureau of Comprehensive Planning				

# **Mitigation Measures**

### **Existing Mitigation Measures**

- The Bureau of Permits and Inspections currently augments the enforcement of the Maryland Building Performance Standards and related County ordinances by encouraging wind-resistant design techniques for new construction during the County's permit process. (BPI)
- Standard tie-downs of propane tanks are mandated to prevent tanks and mobile homes from being lifted by winds and becoming ballistic hazards. (BPI)
- Trees and branches in public areas at risk of breaking or falling in wind are monitored. Trees or branches that pose an immediate threat to property, utility lines, or other significant structures or critical facilities in the county are routinely trimmed. (DPW & Towns)

### **Proposed High-Priority Mitigation Strategies**

Tornado Mitigation High-Priority Strategies - County				
	Responsible	Anticipated	Funding	
Strategy	Agency/ies	Timeline	Source(s)	
No additional strategies identit	fied at this time			

### Lower-Priority Mitigation Measures for Future Consideration

- Require that mobile home parks of a given size build a storm shelter for their residents, whose housing is susceptible to destruction by relatively minor high-wind events. (undetermined)
- Require the construction of a "safe room" in new schools, day cares, nursing homes and similar facilities to provide a room, or adequate space, that is capable of withstanding extreme wind forces and the force of collapsing or propelled materials. (undetermined)
- Mandate standard tie-downs of mobile homes to prevent mobile homes from being lifted by winds and becoming ballistic hazards. (BPI & Towns)



# Chapter Nine: Winter Storm

# **Hazard Identification**

# Hazard Characterization

Winter storms produce heavy precipitation including snow, sleet, ice – or combinations of the three – high winds and, potentially, extreme cold. A winter storm warning is issued by the NWS when snowfall is expected to be over five inches in twelve hours, or seven inches or more within 24 hours. Severe winter storms can significantly slow traffic and commerce, disrupt communications, and cause power outages.

Major winter storms that impact Maryland and other parts of the East Coast are called "Nor-easters" because of the strong northeast winds they produce. These storms often form in the southern states/Gulf region, intensify, and move up the coast. In addition, the presence and position of a high-pressure system over the Maritime Provinces of Canada is critical. The highpressure system supplies the cold air necessary for winter precipitation. The cold air forms what literally looks like a wedge on the weather map from Allegany and Washington Counties eastward. Meteorologists call this the "cold air dam" or "the damming effect." Moist air being lifted over this dam can result in heavy winter precipitation.

Many times, the heaviest snow with a Nor'easter will occur in a band that is just 50-100 miles wide. The band usually is

flanked on its southeastern side by an area of freezing rain-sleet and farther east by rain. Counties west of the Chesapeake are most likely to have snow or mixed precipitation.

A winter storm warning also may be issued for glaze ice accumulation of <sup>1</sup>/<sub>4</sub> inch or more. A "pure ice" storm is rare for Maryland since, due to the bank setup mentioned previously, a wide variety of winter weather along with rainfall often exists in the state.

The wind chill index is an equivalent temperature at which the heat loss from exposed flesh would be the same if the wind were near calm. For example, a wind chill index of -5 indicates that the effects of wind and temperature on exposed skin are the same as if the air temperature were 5 degrees below zero, even though the actual temperature could be much higher. The National Weather Service generally issues a wind-chill advisory when wind-chill temperatures are expected to reach -5 to -19 degrees F, with a minimum wind speed of at least 5 mph. Wind-chill warnings are issued when chills are expected to be lower than -20 degrees F, with a minimum wind speed of 5 mph.

# **Regional & Historical Perspectives**

Based on historical snow depth data, Maryland ranks about average among U.S. states, with a lower risk than for most northern states and a higher risk than for southern states
Total Snowfall Carroll County, Maryland		
1989-2011		
Kecorded at Millers, MD   VEAP Total Snowfall in Inches		
2011	41 0	
2010	59.7	
2009	45.9	
2008	13.4	
2007	29.6	
2006	18.2	
2005	40.2	
2004	23.2	
2003	64.9	
2002	25.7	
2001	24.4	
2000	35.0	
1999	26.0	
1998	11.9	
1997	23.6	
1996	65.5	
1995	31.8	
1994	42.8	
1993	46.5	
1992	15.8	
1991	14.6	
1990	30.3	
1989	23.9	
Source: National Climatic Data Center, 2013		

(FEMA, 1997). The greatest snowstorms in Maryland history have had associated snowfalls ranging from 12 to 30 inches, and usually have occurred in January or February. In February 1979, Ocean City experienced a large storm that placed approximately 24 inches of snow on the ground with wind gusts up to 65 mph.

Most recently, four significant winter storms that occurred over the winter of 2009-2010 created snowfall totals of over 60 inches throughout much of central and western Maryland and crippled many parts of the state. The winter of 1993-1994 was one of the iciest on record. A January 1994 cold wave produced persistent temperatures near or below freezing, causing rolling blackouts to conserve energy, and repeated storms from January into early March of 1994 produced between 19 and 23 days of icy precipitation over the greater Baltimore metropolitan area.

While the majority of Carroll County averages 21 to 30 inches of snow per year, some areas in the central and northeast portions of the county average 31 to 40 inches per year. Two significant winter storms in February 2010 brought heavy snowfall to Carroll County. Snowfall totals from the first storm on February 5 and 6 ranged from 22 inches in Lineboro and Taneytown to 28.5 inches in Mount Airy. The second storm, which occurred on February 9 and 10, added 21 to 26 more inches of snow to the amount already on the ground. From 1993-2010, there were 166 injuries and eight fatalities in the county that were attributed to winter storms.

# **Risk Characterization**

According to the 2011 Maryland State Hazard Mitigation Plan Update, the composite risk for winter weather across Maryland is highest in the central to western parts of the state. This spatial trend is consistent with the patterns described above for Nor'easter storms. Carroll County is considered to be at high risk for winter storms, along with twelve other counties and Baltimore City.

# Hazard High-Impact Areas

When a winter storm strikes Carroll County, the entire county is at risk for some impact. However, the Growth Areas (GA), which are the areas within the Growth Area Boundaries (GAB), are those areas which would be at risk for sustaining the most damage and losses, simply because population and the associated infrastructure, houses, and businesses are concentrated in these areas as part of the ongoing effort to promote efficient growth and preserve agricultural and natural resource land. While the probability of occurrence of a winter storm is not necessarily higher in these areas, the damages and losses that might be sustained within the GAB's would be greater because of this concentration of people and structures. In addition, the people most at risk when a winter storm hits are also most likely to be located in a GA - people in automobiles; people who may not understand a warning due to a language barrier; the elderly and very young; and people with physical or mental disabilities. The GABs provide a logical delineation of areas which will likely incur the most damages.

Each of the eight GAs within the county has been identified on the map entitled "Hazard High-Impact Area for Winter Storms: Growth Areas" on page 116. Appendix A contains individual maps of each GA showing the location of all structures, major employers, critical facilities, and historic sites. These maps are titled "Hazard High-Impact Area for Winter Storms, Hurricanes, and Tornadoes" and are further identified by the name of the specific GA which it depicts.

# **Risk Assessment**

# Critical Facilities

#### **Identification of Vulnerable Assets**

According to the State critical facilities data, approximately 199 critical facilities are located in all the GAs. These facilities include many schools and Board of Education facilities as well as numerous facilities serving McDaniel College. Among these facilities are also several fire departments, municipal offices, County facilities, State facilities, and health-related facilities.

#### **Estimate of Damages & Losses**

The table "Critical Facilities Most at Risk for Winter Storm by Growth Area" breaks down the number of critical facilities by GA and provides the total value of critical facilities in each GA.

#### Population, People, & Residences

#### **Identification of Vulnerable Assets**

During a severe winter storm, the risks to people derive from multiple factors, such as extremely cold temperatures, icy surfaces, and poor visibility, which combine to make activities like shoveling snow and driving dangerous. The risks to people are compounded by the fact that essential systems, such as transportation, utilities, and telecommunications are often

disrupted. Most problems will occur in more developed areas where people and homes are concentrated. The county has delineated eight Growth Areas (GA's) where concentrations of people exist. As of April 2013, an estimated 89,702 people, or 53 percent of the county's population, lived in one of the eight GA's.

Critical Facilities Most at Risk for Winter Storm				
By Growth Area				
	Carroll County, MD			
GA	# of Critical Facilities	Total Value (\$)		
Hampstead	18	71,451,100		
Manchester	8	76,469,800		
Mount Airy*	17	39,860,100		
New Windsor	11	19,740,300		
Sykesville-Freedom	41	283,958,500		
Taneytown	17	35,096,400		
Union Bridge	9	19,014,933		
Westminster	78	549,991,333		
Totals	199	\$1,095,582,466		
* Does not reflect Critical Facilities in Frederick County				
Source: CC Bureau of Comprehensive Planning, MD Assessment and				
Taxation Data, & MEMA, 2013				

The risks to homes include roof damage from the weight of snow and indirect damage stemming from loss of heat or electric power. Among the eight GA's, as of May 2013, there were nearly 30,900 properties with residential buildings. The table entitled "Populations and Structures Most at Risk for

Populations and Structures Most at Risk for Winter Storm by Growth Area Carroll County MD							
	2013 Projected Build-out						
Growth		# of	# of Residential		# of	# of Residential	
Area	Population	Households	Structures	Population	Households	Structures	
Hampstead	7,516	2,694	2,821	8,702	3,119	3,267	
Freedom-	34,039	11,819	12,185	45,801	15,903	16,395	
Sykesville							
Manchester	4,991	1,733	1,815	6,667	2,315	2,424	
Mount Airy*	6,103	2,090	2,166	8,991	3,079	3,190	
New Windsor	1,770	639	683	2,889	1,043	1,116	
Taneytown	7,239	2,576	2,669	14,789	5,263	5,454	
Union Bridge	1,191	460	508	4,268	1,648	1,821	
Westminster	26,853	10,614	11,056	34,018	13,446	14,006	
Totals	89,702	32,625	33,903	126,125	45,816	47,673	
* Mount Airy numbers are for Carroll County portion of the municipality							

Source: Carroll County Bureau of Comprehensive Planning, 2013

Winter Storm by Growth Area" shows the numbers of people, households, and structures within each GA. The estimates for the number of structures were derived by starting with the number of residential structures counted in the 2010 U.S. Census and adding the number of use-and-occupancy permits issued since 2010. By taking the number of structures and multiplying by the residential occupancy rates for each GA, the estimates for the number of households were derived. Next, by taking the number of households and multiplying by the average persons per household figure for each GA, the population estimates were derived. The occupancy rates and persons per household figures came from 2010 U.S. Census data.

#### **Estimate of Damages & Losses**

The Carroll County Health Department does not track casualty rates during winter storms. The population in the hazard area is 89,702.

According to the NCDC, Carroll County had a total of \$1.2 million in property and crop damages from winter storms (both ice and snow events) from 1993 through 2010.

The total value of all residential structures within the eight GA's is \$4,685,233,000. In a scenario, for example, where 30 percent of the buildings suffered roof and structural damage totaling 10 percent of the value of the building, costs would

exceed \$140 million. The table entitled "Value of Residential Structures Most at Risk for Winter Storm by Growth Area" gives the total land and improvement values by GA as well as the average value of structures within each. The data for the table were derived using a query of residential address points, the property data layer, and the tax assessment data. The results from the query provided information by GA for totals and averages.

	17.1 CD 11	· 1.0		<b>D</b> • 1 C III		
	Value of Resid	ential Stru	ctures Most at	Risk for Wi	inter Storm	
	by Growth Area					
		Car	roll County, MI	)		
			Total Impro	ovement	Total La	nd &
	Land Valu	ue (\$)	Value	(\$)	Improvement	Value (\$)
<b>Growth Area</b>	Total	Average	Total	Average	Total	Average
Hampstead	208,340,700	93,678	298,486,300	134,213	506,654,050	227,812
Freedom-	1,534,238,200	144,576	2,051,438,000	193,313	3,585,676,200	337,889
Sykesville						
Manchester	158,525,400	99,702	247,458,000	155,634	405,855,485	255,255
Mount Airy*	25,535,600	127,742	389,662,100	194,929	645,018,400	322,670
New Windsor	56,318,100	96,270	94,022,000	160,721	150,340,100	256,992
Taneytown	175,955,500	72,739	286,465,400	118,423	461,664,477	190,849
Union Bridge	27,865,000	78,493	33,808,300	95,235	61,506,554	173,258
Westminster	811,290,300	97,828	1,283,892,900	154,817	2,085,661,492	251,497
Totals (Ave)	2,998,068,800	(97,110)	4,685,233,000	(151,758)	7,902,376,758	(255,964)
* Mount Airy numbers are for Carroll County portion of the municipality						
Sources: Carroll County Bureau of Comprehensive Planning; Maryland State Department of						
Assessments an	d Taxation, 2013					

Major Employment Facilities Employers With Over 100 Occupants Onsite

Carroll County, MD			
	# of Employees at		
Major Employer <sup>*</sup>	Largest Facility		
Carroll County Public Schools <sup>2</sup>	2,527		
Carroll Hospital Center <sup>2</sup>	1,893		
Random House	722		
Springfield Hospital Center <sup>2</sup>	1,073		
Carroll County Commissioners <sup>3</sup>	306		
EMA/Fairhaven <sup>2</sup>	1,094		
Northrop Grumman	400		
McDaniel College <sup>2</sup>	3,966		
English American Tailoring	385		
Jos. A. Bank Clothiers	675		
EVAPCO	350		
Carroll Lutheran Village <sup>2</sup>	1,316		
Black & Decker	130		
Carroll Community College <sup>2</sup>	14,458		
Flowserve Corporation	260		
Landmark Community Newspapers	145		
Lehigh Cement	165		
Knorr Brake	260		
Solo Cup Company [Div. Dart Container Corp.]	150		
Shelter Systems Limited	100		
PFG/Carroll County Foods	200		
<b>Employment Facilities - Total Occupants</b>	30,575		
<sup>1</sup> 100 or more employees at one site. An employe	r with multiple sites		

counts if any one site has more than 100 occupants based there. <sup>2</sup> Occupants include students or patients, as well as employees; data for

remaining 14 sites are employees only. <sup>3</sup> Multiple locations and some of workforce is mobile; 306 employees are primarily based at the County Office Building; an estimated 594 total employees.

Sources: Carroll County Department of Economic Development, Carroll County Department of Human Resources, Carroll County Board of Education, 2013

# **Agricultural & Natural Resources**

#### **Identification of Vulnerable Assets**

There are minimal agricultural operations located within the defined hazard area for winter storms. Historically, the most significant damage to these operations has been related to roof collapses on large, flat-roofed farm buildings and to the loss of livestock.

#### **Estimate of Damages & Losses**

No significant costs due to damages and losses to agriculture are anticipated within the hazard high impact area.

# Major Employers

#### **Identification of Vulnerable Assets**

If a major employer is defined as an organization that employs, or is occupied by, 100 or more people at any one location, then the county's eight GAs are home to 21 major employers as shown in the table entitled "Major Employment Facilities: Employers With Over 100 Occupants Onsite." The largest employer, the Carroll County Public Schools, has 100 or more occupants at thirty-five locations throughout the GAs. The table entitled "Carroll County Public Schools Facilities with 100 or More Occupants" on page 90 lists the facilities that fit the criteria, including the administrative building and most of the schools in the system. The thirty-five locations are occupied by approximately 25,734, people, or 83 percent of the school system's total occupants.

With regard to the 21 major employers listed in the table entitled "Major Employment Facilities – Employers with Over 100 occupants Onsite", as of spring 2013, over 30,000 people occupied one of the locations listed. Still other large employers, such as certain banks and contractors, cannot be apportioned based on the hazard area because employees are based at numerous locations, or much of the workforce is mobile.

#### **Estimate of Damages & Losses**

For the purpose of estimating damages and losses to major employers, tax assessment data were reviewed for the locations of the 23 employers reported in the table entitled "Assess Values of Major Employment Facilities". Where an employer owns property in multiple locations, those locations with fewer than 100 occupants were excluded. In many cases, what appears as one location is actually made up of multiple properties. Two buildings that appear to be part of the same facility may be on separate properties and assessed separately. Aerial photographs and tax maps were used to identify the property or properties that make up what is, for all intents and purposes, one employment site for each major employer. In some instances, a campus of buildings comprised one employment site.

All told, more than 76 individual properties made up the principal sites of the 23 major employers. The total value of the buildings at the principal sites of these major employers was \$551,121,400. In a scenario, for example, where 30 percent of the buildings suffered roof and structural damage

totaling 10 percent of the value of the building, costs would exceed \$16 million.

Thirty-five school system facilities with 100 or more occupants are located in a GA. The average value of the buildings was over \$12 million per campus. The losses, should all of said school building be destroyed, would total \$426,990,700.

Assessed Values of Major Employment Facilities				
Carroll County, MD				
	Assessed Value	~ .		
Major Employer	of Buildings (\$)	GA		
Knorr Brake	28,000,000	Westminster		
Black & Decker	2,499,800	Hampstead		
Jos. A. Bank Clothiers	3,849,300	Hampstead		
PFG/Carroll County Foods	2,512,300	Westminster		
Carroll Hospital Center	106,864,000	Westminster		
Carroll Lutheran Village	53,044,500	Westminster		
Carroll Community College	55,331,200	Westminster		
Longview Nursing Home	5,609,000	Manchester		
EMA/Fairhaven	43,699,200	Freedom		
EVAPCO	8,436,400	Taneytown		
Flowserve Corporation	5,083,600	Taneytown		
Landmark Community Newspapers	1,653,400	Westminster		
Lehigh Cement	10,407,900	Union Bridge		
Northrop Grumman	4,098,100	Freedom		
Random House	21,907,900	Westminster		
Springfield Hospital Center	60,791,300	Freedom		
English American Tailoring	1,683,000	Westminster		
McDaniel College	70,837,400	Westminster		
Carroll County Commissioners	29,442,300	Westminster		
General Dynamics Robotic Systems	4,831,500	Westminster		
Solo Cup Company	28,915,900	Hampstead		
Taney Stair	1,387,000	Taneytown		
Van Sant Plumbing & Heating	236,400	Mount Airy		
Total Assessed Value	\$551,121,400			
Source: MD Assessment and Taxation Data, 2013				

#### Historic Resources

#### **Identification of Vulnerable Assets**

A total of 675 historic sites, those which are listed on the National Register of Historic Places and/or on the Maryland Historical Trust's Inventory of Historic Properties, are located within a hazard area for winter storms. Historic sites can comprise numerous historic structures. These sites can be buildings such as houses, structures such as bridges, objects such as Mason-Dixon Line boundary markers, or sites such as entire farms. In addition to historic sites, the National Register and the Maryland Historical Trust also inventory historic districts. Historic district designations recognize collections of historic sites that contribute to a whole that is greater than the sum of its parts. A typical example in Carroll County would be a historic main street along which multiple historic sites collectively convey a sense of the town that existed there 100 to 200 years earlier. Five historic districts are within the hazard area for winter storms.

Historic Di National Register Carroll C	<u>Estimate of</u> Damages &	
Historic District Name	GA Location	Lossos
Lineboro	None	L05565
Linwood	None	
McKinstry's Mill	None	The table
Mount Airy	Mount Airy	entitled
New Windsor	New Windsor	"Historic Sites
Sykesville	Sykesville -	Located within
	Freedom	the Hozord Area
Taneytown	Taneytown	the Hazaru Area
Union Mills Homestead	None	for Winter
Uniontown	None	Storm by
Westminster	Westminster	
Source: CC Bureau of Co	omprehensive Planning	

Historic Sites Located Within the Hazard				
Area for Winter Storm				
by Growth Area				
(	Carroll County, J	MD		
	# of Historic			
GA	Sites	<b>Total Property Value (\$)</b>		
Hampstead	61	27,779,317		
Manchester	15	14,329,400		
Mount Airy	12	28,620,500		
New Windsor	24	15,342,200		
Sykesville-Freedom	151	217,017,700		
Taneytown	20	5,978,200		
Union Bridge	15	13,479,500		
Westminster	377	275,744,277		
Totals 675 \$598,291,094				
Source: CC Bureau of Comprehensive Planning & MD Assessment				
and Taxation Data 2013				

Growth Area" identifies the number of historic sites found in the identified hazard area for winter storms. Property values for individual properties and buildings were queried from the assessment data to estimate damages and losses. If all of the historic buildings in the hazard area were destroyed in a winter storm, the quantifiable property losses would total \$400,761,400. However, no real numerical value can be placed on the way the sites tell the history of the community and help to preserve its sense of place. The average value for buildings on a historic site is \$593,720. The average is high because large, expensive buildings at sites such as McDaniel College and Springfield State Hospital are included in the calculation.

The table entitled "Historic Districts on the National Register of Historic Places" lists the historic districts in Carroll County that are on the National Register of Historic Places. Five of the 10 are located within a GA and are, therefore, within the

hazard area for winter storms. The losses in a historic district would go beyond the damage to the individual properties to

also include whatever greater historic value the district as a whole represented.

# **Mitigation Measures**

# **Existing Mitigation Measures**

- The Bureau of Roads Operations (under the Department of Public Works) has the county divided into 63 snowplow routes, has three permanent salt storage facilities, and two temporary salt storage sites. (DPW)
- The Bureau of Permits and Inspections currently augments the enforcement of the Maryland Building Performance Standards and related County ordinances by encouraging wind-resistant design techniques for new construction during the County's permit process. (BPI)
- The Building Code for Carroll County does not permit architects and engineers to reduce snow loads. This is a stricter measure than provided for in the National Building Code. (BPI)

# **Proposed High-Priority Mitigation Strategies**

Winter Storm Mitigation High-Priority Strategies - County			
	Responsible	Anticipated	Funding
Strategy	Agency/ies	Timeline	Source(s)
No additional strategies ident	ified at this time		

# Lower-Priority Mitigation Measures for Future Consideration

 Monitor trees and branches in public areas at risk of breaking or falling in wind, ice, and snow storms. Prune or thin trees or branches that pose an immediate threat to property, utility lines, other significant structures, or critical facilities in the county. (DPW & Towns)



# Chapter Ten: Soil Movement

# **Hazard Identification**

# Hazard Characterization

This hazard includes earthquake, expansive soil, land subsidence, and mass movement. An earthquake is the sudden shaking of the ground due to a release of energy stored in the earth's crust. Stress builds up where tectonic plates come together along a fault line. Eventually the stress becomes too great and the plates slip along the fault; this causes the release of the built up energy and what we recognize as an earthquake. Vertical and horizontal ground motions are caused by seismic waves that radiate outward from the focus, or hypocenter, of rupture. The surface area directly above the focus is called the epicenter (USGS, 2012). shrink-swell potential. The effects of expansive soils are most evident in humid areas during periods of drought, as normally moist soils dry, contract, and crack.

Land subsidence is the lowering of the ground surface due to the loss of subsurface support (FEMA, 1997). It is caused mainly by activities such as underground mining and pumping of subsurface fluids (Cooke and Doornkamp, 1974). The onset of subsidence may be gradual or sudden, and its real extent ranges from broad, regional reductions in elevation to highly localized, often catastrophic collapses. Regional subsidence, usually gradual in onset, can increase the potential for flooding, especially in coastal areas (Cooke and Doornkamp, 1974; USGS, 1999). Localized collapses (sinkholes) are rapid and damaging to buildings, roads, and utilities (Matthews and Kelly, 1997).

Soils that undergo volumetric changes due to gain or loss of moisture are known as expansive soils. These volumetric changes can weaken and crack building foundations, cause uneven settlement of structures, and damage highways, streets, and utility lines (Petak and Atkisson, 1982). The potential for volume change is called





FIGURE 3. Development of a sinkhole due to subsurface erosion caused by water table flucuations (modified from Newton, 1987). Mass movements, commonly called landslides, are spontaneous failures of slopes under the influence of gravity. These down-slope movements range in speed from very slow (soil creep) to very rapid (rock falls and rock slides). Slow mass movements are not usually life threatening but do cause progressive deterioration of structures and infrastructure. Rapid mass movements pose serious threats to life and property and can disrupt traffic and communication. In the U.S. landslides are responsible for damages of more than \$3 billion and more than 25 deaths per year (USGS, 2004).

Areas underlain by calcareous rock formations are identified as karst terrain. These calcium-based rock formations can be very unstable due to the ease by which water movement can dissolve these rock types, leaving subsurface voids. Hazards associated with karst terrain include not only physical risks created by surface collapse, but also rapid contamination of significant underground water supplies typically found within these rock formations. Three things need to be present in order for subsidence and/or collapse of sinkholes to occur: 1) there must be an outlet in the underlying bedrock; 2) the soil must be detachable or movable; and 3) there must be a driving mechanism (Magner et. al., 1986). Specific examples of driving mechanisms include surface drainage modifications, land disturbances, and water-table alterations. Carroll County's karst terrain regions coincide with its marble and limestone deposits, including the Wakefield Marble and Silver Run Limestone formations. In the western and central portions of Carroll County, where areas of karst terrain are found, the land tends to be susceptible to soil movement in the form of sinkholes.

Once the percolating groundwater dissolves and removes bedrock, the contact between bedrock and surface soils tends to become extremely irregular. This process also enlarges any cracks or fractures in the rock. This leads to the formation of conduits and caves, some of which may be well connected. Because the natural process of bedrock dissolution is extremely slow, typically these processes play an insignificant role in sinkhole development

When the subsurface soil layer at the contact interface with the bedrock begins eroding, voids often form. This process proceeds rapidly relative to the rate of rock dissolution. As the subsurface erosion increases, the void enlarges. Eventually, the unsupported soil arch above the dissolved bedrock thins, weakens, and collapses. The resulting surface collapse creates what we see as a sinkhole. The time required for this process

to occur varies considerably and can be altered significantly by various driving mechanisms.

These mechanisms can be both natural and man-induced. A 1987 U.S. Geological Survey publication on the interaction between sinkholes and various types of activities provides an excellent overview of the phenomenon. Under natural conditions, the formation of new sinkholes during a man's lifetime is relatively rare. In contrast, sinkholes induced by man's activities are comparatively abundant (Newton, 1987). Natural water-table fluctuations can cause the subsurface erosion which leads to sinkhole development, but the process is typically slow.

## **Regional & Historical Perspectives**

Maryland's geographic regions tend to describe the relative risks for various types of soil movement hazards. In its recorded history, Maryland has experienced several earthquakes; however, to date none have caused widespread or significant damage. FEMA considers that the state has a moderate earthquake risk due to earthquake activity in Howard County (1993 – 1996) and in nearby portions of surrounding states. Maryland was recently affected by a 5.8 magnitude earthquake with an epicenter located in Mineral, Virginia in August, 2011 (USGS, 2012). Expansive soils are found



Sinkhole on MD 31 – March 31, 1994

throughout Maryland, but their geographic distributions are uneven and tend to be isolated. This sporadic pattern results in more localized impacts for earthquake events. Maryland, like most eastern states, is rated as having slight-to-moderate clay-swelling potential (FEMA, 1997).

The subsidence area surrounding the Chesapeake Bay does not include Carroll County. Landslide hazards are not typically of significant concern in Maryland. Although

most of Maryland is rated as having a high-to-moderate mass soil-movement potential based on various formation types, this risk is primarily linked to past events. Subsidence risks due to various activities, including non-coal mining, exist throughout the state. According to the 2011 Maryland Hazard Mitigation Plan, Maryland has an overall low probability of damage from ground subsidence. The plan notes that any actual risk assessment cannot be performed at a large scale due to insufficient geologic data and a lack of incidence reporting. However, it notes and describes that areas of karst terrain in central Maryland, including Carroll County, are highly susceptible to sinkhole formation.

#### Sinkholes

The greatest potential soil-movement hazard in Carroll County is found in those areas of karst terrain susceptible to sinkholes. Carroll County's geology limits those areas to regions where the Wakefield Marble and Silver Run Limestone are components of the bedrock units. These two calcium carbonate  $(C_aCO_3)$  units underlay approximately 2 percent of the 456 square miles which make up Carroll County. Approximately 720 sinkholes, primarily occurring in the west-central portion of the county, have been investigated and documented in a regularly maintained database. Carroll County did experience a catastrophic sinkhole event in March 1994, when a sinkhole collapsed a major section of the MD 31 roadbed between Westminster and New Windsor in the middle of the night. This sudden collapse occurred during a short interval of time required to travel roundtrip between the City of Westminster's wastewater treatment plant and the town of New Windsor. A vehicle fell into the void, killing the driver. To date, this is the only known fatal incident involving a sinkhole in the county.

#### **Risk Characterization**

The Maryland Emergency Management Agency (MEMA) characterizes Carroll County with an overall medium-high risk for soil-movement hazards. However, Carroll County's specific risk for land subsidence, including sinkholes, is rated as high. The risks associated with sinkholes can be separated into two categories: structural integrity and water quality. Specific hazards which can occur within either of these headings include: injury or loss of life, disruption of service or use, illness, loss of service or use, economic hardship, and potential land devaluation.

# High-Risk Hazard Areas

Just as with many other natural hazards, attempting to predict and assess the location-specific risks associated with area-wide events such as earthquakes proves to be of very limited use. Since clearly defined areas of Carroll can be identified as most at risk for sinkhole formation as a high-threat hazard, this plan will primarily focus on addressing this risk. A set of maps depicting the High Risk Hazard - Areas for Soil Movement, beginning on page 128 identify the specific county locations known to be at risk for soil movement. Theses maps illustrate the individual Zone of Influence (ZOI) impact boundaries around the limestone quarrying areas in Union Bridge, New Windsor, and Westminster. These boundaries were defined by state permitting agencies as the localized areas where quarry dewatering could be anticipated to reduce the water tables sufficiently to cause either loss of well water or surface collapse. Following changes to state law, in these ZOI regions, quarry operators are required to repair well failures, provide

alternate water supply, and repair sinkhole or similar the ground collapses. Zones of influence have been identified for the four quarries in the county: Current LaFarge Medford, LaFarge #2 (future expansion, formerly owned by Arundel), and the Lehigh quarries adjacent to New Windsor and Union Bridge. Lafarge has two active pits at the Medford site. The zone of influence for its current Medford operations and future expansion quarry area are displayed on the same map, as they are overlapping and are considered one area for the purpose of the risk assessment in this plan.

# **Risk Assessment**

# **Critical Facilities**

**Identification of Vulnerable Assets** 





#### **Estimate of Damages & Losses**





# Population, People, & Residences

#### **Identification of Vulnerable Assets**

The primary risks associated with soil movement occur when objects, structures, or people fall into a collapsed sinkhole. Using available state tax assessment data and geographic information and analysis tools, there are 13 homes in the Westminster ZOI and 98 homes in the New Windsor draft ZOI. There are no residential structures included in the Carroll County portion of the Union Bridge ZOI. Although a specific 2010 Census count is not available for the County's ZOI areas, the population can be estimated by multiplying the number of homes by the local occupancy rate, and then multiplying that result by the local average number of people per household. For Westminster, the 2010 occupancy rate was 94.5 percent and the persons per household were calculated at 2.51; in New Windsor those values were 93 percent and 2.75, respectively. Based on this method and data, as of April 2010, approximately 282 people lived within one of County's designated quarry dewatering zones of influence.

Residential Properties* with Structures in the Zone of Influence Carroll County, MD				
Zone of Influence	# of Properties	Avg Value of Improvements	Avg Value of Land & Improvements	
Medford	4	\$136,475	\$186,100	
LaFarge #2	9	\$169,511	\$288,500	
Lehigh**	98	\$138,409	\$254,804	
Total 111				
* Includes buildings thought to be residences on land primarily used for agriculture ** New Windsor Draft ZOI				
Sources: CC Bureau of Comprehensive Planning; MD Assessment and Taxation,				

2013 Sources: CC Bureau of Comprehensive Planning; MD Assessment and Taxation,

Sinkholes also pose an immediate threat to area groundwater supplies. If contaminated surface water flows into a sinkhole, it can infiltrate aquifer systems and degrade groundwater resources that serve both private and public water supply wells. Approximately 72 percent of Carroll County's population receives its water supply from wells (groundwater) only. With the exception of Westminster and the Sykesville-Freedom District, all the GAs in Carroll County rely solely on groundwater from the aquifers in the county (Carroll County Master Plan for Water & Sewerage, p. 47).

#### **Estimate of Damages & Losses**

Some risk of injury or loss of life resulting from a sinkhole exists. Carroll County has experienced one sinkhole fatality caused by a collapsed section of state highway which failed suddenly during the night. A sinkhole may cause significant structural damage to buildings located on or near the collapse, requiring costly repairs or even resulting in the total loss of the structure. Insurance policies do not typically cover damage from soil movement or sinkholes. If or when coverage is available, it must be purchased as a separate rider. Both land and buildings damaged by sinkholes may lose their resale value.

The average value of the properties with a home located in the hazard area is \$243,134. According to tax records, quarry companies own nearly 12 percent of the homes in the zones of influence.

# Agricultural & Natural Resources

#### **Identification of Vulnerable Assets**

Portions of approximately 30 agricultural properties lie within a zone of influence for one of the quarries. Most of the properties are used for crop farming. Farmers in the area primarily rotate the fields between corn and soybeans each year and occasionally vary the rotation by planting hay, wheat, or barley for a year. Sinkholes are a common problem. Farm equipment has been damaged due to sinkholes that have formed in fields.

#### **Estimate of Damages & Losses**

When a sinkhole opens up, the crops that fall into the hole are lost. Farmers in the area tell stories of narrow escapes when coming across a sinkhole or causing a collapse while operating a tractor or combine. No injuries to people resulting from a sinkhole on a farm have been reported. (See People,

Population & Residences for more information). When a sinkhole forms in a crop field, farmers either fill the sinkhole in with dirt or simply farm around the depression. Although filling a sinkhole with dirt is a common practice, it is a short-term solution at best.

The estimated total land value of the farms located partially or entirely in a zone of influence is \$4,504,900. Typically, sinkhole damage would not impact an entire farm. However, local sinkhole activity has been documented to cause severe impacts on tracts of at least 35 acres as in the Westminster-area case of Finley v. Teeter Stone (Court of Appeals of MD, 1968).

Based on tax assessment data, agricultural land values in the zones of influence average \$2,350 per acre. According to local experts, a typical cost to remediate land damaged by a sinkhole runs in the thousands to tens of thousands of dollars if no structures are involved. If the sinkhole damages an agricultural structure and/or its equipment systems, remediation costs run in the tens of thousands to hundreds of thousands of dollars.

# Major Employers

#### **Identification of Vulnerable Assets**

Of the 23 major employers identified, only one is located in one of the high-risk areas for soil movement. Performance Foods Groups/Carroll County Foods (PFG/CCF) is located in the Medford ZOI. As of spring 2013, they employed approximately 200 people. Including the PFG/CCF property, the Medford ZOI includes 10 commercial or industrial properties, some with multiple buildings. The Arundel zone of influence does not include commercial or industrial properties. The Lehigh New Windsor draft ZOI includes one property, Windsor Construction.

#### **Estimate of Damages & Losses**

The following table summarizes impacts to commercial or industrial properties within all Carroll County ZOI boundaries.

Commercial or Industrial Properties with Structures in the Zone of Influence Carroll County, MD				
Zone of Number of Total Value Of Land & Influence Sites Improvements Improvements				
Medford	10	\$11,243,800	\$15,533,200	
LaFarge #2	0	\$0	\$0	
Lehigh	1	\$80,000	\$136,000	
Total	11	\$11,323,800	\$15,669,200	
Sources: CC Bureau of Comprehensive Planning; MD Assessment and Taxation, 2113				

In the Medford zone of influence, the average value of the structures on each commercial or industrial property is \$1,124,380. The average value of the commercial or industrial properties, including the land and buildings, is \$1,553,320.

#### Historic Resources

#### **Identification of Vulnerable Assets**

A total of 14 historic sites, those which are listed on the National Register of Historic Sites and/or on the Maryland Historical Trust Inventory of Historic Sites, are located within a hazard area for soil movement.

#### Estimate of Damages & Losses

The following table addresses sites in the identified hazard area for each Carroll County ZOI and summarizes the location and values for the at-risk historic resources. Total property values were queried from the assessment data to estimate damages

Historic Sites in Zones of Influence for Soil Movement					
	Carroll County, MD				
	# of		Total Value of		
Zone of	Historic	<b>Total Value of</b>	Land &		
Influence	Sites	Improvements	Improvements		
Medford	4	\$519,200	\$2,968,500		
LaFarge #2	1	\$115,900	\$301,300		
Lehigh*	9	\$523,400	\$1,516,700		
All zones	14	\$1,158,500	\$4,786,500		
* New Windsor Draft ZOI					
Sources: CC Bureau of Comprehensive Planning; MD Assessment					
and Taxation,201	13				

and losses. The cumulative total losses would amount to approximately \$1,158,500. However, with historic resources,

the value of the cultural assets which would be lost is beyond a numerical value. The importance of these sites in the telling the community's history and in preserving its sense of place are priceless and would represent an unrecoverable loss.

# **Mitigation Measures**

# **Existing County Mitigation Measures**

- Carroll County's Department of Land Use, Planning, & Development (LUPD) reviews all proposed development plans for either subdivision projects or individual site plans within carbonate rock areas to identify existing sinkholes and evaluate the potential for new sinkholes. Recommendations are made to the Planning Commission as part of the development plan review and approval process.
- The LUPD maintains a sinkhole database, preforming field investigations and documenting areas of the county which are more susceptible to this hazard.
- The LUPD and the Department of Public Works perform semiannual inspections on public roadways in and around the ZOI high-risk areas to monitor conditions and initiate repairs as needed.
- The LUPD has developed a county-wide network of observation wells, many of which are located in and around high risk and ZOI areas of the county. The network monitoring is done on a regular basis at bi-weekly to monthly intervals to track changes in hydraulic support to help predict increasing risk levels in very localized areas.
- The county also requires that approved site development plans for quarrying operations include a Local Contingency Plan and special indenture to address the specific processes and actions for ZOI sinkhole repairs, replacements of water supplies, or other related dewatering impacts.

# **Proposed High-Priority County Mitigation Strategies**

Carroll County is among the most proactive jurisdictions in Maryland relative to monitoring sinkhole activity. Carroll County has provided training and information to other jurisdictions on the topic of sinkholes.

Soil Movement Mitigation High-Priority Strategies - County			
	Responsible	Anticipated	Funding
Strategy	Agency/ies	Timeline	Source(s)
Develop appropriate mechanisms within the Local Contingency Plan and/or Site		2013 and	
Plan approval process to trigger new pre-emptive mitigation actions as		ongoing	N/A
monitoring well trends reveal changes predicting greater risks from quarry	BRM		
dewatering in the ZOI rather than defer action until soil collapse or well failure	BDR		
occurs.	BPI		

**Proposed Lower-Priority County Mitigation Measures** 

None identified at this time.

# **Proposed Municipal Mitigation Strategies**

Soil Movement Mitigation Strategies - Municipal			ļ
Responsible Anticipated Fund		Funding	
Strategy	Agency/ies	Timeline	Source(s)
No high- or lower-priority strategies identified at this time			







11/2013



# Technological Hazards

# Chapter Eleven: Dam Failure

# **Hazard Identification**

# Hazard Characterization

A Dam is any artificial barrier designed to confine water, wastewater, or any other liquid or semi-liquid material. In Maryland, any surface impoundment structure is also considered a dam if it requires a containment wall of 4 feet or higher and is intended to manage any significant storage capacity (MD Conservation Practice Standard Pond Code 378). Dams are constructed across watercourses to retain and control drinking water supplies, for navigation, flood control, agricultural irrigation, and/or power generation. Reservoirs may also serve as wildlife sanctuaries or support recreational activities, such as fishing and boating. In some areas, dams are employed as flood control structures. It is fairly likely that a given dam will function in several of these capacities simultaneously.

Dams utilize numerous types of construction materials and methods. Inventoried dams include those built from concrete, masonry, rock fill, timber cribs, as well as buttressed walls or arches. However, the vast majority of structures are earthen dams. Nationwide, roughly 89 percent are constructed of compacted earth. Numerous factors affect a dam's function, safety, and capacity. The localized vulnerabilities and risks associated with dam failures cannot be underestimated. Age and maintenance of the impoundment structure and/or equipment; changes in the types, locations, and amounts of flows resulting from upstream changes in land use and construction; cycles and patterns of weather and rainfall; and accumulated sedimentation all contribute risk potential to dam hazard assessments.

Dam failure refers to any condition which causes an uncontrolled release of water and downstream flooding. Impacts can range from increased stream flows and minor flooding to catastrophic flash flooding resulting from a complete failure. When a dam collapses, the force and speed of rushing flood waters behind even a small dam are capable of causing loss of life and significant property damage downstream. Resulting damage often includes not only built structures but significant erosion potential. Depending on the material contained within the impoundment, as well as hazards uncovered by erosion, significant and widespread environmental hazards can also result.

Failures can be caused by overtopping, collapse, breaching, or seepage at any point along the structure. Improper maintenance, design or operation all increase the probability that a dam might fail. The potential severity of a dam failure

depends on its storage capacity and the types of land uses downstream (FEMA, 1997).



MD Dam Safety photograph of a failure of the corrugated metal pipe (CMP) spillway at the Medford Quarry Wash Pond Dam in 1989 (Source: FEMA).

# **Regional & Historical Perspectives**

Dams are prevalent throughout the U.S. but are more heavily concentrated in central and eastern regions of the country. Maryland has never experienced a catastrophic dam failure, unlike nearby Pennsylvania and West Virginia.

Johnstown, Pennsylvania is among the most notorious dam failure locations in the country. During the course of less than a century, over 2,300 area residents have died during three separate catastrophic flood events. In 1889, a dam failure upstream from Johnstown, Pennsylvania, resulting in 2,209 deaths and is notorious as the nation's deadliest dam disaster. Other lethal floods followed in March 1936 taking 22 lives and another disaster followed on July 20 1977. This most recent disaster was prompted by stalled thunderstorms dropping 12 inches of rain between July 19-20 overtopping the Johnstown Water Company's Laurel Run and Sandy Run Dams killing 77 residents (National Weather Service, 2012).

Among the nation's other most devastating dam failures was the February 1972 Buffalo Creek Disaster in West Virginia. Following heavy rains and snowmelt, this coal slagheap collapse released approximately 132,000,000 gallons of black waste water in a flood wave cresting at 15-20 feet in height. Of the cumulative population of roughly 5,000 residents in Buffalo Creek Hollow 125 were killed, 1,100 were injured and more than 4,000 were left homeless. The near complete devastation of these communities destroyed 502 houses and 44 mobile homes, damaged 943 homes and caused an estimated \$50 million in property damage (WV Division of Culture and History, 2013).

Surface storage impoundments are also included within this hazard group. A notable failure occurred in June 1995 in Onslow County, North Carolina, when a 30-foot wide section of an 8-acre agricultural sewage lagoon wall crumbled, allowing 25 million gallons of hog waste to flow over roads, fields, and into nearby rivers (New York Times, 1995).

Impoundment risks can also occur when open storage of nonliquid materials becomes too wet. In December 2008, the breech of a 40-acre wet ash slurry impoundment at the Kingston Fossil Power Plant in Tennessee released 1.1 billion gallons of liquefied ash across surrounding neighborhoods,

roadways, a railroad, and then into two rivers (Mansfield, 2009).

In 1972, the U.S. Congress enacted the National Dam Inspection Act, authorizing the U.S. Army Corps of Engineers (USACE) to inventory and inspect all non-federal dams. The first National Inventory of Dams (NID) was published in 1975. This document was most recently revised in 2009. The inventory now includes more than 82,600 structures and includes all high- and significant-risk dams, as well as low-risk dams which are 25 feet high or higher or which retain the equivalent of 50 foot-acres of water or more. According to the most recent inventory, there are 336 dams statewide and 8 dams within Carroll County meeting the inventory criteria for the National Dam Inventory. Currently, the federal risk assessment classifications used by FEMA consider any dam as high risk if the structure's failure is anticipated to result in the loss of one life (MD Department of the Environment, n.d.).

The Maryland Department of the Environment, Dam Safety Division, rates structures according to their downstream flooding potential should a failure occur. Dams are classified as high (MD Class "C"), significant (MD Class "B"), or low (MD Class "A") hazard. High-hazard dams are those whose failure would probably result in the loss of six or more lives; extensive property damage; and major increases in existing flood levels at houses, buildings, major interstates, and state roads. Dams are assessed as significant hazards when their failure would cause significant increased flood risks to roads and buildings and a possible loss of life, with no more than 2 houses or 6 lives in jeopardy. Low-hazard dams are those where failure likely would not result in deaths and only minor increases to existing flood levels at roads and buildings would result (MD Department of the Environment, n.d.).

Statewide, 24.1 percent of dams are considered high risk and 30.6 percent are classified as presenting significant risks in the case of breach or complete failure. In contrast, of Carroll's 8 inventoried dams, only one, equating to 12.5 percent, is considered high risk. However, 50 percent of the county's dams do fall in the significant-risk category.

Inventoried dams also are rated according to their condition as satisfactory or unsatisfactory along with the date of the most recent assessment and notes of assessment findings. Condition ratings, based on subjective field inspections, are subject to change and should be considered relative rather than absolute.

# **Risk Characterization**

The potential for dam failures always exists but risks can be minimized through active planning and preparation. Maryland has developed and maintains an aggressive dam safety program which includes detailed composite risk assessments. The Maryland Emergency Management Agency (MEMA) in consultation with the Dam Safety Division and national data has developed a composite risk assessment system. The risk assessment also consulted the federal inventory for data on dams in adjacent states. Maryland's inventory and risk assessment includes dams listed in the broader inventory plus several not meeting federal size requirements. It does exclude small impoundments such as farm ponds. Every Maryland jurisdiction, including Carroll County, has at least one high- or significant-hazard dam. All counties with a high composite

risk all are located in central Maryland. Carroll County is considered to have a medium composite risk for dam failure.

# High and Significant Risk Hazard Impact Areas

This assessment considers a total of five dams within the county: one high-risk and four significant-risk dams. All of these impoundments are banked earthen dams. Downstream dam inundation areas are defined by an engineering breach analysis to map and model a range of failure scenarios; this mitigation plan's assessments are based on Probable Maximum Flood (PMF) data and maps. A dam breach analysis and risk assessment identifying affected downstream properties is required for all high-hazard dams and recommended for significant-risk structures. These maps include a variety of critical facilities, historic structures, transportation infrastructure, as well as immediately adjacent properties and community resources. This plan uses the most recently reviewed and approved Emergency Action Plan (EAP) risk assessment classification for each included dam. However, because this update also includes 2010 U.S. Census data and some EAP assessments that predate this most recent census, there is a possibility that the impacted population calculations could vary from the population estimates included in current EAPs for these dams.

The only high-hazard dam in Carroll County is Piney Run Dam located northwest of Sykesville. There are four other dams within the county assessed with a significant-risk classification which would impact either critical infrastructure or public facilities. They are: the Medford Quarry Wash Pond, Cranberry Branch Dam and the Carroll County Farm Museum Pond, and Cascade Lake. Two of these assessed dam structures (Cranberry and Medford) are components of the public water supply system for the City of Westminster. The fourth includes public education facilities located in the historic buildings of the former Carroll County Almshouse, now the Farm Museum. The final dam, at Cascade Lake, is a privately owned facility operated as a recreation area and swim club.

# **Risk Assessment**

# **Critical Facilities**

**Identification of Vulnerable Assets** 



Estimate of Damages & Losses	

Population, People, & Residences	
Identification of Vulnerable Assets	
Identification of Vunicitable Assets	
	Estimate of Damages & Losses



Estimate of Damages & Losses	
	Estimate of Damages & Losses
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Historic Resources	
Identification of Vulnerable Assets	





**Mitigation Measures** 

# **Existing County Mitigation Measures**

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**Existing Municipal Mitigation Measures** 







Lower-Priority Mitigation Measures for Future Consideration

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# All-Hazard Mitigation

## Chapter Twelve: All-Hazard Mitigation Measures

Many measures to prevent or minimize the impacts from hazard events exist that are common to all hazards. The following chapter identifies mitigation measures that can be taken to specifically address the stated goals and objectives outlined earlier in the plan. These mitigation measures are applicable to most, if not all, of the identified hazards in the plan.

- OPS = Office of Public Safety Support Services Emergency
  - Management Division
- BCP = Bureau of Comprehensive Planning
- BDR = Bureau of Development Review
- BPI = Bureau of Permits & Inspections
- BRM = Bureau of Resource Management
- DPW = Department of Public Works
- DED = Department of Economic Development

## **Existing Mitigation Measures**

- The comprehensive plan provides a legal framework that guides the growth and development of a community. The plan sets forth the policies for growth management, including the rate of growth, intensity, form, and quality of physical development. Comprehensive/land use planning is not just about planning where development should go; it is also about planning where development should not go. Carroll County has developed and adopted a countywide master plan. Each municipality has also prepared and adopted a community comprehensive plan, many of which have been done as a cooperative effort with the County to jointly plan for areas that will be annexed in the future to accommodate planned growth. (BCP & Towns)
- When updating community comprehensive plans for existing population centers, land use designations for undeveloped land are reviewed to ensure that these properties are not in hazard areas or to ensure that hazards can be mitigated. (BCP & Towns)
- The Carroll County *Emergency Operations Plan* is an all-hazards plan which is used by the County to minimize the effects of any hazard which could occur within the county. The plan addresses major hazards, but it is flexible enough to be used for combating any type of disaster that could occur. The plan contains procedures, organizations, and responsibilities, which will be involved in

the response and recovery phases of major emergencies and disasters. The plan outlines the actions to be taken in the event of an incident; and also assigns responsibilities for notification, response, and support to various departments and agencies within the County. (OPS)

- The Town of Union Bridge and the Town of Manchester have recently completed updates of their respective Emergency Response Plans. (Towns)
- The County enforces the International Building Code which is consistent with FEMA recommendations. (BPI)
- The Emergency Communications Center monitors real time weather information and has a link to the forecast center in Sterling, VA. (OPS)
- The County partners with the National Weather Service to provide training to people throughout Carroll County on storm spotting in the areas of flooding, high winds, etc. (OPS)
- Watches and warnings are received via weather alert radios in all schools and day-care centers as well as most government offices and the county's Senior and Community Centers. (OPS)
- Watch and warning procedures to further alert agencies are carried out by the Emergency Communications Center which calls the County's public information personnel to ensure employees and citizens are alerted. (OPS)
- Differential assessment and taxation practices are used by the State to reduce the tax burden on land that requires fewer public services, thereby discouraging development in areas that have lower allowable densities due to natural or agricultural resources. Lower densities in these areas put fewer lives and properties at risk in a hazard event. (State)
- Disaster warning systems are in place, including both the monitoring of local conditions and the broadcasting of pre-event alerts, through use of sirens, radio, television, cable TV, crawlers on local cable channels, the Office of Public Safety's Facebook page, and other community-based provisions. (OPS)
- Some historic sites throughout the county and towns have been inventoried and mapped. These data have been used to identify historic structures that are at risk from hazard events. (BCP)
- The County and municipalities use local radio and cable stations as a conduit for advertising public forums. (OPS)
- The community is periodically informed of local public warning systems. (OPS)
- Measures that provide additional damage resistance for structures for specific hazards to which the communities within the county are at-risk have been identified and incorporated into the Building Code. (BPI)
- Local building inspectors are required to be certified under the National Code Program, which should help them to better recognize building practices that are suspect with regard to hazard resilience. (BPI)
- Evacuation routes have been identified in the event of a hazardous event. (OPS)
- An all-hazard resource information center is located in the main County Office Building. The center acts as a repository for information on local hazard identification, preparedness, and mitigation strategies for use by citizens, realtors, and lenders. (OPS)

- Outreach efforts are in place that focus on protecting natural systems as a mitigation activity. One example is the bimonthly surveyors' meeting that is held by the County to discuss development issues and requirements. (BDR)
- The environmental and development-related ordinances that have been adopted put requirements in place that help protect environmental resources and natural systems, including their function as mitigation to natural hazards. (BRM & BDR)
- Mitigation measures are incorporated into current capital improvement plans. Examples include projects related to the NPDES permit and stormwater management projects. (All)
- A watershed management plan has already been developed for two sub-watersheds in the county to ensure that development does not exceed the carrying capacity of natural systems, to minimize the impact of development on natural systems, and to sustain the natural function of environmental resources to mitigate natural hazards. (BRM)
- Vegetation and restoration practices that assist in enhancing and restoring the natural and beneficial functions of the watershed have been incorporated into new and updated environmental ordinances adopted by the County in spring of 2004. (BRM)
- Surrounding surface water and ecosystems are protected from pollutants often associated with flooding and stormwater runoff through requirements incorporated into the adopted environmental ordinances. (BRM)
- Unifying organizations are in place to ensure communication and dissemination of natural hazard mitigation information. (OPS)
- The County Building Code currently requires sprinkler systems in certain buildings, including multi-family residences. (BPI)
- The Bureau of Resource Management currently reviews all capital improvement plans to ensure that new critical facilities are not directed toward location-specific hazard areas such as floodplains. (BRM)
- The Office of Public Safety Support Services Emergency Management Division has acquired FEMA's HAZUS-MH risk assessment software program to analyze potential losses from hazard events. (OPS)
- A partnership is in place between the Carroll County Board of Education and the Office of Public Safety Support Services Emergency Management Division to foster the integration of hazard mitigation information and methods into the curriculum for science, math and other subjects. (OPS & BOE)
- The Emergency Management page of Carroll County's website contains links to all-hazards disaster preparedness and mitigation information for use by all county residents. (OPS)
- The Office of Public Safety Support Services Emergency Management Division maintains partnerships with many public and private agencies and organizations throughout the County. These partnerships increase opportunities for coordination of hazard mitigation activities and possible collaboration on mitigation projects. The LEPC fulfills an advisory role in the monitoring, evaluation, and updating of the Hazard Mitigation Plan. (OPS & LEPC)
- Display boards are utilized by the Office of Public Safety Support Services Emergency Management Division to provide mitigation and preparedness information to the public at fairs and other special events. (OPS)

## **Proposed Mitigation Objectives & Strategies**

Each higher-priority mitigation measure is followed by a table showing the responsible/lead agency, timeline and funding source(s) for that measure.

## Higher-Priority Mitigation Strategies for All Hazards

#### **Protection of Life and Property**

*Objective*: Ensure that *critical facilities* are protected from effects of hazard events to the maximum extent possible.

• Explore and implement additional ways to effectively utilize FEMA's HAZUS-MH software. Examples might include using HAZUS-MH to estimate physical damage from hurricane force winds to residential and commercial buildings, schools, critical facilities and infrastructure, or utilizing it to estimate the economic losses from a flooding event.

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County
Support Services Emergency		
Management Division		

Objective: Ensure that impacts from hazard events on public infrastructure are minimized.

• Coordinate emergency transportation routes through communication among the County Public Works Department, neighboring jurisdictions, and the Maryland Department of Transportation. (DPW)

Responsible/Lead Agency	Timeline	Funding Source
Department of Public	Annually through	County
Works	CIP – Regional	
	Protective Action	
	Program –	
	Biennial Bridge	
	Evaluation	

Objective: Reduce the potential impact of natural and man-made disasters on the County's historic and cultural treasures.

*Objective*: Improve the *resistance of structures* against hazard events.

#### **Community Education**

*Objective*: Work with the Carroll County *Board of Education* to promote hazard mitigation education and awareness and discuss ways to better integrate mitigation into the curriculum for science, math, and other subjects.

• Identify new and updated publications and materials from FEMA, the American Red Cross, and other organizations for use in the Carroll County Public School curriculum. Examples might include the Red Cross' Masters of Disaster program, FEMA's free "Understanding U.S. Geography and Weather - Lessons and Activities in Language and Geography" materials, and Discovery Education's "Ready Classroom" resources. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County
Support Services Emergency		
Management Division		

Objective: Educate property owners on the *individual* mitigation *measures* that can be taken before the next hazard event.

• Make the *Carroll County Hazard Mitigation Plan* available to the public by publishing a redacted version of the plan electronically on the County's website. (OPS & BCP)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	FY 15	County
Support Services Emergency		
Management Division		

• Continue to use the County website to provide hazard-related information that is easily accessible to county residents. Ensure that this information is updated regularly. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County
Support Services Emergency		
Management Division		

• Target owners of properties within identified hazard areas for additional outreach regarding mitigation. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County, State, Federal
Support Services Emergency		
Management Division		

*Objective*: Identify, improve, and sustain collaborative programs focusing on the *real estate* industry, the *development community*, and public and private sector organizations to avoid activity that increases risk from hazards.

*Objective*: Identify mechanisms to educate the *business community* on minimizing the risk of hazard events and implementing mitigation projects.

#### **Natural Resource Protection & Sustainable Development**

Objective: Incorporate hazard mitigation into long-range comprehensive and functional planning activities.

• Integrate hazard mitigation into the *needs analysis* and *recommendations* included in comprehensive plans. (BCP)

Responsible/Lead Agency	Timeline	Funding Source
Bureau of Comprehensive	All	County
Planning	comprehensive	
	plan updates	
	after FY 06	



• Identify the technological and civil hazards to which the county and its municipalities are vulnerable, assess the risks from these hazards, and incorporate the appropriate chapters and mitigation strategies in the existing Hazard Mitigation Plan for natural hazards. (LEPC, BCP)

Responsible/Lead Agency	Timeline	Funding Source
Bureau of Comprehensive	FY 15-20	County, State, Federal
Planning & LEPC		

Objective: Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

*Objective*: Protect the community's *water supply*.

*Objective*: Utilize *regulatory approaches* to prevent creation of future hazards to life and property and to minimize risk to environmentally-sensitive areas.

• Integrate through policies and procedures the goals and mitigation measures from the hazard mitigation plan into existing regulatory documents and programs, where appropriate. (LEPC)

Responsible/Lead Agency	Timeline	Funding Source
LEPC & All agencies &	Continuous	County, Towns
Towns		

• Review the zoning ordinances within the municipalities to ensure that appropriate protections are possible for natural systems, that provisions are made for mitigation in hazard areas, and that appropriate zoning districts are provided that can be applied in the applicable hazard areas. (Towns & BCP)

Responsible/Lead Agency	Timeline	Funding Source
Towns & Bureau of	All comprehensive	Towns
Comprehensive Planning	plan updates after FY 06	

• Lower the allowable intensity of development in hazard areas that are not designated growth areas to prevent intense private development within areas delineated as high-hazard.

Responsible/Lead Agency	Timeline	Funding Source
Bureau of Comprehensive	All	County, Towns
Planning & Towns	comprehensive	
	plan updates	
	after FY 06	

#### **Emergency Services**

Objective: Coordinate hazard mitigation activities with other emergency management activities.

#### **Interjurisdictional & Community Partnerships**

*Objective*: Develop *public and private partnerships* to foster hazard mitigation program coordination and collaboration in Carroll County.

• Continue to identify additional organizations within Carroll County that have programs or interests in hazard mitigation. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County
Support Services Emergency		
Management Division		

#### Monitoring, Maintenance, & Implementation

*Objective*: Enhance the County's ability to collect, maintain, and utilize *data* that could be useful for mitigation projects, preparedness, response, and/or recovery as well as to conduct hazard *risk assessments* and *track mitigation* activities.

• Start a database using identified property that has received damage due to hazards identified within this mitigation plan. The database should also include a tax account identification number for the property, a description of the property damage, the value of the damage, and links to photographs of the damage. Developing this database will allow the County to easily identify properties at high risk of damage from certain hazards as well as properties which receive repetitive damage from multiple hazards. In an effort to gain historical information, the County should send a survey to all residents requesting information that should be included in the database. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Currently in	County, State, Federal
Support Services Emergency	Planning Phase	
Management Division		

Objective: Establish a sustainable process for implementing, monitoring, and evaluating countywide mitigation activities.

• Establish clear roles for participants, meeting regularly to pursue and evaluate implementation of mitigation strategies. (LEPC)

Responsible/Lead Agency	Timeline	Funding Source
LEPC	Continuous	County

• Establish measurable standards to evaluate mitigation policies and programs and provide a mechanism to update and revise the mitigation plan. (LEPC)

Responsible/Lead Agency	Timeline	Funding Source
LEPC	Continuous	County, State, Federal

• Biennial review of implementation status of Hazard Mitigation Plan to be conducted by LEPC. (LEPC)

Responsible/Lead Agency	Timeline	Funding Source
LEPC	Ongoing - biennial	County, State, Federal

• Conduct a full review of the Hazard Mitigation Plan every five years after adoption of the plan by evaluating mitigation successes, failures, and areas that were not addressed. (OPS & BCP)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	FY 18	County, State, Federal
Support Services Emergency		
Management Division		

*Objective*: Identify and pursue *funding opportunities* to develop and implement County and municipal mitigation activities and demonstrate *funding needs*.

• Allocate County & Town resources and assistance to mitigation projects when possible. Recommend projects for inclusion in CIP. (LEPC)

Responsible/Lead Agency	Timeline	Funding Source
LEPC & All agencies	Annually –	Federal, State, County,
	submit projects	Towns
	prior to CIP	
	deadline	

• Allocate Town resources and assistance to mitigation projects when possible. (Towns)

Responsible/Lead Agency	Timeline	Funding Source
Towns	FY 15-20	Towns

• Partner with other organizations and agencies in Carroll County to identify grant programs and foundations that may support mitigation activities. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Continuous	County, Towns
Support Services Emergency		
Management Division,		
Grants Office, & Towns		

• Coordinate with Federal, State, and other jurisdictions to identify funding opportunities for implementation of the Hazard Mitigation Plan. (OPS)

Responsible/Lead Agency	Timeline	Funding Source
Office of Public Safety	Ongoing	County
Support Services Emergency		
Management Division		

## Lower-Priority Mitigation Measures for Future Consideration

#### **Protection of Life and Property**

Objective: Ensure that critical facilities are protected from effects of hazard events to the maximum extent possible.

- Take a proactive approach in investigating dangerous damaged structures and take prompt action in condemning damaged structures that have been abandoned. (BPI)
- Retrofit the primary storage location for local government records and/or store digital or hard copies of public records in a hazard-free offsite location to protect important or irreplaceable documents. (All)

Objective: Ensure that impacts from hazard events on *public infrastructure* are minimized.

• To improve road visibility, encourage the Maryland Department of Transportation to place new reflector tape or paint along road edges and in the dividing line on all major roads in the county. (DPW)

Objective: Reduce the potential impact of natural and man-made disasters on the County's historic and cultural treasures.

- Coordinate mitigation efforts between the Maryland Historical Trust and the County/Towns. (BCP)
- Prioritize historic structures to target for mitigation measures to protect this valuable resource. (BCP & Towns)
- Distribute existing educational materials on hazard mitigation developed by local, state, and national cultural heritage organizations to members of the community. (BCP & Towns)

Objective: Improve the resistance of structures against hazard events.

• Develop a process to educate private property owners on limitations of bridges and dangers associated with them and to encourage private property owners to upgrade their bridges to support the weight of fire trucks and emergency vehicles. (OPS)

#### **Community Education**

*Objective*: Work with the Carroll County *Board of Education* to promote hazard mitigation education and awareness and discuss ways to better integrate mitigation into the curriculum, such as the science, math, and other subject curriculums.

• Work with the Board of Education to develop curriculum for school programs and adult education on reducing risk and preventing loss from natural hazards. (OPS)

Objective: Educate property owners on the *individual* mitigation *measures* that can be taken before the next hazard event.

- Develop adult and child educational programs to be used by local radio and cable stations. (OPS)
- Develop a public speaking series on hazard-related topics, such as types of natural disasters and risks, how to develop a family disaster plan, how to develop a family disaster supply kit, how to develop a business continuity plan, simple types of mitigation projects for homeowners, etc., that is available upon request. These speaking engagements will be offered to civic groups such as Rotary, Lions, and Kiwanis Clubs; the Chamber of Commerce; church and interfaith groups; boys and girls clubs; scouting organizations; etc. (OPS)

*Objective*: Identify, improve, and sustain collaborative programs focusing on the *real estate* industry, the *development community*, and public and private sector organizations to avoid activity that increases risk from hazards.

*Objective*: Identify mechanisms to educate the *business community* on minimizing the risk of hazard events and implementing mitigation projects.

- Educate individuals and businesses on the benefit of engaging in mitigation activities, such as developing impact analyses.
- Offer hazard-susceptibility audits to local small businesses to lessen the percent of small businesses that are vulnerable and unprepared for hazards. (OPS)

#### **Natural Resource Protection & Sustainable Development**

Objective: Incorporate hazard mitigation into long-range comprehensive and functional planning activities.

Objective: Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

- Prepare a "green infrastructure" plan for the county and its municipalities to help sustain the mitigation qualities of natural systems and direct development away from high-hazard areas. Green infrastructure refers to the network of open spaces, forest land, wildlife habitat, parks and other natural areas that provide the natural foundation needed to support diverse plant and animal populations and enable valuable natural processes, like filtering water and cleaning the air, to take place. (BCP, & Towns)
- Acquire parcels of land in hazardous areas to conserve or restore as parks to reduce the number of structures and infrastructure elements vulnerable to natural hazards. (Parks & Rec)

Objective: Protect the community's water supply.

*Objective*: Utilize *regulatory approaches* to prevent creation of future hazards to life and property and to minimize risk to environmentally-sensitive areas.

#### **Emergency Services**

Objective: Coordinate hazard mitigation activities with other emergency management activities.

- Coordinate and integrate hazard mitigation activities with emergency operations plans and procedures. (OPS)
- Integrate the hazard mitigation plan and existing emergency operations plans with an umbrella Emergency Management Plan to address all phases of emergency management mitigation, preparedness, response, and recovery and develop preparedness and recovery components. (OPS)

#### **Interjurisdictional & Community Partnerships**

*Objective*: Develop *public and private partnerships* to foster hazard mitigation program coordination and collaboration in Carroll County.

#### Monitoring, Maintenance, & Implementation

*Objective*: Enhance the County's ability to collect, maintain, and utilize *data* that could be useful for mitigation projects, preparedness, response, and/or recovery as well as to conduct hazard *risk assessments* and *track mitigation* activities.

• Develop better hazard data for Carroll County and the municipalities. (OPS)

Objective: Establish a sustainable process for implementing, monitoring, and evaluating countywide mitigation activities.

• Provide training for LEPC members to remain current on developing issues in the hazard loss reduction field. (OPS)

*Objective*: Identify and pursue *funding opportunities* to develop and implement County and municipal mitigation activities and demonstrate *funding needs*.

## **Completed Initiatives to Reduce Hazards and Improve Hazard Mitigation**

In 2004, the County made some major changes to its existing Stormwater Management Code (Chapter 191) and Supplemental Manual; Grading, Erosion and Sediment Control Code (Chapter 121); Forest Conservation Code (Chapter 115) and Manual; and the Landscape Enhancement of Development Code (Chapter 134) and Manual. During that same time, the County adopted new codes and manuals relating to Floodplain Management; Water Resource Management; and Environmental Management of Storm Sewer Systems. Along with the Code changes and additions, the Bureau of Resource Management developed the Water Resource Management Area Guidance Map which helped establish resource protection areas throughout Carroll County.

Since 2004, the County has amended these Codes to meet new State requirements or to refine requirements to better serve the County.

## Chapter Thirteen: Monitoring & Maintenance

For a plan to be effective, it must be implemented. The existing mitigation measures in place must be continued, and action should be taken on the proposed additional mitigation strategies outlined in the plan. A process should be in place to ensure that this is happening.

FEMA requires that each hazard mitigation plan include a description and method for how the plan will be monitored, evaluated, and updated within a five-year cycle. The plan must also be reviewed and revised, if appropriate, by the local jurisdiction, by the State Hazard Mitigation Officer, and by FEMA. The implementation process should include a description of the process of how the jurisdiction will incorporate the plan's strategies into other planning documents, such as comprehensive or capital improvement plans, where appropriate. Continued public involvement must also be part of the ongoing mitigation planning process.

## **Participating Agencies**

Several local agencies – both County and municipal – have a significant role in the monitoring of plan implementation. While there are many parties that have an interest in the monitoring and implementation and may also have some

involvement in the process, a few agencies have the primary responsibilities. The lead agency is the Carroll County Office of Public Safety Support Services Emergency Management Division (OPS). The other major agency players are the Bureau of Comprehensive Planning and Bureau of Resource Management within the Carroll County Department of Land Use, Planning, and Development; the Department of Public Works; and the Bureau of Permits and Inspections within the Department of Public Works. The Local Emergency Planning Committee (LEPC) serves in an advisory role to the OPS. The responsibilities of each agency are outlined below.

## Carroll County Office of Public Safety Support Services Emergency Management Division (OPS)

The Office of Public Safety Support Services Emergency Management Division's mission is to develop, promote, and maintain protection of the people, property, and natural resources of Carroll County. Through leadership, action, and coordination of the County's public safety resources, this office strives to enhance the safety and livability of its citizens and visitors. The Office is dedicated to providing citizens with

protection of life and property through emergency management and fire protection engineering services, as well as effective emergency communications in support of our police, fire, and emergency medical services.

As the agency responsible for emergency management on a daily basis, the OPS takes the lead responsibility for monitoring, evaluating, and maintaining this plan. The Emergency Management Division will be responsible for production of the text of the print-ready document and will ensure that the edits and changes to the document that result from ongoing monitoring and evaluation are incorporated into the text during subsequent updates. The OPS will coordinate with the LEPC to solicit feedback and suggestions. OPS will also coordinate with the other participating County agencies and municipalities. Staff of OPS currently chair the LEPC and will also participate in a multi-agency subcommittee that will review and evaluate the progress of the implementation of the plan on a regular basis.

## Carroll County Bureau of Comprehensive Planning (BCP)

The Bureau of Comprehensive Planning is responsible for comprehensive, countywide master planning. Land use plans are prepared and implemented working with the Carroll County Planning Commission authorized under the Land Use Article. The several functions within the Bureau are designed to ensure County projects and programs conform with the County Master Plan, that current and long-range County planning serve to implement the plan, and that land use and policy decisions are in accordance with the plan. The Comprehensive Planning Bureau is responsible for developing and updating comprehensive plans and functional plans for the County and smaller regions within the County. The Bureau functions as staff to the County Planning and Zoning Commission, which reviews and finalizes the plans prior to adoption. The process and implementation of these comprehensive plans plays a vital role in countywide growth management.

Each staff planner with the Bureau of Comprehensive Planning is assigned a specific geographic region of the County. Within that area, that planner updates any relevant comprehensive plans and provides liaison-planner services to the municipalities. Individual rezoning petitions, annexations, and review of development plans for consistency with appropriate and relevant comprehensive or functional plans for that area are also handled by the appropriate planner.

In addition to the geographic responsibilities, each planner also has a specific issue or functional area of planning which he or she covers. These include such issues as transportation, mineral resources, demographics, economic development, historic sites, parks and recreation, and concurrency management, among others. Many of the issues have functional plans associated with them.

GIS staff under the Department of Land Use, Planning, and Development is responsible for geographic data, mapping, and analysis associated with projects specific to the Bureau of Comprehensive Planning. Each GIS user is responsible for projects for a specific geographic area, working in conjunction

with the comprehensive planners for that area. GIS users also work as a team on countywide projects.

Countywide projects or other special projects may be handled by the Bureau Chief or may be assigned to one or more of the area planners. Technical support is provided to develop implementation measures for the recommendations contained within the comprehensive plans, such as zoning ordinance amendments, drafting of other ordinances, grant applications, and comprehensive rezoning.

The Bureau not only has the knowledge and background for developing plans in general, but also is responsible for developing comprehensive plans for the County and its communities. Consequently, the Bureau of Comprehensive Planning will participate as a member of the agency committee that will help review and evaluate the progress of the implementation of the HMP on a regular basis. Staff from this Bureau will be able to evaluate the progress of the HMP from a perspective of its integration into land use planning issues, planning-related capital improvement projects, and other planning issues.

## Carroll County Bureau of Resource Management (BRM)

External compliance to County environmental rules starts with the review of new development proposals. The environmental review function is the purview of the Bureau of Resource Management. That Bureau's responsibilities ensure that County environmental requirements are adhered to. Environmental review is inclusive of the following types of activities:

1. The survey of existing conditions to ensure that applicable laws are applied appropriately;

2. The review of development plans submitted to the County for consideration to ensure that they comply with established County environmental standards; and

3. The application of appropriate conditions in the approval process.

Enforcement of the County's environmental regulations to ensure both internal as well as external compliance is the purview of the Bureau. BRM is responsible for the enforcement of the environmental chapters of the Carroll County Code. The resultant tasks are inclusive of a variety and number of field inspections as well as enforcement actions, when appropriate. Adequate enforcement is also a factor in maintaining the County's compliance with both State and Federal environmental law.

The BRM also takes a lead role on educating the public, agencies, and appointed and elected officials, about ongoing topics of importance regarding the environment. This is achieved through the use of a locally appointed advisory board that provides information and recommendations to the County Commissioners regarding sensitive environmental and resource-related questions.

As a participating agency in the evaluation of the progress of this plan, this agency will be reviewing the environmental measures and programs existing and proposed to determine whether they are being implemented, when, and how effective

they are. This input will help refine the priority of some of the projects as well as help this agency with grant applications for certain mitigation projects. It will also help with identifying projects that should be proposed for inclusion in the CIP. As projects are completed, projects currently given a lower priority may be given a higher priority status and recommended for inclusion in the plan during the five-year update.

## Carroll County Department of Public Works (DPW)

The Department of Public Works assists the County Commissioners in the efficient operation and maintenance of County roads. The Department is comprised of several bureaus, including the Bureaus of Engineering and Roads Operations. Through these offices, the Department inspects and maintains roads and bridges, and manages engineering and environmental projects. The Department procures land needed for construction of roads, bridges, and drains.

As a participating agency in the evaluation of the progress of this plan, this agency will be reviewing the existing and proposed mitigation measures and programs in the plan that are related to capital facilities, such as roads and bridges, to determine whether these strategies are being implemented, when, and how effective they are. This input will help with identifying projects that should be proposed for inclusion in the CIP. As projects are completed, projects currently given a lower priority may be given a higher priority status and recommended for inclusion in the plan during the five-year update.

## Carroll County Bureau of Permits and Inspections (BPI)

The Bureau of Permits and Inspections, which is one of the bureaus under DPW, enforces the Carroll County building Code (Chapter 97 of the Code of Public Local Laws and Ordinances of Carroll County), which includes building, electrical, plumbing, mechanical, handicapped, and fire codes. The Bureau processes all applications and inspects all phases of construction. The Bureau assigns addresses to new structures using the County Grid System. The Bureau issues electrical, plumbing, gas fitters, and utility contractor licenses. Staff reviews site development and subdivision plans for compliance.

The Site Inspector inspects sites for compliance with approved site plans and for compliance with the Maryland State Building Code for handicapped accessibility.

The Bureau enforces the Carroll County Minimum Livability Code, Chapter 141 of the Code of Public Local Laws and Ordinances of Carroll County, which governs building standards for residential rental housing.

The Bureau also interprets and enforces Chapter 102 of the Code of Public Local Laws and Ordinances of Carroll County, which governs the development impact fees.

This agency will participate in the review and evaluation of the progress of the plan through input on the effectiveness of measures currently in the Building Code. The agency will also be able to help craft any additional revisions to the Code that are proposed as mitigation strategies. They will be able to then recommend changes in priorities and additional mitigation strategies for the five-year update.

## Carroll County Municipalities

As this plan addresses the County as well as each municipality in the county, coordination with the towns is an important component of the annual review process (see discussion under "Monitoring and Evaluating" below). Each town will be asked to provide a status report on the progress and effectiveness of existing and proposed mitigation measures in place in their jurisdiction. OPS will provide this information to the participating agencies and to the LEPC for their consideration in their review and evaluation as it relates to how all of the mitigation measures work together for overall benefit. Townspecific strategies may be incorporated into the plan where appropriate, as well.

# Local Emergency Planning Committee (LEPC)

In 1986, Congress passed the Superfund Amendments and Reauthorization Act (SARA) of 1986. Title III of this legislation requires that each community establish a Local Emergency Planning Committee (LEPC) to be responsible for developing an emergency plan for preparing for, and responding to, chemical emergencies in that community. This emergency plan must include the following: an identification of local facilities and transportation routes where hazardous materials are present; the procedures for immediate response in case of an accident (this must include a community-wide evacuation plan); a plan for notifying the community that an incident has occurred; the names of response coordinators at local facilities; and a plan for conducting exercises to test the plan. The plan is reviewed by the State Emergency Response Commission (SERC). The LEPC is required to review, test, and update the plan each year.

Title III of this act is also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). This act was enacted to empower citizens and emergency responders with the "right to know" what chemicals exist in the communities where they live and work. It mandates planning for chemical emergencies and established a chain of command to ensure that the requirements were met. The LEPC is required to have representatives from specific areas that would have knowledge and interests in environmental emergency planning.

The Carroll County LEPC is an active group of emergency responders, planners, business representatives, health-care providers, elected officials, citizens, and media that work together for the preservation of our environment. Given the nature of the LEPC's responsibilities and its diverse community representation, and the fact that this hazard mitigation plan will eventually address hazards other than natural hazards, the LEPC will be called upon to act in an advisory role to OPS for the evaluation of the progress of the strategies within this plan. The LEPC's diverse representation and background knowledge will provide an invaluable avenue for feedback and suggestions for this process.

## **Plan Maintenance Process**

## Monitoring & Evaluating

The Office of Public Safety Support Services Emergency Management Division will facilitate an annual meeting of the participating agencies to discuss to what extent existing mitigation measures and programs have been implemented, as well as their effectiveness. The agencies will also review which new mitigation strategies are being pursued or have been put into effect and the status of those projects. Each agency will make recommendations on proposed mitigation measures that can be moved from proposed to existing upon the next update of the plan. The agencies will evaluate whether additional efforts need to be made in any areas to ensure improved success for the goals and objectives of the plan.

As a result of this effort, the OPS will prepare a report to the LEPC that provides the status of existing and proposed mitigation strategies and summarizes the recommendations that will be incorporated into the text of the plan at the five-year update. The LEPC will provide additional input on measures other than government projects that have been taken within the community, including whether these measures are perceived as effective and any associated recommendations. The LEPC will combine that information with their feedback on the staff/agency report and provide comments and recommendations back to the OPS.

OPS will monitor and update the annual report and recommendations to ensure that it is current once the five-year

update process to the plan begins. OPS will coordinate with participating agencies and the LEPC to modify efforts, where needed, to achieve the goals and objectives of the plan.

## Implementation through Existing Programs

Each hazard-specific chapter of the plan identifies existing measures in place at the local level to mitigate the impacts of the hazards included in the plan. The ongoing measures will continue to be implemented. The review and evaluation provided by each agency and the LEPC each year will include a discussion of the effectiveness of these programs, as well as recommendations to improve their effectiveness and efficiency.

## **Continued Public Involvement**

As the LEPC contains citizen, private business, and media representation, the LEPC is a vital element of public involvement in this process. It is expected that LEPC members will represent the interests of the segments of the community for which they sit on the committee.

A redacted version of the plan will be available on the County's website. A forum will be available to allow citizens to provide comment and suggestions on the plan. This input will be considered at each annual review and suggestions will be appropriately incorporated into the plan when it is updated.

The process of implementing the education-based strategies of the plan will provide another opportunity for continued public involvement.

The Carroll County Citizen Corps Council will be utilized as a channel for communicating with the public about the plan and the five-year update to the plan will incorporate a citizen participation component.

## Additional Hazard Chapters

One of the strategies included in this plan is to add chapters to the plan to address hazards, other than natural hazards, for which the County and municipalities are at risk. These catastrophic events (as opposed to those incidents with which responders deal on a regular basis) include hazardous materials incidents and transportation accidents. Civil/criminal hazards that may be added include terrorism and other civil disturbance incidents.

## The Five-Year Update

The plan will be reviewed and updated on a five-year cycle. The process to update the plan will start by repeating the annual process to review and evaluate the progress of the plan and its mitigation measures. The resulting report will then be used to identify which proposed mitigation measures can be moved to the list of existing strategies as well as which of the lower-priority strategies can be moved into a higher-priority status.

The update of the plan will also include incorporating additional chapters that have been developed to address other hazards from which the County and municipalities are more at risk.

Meetings will be held with the municipalities to ensure their input and feedback are incorporated and that the specific needs of individual municipalities are met through the plan's proposals.

The public will continue to be involved through the LEPC, through forums available on the County's website where citizens can provide comments on proposed changes to the plan, and through public workshops that will be held to explain the progress of the plan update and the changes proposed through the LEPC and through coordination with the participating agencies.

MEMA will be asked to review the updated draft. Comments will be addressed as appropriate and a revised draft sent to FEMA for approval.

Upon completion of an updated draft plan, the elected officials in each jurisdiction will hold a public hearing on the proposed changes. All comments will be considered and appropriate changes will be made to the plan as directed by the elected officials. The elected officials will then adopt the revised plan.

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# Glossary of Terms and Acronyms



## Terms

**American Community Survey (ACS):** The ACS is an ongoing U. S. Census Bureau statistical survey that samples a small percentage of the population every year, giving communities the information they need to plan investments and services.

**Asset:** Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

**Bedrock:** The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

**Community Rating System (CRS):** An NFIP program that provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of policyholders in these communities are reduced.

**Critical Facility:** Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals. **Earthquake:** A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

**Erosion:** The wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years through the action of wind, water, or other geologic processes. **Fault:** A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

**Flash Flood:** A flood event occurring with little or no warning where water levels rise at an extremely fast rate. **Flood:** A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land. **Flood Hazard Area:** The area shown to be inundated by a

flood of a given magnitude on a map.

**Flood Insurance Rate Map (FIRM):** Map of a community, prepared by FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community. **Floodplain:** Any land area, including watercourse, susceptible to partial or complete inundation by water from any source. **Frequency:** A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

**Enhanced Fujita Scale of Tornado Intensity:** Rates tornados with numeric values from EF0 to EF5 based on tornado wind speed and damage sustained. An EF0 indicates light damage

such as broken tree limbs or signs, while an EF5 indicates incredible damage was sustained.

**Geographic Information Systems (GIS):** A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

**Ground Motion:** The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter; but soft soils can further amplify ground motion.

**Hazard:** A source of potential danger or adverse condition. Hazards can be both natural and technological in origin and include: floods/flash floods, droughts, wind,

thunderstorms/lightning, winter storms, tornados, hurricanes, extreme heat, landslides, earthquakes, wildfires/fires, land subsidence, mining hazards, dam failures, hazardous materials, and nuclear accidents. These events are hazards when they have the potential to harm people or property.

**Hazard Event:** A specific occurrence of a particular type of hazard.

**Hazard Identification:** The process of identifying hazards that threaten an area.

**Hazard Mitigation:** Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

**HAZUS (Hazards US:** A GIS-based, nationally standardized hazard loss estimation tool developed by FEMA.

**Hurricane:** An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74-miles-per-hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the North Atlantic Ocean, northeast Pacific Ocean, or the South Pacific Ocean east of 160° longitude. Hurricane

circulation is counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

**Infrastructure:** Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry-docks, piers and regional dams.

**Landslide:** Downward movement of a slope and materials under the force of gravity.

**Magnitude:** A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

**Mitigation Plan:** A systematic evaluation of the nature and extent of vulnerability to effects of natural hazards typically present in a jurisdiction; includes a description of actions to minimize future vulnerability to hazards.

**National Flood Insurance Program (NFIP):** Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations. See 44 CFR §60.3.

**National Weather Service (NWS):** Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to federal and state entities in preparing weather and flood plans.

**Nor'easter:** An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow or rain.

**Planning:** The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

**Pre-Disaster Mitigation Program:** The Pre-Disaster Mitigation (PDM) Program was authorized by §203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 USC, as amended by §102 of the Disaster Mitigation Act of 2000. Funding for the program is provided through the National Pre-Disaster Mitigation Fund to assist states and local governments (to include Indian Tribal governments) in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program.

**Probability:** A statistical measure of the likelihood that a hazard event will occur.

**Repetitive Loss Property:** A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least \$1000 each have been paid within any 10-year period since 1978.

**Replacement Value:** The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

**Risk:** The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard. **Riverine:** Of or produced by a river.

**Stafford Act:** The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

#### State Hazard Mitigation Officer (SHMO): The

representative of state government who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of preand post- disaster mitigation activities.

**Tornado:** A violently rotating column of air extending ground-ward.

**Tropical Cyclone:** A generic term for a cyclonic, low-pressure system over tropical or sub-tropical waters.

**Tropical Storm:** A tropical cyclone with maximum sustained winds greater than 39 mph and less than 74 mph.

**Vulnerability:** Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

**Vulnerability Assessment:** The extent of injury and damage that may result from a hazard event of a given intensity in a given area.

**Wildfire:** An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

#### Acronyms

GAB: Growth Area Boundary ACS: American Community Survey (by the U. S. Census Bureau) GPD: Gallons per day BCP: Bureau of Comprehensive Planning HMGP: Hazard Mitigation Grant Program **BDR:** Bureau of Development Review HMP: Hazard Mitigation Plan **BOE:** Board of Education LEPC: Local Emergency Planning Committee **BPI:** Bureau of Permits and Inspections LFD: Letter of Final Determination (from FEMA) BRM: Bureau of Resource Management LIDAR: a combination of "LIght" and "raDAR" CCHMP: Carroll County Hazard Mitigation Plan LUPD: Carroll County Department of Land Use, Planning, **CCVESA:** Carroll County Volunteer Emergency Services & Development Association MDE: Maryland Department of the Environment CFR: Code of Federal Regulations MEMA: Maryland Emergency Management Agency CIP: Community Investment Plan; Capital Improvement Program (or Plan) MGD: million gallons per day; million gallons daily **CRS:** Community Rating System MGE: Municipal Growth Element DED: Department of Economic Development MSP: Maryland State Police DFIRM: Digital Flood Insurance Rate Map NCDC: National Climatic Data Center DGA: Designated Growth Area NFIP: National Flood Insurance Program DMA: Disaster Mitigation Act (2000) NID: National Inventory of Dams **DPW:** Department of Public Works EAP: Emergency Action Plan **NWS:** National Weather Service EF-Scale: Enhanced Fujita Scale (tornado-damage OMB: Office of Management and Budget measurement) **EMS:** Emergency Medical Services Management Division **EOC:** Emergency Operations Center PDA: Preliminary damage assessment EPCRA: Emergency Planning and Community Right-to-Know PDM: Pre-Disaster Mitigation Grant Program Act PDSI: Palmer Drought Severity Index PMF: Probable Maximum Flood FEMA: Federal Emergency Management Agency FIRM: Flood Insurance Rate Map FMA: Flood Mitigation Assistance SERC: State Emergency Response Commission GA: Growth Area SFHA: Special Flood Hazard Area

NOAA: National Oceanic and Atmospheric Administration **OPS:** Office of Public Safety Support Services Emergency SARA: Superfund Amendments and Reauthorization Act Page 178



SHA: State Highway Administration
SHELDUS: Spatial Hazard Events & Losses Database for the United States
SWM: Storm Water Management
TBD: To be determined
USACE: United States Army Corps of Engineers
ZOI: Zone of Influence



# Appendices
### Appendix A:

### Maps Showing Areas for Which the Growth Areas are considered the Hazard High-Impact Area

Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Hampstead Growth Area

- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Manchester Growth Area
- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Mount Airy Growth Area
- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – New Windsor Growth Area
- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Sykesville/Freedom Planning Area
- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Taneytown Growth Area

- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Union Bridge Growth Area
- Hazard High-Impact Area for Winter Storms, Hurricanes, Tornadoes – Westminster Growth Area

















THE ATHEN

### Appendix B: National Weather Service – Maryland Listing of Tornadoes by County

#### **Maryland Listing of**

### **Tornadoes by County**

http://www.erh.noaa.gov/lwx/Historic\_Events/MDcntytornado-events.htm

- <u>May 28, 1896</u> at 1500 hours EST, a F2 tornado struck and moved into Adams County, PA. No deaths occurred, but injuries are unknown. The damage path was 5 miles long and of unknown width. No other specifics are known. (Lat. /Long. = ...)
- July 8, 1905 at 1515 hours EST, a F2 tornado struck Westminster. The damage path was 3 miles long and 300 yards wide. There were no deaths or injuries. The tornado uprooted and snapped trees, beat down corn, blew over wheat stocks, knocked fruit from trees and destroyed outbuildings. A 130 ton silo was moved two feet on its foundation. Damages were estimated at \$10,000. (Lat./Long. = ...)
- <u>May 2, 1929</u> at 2116 hours EST, a F3 tornado moved from Frederick to Keymar, southwest of Taneytown. It was the 5th tornado in a killer outbreak that swept north from Virginia. The damage path was 5 mile long in Carroll County and 200 yards wide. Two people were killed and 6 injured in

Frederick County. No significant property damage was reported for Carroll County. (Lat./Long. = 39.29/77.07 to 39.31/77.01)

- <u>May 13, 1937</u> at 1730 hours EST, a F2 tornado struck from 6 miles southwest of Westminster to 2 miles northeast. Its damage path was 8 miles long and up to a mile wide. The funnel was observed. The tornado unroofed and damaged homes and barns, demolished many barns, garages, sheds, chicken coops, wind towers, silos, and out buildings. It twisted a bridge, snapped and uprooted trees, downed utility poles and damaged orchards. Property losses were estimated at \$150,000. No one was killed or injured. (Lat./Long. = ...)
- July 15, 1938 at 0300 hours EST, a F2 tornado struck 1 mile west of Manchester and moved northeast across Baltimore County to 4 miles north of Delta in southeastern York County, PA. No one was killed or injured. The damage path was 30 miles long and a quarter a mile wide. Damages were about \$75,000. (Damages were \$500,000 in York County to property, livestock, and crops). (Lat./Long. = ...)
- July 19, 1963 at 1505 hours EST, a F1 tornado moved in from Frederick County. Its damage path was 14.4 miles long and up to 900 yards wide. There were no fatalities or injuries. Damages are unknown. (Lat./Long. = 39.28/77.23 to 39.31/77.07)

- July 27, 1969 at 2015 hours EST, a F1 tornado struck. Its damage path was 1 mile long and 30 yards wide. There were no fatalities or injuries. Damages are unknown. (Lat./Long. = 39.36/76.50)
- June 19, 1975 at 1930 hours EST, a small F1 tornado struck the Union Mill area. Its damage path was 0.5 miles long and of unknown width. There were no fatalities or injuries. It damaged 3 farms and at least 40 trees. Damages are estimated at \$40,000. (Lat./Long. = 39.29/77.07)
- <u>April 25, 1976</u> at 1945 hours EST, a F2 tornado (corrected F-scale from original Storm Data report) struck 7 miles north of Westminster. Its damage path was 0.1 mile long and 35 yards wide. The tornado moved northeast. There were no fatalities or injuries. The tornado heavily damaged one farm house; hit another farm house and 3 vehicles. Damages were estimated at \$70,000. (Lat./Long. = 39.42/77.00)
- <u>August 28, 1978</u> at 1430 hours EST, a F1 tornado struck near Lineboro. Its damage path was 2.3 miles long and 30 yards wide. The tornado moved southeast from York County, PA. There were no fatalities or injuries. The tornado uprooted and snapped trees, destroyed a shed killing one steer inside. Damages were estimated at \$10,000. (Lat. /Long. = ...)
- <u>May 23, 1979</u> at 1730 hours EST, a F2 tornado struck Westminster. Its damage path was 2 miles long and 150 yards wide. The tornado touched down in the southwest outskirts of town and then moved through the downtown business district and then to Cranberry. 109 homes were damaged and 24 businesses. Some had roofs completely torn off. Trees were uprooted and snapped crushing two cars and damaging some homes. There were no fatalities or injuries. The tornado heavily damaged one farm house; hit another farm house and 3 vehicles. Damages were estimated at \$630,000. (Lat./Long. = 39.35/77.00)

- <u>September 5, 1979</u> at 1200 hours EST, a F1 tornado spawned from the remnants of Hurricane David was observed hitting a home Union Bridge area. The damage path was 0.5 miles long and an average of 30 yards wide. There were no fatalities or injuries. The tornado did some damage to the roof and exterior of the house. Damages were estimated at \$1,000. (Lat./Long. = 38.19/76.26)
- <u>May 22, 1983</u> at 1808 hours EST, a F3 tornado moved northeast from Frederick County across the Monocacy River into Carroll County. Its damage path was 1 miles long and 50 yards wide. It destroyed a spring house and several other buildings on a farm and carried a tin roof a mile away. Some additional damage occurred on adjoining properties. There were no fatalities or injuries. Damages were estimated at \$50,000. (Lat./Long. = 39.42/77.14 to 39.43/77.12)
- <u>September 3, 1993</u> at 1715 hours EST, a small F0 tornado briefly touched down 1.5 miles southwest of Silver Run at Arters Mill damaging a home. Its damage path was 0.2 miles long and 25 yards wide. There were no fatalities or injuries. Damages were estimated at \$3,000. (Lat./Long. = 39.40/77.05)
- <u>October 14, 1995</u> at 1738 hours EST, a small F0 tornado (gustnado) touched down 2 miles northwest of Westminster. Its damage path was 1 mile long and 25 yards wide. There were no fatalities or injuries. Damages were to trees and an orchard. Damages were estimated at \$1,000. (Lat./Long. = .../...)
- <u>October 21, 1995</u> at 0028 hours EST, a small F0 tornado (gustnado) briefly touched down in Taneytown. Its damage path was 0.5 miles long and 50 yards wide. There were no fatalities or injuries. It uprooted trees and caused minor damage to several homes. Damages were estimated at \$5,000. (Lat./Long. = .../...)

- July 19, 1996 at 1435 hours EST, a strong F3 (almost F4) tornado struck the Four Seasons subdivision outside of Gamber. Its damage path was 2.25 miles long and 350 yards wide. There were no fatalities, but 3 people were injured (two were children tossed out of an upper story of a house). 66 homes were damaged of which 12 were destroyed. Cars and vans were moved. One person was injured when their van was lifted and the windows shattered. Corn stalks were sucked out of the ground and one was embedded in a wall a half a mile away. Portions of a demolished barn were found 5 miles away while some of it was deposited 200 yards upwind from where it once stood. Major projectile damage was seen. It was the 13th tornado of an outbreak that started in central PA and moved southeast. Damages were estimated at \$5,000,000. (Lat./Long. = .../...)
- <u>September 28, 1996</u> at 1700 hours EST, a small F1 tornado (gustnado) struck Silver Run area. Its damage path was 0.5 miles long and 75 yards wide. There were no fatalities or injuries. A barn, a garage, and an outbuilding on a farm were damaged. Damages were estimated at \$75,000. (Lat./Long. = .../...)
- June 16, 1998 at 1738 hours EST, a small F1 tornado touched down 3 miles northeast of Finksburg. Its damage path was 0.5 miles long and 50 yards wide. There were no fatalities or injuries. The tornado knocked down trees which fell on a house, a camper and a shed. Damages were estimated at \$20,000. (Lat. /Long. = .../...)
- <u>April 16, 2011</u> at 1938 hours a small, EF-1 tornado touched down 2 miles NNE of New Market and proceeded northeast until it was 2 miles WNW of Winfield. Pine trees were snapped, roofing panels were removed from a garage with damage totaling \$5,000. Utility poles were snapped at the intersection of MD26/ MD 97. The tornado lifted into the

sky at 1951 hours. The maximum path width was 50-75 yards, and wind speeds reached 100mph.

- <u>April 28, 2011</u> at 0737 hours a small, EF-0 tornado touched down in downtown Westminster at the corner of E Main St. and S Bishop St. The tornado passed within 50 yards of the county office building, public school administration building, and sheriff's office. The tornado cross MD 140 at Center Street and lifted into the clouds within 20 yards of the Westminster Town Mall at 0739 hours. Maximum wind speeds were estimated to be 65mph, with a path width of 50 yards.
- <u>April 28, 2011</u> at 0809 hours a small, EF-0 tornado touched down on MD 88, one mile SE of Hampstead. The tornado continued east on Mt. Carmel Rd. before passing into Baltimore County at 0811 hours. Numerous trees were snapped off at their mid sections, shingles from several homes were blown off, with damage totaling \$7,000. The tornado dissipated at 0811 hours in Baltimore County.
- June 1, 2012 at 1448 a small EF-0 tornado touched down 2 miles SE of Mt. Airy and proceeded north. The tornado was on the ground until 1449 hours before lifting back into the clouds. Several large trees were uprooted, but no structural damage, injuries or fatalities were reported.
- June 1, 2012 at 1521 hours a small, EF-1 tornado touched down in Finksburg near the 2600 block of Bird View Road. Several trees were snapped and uprooted as the tornado traveled northeast. The greatest concentration of damage was focused north of Green Mill Road, where some large trees with trunk diameters in excess of two feet were uprooted completely. One tree fell into a house on Green Mill Road and was deemed a total loss, with an estimate property value in excess of \$150,000. The tornado tracked across MD 140 after passing within 1/10 mile of the Finksburg library where

numerous county residents were seeking shelter. No injuries or fatalities were reported. To tornado lifted into the clouds at 1530 hours and was determined to have maximum winds of 90mph, with a path width of 150 yards.

• Tornado Summary Table:

Total #	#F0/F1	#F2/F3	#F4/F5	Deaths	Injuries	Damages
24	15	9	0	1	3	\$6,327,000



### Appendix C Resolutions – Carroll County and Municipalities

Support Services presented to the County Commissioners of Carroll County the proposed "Carroll County Hazard Mitigation Plan" for review; and WHEREAS, on February 27, 2014, the Carroll County Office of Public Safety

deliberation and pending action on the proposed "Carroll County Hazard Mitigation Services appeared before Plan" by the County Commissioners of Carroll County; and WHEREAS, on March 6, 2014, the Carroll County Office of Public Safety Support the County Commissioners of Carroll County to facilitate

adoption of the Plan would advance the public health, safety and welfare WHEREAS, the County Commissioners of Carroll County determined that

Carroll County RESOLVED to ADOPT the proposed "Carroll County Hazard Mitigation Plan", EFFECTIVE immediately NOW, THEREFORE, on the 6th day of March, 2014, the County Commissioners of

THE

COUNY

COMMISSIONERS

P

CARROLL COUNTY, MARYLAND, a body

Nawn D. Reese, County Clerk EST: K corporate and politic of the State of Maryland

David H. Roush, President (SEAL)

(SEAL)

Richard S. Rothschild, Vice President

Robin B/Frazier, Secreta (SEAL)

Douglas Heward, Commissioner (SEAL)

Haven N. Shoemaker, Jr., Commissioner (www (SEAL)

Carroll County Hazard Mitigation Plan

Timothy C. Burke, County Attorney

Approved for legal sufficiency:

### RESOLUTION NO. 02-14

### ADOPTION OF THE CARROLL COUNTY HAZARD MITIGATION PLAN

recognized the need and history concerning disaster and emergency planning in Resolution No. 01-05 adopted on May 23, 2005; and WHEREAS, the Mayor and Town Council of The Town of Union Bridge previously

prior iteration of the Plan; and adopted the 2013 Carroll County Hazard Mitigation Plan thereby revising and updating the WHEREAS, on or about March 6, 2014 the Board of Carroll County Commissioners

and relevant to the Town and the Town's comments were incorporated into the adopted 2013 Plan; WHEREAS, the Town was asked to comment upon the information in the 2013 Plan

determined that the adoption of the revised and updated 2013 Carroll County Hazard The Town of Union Bridge. Mitigation Plan will serve to promote the health, safety, and general welfare of the citizens of WHEREAS, the Mayor and Town Council of The Town of Union Bridge have

maps referenced therein, is hereby adopted by The Town of Union Bridge; and it is further, Hazard Mitigation Plan attached hereto, together with any and all of the component parts and NOW, THEREFORE, BE IT HEREBY RESOLVED that the 2013 Carroll County

government, in the future, thereby superseding any parts of the Plan inconsistent therewith; and it is further changes or other revisions to the 2013 Hazard Mitigation Plan as may be adopted and approved by the Board of Carroll County Commissioners, or similar executive authority of Carroll County without further action, shall be deemed to incorporate, adopt and operate to ratify any updates, RESOLVED that unless the Town takes express action to the contrary, this Resolution

appropriation or commitment of Town funds. RESOLVED that nothing contained herein or in the Plan shall be deemed an

INTRODUCED THIS 24 DAY OF MARCH, 2014

Dawn Metcalf, Clerk Treasurer

Carroll County Hazard Mitigation Plan Approved This 24 05.622.Re HOLLMAN, MAGUIRE, TITUS & KORZENEWSKI, CHTD 00-14, 2013 H N T. MAGUIRE as to Legal Form and Sufficiency day of March, 2014. own Actorney APPROVED THIS 24 DAY OF MARCH, 2014 Dawn Metcalf, Clerk-Treasurer ADOPTED THIS 24 DAY OF MARCH, 2014 N TCA Mayor

history concerning disaster and emergency planning in Resolution No. 2005-03 adopted on February 8, 2005; and WHEREAS, Town of Hampstead (the "Town") previously recognized the need and

WHEREAS, on or about March 6, 2014 the Board of Carroll County Commissioners adopted the 2013 Carroll County Hazard Mitigation Plan thereby revising and updating the prior iteration of the Plan; and

will serve to promote the health, safety, and general welfare of the citizens of Hampstead. WHEREAS, the Mayor and Town Council of the Town of Hampstead have determined that the adoption of the revised and updated 2013 Carroll County Hazard Mitigation Plan

TOWN OF HAMPSTEAD: NOW THEREFORE, BE IT RESOLVED BY THE MAYOR AND COUNCIL OF THE

Hampstead. The 2013 Carroll County Hazard Mitigation Plan, together with any and all of the component parts and maps referenced therein, is hereby adopted by the Town of

executive authority of Carroll County government, in the future, thereby superseding any adopted and approved by the Board of Carroll County Commissioners, or similar updates, changes or other revisions to the 2013 Hazard Mitigation Plan as may be parts of the Plan inconsistent therewith. without further action, shall be deemed to incorporate, adopt and operate to ratify any į.v Unless the Town takes express action to the contrary, this Resolution,

or commitment of Town funds. ŝ Nothing contained herein or in the Plan shall be deemed an appropriation

accordance with Section C2-14 of the Charter This Resolution shall become effective immediately upon its adoption in

Council members opposed, and 0 abstentions Passed this 8th day of April, 2014 by a vote of 5 Council members in favor, 0

with 8

LERK OF THE COUNCIL

MAYOR

day of of Approved as to form and  $\mathcal{L}$ leavel sufficiency this  $\mathcal{S}$ 5 2014

uuuuu X Landor

BY

Town Attorney Michelle M. Ostrander, Esq.

### RESOLUTION NO. 2014 - 07 CITY OF TANEYTOWN ADOPTION OF CARROLL COUNTY HAZARD MITIGATION PLAN

and maps referenced therein, by Resolution 2005-7 on May 9, 2005; and Carroll County Hazard Mitigation Plan, together with any and all of the component parts WHEREAS, the Mayor and City Council of the City of Taneytown believe it is in WHEREAS, since that date this Plan has been reviewed, revised and updated; and WHEREAS, the Mayor and City Council of the City of Taneytown adopted the

jurisdictional plan entitled "Carroll County Maryland Hazard Mitigation 2013"; and the best interests of the Citizens of Taneytown to adopt and follow the updated multi-WHEREAS the adoption of this plan will protect the health, safety and welfare of

the Citizens of Taneytown NOW THEREFORE BE IT RESOLVED by the Mayor and City Council of the

2013 is hereby adopted by the City of Taneytown City of Taneytown, Maryland that the Carroll County Maryland Hazard Mitigation Plan

THIS 14 DAY OF DAY . , 2014. JAMES I. MOCARRON, MAYOR APPROVED THIS CLARA KALMAN, CITY CLERK NTRODUCED AND PASSED THIS Clave OPPOSED Winds tolmen IT DAY OF eva HA DAY OF 540 IN FAVOR AND 2014

岗

JACK A. GULLO, JR., CITY-ATTORNEY

### TOWN OF SYKESVILLE RESOLUTION NO. 2014-02

RESOLUTION OF THE MAYOR AND TOWN COUNCIL "CARROLL COUNTY HAZARD MITIGATION PLAN" SUPPORTING THE

public health, safety and welfare, Mitigation Plan" adopted by the Carroll County Commissioners on March 6, 2014, would advance the WHEREAS, the Mayor and Town Council determined that the "Carroll County Hazard

NOW, THEREFORE, the Mayor and Town Council of the Town of Sykesville RESOLVED to ADOPT the "Carroll County Hazard Mitigation Plan," EFFECTIVE immediately.

READ AND PASSED THIS 14 the day of April, 2014.

ATTEST/WITNESS:

Jadice M. Jerrault, Town Clerk

**Carroll County Hazard Mitigation Plan** 

Frank Robert, Jr., Council President Iar By MAYOR AND TOWN COUNCIL TOWN OF SYKESVILLE Shaw, May who Betz, emp

Leo K Al Grasle Anna Carte ink Council Member ounc ouncil Member Member embei



RESOLUTION No. 14-04

RESOLUTION of the Mayor and Common Council of Westminster

SUBJECT: ADOPTION OF THE 2013 CARROLL COUNTY HAZARD MITIGATION PLAN

WHEREAS, the Board of Carroll County Commissioners adopted the 2013 Carroll County Hazard Mitigation Plan on March 6, 2014, thereby revising and updating the prior iteration of the Plan; and,

WHEREAS, the City of Westminster was requested by Carroll County to review the revised and updated iteration of the Plan; and,

WHEREAS, the Mayor and Common Council of the City of Westminster have determined that adoption of the revised and updated 2013 Carroll County Hazard Mitigation Plan will serve to promote the general health, safety and welfare of the residents and business owners of the City;

NOW, THEREFORE, BE IT RESOLVED that the 2013 Carroll County Hazard Mitigation Plan, together with any and all component parts and maps referenced therein, is hereby adopted by the City of Westminster; and it is further,

RESOLVED that this Resolution shall be deemed to incorporate, adopt and operate to ratify any updates, changes or other revisions to the 2013 Carroll County Hazard Mitigation Plan as may be adopted and approved by the Board of Carroll County Commissioners, thereby superseding any parts of the Plan therewith.

BE IT FURTHER RESOLVED that this Resolution shall become effective upon the date of its adoption and approval.

INTRODUCED this \_\_\_\_\_ day of \_\_\_\_\_ April\_. 2014. ugant Margaret L. Wolff City Administrato day of april ADOPTED this 14 2014. Margaret L. Wolf, City Administrator

14 day of april 2014. APPROVED this Kevin/R. Utz, Mayor

APPROVED AS TO FORM AND SUFFICIENCY this <u>Manual</u> day of <u>Appl</u>, 2014.

Elissa D. Levan, City Attorney

### **RESOLUTION NO. 01-2014** TOWN OF MANCHESTER

# ADOPTION OF THE CARROLL COUNTY HAZARD MITIGATION PLAN

and WHEREAS, the Mayor and Town Council of the Town of Manchester previously recognized the need and history concerning disaster and emergency planning in Resolution No. 02-2006 adopted on February 14, 2006;

County Hazard Mitigation Plan thereby revising and updating the prior iteration of the Plan; and WHEREAS, on or about March 6, 2014, the Board of Carroll County Commissioners adopted the 2013 Carroll

WHEREAS, the Town was asked to comment upon the information in the 2013 Plan relevant to the Town and the Town's comments were incorporated into the adopted 2013 Plan; and

and general welfare of the citizens of the Town of Manchester; and revised and updated 2013 Carroll County Hazardous Mitigation Plan will serve to promote the health, safety, WHEREAS, the Mayor and Town Council of the Town of Manchester have determined that the adoption of the

Plan attached hereto, together with any and all of the component parts and maps referenced therein, is hereby adopted by the Town of Manchester, and it is further, NOW, THEREFORE, IT IS HEREBY RESOLVED that the 2013 Carroll County Hazardous Mitigation

shall be deemed to incorporate, adopt and operate to ratify any updates, changes or other revisions to the 2013 any parts of the Plan inconsistent therewith, and it is further Carroll County Hazardous Mitigation Plan as may be adopted and approved by the Board of Carroll County Commissioners or similar executive authority of Carroll County government, in the future, thereby superseding RESOLVED, that unless the Town takes express action to the contrary, this Resolution, without further action.

RESOLVED, that nothing contained herein or in the Plan shall be deemed an appropriation or commitment of Town funds.

Introduced this 4 day of Afre 2014.

Adopted this Council members opposed 0% day of RAN 2014 by a vote of 7. Council members Ξ favor, and

Mayor, Town of Manchester legal sufficiency this Approved as to form and Ryon M. Warner 2014 Clerk to the Council Kelly Baldwin alla

BY:

14

Town Attorney Michelle M. Ostrander day of

## THE TOWN OF MOUNT AIRY, MARYLAND

### **RESOLUTION NO. 2014-3**

### FOR THE PURPOSE OF:

# Adopting the Carroll County Hazard Mitigation Plan.

the Carroll County Hazard Mitigation Plan (hereinafter "the Plan"); and WHEREAS, on or about March 6, 2014, the Commissioners of Carroll County adopted

WHEREAS, the Town of Mt. Airy, along with other municipalities in Carroll County, had an opportunity to review, comment upon and have input in the Plan prior to its adoption by the Carroll County Commissioners; and

made Carroll County eligible to apply for and receive project grants under the Hazard Mitigation Grant Program, as well as the Pre-Disaster Mitigation, Flood Mitigation Assistance and Severe Repetitive Loss programs; and WHEREAS, adoption of the Plan, which was determined to by the Federal Emergency Management Agency ("FEMA") to comply with the requirements of 44 CFR Section 201.6,

Airy, to also become eligible to apply for and receive such grants, it is legislative body of each municipality wishing to become so eligible to resolution the Plan and submit documentation of such approval to FEMA; and WHEREAS, in order for municipalities in Carroll County, including the Town of Mt. cligible to likewise necessary that adopt by the

Plan. and its citizens to become eligible for the grants mentioned above and therefore to adopt the WHEREAS, the Town Council has determined it to be in the best interests of the Town

NOW, therefore, be it RESOLVED, by the Mayor and Town Council:

Э hazard mitigation plan for the Town of Mt. Airy. That the Carroll County Hazard Mitigation Plan be and is hereby adopted as the

ADOPTED:

This 4th day of August, 2014 by a vote of in favor and 0 opposed

Carroll County Hazard Mitigation Plan B [504480, DOCX Approved this 4th day of August, 2014. ATTEST TTEST: and approved as to legal sufficiency. McCarron, Town Attorney srich, Secretary erich, Secretary 2 2 of 2 Patrick T. Rockinbe Peter sident of the Counci

TOWN OF NEW WINDSOR

RESOLUTION NO. 07-21-14

to be prepared for emergencies which may occur; and WHEREAS, it is in the best interests of the citizens of the Town of New Windsor

by the Carroll County Office of Public Safety Support Services; and adopted the "Carroll County Hazard Mitigation Plan" which had been proposed to them WHEREAS, on March 6, 2014, the County Commissioners of Carroll County

from various sources possible emergency scenarios which may arise, including obtaining possible funding WHEREAS, adoption of this Plan by the Town will assist the Town in dealing with

Plan to be effective immediately. same hereby is adopted by the Mayor and Council of the Town of New Windsor; said adopted Makch MOM 6, 2014 by the County Commissioners of Carroll County, be and the THEREFORE, 2014, that the BE F "Carroll County Hazard Mitigation Plan" RESOLVED this R 2 day q

Introduced this Q1 of day of 2014

ATTEST:

MAYOR AND COUNCIL OF THE TOWN OF NEW WINDSOR

Donna Alban, Clerk/Treasurer 2 han

Treasurer Neal C. Roop, Mayor



Effective 2014

Approved as to form and

**Aichelle** sufficiency M. Ostrande

Town Attorney



