Dewberry

University of Mary Washington
Disaster Resistant University
Hazard Mitigation Plan
2013 Update

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MARY WASHINGTON

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Disaster Resistant University

Hazard Mitigation Plan

2013 Update

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Letter of Adoption

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Letter of Approval

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SECTION 1 EXECUTIVE SUMMARY

1.1 PURPOSE OF THE PLAN

This plan update represents the University of Mary Washington's (UMW) continued dedication to proactive action toward the reduction of loss of life and property due to recurring and known hazards. The *University of Mary Washington Disaster Resistant University Hazard Mitigation Plan* (HMP) identifies the hazards that may affect UMW and assesses the vulnerability of the campus buildings to these hazards. Mitigation strategies have been developed and prioritized to address the vulnerabilities identified in the plan. The plan also includes an assessment of UMW's existing capabilities to implement a hazard mitigation plan. The plan concludes with a description of how UMW intends on implementing these strategies and maintaining the Mitigation Plan.

1.2 PLANNING PROCESS

For both the original 2008 plan and the 2013 Plan Update, UMW modeled its mitigation planning process on the *Building a Disaster Resistant University* guide published in August 2003 by the Federal Emergency Management Agency (FEMA). The process included:

- Convening a UAC comprised of representatives from various University administrative departments, academic departments, student organizations and the local community. The committee worked with a consultant throughout the process to develop the mitigation plan.
- Developing a University profile and capability assessment to determine existing capabilities.
- Gathering and analyzing information on past and potential future impacts of hazards to UMW.
- Creating goals and mitigation strategies to address the risks and vulnerabilities identified in the planning process.

1.3 UNIVERSITY PROFILE

UMW was founded in 1908 as the State Normal and Industrial School for Women. Since the original plan, the University has changed significantly. UMW acquired and built new buildings, including the establishment of the Dahlgren Campus, located in King George, VA. The academic organization was restructured by creating two new academic colleges, the College of Education and the College of Business, bringing the total number of colleges up to three. The number of academic majors is now above 40, approximately representing a 30% increase Total student enrollment for UMW in the fall of 2013 was 5,093 and the University employs 1,023 full and part time faculty and staff.

1.4 CAPABILITY ASSESSMENT

Key points of the capability assessment are:

- UMW has a wealth of staff and faculty that could support the implementation of the hazard mitigation plan.

- UMW has an emergency operations plan, continuity of operations plan, and a general safety plan, along with several other relevant planning documents. These should be reviewed, updated, and exercised to train the appropriate staff.
- UMW has the opportunity to collaborate and coordinate hazard mitigation projects through local and state planning efforts such as the Commonwealth of Virginia's Hazard Mitigation Plan and "Improve Stormwater Management" Project.

1.5 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Hazards were assessed in two distinct manners. They were assessed based on historical occurrence and damages, as well as through structural assessments of UMW's buildings. The University Advisory Committee (UAC) ranked and prioritized the level of consideration for relevant hazards based on their previous and anticipated impact to UMW. These rankings are summarized in Table 1-1.

Table 1-1. Hazard Planning Consideration Levels.

Type	Hazard	2008 Significance Ranking	2013 Significance Ranking
Natural	Hurricane/Wind	Significant	Significant
	Thunderstorms	Significant	Significant
	Winter Storms	Significant	Significant
	Flood	Moderate	Moderate
	Tornado	Moderate	Moderate
	Drought	Limited	Limited
	Northeasters	Limited	Limited
	Earthquake	Not Included	Limited
Human-Caused	Arson/Building Fire	Significant	Significant
	Hazardous Materials Release	Moderate	Moderate
	Crime	Moderate	Moderate
	Terrorism	Moderate	Limited

Using data available from the National Climatic Data Center (NCDC) and the UAC, each hazard was evaluated for its potential risk to UMW. After examining the hazard identification results and available data, Dewberry conducted detailed structural assessments for each building's vulnerability to two natural hazards (hurricane/wind and flood) and two human-caused hazards (hazardous materials release and building fire/arson).

The 2013 plan update consolidates and streamlines content from the 2008 hazard identification and risk assessment. The foundation of the 2008 hazard identification has remained valid; each hazard was reevaluated and a new analysis performed, where applicable. The new analyses included: 1) revising the hazard description; 2) adding historical occurrences based on new events or significant events not included in the previous plan; 3) determining the annualized

number of hazard events and losses using the National Climatic Data Center (NCDC) and other data sources where available; 4) updating the assessment of vulnerability and risk based on updated building data, property tax data, new construction and UAC input; 5) creation of new hazard maps; and 6) providing overall hazard comparisons.

The results for High and Medium-High ranked hazards are listed below.

1.5.1 Hurricane/Wind

The UMW main campus is approximately 150 miles from the Atlantic coastline. Expected wind speeds for the 100-year storm (1% chance of occurrence) are approximately 66 miles per hour or of tropical storm strength. These wind speeds are accounted for in the design and construction of campus buildings. Power outages and debris from trees are more likely impacts to UMW than major building damage. Since 2001, UMW has documented approximately $236,449 in total damages related to hurricanes/high winds. Of the total claims recorded, $147,166 was attributed to Hurricane Isabel in 2003 and more than $88,000 was attributed to the derecho event from June 29, 2012.

1.5.2 Flood

UMW is not located within any FEMA special flood hazard areas. Belmont Estate is located within close proximity to the 500-year flood boundary. Floods have and can be expected to occur on the Rappahannock River during all seasons of the year with mild to moderate flooding more prevalent in the spring; but these events have not affected UMW. The majority of flooding events are the result of heavy rainfall or tropical events.

1.5.3 Winter Storm

The overall impacts of winter storms are expected to be minimal to UMW in terms of property damage and long-term effects. The majority of the impact is most likely to power distribution networks and utilities. As with any type of storm, a severe winter storm has the potential to close UMW therefore impacting campus activities and services, including dining/food, and the educational process. Damage claims from the 2008 plan totaled $10,929 and included vehicle damages and employee injury. The February 5, 2010, event resulted in damages over $129 thousand to building interiors, exteriors and debris removal.

1.5.4 Arson/Building Fire

Building fires are always a concern at universities due to the large residential population. In addition, research labs that use flammable or combustible materials also present a risk for fire. Most of the buildings at UMW have full or partial sprinkler system and/or fire alarms installed to reduce injury and property damage in the event of a building fire. The Mason Hall building fire in November 2012 resulted in $90,000 in damages to UMW.

1.5.5 Hazard Materials Release

No data was available to suggest that a major hazardous materials release has impacted UMW. A search of the National Response Center's database did not contain any information regarding spills in the vicinity of UMW. There are three facilities within UMW's (City of Fredericksburg) zip code that have submitted information to the U.S. Environmental Protection Agency's Toxic Release Inventory (TRI). All of the facilities showed to have submitted all required information and each facility has been researched and reconciled. One building, the Heating Plant, was found to have a high hazard level. One building, the Jepson Science Center, was found to have a medium-high hazard level.

1.6 MITIGATION GOALS

The first step in development of a meaningful mitigation strategy is to identify what ultimately hopes to be accomplished. These goals are derived from information based on the capability and risk assessments. The UAC reviewed the mitigation goals of several other mitigation plans and the goals from the 2008 plan. These same goals were confirmed as still being relevant to the 2013 update. The only exception is one goal that was determined to be redundant. The new 2013 goals are listed in Table 1-2.

Table 1-2. UMW 2013 Mitigation Goals.

ID	Description
Goal 1	Ensure that the University's mission of teaching, research and public service is maintained in the event of a natural or human-caused disaster.
Goal 2	Minimize impacts to health and life safety from human-caused or natural hazards.
Goal 3	Integrate mitigation principles into University decision-making and ensure risk reduction strategies are integral to future planning, policy and practice.
Goal 4	Increase participation in regional hazard mitigation planning
Goal 5	Ensure continuity of the University operations.
Goal 6	Increase the protection of existing facilities and infrastructure from hazard threats through retrofit projects.
Goal 7	Protect University assets and critical infrastructure including utilities infrastructure, communication systems, information technology systems and research facilities.

1.6.1 High Priority Strategies

Based on the established goals, the UAC identified a series of mitigation strategies pertinent to reducing loss of life and property on campus. Those were then prioritized as High, Medium, or Low. Those that were identified as High are listed in Table 1-3. For the complete list, please refer to Section 6.6.

Table 1-3. 2013 High Priority Mitigation Strategies.

ID	Strategy
Goal 1: Ensure that the University's mission of teaching, research and public service is maintained in the event of a natural or human-caused disaster.	
2013-4	Improve electronic and mechanical access systems for all University Facilities including all academic, administrative and residential facilities.
Goal 2: Minimize impacts to health and life safety from human-caused or natural hazards.	
2013-10	Improve capabilities for mass care and sheltering operations.
Goal 3: Integrate mitigation principles into University decision-making and ensure risk reduction strategies are integral to future planning, policy and practice.	
2008-1	Communicate/educate campus community and stakeholders on existing emergency operation planning (i.e. shelter-in-place and warning systems), to include desktop alert providing emergency communications in classrooms, administrative spaces and common areas.
Goal 4: Increase participation in regional hazard mitigation planning.	
2013-1	Add additional emergency management staffing capabilities that will be responsible for managing emergency planning operations, including mitigation plans.
Goal 5: Ensure continuity of the University operations.	
2008-2	Review and enhance emergency communications strategies for students, parents, faculty and staff.
Goal 6: Increase the protection of existing facilities and infrastructure from hazard threats through retrofit projects.	
2013-2	Improve stormwater management systems at Marshall Hall, Virginia Hall, and the Physical Plant.
Goal 7: Protect University assets and critical infrastructure including utilities infrastructure, communication systems, information technology systems and research facilities.	
2008-5	Identify unique and valuable contents that include records, research data, collections and specimens, and develop a plan for preservation.
2013-3	Continue collaboration with the Commonwealth of Virginia on the statewide "Improve Stormwater Management" project.
2013-8	Relocate University Network Support to facilities less susceptible to natural and human-caused hazards; relocate the data center located at GW Hall.
2013-9	Improve fire protection systems for the UMW Information Technology center located at the Stafford Campus.

1.7 Plan Implementation and Maintenance

Responsibility for the overall implementation and maintenance of the UMW HMP rests primarily with the members of the UAC. The Director of Emergency Management and Safety will work with the committee to ensure the implementation and maintenance of the plan.

The UAC will determine at its annual meeting if a formal update of the plan is required. At a minimum, the plan will be updated every five years.

SECTION 2 INTRODUCTION

2.1 PURPOSE OF PLAN

Disasters can impact universities in many ways. They may cause direct damage to buildings and infrastructure, destroy intellectual or historic artifacts, destroy research, cause injuries or loss of life, etc. They can also interrupt regular operations by forcing a campus lockdown or an evacuation. Interruptions to UMW functions can impact research activities, cause a loss of future funding, deter student enrollment, lead to the departure of students or faculty, or cause a loss of educational continuity for students. In addition, insurance premiums may be raised in the aftermath of a disaster. The purpose of this plan is to reduce or eliminate the effects of disasters so that UMW can continue to function at a high level.

This plan represents one of several proactive steps taken by UMW to reduce the impact of disasters and to avoid future losses and disruption. Although the focus of the plan is on mitigation, the plan also addresses some aspects of disaster preparedness, response and recovery, as these elements can enhance or hinder the eventual success of the plan itself. The plan will help to guide UMW in making wise land use and development decisions for new buildings, facilities and utilities, as well as in the renovation of existing buildings and development.

The 2013 Update to the HMP builds upon the original plan adopted by UMW in 2008. In doing so, it meets the requirements set forth in the Disaster Mitigation Act of 2000 (DMA2000) for local plans to be reviewed and updated every five years. The updated plan incorporates additional data on disaster occurrences, new or retrofitted buildings, revised budgets, additional preparedness and response capabilities, changes to the administration, etc.

The 2013 HMP Update identifies the hazards that may affect UMW and assesses the vulnerability of the campus buildings to these hazards. Mitigation strategies have been developed and prioritized to address the vulnerabilities identified in the plan. The plan also includes an assessment of UMW's existing capabilities to implement hazard mitigation strategies. The plan concludes with implementation and maintenance procedures.

2.2 PLANNING PROCESS

Both the original UMW HMP and the 2013 Update were developed using funds administered by the Virginia Department of Emergency Management (VDEM) through FEMA's Hazard Mitigation Grant Program. UMW also undertook a Continuity of Operations (COOP) planning effort at the same time as the original plan was developed and served as the small University pilot for the state's COOP efforts.

University of Mary Washington modeled its mitigation planning process on the *Building a Disaster-Resistant University* guide published in August 2003 by the Federal Emergency Management Agency. The guidance closely follows that provided for state and local plans required by the Disaster

Mitigation Act of 2000. FEMA released an updated Local Mitigation Plan Review Guide in October 2011. This guide has been complied with for the 2013 plan update.

UMW created a UAC comprised of senior University officials from a range of departments. Faculty and staff were represented on the UAC as well as local government and local non-profit agencies. Many of the members participating in the 2013 Update were also involved in development of the original plan. There was significant overlap between members of the mitigation planning team and members of other planning teams, such as the Emergency Operations Plan. Table 2-1 details the members of the planning team.

Table 2-1: University Advisory Committee (UAC).

Name	Title	Department
Deborah Boutchyard	Director of Network and Communication Services	Network and Communications Services
Michael Hall	Police Lieutenant	UMW Police Department
Amy Howard	Mitigation Planning Coordinator	Virginia Department of Emergency Management
Ruth Lovelace	Director of Emergency Management and Safety	Emergency Management and Safety
Les Johnson	Capital Outlay Project Manager	Facilities Services
Robert Parker	Fire Safety Officer	Emergency Management and Safety
Eddie Perry	Chief of Police	UMW Police Department
Victor Podbielski	Deputy Coordinator of Emergency Management	City of Fredericksburg Fire Department
Mark Sandor	Police Captain	UMW Police Department

The UAC was supported by Dewberry Consultants who documented and facilitated the completion of the 2013 plan update. Efforts to include University officials, student and community organizations, and local government officials that have a role in implementing mitigation activities included: invitations to attend meetings; e-mails on project updates; and opportunities to review draft documents, and invitation to the Mitigation Strategies Development Meeting.

The UAC held four formal meetings during the planning process. The dates and a description of activities at those meetings are provided in Table 2-2. In addition, informal meetings and communication occurred between meetings. Telephone calls and e-mail were used to ensure constant and consistent communication between planning process stakeholders.

2.2.1 University Advisory Committee Meetings

The planning process for 2013 HMP Update involved four meetings of the UAC. Three of these meetings were held in person, while one of them was held via conference call and WebEx. Those meetings are summarized in Table 2-2.

Table 2-2. University Advisory Committee Meetings.

Date	Meeting Purpose
June 21, 2012	Kickoff Meeting
December 3, 2012	Hazard Identification and Risk Assessment Meeting
February 6, 2013	Mitigation Strategies Meeting
May 3, 2013	Final Plan Review

Kickoff Meeting – June 21, 2012

The kickoff meeting was held on June 21, 2012 in the Brent Hall upper level conference room on the UMW campus. This facility serves as the Department of Emergency Management and Safety and UMW Police Department headquarters. There were nine members of the UAC in attendance, as well as three contracted personnel.

The purpose of the plan kickoff meeting was to establish the project schedule, milestones, benchmarks, and responsibilities. At the meeting, a project timeline was established. This included estimated dates for draft plan submittals, meetings, and public outreach. The contractor, Dewberry, was responsible for incorporating data, conducting assessments, completing draft plans, coordinating and facilitating meetings, and submitting the final draft plan to VDEM. UMW staff were responsible for submitting data, reviewing and commenting on draft materials, participating in meetings, and coordinating between University Departments.

The meeting also established the formal kickoff of the Hazard Identification and Risk Assessment (HIRA) portion of the plan. Specific data requests were made to the UAC regarding damage events, new buildings, changes in the administration, updated planning documents, etc. This data was used to develop the draft HIRA and Capabilities Assessment portions of the plan.

Hazard Identification and Risk Assessment Meeting – December 3, 2012

On December 3, 2012, the UAC met to discuss the preliminary results of the Hazard Identification and Risk Assessment (HIRA). This meeting lasted approximately two hours and included a thorough review of the data collection and analysis process. Results included overall hazard rankings, as well as specific building analyses for each of the University's properties, encompassing five separate campuses throughout the Fredericksburg region.

While the majority of this data was found to be accurate, the UAC determined the need to include several additional structures in the plan. These included the parking decks around the Fredericksburg Campus, as well as three structures located at the Belmont Campus that are used for historical purposes.

Mitigation Strategies Development Meeting – February 6, 2013

The Mitigation Strategies Development meeting began with a review of the updated HIRA, where the data and rankings were vetted. Following this, the UAC reviewed the 2008 Mitigation Goals and

strategies. The UAC found that two of the goals were redundant, and opted to eliminate one of them, but confirmed all of the other goals were still relevant.

The 2008 strategies had previously been updated to reflect their current status, however, the UAC reviewed these in order to determine which strategies should be brought forward into the 2013 update. The UAC discussed the results of the HIRA, ongoing projects and areas of concern, and developed a list of additional mitigation strategies.

This meeting was followed up by several emails to the UAC, providing opportunities to comment on and revise the Mitigation Action Plan. This process resulted in refinement of the verbiage for the mitigation strategies, identification of potential funding sources, and the addition of several more strategies.

Final Plan Review Meeting

The Final Draft Plan was provided to the UAC on Wednesday, April 24, 2013 in order to provide the opportunity for in depth review. The UAC then held the Final Plan Review meeting on April 3, 2013 to review the Final Draft Plan. This meeting facilitated discussion between members of the UAC and provided the opportunity for further collaboration. The meeting was attended by nine total participants, including six from UMW, one from the City of Fredericksburg, and two contractors.

2.3 PUBLIC INVOLVEMENT

Representatives of student groups, such as the Association of Residence Halls and the Student Government Association, were invited to participate in UAC meetings and given an opportunity to review the plan and provide feedback. UMW issued a press release to the University Newspaper, *The Eagle*, announcing the upcoming Mitigation Strategies Development meeting. Additionally, the draft plan is scheduled to be posted to the UMW website for public review during July 2013. Comments on the plan will be received via email and incorporated into the plan as appropriate.

2.4 INCORPORATION OF EXISTING PLANS AND STUDIES

The 2013 HMP Update references a number of other plans, studies and reports used throughout University operations. These include both plans developed for the University, as well as other local and State plans. This allows for horizontal and vertical integration with and between regional planning groups and State agencies. These documents include:

- The University of Mary Washington Emergency Operations Plan;
- The University of Mary Washington Continuity of Operations Plan;
- The University of Mary Washington Strategic Plan;
- The University of Mary Washington IT Strategic Plan;
- The University of Mary Washington Master Plan;
- The University of Mary Washington General Safety Plan;
- The University of Mary Washington Asbestos Management Plan;
- The George Washington Regional Commission Hazard Mitigation Plan;

- The City of Fredericksburg Comprehensive Plan;
- The Commonwealth of Virginia Systemwide Strategic Plan for Higher Education in Virginia;
- The Commonwealth of Virginia Crime Prevention Plan;
- The Commonwealth of Virginia Emergency Operations Plan;
- The Commonwealth of Virginia's Hazard Mitigation Plan; and
- Other applicable state and local regulations.

Information from these plans and studies is included in Sections 4 and 5 of the plan and full reference information is provided in Section 7.

SECTION 3 UNIVERSITY PROFILE

3.1 HISTORY

UMW is a modern university located in Fredericksburg, VA. It is made up of three academic colleges spread across three physical campuses, employs over one thousand full and part time persons, and maintains an average total enrollment of over 5,000 students. In addition to the main campus located in Fredericksburg, VA, two other campuses are maintained in Stafford County, VA and in Dahlgren, King George County, VA.

UMW was founded in 1908 as the State Normal and Industrial School for Women.[1] Over the past 100 years, the name of the University has changed several times, with the last change from Mary Washington College on July 1, 2004. UMW added a Bachelors of Liberal Studies for part-time and adult students in 1977 and opened the James Monroe Center for Graduate and Professional Studies in 1999. Since 1999, UMW has been comprised of two campuses – Mary Washington College in Fredericksburg and the James Monroe Center for Graduate and Professional Studies in Stafford County. In January 2012, UMW opened its Dahlgren Campus Center for Education and Research located in King George County, VA.

Over time, UMW has continued to expand its academic programs to provide various undergraduate and graduate programs. In the summer of 2010, two new colleges were added: the College of Education and the College of Business.[2] As of Fall 2012, UMW offered over 40 academic majors. A curriculum overview is presented in 3.8.

3.2 LOCATION

The largest of the UMW campuses is the Fredericksburg location. Fredericksburg is approximately halfway between Washington D.C. and Richmond, VA on Interstate 95.[3] Fredericksburg is a city rich in American history, dating back to 1728 when it was opened as a port for Spotsylvania County. Today, Fredericksburg occupies over 27 square miles, with a population of nearly 25,000. It is located on the Rappahannock River near the head of navigation at the fall line.[4]

The Fredericksburg campus encompasses 176 acres, with the western side of the campus bordering U.S. Route 1. UMW has architecture in the style of neo-classical, Georgian, and Jeffersonian, with over sixty academic and student service buildings, athletic facilities, and residence halls.[5]

The other two campuses are located nearby. The Dahlgren Campus is the further of the two and is only 27 miles east of Fredericksburg, on VA Route 301. It is located three miles west of the Potomac River, near the Dahlgren Naval Support Facility. This campus opened in January 2012 and offers graduate science and engineering programs.

The Stafford Campus is located only seven miles northwest of the Fredericksburg campus on VA Route 17, north of the Rappahannock River. This campus caters to working professionals, offering a variety of professional development courses.

3.3 NATURAL FEATURES

Fredericksburg is located in the transition zone of the Atlantic Seaboard fall line, which gives the area a combination of features including the rolling hills of Piedmont uplands and the level Atlantic coastal plain. Fredericksburg is bounded on the north and east by the Rappahannock River and is bounded on the south and west by Spotsylvania County. The western side of Fredericksburg is built on the remains of an ancient river terrace, at an elevation of approximately 150 feet. The city slopes gently eastward towards the river.

The fall line zone in this area has a combination of red/yellow clays from the Piedmont and sandy loam/clay loams from the Atlantic coastal plain. Large deposits of sand and gravel underlie many areas of the region; especially along the Rappahannock River. The Rappahannock River also has dramatic rapids in the area contributed to by the fall line shifts.

Virginia is generally classified as humid subtropical; however the varying natural features of the Appalachian Mountains and the Atlantic Coastal Plain generate dramatic variations of temperature, precipitation, and length of the growing season. These attributes support a mosaic of plant life throughout the Commonwealth. Approximately 70% of the rural area within the Fredericksburg region is wooded, with a high concentration of hardwoods. White oak is a ubiquitous dominant throughout the Piedmont forests, but due to its location on the fall line as well as repeated clearings and alterations, pine-hardwood forests tend to prevail.[6]

3.4 LAND USE AND DEVELOPMENT TRENDS

Requirement §201.6(c)(2)(ii)(C): *[The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

UMW recently undertook a major effort in the development of a Master Plan. This project included the utilization of an outside contractor to assess existing facilities and make recommendations. A draft copy of this document was made public in April 2013.

Chapter 7 of the draft Master Plan delineates some of the actions that UMW will attempt to implement over the next 15 years. Planned projects include:

- Renovation of eight existing residence halls;
- Construction of five new residence halls in place of existing halls in poor condition;
- Revitalization of the performing arts center;
- Extension of the Fredericksburg campus walk and creation of a pedestrian bridge across William St;
- Creation of a new Campus Center and Board Dining facility; and
- Development of an addition to Jepson Hall.

In addition to these planned high priority projects, UMW will also undertake the repurposing and renovation of several existing facilities. Available land for development of campus is limited, so most planned projects aim to make the best use of available space.

All of these projects pose the potential for mitigation. Several of the more susceptible buildings could potentially be mitigated, and several of the most hazardous ones may be replaced altogether.

3.5 CLIMATE

The City of Fredericksburg has a temperate climate with mild winters; it receives an average of 41 inches of rain and 17 inches of snow a year. The wettest and warmest month in the city is July with temperatures high in the ninety and lows in the sixties. The coldest month is January with high temperatures in the mid forties and lows in the low twenties. Average annual temperatures are as follows: spring 68°F, summer 88°F, fall 70°F, and winter 48°F.[7,8]

3.6 POPULATION

UMW's total enrollment has seen a steady increase over the past fifteen years; Fall 2012 enrollment totaled 5,093 for both undergraduate and graduate students. This constitutes an increase in the student body by approximately 36% since 1996. Additionally, the University has nearly 400 faculty members (fulltime and adjunct), 132 administrative personnel, more than 400 support/service personnel, and twelve graduate assistants.[9] Table 3-2 shows the student demographics for UMW between 1996 and 2012.

The City of Fredericksburg is home to 24,286 people, according to the 2010 Census. This is an increase of 5,007 people (or 26%) since the 2000 Census. The racial makeup of the city is 64% White, 23% Black or African American, 11% Hispanic, 3% Asian, 6% Other, and less than 1% American Indian/Alaskan Native. These numbers reflect respondents that identify with only one race; four (4%) percent of respondents indicated they identify with two or more races. The US Census does not provide data regarding the Hispanic population as one race only, and thus creates overlap with other ethnic categories. The median income (2000 Census) for the City of Fredericksburg was $34,585; the 2010 census does not provide household income data.[10] [11]

Historically, unemployment rates have followed national trends very closely but have averaged 1-2% lower than national averages. In the year 2000, unemployment rates were around 2% but saw a sharp increase late that year and into early the following year to about 6%. Rates steadily declined for several years until 2008 when unemployment spiked to 10%. Rates have fluctuated since that time, but linger around 9%. Unemployment in 2011 was 9.6%, but has since dropped to 9.1% in 2012.[12]

Table 3-1 shows the current City of Fredericksburg demographics according to the 2000 and 2010 Census studies.

Table 3-1: City of Fredericksburg Demographics.

Category	2000		2010		% Change (2000 – 2010)
	Total	% of Total	Total	% of Total	
Total Population	**19,279**	**-**	**24,286**	**-**	**26%**
White	14,108	73%	15,498	64%	10%
Black	3,935	20%	5,498	23%	40%
Hispanic	945	5%	2,607	11%	176%
Asian	291	2%	689	3%	137%
American Indian/ Alaskan Native	65	0.3%	100	0.4%	54%
Other	505	3%	1454	6%	188%
Two or More Races	375	2%	949	4%	153%

**The sums of each individual category will exceed 100% of the total population due to multiple ethnicities and rounding to whole numbers.*

Table 3-2: UMW Student Demographics.

Race/Gender	Year																
	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
Black/Non-Hispanic																	
Male	53	47	42	46	54	62	55	51	52	59	50	66	79	89	113	121	118
Female	129	119	132	129	141	141	161	141	148	163	143	152	178	215	237	223	227
American Indian																	
Male	2	7	5	3	6	4	7	8	7	6	8	8	7	7	6	4	2
Female	8	5	8	6	8	13	13	11	7	9	8	14	16	16	10	13	8
Asian/Pacific Rim																	
Male	44	48	44	41	47	53	56	67	73	71	66	59	58	61	77	78	75
Female	88	92	84	89	101	116	130	133	135	121	119	128	135	151	152	156	150
Hispanic																	
Male	25	26	24	28	34	41	46	44	47	53	56	73	78	81	81	99	109
Female	47	52	45	73	65	76	94	94	120	120	107	109	121	119	125	183	200
White/Non-Hispanic																	
Male	1,141	1,156	1,123	1,112	1,202	1,297	1,343	1,397	1,386	1,230	1,192	1,126	1,077	1,118	1,103	1,149	1,149
Female	2,194	2,277	2,294	2,459	2,608	2,664	2,814	2,822	2,726	2,414	2,369	2,271	2,204	2,202	1,971	2,100	2123
Non-Resident Alien																	
Male	5	4	1	9	12	9	9	6	7	6	11	12	11	9	10	10	14
Female	9	7	4	5	5	7	7	18	21	18	27	40	38	47	37	36	32
Unknown																	
Male	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	157	230	306	368	440	447	312	246
Female	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	307	476	637	714	825	834	565	460
Total	***3,745***	***3,840***	***3,806***	***4,000***	***4,283***	***4,483***	***4,735***	***4,792***	***4,729***	***4,734***	***4,862***	***5,001***	***5,084***	***5,380***	***5,203***	***5,170***	***5,093***

*Provided by the UMW Office of Institutional Analysis and Effectiveness

3.7 HOUSING

UMW has eighteen residence halls. There are six first year residence halls, eight upper class halls and three special interest halls. Adjacent to the campus is an apartment complex that houses 350 junior, senior and graduate level students, who receive the amenities of on-campus living with the benefits of an apartment. The total combined capacity of the halls and apartments is approximately 2,500 students.[13] Table 3-3 summarizes available student housing.

Table 3-3: UMW Housing Facilities.

Housing Structure	Category	Co-Ed (C) vs. Female (F)	Capacity	Year Built
Alvey Hall	First Yr	C	145	1990
Bushnell Hall	First Yr	C	151	1959
Jefferson Hall	First Yr	C	192	1953
Randolph Hall	First Yr	C	185	1954
Russell Hall	First Yr	C	173	1965
Arrington Hall	Mixed Yr	C	147	1993
Virginia Hall	Mixed Yr	F	183	1915
Ball Hall	Upper Class	F	105	1935
Custis Hall	Upper Class	C	42	1934
Framar House	Upper Class	C	21	1946
Madison Hall	Upper Class	C	41	1934
Marshall Hall	Upper Class	C	147	1960
Mason Hall	Upper Class	C	185	1956/2011
Westmoreland Hall	Upper Class	C	111	1939
Willard Hall	Upper Class	C	181	1911
UMW Apartments	Upper Class	C	350	1964-1969
Eagle Landing	Upper Class	C	624	2010
		Total Capacity	**2,983**	

The total number of housing units in Fredericksburg is 10,467, which is a 17.8% increase over the 8,888 housing units in 2000. Construction data was not available for the 2010 Census, however the median year that renter-occupied housing units in Fredericksburg were built is 1954.[14]

3.8 CURRICULUM OVERVIEW

UMW offers over 40 major areas of study at both the graduate and undergraduate levels, as well as offering undergraduate students the opportunity to design an individualized major. This represents an increase in the number of areas of study by approximately 30% from when this Hazard Mitigation Plan was originally written in 2008.

The organizational structure of the University's educational programs has also undergone significant change. There are now a total of three academic colleges, with degree programs in education and business having been broken out into distinct colleges. UMW offers five graduate programs, all of which are housed under either the College of Business or the College of Education.[15]

Individual Colleges are as follows:

- College of Arts and Sciences
- College of Business
- College of Education

Major areas of study include:[16]

- American Studies
- Anthropology
- Art and Art History
- Biology
- Business Administration
- Chemistry
- Chemistry – ACS Certified
- Classics
- Computer Science
  - Traditional Track
  - Information Systems
- Economics
- Education
- English
- English – Creative Writing
- Environmental Science
  - Natural
  - Social
- French
- Geography
- Geology
- German
- Historic Preservation
- History
- Interdisciplinary
- International Affairs
- Latin
- Management Information Systems
- Mathematics
- Music
- Philosophy
- Philosophy – Pre-Law
- Physics
- Political Science
- Psychology
- Religion
- Sociology
- Spanish
- Studio Art
- Theatre
- Women's and Gender Studies

SECTION 4 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirement §201.6(c)(2): *The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

4.1 INTRODUCTION

The purpose of the Hazard Identification and Risk Assessment (HIRA) is to:

- Identify the hazards that could affect UMW;
- Profile hazard events and determine what buildings and University assets are most vulnerable to damage from these hazards;
- Estimate losses and prioritize the potential risks to UMW.

The first step, identify hazards, lists the natural and human-caused hazards that might affect UMW. During the creation of the 2008 plan, these hazards were ranked by the UAC to determine what hazards are of most concern to UMW.

On June 20, 2012, the committee reconvened for the 2013 Plan Update Kick-off meeting to discuss and reevaluate hazards. During that meeting, priorities were established for the development of the HIRA update. Only two of the twelve identified hazards warranted minor modifications to their ranking. Terrorism was changed from Moderate to Limited concern, and Earthquake was added to the identified hazards as a Limited concern.

The hazards that were determined to have significant and in some instances, moderate impact, were analyzed in a quantitative manner to determine the likely magnitude of future events and the vulnerability of individual University buildings to these events. The remaining hazards that were ranked as moderate or limited significance to UMW were analyzed in a qualitative manner.

The areas included in this study are all three UMW campuses. The main campus is roughly the area bounded by Jefferson Davis Highway (Route 1), College Avenue, Hanover Street, and Sunken Road. The main campus also encompasses the Battleground Athletic Complex, the Heating Plant, Belmont Estate, and the James Monroe Museum. The Stafford Campus is located in Stafford County and the Dahlgren Campus, Center for Education and Research, is located in King George County. All of the campuses were included in the 2013 building specific analysis. Appendix C contains a base map of the study area.

4.2 SUMMARY OF CHANGES

Hazard Identification
The 2013 plan update consolidates and streamlines content from the 2008 hazard identification and risk assessment. The foundation of the 2008 hazard identification has remained valid; each hazard was reevaluated and a new analysis performed, where applicable. The new analyses included: 1) revising the hazard description; 2) adding historical occurrences based on new events or significant events not included in the previous plan; 3) determining the annualized number of hazard events and losses using the National Climatic Data Center (NCDC) and other data sources where available; 4) updating the assessment of vulnerability and risk based on updated building data, property tax data, new construction and UAC input; 5) creating new hazard maps; and 6) providing overall hazard comparisons.

Information provided by UMW and data from the 2008 HIRA was used to complete the 2013 Hazard, Vulnerability and Priorities Indexes, and to compare how the parameters changed since the last assessment. Scores were adjusted based on the retrofits and renovations made to the facilities. Parameters were adjusted based on more current data such as Contents Value, Annual Operating Budget and Community Impact, based on the Operating Budget for the City of Fredericksburg. Fifteen additional facilities have been included in this update for the building-specific analysis.

For the 2013 plan update, hazard rankings changed slightly based on committee feedback. Terrorism changed from Moderate to Limited and Earthquake was decided to be included as a Limited hazard due to the 5.8 magnitude earthquake in Louisa County, Virginia on August 23, 2011. Appendix B includes HIRA technical documentation and building data sheets. Appendix C contains all figures referenced in this section.

Planning Process
Each section of the plan was reformatted to improve clarity, and additional maps and imagery were included. The 2012 George Washington Regional Commission's Hazard Mitigation Plan and the 2010 Commonwealth of Virginia Hazard Mitigation Plan were reviewed as part of this update and, when applicable, information from those plans has been cited as such.

The hazard profiles have been reformatted based on the outline below and to meet the following Code of Federal Regulations requirements.

Hazard Profile Outline
- Hazard Description
- Hazard History
- Potential Recurrence Intervals (Probabilities)
- Hazard Evaluation (for hazards with detailed analysis)
  - *Hazard Index*
  - *Vulnerability Index*
  - *Mitigation Priorities*

Requirement §201.6(c)(2)(i): *[The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.*

Requirement §201.6(c)(2)(ii): *[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:*

Requirement §201.6(c)(2)(ii)(A): *(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;*

Requirement §201.6(c)(2)(ii)(B): *(B) An estimate of the potential dollar losses to vulnerable structures identified in … this section and a description of the methodology used to prepare the estimate.*

Campus/Building Changes

During 2008, 56 buildings were included in the assessment. In 2013 this increased to 71 buildings. This can be attributed to new construction, a new campus at Dahlgren, as well as buildings and structures that were considered non-essential in the 2008 plan. Additional structures included in the 2013 assessment included:

1. Bell Tower
2. Eagle Landing
3. Eagle Landing Parking Deck
4. Eagle Landing Pedestrian Bridge
5. William Anderson Center
6. Goolrick Recreational Storage Building
7. Alvey Drive Parking Deck
8. 1004 College Avenue
9. 1201 William Street
10. Dahlgren Campus
11. Belmont Cow Barn
12. Belmont Garage
13. Belmont Gift Shop
14. Belmont Stable
15. Belmont Smokehouse

The 2013 Plan Update utilizes best available data for building content values. Content replacement values changed significantly from the previous assessment, based on new data provided by the UAC. Results of this assessment are available in Appendix B and discussed in the building specific analysis for wind, flood, arson/building fire, and hazardous materials release. For several buildings that did not have building or contents replacement values, assumptions based on tax records, facility type, and use were established to estimate a realistic value for the assessment. The majority of changes to building assessment data from 2008 to 2013 can be attributed to one of the following reasons:

- Implementation of a mitigation strategy such as installation of a fire protection system, roof retrofits, etc; or
- Replacement of assumed building replacement and contents values with more accurate data provided by the UAC.

The name of the College of Graduate and Professional Studies (CGPS) buildings has been changed to the Stafford Campus.

Areas of concern (problem spots) from the 2008 plan have been re-evaluated and updated based on information from the UAC. The results of this review are included in Section 4.3.3, Table 4-3 and the mapping in Appendix C. Where applicable, the hazard profiles include references to current areas of concern and areas mitigated since 2008.

4.2.1 Data Limitations

Federal Emergency Management Agency (FEMA) guidelines emphasize the use of "best available" data for hazard mitigation plans. During the 2008 plan creation, Dewberry created GIS data for UMW buildings or infrastructure, base maps and associated building data. The 2013 update includes revised building footprint data and the digital Flood Insurance Rate Maps (DFIRMs) that were not available for the 2008 plan.

The following sections provide information on the data collected and utilized for this study. The Asset Inventory section includes data gaps that exist; future plan updates should consider these as mitigation strategies.

One of the biggest challenges encountered during the 2013 update was data collection. University officials supplied information for buildings that had been previously evaluated such as building replacement values (BRV), contents replacement values, and information on buildings that were recently retrofitted. Assumptions were made for some of the buildings built after 2007 based on usage and square footage when replacement values were not available from University officials. In these cases, a classification of whether the structures are Administrative, Residential, Academic, or other use, was established. Tools such as GIS and Google Earth were used to calculate square footage. The square footage of the footprints was multiplied by the number of stories of the building to estimate the total square footage. The contents replacement value from similar facilities was used in absence of actual contents values.

In order to gain a full understanding of the hazards, a search of historic hazard event data was completed. The data collection effort utilized meetings with University officials, existing reports and studies, state and national data sets and other sources such as newspaper archives. Much of the hazard data collected at the state or national level, such as the National Climatic Data Center's (NCDC) Storm Event Database, is aggregated at a county level and does not provide site-specific information. To the greatest extent possible, information specific to UMW was included.

4.3 HAZARD IDENTIFICATION

During the 2008 plan creation, the *Rappahannock Area Development Commission* All Hazard Mitigation Plan was used as a starting point for the list of hazards prioritized by the UAC. Only the hazards ranked as "High" or "Medium" in this plan were considered by UMW for the plan creation. The 2013 plan update builds upon the hazards identified and profiled in 2008.

The George Washington Regional Commission (GWRC) hazard mitigation plan, approved March 2012, has been reviewed and referenced for King George County, City of Fredericksburg, and Stafford County and relevant information integrated into this plan update. The hazards profiled in that plan are Dam Failure, Drought and Extreme Heat, Wildfires, Earthquakes, Sinkholes and Landslides, Flooding and Erosion, Hurricanes and Thunderstorms, Tornadoes, and Winter Storms and Nor'easters.

4.3.1 Types of Hazards

Although nearly all disasters are possible for any given area in the United States, the UAC identified the following natural hazards of concern to UMW:

- Drought
- Earthquakes
- Flooding
- Hurricanes
- Northeasters
- Thunderstorms
- Tornadoes
- Winter Storms

The human-caused hazards identified by the UAC were:

- Arson/Building Fire
- Crime
- Hazardous Materials Release
- Terrorism

4.3.2 Hazard Rankings

Hazards were ranked by the UAC to indicate the hazards they felt would have the largest impact to UMW. Based on their input, the hazards were separated into three distinct categories, Significant, Moderate, and Limited which represent the level of consideration for the planning process. The results from the 2008 and 2013 update are summarized in Table 4-1. During the 2013 update, earthquake was added as Limited and terrorism was changed from Moderate to Limited. The June 2009 UMW All Hazards Emergency Operations Plan further confirms the hazards likely to impact the University.[17]

Table 4-1: Hazard Planning Consideration Levels.

Type	Hazard	2008 Significance Ranking	2013 Significance Ranking
Natural	Hurricane/Wind	Significant	Significant
	Thunderstorms	Significant	Significant
	Winter Storms	Significant	Significant
	Flood	Moderate	Moderate
	Tornado	Moderate	Moderate
	Drought	Limited	Limited
	Northeasters	Limited	Limited

Type	Hazard	2008 Significance Ranking	2013 Significance Ranking
	Earthquake	Not Included	Limited
Human-Caused	Arson/Building Fire	Significant	Significant
	Hazardous Materials Release	Moderate	Moderate
	Crime	Moderate	Moderate
	Terrorism	Moderate	Limited

Hazards were assessed in two distinct manners. They were assessed based on historical occurrence and damages, as well as through structural assessments of UMW's buildings. These assessments were conducted with varying degrees of detail based on the risk posed by each hazard.

For the historical occurrences assessment, the hazard assessments were prioritized based on their potential risk. All hazards categorized as "Significant" received a detailed assessment, as well as several of those ranked "Moderate". The remaining hazards ranked Moderate and Limited were described in more general terms. These decisions were made by the UAC based on the previous 2008 assessment, as well as their intimate knowledge with hazards UMW faces.

Once the assessment based on historical occurrences were completed and reviewed, Dewberry conducted detailed structural assessments for each building's vulnerability to two natural hazards (hurricane/wind and flood) and two human-caused hazards (hazardous materials release and building fire/arson).

4.3.3 Mitigation Successes

UMW is continually assessing and renovating campus buildings and infrastructure to ensure safety of the campus community. During the 2008 plan development, areas of concern were noted by the committee members. Since the initial plan, 18 of the 35 identified areas of concern have been mitigated or removed from consideration due to no known threat. Table 4-2 summarizes the mitigation successes since 2008 with regard to the identified areas of concern.

Table 4-2: UMW mitigated areas of concern (problem spots).

Area of Concern	2008 Comment	Mitigated	Action Taken
Stafford Campus	No blue lights. Evening classes are held here but there is minimal on-site security at night.	√	Area Warning System has been installed throughout Fredericksburg and Stafford campuses.
George Washington Hall	History of flooding during heavy rain/storm conditions. Building houses main network servers. Potential for data loss in addition to a shutdown of communication via email and Voice Over Internet Protocol	√	Renovated and repaired water intrusion issues with Dri Lock system installed on outside foundation. Campus is moving to VOIP but has some analog phones for emergency purposes.

Area of Concern	2008 Comment	Mitigated	Action Taken
	(VOIP) phones.		
George Washington Hall	Potential for communication loss if building loses power.	√	Generator installed.
George Washington Hall	Potential for data security risk or release – hacking, accidental release.	√	Safeguards installed and firewalls increased.
William Street-Route 3 and College Avenue	Area prone to traffic congestion potentially limiting ability to move people.	√	A pedestrian crosswalk has been built over Rt 3/William St.
College Avenue and Jefferson Davis Highway-Route 1	Area prone to traffic congestion potentially limiting ability to move people.	√	A pedestrian bridge has been built over the Rt 1 Highway.
Staircase behind Trinkle Hall	Potential for injury during inclement weather due to condition of staircase and lack of handrails.	√	Stairway has been renovated.
Marshall Hall	Potential for injury during inclement weather due to steep hill becoming slick and impassible.	√	Stairway has been renovated and redesigned.
Parking Deck	Located in an isolated area. Blue lights are located throughout the structure but there is no closed circuit television system.	√	Camera system has been installed.
Brent House	Insufficient emergency power/generator backup.	√	Generators have been installed at the PD/EM building (Brent House). Com repeaters on IT main servers.
Campus-wide	Limited communications system to keep employees informed during events.	√	Area Warning System has been installed throughout Fredericksburg and Stafford campuses.
Residence Halls	Potential for risks associated with power outages (burning candles for light).	Removed	UMW has a very strict policy of no candles.
Residence Halls	Emergency lighting limited to a certain time frame.	Removed	All UMW buildings meet code requirements for emergency lighting.
Residence Halls	Door access limited during sustained power outages.	Removed	All UMW buildings have access control systems with battery backup installed. Annual End to End is preformed to support efficiency of system performance.
Campus-wide	Lack of infrastructure system redundancy. Lack of IT system redundancy between	Removed	Redundant host in emergency at the University of Virginia (UVA) and James Madison University (JMU) campuses.

Area of Concern	2008 Comment	Mitigated	Action Taken
	Fredericksburg and Stafford campuses.		Redundant servers at UMW.
Campus-wide	Safety concerns during events due to limited exit routes with a large number of people on campus.	Removed	Crowd Management Policy in place.
Campus-wide	Health concerns and employee safety associated with pandemic emergency.	Removed	Pandemic Flu and limited resource policy in place.
Campus-wide	Limited vehicular access throughout campus for emergency vehicles during construction.	Removed	Vehicular accidents / pedestrian incidents are limited.

4.3.4 Remaining Areas of Concern

The committee members validated the remaining 17 areas of concern for continued mitigation consideration. Note that since this list only indicates concerns held by members of the planning committee, it is not comprehensive nor does it completely describe the vulnerabilities of UMW. Table 4-3 presents the remaining areas of concern as noted in 2008 and validated in 2013. Appendix C includes a map showing these locations on campus.

Table 4-3: UMW Remaining Areas of Concern.

Area of Concern	2008 Comment
Stafford Campus North Building	Basement has a high concentration of electrical devices and connections that could overheat or short out and cause a fire. Potential target for arson. Would cause disruption of University operations due to damage to computer equipment.
Stafford Campus North Building	Potential for flood in enterprise equipment server room. The room is equipped with 6 fire sprinkler heads connected to the building-wide fire control system.
Stafford Campus South Building	Potential target for terrorism and potential for damage from storms due to glass front on the building and location on a main Highway.
Stafford Campus	Remote location from the main campus - potential for limited communication during an event.
Stafford Campus	Safety and accountability assurance. Lack of a Police/Facilities Services radio repeater at location. Radios could become inoperable during an incident.
George Washington Hall	Rooms B016, B017, and B018 have a high concentration of electrical devices and connections that could overheat or short-out and cause a fire. Potential target for arson. Would cause disruption of University operations due to damage to computer equipment.
Jepson Science Center	Hazardous substances and chemicals are stored in the building.
Melchers Hall	Chemicals are stored in the building.
Melchers Hall	Potential difficulties during evacuation due to confusing hallways and lack of clear signage.
Combs Hall	Chemicals are stored in the building.
Combs Hall	There has been water damage from leaks of the mechanical system.

Area of Concern	2008 Comment
Woodard Campus Center & Seacobeck Hall	May be difficult to provide food and beverage service for all residents in residence halls during a major event.
University Apartments	Area subject to flooding.
Jepson Alumni Executive Center Area	Area subject to flooding.
Woodward Campus Center	Potential for food/beverage service and storage interruption in power outages.
Seacobeck Hall	Potential for food/beverage service and storage interruption in power outages.
Sunken Parking Lot (area behind Mercer Hall and Willard Hall)	Staircase access can become treacherous during ice and rain storms.

4.4 DAMAGE HISTORY

As part of the 2008 plan, UMW reviewed past damage history records from May 2001 through May 2006. For the 2013 update, events since May 2006 have been incorporated. Past damage history records were used to identify past events and to quantify the impacts each type of event had on UMW. In each hazard profile, damage history claims by hazard type have been summarized given the available data. Where possible, a damage record table includes the following information:

- Loss Date: This is the date in which the loss/event occurred;
- Description: This is a general description of the type of event;
- Damage History: Total losses for the specified event.

Table 4-4 summarizes the number and amount of damages estimated by UMW as the result of natural and human-caused hazard events. Between 2001 and 2006, winter storms had generated the most events, though two hurricanes resulted in the most damages. Since 2006, five events have directly impacted the University resulting in $694,795 in damages; these include the February 2010 snow storm, July 2010 microburst, August 2011 earthquake, July 2012 derecho wind event, and the November 2012 building fire in Mason Hall.

Table 4-4: Summary of damage history by hazard (2001 – 11/2012).

Hazard	Total Records (2001-2006)	Total Damages (2001-2006)	Significant Events (2006-2012)	Total Damages (2006-2012)	TOTAL DAMAGES (2001 – 2012)
Flood	2	Not recorded	-	-	**-**
Winter Storm	3	$6,852	1	$129,199	**$136,051**
Thunderstorm (Wind/Lightning)	2	$16,537	1	$1,800	**-**
Hurricane (Wind/Flooding)	2	$147,766	1	$88,683	**$18,337**
Earthquake	-	-	1	$385,113.14*	**$236,449**
Building Fire	**-**	**-**	1	$90,000	**$385,113**
Grand Total	**9**	**$171,155**	**5**	**$694,795**	**$865,950**
*Estimated repair cost					

4.5 ASSET INVENTORY

4.5.1 General Building and Facility Information

UMW's Fredericksburg (main campus), Stafford, and Dahlgren campus buildings were categorized and prioritized by the UMW project managers in order to exclude the non-essential buildings. The information below is presented in terms of the sixty buildings comprising the entire university.[18] The Battleground Athletic center was considered a non-essential facility, due to no structures present or at risk, and was not included in this assessment.

UMW owns and operates the buildings on the main campus as well as a limited number off-campus (i.e., James Monroe Museum and the Belmont Estate). The Fredericksburg campus is situated on 176 acres and located within the City of Fredericksburg.[19] The Stafford Campus is located northwest of the main campus in nearby Stafford County and the Dahlgren Campus is located northeast of the main campus in King George County. Campus locations are shown relative to each other on the basemap in Appendix C.

All property and university-owned contents and equipment are covered through The Commonwealth of Virginia's Risk Management Plan, which provides a self-insurance pool for all state property. Self-insurance is a way for the Commonwealth and UMW to lower premium expenditures and have control over certain types of risk. The University maintains funds for repair and maintenance of its own facilities and submits for reimbursement under the Risk Management Plan when damages exceed the State's deductible.

The Emergency Operations Center (EOC) for UMW is located within Woodward Campus Center. This room has been prepared for emergency operations and is equipped with telephone lines, tables, and chairs. Brent Hall Police Departments is the alternate location for the EOC. The EOC will be updated and included in the new Information Technology Communications Center (Data Center) that is currently being constructed, with an estimated completion of September 2014. The Woodard Campus EOC location will begin to have limited resources in July 2013. Brent Hall will serve as the EOC in the interim. More information can be found in the UMW Continuity of Operations (COOP) Plan.

According to University officials, campus buildings and facilities critical to campus operations include:

- Brent House
- George Washington Hall
- Heating Plant
- Jepson Science Center
- Seacobeck Hall
- Woodard Campus Center

Appendix C shows the locations of the facilities critical to campus operations.

4.5.2 Daily Occupancy/Hours of Use

There are approximately 5,170 students, faculty and staff at UMW at any given time during the school year (i.e., August through May).[20] The population during the summer months is significantly lower, though the campus does hold summer classes as well as other events. Most students live on or near campus, with nearly 2,800 in on-campus dormitories.[21] The College of Professional and Graduate Studies located in Stafford County has approximately 750 students enrolled in degree programs and other credit bearing courses.[22]

4.5.3 Total Replacement Values

The UMW Asset Detail Report estimates the total replacement value for the buildings included in this plan at over $358 million. For the 2013 update, UMW officials provided updated building contents information estimating over $141 million for the assessed buildings. For new construction, contents values were determined according to building use and square feet.

4.5.4 Generators

In the 2008 plan, the UAC noted a campus-wide lack of generators as a concern for the entire campus (Table 4-3). During the 2013 update, the UAC members reassessed this listing and have acknowledged the generators installed at the Brent House, George Washington Hall and Stafford Campus. It was also noted that IT had installed generators on main servers with repeaters. The Continuity of Operations (COOP) Plan accounts for these generators.

4.6 HAZARD ANALYSIS

4.6.1 General Methodology

The methodology used to assess hurricane/wind, flood, hazardous materials, and building fire and is analogous to the 2008 approach. The following section explains the general methodology for the three components of the analysis: Hazard Index, Vulnerability Index, and Mitigation Priorities. Hazard-specific considerations are explained in more detail in the appropriate sections. The results of each assessment are included in the hazard profiles below.

For the 2013 update, university buildings were reevaluated based on updated information. Site inspection and data collection were conducted only for buildings that were built after 2007 and were being added to the plan update.

Updated University information and data from the 2008 HIRA was used to establish the 2013 Hazard and Vulnerability Indexes and Mitigation Priorities to compare how the parameters changed since the last assessment. Scores were adjusted based on retrofits and renovations made to the facilities. Parameters were adjusted based on more current data such as Contents Value, Annual Operating Budget and Community Impact, based on the Operating Budget for the City of Fredericksburg.

Hazard Index

Given the defined hazard-specific parameters, a preference scale method (also known as a Likert scale) was used to arrive at a Hazard Index for each of the buildings and facilities on campus for the significant hazards. The preference scale method begins by assigning values to the levels of each parameter, with 1 representing the lowest potential hazard and 5 being the highest. This value is adjusted by an importance factor, with 0.5 for parameters of lowest importance and 2.5 for parameters of highest importance. The importance factors were validated (adjusted as necessary) by the UAC to reflect the level of confidence in a given parameter. Table 4-5 illustrates the fire protection parameter values and adjusted scoring using an importance factor of 2.

Table 4-5. Example of hazard-specific parameter (fire protection).

Parameter: Fire Protection			
Based on VAPS database and campus data on types of fire protection systems. Importance Factor: 2			
Fire Protection	**Hazard Level**	**Score**	**Adjusted Score**
None	High	5	10
Fire alarm only	Medium-High	4	8
Fire alarm & security/intrusion system	Medium	3	6
Fire alarm & partial sprinklers	Medium-Low	2	4
Fire alarm & sprinklers	Low	1	2
Fire alarm & sprinklers & security/intrusion system	Low	1	2

The preference scale computations used to determine the hazard indices for each of the UMW buildings and facilities are summarized in tabular form in Appendix A. Note that the assigning of numerical values and importance factors for parameters is qualitative in nature and based on data from a number of sources with varying degrees of accuracy. For each hazard, different parameters were used to establish the Hazard Index. Parameters such as Construction Type and Damage History were common parameters in this evaluation. Damage History was based information provided by the UAC and publicly available data for the City of Fredericksburg[23]. The 2010 snowstorm and the 2011 earthquake are the events with the greatest impact on record.

Vulnerability Index

A vulnerability analysis for each hazard was developed for the campus using eight parameters. A detailed description of each of these parameters, along with tables listing facility and building vulnerability parameters for UMW, is provided in Appendix A of this plan. All calculations have been updated for the 2013 plan. The eight components within the vulnerability analysis are:

1. Hazard Index (HI)
2. Building Square Footage (BSF)
3. Building Replacement Value (BRV)($)
4. Contents Replacement Value (CRV)($)
5. Loss of Function (LOF) ($/day)
6. Community Impact (CI)($/day)
7. Criticality (CR)

8. Hazard-specific Damage Functions (HSDF)

The total unit cost of damage in dollars per square foot was used to arrive at a Vulnerability Index for each of the buildings and facilities on campus. The total unit cost of damage was determined by adding the damage costs using the following formula:

$$\textbf{Total Damage (TD) Cost} = \frac{(BRV * HSDF) + (CRV * HSDF) + LOF + CI}{BSF}$$

The LOF costs were estimated by first multiplying the building square footage by a building criticality score assigned by University officials. This factored square footage was then divided by the total factored square footage of the campus. The resulting amount then was multiplied by the daily budget of the University (derived from the annual budget divided by 365 days) to develop an average per day loss of function cost for that building. This amount then was multiplied by the estimated number of loss of function days to result in the final loss of function cost. The specific formula used is:

$$\textbf{LOF Cost} = SFF * \left(\frac{Annual\ University\ Budget}{365\ Days} * LOF\ Days\right)$$

$$where\ Square\ Footage\ Factor\ (SFF) = \frac{BSF\ x\ CR}{Total\ Campus\ BSF}$$

Community impact estimates were developed using the City of Fredericksburg's general fund budget as a proxy for the community's annual budget. This number was then divided by the City's population to determine a per capita community impact amount. This amount was then multiplied by the UMW population (including faculty and staff) to act as a proxy for the community economic impact of UMW. The campus impact figure was then multiplied by the same factored square footage amount used in the loss of function calculation. The specific formula used is:

$$\textbf{CI Cost} = SFF * \left(\frac{Annual\ City\ Budget}{City\ Population} * Campus\ Population\right)$$

Finally, the Vulnerability Index was calculated by adding TD costs, LOF costs and CI costs and divided by the building square footage. The buildings with the highest relative unit costs were considered to have the highest potential vulnerability. The specific formula used is:

$$\textbf{Vulnerability Index} = \frac{TD\ Cost + LOF\ Cost + CI\ Cost}{\text{BSF}}$$

The calculations used to determine the Vulnerability Index for each of the UMW buildings and facilities are summarized in tabular form in Appendix A. Note that the assigning of numerical values and importance factors for parameters is qualitative in nature and based on data from a number of sources with varying degrees of accuracy.

Mitigation Priorities

Looking at the Hazard and Vulnerability Indices, the UAC was able to identify mitigation priorities. The Hazard Index presents an indication of which campus buildings have the greatest potential for damage. This index helps to prioritize mitigation actions because the facilities subject to the greatest hazard are generally well suited for effective mitigation to reduce potential risks. The Vulnerability Index presents an indication of which buildings stand to suffer the greatest potential losses due to a particular hazard event. This helps to prioritize mitigation actions because the most vulnerable facilities are generally well suited for cost-effective mitigation to reduce potential building damage and business interruption costs.

Based on the Hazard Index and Vulnerability Index, a simplified preference scale was used to arrive at a Mitigation Priority for each of the buildings and facilities on campus. The preference scale method began by assigning numbers to the index values by factor, with 1 being the Lowest and 5 being the Highest. Next, these numbers were added to form a Mitigation Priority score. The buildings with the Highest priority scores were considered to be the Highest priority for mitigation actions.

The preference scale computations used to determine the Mitigation Priority for each of the UMW buildings and facilities are summarized in tabular form in Appendix A. Note that the assigning of numerical values and importance factors for parameters is qualitative in nature based on data compiled from a variety of sources with varying degrees of accuracy. The list of Mitigation Priorities was considered as a starting point for discussion of mitigation strategies. It is important to note that campus needs and capabilities as well as the hazard identification and risk assessment play an essential role in establishing Mitigation Priorities. For buildings ranked as High or Medium-High Mitigation Priority for any hazard, a building-specific analysis was conducted to identify specific building vulnerabilities and recommended mitigation measures. These building data sheets can be found in Appendix B.

4.7 NATURAL HAZARD PROFILES

This section presents profiles for each of the natural hazards identified by the UAC.

4.7.1 Hurricane/Wind (Significant)

The analysis in this plan focuses on hurricane as the most likely type of wind hazard to impact UMW, though damage from high winds also can be caused by straight line wind events, tornados and thunderstorms. Thunderstorms and tornadoes are profiled separately.

Hazard Description

A tropical cyclone is the generic term for a storm system with a closed circulation around a low pressure center, fueled by the heat released when moist air rises and condenses. Depending on strength, these weather systems are classified as hurricanes, tropical storms or tropical depressions. Tropical cyclones involve both atmospheric and hydrologic characteristics such as severe winds, storm surge flooding, high waves, coastal erosion, extreme rainfall, thunderstorms, lightning, and, in some cases, tornadoes.

High winds are associated with hurricanes, with two significant effects: 1) widespread debris due to damaged and downed trees and damaged buildings and 2) power outages. These effects have been felt by UMW in the past.

The impacts of flood are described in more detail in the next section on flooding but, generally, UMW is not impacted by riverine flooding. Heavy rains can cause flooding due to poor drainage and, in portions of the campus that are flat, intense prolonged rainfall may accumulate in areas without established drainage paths.

Hurricanes are categorized by the Saffir-Simpson Scale. Table 4-6 includes detailed descriptions of each category and the potential damage caused by each.

Table 4-6. Saffir-Simpson Hurricane Damage Scale.

Hurricane Category	Sustained Winds (mph)	Damage Potential	Description
1	74 - 95	Minimal	Minimal damage to unanchored mobile homes along with shrubbery and trees. There may be pier damage and coastal road flooding, with storm surge 4-5 feet above average.
2	96 - 110	Moderate	Moderate damage potential to mobile homes and piers, as well as significant damage to shrubbery and tress with some damages to roofs, doors and windows. Impacts include flooding 2-4 hours before arrival of the hurricane in coastal and Low lying areas. Storm surge can be 6-8 feet above average.
3	111 - 130	Extensive	Extensive damage potential. There will be structural damage to small residences and utility buildings. Extensive damage is to mobile homes and trees and shrubbery. Impacts include flooding 3-5 hours before the arrival of the hurricane cutting

Hurricane Category	Sustained Winds (mph)	Damage Potential	Description
			off the Low lying escape routes. Coastal flooding has the potential to destroy the small structures, with significant damage to larger structures as a result of the floating debris. Land that is Lower than 5 feet below mean sea level can be flooded 8 or more miles inland. Storm surge can be 6-12 feet above average.
4	131 - 155	Extreme	Extreme damage potential. Curtain wall failure as well as roof structure failure. Major damage to Lower floors near the shoreline. Storm surge generally reaches 13-18 feet above average.
5	> 155	Catastrophic	Catastrophic damage potential. Complete roof failure on residence and industrial structures, with complete destruction of mobile homes. All shrubs, trees and utility lines blown down. Storm surge is generally greater than 18 feet above average.

Hazard History

Figure 4-1 shows the historical occurrences of hurricanes and tropical storms within 50 miles of Fredericksburg. From the figure, it can be seen that twenty-eight storms have passed within 50 miles of the main campus between 1876 and 2012. The majority of these have been tropical storms. The track of Hurricane Isabel (2003), which caused significant damages to the City of Fredericksburg, passed between 75 and 125 miles to the west of the City center.

Hurricane Isabel entered Virginia on September 18, 2003. The Commonwealth experienced tropical storm winds for 29 hours with some maximum winds approaching 100 mph. Over 2 million people were left without power within the Commonwealth. Damages in Virginia totaled over $625 million and the passage of the storm resulted in 36 direct or indirect deaths throughout Virginia.[24]

UMW canceled classes before Isabel arrived, however, approximately 1,500 students remained on campus. Impacts to the University included downed trees, scattered debris, and power outages (Figure 4-2). Approximately 200 trees fell throughout the campus. Power outages lasted for 36 hours. The Facilities Services Team estimated the cost of clean-up at approximately $100,000. Generators were rented to keep medical and food supplies cold. Students were provided box dinners to take back to their rooms.[25]

Hurricane Irene (2011) weakened considerably as it blew through the North Carolina and Virginia mainland. The storm bands brought winds averaging between 20 and 30 mph, with gusts in the low 40s. Power outages impacted 1,100 people. Minor damages were limited to storm debris. The Fredericksburg weather station recorded a high of 1,590 lightening strikes per minute for nearly two hours and a total of 1.34 inches of rain during Irene on August 25, 2011.

On June 29, 2012 a derecho, or straight-line wind-storm with fast-moving severe thunderstorms, caused significant damage to a university van and trees on campus. The extremely hot and humid

conditions caused high amounts of instability, with thunderstorms causing widespread wind damage throughout the campus and city. Over 2,130 lightening strikes per minute for one hour and maximum wind gusts of SSW 77 mph were recorded at the Fredericksburg weather station near Shannon airport.

Due to the potential severity of Superstorm Sandy, UMW cancelled classes for all campuses (Fredericksburg, Stafford and Dahlgren on October 29, 2012. The University's Emergency Operations Team (EOT) was activated and engaged in preparation; however no damages were reported as a result of this event.[26]

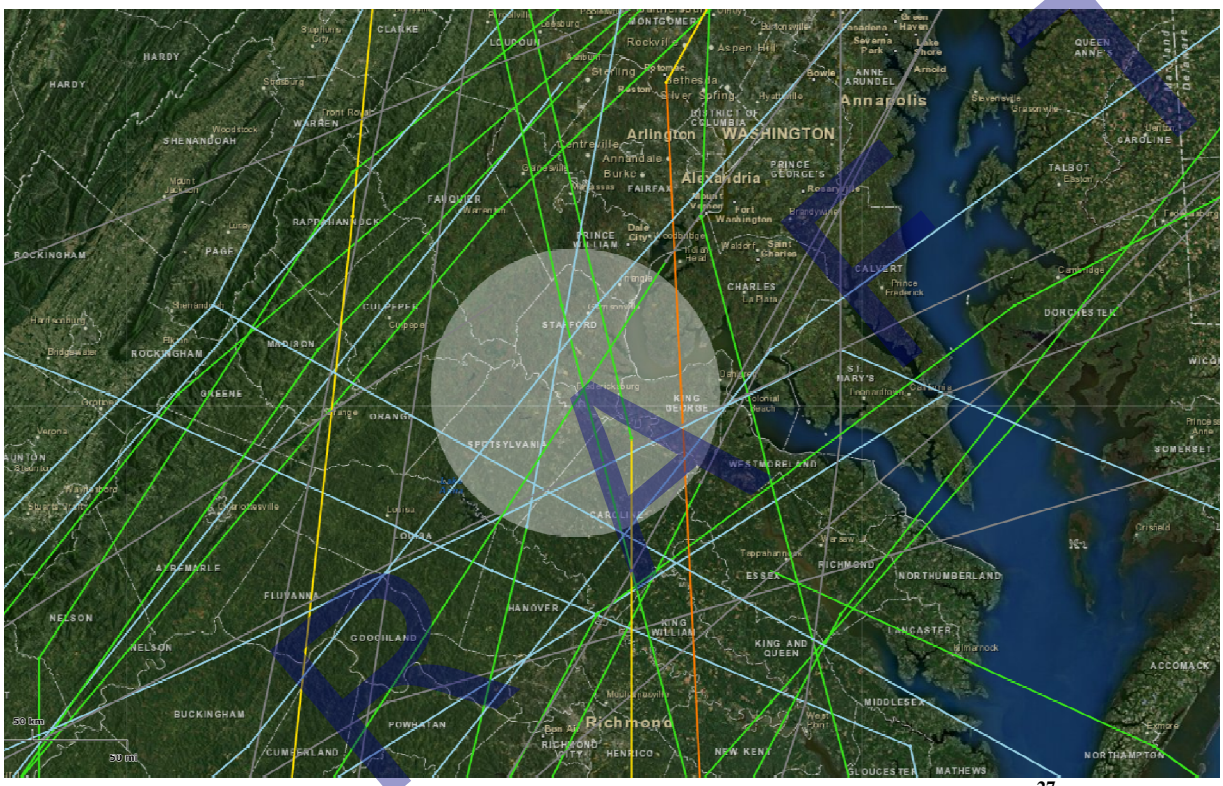


Figure 4-1. Hurricane Tracks within 25 miles of UMW (1876-2013).[27]

Figure 4-2. Downed tree near the UMW Main Campus post-Hurricane Isabel, 2003.

Hurricane/wind-related events that included the greater Fredericksburg area, Stafford County, and King George County and possibly impacted UMW include:

- Tropical Storm Able – 1952
- Tropical Storm Diane – 1955
- Tropical Depression Bret - 1981
- Tropical Depression Chris – 1988
- Tropical Depression Dennis – 1999
- Tropical Depression Ivan – 2004
- Hurricane Cindy - 2005
- Hurricane Irene -2011
- Superstorm/Hurricane Sandy - 2012

Three different types of events associated with hurricanes and high winds were recorded in the damage history data. These events are shown in Table 4-7.

Table 4-7. Damage History Due to Hurricane/Wind (5/2001-12/2012).

Loss Date	Description	Damage Amounts
06/2003	Fence damage due to wind	$600.00
09/18/2003	Hurricane Isabel damage	$147,166.00
6/29/2012	"Derecho" storm and thunderstorms cause damage to van and multiple trees downed.	$88,683.17

Potential Recurrence Intervals (Probabilities)

The City of Fredericksburg, Stafford County, and King George County have been affected by twelve tropical depressions, tropical storms or hurricanes between 1876 and 2012 (storm track passed within 25 miles), resulting in a recurrence interval of approximately 11.5 years.

The UMW campuses are located within the 80-90 mph wind speed zone according to the American Society of Civil Engineers (ASCE) design wind speeds and the statewide building code (Figure 4-3). Based on modeling in FEMA's Benefit-Cost Analysis software, the predicted maximum sustained wind speed for a 100-year storm would be 66 miles per hour (tropical storm strength).

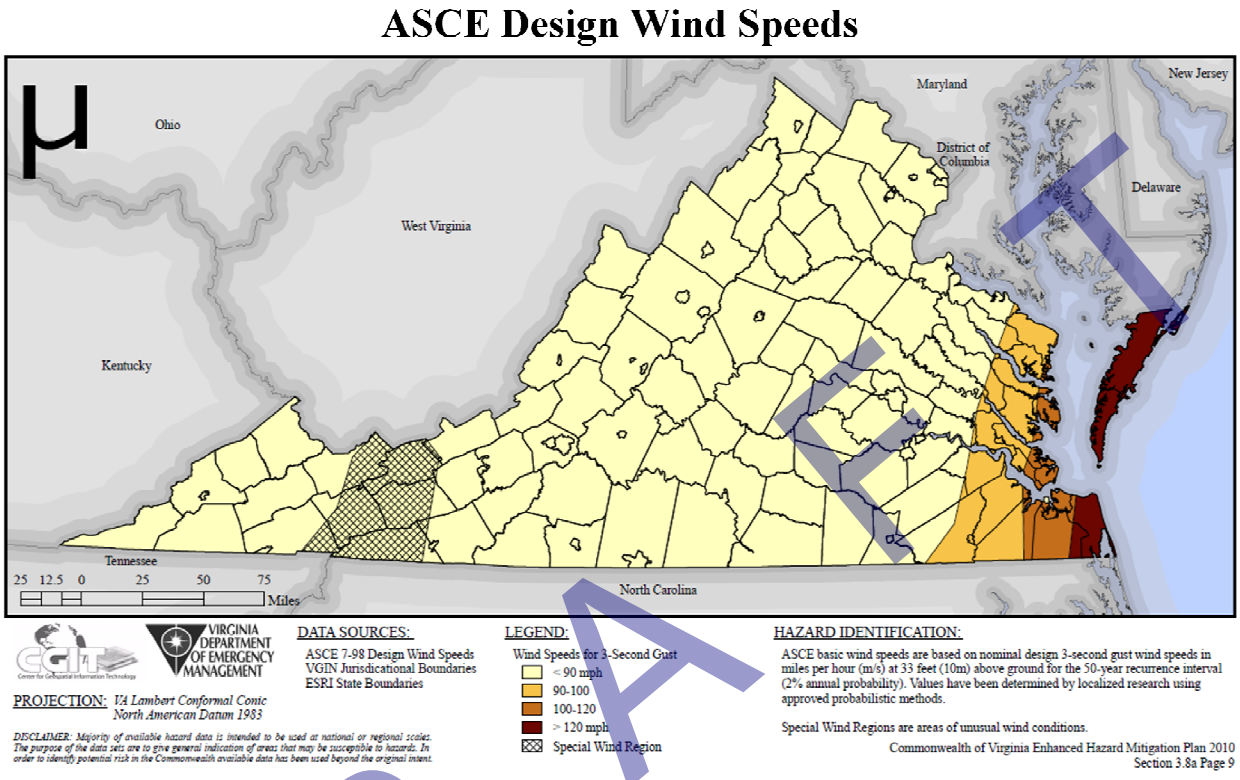


Figure 4-3. Basic Wind Speeds in Virginia (Virginia Standard Hazard Mitigation Plan 2009).

Hazard Evaluation

An evaluation of wind hazards was performed for all buildings and facilities at the UMW campuses and involved an analysis of eight technical parameters listed below:

1. Construction Date
2. Framing Type
3. Cladding Type
4. Opening Protection
5. Roof Shape
6. Roof Construction Type
7. Tree Cover
8. Damage History

Data was collected during the 2007 and 2012 site visits. A detailed description of each building and the hazard parameters used in the analysis along with tables listing their associated parameters are provided in Appendix A.

Buildings constructed before 1965 were assumed to be built to a less stringent wind code and are assigned a high hazard level. Most (45) of the buildings on the UMW campus were built before 1965 and were assigned a high hazard level. Fifteen buildings on the campus were built after 1996 and were assigned a low hazard level. With respect to framing type, the majority of the buildings on

campus are non-engineered wood, which falls into the medium-high hazard level. Buildings with reinforced masonry, brick, block, or stone exteriors were categorized as having a medium-low hazard level; this category includes forty-two of the seventy-one campus buildings assessed. Most of the buildings on campus have numerous, small openings with minimal protection; therefore, most buildings were categorized as having a high hazard level with respect to opening protection.

The flat roof shape places the majority of buildings on campus in the medium hazard level for roof shape because flat roofs are less susceptible to damage than gable-end roofs but are more susceptible to damage than hip roofs. The tar and gravel coverings that account for approximately half of the campus buildings were considered to be a medium-high hazard level. Most buildings on campus have light or no tree cover surrounding them; therefore, the majority of buildings were categorized as having a low or medium-low hazard level with respect to tree cover.

Hazard Index

The Hazard Index (Table 4-8) provides an indication of which campus buildings have the greatest potential for wind damage. As discussed previously, the hazard indices have changed from the 2008 rankings due to the availability of improved building data for campus structures. Anne Fairfax House remains as a High Hazard Index for hurricane/wind and Hamlet House was elevated from Medium-High to High. Nine buildings have a Medium-High Hazard Index for wind. Buildings from the Belmont Estate, which were not included in 2008, have a Medium-High Hazard Index for wind. As shown in the table, 1104 College Avenue was reassigned from High to Medium-High a result of no damage history being recorded for this building. James Monroe Museum was reassigned from Medium-High to Medium (Table 4-9) as a result of roof renovations; the roof was renovated and changed from asbestos shingles to seam metal. Other changes include five buildings reassessed from High to Medium and two from Medium-High to Medium-Low due to mitigation activities related to reduction in the number of overhanging trees as well as corrections to the construction type of some of the buildings. Specific information on the structural assessments is available in Appendix B.

Table 4-8. Wind Hazard Index for High and Medium-High Risk Buildings.

Building Name	2008 Hazard Index	2013 Hazard Index
Anne Fairfax House	High	High
Hamlet House	Medium-High	High
1104 College Avenue	High	Medium-High
Framar House	Medium-High	Medium-High
Marye House	Medium-High	Medium-High
1206 College Avenue	Medium-High	Medium-High
Tyler House	Medium-High	Medium-High
Belmont Garage	Not Included	Medium-High
Belmont Gift Shop	Not Included	Medium-High
Belmont Smokehouse	Not Included	Medium-High
Belmont Stables	Not Included	Medium-High

Table 4-9. Wind Hazard Index Re-Assessment of Building Rankings.

Building Name	2008 Hazard Index	2013 Hazard Index
Brent House	Medium-High	Medium
Brompton Guest House #1	Medium-High	Medium
Brompton Guest House #2	Medium-High	Medium
Cornell House	Medium-High	Medium
James Monroe Museum	Medium-High	Medium
Belmont Main House	Medium-High	Medium-Low
Brompton House	Medium-High	Medium-Low

Appendix B includes the building specific worksheets and additional information on the Medium, Medium-Low, and Low Hazard Index buildings. Appendix C includes the Wind Hazard Index map for UMW superimposed on an aerial photograph of the campus. High risk buildings are identified in red followed by Medium-High risk buildings in orange. Medium risk buildings are highlighted in yellow while Medium-Low and Low risk buildings are represented by shades of green.

Vulnerability Index

The impact to UMW from strong winds and hurricanes is very high. Falling trees, flying debris, and downed power lines pose a significant danger to students, faculty, and staff. The Vulnerability Index (Table 4-10) provides an indication of which buildings stand to suffer the greatest potential losses due to a particular hazard event. Belmont Main House and James Monroe Museum were elevated from Medium-High to High for the 2013 update. Belmont Studio Building and Ridderhof Martin Gallery were elevated from Medium-Low to High; this is a result of the updated contents value for these buildings. The Goolrick Recreational Storage Building and Eagle Landing Pedestrian Bridge were added to the High wind vulnerability in 2013. Specific information on the structural assessments is available in Appendix B.

Table 4-10. Wind Vulnerability Assessment for High and Medium-High Risk Buildings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Belmont Main House	Medium-High	High
James Monroe Museum	Medium-High	High
Belmont Studio Building	Medium-Low	High
Ridderhof Martin Gallery	Medium-Low	High
Goolrick Recreation Storage Building	Not Included	High
Eagle Landing Pedestrian Bridge	Not Included	High

It should be noted that the buildings from 2008 were reassessed as a result of newly available contents information. Buildings that were previously ranked as High and Medium-High that have changed are included below in Table 4-11. In addition, Annexes A and B have been reassigned to low as a result of updated information for building and contents Wind Damage Functions. Specific information on the structural assessments is available in Appendix B.

Table 4-11. Wind Vulnerability Re-Assessment of Building Rankings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Brent House	Medium-High	Medium
Brompton Guest House #1	Medium-High	Medium
Heating Plant	Medium-High	Medium-Low

Appendix B provides a complete listing of the building information on the Medium, Medium-Low, and Low Hazard Index buildings. The wind Vulnerability Index map is located in Appendix C.

Mitigation Priorities

The Hazard Index and the Vulnerability Index building ratings feed directly into the Mitigation Priorities. Table 4-12 provides a listing of the High and Medium-High Mitigation Priorities for wind. These facilities are generally well suited for cost-effective mitigation to reduce potential building damage and business interruption costs.

The Anne Fairfax House and James Monroe Museum have remained as High Mitigation Priorities for hurricane/wind and Hamlet House was elevated to High. Belmont Studio Building was elevated from Medium-Low to High. Framer House and 1201 William Street have remained Medium-High for Mitigation Priorities. Ridderhof Martin Gallery was elevated from Low to Medium-High ranking because of updated information received from UMW for contents value. For the 2013 assessment, contents value increased seven fold. The increase in contents value translates to a larger damage per square feet for the building resulting in a higher Vulnerability Index. Specific information on the structural assessments is available in Appendix B.

Table 4-12. Wind Mitigation Priorities for High and Medium-High risk buildings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Anne Fairfax House	High	High
James Monroe Museum	High	High
Hamlet House	Med-High	High
Belmont Main House	High	Med-High
Framar House	Med-High	Med-High
1206 College Ave Residence	Med-High	Med-High
Belmont Studio Building	Med-Low	Med-High
Ridderhof Martin Gallery	Low	Med-High

It should be noted that the building rankings from 2008 changed as a result of updated content value information for the 2013 plan update. Buildings that were previously ranked as High or Medium-High that have changed are shown below in Table 4-13. Brompton Guest House and Brent House were reassessed from High in 2008 to Medium as a result of a reduction in the contents values for those facilities. The contents values used in the previous version of the plan were estimated based on the building usage and the building replacement value. The newly assessed values were available through the University's buildings capital management personnel and reflect actual content values. Appendix B provides a complete listing of the building information on the Medium, Medium-Low,

and Low Hazard Index buildings. Additionally, Annexes A and B have been reassigned to Low as a result of updated information for building and contents Wind Damage Functions.

Table 4-13. Wind Mitigation Priorities Re-Assessment of Building Rankings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Brent House	High	Medium
Brompton Guest House #1	High	Medium
Marye House	Med-High	Medium
1104 College Avenue	Med-High	Medium
Tyler House	Med-High	Medium
Brompton House	Med-High	Med-Low

The list of Mitigation Priorities was considered as a starting point for discussion of mitigation strategies. It is important to note that campus needs and capabilities as well as the hazard identification and risk assessment play an essential role in establishing Mitigation Priorities.

For buildings ranked as High or Medium-High Mitigation Priority for any hazard, a building-specific analysis was conducted to identify vulnerabilities and recommended mitigation measures. These building data sheets can be found in Appendix B. Appendix C includes the wind Mitigation Priorities map for all buildings assessed during the 2013 plan update.

4.7.2 Severe Thunderstorms (Significant)

Hazard Description

The National Weather Service (NWS) defines a thunderstorm as a local storm (accompanied by lightning and thunder) produced by a cumulonimbus cloud, usually with gusty winds, heavy rain, and sometimes hail. Non-severe thunderstorms rarely have lifetimes over two hours. The National Weather Service considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado. Severe thunderstorms are distinguished by stronger winds and heavier rain than the normal thunderstorm. These severe storms have the potential to produce damaging hail, spawn tornadoes, and initiate flash flooding. Thunderstorms may occur singly, in clusters, or in lines. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time.

Thunderstorms affect relatively small areas when compared with hurricanes and winter storms. The typical thunderstorm is 15 miles (24 kilometers) in diameter and lasts an average of 20 to 30 minutes. Of the estimated 100,000 thunderstorms occurring each year in the United States, only about 10 percent are classified as severe.

Downbursts and straight-line winds associated with thunderstorms can produce winds of 100 to 150 miles (161 to 241 kilometers) per hour—enough to flip cars, vans, and pickup trucks. The resulting damage can equal the damage of most tornadoes.[28]

Many strong thunderstorms produce hail. Large hail, and the glass it may break, can injure people and animals. Hail can be smaller than a pea, or as large as a softball, and can be very destructive to automobiles, glass surfaces (e.g., skylights and windows), roofs, plants, and crops.[29] The size of hailstones is a direct function of the severity and size of the storm. Hailstorms occur more frequently in the late spring and early summer and are more common in the Midwest. The land area affected by individual hailstorms is not much smaller than that of a parent thunderstorm, an average of 15 miles in diameter around the center of a storm.[30]

The impact to UMW from thunderstorms is relatively high. Falling trees, flying debris, and downed power lines may be the result of strong thunderstorms and pose a danger to students, faculty, and staff.

Hazard History

According to the NCDC database there were 28 occurrences of severe thunderstorms recorded in the City of Fredericksburg between 1979 and 2012. Due to the geography of the City of Fredericksburg (approximately 11 square miles), and the fact that most severe thunderstorms have a diameter of approximately 15 miles, it is likely that most of the recorded storms affected the UMW campus. The NCDC database has 15 hail storms recorded with hail size diameter greater than 0.75 inches, none of which resulted in documented property damage.

Thunderstorm events of significance include:

- On July 1, 2001, a Fredericksburg man was injured when a bolt of lightning struck his home. There were no direct reports of any additional injuries and/or damage for the city or surrounding areas.[31]
- Numerous thunderstorms broke out across the region on May 8, 2008. In Fredericksburg structural damage was noted on Landsdowne Road as well as damage to a railroad crossing. A spotter estimated winds upward to 80 mph.
- A strong upper level system moved across the Mid-Atlantic on June 1, 2008, resulting in scattered thunderstorms. City of Fredericksburg Emergency Management reported trees and wires down. Several trees fell on automobiles. Property damages were estimated near $25,000 in NCDC storm events database.
- An intense storm system struck the main campus on July 16, 2010, and resulted in downed power line, downed trees, and damage to several structures on campus. The damages from this event included: storage shed near the UMW apartments was damaged by wind and water, privacy fence at Annex B was destroyed, Annex C trailer damage, power lines downed near College Avenue ,and campus-wide tree damage. One-third of the campus services and activities were impacted due to loss of power, phone and internet services. It was estimated that the clean-up costs were in excess of $5,000.[32]
- A thirty-minute thunderstorm on August 29, 2011, caused significant damage within the City. The 911 center was inundated with calls reporting damages. Winds peaked at 57 mph and resulted in the roof being ripped off of the Virginia Deli on William and Sophia Streets.[33]

Three events associated with severe thunderstorms were recorded in the damage history data for UMW. These events are shown in Table 4-14.

Table 4-14. Damage History due to Severe Thunderstorms (5/2001-12/2012).

Loss Date	Description	Damage Amounts
05/29/2001	Lightning Strike (police primary radio system struck – Lee Hall)	$13,688
06/23/2001	Lightning Strike (fire alarm system – James Monroe Museum)	$2,849
07/16/2010	Microburst campus wide	$1,800

Potential Recurrence Intervals (Probabilities)

There were 43 thunderstorms, 7 significant lightening and 17 hail events recorded in the City of Fredericksburg; 81 thunderstorms, two significant lightening and 28 hail events recorded in King George County; and 122 thunderstorms, four significant lightening and 48 hail events recorded in the in Stafford County over a 63 year period collected by NWS NCDC. Based on the assumption that the thunderstorm occurrences will continue with a similar probability as in past years, there will likely be a significant lightening event that causes death, injury or property damage every 18 years. All campuses will likely experience an average of at least one thunderstorm and 2.4 hail events per year. This probability, because it is based on NCDC records, may underestimate the frequency of severe thunderstorm events.

4.7.3 Winter Storms (Significant)

Hazard Description

Winter storms can be a combination of heavy snowfall, high winds, ice and extreme cold. Winter weather impacts the Commonwealth of Virginia between the months of November and April, with varied intensities from east to west.

The impacts of winter storms are typically minimal in terms of property damage and long-term effects. The most notable impact from winter storms is usually damage to power distribution networks and utilities. Severe winter storms have the potential to inhibit normal functions of the community. Closure of UMW can impact the educational process. In addition, the University is responsible for continuing to provide services, including dining services, to its residential students.

Governmental costs for this type of event are a result of the needed personnel and equipment for clearing streets. Private sector losses are attributed to lost work when employees are unable to travel. Homes and businesses suffer damage when electric service is interrupted for long periods of time. Health threats can become severe when frozen precipitation makes roadways and walkways very slippery, when there are prolonged power outages, or if fuel supplies are jeopardized. Occasionally, buildings may be damaged when snow loads exceed the design capacity of their roofs or when trees fall due to excessive ice accumulation on branches.

The primary impact of excessive cold is increased potential for frostbite and potentially death as a result of over-exposure to extreme cold. Some of the secondary effects presented by extreme/excessive cold are a danger to livestock and pets and frozen water pipes in homes and businesses.

Buildings with large-span flat roofs are the most susceptible to failure during and after heavy snowfalls. Failures of roofs occur when the total load upon the structure exceeds its capacity. During milder temperatures, the flat roofs are vulnerable to collapse with a large amount of snow on roofs as rainfall will be partially absorbed into the existing snowpack, thus substantially increasing the load upon the rooftop.

Slippery streets, steps and sidewalks pose a threat during winter storms for both pedestrians and motorists. While snow is slippery by nature, ice and black ice can be a great danger. Black ice is when a surface appears wet, but it is instead a thin layer of ice.

Clogged storm drains occur as snow and ice plowed along streets and sidewalks can lead to flooding. Clogged downspouts can result to roof leaks. Heat from a building's attic melts snow and ice over most of the roof, but the heat cannot get to the eaves of the building and ice and snow may pile up near the downspouts. This forces the water from above, up under the shingles, which can leak into the building itself.

Blocked fire hydrants from mounds of snow and ice plowed from the roadway pose another danger as fire trucks may not be able to see the nearest fire hydrant should a fire occur. Snow and ice piled

on top of the hydrants may also cause the water to freeze in the waterlines used by the hydrant. It is very important to ensure fire hydrants are not blocked during and after a winter storm. Following the snow emergency procedure established in the City and on campus will enable snow removal crews to do the best they can in removing snow and ice without the danger of parked cars nearby.

Lastly, narrowed streets are an issue after heavy snows that may lead to trouble in getting fire and ambulances down streets if an emergency were to occur. Trees hanging over utility lines and roadways may fall during and after a freezing rain event thus making it important to make sure trees are properly trimmed before the winter season.

Table 4-15 shows the Northeast Snowfall Impact Scale (NESIS) that was developed by Paul J. Kocin and Louis W. Uccellini and released to the public in 2007. NESIS combines GIS population data from the 2000 Census, overlays snowfall totals, and uses statistical methods to arrive at a "NESIS value."[34] NESIS values are placed into five distinct "categories" ranging from one to five with one being a "notable" snowstorm, to five rating as an "extreme" snowstorm. The scale is seen below in Table 4-15.

Table 4-15. The Northeast Snowfall Impact Scale (NESIS) developed by Kocin and Uccellini.

Category	NESIS Value	Description
1	1 – 2.499	Notable
2	2.5 – 3.99	Significant
3	4 – 5.99	Major
4	6 – 9.99	Crippling
5	10.0 +	Extreme

Hazard History

According to the NCDC database, there were 59 occurrences of winter storms recorded in Stafford County between 1960 and 2012 (Note: winter storms that affected Stafford County are assumed to have affected the City of Fredericksburg in a similar manner. Data was not available for the City of Fredericksburg). Of the 59 occurrences recorded, 17 were classified as heavy snow events and 3 were classified as ice storms. The remaining events were classified as general winter weather or winter weather/mix combining wind, snow, sleet, rain, and ice. Some of the more significant winter storms for the City of Fredericksburg and UMW are listed below.

In late January 1966, two consecutive day blizzards dropped 15.5 inches of snow in the City of Fredericksburg. Intense blowing and drifting snow closed roads for several days after the storms. Temperatures dropped into single digits which were associated with dangerously low wind chills. [35]

A devastating winter storm struck the Commonwealth on February 10-11, 1994, with the hardest hit areas stretching from Danville and Lynchburg northeast through Fredericksburg. The area was coated with one to three inches of ice. Some counties lost 10 to 20 percent of their trees due to the heavy ice. Many roads were blocked and impassible and there were many accidents including automobile and slip and fall accidents. Electric lines were down in many counties and as much as 90

percent of the people were without power in selected counties. A presidential disaster declaration was issued and damages were estimated at $61 million.[36]

The winter of 1996 was particularly intense for the City of Fredericksburg where more than 60 inches of snow fell. In particular, the February 2-3, 1996, storm dropped one to two feet of snow over the area. Following the storm were extremely cold temperatures reaching single digits and in some areas negative numbers. On February 16, another storm moved up the coast adding an additional 6 to 12 inches of snow.[37]

In Figure 4-4, the 1996 snowstorm is shown in the map and is rated a "Category Five." The only other "Category Five" snowstorm to impact UMW and the Northeast United States is the "Blizzard of 1993," which pummeled areas from Georgia to Maine with record snowfall amounts in some locations. Another snowstorm of recent memory is the "President's Day Snowstorm" of February 2003 which rates as a "Crippling" snowstorm and a "Category Four"[113] on the NESIS scale.

A winter storm with ice and snow entered the City of Fredericksburg on February 14-16, 2003. The storm resulted in the closure of several portions of Interstate 95. Several sports teams were stranded in Fredericksburg for an additional two days to allow for the clearing of major roads.[38]

A major winter storm occurred on February 11-12, 2006, across much of the northern and central regions of the State. The City of Fredericksburg snowfall accumulation totaled 5 to 8 inches of wet, heavy snow. In addition to the snow, nearly 17,500 customers in Fredericksburg were without power, according to Dominion Virginia Power, due to downed trees and power lines.[39]

Record-breaking snowfall fell over much of the Mid-Atlantic on February 5, 2010. A storm system moving through the Midwest phased with another system moving across the South, growing more powerful off the Carolina coast. The system then tracked northeast and then east along the Mid-Atlantic coast before heading out to sea. Snow began during the afternoon hours of February 5 and continued into the early evening of February 6. Preliminary indications are that 32.4 inches fell over the two-day period at the NWS Forecast Office in Sterling, Virginia near Dulles International Airport, with 17.8 inches at Ronald Reagan Washington National Airport. Whether by air, rail, or roadway, travel became nearly impossible as winds gusting over 35 mph whipped snow into drifts of up to four feet deep. This storm was the second paralyzing snowstorm of the season for what would turn out to be (according to preliminary NWS data) northern Virginia's snowiest winter on record. The storm was nicknamed "Snowpocalypse" and "Snowmageddon" by local media and others. The snow forced the shutdown of the federal government for four and a half consecutive days. UMW also closed for the week. This event was considered a "Category Three" which is described as "Major" on the NESIS scale.

Three events associated with winter weather were recorded in the damage history data for UMW. These events are shown in Table 4-16. At least one winter storm closed the University and resulted in receiving FEMA public assistance funds.

The 2010 winter event resulted in damages over $129,199 which $88,633 was processed by the Division of Risk Management for reimbursement by the state. Costs from this event include Brompton gutters and wood fascia damage, Indoor Tennis Center snow guard system, and Annex roof failure and internal damage to drywall. Of the damages, $71,511 was for campus-wide debris removal.

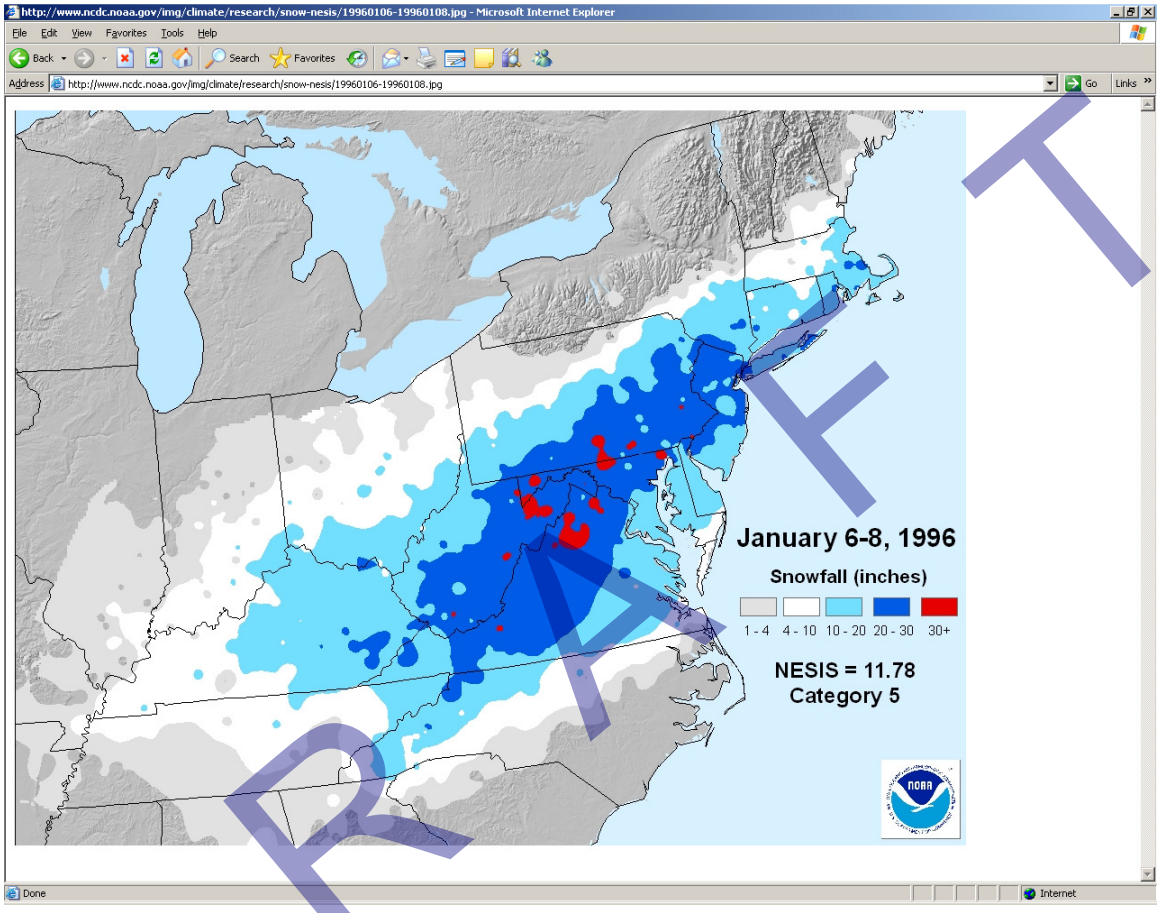


Figure 4-4. The "Blizzard of 1996" NESIS Map courtesy of Kocin and Uccellini

Table 4-16. Damage History due to Winter Weather (5/2001-12/2012).

Loss Date	Description	Damage Amounts
02/18/2003	Employee Injury & Vehicle Damages	$9,384
02/26/2003	Vehicle Damages	$1,545
02/05/2010	Damage to buildings exterior and interior.	$129,199

Potential Recurrence Intervals (Probabilities)

The UMW campuses are vulnerable to winter storms. With many winter storms occurring during the past 100 years, the probability of winter storms occurring in the future is probable, and the affects of the storm may impact the University. There were 44 occurrences of winter storms recorded in the City of Fredericksburg, 30 in King George County, and 59 in Stafford County over a 20 year period. Based on the assumption that the winter storm activity will continue with a similar probability as in

past years, there is the chance of two to three storms per year with two events likely in the City of Fredericksburg and King George County and three in Stafford County.

Annex C of the UMW Emergency Operations Plan provides a summary of snow and ice management for the University. Snow and ice removal is addressed through contracted vendors. Students, faculty, and staff are advised of severe weather conditions through a variety of means, including but not limited to local weather services, UMW alerts, mass emails, National Oceanic & Atmospheric Administration (NOAA), standard radio announcements, and TV announcements.

4.7.4 Flood (Moderate)

Hazard Description

A flood occurs when an area that is normally dry becomes inundated with water. Floods may result from the overflow of surface waters (riverine flooding), overflow of inland and tidal waters (coastal flooding), or mudflows (alluvial fan flooding). Flooding also may occur in localized areas because of inadequate drainage facilities, topography or soil characteristics; this type of flooding is more pervasive at UMW than riverine flooding.

Floods typically are characterized by frequency; for example, the "1 percent-annual chance flood" is commonly referred to as the "100-year" flood. Although more frequent floods do occur, in addition to larger events that have lower probabilities of occurrence, the 1-percent annual chance flood is used for most regulatory and hazard identification purposes.

Floods pick up chemicals, sewage, and toxins from roads and factories, therefore any property affected by the flood may be contaminated with hazardous materials. Debris from vegetation and manmade structures also may be hazardous following a flood. In addition, floods may threaten water supplies and water quality, as well as initiate power outages.

The City of Fredericksburg is at an elevation of approximately 150 feet. The city is in a combination area of piedmont uplands and level coastal plain. As noted in the University Profile, the city slopes gently eastward towards the Rappahannock River. Kenmore Avenue south of UMW, also known as the Kenmore Bottom area, is prone to flash flood events. Residents within this area have noted basement flooding, impacts to the sanitary and storm sewer systems, and restricted access within the area due to flood waters overtopping roadways.[40]

UAC members identified a number of concerns regarding campus vulnerabilities to flooding. The concerns are summarized on the problem spot map (Appendix C) and the flood-specific concerns are re-stated in the text box on the following pages. Most concerns are related to basement flooding and low-lying area flooding. Basement flooding is a concern especially in areas where there is a high concentration of important contents such as computer servers. Low-lying area flooding primarily results in loss of function (e.g., UMW has to cancel classes) but not damage to the buildings or their contents.

UMW's Emergency Operations Center's primary location is on the upper level of the Woodard Campus Center. The location is considered to be above any reasonably anticipated flood levels.

Hazard History

As shown on the basemap in Appendix C, the UMW campuses are not located within a FEMA Special Flood Hazard Area. The GWRC plan noted several past events in which roads leading to Mary Washington hospital were flooded. The Kenmore Bottom area is prone to flash flooding.

According to the Flood Insurance Study for the City of Fredericksburg, floods have and can be expected to occur on the Rappahannock River during all seasons of the year with mild to moderate

flooding more prevalent in the spring. Most of the flood problems are the result of heavy rainfall or hurricanes/tropical storms.

George Washington Hall experienced basement flooding on several occasions as a result of heavy rain/storm conditions. Combs Hall also has been subject to flooding. The area around the UMW Apartments and the Jepson Alumni Executive Center has a history of flooding during storms.

On April 26, 1937, the steel Free Bridge was destroyed when waters rose 39 feet above normal. The worst flood in the city's history was October 15-16, 1942. The water level was recorded at 44 feet above normal when the river rose as much as three feet an hour. There were several hazardous material incidents as well as public health impacts.[41] Hurricane Agnes blew into Fredericksburg on June 21, 1972 and resulted in the second worst flood in the city's history. The Rappahannock River crested at about 34 feet in the City of Fredericksburg.[42] Hurricane Fran on September 6, 1996 was the fifth worst flood since 1889.

Hurricane Isabel in 2003 dropped 7 inches of rain, which caused almost $250,000 in damages to UMW.[43] The City of Fredericksburg also experienced a particularly intense thunderstorm that dropped up to 4 inches of rain on the area during the summer of 2005. The heavy rain resulted in several road closures including the main road into the Mary Washington Hospital. Several businesses in the area were flooded and many others were impacted.[44]

Much of campus flooding occurs during heavy rains and is the result of undersized storm drains. During the plan update kickoff meeting, it was noted that there have been no significant flood events on campus for the last 5 years.

Table 4-17 shows the damage history record due to floods dating back to 2001. The only damage record is due to flooding from Hurricane Isabel on September 18, 2003 (note: actual damages could be greater if not recorded). No additional events were noted during the 2013 plan update.

Table 4-17. Damage History due to Floods (5/2001-12/2012).

Loss Date	Description	Damage Amounts
9/18/2003	Hurricane Isabel	$147,166

Potential Recurrence Intervals (Probabilities)

Two buildings, the Belmont Main House and Belmont Studio, are located within the limits of the 500-year flood. Given the flooding history of UMW and the high probability of future rain events, there is a high potential of flooding in the future.

There were 16 occurrences of flood recorded in the City of Fredericksburg, 11 in King George County, and 40 in Stafford County over a 17 year period. Based on the assumption that the flooding will continue with a similar probability as in past years, there will likely be a flood every year to 1.5 years in the City of Fredericksburg and King George County and potentially two floods per year in Stafford County.

Hazard Evaluation

An evaluation of flood hazards was performed for all buildings and facilities at UMW and involved an analysis of the eight technical parameters listed below:

1. Hazard Zone
2. Construction Date
3. Construction Type
4. Foundation Type
5. Low Point of Entry (LPE) Depth
6. Building Height
7. Contents Value Below Grade
8. Damage History

Data was collected during the 2007 and 2012 site visits. A detailed description of each building and the hazard parameters used in the analysis along with tables listing their associated parameters are provided in Appendix A.

The Hazard Zone factor is based on the building's location with respect to the FEMA mapped floodplain. The National Flood Insurance Program was established in 1969. It was assumed that buildings built prior to 1969 were not built with flood protection in mind. Therefore, buildings built before 1969 were assigned a high hazard level.

Construction type was evaluated as discussed in the hurricane/wind profile. Of similar importance for the flood analysis was foundation type. Most buildings on campus have a full or partial basement. Full basements were assigned a high hazard level and partial basements are assigned a medium-high hazard level. With respect to a related factor, low point of entry, the majority of buildings were assigned a medium hazard level with the anticipated low point of entry being at grade. Most of the buildings have minimal contents below the base flood elevation; so all of the buildings were categorized as a medium-low hazard level for contents value below grade. Finally, most buildings have no recorded flood events and were categorized as low for damage history. George Washington Hall has one reported flooding incident and was categorized as medium for damage history.

Hazard Index

The Hazard Index provides an indication of which campus buildings have the greatest potential for damage related to flooding. As discussed previously, the hazard indices have changed from the 2008 rankings due to the availability of improved building data for campus structures, such as contents replacement values. The Hazard Index for 2008 and 2013 is shown in Table 4-18. Hamlet House continues to have a High Hazard Index for flooding. Brompton Guest House #1 was reassessed from High to Medium High as a result of revised contents values. 1104 College Avenue was reassessed from Medium-High to High Hazard Index for flood due to a corrected value for the exterior cladding type. George Washington Hall has been mitigated and as a result the 2008 Hazard Index of High has been changed to Medium-High. 1004 College Avenue was added to the assessment for 2013 and received ranking of High and Medium-High rankings. This may seem odd considering that these are rather modern buildings of masonry construction, however these structures receive high flood hazard ranking scores because they have fully finished basements with high contents values below the base flood elevation. It should also be noted that 1004 College Avenue was originally constructed in 1975, which also elevates its hazard ranking score.

Table 4-18. Flood Hazard Index for High and Medium-High Risk Buildings.

Building Name	2008 Hazard Index	2013 Hazard Index
Hamlet House	High	High
1104 College Avenue	Medium-High	High
1004 College Ave	Not Included	High
Brompton Guest House #1	High	Medium-High
Monroe Hall	Medium-High	Medium-High
Tyler House	Medium	Medium-High
George Washington Hall	High	Medium-High
1201 Williams St	Not Included	Medium-High

Buildings that were previously ranked as High or Medium-High that have changed are shown in Table 4-19. Appendix B provides a complete listing of the building information and Appendix C includes mapping of the analysis. James Monroe Museum, Lee Hall, Marshall Hall, Brent House, Bushnell Hall, and Randolph Hall were reassessed due to either adjusted replacement or contents value.

Table 4-19. Flood Hazard Index Re-Assessment of Building Rankings.

Building Name	2008 Hazard Index	2013 Hazard Index
James Monroe Museum	Medium-High	Medium
Lee Hall	Medium-High	Medium
Marshall Hall	Medium-High	Medium
Westmoreland Hall	Medium-High	Medium
Willard Hall	Medium-High	Medium
Brent House	Medium-High	Medium-Low
Bushnell Hall	Medium-High	Medium-Low
Randolph Hall	Medium-High	Medium-Low

Appendix B includes the building specific worksheets and additional information on the Medium, Medium-Low, and Low Hazard Index buildings. Appendix C includes the map of the Flood Hazard Index for UMW superimposed on an aerial photograph of the campus. High risk buildings are identified in red followed by Medium-High risk buildings in orange. Medium risk buildings are highlighted in yellow while Medium-Low and Low risk buildings are represented by shades of green.

Vulnerability Index

The impact of flooding to the University is high. Flooding can cause large monetary damages to property. It is also the leading cause of death (especially in vehicles) among all natural hazards across the United States.

As discussed previously, the hazard indices have changed from the 2008 rankings due to the availability of improved building data for campus structures. The Vulnerability Index for 2008 and 2013 is shown in Table 4-20. The Flood Vulnerability Index in Appendix C illustrates the results of the flood vulnerability for UMW. Four of the buildings that were ranked as High Vulnerability Index

remain the same. Ridderhof Martin Gallery was elevated from Medium to High as a result of the increased contents value ($3.5 million) provided by UMW. The increased contents value factors into the total potential damage of the building and damage per square feet. The William Anderson Center is new to the 2013 assessment and received a High Vulnerability Index. The Alumni Executive Center remains at Medium-High and Stafford North were reassigned from High to Medium-High. Both the building replacement value and the contents values were reassessed for the Stafford Campus North Building and as a result the vulnerability index was lowered. It should be noted that the Eagle Landing Pedestrian Bridge received a high Flood Vulnerability Index only as a result of its high replacement costs.

Table 4-20. Flood Vulnerability Index for High and Medium-High Risk Buildings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Belmont Main House	High	High
Belmont Studio Building	High	High
James Monroe Museum	High	High
Stafford Campus (South Bldg)	High	High
Ridderhof Martin Gallery	Medium	High
William Anderson Center	Not Included	High
Stafford Campus (North Bldg)	High	Medium-High
Anne Fairfax House	Medium-High	Medium-High
Jepson Alumni Executive Center	Medium-High	Medium-High
Eagle Landing Pedestrian Bridge	Not Included	Medium-High

It should be noted that the building rankings from 2008 changed as a result of newly available content value information for the 2013 plan update. Buildings that were previously ranked as High or Medium-High that have changed are shown in Table 4-21. For the previous plan, unknown contents values for buildings was estimated based on a percentage of the building replacement value based on the building use. Woodward Campus Center has been reassigned to Medium as a result of updated information for building and contents Flood Damage Functions. George Washington Hall has been mitigated and as a result has decreased in vulnerability. Chandler Hall, Monroe Hall, Trinkle Hall, Gary Melchers Hall and the Heating Plant received lowered vulnerability ratings as a result of adjusted contents values. As stated earlier, the 2013 plan update includes revised building and contents information provided by UMW resulting in a more precise vulnerability assessment. Specific information on the structural assessments is available in Appendix B and mapping in Appendix C.

Table 4-21. Flood Vulnerability Index Re-Assessment of Building Rankings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
George Washington Hall	High	Medium
Jepson Science Center	High	Medium
Seacobeck Hall	High	Medium
Woodard Campus Center	High	Medium

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Chandler Hall	High	Medium-Low
Monroe Hall	High	Medium-Low
Trinkle Hall	High	Medium-Low
Combs Hall	Medium-High	Medium-Low
Pollard Hall	Medium-High	Medium-Low
Tyler House	Medium-High	Medium-Low
Gary Melchers Hall	Medium-High	Low
Heating Plant	Medium-High	Low

Mitigation Priorities

The Hazard Index and the Vulnerability Index ratings feed directly into the Mitigation Priorities. These facilities are generally well suited for cost-effective mitigation to reduce potential building damage and business interruption costs. As was mentioned above, Belmont Main House is now estimated to contain up to 25% of the contents values below the base flood elevation; this resulted in a higher hazard index and thus a higher mitigation priority ranking. Stafford Campus South and 1104 College Avenue have been elevated from a Medium to Medium-High Mitigation Priority for flooding simply due to the adjusted building replacement and contents values. Several of the buildings have changed ranking and are shown in Table 4-22. George Washington Hall has been dry-flood proofed, and, as a result, reassigned to a Medium-High ranking. William Anderson Center and 1004 College Avenue are new to the 2013 risk assessment.

Table 4-22. Flood Mitigation Priorities for High and Medium-High Risk Buildings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Anne Fairfax House	Medium-High	Medium-High
Belmont Main House	Medium-High	Medium-High
Belmont Studio Building	Medium-High	Medium-High
George Washington Hall	High	Medium-High
James Monroe Museum	High	Medium-High
Jepson Alumni Executive Center	Medium-High	Medium High
Stafford Campus (South Bldg)	Medium	Medium-High
Tyler House	Medium-High	Medium
William Anderson Center	Not Included	Medium
1004 College Ave	Not Included	Medium-High
1104 College Avenue	Medium	Medium-High

It should be noted that the building rankings from 2008 changed as a result of newly available content value information for the 2013 plan update. Contents value for 2008 was estimated based on Building Replacement Value and the building use. Since the Mitigation Priorities is the end result of the hazard vulnerability indices, the changes to these buildings directly impacts the priorities. Buildings that were previously ranked as High or Medium-High that have changed are shown in

Table 4-23. Appendix B provides a complete listing of the building information on the Medium, Medium-Low, and Low Hazard Index buildings.

Table 4-23. Flood Mitigation Priorities Re-Assessment of Building Rankings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Brompton Guest House #1	Medium-High	Medium
Hamlet House	Medium-High	Medium
Jepson Science Center	Medium-High	Medium
Monroe Hall	High	Medium
Pollard Hall	Medium-High	Medium
Seacobeck Hall	Medium-High	Medium
Brent House	Medium-High	Medium-Low
Chandler Hall	Medium-High	Medium-Low
Combs Hall	Medium-High	Medium-Low
Trinkle Hall	Medium-High	Medium-Low
Gary Melchers Hall	Medium-High	Medium-Low

The list of Mitigation Priorities was considered as a starting point for discussion of mitigation strategies. It is important to note that campus needs and capabilities as well as the hazard identification and risk assessment play an essential role in establishing Mitigation Priorities. For buildings ranked as High or Medium-High Mitigation Priority for any hazard, a building-specific analysis was conducted to identify vulnerabilities and recommended mitigation measures. These building data sheets can be found in Appendix B. Appendix C includes the flood hazard Mitigation Priorities map for the UMW campus, based on the methodology described previously.

4.7.5 Tornado (Moderate)

Section 4.7.1 on hurricane/wind covers risks and vulnerabilities and is consistent with the threat posed by tornadoes.

Hazard Description

Tornadoes are classified as a rotating column of wind that extends between a thunderstorm cloud and the earth's surface. Winds are typically less than 100 miles per hour (mph), with severe tornado wind speeds exceeding 200 mph. The rotating column of air often resembles a funnel-shaped cloud. The widths of tornadoes are usually several yards across, with infrequent events being over a mile wide. Nationally, peak tornado activity normally spans from April through September but tornadoes can occur at any time throughout the year. In Virginia, peak tornado activity is in July when hot, humid conditions stimulate tornado formation.

Strong tornadoes may be produced by thunderstorms and often are associated with the passage of hurricanes. On average, about seven tornadoes are reported in Virginia each year. The total number may be Higher as incidents may occur over areas with sparse populations, or may not cause any property damage.

Tornadoes and their resultant damage can be classified into six categories using the Fujita Scale (Table 4-24). Classification is based on the amount of damage caused by the tornado, where the measure of magnitude is based on the impact. The majority of Virginia's tornadoes since 1950 have been F0 and F1 on the Fujita Scale. These result in minimal damage to trees, shrubbery, signs, antennas, with some damage to roofs and unanchored trailers.

As of February 1, 2007, the United States has implemented a revised scale named the Enhanced Fujita Scale. It is important to note that the Enhanced Fujita Scale is still a set of wind estimates based on damage and not measurements. The Enhanced Fujita Scale uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to 28 indicators.[45]

The impact of tornadoes to UMW is High. Tornadoes can cause property destruction, injuries, and loss of life. Tornadoes can strike with little or no warning during a thunderstorm. This is why it is very important to take cover right away in a sturdy building should severe weather approach the UMW.

Hazard History

Between 1950 and 2013, three (3) tornados touched down in the City of Fredericksburg and are described below. Table 4-24 shows the total number of tornado touchdowns in the Commonwealth of Virginia for the period 1950 to spring 2012. No recorded tornado events have directly affected UMW.[46,47]

On July 24, 1999, an F1 tornado touched down in Orange County and followed an east-southeast route for 20 miles cutting across the City of Fredericksburg. The entire path of the tornado took down thousands of trees and damaged exteriors of houses, schools, and businesses.[48]

On September 17, 2004, an F0 tornado spawned as part of a thunderstorm at approximately 4:36 p.m. The storm moved from Spotsylvania County into the eastern portion of the City of Fredericksburg. Debris was scattered across Dixon Street, but no property damage was reported.[49]

On April 19, 2013, an EF1 tornado touched down in Fredericksburg at the Westwood Shopping Plaza, ripping off roofing materials and ventilation units. The path was about three-quarters of a mile long with 90 mph winds and wind gusts of 76 mph. Intense straight-line winds, upward of 80 mph were reported in Spotsylvania, resulting in damage to homes and thousands without power. [50]

Although tornadoes are not common in the Fredericksburg area, the City and UMW are not immune.

Table 4-24. The Fujita Scale and Virginia Tornado Statistics 1950-3/2012.[51]

Fujita Scale		Enhanced Fujita Scale		Class	Damage	# in VA	Deaths/ Injuries
Scale	MPH	Scale	MPH				
Unknown						26	0/3
F0	40-72	EF0	65-85	Weak	Light damage. Tree branches snapped; antennas and signs damaged.	260	0/10
F1	73-112	EF1	86-110	Moderate	Moderate damage. Roofs off; trees snapped; trailers moved or overturned.	292	1/117
F2	113-157	EF2	111-135	Strong	Considerable damage. Weak structures and trailers demolished; cars blown off road.	96	4/114
F3	158-206	EF3	136-165	Severe	Roofs and some walls torn off well constructed buildings; some rural buildings demolished; cars lifted and tumbled.	38	27/428
F4	207-260	EF4	166-200	Devastating	Houses leveled leaving piles of debris; cars thrown some distance.	2	4/248
F5	261-318	EF5	>200	Incredible	Well built houses lifted off foundation and disintegrated with debris carried some distance.	0	-

No damage history data as a result of damage from a tornado has been filed for UMW.

Potential Recurrence Intervals (Probabilities)

The Commonwealth of Virginia State Hazard Mitigation Plan includes a tornado frequency analysis for the Commonwealth using SVRGIS data and is shown in Figure 4-5. The tornado hazard frequency is calculated as the total area impacted by each tornado divided by the defined planning area and the number of years in the period of record.

The UMW campuses are vulnerable to tornadoes. With several tornadoes occurring near the campuses during the past 100 years, the probability of tornadoes occurring in the future is real. There were three occurrences of tornados for the City of Fredericksburg, 6 in King George County and 16 in Stafford County over a 63 year period within the NCDC storm events database. Assuming that tornado activity will continue at a similar rate as in past years, Stafford County will experience one tornado every four years, King George every 10.5 years, and the City of Fredericksburg every 21 years.

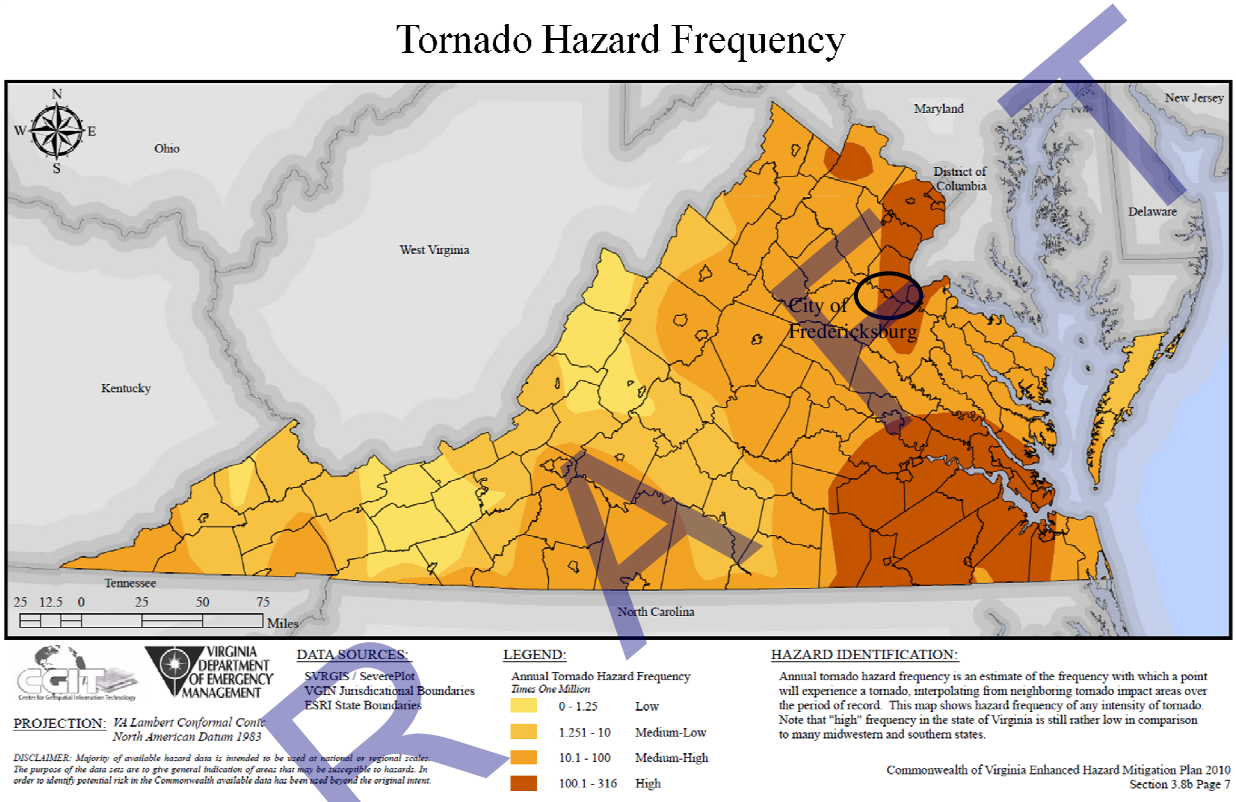


Figure 4-5. Estimated Tornado Frequency in Virginia (Commonwealth of Virginia Standard Hazard Mitigation Plan 2010).

4.7.6 Drought (Limited)

Hazard Description

A drought can be characterized in several different ways depending on the impact. The most common form of drought is agricultural. Agricultural droughts are characterized by unusually dry conditions during the growing season. Meteorological drought is an extended period of time (i.e., 6 or more months) with precipitation less than 75 percent of the normal precipitation. Severity of a drought often depends on community reliance of a specific water source. The probability of a drought is difficult to predict given the number of variables involved.

The Palmer Drought Severity Index has become the semi-official drought index in the United States. It was developed in the 1960s and is most effective in measuring long term drought and can reflect both below and above average precipitation. The advantage of the Palmer Index is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. Its disadvantage is that it is not as good for short-term forecasts, and is not particularly useful in calculating supplies of water locked up in snow, so it works best east of the Continental Divide.[52]

The equation for the index was empirically derived from the monthly temperature and precipitation scenarios of 13 instances of extreme drought in western Kansas and central Iowa and by assigning an index value of -4 for these cases. Conversely, a +4 represents extremely wet conditions. From these values, 7 categories of wet and dry conditions are defined (Table 4-25).[53]

Table 4-25. Palmer Drought Severity Index.

Severity Classification	Index Value
Extreme Drought	-4.0 or less
Severe Drought	-3.0 or -3.9
Moderate Drought	-2.0 or -2.9)
Near Normal/Mid-Range	-1.9 to +1.9
Unusual Moist Spell	+2.0 or +2.9
Very Moist Spell	+3.0 or +3.9
Extremely Moist	+4.0 or above

Droughts are an accumulating and long term threat to any University; they pose a threat to agriculture, hydrology, the environment and the human race. Depleted water supplies during periods of drought put a large strain on the interests stated above. Conservation of water, especially in times of drought will help mitigate the effect of prolonged dry weather to UMW. The impact of drought to UMW is limited. Water restrictions are the main impact during a drought.

UMW and the City of Fredericksburg are vulnerable to drought conditions. With droughts occurring in the Fredericksburg area within the past 100 years, the probability of droughts occurring in the future is likely.

Hazard History

The drought index for Fredericksburg is currently in the "near normal or mid-range" conditions.[54] According to the historical data, there have been 13 occurrences of drought that have affected the City of Fredericksburg and King George County and 15 that have impacted Stafford County since 1993. Notable droughts were recorded in March 1986, August 1993, August 1995, August 1998, November-December 1998, and May-September 1999.[55] There is no recorded information regarding drought impacts to UMW.

The City of Fredericksburg water is provided by Motts Run Water Treatment Plant and Ni River Water Treatment Plant. The City is served by two reservoirs both located in Spotsylvania County. These reservoirs, along with the Rappahannock River supply drinking water to the City of Fredericksburg residents.[56] At the current time, the supply appears adequate to the demand.

No previous damage history has been recorded by UMW as a result of a drought.

Potential Recurrence Intervals (Probabilities)

The drought index for Fredericksburg, Stafford and King George counties was in "abnormally dry" and "moderate drought" range during the summer and fall of 2012 and is currently not in drought conditions as of January 2013. Given the historical presence of drought, there is a potential recurrence interval of 1 drought every two years.

4.7.7 Northeaster (Limited)

Hazard Description

A northeaster, or nor'easter, is very similar to a hurricane and is often labeled a "White Hurricane." Nor'easter is derived from strong winds from the northeast. This is a counterclockwise cyclone with the storm center carrying warm, moist air from the Gulf Stream. The air rises over the cold inland air and cools as a result, forming snow. Heavy snow forms within a 50-mile wide path about 150 miles northwest of the low pressure center. Unlike a hurricane, a nor'easter can linger through several tides, with each tide piling more water on shore and in the bays. These events can bring strong winds and anything from rain to ice to snow to even blizzard conditions over a very large area. This combination of heavy frozen precipitation and winds can be quite destructive and lead to widespread utility failures and high cleanup costs.

Nor'easters may occur from November through April, but are usually at their worst in January, February and March. Other hazards already covered (hurricane/wind, flooding, and winter storms) take the impact of nor'easters into account.

UMW and the City of Fredericksburg are vulnerable to Nor'easters. With nor'easters occurring in the Fredericksburg area during the past 100 years, the probability of nor'easters occurring in the future is likely, and the affects of the storm may impact UMW.

Hazard History

Based on the City of Fredericksburg's hazard mitigation plan, ten nor'easters have impacted the surrounding area, dating back to January 1772. Several recent events include winter of 1995/1996 and January 2000.

No previous damage history data has been recorded by UMW as a result of a Northeaster.

Potential Recurrence Intervals (Probabilities)

According to the George Washington Regional Commission Hazard Mitigation Plan, the frequency of major northeasters has increased in recent years. In the period 1987 to 1993, at least one class four or five storm has occurred each year along the Atlantic seaboard of the United States, a situation duplicated only once in the last 50 years.[57]

4.7.8 Earthquake (Limited)

Earthquake was added to the HIRA during the 2013 plan update kick-off meeting.

Hazard Description

The Unites States Geological Survey (USGS) Earthquake Hazards Program defines earthquake as a sudden slip on a fault and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth. Earthquakes can result from a multitude of events including crustal strain, volcanism, landslides, or the collapse of caverns. The most severe damage from an earthquake can result in loss of life, injuries and billions of dollars in property and infrastructure damage.

The majority of property damage and deaths tend to be associated with the failure and collapse of structures due to ground shaking. The level of damage oftentimes depends on the intensity and duration of the shaking, which are directly related to the size of the earthquake, fault distance, and surrounding geology. As with most other hazards, associated events such as landslides can have damaging effects.

Most earthquakes occur at the boundaries where the Earth's irregularly shaped tectonic plates meet. The majority of earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's other crust. These fault planes are typically found along borders of the Earth's ten tectonic plates. There are three types of plate boundaries: spreading zones, transform faults, and subduction zones. The North American and Eurasian plates are part of a spreading zone along the mid-Atlantic ocean ridge. While earthquakes occurring in the mid-Atlantic ridge tend to pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast.

The severity of an earthquake can be expressed using several terms. The magnitude, usually expressed by the Richter Scale, is a measure of the amplitude of the seismic waves. The moment magnitude of an earthquake is a measure of the amount of energy released. The intensity is expressed by the Modified Mercali Scale and is a subjective measure that describes how strong a shock was felt at a particular location. Both scales are described in Table 4-26.

Table 4-26. Modified Mercali Intensity Scale for Earthquakes.

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<5.4

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent peak ground acceleration (%PGA), over a specified period of years. The severity of earthquakes is site specific and influenced by proximity to the earthquake epicenter and soil type, among other factors. Figure 4-6 below shows the PGA with a 2% probability of exceedance in 50 years for the Commonwealth. The City of Fredericksburg is located in an area of moderate risk, with a PGA of 6 to 10%g.

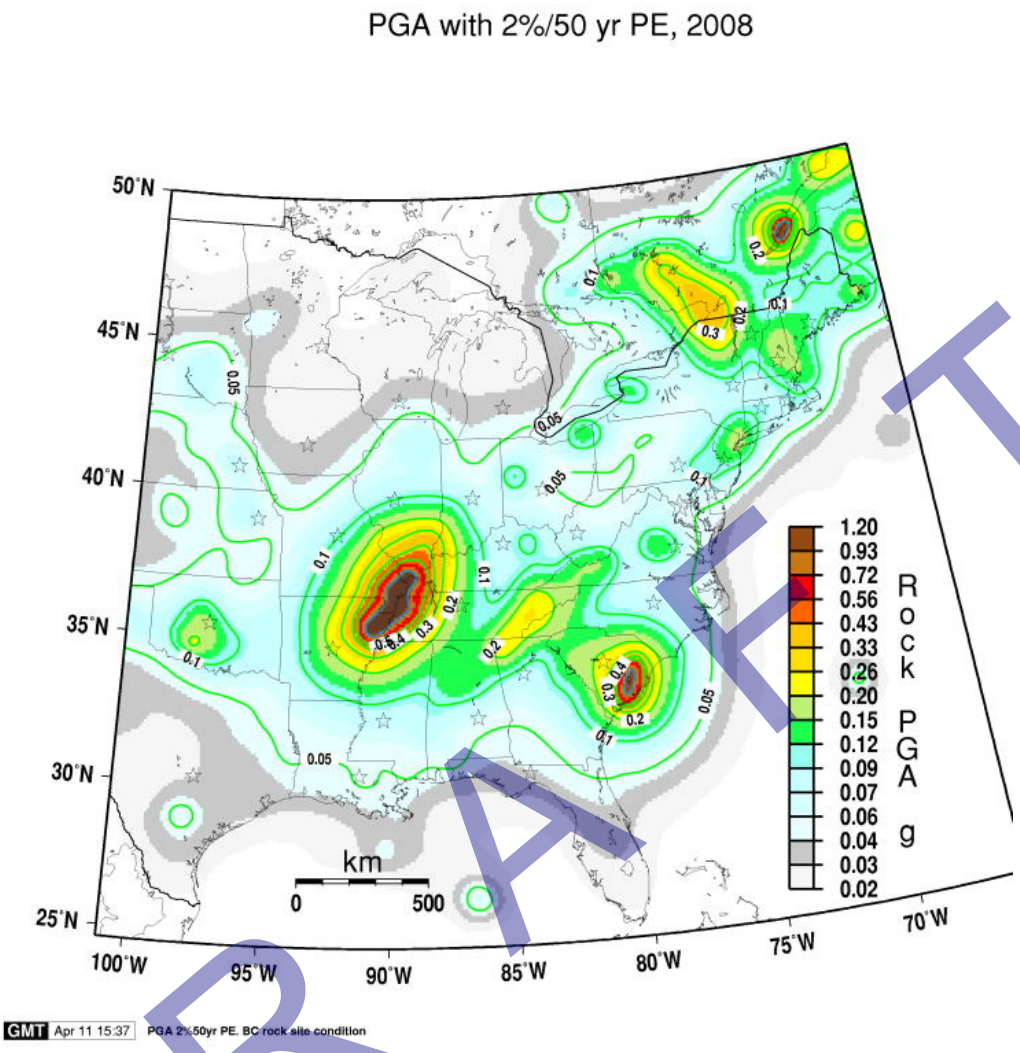


Figure 4-6. Earthquake Peak Acceleration for Virginia.[58]

Earthquakes, although not frequently occurring, are a hazard to the University, as experienced in August 2011. It is advised to drop to the ground, cover your head, crawl under a table if possible, and hold on to a sturdy object (such as a table) during an earthquake. Persons outside during an earthquake risk injury from falling debris from buildings, thus the drop, cover, and hold on practice is advised.

The impact of earthquakes to UMW is limited. With previous earthquake events causing minimal damage to the University, one would expect future events to be relatively minor.

Hazard History

In 1886, one of the largest earthquakes ever to hit the Southeastern United States rocked Charleston, South Carolina killing 60 people. The magnitude was 7.3, unlike any other in the region. Extensive damage was reported from the quake as far away as Ohio and West Virginia.[59] The crust of the Earth is stronger in the eastern part of the country and therefore shock waves moving away from the

epicenter do not lose much energy.[60] This allows a larger geographical area to be affected by the earthquake. If an earthquake near or above a 7.3 magnitude was to occur in South Carolina today along this interpolate, extensive damage even as far north as Virginia, would be possible.

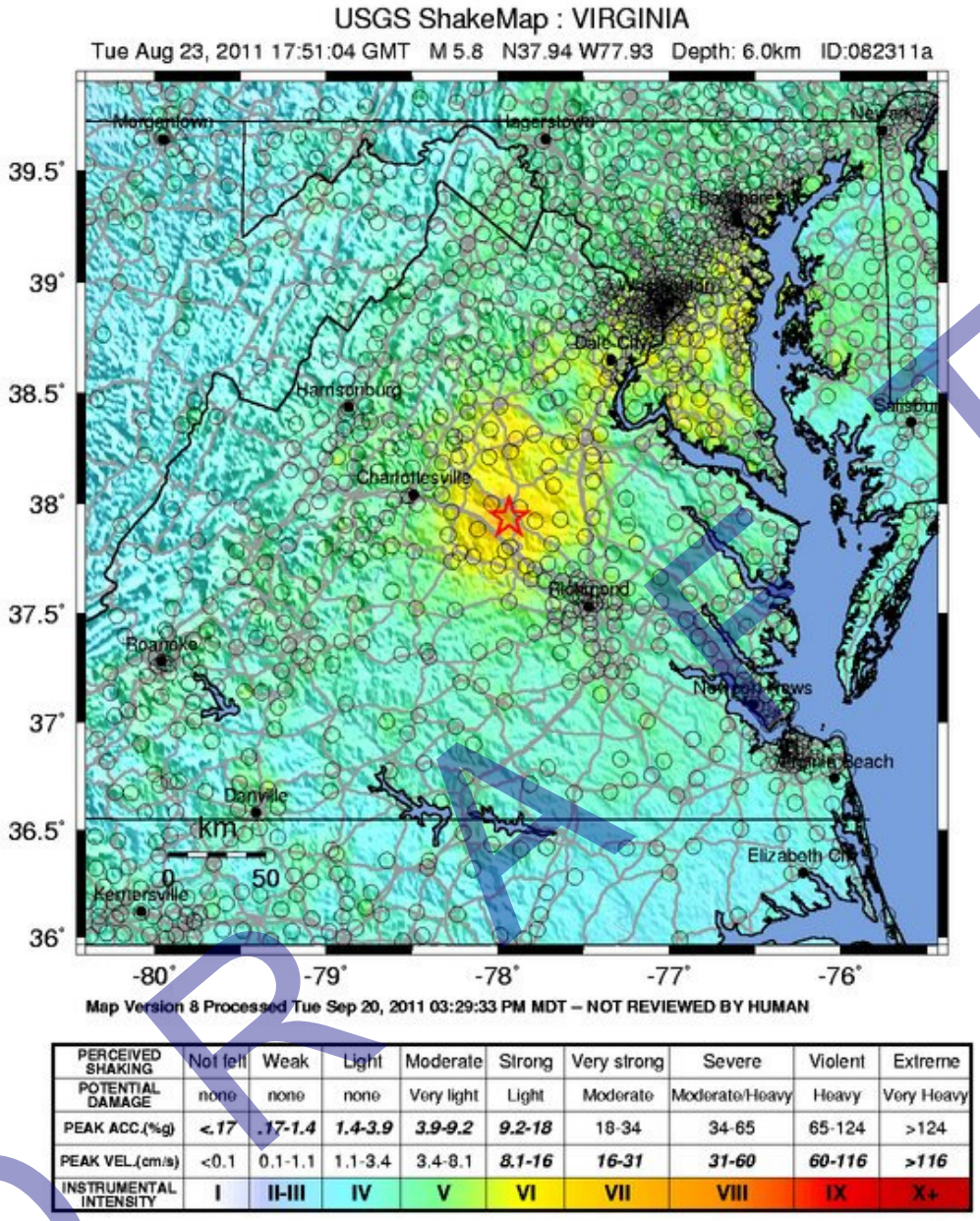
A 5.8 magnitude quake centered near Mineral, VA occurred on August 23, 2011. Aftershocks were felt for several hours after the main shock. The earthquake was reportedly felt as far north as Boston, as far south as Georgia and as far west as Chicago. Effects of the earthquake were reported to the USGS through its online survey from over 8,434 zip codes, and ranged from weak intensity to very strong (Figure 4-7). In terms of damage, particularly hard-hit were brick and unreinforced structures and infrastructure near the quake's epicenter. In addition to cracks and buckling, some buildings were knocked off of their foundations. Minor injuries were reported as a result of the damage and debris. The earthquake forced the North Anna Power Station nuclear power plant offline pending an all-clear from a Nuclear Regulatory Commission review. Aftershocks of a lesser magnitude continued to plague the area for several weeks after the event. The strongest aftershock measured 4.5 on August 25, 2011.

The City of Fredericksburg, about 37 miles northeast of the epicenter, experienced damages from the August 23, 2011, event. A gas leak in the city resulted in the evacuation of homes and businesses; damages to houses, businesses, churches, and public buildings were estimated around $711,000. City-owned buildings affected include City Museum (Old Town Hall), Circuit and General District courthouses, police headquarters, the Visitor Center, Fire Station 1, City Hall, Bass Ellison building, FRED Transit, the Old Stone Warehouse and Central Rappahannock Regional Library. Campus was evacuated directly following this event and the buildings were inspected for damage. [61, 62]

Table 4-27 shows the report of loss ($385,113.14) to State-Owned property due to the August 23, 2011 earthquake. Initial damage assessments were in excess of $700,000. The loss estimate shown in the table below includes $136,582.52 in damages to the chimney and parapets in Monroe Hall and $83,225.11 in open and exposed cracks and water damages in Goolrick Hall.

Table 4-27. Damage History due to Earthquakes (through 11/2012).

Loss Date	Description	Damage Amounts
8/23/2011	5.8 magnitude Earthquake with epicenter in Louisa County. Includes Fredericksburg and Stafford campuses.	$385,113.14



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 4-7. USGS Shake Map of August 23, 2011 earthquake with epicenter in Louisa County, VA.

Potential Recurrence Intervals (Probabilities)

According to the USGS, since at least 1774, people in central Virginia have felt small earthquakes and suffered damages from infrequent larger ones. The largest damaging earthquake occurred in 1897 and was a magnitude 5.8. Smaller earthquakes that cause little or no damage are felt every several years.[63]

With infrequent earthquake occurrence during the past 100 years, there is a low probability of severe earthquake damage occurring in the future.

4.8 HUMAN-CAUSED HAZARDS

The UAC and the Commonwealth of Virginia understand that the classification of the human-caused hazards is unique. Building fire, hazardous materials release, and crime can occur by accident, intentionally (i.e. criminally), or as an act of terrorism. For example, a building fire may occur as a result of a natural gas leak or by arson; crime may be intentional or occur out of negligence; and a hazardous materials release may occur as a criminal or terrorist act, but may also occur as an accident in laboratories or as the result of a traffic accident.

The human-caused hazards included in this plan are shown in Table 4-28 and an example of how each can be either the result of an accident, crime or an act of terror follows. Please note that many other examples may qualify, these examples are not exhaustive of all possible causes of these human-caused hazards applicable to UMW.

Table 4-28. Human-caused Hazard Examples.

Hazard	Accident	Crime	Terrorism
Building Fire	Natural gas leak	Intentional arson to building	Intentional arson to building
Hazardous Materials Release	Traffic incident or chemical laboratory spill	Illegal dumping	Intentional biological, radiological, or chemical release
Crime	An action committed out of negligence	Any illegal action intentionally committed to cause harm	Any illegal action intentionally committed to cause harm
Terrorism	Unintended collateral effects of a terrorist act; fire, hazard release	Campus shooting incident bomb threats	A domestic or international terrorist act, intentional food poisoning, etc.

4.8.1 Arson/Building Fire (Significant)

Hazard Description

As previously explained, building fires may be accidental or intentional. Generally, intentional fires can be classified as arson. The State of Virginia defines arson as an act of unlawful and intentional damage, or attempt to damage, any real or personal property by fire or incendiary device. In 2011, there were 1,167 arson incidents reported by the Virginia State Police in its annual crime report. The arson incidents resulted in a total property loss of more than $12 million. The value of property burned, including incidental damage resulting from fighting the fire, is reported in the value of the property loss. [64]

Ignition sources include:

- Heat from fuel-fired, fuel-powered object (e.g., heat, spark, ember, or flame from equipment);
- Heat from electrical equipment arcing, overloaded (e.g., short circuit arc, fluorescent light ballast);
- Heat from smoking material (e.g., cigarette);
- Heat from open flame, spark (e.g., lighter, candle);
- Heat from hot object (e.g., electric lamp, spark from friction);
- Heat from explosive, fireworks (e.g., fireworks, incendiary device);
- Heat from natural source (e.g., lightning);
- Heat spreading from another hostile fire (exposure) (e.g., radiated heat, direct flame);
- Other.[65]

The Code of Virginia mandates annual inspections for all student residence facilities (dormitories) owned, leased, or otherwise operated by a State college or University §36-139.3. These inspections are conducted annually by the State Fire Marshal's Office.[66]

A National Fire Protection Association report states that there were an estimated 3,840 annual average reported fires in dormitory properties based on data from 2005 through 2009. The fires caused three civilian deaths, 38 civilian injuries and $20.9 million in estimated direct property damage. Dormitories include school, college and University dormitories; nurses' quarters; convent, monastery and other religious dormitories; and bunk houses and worker's barracks. The number of dormitory fires increased 17% from 3,200 in 1980 to 3,740 in 2009.from 2,300 to 2,700 from 1982 through 1995, and then declined further in 1996 to 1998. Estimates rapidly increased after 1998, until becoming somewhat more stable in recent years. The increase in recent years is likely affected by the change in reporting, which allows for easier reporting of certain kinds of fires, notably confined cooking fires, which are quite common in this occupancy type (78% of all fires). [67]

Two-thirds (65%) of fires in dormitories began in the kitchen or cooking area. Nine percent of fires started in the bedroom, but these fires were responsible for 22% of injuries. Common places fires start are in bathrooms, locker rooms, hallways or corridors, and in common areas.[68]

According to the United States Fire Administration, there are many factors that can contribute to the problem of dormitory housing fires. These factors are:

- Improper use of 911 notification systems delays emergency response.
- Student apathy is prevalent. Many are unaware that fire is a risk or threat in the environment.
- Evacuation efforts are hindered since fire alarms are often ignored.
- Building evacuations are delayed due to lack of preparation and preplanning.
- Vandalized and improperly maintained smoke alarms and fire alarm systems inhibit early detection of fires.
- Misuse of cooking appliances, overloaded electrical circuits and extension cords increase the risk of fires.[69]

Accident. UMW may always be vulnerable to accidental building fires. However, mitigation activities such as installing and regularly testing smoke alarms and sprinkler systems may help to reduce their severity. Particular attention should be paid to high-occupancy areas (such as dormitories, cafeterias, student commons, etc.), and areas that contain flammable or incendiary materials (laboratories, chemical storage facilities, libraries, etc.).

Crime. The vulnerability of building fires as a result of criminal activity could include but not be limited to: acts of vandalism, illicit substance use, malicious or intentional acts, and rioting.

Terrorism. Building fires may occur as a result of a terrorist act. For example, the use of an Improvised Explosive Device (IED) in an enclosed space (such as a cafeteria or common area) that is purposefully designed and detonated to inflict human fatalities could lead to the immediate area catching fire. The use of and regular maintenance of smoke detectors, sprinkler systems, and an effective Fire and Rescue Department may help to reduce the potential impact of such an occurrence.

Hazard History

UMW campus police crime statistics (Table 4-40) indicates there were 3 on-campus arson events in 2011.

A fire broke out in one room of Mason Hall on November 9, 2012, as a result of a malfunctioning one cup type coffee maker. No one was injured from the fire but approximately 159 students were evacuated from Mason Hall.[70] The November 9, 2012, fire in Mason Hall resulted in $90,000 damages, mostly sustained by activation of the sprinkler system. Table 4-29 shows dollar losses due to building fire.

Table 4-29. Damage History due to Building Fire (through 11/2012).

Loss Date	Description	Damage Amounts
11/9/2012	Mason Hall dormitory fire	$90,000

Potential Recurrence Intervals (Probabilities)

Building fire is relatively unpredictable. Given the number of people on the University campus at any one time and the likelihood for accidental fire, the potential for a building fire in the future highlights the need for a regular preventative maintenance program. Such programs ensure that UMW facilities are in the best possible condition, thereby reducing the opportunity for fires to occur. In addition, arson cannot completely be excluded from any campus.

Hazard Evaluation

Dewberry performed an identification of building fire hazards for all buildings and facilities at the UMW campus. This involved an analysis of five technical parameters listed below:

1. Fire Protection
2. Construction Type
3. Exterior Construction Type
4. Roof Type
5. Contents Type

Data was collected during the 2007 and 2012 site visits. A detailed description of each building and the hazard parameters used in the analysis along with tables listing their associated parameters are provided in Appendix A.

Most buildings on campus have both a fire alarm and sprinkler system, or at a minimum a fire alarm in place. Only one building had no alarm or sprinkler system. The majority of buildings on campus are built with wood framing (classified as a high hazard) but do have a brick exterior, which was classified as a medium-low hazard. With respect to roof type, most buildings have tar and gravel or composition shingle roofing, which was classified as a medium-high hazard. Finally, two buildings have flammable or hazardous materials stored within them resulting in a categorization of high for content type.

Hazard Index

The Hazard Index provides an indication of which campus buildings have the greatest potential for damage. Table 4-30 summarizes the High and Medium-High Hazard Index scores for building fire. Anne Fairfax House and Hamlet House have been elevated from Medium-High to High for the Hazard Index while Belmont Main House was reassessed as Medium-High. Six buildings remained as Medium-High, seven were elevated to Medium-High. Russell Hall was updated to Medium-High from Medium-Low. It should be noted that the Belmont Garage, Smokehouse and Stables are historic structures that were renovated in 2010. These structures were built in a manner to preserve their historic value but do not contain habitable space and are never occupied. The Belmont Gift Shop was similarly renovated and built but does contain some modern fire safety measures.

Table 4-30. Building Fire Hazard Index for High and Medium-High Risk Buildings.

Building Name	2008 Hazard Index	2013 Hazard Index
Anne Fairfax House	Medium-High	High
Hamlet House	Medium-High	High
Belmont Garage	Not Included	High

Building Name	2008 Hazard Index	2013 Hazard Index
Belmont Gift Shop	Not Included	High
Belmont Smokehouse	Not Included	High
Belmont Stables	Not Included	High
Belmont Cow Barn	Not Included	Medium-High
Belmont Main House	High	Medium-High
Cornell House	Medium-High	Medium-High
Dolly Madison Hall	Medium-High	Medium-High
Heating Plant	Medium	Medium-High
Jefferson Hall	Medium	Medium-High
Marshall Hall	Medium	Medium-High
Mary Ball Hall	Medium	Medium-High
Mary Custis Hall	Medium	Medium-High
Physical Plant Building	Medium-High	Medium-High
Russell Hall	Medium-Low	Medium-High
Tyler House	Medium-High	Medium-High
Westmoreland Hall	Medium	Medium-High
William Anderson Center	Not Included	Medium-High
1104 College Ave Residence	Medium-High	Medium-High
1206 College Ave Residence	Medium-High	Medium-High

It should be noted that the building rankings from 2008 changed as a result of newly available content value information for the 2013 plan update. Buildings that were previously ranked as High or Medium-High that have changed are shown in Table 4-31. Since the previous plan, the James Monroe Museum roof was renovated from asbestos shingles to metal. This renovation, coupled with the upgrade to the fire protection system, resulted in a reassignment from Medium-High to Medium-Low. Appendix B includes the building specific worksheets and additional information on the Medium, Medium-Low, and Low Hazard Index buildings.

Table 4-31. Building Fire Hazard Index Re-Assessment for Building Rankings.

Building Name	2008 Hazard Index	2013 Hazard Index
Annex A - Admissions	Medium-High	Medium
Annex B - Bookstore	Medium-High	Medium
Brompton Guest House #1	Medium-High	Medium
Brompton Guest House #2	Medium-High	Medium
Brompton House	Medium-High	Medium
University Apartments	Medium-High	Medium
James Monroe Museum	Medium-High	Medium-Low

Appendix C includes the Building Fire Hazard Index map for UMW superimposed on an aerial photograph of the campus. High risk buildings are identified in red followed by Medium-High risk

buildings in orange. Medium risk buildings are highlighted in yellow while Medium-Low and Low risk buildings are represented by shades of green.

Vulnerability Index

The Vulnerability Index provides an indication of which buildings stand to suffer the greatest potential losses due to a particular hazard event. The impact from building fire to UMW is very high. Fires can not only cause extensive damages to property but can also cause loss of life, especially when occurring during the night.

Table 4-32 summarizes the High and Medium-High Vulnerability Index buildings. Belmont Main House remains a High vulnerability. James Monroe Museum was elevated from Medium-High to High. Five buildings remained Medium-High while George Washington Hall was reassessed as Medium-High. Belmont Studio Building was determined to be a Medium-High vulnerability in 2013 as a result of the updated contents value. Eagle Landing is new to this risk assessment and has been included as High. Appendix B includes the building specific worksheets and additional information on the Medium, Medium-Low, and Low Hazard Index buildings. Appendix C includes the building fire Vulnerability Index map.

Table 4-32. Building Fire Vulnerability Assessment for High and Medium-High Risk Buildings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Belmont Main House	High	High
James Monroe Museum	Medium-High	High
Anne Fairfax House	Medium-High	Medium-High
Belmont Studio Building	Low	Medium-High
Brompton Guest House #1	Medium-High	Medium-High
Brompton House	Medium-High	Medium-High
George Washington Hall	High	Medium-High
Jepson Alumni Executive Center	Medium-High	Medium-High
1206 College Ave Residence	Medium-High	Medium-High

It should be noted that the building rankings from 2008 changed as a result of newly available content value information for the 2013 plan update. Buildings that were previously ranked as High or Medium-High that have changed are shown in Table 4-33.

Table 4-33. Building Fire Vulnerability Re-Assessment of Building Rankings.

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Chandler Hall	High	Medium
Combs Hall	High	Medium
Monroe Hall	High	Medium
Hamlet House	Medium-High	Medium
Lee Hall	Medium-High	Medium
Mary Ball Hall	Medium-High	Medium
Marye House	Medium-High	Medium

Building Name	2008 Vulnerability Index	2013 Vulnerability Index
Tyler House	Medium-High	Medium

Mitigation Priorities

The Hazard Index and the Vulnerability Index building ratings feed directly into the Mitigation Priorities. These facilities are generally well suited for cost-effective mitigation to reduce potential building damage and business interruption costs. Table 4-34 highlights the Mitigation Priorities for High and Medium-High risk buildings. This table also compares the 2008 and 2013 assessments. As shown in the table, Anne Fairfax House, Hamlet House, and 1206 College Avenue remained the same as in 2008. Belmont Main House was reassessed as Medium-High as a result of the Hazard Index rating decreasing due to suppression type re-categorization. Eagle Landing and several Belmont Estate buildings are new in the 2013 risk assessment.

The list of Mitigation Priorities was considered as a starting point for discussion of mitigation strategies. It is important to note that campus needs and capabilities as well as the hazard identification and risk assessment play an essential role in establishing Mitigation Priorities.

For buildings ranked as High or Medium-High Mitigation Priority for any hazard, a building-specific analysis was conducted to identify vulnerabilities and recommended mitigation measures. These building data sheets can be found in Appendix B. Appendix C includes the fire hazard Mitigation Priorities map for the UMW campus.

Table 4-34. Building Fire Mitigation Priorities for High and Medium-High Risk Buildings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Anne Fairfax House	Medium-High	Medium-High
Belmont Main House	High	Medium-High
Hamlet House	Medium-High	Medium-High
Eagle Landing	Not Included	Medium-High
Belmont Gift Shop	Not Included	Medium-High
Belmont Smokehouse	Not Included	Medium-High
Belmont Stables	Not Included	Medium-High
Belmont Main House	High	Medium-High
1206 College Ave Residence	Medium-High	Medium-High

It should be noted that the building rankings from 2008 changed as a result of newly available content value information for the 2013 plan update. Buildings that were previously ranked as High or Medium-High that have changed are shown in Table 4-35. The reassignments are attributed to the updated contents information and the upgraded fire protection of a fire alarm and sprinkler system.

Table 4-35. Building Fire Mitigation Priorities Re-Assessment for Building Rankings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Brompton Guest House #1	Medium-High	Medium
Brompton House	Medium-High	Medium

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
James Monroe Museum	Medium-High	Medium
Tyler House	Medium-High	Medium
Chandler Hall	Medium-High	Medium-Low
George Washington Hall	Medium-High	Medium-Low

4.8.2 Hazardous Materials Release (Moderate)

Hazard Description

Hazardous materials (HazMat) can include explosive, flammable, combustible, corrosive, oxidizing, toxic, infectious and radioactive materials that are involved in an accidental or intentional release causing danger to the general public. However, a spill still can be deemed hazardous if benign materials or non-toxic materials cause a hazard to those in the immediate area. Hazardous material events also can be caused by natural hazards such as hurricanes and floods.

A hazardous materials release may come from either fixed facilities or mobile containers. The duration of such events can last for hours or even days. Chemicals may be corrosive or otherwise damaging over time and fire and/or explosion may occur. In addition, contamination may be carried out of the incident area by persons, vehicles, water, or wind.

The magnitude of a hazardous materials event is directly related to the type and amount of materials released and the speed and efficiency of which emergency and clean-up crews respond. Another important factor is in what form the spill occurs. Solid state spills are typically the easiest to clean-up and control, followed by liquid spills and then gaseous state spills. Liquid state spills require rapid response if they are to be contained and if they infiltrate a watershed, steps must be taken to monitor the influence downstream. Gaseous state spills are almost impossible to contain and depending on the volume, usually require evacuations down wind.

According to the United States Department of Transportation, highway incidents were responsible for 86 percent of the total hazardous material spills in the United States between 2003 and 2012. Damages from highway incidents alone accounted for over $568 million over that period of time.[71]

Interstate 95 runs approximately 3 miles to the southeast of the Stafford Campus and approximately 3 miles to the northwest of the main campus and is a major transportation route for trucks carrying hazardous materials. There is a railroad line to the southeast of the campus. This railroad line serves Amtrak as well as commercial purpose trains including CSX.[72] While no incidents have been reported to have affected UMW, the risk is present.

Accident. The possibility of an accidental hazardous materials incident cannot be discounted. Regular training, thorough safety and inventory control procedures, coordination with local and State emergency response officials, and strict adherence to applicable local, State and Federal laws governing the acquisition, handling, use, and disposal of such materials may lessen the potential, frequency, and impact of such an incident.

Crime. The presence of hazardous materials on or near UMW campus raises the possibility of a hazardous materials release occurring as the result of criminal activity. A comprehensive inventory system, coupled with enhanced security procedures governing the acquisition, storage, use, and disposal of such materials could reduce the likelihood of a hazardous materials incident caused by criminal activity.

Terrorism. A hazardous materials release occurring as a result of terrorism is a possibility. The implementation of a comprehensive inventory system, coupled with enhanced security procedures governing the acquisition, storage, use, and disposal of these materials may reduce the likelihood of a hazardous materials incident caused by terrorist activity.

Hazard History

No data was available to suggest that a major hazardous materials release has impacted UMW. As noted above, the National Response Center's database did not contain any information regarding spills in the vicinity of the University. There are two facilities (Chesapeake Wood Treating Company and Insteel Wire Products) are within the UMW zip code that have submitted information to the U.S. Environmental Protection Agency's Toxic Release Inventory (TRI). All of these facilities are part of a dataset that includes identification information for all facilities, in a specific state, that have ever reported to TRI.[73]

No additional damage history data was available as a result of hazardous materials release.

Potential Recurrence Intervals (Probabilities)

There is no established methodology for determining the probability of a hazardous materials release. Given the presence of hazardous materials and that there have been minor incidents involving hazardous materials in the past at UMW, there is potential for a hazardous materials release in the future.

Hazard Evaluation

An evaluation of the hazardous materials release hazard was performed for all buildings and facilities at the UMW campus and involved an analysis of the five technical parameters listed below:

1. Hazard Zone
2. Lab Access Control
3. Lab Response Capabilities
4. HVAC Type
5. Damage History

Data was collected during the 2007 and 2012 site visits. A detailed description of each building and the hazard parameters used in the analysis along with tables listing their associated parameters are provided in Appendix A. The parameters with the largest influence on the hazard identification outcomes were hazard zone and hazard history. One building on campus had a minimal hazardous materials incident in the past.

Two buildings were given a High hazard level for hazard zone, denoting that it had both High quantities of hazardous materials and a High potential for spread. In terms of response capabilities, one building has some capability to respond to an incident within the building.

Hazard Index

The Hazard Index provides an indication of which campus buildings have the greatest potential for damage. Table 4-36 includes the HazMat Hazard Index for the High and Medium-High ranked buildings. The Heating Plant remains as a High Hazard Index for hazardous materials release. The Jepson Science Center remained as Medium-High hazard level.

Table 4-36. HazMat Hazard Index for High and Medium-High Risk Buildings.

Building Name	2008 Hazard Index	2013 Hazard Index
Heating Plant	High	High
Jepson Science Center	Medium-High	Medium-High

The 2013 Hazard Identification and Risk Assessment drastically revised the formula for calculating the ranking system for Hazardous Materials. This was done on in order to better reflect actual risk posed by this hazard. The formula includes risk scores for criteria such as: lab access control measures, lab response capabilities, and Heating and Ventilation/Air Conditioning Systems. These criteria assume that the structure actually contain a chemical lab or other hazardous materials, and previously contained no option for "Not Applicable" where no lab was present. As a result many of the rankings were artificially inflated. The 2013 rankings now provide a more realistic assessment of the risk posed by hazardous materials. It should be noted, however, this change did not significantly affect the High and Medium-High Hazard Rankings.

Appendix C includes the Hazardous Materials (HazMat) Release Hazard Index map for UMW superimposed on an aerial photograph of the campus. High risk buildings are identified in red followed by Medium-High risk buildings in orange. Medium risk buildings are highlighted in yellow while Medium-Low and Low risk buildings are represented by shades of green.

Vulnerability Index

The impact of a hazardous materials release is relatively moderate to UMW. Hazardous materials can quickly contaminate the soil, water, and air. With time being of the essence during a hazardous materials release, preparation and first response is of utmost importance. To be able to correctly identify vulnerability, structures without HVAC systems received a Not Applicable ranking for this category (see Appendix B).

The Heating Plant and Jepson Science Center were evaluated as having High HazMat vulnerability (Table 4-37). Five buildings remain the same as in 2008 with a Medium-High ranking.

Table 4-37. HazMat Vulnerability Assessment for High and Medium-High Risk Buildings.

Building Name	2008 Vulnerability Assessment	2013 Vulnerability Assessment
Heating Plant	High	High
Jepson Science Center	High	High
Anne Fairfax House	Medium-High	Medium-High
Jepson Alumni Executive Center	Medium-High	Medium-High

Building Name	2008 Vulnerability Assessment	2013 Vulnerability Assessment
Monroe Hall	Medium-High	Medium-High
Physical Plant Building	Medium-High	Medium-High
Seacobeck Hall	Medium-High	Medium-High

The 2013 Hazard Identification and Risk Assessment drastically revised the formula for calculating ranking system for Hazardous Materials. This was done on in order to better reflect actual risk posed by this hazard. The formula includes risk scores for criteria such as: lab access control measures, lab response capabilities, and heating and ventilation/air conditioning systems. These criteria assume that the structure actually contain a chemical lab or other Hazardous Materials, and previously contained no option for "Not Applicable" where no lab was present. As a result, many of the rankings were artificially inflated. The 2013 rankings now provide a more realistic assessment of the risk posed by hazardous materials. It should be noted, however, this change did not significantly affect the High and Medium-High Hazard Rankings.

Appendix B includes the results of the hazardous materials release vulnerability analysis for UMW based on the methodology described previously. Appendix C contains the HazMat Vulnerability Index map.

Mitigation Priorities

The Hazard Index and the Vulnerability Index building ratings feed directly into the Mitigation Priorities. These facilities are generally well suited for cost-effective mitigation to reduce potential building damage and business interruption costs. As shown in Table 4-38, there are two High Mitigation Priorities for hazardous materials release.

Table 4-38. HazMat Mitigation Priorities for High and Medium-High risk buildings.

Building Name	2008 Mitigation Priority	2013 Mitigation Priority
Heating Plant	High	High
Jepson Science Center	High	High

The list of Mitigation Priorities was considered as a starting point for discussion of mitigation strategies. It is important to note that campus needs and capabilities as well as the hazard identification and risk assessment play an essential role in establishing Mitigation Priorities.

For buildings ranked as High or Medium-High Mitigation Priority for any hazard, a building-specific analysis was conducted to identify vulnerabilities and recommended mitigation measures. These building data sheets can be found in Appendix B. Appendix C includes the hazardous materials release (HazMat) hazard Mitigation Priorities map for the UMW campus, developed through the methodology described previously.

It should be noted that the building rankings from 2008 changed as a result of the University providing specific content value information for the 2013 plan update. Buildings that were previously

ranked as High or Medium-High that have changed are shown in Table 4-39. The reassignments may be attributed in part to the updated contents information.

Table 4-39. HazMat Mitigation Priorities Re-Assessment for building rankings.

Building Name	2008 Mitigation Priorities	2013 Mitigation Priorities
Physical Plant Building	Medium-High	Medium
Anne Fairfax House	Medium-High	Medium-Low
Jepson Alumni Executive Center	Medium-High	Medium-Low
Monroe Hall	Medium-High	Medium-Low
Seacobeck Hall	Medium-High	Medium-Low

4.8.3 Crime (Moderate)

Hazard Description

Unfortunately, crime is an inevitable component of campus life. The April 16, 2007, Virginia Tech tragedy illustrates that no one campus community is immune from acts of crime, including crimes of unimaginable proportions. This horrific tragedy highlights the importance of being vigilant about our surroundings and having open lines of communication for all members of the campus community.

The University Police are assisted by and maintain close working relationships with surrounding police departments including the Virginia State Police, City of Fredericksburg Police and the Stafford and Spotsylvania County Sheriff's Offices.[74]

The impact of crime to UMW is moderate. UMW has a dedicated police force with jurisdiction over University-owned or controlled property including public sidewalks and streets immediately adjacent to University controlled property. University Police regularly patrol the streets, parking lots and grounds as well as make periodic foot patrols of the area around and inside buildings during each shift. The University Police also are responsible for maintaining order and security during all campus events including concerts, rallies and other hosted/sponsored events. University Police, however, do not patrol the Stafford campus.

Areas of concern include:

- Unsecured heating, ventilation, and air conditioning systems throughout campus.
- Access control of principle residence buildings on core campus.
- Academic buildings are generally keyed but are often open.
- *University Apartments:* Complex is adjacent to main campus but is located on a major thoroughfare, which reduces police "visibility" of the site.
- *Parking Decks:* Located in isolated area on edge of campus; blue lights are located throughout the structure but there is no closed circuit television (CCTV) system in place for monitoring.
- *Stafford Campus*: Potential target for terrorism due to glass front on Building #2 on a main highway. In addition, evening classes are held at the college but there is limited on-site security.
- *George Washington Hall*: Potential for computer/server data loss, theft, or interruption.

Hazard History

UMW is an open campus and there are times when crime and arrests take place. Table 4-40 shows the crime statistics for UMW according to the University Police Department.[75]

Data is also collected from the following University Departments: Athletics Department, EOAA Office, Office of Residence Life, Office of Judicial Affairs, Student Affairs, Student Activities, Psychological Services and Health Center. Data on offenses involving UMW students that occur within the City of Fredericksburg, but not on the UMW campus, are provided by the City of Fredericksburg Police Department.

Larceny, or theft, represents the majority of crime on campus, followed by forcible sex offenses. It should be noted that there have been no hate crimes reported on campus.

Table 4-40. Crime statistics on campus and/or in dormitories or residential properties.[76]

Category	2005	2009	2010	2011
Criminal Homicide	0	0	0	0
Negligent Manslaughter	0	0	0	0
Forcible Sex Offenses	5	6	1	4
Non-Forcible Sex Offenses	0	0	0	0
Robbery	0	0	0	1
Aggravated Assault	1	2	0	3
Burglary	3	3	2	1
Larceny	Unknown	62	79	82
Motor Vehicle Theft	Unknown	0	0	0
Arson	Unknown	0	1	3
Liquor Law Violation Arrest (Adult/Juvenile)	Unknown	3/0	0/0	2/0
Drug Related Violation Arrest (Adult/Juvenile)	Unknown	5/0	7/0	8/1
Weapons Possession Arrest (Adult/Juvenile)	Unknown	0/0	0/0	0/0
Public Intoxication Arrest (Adult/Juvenile)	Unknown	8/0	4/0	16/0
Driving Under the Influence Arrest (Adult/Juvenile)	Unknown	1/0	0/0	1/0

There is no record of damage history being filed for UMW as a result of damage from crime.

Potential Recurrence Intervals (Probabilities)

Crime is an inevitable component of campus life. Given the presence of a large residential population on campus, the potential for crime to continue in the future is high.

4.8.4 Terrorism (Limited)

In 2008 terrorism was ranked as moderate, in 2013 it was reassessed by the UAC as a limited concern.

Hazard Description

Terrorism is the use of violence or force against people, property, or the environment to achieve political or social change. Although a terrorist attack can take several forms, bombings are the most frequently used method. Other possibilities include the use of chemical, biological, radiological or nuclear weapons (chemical/biological/nuclear explosive attacks); the use of computer viruses and other attacks on information systems (cyber terrorism); and tactical assaults or sniper attacks with small arms or stand-off weapons from a remote location (armed attack). A terrorist attack could produce the following results:

- Large number of casualties and/or damage to buildings.
- Disruptions in services such as electricity, water supply, public transportation and communications.
- Local, state, and federal law enforcement involvement due to the criminal nature of the event.
- Emergency medical and mental health resources may be overwhelmed.
- Extensive media coverage and strong public fear can continue for a prolonged period.
- Workplaces and schools may be closed, and there may be restrictions on travel.
- Evacuation of areas may occur.
- Clean-up activities may take months.

Response to a terrorist incident may involve little or no warning and no immediate indicators of an exposure. Because the release of a chemical or biological agent may not be immediately apparent, emergency response personnel and caregivers may become casualties before the identification of the agent is made. Incidents could escalate quickly from one scene to multiple locations and jurisdictions. The site of a terrorist incident is a crime scene and it is important to consider the preservation of evidence.

Hazard History

No acts of terrorism are known to have impacted UMW or the City of Fredericksburg. UMW may have special events, such as graduation or concerts, on campus which may be considered a potential target of terrorism. Regular campus police activities and general awareness and knowledge of reporting procedures are valuable methods to recognizing and preventing any such acts.

There is no known damage due to terrorism.

Potential Recurrence Intervals (Probabilities)

There is no established methodology for determining the probability of terrorism.

4.9 RISK ASSESSMENT SUMMARY

The UAC identified hurricane/wind, severe thunderstorm and winter storm as the most significant natural hazards to consider in developing the Hazard Identification and Risk Assessment. This section provides a comparison of the building analysis for the high and medium-high risk buildings and summarizes the information presented in the hazard profiles above.

Comparing the High and Medium-High risk buildings by hazard allows for comprehensive mitigation strategy development. For example, Table 4-41 summarizes the scores for the Anne Fairfax House. Nine of the 12 indices are High or Medium-High for this building and would lend itself to an integrated migration strategy to address the factors that make the building vulnerable.

Table 4-41. Anne Fairfax House Building Analysis Comparison.

Indices	Wind	Flood	Building Fire	HazMat
Hazard Index	High	Medium	High	Low
Vulnerability Index	Medium	Medium-High	Medium-High	Medium-High
Mitigation Priorities	High	Medium-High	Medium-High	Medium-Low

Table 4-42 through Table 4-44 summarizes the buildings that have at least one high or medium-high rating for the given index. Buildings with the most High Hazard Index scores (Table 4-42) include Hamlet House and Anne Fairfax House. James Monroe Museum and Belmont Main House have three High Vulnerability Index scores (Table 4-43). Belmont Main House and Anne Fairfax House have one High and two Medium-High scores for Mitigation Priorities (Table 4-44).

Table 4-42. Overall Hazard Index for High and Medium-High Risk Buildings.

Building Name	Wind Hazard Index	Flood Hazard Index	Building Fire Hazard Index	HazMat Hazard Index
Anne Fairfax House	High	Medium	High	Low
Bell Tower	Low	Low	Medium-High	Low
Belmont Cowbarn	Medium	Medium-Low	Medium-High	Low
Belmont Garage	Medium-High	Low	High	Low
Belmont Gift Shop	Medium-High	Medium-Low	High	Low
Belmont Main House	Medium-Low	Medium	Medium-High	Low
Belmont Smokehouse	Medium-High	Medium-Low	High	Low
Belmont Stables	Medium-High	Medium-Low	High	Low
Brompton Guest House #1	Medium	Medium-High	Medium	Low
Cornell House	Medium	Medium-Low	Medium-High	Low
Dolly Madison Hall	Medium-Low	Medium-Low	Medium-High	Low
George Washington Hall	Medium-Low	Medium-High	Medium-Low	Low
Hamlet House	High	High	High	Low
Heating Plant	Low	Low	Medium-High	High

Building Name	Wind Hazard Index	Flood Hazard Index	Building Fire Hazard Index	HazMat Hazard Index
Jepson Science Center	Low	Medium-Low	Medium	Medium-High
Marshall Hall	Medium-Low	Medium	Medium-High	Low
Mary Ball Hall	Medium-Low	Low	Medium-High	Low
Mary Custis Hall	Medium-Low	Medium-Low	Medium-High	Low
Marye House	Medium-High	Medium	Medium	Low
Russell Hall	Medium	Medium	Medium-High	Low
Tyler House	Medium-High	Medium-High	Medium-High	Low
Westmoreland Hall	Medium-Low	Medium	Medium-High	Low
William Anderson Center	Low	Low	Medium-High	Low
1004 College Ave	Medium	High	Low	Low
1104 College Avenue (Alvey House)	Medium-High	High	Medium-High	Low
1201 Williams St	Medium-Low	Medium-High	Medium	Low
1206 College Ave	Medium-High	Medium-Low	Medium-High	Low

Table 4-43. Overall Vulnerability Index for High and Medium-High Risk Buildings.

Building Name	Wind Vulnerability Index	Flood Vulnerability Index	Building Fire Vulnerability Index	HazMat Vulnerability Index
Anne Fairfax House	Medium	Medium-High	Medium-High	Medium-High
Belmont Main House	High	High	High	Low
Belmont Studio Building	High	High	Medium-High	Low
Brompton Guest House #1	Medium	Medium-Low	Medium-High	Medium
Eagle Landing	Low	Medium	High	Medium-Low
Eagle Landing Pedestrian Bridge	High	Medium-High	Low	Low
Goolrick Recreational Storage Facility	High	Medium-Low	Low	Medium
Heating Plant	Medium-Low	Low	Medium-Low	High
James Monroe Museum	High	High	High	Medium
Jepson Science Center	Medium-Low	Medium	Medium-Low	High
Jepson Alumni Executive Center	Medium-Low	Medium-High	Medium-High	Medium-High
Monroe Hall	Medium-Low	Medium-Low	Medium	Medium-High
Stafford Campus (North Bldg)	Medium-Low	Medium-High	Medium-Low	Low
Stafford Campus (South Bldg)	Medium-Low	High	Medium-Low	Low
William Anderson Center	Low	High	Medium	Medium-Low
Ridderhof Martin Gallery	High	High	Medium	Low
1206 College Ave	Medium	Medium-Low	Medium-High	Medium-Low

Table 4-44. Overall Mitigation Priorities for High and Medium-High Risk Buildings.

Building Name	Wind Mitigation Priorities	Flood Mitigation Priorities	Building Fire Mitigation Priorities	HazMat Mitigation Priorities
Anne Fairfax House	High	Medium-High	Medium-High	Medium-Low
Belmont Main House	Medium-High	Medium-High	Medium-High	N/A
Belmont Garage	Medium-Low	Low	Medium-High	Low
Belmont Gift Shop	Medium-Low	Medium-Low	Medium-High	N/A
Belmont Smokehouse	Medium-Low	Low	Medium-High	N/A
Belmont Stables	Medium-Low	Low	Medium-High	Low
Eagle Landing	Low	Medium-Low	Medium High	Low
Framar House	Medium-High	Low	Medium-Low	Low
George Washington Hall	Low	Medium-High	Medium-Low	Low
Hamlet House	High	Medium	Medium-High	Low
Heating Plant	Low	Low	Medium-Low	High
James Monroe Museum	High	Medium-High	Medium	Low
Jepson Science Center	Low	Medium	Medium-Low	High
Ridderhof Martin Gallery	Medium-High	Medium	Medium-Low	N/A
1206 College Avenue	Medium-High	Medium-Low	Medium-High	Low

Chapter 6 of this plan documents the Mitigation Strategies for UMW. Appendices B and C contain all the accompanying building analysis and maps discussed in this section.

4.9.1 Hurricane/Wind Summary

The UMW main campus is approximately 150 miles from the Atlantic coastline. Expected wind speeds for the 100-year storm (1% chance of occurrence) are approximately 66 miles per hour or of tropical storm strength. These wind speeds are accounted for in the design and construction of campus buildings. Power outages and debris from trees are more likely impacts to UMW than major building damage. Since 2001, UMW has filed approximately $236,449 in insurance claims and/or total damages related to hurricanes/high winds. Of the total claims recorded, $147,166 was attributed to Hurricane Isabel in 2003 and over $88,000 is attributed to the derecho event from June 29, 2012.

4.9.2 Severe Thunderstorms Summary

Thunderstorms are likely to cause minimal disruption to UMW. Two claims were recorded for lightning strikes totaling $16,537 (2007 dollars) and one severe wind event in July 2010 resulting in $1,800 in damages with an estimated clean-up cost of over $5,000. Severe thunderstorms and associated lightning are likely to cause minimal disruption to daily activities; however, a storm may prompt the cancellation or postponement of a campus event. Communications systems have the possibility of being disrupted during storms; as shown during the July 2012 microburst.

4.9.3 Winter Storms Summary

The overall impacts of winter storms are expected to be minimal to UMW in terms of property damage and long-term effects. The majority of the impact is most likely to power distribution networks and utilities. As with any type of storm, a severe winter storm has the potential to close the University therefore impacting campus activities and services, including dining/food, and the educational process. Damage claims from the 2008 plan totaled $10,929 and included vehicle damages and employee injury. The February 5, 2010, event resulted in damages over $88 thousand to building interiors and exteriors.

4.9.4 Flood Summary

UMW is not located within any FEMA special flood hazard areas. Belmont Estate is located within close proximity to the 500-year flood boundary. Floods have and can be expected to occur on the Rappahannock River during all seasons of the year with mild to moderate flooding more prevalent in the spring; but these events have not affected UMW. The majority of flooding events are the result of heavy rainfall or tropical events.

4.9.5 Tornado Summary

Although tornados can produce substantial damage and have a high impact over the area of touchdown, the likelihood of one affecting UMW is Low. Only two tornadoes are on record in the City of Fredericksburg between 1950 and 2012. In 1999, an F1 tornado touched down and, in 2005, an F0 tornado touched down. In both occurrences, the major impacts were reported to be debris from downed trees and exterior building damage. No known tornado events are on record as directly affecting the UMW campus.

4.9.6 Arson/Building Fire Summary

Building fires are always a concern at universities due to the large residential population. In addition, research labs that use flammable or combustible materials also present a risk for fire. Most of the buildings at UMW have full or partial sprinkler system and/or fire alarms installed to reduce injury and property damage in the event of a building fire. The Mason Hall building fire in November 2012 resulted in $90,000 in damages to UMW.

4.9.7 Hazardous Materials Release Summary

No data was available to suggest that a major hazardous materials release has impacted UMW. A search of the National Response Center's database did not contain any information regarding spills in the vicinity of UMW. There are two facilities within the UMW (City of Fredericksburg) zip code that have submitted information to the U.S. Environmental Protection Agency's Toxic Release Inventory (TRI). All of the facilities showed to have submitted all required information and each facility has been researched and reconciled.

4.9.8 Crime Summary

Crime including sexual assault and theft are a much more likely event in the campus environment. UMW has a dedicated police force and regularly patrol streets, parking lots and the grounds via vehicle and foot patrol in an effort to reduce the potential for crime.

SECTION 5 CAPABILITY ASSESSMENT

Requirement §201.6(c)(3): *The plan shall include a mitigation strategy… based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

5.1 INTRODUCTION

A capability assessment evaluates the existing programs and resources in order to determine the extent of mitigation activities that are already in place, and helps to emphasize the potential for new strategies. Through a thorough review of UMW's financial resources, personnel expertise, and existing mitigation activities, planners can reach a better understanding of factors that may influence the University's ability to implement mitigation strategies that address the effects of the hazards identified in Section 4. This assessment includes a comprehensive assessment of:

- Administrative Capabilities
- Plan and Program Capabilities
- Fiscal Capabilities
- Regulatory Environment
- Community Interaction

This update involved a thorough review of each of the aforementioned areas. Revisions to the sections below include changes to the existing Administrative Offices where appropriate, faculty expertise, fiscal and budgetary standing, student body and enrollment, planning capabilities, etc. This assessment identified a significant increase in all areas of review, especially in the area of planning capabilities and emergency management.

5.2 ADMINISTRATIVE CAPABILITY

The 1,023 (Fall 2012) full- and part-time UMW employees represent significant University assets. Faculty, administrative offices, and academic departments contain a wealth of physical and metaphysical resources that contribute to the overall functioning, safety, and security of the University. This section reviews those resources to identify existing capabilities and potential champions of new mitigation strategies.

5.2.1 Administrative Offices

Responsibility for managing, securing, and organizing all of the University's activities belongs to 83 administrative departments and associations, and the 132 Administrative Faculty (Fall 2012) within UMW.[77] Many of these departments could potentially help develop, implement, and pioneer the execution of one or more mitigation strategies. Furthermore, several academic departments wield significant expertise in a variety of subject matters which could be useful in the implementation of these strategies.

In addition to the Administrative Faculty, UMW employs nearly 400 Classified staff, and 125 Wage staff. These personnel perform a wide variety of clerical, technical, maintenance, and other support activities to ensure the full function of UMW's programs and activities. They help maintain the University's infrastructure and support on-going programs. These personnel are spread out over a multitude of administrative agencies and departments. Table 5-1 lists those departments and agencies that could potentially address the effects of the hazards identified in Section 4.

Table 5-1: Departments and Agencies.

Department/Office	Key Responsibilities
Alumni Association	Provides a wealth of professional and academic expertise across a variety of subject matters. Provides the University with additional resources through fundraising and networking events.
Design Services	Graphic design for outreach materials.
Department of Emergency Management and Safety[78]	In 2006 Environment Health and Safety was moved from Facilities Services into a newly formed department of Public Safety which incorporated Police and Risk Management. This was once again reorganized into the stand-alone department of Emergency Management and Safety in 2012. The Department is responsible for the following: • Emergency Management • Life Safety • Occupational Safety • Access Control (Locksmith & Keyless Entry Services) • Environmental Health
Facility Services	Stewardship responsibility for maintenance and operations of the real property assets of UMW.
Information Technologies	Provides network and communications services for students, faculty and staff by maintaining the infrastructure, security, central systems equipment and email systems, ensuring consistent availability and reliability. Maintains UMW servers. Ensures network security.
Police Department	Provides a safe and secure living, working and learning environment to UMW students, employees and visitors.
University Advancement	Fundraising and alumni activities.
University Relations and Communications	Coordinates the institution's external and internal relations and communications programs. Maintains an advisory program and network for alerting the UMW community.

While the UMW Police Department has a limited number of personnel available to respond to incidents, the department, as well as the Office of Emergency Management is fully NIMS/ICS compliant and has established mutual aid agreements with other local first responders. These established relationships represent an understanding of the importance of interoperability and scalability of resources during times of crises, and provide the availability of additional resources should they be needed.

5.2.2 Academic Organization

University of Mary Washington's various academic departments employ nearly 250 faculty members in three academic colleges and three physical campuses, with over 20 individual academic departments. In addition to these full-time faculty members, UMW also employs 171 Adjunct Faculty and twelve Graduate Assistants[79]. These faculty members command an expertise in a wide array of subject matter areas. This knowledge and expertise could potentially assist UMW in implementing the Hazard Mitigation Plan. Key Departments are identified in Table 5-2.[80]

Table 5-2: Subject Matter Expertise.

College	Department
Arts and Science	Biological Sciences
Arts and Science	Chemistry
Arts and Science	Computer Science
Arts and Science	Economics
Arts and Science	Earth and Environmental Science
Arts and Science	Geography
Arts and Science	Historic Preservation, Department of / Center for
College of Business	Management and Marketing

5.2.3 Student Body

With over 4,000 undergraduate students and over 1,000 graduate students, the student body makes up an important part of the UMW community. Over 60% of the undergraduate population lives on campus, making them a potential resource for hazard mitigation with a vested interest in reducing their own vulnerability.

The UMW community is an active one; the students have created, organized, managed and maintained more than 100 student clubs and organizations. These student run clubs are made up of active members who are interested in their own personal growth, as well as contributing to the development and enhancement of their community. As such, they may be of potential benefit to the University's mitigation planning and implementation efforts. Some of the clubs that may help in the implementation of mitigation strategies are listed in Table 5-3.[81]

Table 5-3: Student Clubs.

Club	Description
Biology Club	A group that convenes to review biological topics and research.
The Bullet	UMW's student-run, award winning newspaper. Goal of The Bullet is to inform the UMW community of events and concerns.
Economics Club	Meets to discuss economics and economics related issues.
Finance Committee	Oversees the fair disbursement of funds to UMW recognized

Club	Description
	clubs and organizations.
Future Business Leaders of America (FMLA)	Forum for UMW's future business leaders to meet and engage on business related topics.
Geography Club	Resource for students in the study of geography.
Historic Preservation Club	For the study and implementation of activities related to historic preservation.
Student Government Association (SGA)	A forum where students bring their concerns about campus issues ranging from academics to safety.
WMWC Radio – 91.5	University's Radio Station. Broadcasting since 1949.

5.3 PLAN AND PROGRAM CAPABILITY

Since the development of the 2008 Hazard Mitigation Plan, the University has invested significantly in its emergency planning and preparedness programs. These programs have contributed significantly to the well being of community residents, employees and visitors, as well as enhancing the ability of UMW to respond to major events. This section represents the biggest changes in the University's capabilities.

5.3.1 University Plans and Programs

UMW's Office of Emergency Management and Safety maintains a number of plans designed to protect the UMW community and to mitigate potential hazards. Each plan addresses either known hazards or provides a general framework for responding to emergency situations.

Table 5-4: University Planning Capabilities.

Plan Name	Description
Asbestos Management Plan	Many of UMW's facilities are historic structures, and as such asbestos exists as a potential hazard. UMW has developed an Asbestos Management Plan to address and mitigate this hazard.
Continuity of Operations (COOP) Plan	UMW's COOP plan identifies the University's essential functions after an emergency and how these functions will remain operational. It also delineates a timeframe over which other operations will begin returning to service.
Emergency Operations Plan	UMW maintains an EOP as a means of identifying response procedures, identifying key personnel, and acting as a general guide to responding to major events.
General Safety Plan	Covers a wide array of potential hazards and identifies criteria to evaluate, as well as some basic response protocols.
Master Plan	A draft Master Plan was made public in April 2013. This document delineates planned projects to address the growth of the University in accordance with the identified goals in the Strategic Plan.

Emergency Operations Plan

The UMW Emergency Operations Plan is a detailed procedures-based plan to provide protection to the lives, property, and operations through effective use of available resources. The most recent update was adopted in February 2013.[82]

In general, the plan does not address overall preparedness or mitigation. What it does address are the response systems that have been put in place to address emergent disasters. It discusses the basic needs for responding to emergency situations, response components such as Emergency Support Functions (ESFs), coordinating entities, communications tactics, and guidelines for requesting needed staff and equipment. The plan also briefly addresses continuity of operations and recovery, detailing how the plan integrates other planning documents.

Additionally, the plan includes some situation-specific guidelines. The plan includes Shelter-in-Place procedures, Emergency Operations Center guidelines, general operations descriptions and definitions, primary and secondary locations, a staffing list, and equipment needs. The majority of the plan consists of specific flow charts to assist in the response to forty three of the most commonly encountered emergencies on campus. The flow charts include responding to environmental events, mechanical failures, inclement weather, violence, threats, and potential terrorist events. Reporting procedures and general guidance for situation/scene assessment are included for each of the described emergencies.

UMW Strategic Plan

UMW adopted its first official strategic plan in June 1985, and strategic planning has continued to take place at the institution since then. The most recent update was in November 2009. The Strategic Plan expresses institutional values, goals and objectives for grounding decisions, guiding resource allocations, directing efforts, and determining progress. Table 5-5 identifies those objectives that might be supported through mitigation related activities. [83]

Table 5-5: University Strategic Planning Objectives.

Number	Objective
Objective 2.E	Ensure that institutional facilities, buildings, and improvements to the campuses are designed to promote and enhance the quality of student life.
Objective 5.D	Ensure that all UMW campuses and physical facilities are planned, constructed, improved, and maintained to foster student and academic life and to support UMW's missions and goals.
Objective 5.E	Design, procure, install, and maintain a superior information and instructional technology infrastructure that supports all UMW organizational functions and provides the technology, tools, training, and user support that allows all members of the institution to use technology effectively and efficiently.
Objective 5.F	UMW will commit to sustainability, managing its resources to meet the social, economic, and environmental needs of the present without compromising the ability to meet the needs of future generations. Sustainability will be a strong component of our efforts to ensure that our students, faculty and staff take active responsibility for what they do and will be part of our "scholarship in action," fostering interdisciplinary studies, experiential and service learning, opportunities for research, professional development, and support of our region

Number	Objective
	and its environment.
Objective 6.A	Serve as a catalyst for regional collaboration and cohesion, and for identifying challenges and opportunities to enhance the connections, inclusion, and participatory engagement with and among members of the entire region.
Objective 7.B	Seek expanded state funding for capital projects and operating costs of new facilities coming online.
Objective 7.C	Develop a plan for internal reallocation of operating dollars in order to support priority projects in the strategic plan.
Objective 8.B	Actively recruit alumni to participate in University advisory, planning, and other groups, capitalizing on their expertise, involving them in the life of the University, and maintaining a strong, active relationship with the alumni as invested and on-going partners in the institution's identity and future.
Objective 8.D	In building the institution's image and identity, the following elements, at minimum, shall be considered: University website, admissions materials, media relations, campus signage, publications, career services, alumni relations, fundraising efforts, facilities (including all historic properties affiliated with UMW, faculty recognitions, educational innovation, bookstore merchandising, government relations, intercollegiate athletics, and external rankings; UMW will invest in staff and other internal resources as needed to support these initiatives.

UMW Information Technology Strategic Plan

In 2011, UMW developed a strategic plan specific to information technology. This plan was developed in order to identify the specific technological infrastructure needed to support the overall goals identified in the UMW 2009 Strategic Plan. Several of these goals may prove pertinent to the mitigation plan. Those objectives are identified in Table 5-6.[84]

Table 5-6: Information Technology Objectives.

Number	Objective
Objective 2.1	Maintain and Improve the Core Infrastructure.
Objective 2.3	Build and manage appropriate supporting infrastructure for the storage and operations of servers, applications and data.
Objective 5.1	Proactively protect university technology and data assets.

Maintenance Policies and Issues

The Facility Services Department is charged with the stewardship responsibility for maintenance and operations of real property assets of UMW. UMW uses a work order process to prioritize and implement maintenance activities. Any disaster, unusual occurrence, utility malfunction or equipment failure that presents an imminent danger to life, health or property is considered an emergency, requires immediate reporting to Facilities Services, and is addressed as soon as possible.

UMW is responsible for the maintenance and operation of approximately sixty buildings ranging in age from two years old to 250 years old. UMW has an ongoing process of prioritization and resource allocation in order to accomplish repair, replacement, or alteration of these facilities.

Two overarching conditions often limit UMW's efforts to address maintenance issues. According to the Facilities Services website:

> "The first is that as a state institution our physical plant operating budget is funded at less than 50% of recommended national standards based upon the aggregate size of our campus of 1.4 million square feet. Even without adjusting for inflation, the budgets for maintenance and operations have decreased over the last ten years. The University itself however has continued to grow in both size and number of students and faculty. This means that in any given year we lack both the staff and funds to keep up with normal annual maintenance… Much of our available budget becomes tagged to "fire fighting" and preventive maintenance suffers.
>
> "The second condition is the accumulation of 'deferred maintenance' across the years. This may be illustrated with the results of the previously mentioned exterior painting. We now are seeing the expected results – increased rotting of wood exterior elements that will be even more expensive to repair or replace. We often must postpone replacement of roofs, windows, floors… mechanical and electrical systems, and other building components."

Deferred maintenance can result in weakened building elements that could make the building vulnerable to damage from a natural hazard event, such as heavy rain or high winds. In addition, deferred maintenance can result in hazardous conditions that result in building fires, unsafe health conditions, and other forms of increased vulnerability.

Continuity of Operations (COOP) Plan

UMW maintains a Continuity of Operations plan first developed in June 2007. This plan enables the University to maintain essential functions of the institution for up to thirty days. All department faculty and staff are trained on COOP activation and the plans are available for their review.

The UMW Continuity of Operations is comprised of a Base Plan, as well as department specific plans. The Basic COOP Plan is intended to support those plans developed by departments to address emergency situations that cause a disruption to essential functions to their faculty, staff, students, and visitors. The organizational departments are covered by the Basic Plan are:

- Office of News and Public Information
- Emergency Management and Safety
- Human Resources
- Registrar
- Business Services
- Budget and Financial Analysis
- Dining Services
- Stafford Campus
- Facilities Services
- Residence Life
- Information Technologies

- Office of the President (division)
- Student Health Services

Each unit plan contains the following elements, which mirror the base plan:

- Alert and Notification
- Succession of Leadership and Delegation of Authorities
- Division Personnel
- Alternate Locations
- Essential Functions
- COOP Execution

The plans also include unit-specific risk mitigation recommendations. These recommendations generally deal with policy or procedures (e.g., staff training, documentation back-up) and not physical measures. Implementation of these recommendations will be included as appropriate in this mitigation plan.

UMW Emergency Notification Systems

UMW provides emergency alerts through its Emergency Alert Notification System (EANS) which is a service available to all of the UMW community, including parents. This system manages all emergency communication tools available to the UMW community.[85] In order to receive e-mail or text alerts, users must "opt-in" These systems include:

- Alert UMW (text messaging)
- Area Warning System (siren/speaker)
- Mass Emails and/or Website Postings
- Information Hotline (540-654-2424)

The system allows UMW to alert students, faculty, and staff about campus emergencies on both the Fredericksburg and Stafford campuses. The text alert system is compatible with cell phones, e-mail, pagers, smart-phone, and fax machines.[86]

The Area Warning system is located throughout all areas of the campus and is capable of broadcasting pre-programmed spoken messages, as well as sirens. It is intended to alert individuals who are outside of buildings or otherwise unable to receive other forms of emergency communication such as email, phone or the internal public address (PA) system.

EANS provides the capability of sending mass e-mails as to all users who have "opted-in". E-mail messages provided through EANS, though, are relatively short. In order to provide full details on emergency situations, closures or relocation of classes, etc., the e-mail system works in conjunction with the "campus advisories" webpage, as well as the "Information Hotline". These other tools provided added redundancy in the event that University Relations Staff do not have access to on-line systems.

Student Fire Marshals

Each residence hall at UMW has a designated Student Fire Marshal. This position is a Resident Assistant auxiliary position. Student Fire Marshals receive training in fire extinguisher use, evacuation procedure, fire safety awareness and fire alarm system operation. Duties include:

- Extinguisher Inspection
- Building/Room Inspection
- Fire Drills
- Information Resource

Training

The UMW Emergency Management and Safety Office provides a variety of training to its student staff, as well as to all regular employees. Training is provided for all staff whose duties require certifications in such areas as lock out/tag out, confined space entry, respiratory protection, blood borne pathogens, etc. These trainings are OSHA certified. All employees are required to attend annual training on a variety of safety topics including "Employee Right to Know", emergency evacuation, fire extinguisher usage, and asbestos awareness.

Additionally, training is provided each year for all new and returning student staff, HR/RA. Training includes fire safety, safe storage techniques, fire extinguisher training, and evacuation. Driver training is available for all UMW students wishing to drive State owned vehicles for college recognized events.

Asbestos Management Plan

Many of the UMW facilities were constructed prior to the realization that asbestos is carcinogenic. As such, UMW maintains a number of buildings that contain asbestos and has developed an Asbestos Management Plan. The plan describes what asbestos is, how it was used, and when it is potentially harmful.

According to the plan, asbestos is harmful when small dust particles are inhaled repeatedly over an extended period of time. This usually only occurs in environments where workers come into regular contact with asbestos, or where the asbestos itself is damaged and/or disturbed. Intact and undisturbed asbestos materials do not pose a health risk.

UMW is concerned about the health of its students. As such, UMW has developed this plan to monitor asbestos in all of its facilities, evaluate its quality and friability, and determine a course of action. In situations where asbestos is determined to be potentially harmful, this plan outlines a course of action for dealing with it, and for protecting the UMW community.

Safety Plan

The Office of Emergency Management and Safety maintains a general Safety Plan. This plan identifies potential hazards and risks that may be encountered on campus, as well as best practices for mitigating those risks. Each of the 21 chapters identifies a separate policy related to the protection of health and wellness of the UMW community.

5.3.2 Local Policies and Plans

George Washington Regional Commission Hazard Mitigation Plan

In March 2012, the George Washington Regional Commission completed the update to its Hazard Mitigation Plan. The City of Fredericksburg, Counties of Stafford, Spotsylvania, Caroline, and King George, and Towns of Bowling Green and Port Royal all participated in the development of the plan. UMW had an opportunity to comment on the plan during its development, however the plan does not specifically address risks to the University nor are there any mitigation actions that include UMW by name.

The plan states that, "Kenmore Avenue below the University of Mary Washington, also known as the Kenmore Bottom area, is prone to flash flood events. Residents within this area have noted basement flooding, impacts to the sanitary and storm sewer systems, and restricted access within the area due to flood waters overtopping roadways."

According to the original 2008 Hazard Mitigation Plan "a small portion of the University's campus is currently in a regulated floodplain". The revised Digital Flood Insurance Rate Map (DFIRM) was published in 2007. The new map shows that none of the University's property lies within the regulated floodplain. This does not eliminate UMW's flood risk. The revised DFIRM shows that UMW lies just a few blocks away from several different floodplains, and the 2013 Hazard Mitigation Plan Update identifies the need for additional flood protection.

Additionally, the recent earthquakes in Virginia generated interest in additional earthquake preparedness. The City of Fredericksburg has identified a mitigation strategy specifically geared toward earthquake mitigation.

Some of the mitigation strategies identified as relevant to UMW are identified in Table 5-7. These strategies may be useful to the UMW community in its engagement with the City of Fredericksburg.[87]

Table 5-7: City of Fredericksburg 2012 Mitigation Strategies.

ID	Project Description
CF1	Foster Interdepartmental relationships for hazard mitigation across the City.
CF2	Study the feasibility for construction of barriers or structures to reduce the impact of hazards/floods.
CF4	Develop an earthquake preparedness guide and distribute at local events (i.e. Fredericksburg Agricultural Fair).

5.3.3 Commonwealth of Virginia Policies and Plans

Commonwealth of Virginia Emergency Operations Plan (COVEOP)

Most recently updated in August, 2012, the Commonwealth of Virginia's Emergency Operations Plan "describes the concepts and structures of response and recovery operations, identifies agencies with essential (primary) and support emergency management functions, and defines emergency prevention, preparedness, response and recovery duties and responsibilities of local governments,

nongovernmental organizations (NGO), and private partner."[88] It serves as the Commonwealth's primary resource for predetermining response protocols and identifying agency responsibilities during times of crisis.

In addition to the Basic Plan, the COVEOP contains numerous additional annexes. Support Annexes include:

- Support Annex 1: Continuity of Government
- Support Annex 2: Recovery Programs
- Support Annex 3: Finance & Administration
- Support Annex 4: Mass Care & Sheltering
- Support Annex 5: Evacuation & Re-entry

Hazard Specific Annexes include:

- Radiological Emergency Response Plan
- Terrorism Consequence Management (secure)
- Hurricane & Tropical Storm Response
- Pandemic Influenza Response
- Hazardous Materials Response
- Technological Hazards Response (secure)

For the purposes of this Capabilities Assessment, only the Commonwealth's Standard Hazard Mitigation Plan has been reviewed.

COVEOP Support Annex 3: Standard Hazard Mitigation Plan

The Commonwealth of Virginia's most recent Standard Hazard Mitigation Plan was approved by FEMA in March 2010. Prior to the most recent update to the Commonwealth of Virginia Emergency Operations Plan (COVEOP), the Commonwealth's Hazard Mitigation Plan was incorporated as a Support Annex in the COVEOP. The August 2012 Update to the COVEOP removed the State Hazard Mitigation from the list of Support Annexes, and is no longer available online.

Chapter 6 of the plan outlines a three year process to engage all Virginia communities in hazard mitigation planning. According to the plan, 27 local plans have received FEMA approval, as well as eight disaster resistant universities.

A number of goals and objectives within the plan are relevant to UMW's mitigation plan. Table 5-8 outlines those.

Table 5-8: 2011 Commonwealth of Virginia Mitigation Goals and Objectives.

ID	Description
Goal 1	***Structural Mitigation Projects - Identify and Implement projects that will eliminate long-term risk, directly reducing impacts from hazards and maintain continuity of operations.***
Objective 1.1	Warning and Detection – Projects to include but not limited to river gauges, rain gauges, water quality gauges, security cameras, NOAA weather radios, tidal gauges, cameras, fire alarms and

ID	Description
	any other early warning/detection equipment.
Objective 1.2	Construct Hazard Resistant Buildings and Infrastructure – Projects that are constructed using hazard resistive methods including low hazard site selection.
Objective 1.3	Mitigation of Existing Facilities and Infrastructure – To include but not limited to modifying structures, installation of fire suppression systems; generator hook-ups; flood, wind, and seismic retrofitting; wastewater, storm water, and utility improvements.
Objective 1.4	Mitigation of Flood Prone Properties – To include but not limited to acquisition, elevation, relocation, and dry and wet floodproofing of flood prone structures.
Objective 1.5	Maintain functionality of emergency and communication systems and critical facilities – Projects to include but not limited to underground wiring, emergency backup generators/systems, reverse 911, interoperability of communication lines, security cameras to maintain redundancy.
Objective 1.6	Contract Development – To involve but not limited to debris removal/clearing, evacuation vehicles, sheltering, long term housing.
Goal 2	***Planning Projects – Incorporate mitigation concepts and objectives into existing and future policies, plans, regulations, and laws in the Commonwealth.***
Objective 2.1	Comprehensive State Plan Integration – To include state and local planning processes in which mitigation integration would be appropriate.
Objective 2.2	Disaster Resistant University Plans – To include universities wishing to develop or update their DRU plan
Objective 2.3	Evacuation Plans – To include state, regional, and local evacuation plan initiatives.
Objective 2.4	COOP Planning – To include COOP planning on a state, local, and university level.
Objective 2.5	New State Legislation and State Agency Policy – To include new legislation and policies regarding mitigation practices/methods.
Objective 2.6	Emergency Operations Plans – To include state agency, local government, university, and the Commonwealth Emergency Operations Plans.
Goal 3	***Hazard Identification and Risk Assessment – Improve quality of the data and analyses used in the hazard identification and risk assessment process.***
Objective 3.1	Accuracy and Completeness of Data – To include but not limited to improved hazard mapping, data collection sources, format of data, historical occurrences, geographical location, as well as state owned facility data.
Objective 3.2	State and Local Data Improvement – Improve the integration of local plans and the state plan by means of standardized forms and required fields.
Objective 3.3	Ongoing Data Collection – Including methods to keep hazard data current on a quarterly or semi-annual basis.
Goal 4	***Outreach and Education – Through training, education and outreach, promote awareness of hazards and potential mitigation strategies in order to increase resiliency.***
Objective 4.1	Target State Agencies, Universities, and Local Governments for Outreach and Education Materials.
Objective 4.2	Improve on Current and New Training Development
Objective 4.3	Develop Hazard Specific Awareness Campaign – To be based on need and the time of year, i.e. hurricane season, snowstorms in winter, tornados in spring.

The Commonwealth's 2010 Standard Hazard Mitigation Plan further identifies the criteria that the Commonwealth used in prioritizing mitigation strategies and projects. The mitigation strategy

development process will take these criteria – as well as the Commonwealth's goals and objectives – under consideration when identifying its own goals, objectives and strategies for UMW. The University, however, is not specifically addressed in the Commonwealth's Hazard Mitigation Plan.

Higher Education Opportunity Act (Restructuring)

In March 2010, Governor Robert McDonnell signed Executive Order No. 9, "Governor's Commission on Higher education Reform, Innovation and Investment". The formation of this commission led to *The Higher Education Opportunity Act*, passed in 2011. The act hopes to fuel economic growth through increased higher education throughout the commonwealth.

In order to achieve this, the Act established specific goals and strategies. These include both programmatic requirements, as well as financial incentives. Some of these include:

- *Calculation of State Share of Basic Operations and Instruction:* The Commonwealth will provide 67% of the projected basic operations and instructional costs from state General funds, calculated based on total student enrollment and faculty salaries.
- *Needs-based financial aid:* Each institution must develop a student financial aid program that assists students from both low-income and middle-income families.
- *Enrollment based funding per in-state-student:* The Commonwealth provides a per student financial incentive to institutions that have in-state students enrolled in certain degree programs.

These strategies hope to increase enrollment of Virginia Students, increase the number of undergraduate degrees, improve retention and graduation rates, and improve public-private collaboration.

In addition, each state funded institution must submit a six-year plan on odd years; on even years, they must submit an updated plan. These plans must address how the institution will manage its finances, provide financial aid, meet degree conferral targets, provide for year-round use of facilities and instructional resources, develop instructional resource sharing programs with other Commonwealth higher education institutions, and identify new programs or initiatives for quality improvement.[89]

Systemwide Strategic Plan for Higher Education in Virginia (2002)

Following a needs assessment, State Council of Higher Education for Virginia (SCHEV) developed a system-wide strategic plan. The plan noted that over half of Virginia's college buildings are more than fifty years old and are in need of repair or renovation. The total anticipated cost of these repairs or renovations was more than $1 billion. The plan also noted that system-wide, there was a $240 million shortfall in operating funds for Fiscal Year 2001 and a $342 million shortfall in Fiscal Year 2002. The plan outlined three goals, the first of which being "accommodate at least 61,000 additional students." In order to achieve this goal, the strategic plan stated that institutions needed to minimize deferred maintenance and provide world-class facilities as part of ensuring adequate operating and capital resources.

A status report was issued by the SCHEV in 2006. With respect to Goal 1, which is stated above, the Commonwealth's institutions enrolled over 49,000 additional students between Fall 2000 and Fall 2005. Clearly the universities are on target to meet this goal. Goal 2 was to "Increase Virginia's national standing in sponsored research." While all six research universities have increased the actual dollar amounts of research, only two have seen an increase in terms of national ranking; in addition, the Commonwealth remained ranked 37th for research expenditures per capita (though the per capita spending rose by $50).

Advancing Virginia: Access, Alignment, Investment. 2007-13 Strategic Plan for Higher Education in Virginia (2007)

In 2007, SCHEV developed a new Strategic Plan that built off the previous plan. The purpose of the 2007 strategic plan is to focus on statewide aspects of higher education that require coordination. The plan notes that current policy results in a "presumptive 67/33 split between enrollment-driven state support and tuition" that works well. The plan identifies twelve goals split between three areas: access, alignment and investment. None of the goals are directly, or even indirectly, supportive of hazard mitigation activities.

Crime Prevention through Environmental Design

The Crime Prevention through Environmental Design (CPTED) concept is based upon the theory that the proper design and effective use of the built environment can reduce crime, reduce the fear of crime, and improve the quality of life. The Commonwealth of Virginia has become a leader in the implementation of CPTED at the local level.

In 1992, the SCHEV Task Force on Campus Rape submitted its first report on sexual assault and rape on Virginia's campuses to the Governor and General Assembly. The report recommended that campuses should, "all campuses should incorporate crime prevention through environment design into the campus master plan and architectural design of new facilities and planned renovations."[61]

The *Governor's Crime Prevention Plan*, published in 1994, recommended that all master plans for state facilities include a CPTED component and that CPTED reviews should be included in the design and review of all new state buildings.[62]

In 2006, the Virginia Crime Commission published HJR 122 Final Report: Study on Campus Safety, which was required by House Joint Resolution (HJR) 122. Best Practice #2 states, "Colleges and universities should apply Crime Prevention through Environmental Design (CPTED) in planning and maintaining facilities and grounds." In addition, Best Practice #15 states "Each college and University should seek inclusion in regional disaster plans consistent with the National Incident Management System (NIMS) and other regional and local plans."63 HJR 122 also directed the commission to create the Office of Campus Policing and Security (OCPS), which will be responsible for establishing minimum standards for employment, job –entry and in-service training curricula, and certification requirements for campus security officers for all of Virginia's institutions of higher learning. OCPS also provides technical assistance to campus security departments on the establishment and implementation of policies and procedures, judicial referrals, the establishment

and management of databases for campus safety and security information sharing, and development of uniform record keeping for disciplinary records and statistics.

Threat Assessment Teams

State legislation § 23-9.2:10, "Violence prevention committee; threat assessment team", was passed in 2008 by the General Assembly. This law requires colleges and universities to implement Violence Prevention Committees and Threat Assessment Teams on their campuses. The UMW University Police operates a Threat Assessment Team. The Team "evaluates whether an individual poses a threat of violence to self or others, or exhibits significantly disruptive behavior or need for assistance." The Team has an established action plan in order to address the needs of the individual and the UMW community.

5.4 FISCAL CAPABILITY

The fiscal capabilities of the University represent the financial assets available to implement all of UMW's ongoing operations. This includes instructional activities, complex maintenance, administration, safety, research, etc. The financial resources of the University have seen regular growth since the original Hazard Mitigation Plan was written in 2008. This is due to variety of increased revenue seen in the form of: larger State appropriations (E&G), receipt of federal funds for fiscal years 2009 and 2010 under the American Reinvestment and Recovery Act (ARRA), increased enrollment, as well as increased tuition. Detailed revenue sources and allocations from the last three years, as well as the expected annual operating budget for Fiscal year 2012 are listed in Table 5-9 and Table 5-10.

State funds have continued to decrease since the original Hazard Mitigation Plan was developed, and now constitutes approximately 22% of the UMW annual budget. UMW has continued to seek out new funding opportunities to supplement these decreases. Sources of new funding include: alumni contributions, increased tuition fees, increased sales and services fees, contracting opportunities, etc.

Table 5-9: State Funding.[90]

Category	2009-2010	2010-2011	2011-2012	2012-2013
State General Funds	$23,484,537	$21,348,021	$21,120,740	$21,404,864

Table 5-10: Funding Allocations.[91]

Category	2009-2010	2010-2011	2011-2012	2012-2013
Instruction	$28,145,952	$26,190,946	$26,410,239	$27,141,717
Administration and Support	$21,085,577	$27,593,099	$23,996,485	$25,725,100
Auxiliary Services	$21,676,011	$21,025,911	$20,344,999	$22,192,750
Comprehensive Fees	$17,023,876	$19,437,060	$22,398,399	$24,755,601
Museums and Cultural Services	$971,344	$970,969	$970,969	$970,969
Dahlgren Education and Research Center	--	--	$1,250,000	$2,000,000
Total Annual Budget	$88,902,760	$95,217,985	$95,371,091	$99,786,137

5.5 REGULATORY ENVIRONMENT

5.5.1 Local

City of Fredericksburg Zoning Regulations

The City of Fredericksburg implements floodplain management regulations through its zoning ordinance. The zoning ordinance includes a floodplain overlay district, which applies to all areas subject to inundation by the 100-year flood as shown on the FEMA floodplain maps as well as other areas designated by the city council. The ordinance adopts the Flood Insurance Rate Map (FIRM) and the Flood Insurance Study (FIS) as the official boundaries for the floodplain, and limits development within those areas. By-right uses are restricted to agriculture, non-residential, recreational and parking. Other uses require a special use permit. The code states, "No special use permit shall be granted for a nonresidential structure unless adequate flood proofing to the level of the 100-year flood is provided in accordance with the Virginia Uniform Statewide Building Code."[92]

The Fredericksburg Campus is in compliance with these regulations and is located outside of the SFHA.

King George County Zoning Regulations

Appendix A, Article 9 of the King George County Zoning Commission addresses Floodplain Management Overlay District. This provision regulates use, activity and development in the floodplain in order to prevent loss of life and property, creation of health and safety hazards, disruption to community functions, expenditure of public funds, and impairment of the tax base. The ordinance adopts the Flood Insurance Rate Map (FIRM) and the Flood Insurance Study (FIS) as the official boundaries for the floodplain, and limits development within those areas. It adopts the 100 year floodplain boundary, determined by FEMA, as the political boundary known as the Special Flood hazard Area (SFHA).

Within the floodplain, no development, or improvement can be made without the issuance of a permit from the County, as well as other regulatory agencies (i.e. U.S. Army Corps of Engineers). Development undertaken within the floodplain is to be done in compliance with the provisions of the floodplain management ordinance, and other applicable codes (i.e. Virginia Uniform Statewide

Building Code). Such provisions include the minimum lowest floor elevation, floodproofing of non-residential structures, no adverse effect to the floodplain, etc. The ordinance also addresses requirements for mobile and manufactured homes.[93]

The Dahlgren Center, located in King George County, is in compliance with these regulations and is located outside of the SFHA. One of the several soils types at the campus is tidal marsh. By definition, tidal marshes are affected by the tidal movement of the adjacent water body. The Environmental Impact Report prepared by Williamsburg Environmental Group identified several intermittent tributaries near the site of the Dahlgren Center, which drain into Williams Creek and ultimately into to the Rappahannock River. The tributaries are classified as non-tidal, despite the soil classification.

Stafford County Zoning Regulations

Stafford County Zoning Regulation Chapter 28, Article IV, Section 28-57 – Flood Hazard Overlay District (FH) addresses floodplain management in the County. The ordinance adopts the Flood Insurance Rate Map (FIRM) and the Flood Insurance Study (FIS) as the official boundaries for the floodplain, and limits development within those areas. Development is allowed by permit only, and must meet all floodplain development criteria specified therein.[94]

UMW's two buildings located in Stafford County are both in compliance with these regulations and is located outside of the SFHA.

5.5.2 State

Floodplain Management Program for State Agencies (Executive Memorandum 2-97)

Governor George Allen issued Executive Memorandum 2-97 in 1997, which directed state agencies to comply with local floodplain management ordinances when undertaking any construction or land disturbing activity. The memorandum reinforces Section 10.1-603 of the Code of Virginia and 44 CFR Section 60.12, both of which require state agencies to comply with local floodplain regulations.

The memorandum requires, as a matter of policy, that new state-owned facilities not be built within a 100-year floodplain unless a variance is granted by the state building official (Director, Division of Engineering and Buildings, Department of General Services). Variances are granted if three conditions are met:

1. Reasonable or economically justified alternative does not exist,
2. The lowest floor of the new facility is elevated or flood proofed two feet above the base flood elevation, and
3. Reasonable access during flood events is demonstrated.

The Code of Virginia

Chapter 3.2 (Emergency Services and Disaster Law) of the Code of Virginia outlines the state's emergency management authorities and provides a broad outline of power, duties and responsibilities of state agencies and local government.

The code outlines the various responsibilities of the Virginia Department of Emergency Management, which include providing guidance and assistance to state agencies in developing emergency management and continuity of operations (COOP) plans (§ 44-146.18.B.7). In addition, the department is obligated to consult with the State Council of Higher Education in the development and revision of a model institutional crisis and emergency management plan (§ 44-146.18.B.12).

The code states that, as part of the powers and duties of political subdivisions, "the director of each local organization for emergency management may, in collaboration with (i) other public and private agencies within the Commonwealth… develop or cause to be developed mutual aid arrangements for reciprocal assistance in case of a disaster too great to be dealt with unassisted" (§ 44-146.19.D). This subsection clearly gives local governments the ability to enter into mutual aid agreements with state agencies such as UMW.

Under the code, the governor has the authority to expend funds to assist state agencies and local governments in meeting the financial obligations of an incident. The governor exercises this authority under his discretion, and it can only be executed if the governor has issued a Declaration of Emergency (§ 44-146.28).

Uniform Statewide Building Code

The Commonwealth of Virginia has mandated adoption of a Uniform Statewide Building Code by all local governments. The current version was most recently updated in 2009. The provisions of the code are based on nationally recognized International Code Commission standards with state amendments.[95] Construction undertaken by the University itself is subject to the USBC as implemented by the Bureau of Capital Outlay Management, Department of General Services.

Governor's Taskforce on School and Campus Safety (Executive Order 56)

In response to the Newtown, CT tragedy in December 2012, Governor Robert McDonnell issued Executive Order 56. This initiative aims to improve campus and school safety through the collaboration of leaders across both public and private institutions. Some of the membership of the taskforce includes: parents; elementary, high school, and college students; school faculty and administrators, Virginia Congressional Representatives; the Directors of the Department of Criminal Justice Services, Department of Juvenile Justice, and the Department of Emergency Management; Commissioner of the Department of Health and the Department of Behavioral Health and Developmental Services; the Superintendant of State Police; *et al.*

The taskforce has been given the responsibility of evaluating existing school safety and making recommendations. This includes evaluation of existing programs, suggestions on improving programs or resources, identification of needed improvements to school safety audits, make recommendations on safety policies and procedures, make recommendations on ways to address mental health, etc.

The Taskforce also includes the formation of a Mental Health Workgroup. This group is to be led by the Secretary of Health and Human Resources and will evaluate existing mental health systems. The workgroup is to coordinate with the Taskforce and make recommendations.[96]

Establishing Preparedness Initiatives in State Government (Executive Order 44)

Governor Tim Kaine issued Executive Order 44 on January 12, 2007. The order directs state agencies, including universities to "to include emergency preparedness planning, training and promotion as a core component of their mission."[97] In addition, it requires that state employees receive preparedness training as part of creating a culture of preparedness. The executive order also directs the Office of Veterans Affairs and Homeland Security, formerly the Office of Commonwealth Preparedness, to ensure that state agencies annually review and update their emergency operations plan. Finally, the executive order requires that agencies develop or update Continuity of Operations Plans by April 1 on an annual basis.

5.6 COMMUNITY INTERACTION

5.6.1 Interaction with Local Economy

UMW is the second largest employer in the City of Fredericksburg after the Mary Washington Healthcare facility. UMW nurtures a lively performing arts community, including theater and orchestra performances. It also attracts a multitude of professionals to the area; the city of Fredericksburg boasts a population with degrees in higher education double that of the national average.[98]

Additionally, the majority of undergraduate students reside at the Fredericksburg Campus, while the rest commute from around the area. This student population significantly contributes to the local economy and growth in the region.

SECTION 6 MITIGATION STRATEGY

Requirement §201.6(c)(3): *The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

Development of mitigation strategies is the result of the numerous steps already accomplished in the mitigation planning process. Each chapter prior to this one has supported the process to evaluate conditions that allow for sound decision making and investment of resources that will mitigate the effects of future hazard events. The steps that have been accomplished thus far include:

- Describe the problem (Hazard Identification);
- Estimate the impacts the problem could cause (Risk Assessment);
- Assess what safeguards currently exist and available resources for implementing new mitigation strategies (Capability Assessment)

Using this information, the UAC determined a range of strategies that could reduce impacts of a disaster, and select those actions that are appropriate for UMW. Deciding upon mitigation strategies, however, also involves its own several step process. These steps include:

- Setting Mitigation Goals (Section 6.3);
- Identifying Mitigation Actions; (Section 6.4)
- Prioritizing Mitigation Strategies (Section 6.5); and
- Developing a Mitigation Action Plan. (Section 6.6)

Each step of this process and their outcomes is documented in this chapter. Final mitigation strategies can be found in the detailed Action Plan at the end of this section.

6.1 MITIGATION GOALS, OBJECTIVES, AND STRATEGIES DEFINED

Development of specific, targeted, and strategic mitigation actions is the result of focused efforts to identify desired outcomes. This is accomplished by identifying intentions that are successively more definite, ultimately resulting in explicit and actionable strategies. Each strategy should support the identified objective, and each objective should support the goal. Together, each strategy should work together to help accomplish end goals.

Goals are general, long term accomplishments that would like to be achieved. Identifying goals allows planners to identify desired outcomes, thereby focusing objectives and strategies on ways to support that goal. For example, if a community's greatest threat is flooding, then a good mitigation goal would be to "reduce the cost of flooding events by 10% by 2015".

Objectives are slightly more focused and more definite than goals, but are not yet actionable. For example if the community would like to reduce the cost of flooding events, a good objective would be to "decrease susceptibility of flooding through structural projects".

Finally, strategies are specific and actionable tasks that support both the goals and objectives that have already been identified. These tasks should be Simple, Measurable, Achievable, Realistic, and Timely (SMART). They should provide tangible means of accomplishing goals. For example, a good mitigation strategy for the community that would like to decrease susceptibility to flooding through structural projects would be to "pursue the acquisition of flood prone homes in the community".

Mitigation goals and strategies can involve both structural and non-structural projects. The best time to incorporate structural mitigation activities is either directly after a disaster when additional repairs and construction must be done in response to the disaster, or when new construction is occurring. Structural mitigation activities are ideally incorporated into Capital Improvement Plans (CIP) or other developmental programs. For this reason, close collaboration between the mitigation planning team and other members of the UMW community is necessary. The principals of mitigation and long-term cost reduction should be incorporated into all of the University's long-term goals.

Alternatively, vulnerability can be reduced through additional planning and public outreach. These tasks are usually accomplishable in a much shorter time-frame and offer opportunities to reduce vulnerability at relatively low cost. These projects, however, require regular maintenance updates, and must be exercised frequently in order to remain useful. An example of non-structural mitigation projects might include planning evacuation routes, educating the public on preparedness activities, or working to receive the National Oceanic and Atmospheric Administration's (NOAA) "Storm Ready" certification.

6.2 Incorporating Goals for Mitigation into other Planning Documents

By setting mitigation goals, the UMW Community has demonstrated its commitment to protecting life and property on Campus. These goals, however, should not be relegated to this plan. The process of mitigation requires consistent efforts throughout all of the University's activities and decision making processes.

In order to truly apply a mitigation plan, the concepts and principals of mitigation need to be applied in all areas of UMW's development. This requires using prudent judgment and consideration of long-term consequences throughout all planning and decision making processes. In order to accomplish this, members of the UAC represent a wide swath of the UMW community. As such, members should take these concepts with them into their other affairs. Mitigation planning can only be promulgated if it is incorporated with all areas of UMW's growth. More detail on incorporating the mitigation plan into other plans is found in Section 7.

6.3 SETTING MITIGATION GOALS

Requirement §201.6(c)(3)(i): *[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

The UAC met on February 6, 2013, to discuss the results thus far in the planning process and to identify new goals, objectives, and strategies for the forthcoming planning period. At this meeting, members discussed the results of the planning process thus far, including the HIRA, identified vulnerabilities, and the Capability Assessment.

Section 4 of this plan provides details regarding the risks and vulnerabilities being faced by UMW. Wind, flood, building fire, and hazardous materials release were determined to be some of the highest risk hazards; detailed assessments of each of the UMW buildings and facilities was conducted to evaluate the structure's risk and vulnerability to some hazards. It also used a weighted formula to assess which structures would be most important to mitigate against each of the hazards. In all, three indexes were developed: hazard index, vulnerability index, and mitigation priorities index. Below are some of the results from the mitigation priorities listed in Section 4:

- three structures ranked high as a mitigation priority for Wind
- two structures ranked high as a mitigation priority for HazMat Release
- four structures ranked medium-high as a mitigation priority for Wind
- four structures ranked medium-high as a mitigation priority for Flood
- nine structures ranked medium-high as a mitigation priority for Building Fire
- one structure ranked medium-high as a mitigation priority for HazMat Release

One particular building, the Anne Fairfax House, stood out from this assessment, as it had high or medium-high ranking for nine of the twelve indices. As a result, this building received special consideration during the mitigation strategies development process.

In addition to the new data acquired in this planning process, the UAC reviewed the mitigation goals from the 2008 UMW Hazard Mitigation Plan, the Commonwealth of Virginia's 2010 Hazard Mitigation Plan, and the 2012 George Washington Regional Commission's (GWRC; which includes the City of Fredericksburg) Hazard Mitigation Plan. Additionally, Committee members reviewed mitigation goals, objectives and strategies from other local, regional, and state plans across the eastern seaboard. This review served to provide the Committee members with context regarding the goals of neighboring communities, as well as a historical backdrop for the previous plan's desired accomplishments. Finally, the committee also discussed accomplishments achieved throughout the previous planning cycle in order to identify how previous accomplishments have reduced UMW's vulnerability.

Table 6-1 identifies the mitigation goals from the 2008 UMW Hazard Mitigation Plan, the 2010 Commonwealth of Virginia Hazard Mitigation Plan, and the 2012 GWRC Hazard Mitigation Plan.

Table 6-1: Mitigation Goals Reviewed by the University Advisory Committee.

ID	Description
	UMW 2008 Mitigation Goals
Goal 1	Ensure that the University's mission of teaching, research and public service is maintained in the event of a natural or human-caused disaster.
Goal 2	Minimize impacts to health and life safety from human-caused or natural hazards.
Goal 3	Integrate mitigation principles into University decision-making and ensure risk reduction strategies are integral to future planning, policy and practice.
Goal 4	Increase participation in regional hazard mitigation planning
Goal 5	Minimize the impact of human-caused or natural hazards.
Goal 6	Ensure continuity of the University operations.
Goal 7	Increase the protection of existing facilities and infrastructure from hazard threats through retrofit projects.
Goal 8	Protect University assets and critical infrastructure including utilities infrastructure, communication systems, information technology systems and research facilities.
	Commonwealth of Virginia Mitigation Goals
Goal 1	Structural Mitigation Projects - Identify and Implement projects that will eliminate long-term risk, directly reducing impacts from hazards and maintain continuity of operations.
Goal 2	Planning Projects – Incorporate mitigation concepts and objectives into existing and future policies, plans, regulations, and laws in the Commonwealth.
Goal 3	Hazard Identification and Risk Assessment – Improve quality of the data and analyses used in the hazard identification and risk assessment process.
Goal 4	Outreach and Education – Through training, education and outreach, promote awareness of hazards and potential mitigation strategies in order to increase resiliency.
	GWRC Mitigation Goals
Goal 1	Reduce the future impacts and losses from identified hazards.
Goal 2	Educate and engage the public regarding hazards, their impacts, and feasible actions.
Goal 3	Maximize the impact of public resources through effective coordination among agencies and the efficient use of technology.
Goal 4	Improve and enhance emergency management capabilities.

After discussing the results of the capability assessment, HIRA, and the mitigation goals of other mitigation planning documents, the UAC developed the new mitigation goals for the 2013 Updated Plan. The new goals are listed in Table 6-2. The 2013 goals are very similar to the 2008 goals, with the only change being the elimination of the 2008 goal #5. It was determined that this goal was redundant with goal #1.

Table 6-2: UMW 2013 Mitigation Goals.

ID	Description
Goal 1	Ensure that the University's mission of teaching, research and public service is maintained in the event of a natural or human-caused disaster.
Goal 2	Minimize impacts to health and life safety from human-caused or natural hazards.
Goal 3	Integrate mitigation principles into University decision-making and ensure risk reduction strategies are integral to future planning, policy and practice.

ID	Description
Goal 4	Increase participation in regional hazard mitigation planning
Goal 5	Ensure continuity of the University operations.
Goal 6	Increase the protection of existing facilities and infrastructure from hazard threats through retrofit projects.
Goal 7	Protect University assets and critical infrastructure including utilities infrastructure, communication systems, information technology systems and research facilities.

6.4 IDENTIFYING MITIGATION ACTIONS

At its February 6, 2013, meeting, the UAC was provided with an overview of the types of mitigation actions that could be undertaken. The committee then was provided a range of potential mitigation actions specific to the University's vulnerabilities and capabilities. The committee reviewed the list and refined it further based on their knowledge of the University. In addition, the committee added a number of mitigation actions not previously included on the list. The full list, with associated rankings, is provided in Table 6-4.

In addition to the meeting on February 6, 2013 the UAC further refined these strategies and identified details required for implementation via email. For more information on this process please refer to Section 2.2 of this plan for more information.

Below is some of the material that was considered by the Committee. This material includes types of mitigation actions recommended by the Emergency Management Accreditation Program (EMAP), as well as broad categories of mitigation actions. EMAP recommended mitigation action types include:

1. The use of applicable building construction standards;
2. Hazard avoidance through appropriate land-use practices;
3. Relocation, retrofitting, or removal of structures at risk;
4. Removal or elimination of the hazard;
5. Reduction or limitation of the amount or size of the hazard;
6. Segregation of the hazard from that which is to be protected;
7. Modification of the basic characteristics of the hazard;
8. Control of the rate of release of the hazard;
9. Provision of protective systems or equipment for both cyber or physical risks;
10. Establishment of hazard warning and communication procedures; and
11. Redundancy or duplication of essential personnel, critical systems, equipment, information materials.

All activities considered by the Committee can be classified under one of the following six (6) broad categories of mitigation techniques:

6.4.1 Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Shoreline / riverine / fault zone setbacks

6.4.2 Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

6.4.3 Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes and sand dunes. Parks, recreation or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Beach and dune preservation
- Riparian buffers
- Forest/vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Erosion and sediment control
- Wetland preservation and restoration

- Habitat preservation
- Slope stabilization

6.4.4 Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls / seawalls
- Diversions / detention / retention
- Channel modification
- Beach nourishment
- Storm sewers

6.4.5 Emergency Services

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

6.4.6 Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions

6.5 PRIORITIZING ALTERNATIVES

As with the identification of the 2008 mitigation strategies, the UAC used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to select and prioritize the most appropriate mitigation alternatives for UMW. This methodology requires that social, technical, administrative, political, legal, economic and environmental considerations be taken into account when reviewing potential actions for the area's jurisdictions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on UMW's capabilities. Table 6-3, below, provides information regarding the review and selection criteria for alternatives.

Table 6-3: STAPLE/E Mitigation Strategy Review and Selection Criteria.

Social
• Is the proposed action socially acceptable to the University and surrounding community? • Are there equity issues involved that would mean that one segment of the University and/or community is treated unfairly? • Will the action cause social disruption?
Technical
• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other University goals?
Administrative
• Can the University implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political
• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal
• Is the University authorized to implement the proposed action? • Are there legal side effects? Could the activity be construed as a taking? • Will the University be liable for action or lack of action? • Will the activity be challenged?
Economic
• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit and private)? • How will this action affect the fiscal capability of the University? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity?

• Does the action contribute to other University goals? • What benefits will the action provide?
Environmental
• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to the identified hazards. The committee used a voting process to prioritize the mitigation strategies based on the criteria described above. Actions were assigned a ranking of high, medium or low, with the following general meanings:

- High (H) – implement in the short-term;
- Medium (M) – implement in the long-term;
- Low (L) – implement only as funding becomes available.

6.6 MITIGATION ACTION PLAN

As discussed above, mitigation strategies were developed at the Committee meeting on February 6, 2013. These strategies were further refined over two conference calls following this meeting. These calls refined the language used for identifying the strategies in the action plan below, as well as identified target dates for completion, interim measures of success, agencies responsible for overseeing the implementation of the strategy, potential funding sources, and priority level.

Additionally, some strategies were determined to be an ongoing effort from the previous planning period. For this reason, the second column identifies the year in which the strategy was developed. Strategies that were brought forward from the previous plan are listed first, using the original strategy ID, and are identified as "2008" under the column titled "Year"; strategies that were developed for this Plan Update are listed second and are identified as "2013" under the column titled "Year".

The detailed action plan can be found in Table 6-4.

Table 6-4: Mitigation Action Plan.

ID	Strategy Description	Priority	Responsible Agency	Funding Source	Interim Measure of Success	Target Completion Date	Hazards Being Mitigated											
							Hurricane/Wind	Thunderstorms	Winter Storms	Flood	Tornado	Drought	Northeasters	Earthquake	Arson/Building Fire	Hazardous Materials Release	Crime	Terrorism
Goal 1: Ensure that the University's mission of teaching, research and public service is maintained in the event of a natural or human-caused disaster.																		
2008-14	Implement centralized access system for all university facilities.	M	Facilities Services	Capital Outlay Funding	Determine costs and resources needed for implementation; prioritize those facilities to receive system first.	2016	X	X	X	X	X	X	X	X	X	X	X	X
2008-21	Implement a training and exercise program to address potential natural and man-made hazards as identified in the Risk Assessment portion of this plan.	M	Emergency Management and Safety	Emergency Management and Safety Department	Identify training and exercises to be completed and develop a training and exercise schedule.	2017	X	X	X	X	X	X	X	X	X	X	X	X
2013-4	Improve electronic and mechanical access systems for all University Facilities including all academic, administrative and residential facilities.	H	Emergency Management and Safety	Capital Outlay	Identify and prioritize structures for improvement.	2017									X	X	X	X
Goal 2: Minimize impacts to health and life safety from human-caused or natural hazards.																		
2008-9	Establish or update mutual aid agreements with out-of-area campuses. Activities to be included in the mutual aid agreements may be sheltering of students, and/or provision of instructional space.	M	Emergency Management and Safety	Emergency Management and Safety Department Budget	Identify and prioritize neighboring jurisdictions and POCs to establish mutual aid agreements with.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2008-18	Install closed circuit television monitoring system.	M	Facilities Services	Capital Outlay Funding	Identify and prioritize which areas should have monitoring systems.	2017	X	X	X	X	X	X	X	X	X	X	X	X
2008-23	Host public events at University of Mary Washington that emphasize safety and disaster preparedness.	L	Emergency Management and Safety	Emergency Management and Safety Department	Develop pamphlets and brochures to be distributed and develop event schedule.	2016	X	X	X	X	X	X	X	X	X	X	X	X
2008-26	Work with faculty to integrate disaster-resistant concepts into curricula in relevant disciplines at the University. Identify and implement service-learning opportunities in emergency management for students.	L	Emergency Management and Safety	Emergency Management and Safety Department	Identify which disciplines most appropriate for integration and types of service-learning opportunities available.	2017	X	X	X	X	X	X	X	X	X	X	X	X
2013-5	Evaluate potential for outdoor lighting in order to improve safety on campus in the areas of Simpson Library, Sunken Road, Fine Arts Complex, and at Battleground Athletics Complex.	M	Emergency Management and Safety; Facilities Services	Maintenance Reserve	Secure resources and develop specific project work plan.	2017									X	X	X	X
2013-7	Consider sustainability and vulnerability to hazards of Hamlet, Tyler, and Fairfax. Consider reappropriation of property for new structures noted in Master Plan.	M	Facilities Services	Capital Outlay	Evaluate structures and determine specific deficiencies.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2013-10	Improve capabilities for mass care and sheltering operations.	H	Emergency Management and Safety	Capital Outlay	Identify specific projects for development.	2018	X	X	X	X	X	X	X	X	X	X	X	X

ID	Strategy Description	Priority	Responsible Agency	Funding Source	Interim Measure of Success	Target Completion Date	Hazards Being Mitigated										
							Hurricane/Wind	Thunderstorms	Winter Storms	Flood	Tornado	Drought	Northeasters	Earthquake	Arson/Building Fire	Hazardous Materials Release	Crime	Terrorism
Goal 3: Integrate mitigation principles into University decision-making and ensure risk reduction strategies are integral to future planning, policy and practice.																	
2008-1	Communicate/educate campus community and stakeholders on existing emergency operations planning (i.e. shelter-in-place and warning systems), to include desktop alert providing emergency communications in classrooms, administrative spaces and common areas.	H	Emergency Management and Safety	Emergency Management and Safety Department Budget	Determine specific tools to be utilized and determine costs to University.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2008-15	Create an orientation and awareness program on natural and human-caused hazards for new students, faculty and staff.	M	Emergency Management and Safety	Capital Outlay	Draft material to be included in a handout or pamphlet for distribution.	2016	X	X	X	X	X	X	X	X	X	X	X	X
2008-19	Take into consideration areas at risk for natural and human-caused hazards when selecting new construction sites.	M	Facilities Services	Capital Outlay	Review UMW Master plan and assess potential new construction possibilities.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2008-22	Conduct outreach and training for decision-makers on natural and human-caused hazards.	M	Emergency Management and Safety	Emergency Management and Safety Department Budget	Develop presentation materials and an outreach and training schedule.	2016	X	X	X	X	X	X	X	X	X	X	X	X
2013-11	Consider risks posed by drought hazards upon development of a University Arboretum.	M	Facilities Services	Maintenance Reserve	Meet with appropriate University personnel responsible for project design to discuss design considerations	2014						X						
Goal 4: Increase participation in regional hazard mitigation planning.																	
2008-17	Maintain the planning committee established for the hazard mitigation plan. Broaden responsibilities to include all stages of emergency management (i.e., preparedness, response, recovery, and mitigation).	M	Emergency Management and Safety; Facilities Services	Emergency Management and Safety Department Budget	Identify the specific aspects of responsibilities to be included.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2013-1	Add additional emergency management staffing capabilities that will be responsible for managing emergency planning operations, including mitigation plans.	H	Emergency Management and Safety	Budget Amended	Work with budgeting personnel to secure funding.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2013-12	Include personnel from the University Police Department on the University Advisory Council.	M	Emergency Management and Safety	Capital Outlay	Meet with University Police to discuss potential staff for inclusion.	2015	X	X	X	X	X	X	X	X	X	X	X	X
2013-13	Implement a unified tracking mechanism for accounting for all damages sustained by university due to natural or human-caused hazards, specifically incorporating damages incurred by crime.	M	Emergency Management and Safety	Capital Outlay	Draft procedures to be used by partner agencies.	2016	X	X	X	X	X	X	X	X	X	X	X	X

ID	Strategy Description	Priority	Responsible Agency	Funding Source	Interim Measure of Success	Target Completion Date	Hazards Being Mitigated											
							Hurricane/Wind	Thunderstorms	Winter Storms	Flood	Tornado	Drought	Northeasters	Earthquake	Arson/Building Fire	Hazardous Materials Release	Crime	Terrorism
Goal 5: Ensure continuity of the University operations.																		
2008-12	Work with professors to encourage use of alternative teaching techniques that can allow for continuity of instruction when physical campus is closed.	M	Emergency Management and Safety	IT Budget and Academics Funding	Conduct review of recently implemented distance learning tools.	2016	X	X	X	X	X	X	X	X	X	X	X	X
2008-2	Review and enhance emergency communications strategies for students, parents, faculty and staff.	H	Emergency Management and Safety; Human Resources; Student Affairs	Emergency Management and Safety Department Budget	Determine mechanism for enhancing emergency communication.	2016	X	X	X	X	X	X	X	X	X	X	X	X
Goal 6: Increase the protection of existing facilities and infrastructure from hazard threats through retrofit projects.																		
2008-13	Continue annual inspections of roof and rooftop equipment to ensure that roofs are in good condition and equipment connections are secure.	M	Facilities Services	Maintenance Reserve	Conduct annual review of rooftop inspections to ensure regular compliance.	2018	X	X	X				X	X				
2008-16	Continue working with the region to implement stormwater drainage and sanitary sewer improvements. Prioritize projects that would reduce identified street flooding problem spots.	M	Facilities Services	Capital Outlay Funding	Identify and prioritize specific areas for improvement.	2018				X								
2008-28	Continue to choose species that are more resistant to wind and snow/ice when selecting trees for landscaping around the university facilities.	L	Facilities Services	Maintenance Reserve	Conduct review of tree species and document which species most appropriate.	2018	X	X	X				X					
2013-2	Improve stormwater management systems at Marshall Hall, Virginia Hall, and the Physical Plant.	H	Facilities Services	State Funded Pool through DCR	Develop specific work plans for project implementation.	2018				X								
2013-6	Evaluate roof systems for potential retrofits for reduced vulnerability to wind hazards.	L	Facilities Services	Maintenance Reserve	Identify and prioritize structures for improvement.	2016	X	X	X				X					
Goal 7: Protect University assets and critical infrastructure including utilities infrastructure, communication systems, information technology systems and research facilities.																		
2008-5	Identify unique and valuable contents that include records, research data, collections and specimens, and develop a plan for preservation.	H	Institutional Technologies (IT); Facilities Services; Emergency Management & Safety	Individual Department Budgets	Identify and prioritize structures with unique and valuable contents.	2018	X	X	X	X	X	X	X	X	X	X	X	X
2008-10	Consider the implementation of a campus Geographic Information System (GIS) to include building data and photos. Include a mechanism for documenting, tracking and updating identified risks, hazards and mitigation efforts.	M	Emergency Management and Safety; Facilities Services	Capital Outlay / Maintenance Reserve	Determine personnel or resources available to conducting work and develop work plan.	2017	X	X	X	X	X	X	X	X	X	X	X	X
2013-3	Continue collaboration with the Commonwealth of Virginia on the statewide "Improve Stormwater Management" project.	H	Facilities Services	State Funded Pool through DCR	Identify specific personnel to work with the Commonwealth.	2018				X								

ID	Strategy Description	Priority	Responsible Agency	Funding Source	Interim Measure of Success	Target Completion Date	Hazards Being Mitigated											
							Hurricane/Wind	Thunderstorms	Winter Storms	Flood	Tornado	Drought	Northeasters	Earthquake	Arson/Building Fire	Hazardous Materials Release	Crime	Terrorism
2013-8	Relocate University Network Support to facilities less susceptible to natural and human-caused hazards; relocate the data center located at GW Hall.	H	Information Technology (IT)	Capital Outlay	Determine new location for University Network Support facilities and develop timeline for relocation.	2017	X	X	X	X	X	X	X	X	X	X	X	X
2013-9	Improve fire protection systems for the UMW Information Technology center located at the Stafford Campus.	H	Information Technology (IT); Emergency Management and Safety	Maintenance Reserve / Budget Amendment	Evaluate funding resources and create project timeline for implementation.	2017									X			

SECTION 7 PLAN MONITORING, EVALUATION AND UPDATE

The long-term success of the UMW HMP depends on its success in implementing the plan and in establishing a process to ensure that the plan is current and continues to provide value to the University. This section delineates the process to address:

- Implementation
- Integration
- Maintenance and updates

7.1 PLAN IMPLEMENTATION

Responsibility for the overall implementation and maintenance of the UMW HMP rests primarily with the members of the UAC. The Director of Emergency Management and Safety will work with the committee to ensure the implementation and maintenance of the plan.

For high priority mitigation strategies, an appropriate University department(s) has been identified that will have primary responsibility for implementation of that particular action. The UAC, in concert with the primary responsible department, has established measures of success, potential funding sources, and target completion dates for each high priority hazard mitigation action. The measures of success will be used to gauge how well the plan is being implemented and whether the actions are achieving their intended purpose; while the other criteria create a level of responsibility and accountability for each of the mitigation strategies.

Beyond these initial measures of success, additional implementation needs and measures will be the responsibility of the primary responsible department, the Director of Emergency Management and Safety and ultimately the members of the UAC. This may include any meetings with local officials, integration measures with other planning documents, identifying additional funding sources, etc.

Just as important as the mitigation actions themselves, is the development of a risk averse culture. The members of the UAC will continue to ensure that the goals and strategies of new and updated planning documents are consistent with the goals and actions of this plan, and that new projects throughout the University consider potential risks and are designed in such a way as to avoid them. Risk reduction principles identified in this plan should be carefully considered when developing new goals and actions of other University planning documents and projects.

7.2 INTEGRATION WITH LOCAL AND STATE HAZARD MITIGATION PLANS

UMW will take a number of steps to ensure that the UMW Hazard Mitigation Plan is integrated with its relevant planning documents of UMW's neighboring jurisdictions, as well as with the Commonwealth. In order to accomplish this, UMW will:

1. Provide copies of the *University of Washington Mary Disaster Resistant University Hazard Mitigation Plan* to the Virginia Department of Emergency Management
2. Provide a representative to the commonwealth's mitigation planning team
3. Participate in local mitigation planning efforts and ensure that its plan complements the George Washington Regional Commission (GWRC) Hazard Mitigation Plan

UMW participated in the update to Rappahannock Regional Hazard Mitigation Plan, which is now the GWRC Hazard Mitigation Plan, and will continue to do so in the future. UMW will also participate in any available opportunities to participate in any planning efforts with the Virginia Department of Emergency Management by providing a representative to public outreach meetings or by commenting on draft documents when available. The representative will provide input into the plans and work to ensure that the information contained in UMW HMP is integrated into the state and local mitigation plans.

As mentioned in Section 7.1, The UAC also will identify information that should be incorporated into the next version of UMW's strategic and master plans. This was largely accomplished in the 2009 update to UMW's five year strategic plan, and is recognizable in the number of strategic goals and objectives that may be relevant in the enactment of mitigation strategies. The previous Hazard Mitigation Plan identified one strategic objective as potentially relevant to mitigation. Chapter 5 of this update to the Hazard Mitigation Plan identifies 9 different strategic objectives as potentially relevant to mitigation. This signifies the importance that the University has placed on activities related to mitigating potential risks. This process will continue to progress, and appropriate information will be provided to the University council or committee for consideration.

7.3 MAINTENANCE OF PLAN AND UPDATE SCHEDULE

Plan maintenance requires an ongoing effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks or changing circumstances are recognized. The UAC will be responsible for monitoring and updating the plan. The team should develop the following:

- Annual progress reports from departments designated as "Primary Department" in the mitigation action plan detailed in Section 6,
- An annual review of these progress reports and the overall plan by the UAC, and
- A 5-year written update to be submitted to the state and FEMA Region III, unless a disaster or other circumstances (e.g., change in regulations) leads to a different time frame.

The timing of the yearly reports should coincide with either the anniversary of the approval date of this plan or another date chosen by the team (e.g., end of the fall semester). The annual progress reports will be reviewed by the UAC who will determine what action is needed. Re-prioritization may be needed as high priority mitigation actions are completed.

As described above, the UAC and primary responsible departments will be responsible for evaluating progress in implementing mitigation actions using the measures of success described in the action plan. Measures of success may need to be updated annually. The UAC, during its annual review, also may identify corrective actions. In addition, the UAC should review its organizational composition annually and adjust membership, if needed.

The UAC will determine at its annual meeting if a formal update of the plan is required. At a minimum, the plan will be updated every five years. Factors to consider when determining if an update is necessary include:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions;
- Increased vulnerability as a result of new development;
- New state/federal laws, policies, or programs;
- Changes in resource availability; and/or
- Applicability of goals/objectives/strategies.

A major event, such as a Presidentially-declared disaster, may trigger a need to review the plan. If such an event affects the University, the UAC will coordinate to determine how best to review and update the plan. Major changes to the plan will be submitted to the state and to FEMA Region III.

Public notice of the annual review will be given and public participation will be invited. At a minimum, notification will be through web postings and press releases to the University and local media outlets, primarily newspapers and radio stations. In addition, an annual event will be held to publicize progress on implementing the mitigation plan. This event could be timed to coincide with the anniversary of a significant event or annual awareness event (i.e., Hurricane Preparedness Week). The UAC also should provide an annual update to the University's Board of Visitors to keep them informed about plan implementation.

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