



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																				
6	2010	Determine feasibility of developing a drought preparedness and response plan	Town Manager					X									General Funds, FEMA Unified Hazard Mitigation Assistance funding,	December 2013	Research and identify applicable funding mechanisms to develop the plan.	Medium	No	



XVIII. Town of Quantico

Quantico is located on the Potomac River in Prince William County and surrounded by Marine Corps Base Quantico. The 2000 census estimate for the town was 561 and was estimated by the Census Bureau to be 607 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 63.8% white, 16.1% black or African American, 1.3% Native American, 6.3% Asian, 2.9% from other races, and 9.5% bi-racial. Hispanics or Latinos, of any race, represent 8.4% of the total population.

Quantico has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 41 inches of rain and 16 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town is also subjected to tidal and storm surge flooding, due to its location on the Potomac River. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a concern. Quantico is also susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter and summer seasons.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Quantico, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁵. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as 'High' for Quantico. See Table 7.83 for a summary of hazard rankings.

Table 7.83: Hazard Ranking for Town of Quantico

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-Low	Med	Med-Low



Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.84.

Table 7.84: NCDC Annualized Loss by Hazard for Prince William County

Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
Years of Record	17	17	21	59	17	
Prince William County	\$114,402	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA's HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Quantico based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.85, 7.86, and 7.87 below.

Table 7.85: HAZUS^{MH} - Annualized Loss Due to Flood for Town of Quantico

Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Quantico	\$16,000	\$17,000	\$0	\$0	\$0	\$0	\$0	\$33,000

Table 7.86: HAZUS^{MH} - Annualized Loss Due to Hurricane for Town of Quantico

Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Quantico	\$2,050	\$370	\$4	\$211	\$38	\$151	\$40	\$2,864

Table 7.87: HAZUS^{MH} - Annualized Loss Due to Earthquake for Town of Quantico

Jurisdiction	Annualized Loss
Town of Quantico	\$1,032

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to flooding is high, due to Quantico's location. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Quantico Mitigation Actions and Action Plan

#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1	2010	Assess the roadway structure at various intersections throughout the Town of Quantico to avoid repeated flooding.	Office of the Mayor	X	X		X	X	X	X	X	X	X	X	X	X		Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2	2010	Continue to identify and employ a broad range of warning systems throughout the Town of Quantico.	Office of the Mayor	X	X	X	X	X	X	X	X	X	X	X	X	X		UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3	2010	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Office of the Mayor	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4	2010	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood	Office of the Mayor	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.																				
5	2010	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Office of the Mayor	X	X	X	X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No	
6	2010	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of	Office of the Mayor	X	X	X	X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No	



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																				
7	2010	Determine feasibility of developing a drought preparedness and response plan	Office of the Mayor					X									General Funds, FEMA Unified Hazard Mitigation Assistance funding,	December 2013	Research and identify applicable funding mechanisms to develop the plan.	Medium	No	



XIX. Town of Round Hill

Named after the 910 foot hill located just southwest of the town center, and part of the foothills of the Blue Ridge Mountains, Round Hill was incorporated in 1900. Round Hill was used during the American Civil War as a signals post by both the Confederate and Union troops.

The Town is located at the crossroads of Virginia routes 7 and 719, approximately 45 miles northwest of Washington, DC. The town was the terminus of the Washington and Old Dominion Railroad, formerly the Washington and Ohio line. It is located 7 miles from the Shenandoah River, 15 miles from Harpers Ferry and four miles from the Appalachian Trail.



The population of the Round Hill was 500 as of the 2000 Census and was 539 in 2010. It is part of Loudoun County. Round Hill covers 0.2 square miles of land. The town population was comprised of 93% white, 2.8% Black or African American, 1.1% Asian, and 0.9% bi-racial.

Round Hill has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 20 inches of snow fall in any given year, with May being the wettest month on average. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Round Hill is subject to high wind events and extreme winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Round Hill, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁶. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as ‘High’ for Round Hill. See Table 7.88 for a summary of hazard rankings.



Table 7.88: Hazard Ranking for Round Hill

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-High	Med-Low	Med-Low

Annualized loss statistics for Loudoun County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.89.

Table 7.89: NCDC Annualized Loss by Loudoun County

Annualized Loss as Determine through NCDC Data <i>(based on property and crop damages and number of years of record)</i>						Total Annualized Losses (All Hazards)
	Drought	Flood	High Wind	Tornado	Winter Storm	
Years of Record	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA's HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Round Hill based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.90 and 7.91 below.

Table 7.90: HAZUS^{MH} - Annualized Loss Due to Hurricane for Round Hill

Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Round Hill	\$44	\$2	\$0	\$2	\$0	\$1	\$0	\$48

Table 7.91: HAZUS^{MH} - Annualized Loss Due to Earthquake for Round Hill

Jurisdiction	Annualized Loss
Town of Round Hill	\$53

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is relatively low at \$49 for hurricane wind and \$53 for earthquake. Although





somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Round Hill Mitigation Actions and Action Plan



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1	2010	Identify the Town's Critical Infrastructure and develop a GIS layer	Loudoun County Office of Emergency Management/Town of Round Hill Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2012	Secure funding	Critical	No
2	2010	Implement drainage improvements in low-lying roadways.	Virginia Department of Transportation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No
3	2010	Provide back-up power for critical facilities.	Town of Round Hill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No
4	2010	Establish and test emergency notification procedures and protocols for Town personnel.	Town of Round Hill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding	December 2012	Allocate funding	Critical	No
5	2010	Develop and test a Continuity of Operations Plan (COOP).	Town of Round Hill / Loudoun County Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
6	2010	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Planning Commission	X	X		X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
7	2010	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.	Planning Commission	X	X	X												FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
8	2010	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept	Planning Commission	X	X	X												FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the	Medium	No

#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		generators, etc.																	structural review.			
9	2010	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Planning Commission	X	X	X												General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
9	2010	Determine feasibility of developing a drought preparedness and response plan	Town of Round Hill / Loudoun County Office of Emergency Management					X										General Funds, FEMA Unified Hazard Mitigation Assistance funding,	December 2013	Research and identify applicable funding mechanisms to develop the plan.	Medium	No



XX. Town of Vienna

Originally called Ayr Hill, the Fairfax County village agreed in the 1850s to change its name to Vienna at the request of William Hendrick, a medical doctor who grew up in Vienna, New York. Vienna was incorporated into a town in 1890. The population of the town was 14,453 as of the 2000 Census and was estimated by the Census Bureau to be 15,215 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 76.5% white, 6% black or African American, 0.2% Native American, 11% Asian, 4.5% from other races, and 1.8% bi-racial. Hispanics or Latinos, of any race, represent 10.7% of the total population.



The Town of Vienna has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 45 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town's location on the eastern edge of the Virginia piedmont make it susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter season.

The Town of Vienna's situation in the Washington metropolitan area and its ease of access by car and public transportation have attracted an increasingly-varied residential and commercial development. Fairfax County's central business district, Tyson's Corner, is just outside of the town's corporate limits. It is the 12th largest central business district in the United States.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including the Town of Vienna, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁷. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as 'High' for the Town of Vienna. See Table 7.92 for a summary of hazard rankings.

**Table 7.92: Hazard Ranking for the Town of Vienna**

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Fairfax County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.93. The NCDC only reports losses for hazards at the city and county level.

Table 7.93: NCDC Annualized Loss by Hazard for Fairfax County

**Annualized Loss as determine through NCDC data
(based on property and crop damages and number of years of record)**

	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
Years of Record	17	21	59	17	
Fairfax County	\$801,903	\$612,562	\$2,265,041	\$60,537	\$3,830,698

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA's HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for the Town of Vienna based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.94, 7.95 and 7.96 below.

Table 7.94: HAZUS^{MH} - Annualized Loss Due to Flood for the Town of Vienna

Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Vienna	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Table 7.95: HAZUS^{MH} - Annualized Loss Due to Hurricane for the Town of Vienna

Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Vienna	\$36,154	\$3,979	\$43	\$2,263	\$403	\$791	\$460	\$44,093

Table 7.96: HAZUS^{MH} - Annualized Loss Due to Earthquake for the Town of Vienna

Jurisdiction	Annualized Loss
Town of Vienna	\$29,422



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to hurricanes is significant for the town. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Vienna Mitigation Actions and Action Plan



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1	2010	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Town of Vienna Public Works	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2	2010	Continue to identify and employ a broad range of warning systems throughout the Town of Vienna.	Town of Vienna Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3	2010	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	Town of Vienna Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4	2010	Support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation, flood proofing, minor localized flood	Town of Vienna Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Year	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.																				
5	2010	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	Town of Vienna Police Department	X	X	X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No	
6	2010	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of	Town of Vienna Police Department	X		X	X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No	





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Chapter 8: Plan Maintenance

This section discusses how the mitigation strategies will be implemented by the Northern Virginia jurisdictions and how the overall Plan will be evaluated and enhanced over time. These aspects were reviewed and updated by the MAC for the 2010 update. This section also discusses how the public will continue to be involved in the hazard mitigation planning process. It consists of the following three subsections:

- Implementation;
- Monitoring, Evaluation and Enhancement; and
- Continued Public Involvement.

I. Implementation

Each jurisdiction participating in the Northern Virginia Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in their locally adopted Mitigation Action Plan. In each Mitigation Action Plan, every proposed action is assigned to a specific local department or agency in order to assign responsibility and accountability and increase the likelihood of subsequent implementation. This approach enables individual jurisdictions to update their unique Mitigation Action Plan as needed without altering the broader focus of the Regional Plan. The separate adoption of locally-specific actions also ensures that each jurisdiction is not held responsible for monitoring and implementing the actions of other jurisdictions involved in the planning process.

In addition to the assignment of a local lead department or agency, the completion date and interim measure of success date have been assigned in order to assess whether actions are being implemented in a timely fashion. The Northern Virginia jurisdictions will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified and targeted for the proposed actions listed in the Mitigation Action Plans.

It will be the responsibility of each participating jurisdiction to determine additional implementation procedures beyond those listed within their Mitigation Action Plan. This includes integrating the requirements of the Northern Virginia Hazard Mitigation Plan into other local planning documents, processes, or mechanisms, such as comprehensive or capital improvement plans, when appropriate⁵⁸. The members of the Northern Virginia MAC will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions or agencies are consistent with the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability in their particular jurisdictions or the region as a whole.

Opportunities to integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of the Northern Virginia MAC and through the five-year review process described herein. Although it is recognized that there are many possible benefits to integrating components of this Plan into other local planning mechanisms, the development and maintenance of this stand-alone Hazard Mitigation Plan is



deemed by the Northern Virginia MAC to be the most effective and appropriate method to implement local hazard mitigation actions at this time. As such, the primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update, and implementation of each jurisdiction's individual Mitigation Action Plan specific planning and administrative tasks (e.g., plan amendments, ordinance revisions, capital improvement projects, etc.).

The MAC will continue to coordinate with local jurisdictions in creating processes by which the requirements of this Plan will be incorporated into other local plans. During the planning process for new and updated local planning documents, such as a comprehensive plan, capital improvements plan, or emergency management plan, the MAC will provide a copy of the Plan to the appropriate parties. The MAC will continue to recommend that all goals and strategies of new and updated local planning documents be consistent with the Regional Plan and will not contribute to increased hazards in the affected jurisdiction(s).

II. Monitoring, Evaluation, and Enhancement

Periodic revisions and updates of the Northern Virginia Hazard Mitigation Plan are required to ensure that the goals of the plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable Federal and State regulations. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to each participating jurisdiction's individual Mitigation Action Plan.

The Northern Virginia MAC will continue to meet annually and following any disaster events warranting a reexamination of the mitigation actions being implemented or proposed by the participating jurisdictions. This will ensure that the Plan is continuously updated to reflect changing conditions and needs within the region. Additionally, they will reexamine the need to incorporate specific strategies into other planning initiatives as necessary. Each participating jurisdiction will be encouraged by the MAC to complete yearly reviews on the progress of their respective Mitigation Action Plan, and incorporate their strategies into local planning initiatives as appropriate. If determined appropriate or as requested, an annual report on the Plan will be developed by the MAC and submitted to the local governing bodies of participating jurisdictions in order to report progress on the actions identified in the Plan and to provide information on the latest legislative requirements and/or changes to those requirements.

If any participating jurisdiction no longer wishes to actively participate in the development and maintenance of the plan, they must notify the MAC in writing.

A. Five-Year Plan Review

The plan will be reviewed by the MAC every five years to determine whether there have been any significant changes in the region that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, the increase or decrease in capability to address hazards, and changes to Federal or State legislation are examples of factors that may affect the necessary content of the Plan.



The plan review process provides regional and community officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. The MAC will be responsible for reconvening the MAC and conducting the five-year review in coordination with the VDEM.

During the five-year plan review process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the regional goals address current and expected conditions?
Has the nature or magnitude of risks changed?
- Are the current resources appropriate for implementing the Plan?
- Are there local implementation problems, such as technical, political, legal, or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did the jurisdictions, agencies, and other partners participate in the plan implementation process as proposed?

Following the five-year review, any necessary revisions will be implemented according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process, the Northern Virginia Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer for final review and approval in coordination with FEMA.

B. Disaster Declaration

Following a disaster declaration, the Northern Virginia MAC will reconvene and the Plan will be revised as necessary to reflect lessons learned, or to address specific circumstances arising from the event. It will be the responsibility of the NVRC to reconvene the MAC and to ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

C. Reporting Procedures

The results of the five-year review will be summarized by the MAC in a report that will include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report will also include an evaluation of implementation progress for each of the proposed mitigation actions, identifying reasons for delays or obstacles to their completion along with recommended strategies to overcome them.

Any necessary revisions to the Regional Plan elements shall follow the plan amendment process outlined herein. For changes and updates to the individual Mitigation Action Plans, appropriate local designees will assign responsibility for completion of the task.

D. Plan Amendment Process

Local participating jurisdictions have the authority to approve/adopt changes to their own Mitigation Action Plans without approval from the MAC; however, the MAC should be advised of all changes as a courtesy and for consideration for changes or modifications to the regional



Plan. The MAC will be responsible for verifying that the proposed change will not affect the jurisdiction's compliance with current State and Federal mitigation planning requirements. Changes to either the Regional Plan or local Mitigation Action Plans will necessitate the adoption of these changes by the appropriate governing body, and ultimately or upon request the updated Plan or plan component(s) will be submitted to VDEM.

The MAC and its participating jurisdictions will forward information on any proposed change(s) to all interested parties including, but not limited to, all affected county and municipal departments, residents and businesses. When a proposed amendment may directly affect particular private individuals or properties, each jurisdiction will follow existing local, State or Federal notification requirements which may include published public notices as well as direct mailings. Information on any proposed plan amendments will also be forwarded to VDEM. This information will be disseminated in order to seek input on the proposed amendment(s) for not less than a 45-day review and comment period.

At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the MAC for final consideration. The committee will review the proposed amendment along with the comments received from other parties, and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan to each appropriate governing body within 60 days.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered by the MAC:

- There are errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan;
 - New issues or needs have been identified which are not adequately addressed in the Plan;
 - There has been a change in information, data, or assumptions from those on which the Plan is based; and
- There has been a change in local capabilities to implement proposed hazard mitigation activities.

Upon receiving the recommendation from the Northern Virginia MAC and prior to adoption of the Plan, each local governing body will hold a public hearing. The governing body will review the recommendation from the committee (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing body will take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to the MAC for further revision; or
- Defer the amendment request back to the MAC for further consideration and/or additional hearings.



III. Continued Public Involvement

Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves over time. As described above, significant changes or amendments to the Plan may require a public hearing prior to any adoption procedures.

Additional efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising meetings of the MAC in the local newspaper, public bulletin boards, and/or municipal or county office buildings;
- Designating willing and voluntary citizens and private sector representatives as official members of the MAC;
- Utilizing local media to update the public on any maintenance and/or periodic review activities taking place;
- Utilizing the MAC and municipal or county websites to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies of the Plan in public libraries and making it accessible via public Websites.



¹ Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

² The Future of the Washington Area Economy: Alternative Forecast, Employment and Housing Implications. Center for Regional Analysis George Mason University. September 2009. <http://www.cra-gmu.org/forecastreports/10forecasts/2%20-%202030%20Alternatives%20and%20Implications%20Sept%202009.pdf>

³ Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley. 2003. Social vulnerability to environmental hazards. *Social Science Quarterly* 84 (1):242-261

⁴ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵ National Water Service Instruction 10-1605. Operations and Services Performance: Storm Data Preparation Guide. August 17, 2007. Available at: <http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf>

⁶ Commonwealth of Virginia Emergency Operations Plan Annex 3 (Volume II)

⁷ 2006 FEMA Mitigation BCA Toolkit. July 2006, Version 3.0

⁸ IPCC. (2007). Climate Change 2007: The Physical Science Basis. Intergovernmental Panel on Climate Change.

⁹ Pfeffer, W., Harper, J., & O'Neil, S. (2008). Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise. *Science*, 321, 1340-1343.

¹⁰ FEMA Severe Repetitive Loss Guidance for Severe Repetitive Loss Properties <http://www.fema.gov/pdf/nfip/manual200610/20srl.pdf> 10/2006

¹¹ NFIP repetitive loss data is protected under the federal Privacy Act of 1974 (5 U.S.C. 552a) which prohibits personal identifiers (i.e., owner names, addresses, etc.) from being published in local mitigation plans.

¹² National Flood Insurance Program (www.fema.gov)

¹³ HAZUS-MH MR4 Flood User Manual

¹⁴ Currently hosted at: <http://hurricane.ncdc.noaa.gov/CDO/cdo>

¹⁵ Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009.

¹⁶ Changes in severe thunderstorm environment frequency during the 21st century caused by anthropogenically enhanced global radiative forcing; Robert J. Trapp*,†, Noah S. Diffenbaugh*, Harold E. Brook§, Michael E. Baldwin*, Eric D. Robinson*, and Jeremy S. Pal; PNAS December 11, 2007, vol. 104, no. 50.

¹⁷ IPCC Special Report on Emissions Scenarios, 2000

¹⁸ Modeled Impact of Anthropogenic Warming on the Frequency of intense Atlantic Hurricanes, Morris A. Bender, Thomas R. Knutson, Robert E. Tuleya, Joseph J. Sirutis, Gabriel A. Vecchi, Stephen T. Garner, Isaac M. Held

¹⁹ HAZUS Hurricane Manual

²⁰ Whole Building Design Guide (WBDG) Wind Safety of the Building Envelop by Tom Smith 5/26/2008

²¹ Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

²² Significant Earthquakes figure is from the 2010 Commonwealth of Virginia's Hazard Mitigation Plan. Earthquake Section 3.13, Figure 3.13-1.

²³ The Daily News Spot July 16, 2010 interview with Amy Vaughan, geophysicist USGS National Earthquake Information Center.

²⁴ Recent Earthquakes from NEIC Earthquake Bulletin: Magnitude 3.4-Potomac-Shenandoan Region. USGS July 16, 2010. <http://earthquake.usgs.gov/earthquakes/recenteqsw/Quakes/us2010yua6.php>

²⁵ Recent Earthquakes from NEIC Earthquake Bulletin: Magnitude 3.4-Potomac-Shenandoan Region. USGS July 16, 2010. <http://earthquake.usgs.gov/earthquakes/recenteqsw/Quakes/us2010yua6.php>

²⁶ 2500-year Return Period Peak Ground Acceleration (PGA) figure is from the 2010 Commonwealth of Virginia's Hazard Mitigation Plan. Earthquake Section 3.13, Figure 3.13-3.

²⁷ Telephone and Email correspondence with Dr. Martin Chapman. June 3, 2010.



²⁸ Smith, K., *Environmental Hazards, Assessing Risk and Reducing Disaster*, Third Edition, Rutledge Press, New York 1991

²⁹ USGS Fact Sheet 2004-3072

³⁰ The National Wildfire Coordinating Group (NWCG) is made up of the USDA Forest Service; four Department of the Interior agencies: Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Fish and Wildlife Service (FWS); and State forestry agencies through the National Association of State Foresters. The purpose of NWCG is to coordinate programs of the participating wildfire management agencies so as to avoid wasteful duplication and to provide a means of constructively working together.

³¹ U.S. Fire Administration. *National Fire Incident Reporting System (NFIRS), Version IV.1 Incident Codes*. Retrieved from www.usfa.fema.gov/nfirs/tools.

³² Tihansky, B, Ann. U.S Geological Survey, Tampa, Florida. Sinkholes, West-Central Florida: A link between surface water and ground water.

³³ Hubbard, D. A. "Sinkhole Distribution of the Valley and Ridge Province, Virginia." Geotechnical and Environmental Applications of Karst Geology and Hydrology, (April 2001): 33–36.

³⁴ Loudoun County Zoning Ordinance Section 4-1900 Limestone Overlay District. May 6, 2010.

³⁵ Commonwealth of Virginia Emergency Hazard Mitigation Plan, 2010.

³⁶ See Protecting the Past from Natural Disasters. 1989. Nelson, Carl. National Trust for Historic Preservation: Washington, D.C.

³⁷ The EMAP Standard is based on the NFPA 1600 Standard on Disaster/Emergency Management and Business Continuity Programs, 2004 Edition.

³⁸ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

³⁹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁰ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴² NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴³ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁴ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁵ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁶ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁷ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁸ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁴⁹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁰ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵² NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵³ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁴ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁵ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁶ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁷ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

⁵⁸ A listing of each jurisdiction's local planning documents (or those under development) is provided in Section 7: Capability Assessment.

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APPENDIX A

PLAN CROSSWALK

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Instructions for Using the Plan Review Crosswalk for Review of Local Mitigation Plans

Attached is a Plan Review Crosswalk based on the ***Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000***, published by FEMA, dated March 2004. This Plan Review Crosswalk is consistent with the *Disaster Mitigation Act of 2000* (P.L. 106-390), enacted October 30, 2000 and 44 CFR Part 201 – *Mitigation Planning, Interim Final Rule* (the Rule), published February 26, 2002.

SCORING SYSTEM

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Each requirement includes separate elements. All elements of a requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a summary score of "Satisfactory." A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing.

When reviewing single jurisdiction plans, reviewers may want to put an N/A in the boxes for multi-jurisdictional plan requirements. When reviewing multi-jurisdictional plans, reviewers may want to put an N/A in the prerequisite box for single jurisdiction plans.

States that have additional requirements can add them in the appropriate sections of the *Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

Optional matrices for assisting in the review of sections on profiling hazards, assessing vulnerability, and identifying and analyzing mitigation actions are found at the end of the Plan Review Crosswalk.

The example below illustrates how to fill in the Plan Review Crosswalk.

Example

Assessing Vulnerability: Overview

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.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	Section II, pp. 4-10	The plan describes the types of assets that are located within geographically defined hazard areas as well as those that would be affected by winter storms.		✓
B. Does the new or updated plan address the impact of each hazard on the jurisdiction?	Section II, pp. 10-20	<p>The plan does not address the impact of two of the five hazards addressed in the plan.</p> <p>Required Revisions:</p> <ul style="list-style-type: none"> Include a description of the impact of floods and earthquakes on the assets. <p>Recommended Revisions:</p> <ul style="list-style-type: none"> This information can be presented in terms of dollar value or percentages of damage. 	✓	
SUMMARY SCORE			✓	

Local Hazard Mitigation Plan Review Crosswalk
Jurisdiction:

FEMA Region III

Local Mitigation Plan Review and Approval Status

Jurisdiction:	Title of Plan:	Date of Plan:
Local Point of Contact:		Address:
Title:		
Agency:		
Phone Number:		E-Mail:

State Reviewer: Robbie Coates	Title: Hazard Mitigation Coordinator	Date: April 25, 2011
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FEMA Reviewer:	Title:	Date:
Date Received In FEMA Region [Insert #]		
Plan Not Approved		
Plan Approved		
Date Approved		

Jurisdiction:	NFIP Status*			
	Y	N	N/A	CRS Class
1.				
2.				
3.				
4.				
5. [ATTACH PAGE(S) WITH ADDITIONAL JURISDICTIONS]				

* Notes:

Y = Participating

N = Not Participating

N/A = Not Mapped

LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a "Needs Improvement" score.

Prerequisite(s) (Check Applicable Box)

1. Adoption by the Local Governing Body:
§201.6(c)(5) OR

2. Multi-Jurisdictional Plan Adoption: §201.6(c)(5)
AND

3. Multi-Jurisdictional Planning Participation:
§201.6(a)(3)

NOT MET **MET**

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Planning Process

4. Documentation of the Planning Process:
§201.6(b) and §201.6(c)(1)

N **S**

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Risk Assessment

5. Identifying Hazards: §201.6(c)(2)(i)

6. Profiling Hazards: §201.6(c)(2)(i)

7. Assessing Vulnerability: Overview:
§201.6(c)(2)(ii)

8. Assessing Vulnerability: Addressing
Repetitive Loss Properties. §201.6(c)(2)(ii)

Assessing Vulnerability: Identifying Structures,
Infrastructure, and Critical Facilities:
§201.6(c)(2)(ii)(B)

10. Assessing Vulnerability: Estimating Potential
Losses: §201.6(c)(2)(ii)(B)

11. Assessing Vulnerability: Analyzing
Development Trends: §201.6(c)(2)(ii)(C)

12. Multi-Jurisdictional Risk Assessment:
§201.6(c)(2)(iii)

N **S**

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*States that have additional requirements can add them in the appropriate sections of the *Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement.
Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Mitigation Strategy

13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)

14. Identification and Analysis of Mitigation Actions:
§201.6(c)(3)(ii)

15. Identification and Analysis of Mitigation
Actions: NFIP Compliance. §201.6(c)(3)(ii)

16. Implementation of Mitigation Actions:
§201.6(c)(3)(iii)

17. Multi-Jurisdictional Mitigation Actions:
§201.6(c)(3)(iv)

N **S**

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Plan Maintenance Process

18. Monitoring, Evaluating, and Updating the Plan:
§201.6(c)(4)(ii)

19. Incorporation into Existing Planning
Mechanisms: §201.6(c)(4)(ii)

20. Continued Public Involvement: §201.6(c)(4)(iii)

N **S**

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Additional State Requirements*

Insert State Requirement

Insert State Requirement

Insert State Requirement

N **S**

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LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED

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See Reviewer's Comments

PLAN APPROVED

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PREREQUISITE(S)

1. Adoption by the Local Governing Body

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Has the local governing body adopted new or updated plan?				
B. Is supporting documentation, such as a resolution, included?				
SUMMARY SCORE				

2. Multi-Jurisdictional Plan Adoption

Requirement §201.6(c)(5): For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the new or updated plan indicate the specific jurisdictions represented in the plan?	Executive Summary (Pp. 1) Chapter 1: (Pp. 4) Chapter 3: Section I (Pp. 17)			
B. For each jurisdiction, has the local governing body adopted the new or updated plan?	Chapter 1: Section IV, Authority (Pp. 7) (will upon completion) Appendix B			
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	Appendix B (to be completed after adoption)			
SUMMARY SCORE				

3. Multi-Jurisdictional Planning Participation

Requirement §201.6(a)(3): Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process ... Statewide plans will not be accepted as multi-jurisdictional plans.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET

A. Does the new or updated plan describe how each jurisdiction participated in the plan's development?	Chapter 2: Planning Process (Pp. 11-15), Chapter 6: Mitigation Strategies (Pp. 291-300)		
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	Executive Summary: Page 1 Chapter I (Pp. 4); Chapter 3: Section I (Pp. 17)		
SUMMARY SCORE			

PLANNING PROCESS: §201.6(b): *An open public involvement process is essential to the development of an effective plan.*

4. Documentation of the Planning Process

Requirement §201.6(b): *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*

- (1) *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
- (2) *An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
- (3) *Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

Requirement §201.6(c)(1): *[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the plan provide a narrative description of the process followed to prepare the new or updated plan?	Chapter 2 (Pp. 11-15); Appendix C			
B. Does the new or updated plan indicate who was involved in the current planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)	Chapter 2: Planning Process (Pp. 11-15)			
C. Does the new or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Chapter 2: Section II Public Involvement and Citizen Input (Pp. 13-15); Appendix H			
D. Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested	Chapter 2: Section II Public Involvement and Citizen Input (Pp. 13-15)			

4. Documentation of the Planning Process

Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
- (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Location in the		SCORE
parties to be involved in the planning process?		
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	Chapter 2: Section III Incorporation of Existing Plans and Studies (Pp. 15)	
F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	Chapter 2: Planning Process (Pp. 11-12) Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433) Chapter 8: Plan Maintenance (Pp. 439)	
SUMMARY SCORE		

RISK ASSESSMENT: §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.

5. Identifying Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type ... of all natural hazards that can affect the jurisdiction.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?	Chapter 1 : Section I Background (Pp. 4-5) Chapter 4: Section III Hazard Identification: (Pp. 66-75) Chapter 4: Regional Hazard Identification and Risk Assessment: Flood (Pp.89)			

	Winter Storm (with extreme cold) (Pp. 125) High Wind/Severe Storm (Pp. 138) Tornadoes (Pp. 174) Drought (and extreme heat) (Pp. 188) Earthquake (Pp. 197) Landslide (Pp. 217) Wildfire (Pp. 229) SinkHoles/Karsts/Land Subsidence (Pp. 244) Dam Failure (Pp. 256) Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433) Chapter 3: Regional Information Section 1 Profiles (Pp. 17-20)		
SUMMARY SCORE			

6. Profiling Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the ... 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.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp. 95-97) Winter Storm (with extreme cold) (Pp. 126) High Wind/Severe Storm (Pp. 139), Tornadoes (Pp. 176-177) Drought (and extreme heat) (Pp. 189-190) Earthquake (Pp. 197-198) Landslide (Pp. 217-218) Wildfire (Pp. 230) Sink Holes/Karsts/Land Subsidence (Pp. 245-247) Dam Failure (Pp. 256-258)			
B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp. 95-97)			

plan?	Winter Storm (with extreme cold) (Pp. 126) High Wind/Severe Storm (Pp. 139), Tornadoes (Pp. 176-177) Drought (and extreme heat) (Pp. 189-190) Earthquake (Pp. 197-198) Landslide (Pp.217-218) Wildfire (Pp. 230) Sink Holes/Karsts/Land Subsidence (Pp. 245-247) Dam Failure (Pp.256-258)		
C. Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp.98-100) Winter Storm (with extreme cold) (Pp. 126-130) High Wind/Severe Storm (Pp. 143-145), Tornadoes (Pp. 180-183) Drought (and extreme heat) (Pp. 191-193) Earthquake (Pp. 200-203) Landslide (Pp.221) Wildfire (Pp. 230-232) Sink Holes/Karsts/Land Subsidence (Pp. 248) Dam Failure (Pp.259)		
D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp.105) Winter Storm (with extreme cold) (Pp. 130-133) High Wind/Severe Storm (Pp. 145), Tornadoes (Pp. 183) Drought (and extreme heat) (Pp. 193) Earthquake (Pp. 204-205) Landslide (Pp.221) Wildfire (Pp. 232) Sink Holes/Karsts/Land Subsidence (Pp. 249) Dam Failure (Pp.259)		

C

SUMMARY SCORE	<input type="text"/>	<input type="text"/>
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7. Assessing Vulnerability: Overview

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.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp.105-106) Winter Storm (with extreme cold) (Pp. 134) High Wind/Severe Storm (Pp. 159), Tornadoes (Pp. 183) Drought (and extreme heat) (Pp. 193) Earthquake (Pp. 206) Landslide (Pp.222) Wildfire (Pp. 232) Sink Holes/Karsts/Land Subsidence (Pp. 249-250) Dam Failure (Pp.259)			
B. Does the new or updated plan address the impact of each hazard on the jurisdiction?	Chapter 4: Regional Hazard Identification and Risk Assessment, Flood (Pp.105-106) Winter Storm (with extreme cold) (Pp. 134) High Wind/Severe Storm (Pp. 159), Tornadoes (Pp. 183) Drought (and extreme heat) (Pp. 193) Earthquake (Pp. 206) Landslide (Pp.222) Wildfire (Pp. 232) Sink Holes/Karsts/Land Subsidence (Pp. 249-250) Dam Failure (Pp.259)			

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SUMMARY SCORE	<input type="text"/>	<input type="text"/>
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8. Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?	Chapter 4: Regional Hazard Identification and Risk Assessment (Pp. 103-104) Table 4.23	Note: This requirement becomes effective for local plans approved after October 1, 2008, for any jurisdiction with NFIP repetitive loss properties.		
SUMMARY SCORE				

9. Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?	Chapter 4: Section II Data Availability (Pp. 50-65) Table 4.1 Table 4.3 Appendix D2			
B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?	Chapter 3, Section I, D, 2. Development Trends (Pp. 42-43)			
SUMMARY SCORE				

10. Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate . . .

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan estimate potential dollar losses to vulnerable structures?	Executive Summary (Pp. 2) Chapter 4: Regional Hazard Identification and Risk Assessment (Pp. 64-65) Tables 4.26, 4.27, 4.28, 114-120,	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.		
B. Does the new or updated plan describe the methodology used to prepare the estimate?	Executive Summary (Pp. 2,8,10) Chapter 4: Section III: Hazard Identification (Pp. 66-67) Chapter 4: Section II Data Availability and Limitations (Pp. 50-67) Chapter 4: Section IV: Ranking and Analysis Methodologies (Pp. 76-83)	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.		
SUMMARY SCORE				

11. Assessing Vulnerability: Analyzing 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.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe land uses and development trends?	Chapter 3: Section I: D: 1: Land Use, Development (Pp. 36-41)	Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.		
SUMMARY SCORE				

12. Multi-Jurisdictional Risk Assessment

Requirement §201.6(c)(2)(iii): For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S

A. Does the new or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	Page 270, Table 4.91			
		SUMMARY SCORE		

MITIGATION STRATEGY: §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.*

13. Local Hazard 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.*

Element	Location In the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A Does the new or updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?	Chapter 6: Mitigation Strategies (Pp. 296-298)			
		SUMMARY SCORE		

14. Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): *[The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?	Chapter 6 Pp. 298, Chapter 7 Executive Summaries (Pp.301-433)			
B. Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?	Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433)			
C. Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?	Chapter 7: Jurisdiction Executive Summaries Pages 301-433, Property Protection (Pp. 293)			

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SUMMARY SCORE	<input type="text"/>	<input type="text"/>
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15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	National Flood Insurance Program (Pp. 100-102) Table 4.21, Section III Identifying Objectives and Strategies (Pp. 297)	Note: This requirement becomes effective for all plans approved after October 1, 2008.		
B. Does the mitigation strategy identify actions related to participation in and continued compliance with the NFIP?	Chapter 6: Section III: Identifying Objectives and Strategies (Pp. 296-300) Chapter 7: Jurisdiction Executive Summaries: Alexandria (Pp. 305-306) Arlington (Pp.314-316) Fairfax (Pp. 324, 331) Loudoun (Pp. 338) Prince William (Pp. 345-346) City of Fairfax (Pp. 351) City of Falls Church (Pp. 357-358) City of Manassas (Pp. 363-364) City of Manassas Park (Pp. 371-372) Town of Clifton (Pp. 377-378) Town of Dumfries (Pp. 382-383) Town of Haymarket (Pp. 388-389) Town of Herndon (Pp. 394-395) Town of Leesburg (Pp. 403-404) Town of Middleburg (Pp. 407-408) Town of Occoquan (Pp. 412-413) Town of Purcellville (Pp. 417-418) Town Quantico (Pp. 421-422) Town of Round Hill (Pp.427-428) Town of Vienna (Pp. 432-433)	Note: This requirement becomes effective for all plans approved after October 1, 2008.		

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16. Implementation of Mitigation Actions

Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated mitigation strategy include how the actions are prioritized? (For example, is there a discussion of the process and criteria used?)	Chapter 6: Section II: Considering Mitigation Alternatives (Pp. 292)			
B. Does the new or updated mitigation strategy address how the actions will be implemented and administered, including the identification of the department responsible for implementing each action, existing and potential resources for each action and the timeframe for completion of each action?	Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433)			
C. Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?	Chapter 6: Section II: Considering Mitigation Alternatives B. Prioritizing Alternatives (Pp. 294)			
D. Does the updated plan identify the completed, deleted, or deferred actions as a benchmark for progress, and if activities are unchanged (i.e., deferred) does the updated plan describe why no change has occurred?	Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433) Appendix E			
SUMMARY SCORE				

17. Multi-Jurisdictional Mitigation Actions

Requirement §201.6(c)(3)(iv): For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan include identifiable action items for each jurisdiction requesting FEMA approval of the plan?	Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433)			
B. Does the updated plan identify the completed, deleted, or deferred actions as a benchmark for progress, and if activities are unchanged (i.e., deferred) does the updated plan describe why no change has occurred?	Chapter 7: Jurisdiction Executive Summaries (Pp. 301-433); Appendix E			
SUMMARY SCORE				

PLAN MAINTENANCE PROCESS

18. Monitoring, Evaluating, and Updating the Plan

Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department and other methods or schedules?	Chapter 8: Plan Maintenance: Section II Monitoring, Evaluation, and Enhancement (Pp. 436)			
B. Does the new or updated plan describe the method and schedule for evaluating the plan, including the responsible department and the criteria used to evaluate the plan?	Chapter 8: Plan Maintenance: Section II Monitoring, Evaluation, and Enhancement (Pp. 436)			
C. Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?	Chapter 8: Plan Maintenance II Monitoring, Evaluation, and Enhancement (Pp. 436-437)			
SUMMARY SCORE				

19. Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	Chapter 2: Section III Incorporation of Existing Plans and Studies (Pp.14)			
B. Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other planning mechanisms, when appropriate?	Chapter 5: Section III, Subsection B: Planning and Regulatory Capability (Pp. 279) Chapter 8: Plan Maintenance (Pp. 435)			
C. Does the updated plan explain how the local government incorporated the mitigation strategy into other planning mechanisms, when appropriate?	Chapter 5: Section III, Subsection B: Planning and Regulatory Capability (Pp. 279) Chapter 8: Plan Maintenance (Pp. 435)			
SUMMARY SCORE				

Continued Public Involvement

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan explain how continued public participation will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	Chapter 8: Plan Maintenance Section III Continued Public Involvement (Pp. 435)			
SUMMARY SCORE				

ADDITIONAL STATE REQUIREMENTS

Virginia State Requirements

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the plan include a Capability Assessment for each participating jurisdiction?	Chapter 5: Capability Assessment (Pp. 271-290)			
B. Are flood maps included for each participating jurisdiction?	Chapter 4: (A) Flood Hazard Profile (Pp. 96)			
C. Have other high hazard risk maps been included for each participating jurisdiction?	Chapter 4, Section XV Overall Hazard Results (Pp. 265) Fig. 4.61	<i>Note: A "Needs Improvement" score on this requirement will not preclude the FMA plan from passing.</i>		
SUMMARY SCORE				

Other Comments

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Matrix A: Profiling Hazards

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the jurisdiction. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Location		B. Extent		C. Previous Occurrences		D. Probability of Future Events	
		Yes		N	S	N	S	N	S
Avalanche		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Coastal Erosion		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Coastal Storm		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Dam Failure		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Drought		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Earthquake		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Expansive Soils		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Levee Failure		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Flood		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Hailstorm		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Hurricane		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Land Subsidence		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Landslide		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Severe Winter Storm		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Tornado		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Tsunami		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Volcano		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Wildfire		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Windstorm		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Other _____		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Other _____		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				
Other _____		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>				

Legend:

To check boxes, double click on the box and change the default value to "checked."

§201.6(c)(2)(i) Profiling Hazards

- Does the risk assessment identify the location (i.e., geographic area affected) of each hazard addressed in the new or updated plan?
- Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- Does the plan provide information on previous occurrences of each natural hazard addressed in the new or updated plan?
- Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the plan?

Matrix B: Assessing Vulnerability

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that the new or updated plan addresses each requirement. Completing the matrix is not required.

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each applicable hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.

Note: Receiving an N in the shaded columns will not preclude the plan from passing.

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Overall Summary Description of Vulnerability		B. Hazard Impact		A. Types and Number of Existing Structures in Hazard Area (Estimate)	B. Types and Number of Future Structures in Hazard Area (Estimate)	§201.6(c)(2)(ii) Assessing Vulnerability: Overview	A. Loss Estimate		B. Methodology	
		N	S	N	S				N	S	N	S
Avalanche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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§201.6(c)(2)(ii) Assessing Vulnerability: Overview

To check boxes, double click on the box and change the default value to "checked."

- A. Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
 B. Does the new or updated plan address the impact of each hazard on the jurisdiction?

§201.6(c)(2)(ii)(A) Assessing Vulnerability: Identifying Structures

- A. Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?

- B. Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

§201.6(c)(2)(ii)(B) Assessing Vulnerability: Estimating Potential Losses

- A. Does the new or updated plan estimate potential dollar losses to vulnerable structures?
 B. Does the new or updated plan describe the methodology used to prepare the estimate?

Matrix C: Identification and Analysis of Mitigation Actions

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure consideration of a range of actions for each hazard. Completing the matrix is not required.

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each applicable hazard. An "N" for any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)		A. Comprehensive Range of Actions and Projects	
	Yes		N	S
Avalanche	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Expansive Soils	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Hailstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Windstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

To check boxes, double click on the box and change the default value to "checked."

Legend:

§201.6(c)(3)(ii) Identification and Analysis of Mitigation Actions

A. Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?

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APPENDIX B

PLAN ADOPTION

Note, to be completed following conditional approval.

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APPENDIX C

MEETING DOCUMENTATION

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Update of the Northern Virginia Hazard Mitigation Plan Proposal Presentation

Kick Off Meeting

Dewberry

December 4, 2009

Digital Sandbox

Risk Optimized Solutions

Dewberry

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

Corporate Overview

Dewberry

- 50 years in Northern Virginia
- 2,000 professionals
- More than \$300 M annual revenue
- Core service: Emergency Management and Hazard Mitigation
- 10+ years developing and deploying risk management solutions
- Holds 3 U.S. patents

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Company Roles

Dewberry

- Steering Committee Facilitation
- Hazard Identification/Risk Assessment
- Goals, Objectives and Project Development
- Project Scoping
- Public Outreach
- Adoption Tracking

Digital Sandbox

Risk Optimized Solutions



- Human-caused Threat Analysis

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Meeting Agenda

1. Welcome & Introductions – Lucia Schmit
2. Meet the Team – Larry Zensinger
3. Plan Update Requirements – Deborah Mills
4. Plan Update Process and Schedule – Jane Sibley Frantz
5. Human-Caused Risk Analysis – Digital Sandbox
6. Visioning : Desirable Plan Outcomes – Deborah Mills
7. Visioning : Engaging Internal & External Stakeholders – Carrie Speranza and Shandi Treloar
8. Wrap Up & Future Meetings – Lucia Schmit & Deborah Mills

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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It's Your Plan!

We are here to:

- ✓ Facilitate the process
- ✓ Lend technical expertise and consultation
- ✓ Do the heavy lifting and dirty work

You need to:

- ✓ Participate & Make the final decisions
- ✓ Ensure a feasible plan that meets regional, community and stakeholder needs

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Project Team

Arlington County & Northern Virginia
Mitigation Planning
Steering Committee

Principal-in-Charge
Larry Zensinger

Project Manager
Deborah Mills, CFM

Quality Manager
Scott Choquette, CFM

Human Identification
and Risk Assessment
Committee, HIRAC
Chairwoman: Lucia Schmit

Planning Process
Joint Zoning Action Committee
Chairwoman: Carrie Speranza

Project Team
Jane Sibley Frantz, CFM
Andy Miller, EIT, CFM
Robert Holley-Hermann, CFM –
GIS/MAP

Human-Caused
Risk Analysis
Chairwoman: Shandi Treloar

Project Team
Carrie Speranza, CFM
Mark Matlock, CFM – ICA
Linen Johnson – Project
Secretary
Mike Stanley, CFM – DMAP

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Understanding Requirements

- **New FEMA Local Plan Requirements**

- Clear roadmap on update process
- Incorporate previous plan crosswalk comments
- Integrate NFIP program
- Describe current status of projects
- Address critical facilities

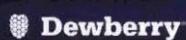
UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Project Schedule

Project Task	Oct 2010	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Mar 2011	Apr 2011	May 2011	Jun 2011	Jul 2011	Aug 2011
Task 1 Planning Support & Project Management											
Task 2 Hazard Identification and Risk Assessment											
Task 3 Mitigation Goals, Objectives and Projects											
Task 4 Plan Production & Adoption											

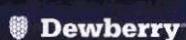
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HAZARD MITIGATION PLAN



Tools We Use

- Facilitated Meetings
- Public Workshops
- Secure Northern Virginia Project Share Site

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HAZARD MITIGATION PLAN



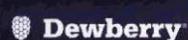
Understanding Requirements

- **Challenges unique to region**

- Scheduling conflicts
- Disasters happen
- Multiple GIS sources
- Complicated review process



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Planning Support

- Encourage diverse Steering Committee membership
- Meet up to two times with each participating jurisdiction
- Use multi-faceted approach to public input
- Stay in constant communication

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Hazard Identification and Risk Assessment (HIRA)

- Address natural and human-caused hazards
- Build on existing data from VDEM, MWCOG, and jurisdictions
- Use risk matrix to prioritize hazards
- Use GIS to conduct vulnerability assessment and estimate losses



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Meet Digital Sandbox

Digital Sandbox provides risk management solutions to homeland security organizations.

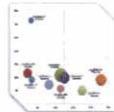
We strive to enable organizations to make policy, budget, and operational decisions based on analysis of the terrorism and natural hazard risks they face.



Leading tools for collection, analysis, and reporting



Expert analysts to interpret risk data, uncover trends



Analytic processes and presentations to drive business results

Quick Facts

- Rapidly growing, 13-year old business headquartered in McLean, Virginia
- Provider of threat and risk ranking system to all levels of government
- Sponsored by IC, DOD, DoD, and DHS to develop analytic approaches and technology for risk analysis and management
- Our analytics have directed in excess of \$10M of investments over the past 3 years
- Regularly brief Congress, the White House, and senior government executives on risk
- Advisors to Financial Services Firm, Corporate Security Officers, Governors, and Mayors
- Holders of 3 US patents for risk analysis with others pending

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The Digital Sandbox Project Team

Project Team

Anthony Bevirina - President & Founder

- Leading expert on state & local homeland security
- Works directly with state and local Homeland Security Advisors (HSAs), Chiefs of Police, and Fire Chiefs

Adam Trister - Chief of Staff

- Responsible for executive oversight of the engagement
- Former Maryland CIP Manager

Erin Mohres - Project Manager

- Responsible for day to day management of this engagement
- Former Emergency Manager for the City of Fort Lauderdale
- Currently managing DSB's work in Hampton Roads Virginia

Adam McCann - Lead Analyst

- Responsible for authoring the risk context
- Former analyst at DC HESEMA

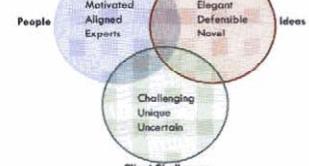
Digital Sandbox staff include world-class quantitative analysts, software developers, and homeland security experts.

2/3 of staff have active clearances

40% of staff have advanced degrees

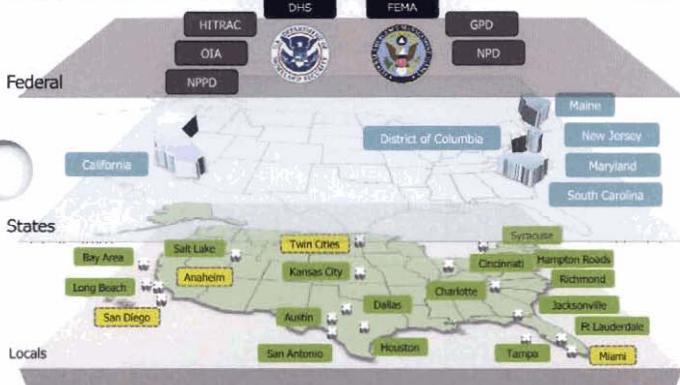
Staff include former:

- Deputy Homeland Security Advisor
- City Emergency Manager
- State CIP Manager
- Military and Intelligence Officers
- Senior DHS Executives



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Digital Sandbox Clients



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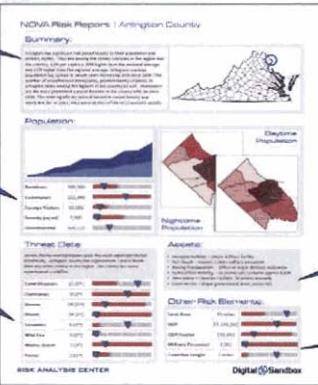
DSB will develop Terrorism Risk Context "Tear Sheets" that...

- Identifies High Profile Infrastructure within each region
- Identifies Factors (Drivers) of Risk within each region
- Discusses the risk impact on Local and National Level
- Will be developed quickly (30 days) and can be delivered individually to each jurisdiction as well to the Project Team to drive HIRA development



Terrorism Risk Content - Example

Jurisdictional summary



Population risk for each jurisdiction and how that compares to other jurisdictions

Commuter population displays how the risk changes from night to day

Overview of threats each jurisdiction is susceptible to

Summary of potential high risk assets in each jurisdiction

Overview of additional factors that effect risk in a jurisdiction

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HIRA cont.

- Capture NFIP requirements such as repetitive loss
- Incorporate existing land use and other plans
- Create a regional HIRA with jurisdiction-specific executive summaries

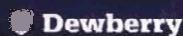


UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

HIRAs build a foundation

- A solid HIRA is the foundation for all emergency management planning
- Your investment in a strong mitigation plan will support:
 - Emergency Operations Plans
 - Emergency Response Plans
 - Shelter and Evacuation Plans
 - Long Term Community Recovery Plans – ESF 14
 - Continuity of Operations Plans

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Mitigation Goals, Objectives and Projects

- Inventory and assess status of 2007 mitigation actions
- Develop regional goals and projects by Steering Committee
- Facilitate development of jurisdiction-specific goals and projects
- Create mitigation strategy tracking tool for use over next 5 years



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Plan Production and Adoption

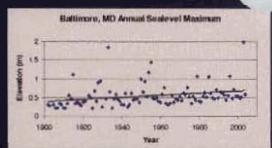
- Circulate drafts early and often
- Submit completed plan with crosswalk to VDEM
- Provide adoption resolution templates
- Compile adoption notices and submit full plan to VDEM and FEMA

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Value Added Services

- Address non-traditional hazards like climate change
- Conduct a Social Vulnerability Analysis
- Scope highest priority projects
 - Project Description
 - Feasibility Analysis
 - Benefit Cost Analysis
 - EHP Review
- EMAP Compliance



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Visioning Exercise – Desired Plan

Outcomes

- See written notes

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HAZARD MITIGATION PLAN



Brainstorming : Engage Internal and External Stakeholders

- See written notes

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN





Brainstorming : How to Engage Internal and External Stakeholders

- Internal kickoff for each jurisdiction
- Invite them to HIRA meetings

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

 **Dewberry**



Primary Contacts

Project Manager: Deborah Mills

dmills@dewberry.com 703.849.0162

Planning Lead: Jane Sibley Frantz

jfrantz@dewberry.com 703.849.0473

HIRA Lead: Rachael Heltz-Herman

rherman@dewberry.com 585.949.6327

Digital Sandbox:

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Northern Virginia Mitigation Plan Update Kick Off Meeting

December 4, 2009 Sign-in Sheet

Name	Department/Organization	Phone	Fax	E-mail
Becky McKinney	Fairfax County OEM	571-350-1009		Elizabeth.mckinney@fairfaxcounty.gov
Pat Collins	Prince William County OEM	703-792-5828	703-792-7149	pcollins@pwgov.org
Alexa Hussar	Prince William County OEM	703-792-5254	703-792-7149	ahussar@pwgov.org
Kevin Johnson	Loudon County OEM	703-737-8831	703-779-0012	Kevin.johnson@loudon.gov
Charlie McRorie	City of Alexandria	703-838-3825	703-548-6952	Charlie.mcrories@alexandriava.gov
Beth Brown	VDEM	804-317-6685		Beth.brown@vdem.virginia.gov
Robbie Coates	VDEM	804-897-6800, ext. 6582		Robbie.coates@vdem.virginia.gov
Lucia Schmit	Arlington County	703-228-7936		lschmit@arlingtonva.us
Dan Ellis	City of Falls Church	703-248-5058	703-248-5158	delis@fallschurchva.gov
Sam Myers	Loudon County OEM	703-737-8130	703-779-0012	Sam.myers@loudon.gov
Deborah Mills	Dewberry (contractor)	703-849-0216	703-206-0803	dmills@dewberry.com
Larry Zensinger	Dewberry (contractor)	703-849-0139	703-206-0803	lzensinger@dewberry.com

Meeting Agenda

Subject:	<i>Northern Virginia RC Hazard Mitigation Plan Update</i>	Date & Time:	Friday January 15, 2010 9:30 am – 12:00 pm
Location:	<i>Dewberry HQ Office 8403 Lobby Conference Room</i>		
Purpose:	<i>Hazard Identification & Risk Assessment (HIRA) Kick-Off Meeting</i>		
Attendees:	<i>NoVA Hazard Mitigation Planning Committee Digital Sandbox Dewberry</i>		
Description	Lead	Est. Time	
Welcome and Introductions <ul style="list-style-type: none">• SharePoint Site• Planning Process	Deborah Mills	9:30 – 9:45	
Plan Update Requirements & Data Availability <ul style="list-style-type: none">• Overview of HIRA Planning Process• Hazard Analysis consistent with State Hazards• New Hazards to Consider?• Identified Weaknesses of Existing Plan• Data discrepancies from previous plan, what can be improved• Historical Event Descriptions• Critical Facilities and Assets	Rachael Heltz Herman	9:45 – 10:30	
BREAK		10:35 – 10:45	
Ranking Methodology, Risk & Vulnerability <ul style="list-style-type: none">• Review of Existing Ranking• Potential Methodology for Revision• Determining Risk & Vulnerability• Annualized Loss	Rachael Heltz Herman	10:45 – 11:15	
	Digital Sandbox	11:15 - 11:45	
Project Schedule - Milestones	Deborah Mills	11:45 – 11:50	
Wrap Up and Future Meetings <ul style="list-style-type: none">• Individual meetings with each jurisdiction• Next Steering Committee Meeting• Overview of Action Items	Deborah Mills Rachael Heltz Herman	11:50 – 12:00	

2006 Local Plan Comparison to Virginia 2010 Plan

PDC/Jurisdiction	Flood	Erosion	Wind	Hurricane	Tornado	Thunder storm	Lightning	Hail	Winter	Extreme Heat	Extra Col.
2006 Northern Virginia RC	High	Low	Medium	Medium	High	High	NA	NA	High	Low	Low
Average Ranking From Local Plans	High	Low	Medium	Medium-High	Medium-Low	Medium-Low	NA	Low	Medium-High	Low	NA
2010 Statewide Analysis Ranking	High	NA	Medium-High	Medium	NA	NA	NA	NA	Medium-High	NA	NA

PDC/Jurisdiction	Drought	Earthquake	Tsunami	Wildfire	HazMat	Land slide	Karst	Terrorism	Bio.
2006 Northern Virginia RC	Medium	Low		Medium	NA	Low	Low		
Average Ranking From Local Plans	Medium-Low	Low	NA	Medium-Low	Low	Low	Low	NA	Low
2010 Statewide Analysis Ranking	Medium	Medium-Low	NA	Medium	NA	Medium-Low	Low		NA

Update of the Northern Virginia Hazard Mitigation Plan

Hazard Identification & Risk Assessment Kick Off Meeting

Dewberry

January 15, 2010

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Digital Sandbox
Risk Optimized Solutions

Dewberry

Plan Update Process

- Data Collection & 2006 Plan Evaluation
- Hazard Identification and Risk Assessment Update
- Mitigation Goals, Strategies and Projects (revision)
- Capability Assessment
- Plan Maintenance
- Draft Plan Submittal and Review
- Plan Adoption
- Plan Submission to VDEM & FEMA

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Plan Update Requirements

- Must be updated every five years
- Re-assess Hazard Identification and Risk Assessment (HIRA)
 - Considers changes to hazards and vulnerability of people and assets
 - Address hazard events that have occurred since the last plan
- Incorporate local planning efforts with Virginia State Plan
- Report on progress with mitigation strategy to-date and discuss adjustments
- Address weaknesses identified in previous plan review

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Meeting Agenda

1. Welcome & Introductions
 - SharePoint Site
2. Plan Update Requirements & Data Availability
3. Ranking Methodology, Risk & Vulnerability
4. Digital Sandbox
5. Project Schedule - Milestones
6. Wrap Up & Future Meetings

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Understanding Requirements

- New FEMA Local Plan Requirements
 - Clear roadmap on update process
 - Incorporate previous plan crosswalk comments
 - Integrate NFIP program
 - Describe current status of projects
 - Address critical facilities



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Hazard Identification and Risk Assessment (HIRA)

- Address natural and human-caused hazards
- Build on existing data from VDEM, MWCOG, and jurisdictions
- Use risk matrix to prioritize hazards
- Use GIS to conduct vulnerability assessment and estimate losses



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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HIRA [Continued]

- Capture NFIP requirements such as repetitive loss
- Incorporate existing land use and other plans
- Create a regional HIRA with jurisdiction-specific executive summaries



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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HIRA Sections [Continued]

Assessing Vulnerability

Jurisdictions vulnerability to Hazard

Impact of Hazard

Repetitive Loss Properties Addressed

Types & Numbers of existing structures (buildings, infrastructure, critical facilities) in Hazard Areas

Types & Numbers of future structures in Hazard Areas

Methodology & Estimation of potential dollar loss to vulnerable structures

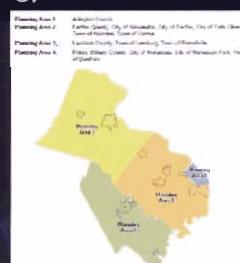
Land Use & Development Trends

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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2010 HIRA Update

- Update Hazard Profiles
- Review identified hazards & their priority/ranking
- Review and update methodology for:
 - Vulnerability Analysis
 - Potential Loss Estimates



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

HIRA Sections

Identify Hazards

Profile Hazards

Geographic area affected

Magnitude or extent

Previous occurrences

Probability of future events

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HAZARD MITIGATION PLAN

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Risk Assessment	
1. Identifying Hazards (\$201.6(c)(2)(i))	
2. Profiling Hazards (\$201.6(c)(2)(ii))	
3. Assessing Vulnerability - Overview (\$201.6(c)(2)(iii))	
4. Assessing Vulnerability - Addressing Repetitive Loss Properties (\$201.6(c)(2)(iv))	
5. Assessing Vulnerability - Addressing Buildings, Infrastructure, and Critical Facilities (\$201.6(c)(2)(v))	
6. Assessing Vulnerability - Estimating Potential Losses (\$201.6(c)(2)(vi))	
7. Assessing Vulnerability - Analyzing Mitigation Options (\$201.6(c)(2)(vii))	
8. Multi-Jurisdictional Risk Assessment (\$201.6(c)(2)(viii))	

"Risk Assessments needed for EACH JURISDICTION to reflect the unique or varied risk"

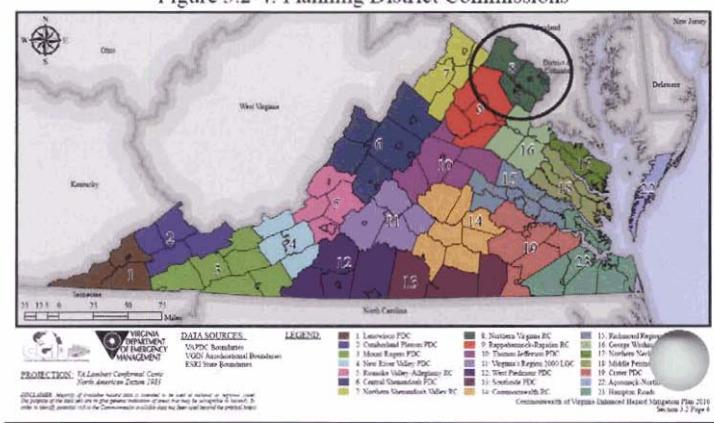
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RISK ASSESSMENT: §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	
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1. Identifying Hazards Requirement: §201.6(c)(2)(i) The risk assessment shall include a description of the type of all natural hazard that could affect the jurisdiction, including the types and locations of all natural hazards that could affect the jurisdiction.	
2. Profiling Hazards Requirement: §201.6(c)(2)(ii) The risk assessment shall include a description of the location and nature of all natural hazards that could affect the jurisdiction, including the types and locations of all natural hazards that could affect the jurisdiction.	
3. Assessing Vulnerability - Overview Requirement: §201.6(c)(2)(iii) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
4. Assessing Vulnerability - Addressing Repetitive Loss Properties Requirement: §201.6(c)(2)(iv) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
5. Assessing Vulnerability - Addressing Buildings, Infrastructure, and Critical Facilities Requirement: §201.6(c)(2)(v) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
6. Assessing Vulnerability - Estimating Potential Losses Requirement: §201.6(c)(2)(vi) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
7. Assessing Vulnerability - Analyzing Mitigation Options Requirement: §201.6(c)(2)(vii) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
8. Multi-Jurisdictional Risk Assessment Requirement: §201.6(c)(2)(viii) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	

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7. Assessing Vulnerability - Analyzing Mitigation Options Requirement: §201.6(c)(2)(vii) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	
8. Multi-Jurisdictional Risk Assessment Requirement: §201.6(c)(2)(viii) The risk assessment shall identify the location(s) of all natural hazards that could affect the jurisdiction, and the types of all natural hazards that could affect the jurisdiction.	

Figure 3.2-4: Planning District Commissions



Hazard Identification: New Hazards to Consider?

- Flood
- Severe Thunderstorms
- Tornadoes
- Winter Storms
- Hurricanes & Tropical Storms
- Drought
- Wildfire
- Earthquakes
- Extreme Temperatures
- Dam Failure
- Erosion
- Landslides
- Sinkholes

Table 6.37 Conclusions on Hazard Risk for the Northern Virginia Region	
HIGH RISK	Flood Severe Thunderstorms Tornadoes Winter Storms
MODERATE RISK	Hurricanes and Tropical Storms Drought Wildfire
LOW RISK	Earthquakes Extreme Temperatures Dam Failure Erosion Landslides Sinkholes

Climate Change as an amplifier of other hazards?

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Hazard Naming Ambiguity

- Interrelated Hazards
- Review Virginia State Plan to see what hazard naming conventions were used
 - Do these seem reasonable?
 - Any hazards missing?

Flood	Wind	Waves	Waves	Wildfire
Storm Surge	Wind	Extreme C Hurricane	Extreme Heat	Lightning
Earthquake	Land Subsidence (Earth)	Landslide	Dam Infiltration	Human Caused
Earthquake	Land Subsidence	Landslide	Dam Failure	Industrial Crane Terror

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

Local vs. State Hazard Ranking Comparison

PDO/Jurisdiction	Flood	Erosion	Wind	Hurricane	Tornado	Thunder Storm	Lightning	Hail	Water	Extreme Heat	Extreme Cold
2006 Northern Virginia RC	High	Low	Medium	Medium	High	High	N/A	N/A	Low	Low	Low
Average Ranking from Local Plans	High	Low	Medium	Medium-High	Medium-Low	Medium-Low	N/A	Low	Medium-High	Low	N/A
2010 Statewide Analysis Ranking	High	NA	Medium-High	Medium	NA	NA	NA	Medium-High	NA	NA	NA

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Hazards Addressed in 2010 VA State Plan

- | High | Medium-High | Medium Low |
|---------|-------------------------------------------|-----------------------------|
| - Flood | - Non-Rotational Wind
- Winter Weather | - Earthquake
- Landslide |
| Medium | - Tornado | - Karst |
| | - Drought | - Dam Failure |
| | - Wildfire | |

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Table 6.1-2: Current NHP inventory of hazard mitigation measures, comparing with 2010 statewide hazard ranking results																			
PDO/Jurisdiction	Flood	Kingston	Wind	Waves	Torrents	Thunder Storm	Lightning	Hail	Water	Extreme Heat	Extreme Cold	Earthquake	Volcanic	Weather	Wildlife	Landslide	Soil Erosion	Torrents	Dust, Ash, Volcanic
Loudoun PDC	High	Low	Medium	Medium	Low	Medium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Virginia Beach PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Clarke County PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
James River Valley PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Williamsburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Central Shenandoah PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Roanoke PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Southwest Virginia PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carroll Co PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Charles City PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Falls Church PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Fredericksburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Winchester PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Charlottesville PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Franklin PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Luray PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Waynesboro PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Charlottesville PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Franklin PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Charlottesville PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Franklin PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Charlottesville PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Franklin PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Charlottesville PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Franklin PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Staunton PDC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
City of Harrisonburg PDC	NA</																		



Identified Weaknesses in Existing Plan [Continued]

- What would you like changed in the revision?
 - Simple rather than wordy
 - Subject matter experts
 - Useful HIRA with better data
 - Social Vulnerability improved
 - Components to Address

UPDATE OF THE NORTHERN VIRGINIA Hazard Mitigation Plan



Data Needs: Building & Critical Facilities

- Local Data
 - Building Specific (year, materials, value...)
 - Infrastructure
 - Critical/Essential Facilities
 - Local Facilities with Building Specific Parameters
 - HAZUS-MH default Data
 - VDEM does not have a standard definition of a Critical Facility
 - 2010 HMP identifies broad types of CF with only general location:

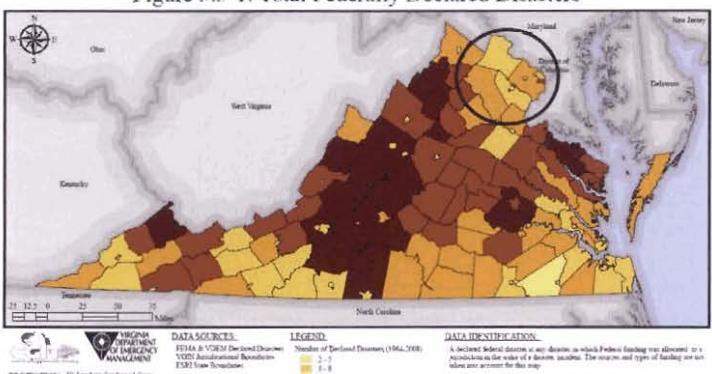
Law Enforcement
Facilities
Schools
EOCs

**Fire Stations
Hospitals
Nursing Homes**

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Figure 3.3-1: Total Federally Declared Disasters



Data Discrepancies

- What can be improved?
 - Tying HIRA to specific mitigation projects/activities
 - Does your locality/agency have new data sources that have been created since the 2006 plan?
 - What types of data would you like to see in the revision?

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



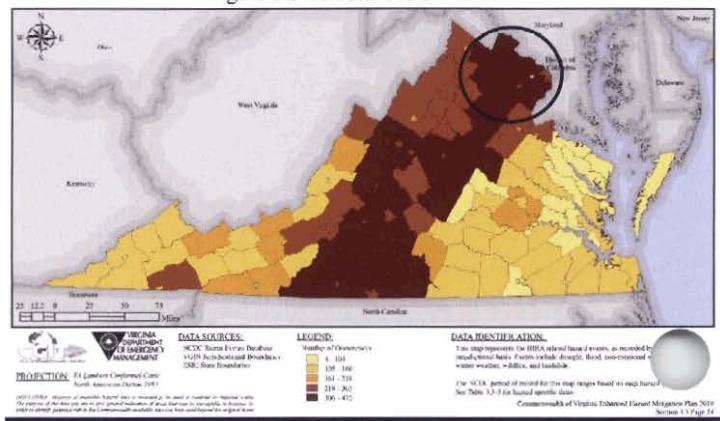
General Historical Disaster Databases

- List of Federally Declared Disasters from FEMA
 - Jurisdictions declared
 - Nature of disaster
 - Type(s) of assistance provided
 - National Climatic Data Center (NCDC) Storm Events Database
 - Area Impacted
 - Damages
 - Description of event
 - Virginia Department of Forestry

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Figure 3.3-9: Total NCDC Events



Data Sources & Needs

- Demographics
 - Census Data
- Hazard Data
 - Flood: FEMA FIRMS, FEMA Rep Loss, VDEM, DCR, NCDC & HAZUS-MH
 - Tornado: NCDC & SVRGIS
 - Wind (Microburst/Straightline): HAZUS-MH, NCDC & SVRGIS
 - Land & Mine Subsidence: USGS
 - Severe Thunderstorms: NCDC & SVRGIS
 - Winter Weather: NCDC
 - Earthquake: HAZUS-MH
 - Wildfire: VDOF & NCDC
- Land Use
 - Local Planning Efforts (population changes and/or shifts, changes in land use activities)
 - National Land Cover Data (NLCD)

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



10 Minute Break



Qualitative Approach

- Historical & Anecdotal Data, Community Input, Professional Judgment
- Priority Risk Tool (PRI)
- MAC Score 1-4 with weighting factors

$$PRI \text{ Value} = [(Probability \times .30) + (Impact \times .30) + (Spatial Extent \times .20) + (Warning Time \times .10) + (Duration \times .10)]$$

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Data Transfer from Localities to Dewberry

- Local GIS contacts
- Data used in previous planning efforts
- Other Planning Efforts (MWCOG, NCR SHIELD, Critical Infrastructure Plan)

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UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



2006 Ranking Parameters

- A "hybrid" approach was developed to include:
 - Quantitative Analysis
 - Hazard Loss Estimates (HAZUS, NCDC, VDOT)
 - At-risk Community Assets
 - Qualitative Analysis
 - Mitigation Advisory Committee's scoring system results
 - Likelihood of occurrence, spatial extent, potential impact
- Dual-faceted review of the hazards

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

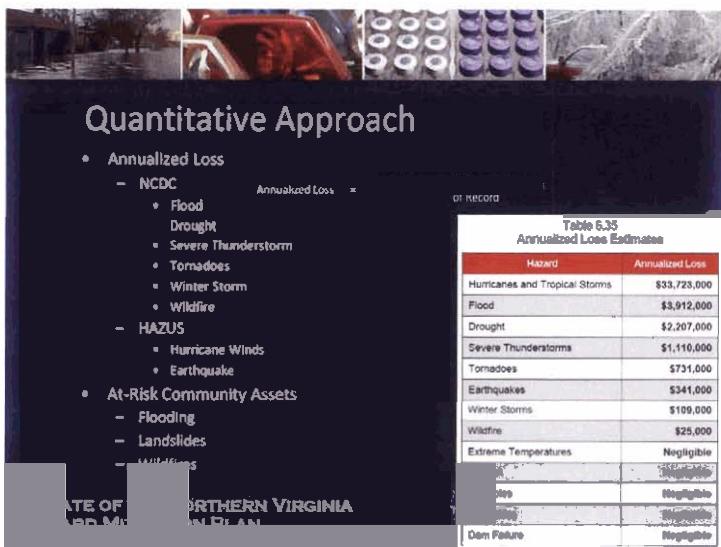


Priority Risk Index

- Discussion from Planning Committee
- Benefits
- Limitations

Table 4.30 Priority Risk Index (PRI) Values		
Hazard	PRI Value	
Flood	3.2	
Water Storages	3.0	
Severe Thunderstorms	2.7	
Tornadoes	2.7	
Hurricanes and Tropical Storms	2.6	
Wildfire	2.6	
Extreme Temperatures	2.4	
Drought	2.3	
Debris Fallouts	2.3	
Erosion	1.9	
Earthquakes	1.9	
Volcanoes	1.6	
Icestorms	1.5	

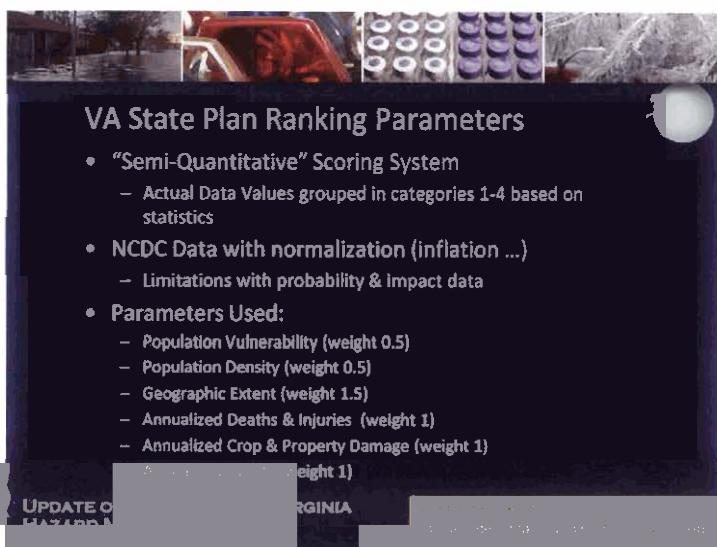
PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Positive	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
Impact	Highly Likely	100% annual probability	4	30%
	Major	Major hazard only. Minor hazard property damage and minimal disruption on critical facilities.	1	
	Severe	Minor property only. More than 10% of area affected. Moderate disruption of critical facilities.	2	
Intensity	Medium	Multiple households possibly destroyed. Moderate disruption of critical facilities.	3	30%
	Catastrophic	High number of households possibly destroyed. Complete shutdown of critical facilities.	4	
	Extremely	More than 50% of property in affected area destroyed. Complete shutdown of critical facilities for 30 days or more.	5	
Spatial Extent	Small	Less than 1% of area affected.	1	20%
	Medium	Between 1 and 10% of area affected.	2	
	Large	Between 10 and 100% of area affected.	3	
Warning Time	Very Short	Less than 1 hour.	1	20%
	Short	1 to 12 hours.	2	
	Medium	12 to 72 hours.	3	
Duration	Very Short	Less than 1 hour.	1	10%
	Short	1 to 12 hours.	2	
	Medium	More than one week.	3	



Quantitative Approach

- Annualized Loss
 - NCDC
 - Flood
 - Drought
 - Severe Thunderstorm
 - Tornadoes
 - Winter Storm
 - Wildfire
 - HAZUS
 - Hurricane Winds
 - Earthquake- At-Risk Community Assets

Table 6.35 Annualized Loss Estimates	
Hazard	Annualized Loss
Hurricanes and Tropical Storms	\$33,723,000
Flood	\$3,912,000
Drought	\$2,207,000
Severe Thunderstorms	\$1,110,000
Tornadoes	\$731,000
Earthquakes	\$341,000
Winter Storms	\$109,000
Wildfire	\$25,000
Extreme Temperatures	Negligible
Sea Level Rise	Negligible
Soil Erosion	Negligible
Dem. Failure	Negligible



VA State Plan Ranking Parameters

- “Semi-Quantitative” Scoring System
 - Actual Data Values grouped in categories 1-4 based on statistics
 - NCDC Data with normalization (inflation ...)
 - Limitations with probability & Impact data
 - Parameters Used:
 - Population Vulnerability (weight 0.5)
 - Population Density (weight 0.5)
 - Geographic Extent (weight 1.5)
 - Annualized Deaths & Injuries (weight 1)
 - Annualized Crop & Property Damage (weight 1)

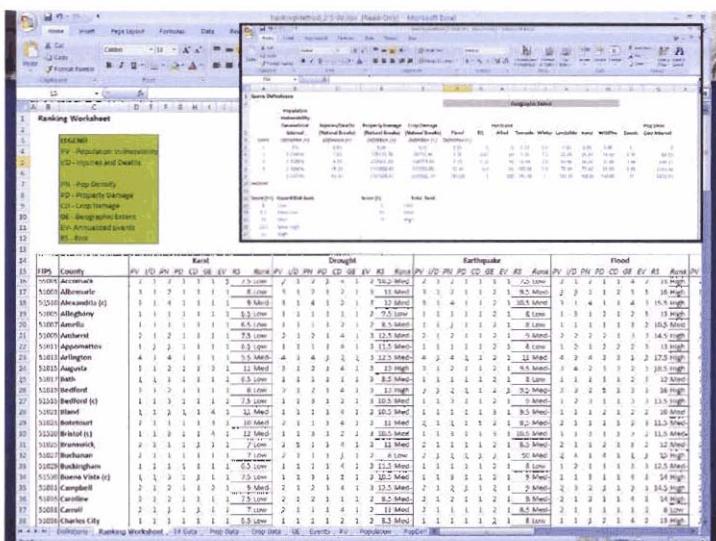
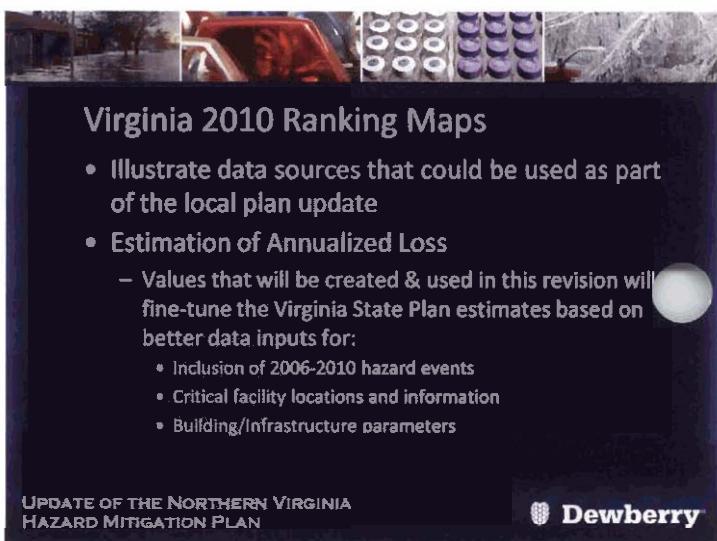
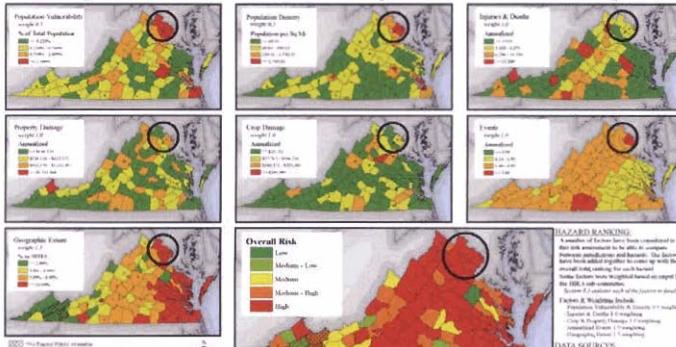


Figure 3.7-5: Flood Hazard Ranking Parameters and Risk Map



Virginia 2010 Ranking Maps

- Illustrate data sources that could be used as part of the local plan update
 - **Estimation of Annualized Loss**
 - Values that will be created & used in this revision will fine-tune the Virginia State Plan estimates based on better data inputs for:
 - Inclusion of 2006-2010 hazard events
 - Critical facility locations and information
 - Building/infrastructure parameters

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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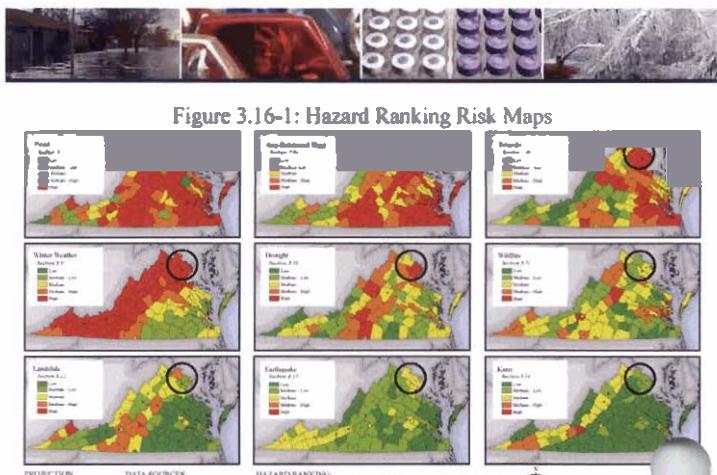


Figure 3.16-1: Hazard Ranking Risk Maps

Vulnerability Analysis & Loss Estimation

- Annualized Loss based on NCDC and HAZUS-MH
- Building Specific Analysis for Buildings & Critical Facilities
 - Data Dependant
- Social Vulnerability
- Development Trends
 - In areas of high risk?

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Flood Loss Estimation

TABLE 5.10 100-year Floodplain Exposure in the Northern Virginia Region (Zones A and AE)						
Jurisdiction	Total Number of Parcels	Total Number of Developed Parcels	Number of Undeveloped Parcels	Total Number of Structures	Assessed Value for Parcels with One or More Structures	Assessed Value for Parcels with No Structures
Arlington City	19,200	14,337	4,863	1,000	\$11,077,511,000	\$11, \$109,907,702
Clarendon City	7,200	3,337	3,863	2,400	\$1,000,000	—
City of Falls Church	2,700	1,875	825	950	\$1,000,000	—
City of Manassas	1,000	100	900	100	\$1,000,000	—
City of Manassas Park	1,000	100	900	100	\$1,000,000	—
City of McLean	1,000	100	900	100	\$1,000,000	—
City of Vienna	1,000	100	900	100	\$1,000,000	—
County of Arlington	10,000	6,000	4,000	1,000	\$11,077,511,000	\$11, \$109,907,702
County of Fairfax	10,000	6,000	4,000	1,000	\$11,077,511,000	\$11, \$109,907,702
County of Prince William	10,000	6,000	4,000	1,000	\$11,077,511,000	\$11, \$109,907,702
County of Loudoun	10,000	6,000	4,000	1,000	\$11,077,511,000	\$11, \$109,907,702
County of Manassas	1,000	100	900	100	\$1,000,000	—
County of Prince William	1,000	100	900	100	\$1,000,000	—
County of Virginia	10,000	6,000	4,000	1,000	\$11,077,511,000	\$11, \$109,907,702
Total	38,200	18,337	18,863	3,000	\$11,077,511,000	\$11, \$109,907,702
Subtotal	38,200	18,337	18,863	3,000	\$11,077,511,000	\$11, \$109,907,702
Total	38,200	18,337	18,863	3,000	\$11,077,511,000	\$11, \$109,907,702

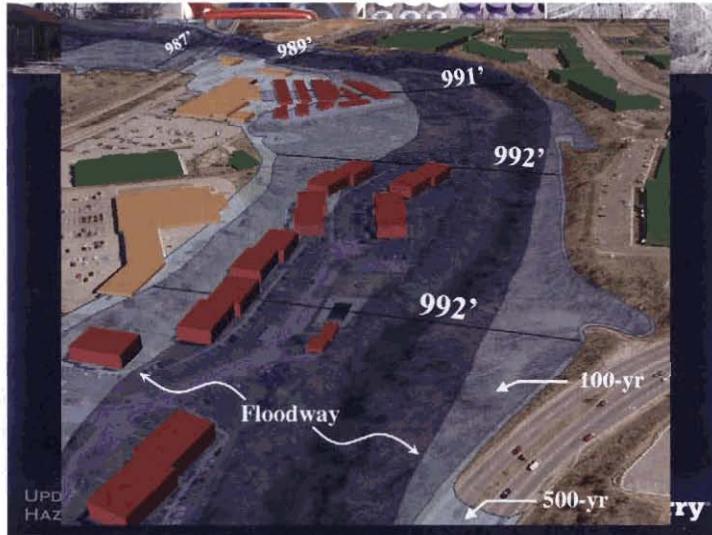
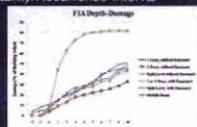
Jurisdiction	Annualized Loss
Fairfax County (2)	\$7,505,247
Prince William County (6)	\$5,069,348
Loudoun County (8)	\$2,157,843
Alexandria, City of (10)	\$1,997,414
Falls Church, City of	\$420,031
Arlington County	\$308,725
Manassas, City of	\$212,413
Falls Church, City of	\$112,540
Manassas Park, City of	\$41,588
TOTAL	\$15,824,658

Planning Area	2010 State Plan	2006 Local Plan
Planning Area 1	\$308,235	\$1,236,000
Planning Area 2	\$10,095,732	\$1,240,000
Planning Area 3	\$2,157,842	\$556,000
Planning Area 4	\$3,323,349	\$880,000
Total	\$15,824,658	\$3,912,000

2010 Plan Update: Potential Assumptions for annualized loss Calculations

Annualized Loss = Percent Damaged * Building \$\$ Exposure * Hazard Probability/Recurrence Interval

FEMA Flood Zone	Flood Depth (feet)	Annual Probability	Percent Damaged
Floodway, VE	6	0.0100	40%
AE	2	0.0100	22%
A, AO, AH	1	0.0100	14%
0.2 percent annual change (500 year)	1	0.0020	14%



HAZUS-MH Scenarios

• Level I Analysis

- Nationally-developed data for building square footage, building value, population characteristics, costs of building repair and economic data (broken down by census division units)
 - Flood
 - Earthquake
 - Hurricane Winds
- HAZUS is not required in Local Mitigation Plans, communities are encouraged to use HAZUS to form a scientific basis from which the mitigation strategy is developed.

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Annualized Loss

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate

2006 Local Plan Loss Estimates for:

Hurricanes (HAZUS-MH)	Earthquake (HAZUS-MH)
Flood (NCDC)	Winter Storm (NCDC)
Drought (NCDC)	Wildfire (NCDC)
Severe T-storms (NCDC)	Landslide (NCDC)
Tornado (NCDC)	

2010 State Plan Loss Estimates for:

Flooding (Flood depth assumptions & NCDC)	Winter Storm (NCDC)
Non-Rotational Wind (HAZUS-MH)	Wildfire (NCDC & VDOF)
Drought (NCDC)	Landslide (NCDC)
Earthquake (HAZUS-MH)	
Tornado Wind (NCDC)	

2010 Local Plan Estimates should align with (or update) state data sources and established hazard occurrence probabilities

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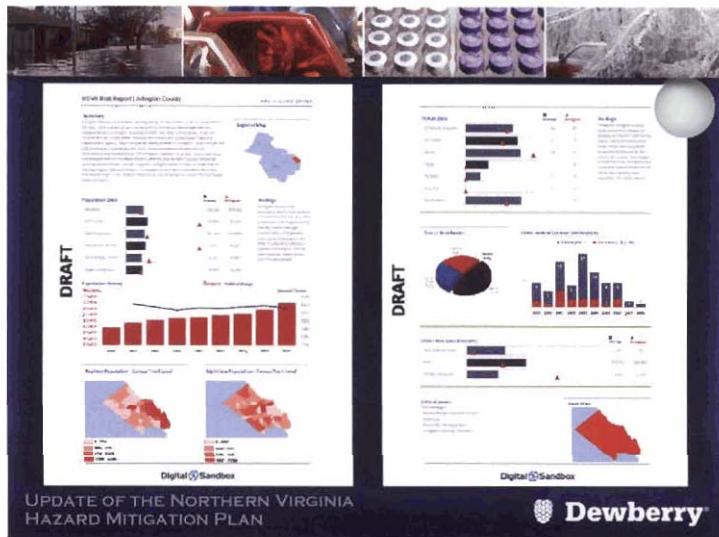
Terrorism Context Report

Digital Sandbox

- Risk Input Template
- Expectations
- What Hazards to Consider?
- Specific Buildings/Infrastructure

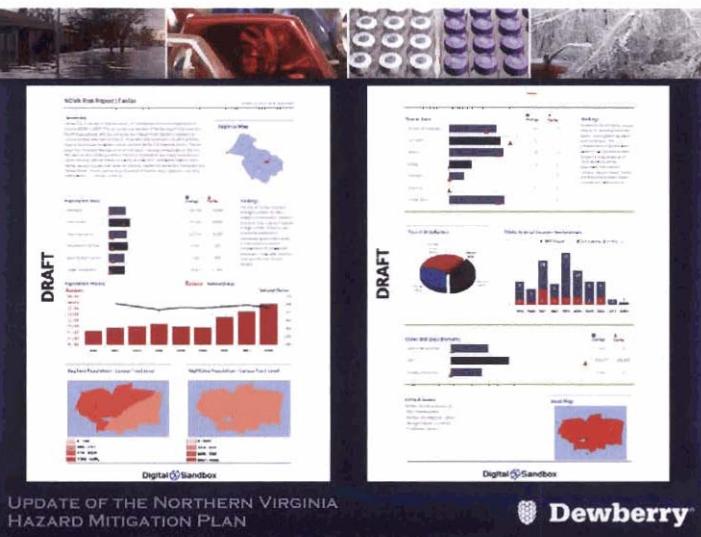
UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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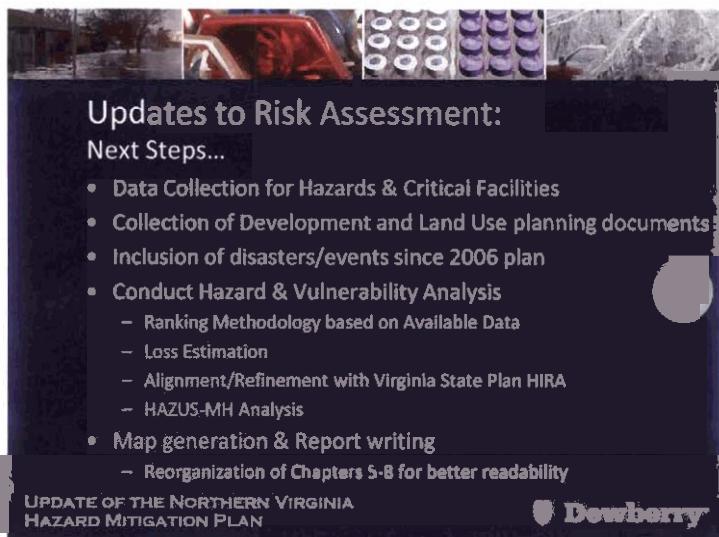
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Updates to Risk Assessment:

Next Steps...

- Data Collection for Hazards & Critical Facilities
- Collection of Development and Land Use planning documents!
- Inclusion of disasters/events since 2006 plan
- Conduct Hazard & Vulnerability Analysis
 - Ranking Methodology based on Available Data
 - Loss Estimation
 - Alignment/Refinement with Virginia State Plan HIRA
 - HAZUS-MH Analysis
- Map generation & Report writing
 - Reorganization of Chapters 5-8 for better readability

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Project Schedule

Project Task	Dec 2009 - June 2010	June 2010 - Nov 2010	Aug 2011
Task 1 Planning Support & Project Management			
Task 2 Hazard Identification and Risk Assessment			
Task 3 Mitigation Goals, Objectives and Projects			
Task 4 Plan Production & Adoption			

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Northern Virginia Mitigation Plan Update Kick Off Meeting

~~December 4, 2009 Sign-in Sheet~~

January 15, 2010

Name	Department/Organization	Phone	Fax	E-mail
Becky McKinney	Fairfax County OEM	571-350-1009	571-351-1010	Elizabeth.mckinney@fairfaxcounty.gov <i>EM</i>
Pat Collins	Prince William County OEM	703-792-5828	703-792-7149	pcollins@pwgov.org <i>PW</i>
Alexa Hussar	Prince William County OEM	703-792-5254	703-792-7149	ahussar@pwgov.org <i>AH</i>
Kevin Johnson	Loudon County OEM	703-737-8831	703-779-0012	Kevin.johnson@loudon.gov
Charlie McRorie	City of Alexandria	703-838-3825	703-548-6952	Charlie.mcrorie@alexandriava.gov <i>CM</i>
Beth Brown	VDEM	804-317-6685		Beth.brown@vdem.virginia.gov <i>BWB</i>
Robbie Coates	VDEM	804-897-6800, ext. 6582		Robbie.coates@vdem.virginia.gov
Lucia Schmit	Arlington County	703-228-7936		l schmit@arlingtonva.us
Dan Ellis	City of Falls Church	703-248-5058	703-248-5158	delis@fallschurchva.gov
Sam Myers	Loudon County OEM	703-737-8130	703-779-0012	Sam.myers@loudon.gov
Deborah Mills	Dewberry (contractor)	703-849-0216	703-206-0803	dmills@dewberry.com
Larry Zensinger	Dewberry (contractor)	703-849-0139	703-206-0803	lzensinger@dewberry.com

Update of the Northern Virginia Hazard Mitigation Plan Agenda

Northern Virginia Hazard Mitigation Plan Update
Hazard Identification, Risk Assessment and Vulnerability Analysis
Review and Update of 2006 Plan Goals, Objectives and Regional Strategies



Monday, July 12, 2010 9:00 – 3:00 PM

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8403 Arlington Boulevard (rear Building), Fairfax VA 22031

Training Center – Ground Floor

Description	Lead	Time
Welcome, Introductions and Agenda <ul style="list-style-type: none">• Planning Process Review• Progress to Date	Deborah Mills	9:00 – 9:30
Hazard identification, Risk Assessment and Vulnerability Analysis by hazard	Ryan Towell, Ginni Melton	9:15 – 10:15
BREAK		10:15 – 10:30
HIRA Review, continued	Ryan Towell, Ginni Melton	10:30 – 11:00
Human Caused Hazards Analysis	Digital Sandbox	11:00 - NOON
LUNCH	Provide	NOON – 12:30 PM
Review and Validation of 2006 Plan Goals and Action Strategy	Jane Sibley Frant:	1:00 – 2:30
Next Steps: Local Plan Committee Scheduling Project Schedule Remaining Local Inputs Required 2006 Evaluation Capability Analysis	Deborah Mills Carrie Speranza	2:30 – 3:00

Attendees Morning Session:

HIRA, Vulnerability Analysis and Human-Caused Hazard Presentations:

NOVA Hazard Mitigation Committee	VDEM
Northern Virginia Regional Commission Climate Change Committee	FEMA
NOVA Emergency Managers or designees	

Attendees Afternoon Session:

2006 Plan Goals and Mitigation Actions Group Review, Validation and Update

NOVA Hazard Mitigation Committee	VDEM
Northern Virginia Regional Commission	FEMA
NOVA Emergency Managers or designees	

Update of the Northern Virginia Hazard Mitigation Plan



Dewberry Team:

Project Manager	Deborah Mills	703.849.0162 804.335.9946 (c)	dmills@dewberry.com
HIRA Lead	Rachael Herman	585-429-7448	rherman@dewberry.com
Planning Lead	Jane Sibley Frantz	703.849.0473	jfrantz@dewberry.com
Planning Support and Share Point Site	Carrie Speranza	703.849.0367	csperanza@dewberry.com
Climate Change and HIRA Support	Ryan Towell	703.849.0275	rtowell@dewberry.com
Local Plan Annex Leads	Carrie Speranza Shandi Treloar	703.849.0367 703.849.0449	csperanza@dewberry.com streloar@dewberry.com
Structural Mitigation Project Scoping	Julia Moline Jennifer Holcomb	703.849.0610 703.849.0556	jmoline@dewberry.com jholcomb@dewberry.com

Arlington County Project Management Team:

Project Manager	Stephanie Jaffe	(703) 228-4739	sjaffe@arlingtonva.us
Financial Lead	Joanne Hughes	703.228.3560	jmhughes@arlingtonva.us
Senior Advisor	Bonnie Regan	703.228.3464	bregan@arlingtonva.us
Outreach Lead	TBD		

SharePoint Site

The screenshot shows the SharePoint site 'NovaMitPlan' with the following details:

- Navigation:** Home, Documents and Lists, Create, Site Settings, Help.
- Header:** Home - NovaMitPlan - Windows Internet Explorer, dewberry.com.
- Announcements:**
 - Welcome! by Carrie Sibley 3/2/2010 2:17 PM
 - Welcome to the Northern Virginia Hazard Mitigation Plan Update Sharepoint Site. This site will be used to transfer data, update project documents, and continue committee communications in between project meetings. Please stay tuned for project...
 - Add new announcement.
- Site usage reminder:** Project team sites are for file sharing and collaboration, not for file storage. Sites and files that have not been accessed in over 2 years are subject to deletion to recover much needed disk space.
- Logging In Securely:** Tip: Change the protocol in the URL to your site from <http://> to <https://> to logon to your project site securely using SSL...
- Need a password reset?** Helpdesk@dewberry.com is the new contact for password reset requests.
- Information:** If you have forgotten your password, send an email to helpdesk@dewberry.com to have it reset. Include the subject line "Team Site Password Reset" and the web site address and your email address in the body of the message.
- Sidebar:** Lists for various county strategies: Arlington County Strategies, City of Alexandria Strategies, City of Fairfax Strategies, City of Falls Church Strategies, City of Manassas Park Strategies, City of Manassas Strategies, Fairfax County Strategies, Loudoun County Strategies, Prince William County, Town of Dumfries Strategies, Town of Herndon Strategies, Town of Leesburg Strategies, Town of Purcellville Strategies, Town of Vienna Strategies.
- Footer:** Dewberry projects.dewberry.com PROJECT TEAM WEB SITES.

Email Carrie Speranza for access to the Share Point Site: csperanza@dewberry.com

Update of the Northern Virginia Hazard Mitigation Plan

2006 Plan Goals

- Goal #1** Improve the quality of *best available data* for conducting detailed hazard risk assessments and preparing meaningful mitigation action plans.
- Goal #2** Increase the financial capability of local jurisdictions throughout the Northern Virginia region to implement hazard mitigation measures through maximizing grant funding opportunities as well as locally available fiscal resources.
- Goal #3** Develop and maintain specific plans to minimize the potential affects of natural hazards, including the relevant local emergency preparedness, response and recovery plans.
- Goal #4** Work to improve existing local policies, codes and regulations to reduce or eliminate the impacts of known natural hazards. This includes maintaining continued compliance with the National Flood Insurance Program (NFIP) for all participating jurisdictions.
- Goal #5** Investigate and implement a range of structural projects that will reduce the effects of natural hazards on public and private property throughout the region.
- Goal #6** Disseminate information to increase the general public's awareness of natural hazard risks in the Northern Virginia region, while also educating residents and businesses on the mitigation measures available to minimize those risks.

NVRC Mitigation Action 1	Coordinate with participating local jurisdictions on the acquisition and/or development of improved GIS data layers for use in conducting enhanced risk assessment studies for future updates to the Northern Virginia Regional Hazard Mitigation Plan.
Category:	Planning
Hazard(s) Addressed:	All Hazards
Lead Agency/Department Responsible:	Regional Planning Services
Estimated Cost:	\$100,000
Potential Funding Sources:	U.S. Department of Homeland Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP), Pre-Disaster Mitigation Grant (PDM) Program
Implementation Schedule:	2006 – 2007
Priority (High, Moderate, Low):	High

Update of the Northern Virginia Hazard Mitigation Plan



2006 Plan Mitigation Techniques:

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

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

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

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

Update of the Northern Virginia Hazard Mitigation Plan

- Beach nourishment
- Storm sewers

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. 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

2010 Update of the Northern Virginia Hazard Mitigation Plan

Hazard Identification & Risk Assessment (HIRA) Results

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July 12, 2010



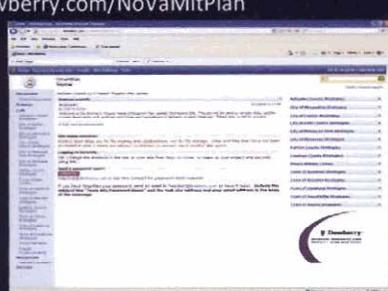
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Reviewing HIRA

via SharePoint

- <http://projects.dewberry.com/NoVaMitPlan>
- Requires:
 - Username
 - Password



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Meeting Agenda

1. Welcome & Introductions
2. Hazard Identification and Risk Assessment
3. Human Caused Hazards Analysis
4. Review and Validation of the 2006 Plan Goals and Action Strategy
5. Next Steps:
 - Local Plan Committee Scheduling
 - Project Schedule
 - Remaining Local Inputs Required
 - 2006 Evaluation
 - Capability Analysis

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HIRA: Hazard Identification & Risk Assessment

- Purpose: Provides a factual basis for prioritizing hazard mitigation activities
- Major components:
 - Identify and profile natural hazards
 - Describe vulnerability to jurisdictions and estimate potential losses
 - Assess Vulnerability to Repetitive Loss properties
 - Describe vulnerability to critical facilities, and estimate potential losses
 - Describe land use and development trends

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FEMA Guidance for HIRA

- Identify Hazards
 - Which hazards are significant enough to warrant investigation?
 - How is each hazard defined?
- Profiling Hazards
 - Identify Location (geographic areas affected) and Intensity
 - Information on Previous Occurrences
 - Probability of Future Events

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FEMA Guidance for HIRA

- Assessing Vulnerability
 - Jurisdictions most threatened & vulnerable to damage and loss
 - Identify facilities most threatened & vulnerable to damage and loss
 - Updated plan needs to *Reflect changes in development for jurisdictions in hazard prone areas*
- Estimating Potential Losses to Local Critical Facilities
 - Analysis of potential losses by jurisdiction
 - Analysis of potential losses to the identified vulnerable structures
 - Updated plan needs to *Reflect the effects of changes in development on loss estimates*

For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

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HIRA

- 2010 HIRA Update
 - Review & revision to the 2006 HIRA and Vulnerability assessment
 - “Base” 2006 hazard identification still valid
 - Incorporate new jurisdictions into HIRA

Arlington County	Prince William County
Fairfax County	Town of Dumfries
Town of Herndon	Town of Manassas
Town of Vienna	Town of Occoquan
Town of Clifton	Town of Quantico
Loudoun County	City of Alexandria
Town of Leesburg	City of Fairfax
Town of Purcellville	City of Falls Church
Town of Middleburg	City of Manassas
Town of Round Hill	City of Manassas Park

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Hazards Addressed

- Multiple hazards impact NoVA; how do we determine priority hazards?
 - Previous Hazard Mitigation Plan (2006)
 - Declared Disasters
 - Availability of Data

Flood	Extreme Temperatures
Winter Storms	Dam Failure
Severe Thunderstorms	Erosion
Tornadoes	Landslides
Hurricanes & Tropical Storms	Sinkholes
Drought	Human-Caused (Digital Sandbox)
Wildfire	
Earthquakes	

Flood	Extreme Temperatures
Winter Storms	Dam Failure
Severe Thunderstorms	Erosion
Tornadoes	Landslides
Hurricanes & Tropical Storms	Sinkholes
Drought	Human-Caused (Digital Sandbox)
Wildfire	
Earthquakes	

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HAZARD MITIGATION PLAN



Population

- Primary measure of vulnerability in the hazard ranking system.
- Hazards affecting populated areas have greater impact than hazards affecting uninhabited areas.
- Maps & Data for:
 - 2009 Population
 - 2009 Population Density
 - Population Change
 - Land Use trends were briefly assessed at a broad scale, noting areas of significant urbanization

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HAZARD MITIGATION PLAN



Report Re-Structuring with Hazard Specific Sub-Sections

- SPECIFIC HAZARD – RANKING
- 2010 Commonwealth of Virginia Ranking Results
- Description
- Hazard History
- Risk Assessment
 - Probability
 - Impact & Vulnerability
 - Risk
 - Critical Facility Risk
 - Jurisdictional Risk

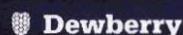
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Background Data

- Population
- Social Vulnerability
- Climate Change
- Land Use and Development
- Local Zoning
- Critical Facilities
- Building Inventory
- Disaster Data
 - Federally Declared
 - NCDC

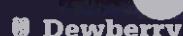
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Population

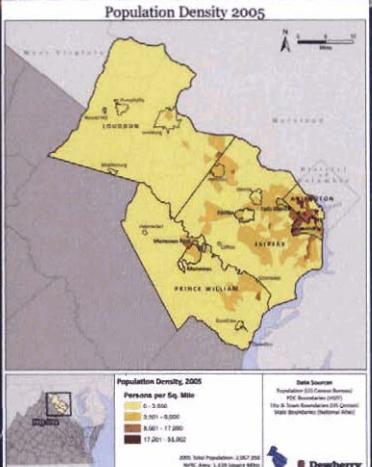
Jurisdiction	2000 Census	Estimated 2009	Percent Change
Arlington County	185,453	217,038	11.92%
Fairfax County	969,749	1,034,473	6.88%
Town of Herndon	21,853	27,045	1.80%
Town of Vienna	14,458	16,908	3.11%
Town of Clifton	185	210	
Loudoun County	169,598	296,115	75.78%
Town of Leesburg	28,311	39,641	40.02%
Town of Purcellville	3,584	3,137	43.33%
Town of Middleburg	812	943	49.21%
Town of Round Hill	500	746	49.20%
Prince William County	280,813	386,934	37.79%
Town of Dumfries	4,937	4,805	-2.67%
Town of Haymarket	879	1,226	39.48%
Town of Occoquan	759	816	7.51%
Town of Quantico	561	607	8.20%
City of Alexandria	128,283	141,738	10.49%
City of Fairfax	21,498	24,702	14.90%
City of Falls Church	10,377	11,711	12.86%
City of Manassas	35,135	36,218	3.07%
City of Manassas Park	10,290	14,024	36.31%

Source: U.S. Cens.



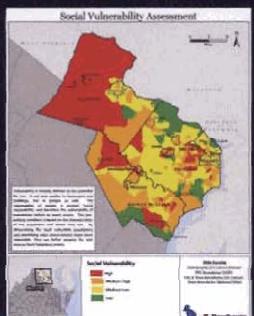
NOVA Population Density

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30 Social Vulnerability variables were measured and grouped into 8 Principal Components:

1. Socioeconomic Status
2. Wealth
3. Elderly
4. Densely Populated Female Headed Households
5. Rural Agriculture
6. Female/Female Labor
7. Asian Population
8. Mobile Homes



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Social Vulnerability

- The vulnerability of people is termed '*social vulnerability*' and describes the vulnerability of populations before an event occurs.
- Pre-existing condition that impacts:
 - Ability to prepare for event
 - Recover from event
- By determining the most vulnerable populations and identifying why they are at risk, we can tailor preparedness and recovery programs for hazard events.

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Climate Change

- Considered as a potential *amplifier* of existing natural hazards
- Discussion of projections as related to specific hazards (i.e. flooding, drought)
 - Potential future impact on hazard:
 - Frequency
 - Intensity
 - Distribution

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Sustainable Shorelines and Community Management

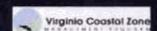
Project Manager
Laura Grape
Senior Environmental Planner
lgrape@novaregion.org

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Working together to:

- Collect Data
- Assess Vulnerability
 - Storm Surge Flooding
 - Sea Level Rise
- Develop Strategies
 - Protect
 - Accommodate
 - Retreat
- Improve Resilience



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Scope of Work

Phase I

Oct 08 - Sep 09

- Workgroup Establishment;
- Broad Vulnerability Analysis;
- Policy Review



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Phase II

Oct 09 - Sep 10

- Assessment Refinement:
 - Economic Analysis
 - Strategy Development
 - Best Practices
 - Community Awareness



Phase III

Oct 10 - Sep 11+

- Strategy Refinement;
 - Implementation Framework
 - Outreach, as appropriate



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Workgroup

- Identify key targeted planning areas
- Provide data and information
- Shape the strategy and recommendations



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Arlington County
City of Alexandria
Fairfax County
Prince William County
Town of Quantico
Town of Occoquan
George Mason University
Virginia Tech
NPS – Center for Urban Ecology
NPS – GW Memorial Parkway
Fort Belvoir
Quantico Marine Corps Base
VA DCR – Mason Neck
USFWS – Mason Neck Refuge
VA Dept of Transportation

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End Goals

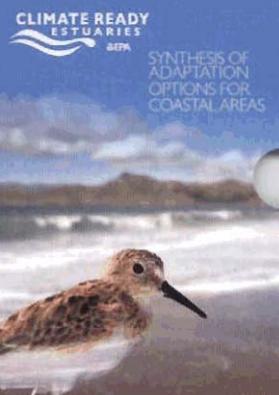
- Maps showing areas at risk of inundation from SLR and Storm Surge in the region.
- Quantification of specific elements vulnerable for both the built and natural environments.
 - Building, roadways, parks, tidal wetlands, critical infrastructure, wells, septic fields, etc...
 - Economic value/Ecosystem services
- Strategies to improve resilience of communities & structures located in areas at risk.

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Current Efforts

- VIMS Shoreline Situation Report update
- Quantifying other important elements
 - Economic Evaluation
- Survey of Waterfront Property Owners
- Analysis of adaptation options and applicability to NoVA



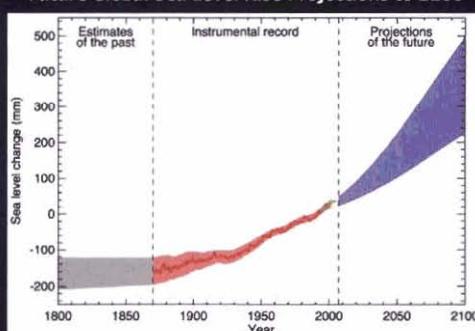
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SLR Scenarios

Scenario	Definition	Relative Sea Level Rise Rate
Steady State	Observed historic trend at Washington, D.C. gage. (NOAA Tides and Currents, Station 09400)	3.3 mm/year (1 foot by 2100)
Average Accelerated	Average projected sea level rise rate for the Chesapeake Bay region. (IPCC, AR4, SREC, AR4, and GCM, AR4)	11.6 mm/year (1.9 feet by 2050; 3.8 feet by 2100)
Worst Case	Highest projected rate for the mid-Atlantic and Chesapeake Bay regions. (SREAC, AR4, and GCM, AR4)	16 mm/year (2.6 feet by 2050; 5.2 feet by 2100)

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Future Global Sea Level Rise Projections to 2100



Uncertainties lie with the magnitude and speed of changes in the future.

If the West Antarctic Ice Sheet and the Greenland Ice Sheet were to melt, there would be a global increase in sea level rise of at least 13 meters.
(IPCC 2007, NRC 2002).

Source: IPCC 2007 - <http://www.epa.gov/climatechange/science/futureseas.html>

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NOVA Areas at Risk - SLR

- Sea Level Rise = Hot Spots (i.e. the lowest lying areas in the region)



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Hot Spots for Sea Level Rise	
Arlington	<ul style="list-style-type: none">National AirportFour Mile Run
Alexandria	<ul style="list-style-type: none">Four Mile RunDangerfield IslandOld TownJones Point
Fairfax County	<ul style="list-style-type: none">HuntingtonBelle Haven/New AlexandriaDyke MarshTidal EmbaymentsHallowing Point
Prince William County	<ul style="list-style-type: none">Occoquan NWRTidal EmbaymentsTown of QuanticoOccoquan River

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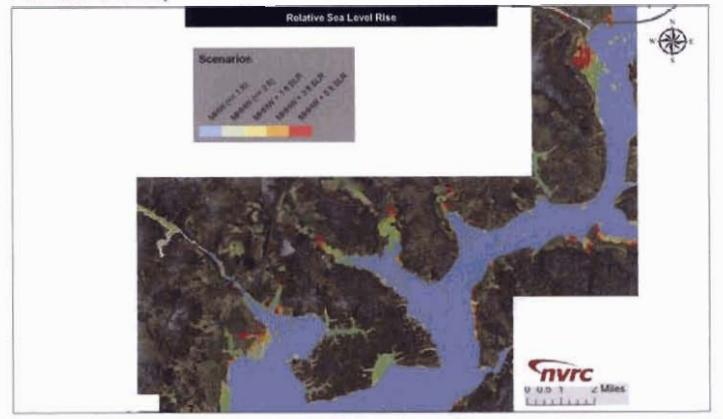
City of Alexandria



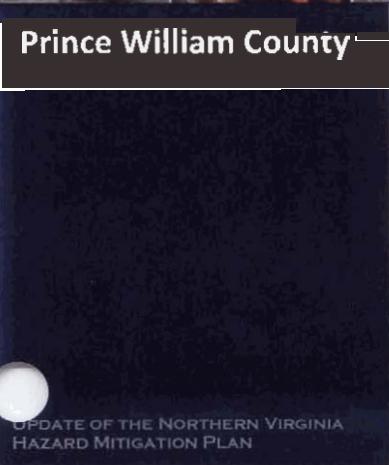
Arlington County



Fairfax County



Prince William County



Land Use and Development

- Jurisdiction Provided Zoning Data and/or Maps discussed in report
- National Land Cover Dataset (NLCD)
 - 1992 & 2001 datasets
 - Land Use types defined by the NLCD Land Use Change Project
 - Percent Change for:
 - Urban Land Cover
 - Forest Cover
 - Wetland Cover
 - Agricultural Land Cover

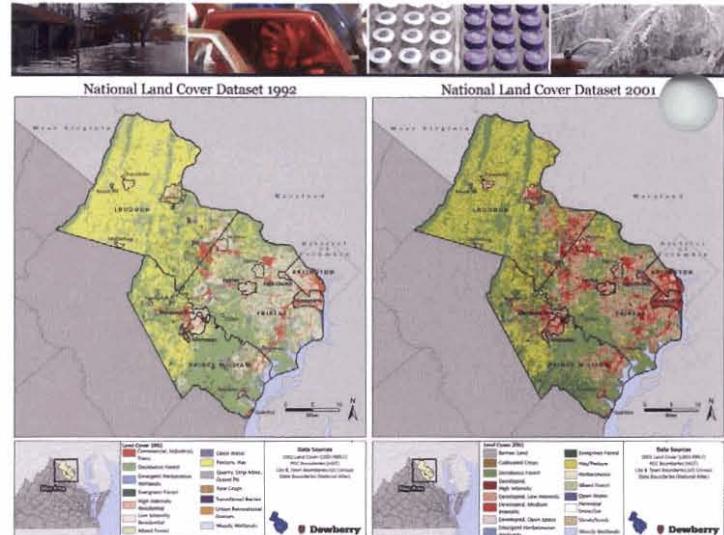
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Land Use Changes

Jurisdiction	Urban Change (Acres)	Forest Change (Acres)	Agricultural Change (Acres)	Wetland Change (Acres)
Arlington County	(628.49)	(1,693.09)	385.19	146.34
Fairfax County	(16,529.25)	(27,808.21)	13,700.61	(1,425.55)
Herndon	(84.73)	(228.18)	(72.06)	(28.91)
Vienna	(688.53)	(274.21)	111.20	9.56
Clifton	(43.59)	(12.23)	24.24	1.33
Loudoun County	9,838.96	(17,791.12)	(8,349.58)	72.95
Leesburg	1,596.13	(1,517.62)	(1,259.64)	(15.12)
Purcellville	215.95	(160.57)	(489.49)	0.00
Middleburg	(27.80)	(37.14)	(52.93)	0.00
Round Hill	22.68	(38.25)	(56.49)	(3.11)
Prince William	(1,350.38)	(16,364.01)	8,406.07	840.43
Dumfries	(65.61)	14.90	12.45	(41.37)
Haymarket	(44.92)	4.67	(45.59)	3.78
Occoquan	(17.57)	(4.23)	(4.89)	1.56
Quantico	(2.67)	(2.22)	6.23	(3.78)
Alexandria	(211.27)	(695.65)	(62.49)	(39.14)
Fairfax City	(555.10)	(640.05)	245.75	23.57
Falls Church	(288.89)	(48.93)	20.02	(0.44)
Manassas	(231.29)	(294.45)	(328.03)	10.01
Manassas Park	(121.65)	(86.73)	31.36	(1.33)
Total	(9,218.03)	(67,677.32)	12,221.93	(449.24)

UPDATE OF THE
HAZARD MITIGATION PLAN

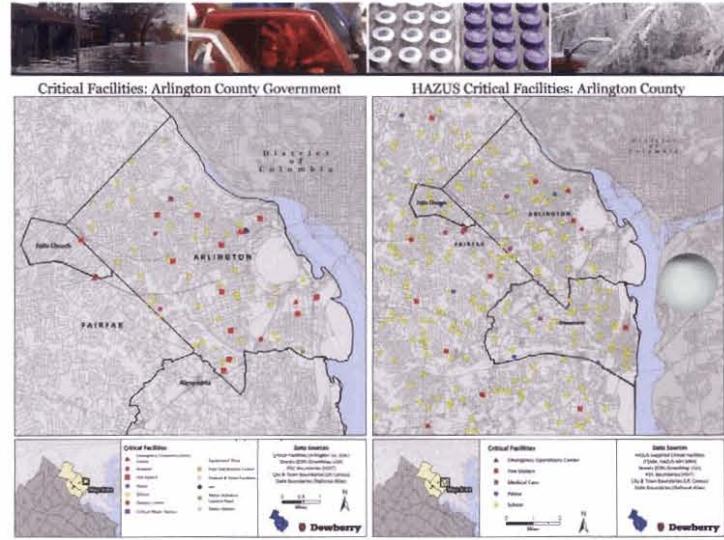


Critical Facilities

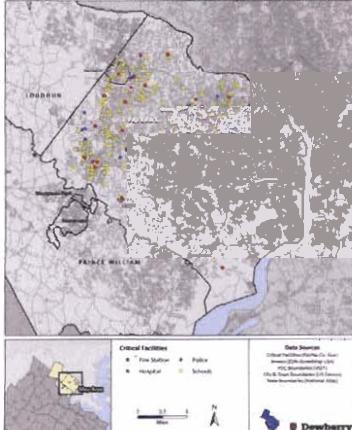
- GIS Data collected from each of the participating jurisdictions

Jurisdiction	Schools	Fire Stations	Hospital	Police	Total
Arlington County	275	39	26	35	375
Fairfax County					
Town of Herndon					
Town of Vienna					
Town of Clifton					
Loudoun County	84		2		86
Town of Leesburg					
Town of Purcellville					
Town of Middleburg					
Town of Round Hill					
Prince William County					
Town of Dumfries					
Town of Haymarket					
Town of Occoquan					
Town of Quantico					
City of Alexandria	18				18
City of Fairfax					
City of Falls Church					
City of Manassas					
City of Manassas Park					
Total	377	39	28	35	479

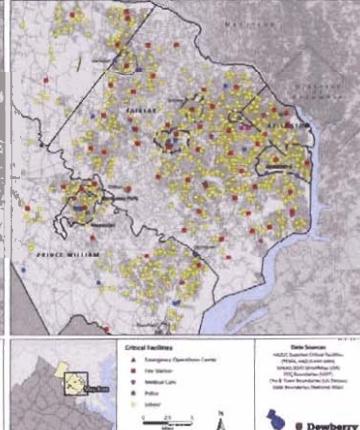
UPDATE OF THE NORTHERN
HAZARD MITIGATION PLAN



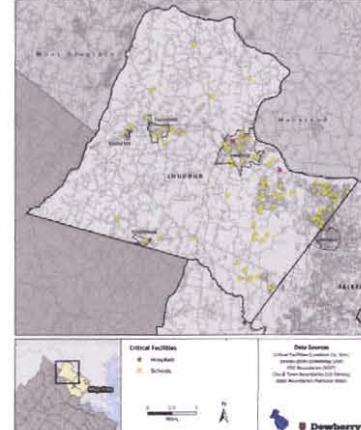
Critical Facilities: Fairfax County Government



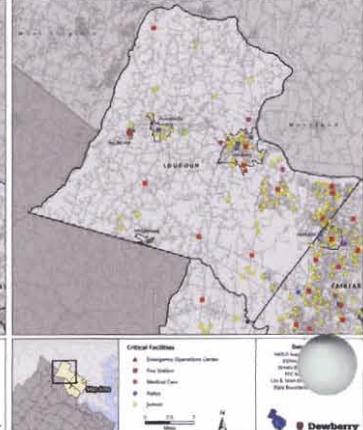
HAZUS Critical Facilities: Fairfax County

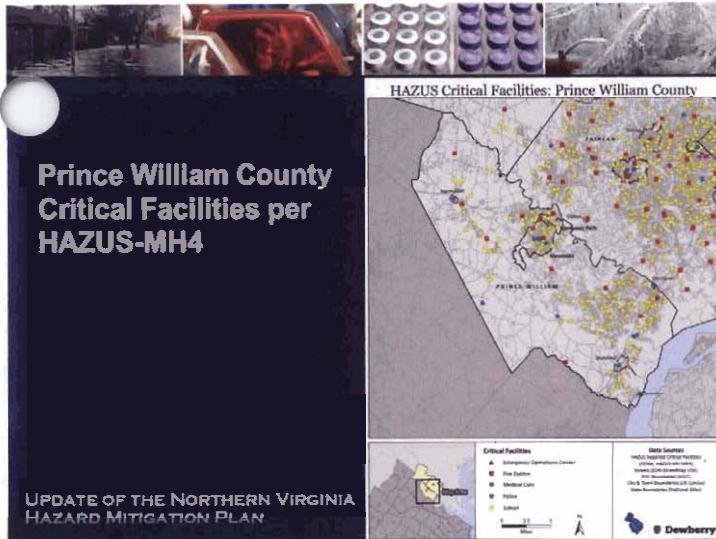


Critical Facilities: Loudoun County Government



HAZUS Critical Facilities: Loudoun County





Critical Facilities

Local data supplemented with HAZUS essential facility data

Jurisdiction	EOC	Fire Station	Hospitals	Police Stations	Schools (grade)	Total
Alexandria	3	3	1	43	50	
Arlington	1	1	2	31	35	
Fairfax	4	0	4	14	22	
Falls Church		0	1	5	6	
Manassas	1	1	5	19	26	
Manassas Park	1	0			3	4
Montgomery County	35	8	9	303	355	
Prince William County	1	8	3	61	78	
Tysons Corner	9	1	5	114	129	
Town of Clifton	1	0			1	
Town of Dumfries		0	1	2	3	
Town of Haymarket		0	1		1	
Town of Herndon	1	0	1	8	10	
Town of Leesburg	2	0	5	17	24	
Town of Middleburg		0	1	2	3	
Town of Occoquan		0	1		1	
Town of Purcellville		0	2	3	4	
Town of Quantico		0	1		1	
Town of Round Hill	1	0			1	
Town of Vienna	1	0	1	11	12	
Total	1	68	17	40	636	762

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

Hazard Data Availability

- Federally Declared Disasters
 - Jurisdictions declared
 - Nature of disaster
 - Type(s) of assistance provided

National Climatic Data Center (NCDC) Storm Events Database

- Local NWS Offices
- Includes location and time of event, property and crop damages, injuries and deaths
- Data may be biased by population
- Need to process data to assign all events/damages to specific jurisdictions

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Federally Declared Disasters

- 14 of the 52 Virginia disasters have included at least one community in the NoVA planning area
 - City of Alexandria has been declared 11 times
- Disaster Types
 - 5 Severe winter storms, snowstorms or blizzards
 - 4 Hurricanes or tropical storms
 - 4 Severe storms (tornadoes) and flooding
 - 1 Terrorism

Jurisdiction	Drought	Flood	High Wind	Tornado	Winter Storm	Total
LOUDOUN	81	75	244	24	144	518
FAIRFAX	20	101	209	19	126	475
PRINCE WILLIAM	20	75	128	13	128	364
ARLINGTON	20	50	94	2	113	279
MANASSAS (C)	20	46	54	2	124	246
ALEXANDRIA (C)	20	47	60	1	111	239
FALLS CHURCH (C)	20	38	46	1	111	216
FAIRFAX (C)		5	20			25
MANASSAS PARK (C)	2	1	1			4
Total	151	439	856	63	857	2,366

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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National Climatic Data Center (NCDC) Storm Events Database

- Events records from February 1, 1951 – August 31, 2009
- Data from VDEM for ranking parameters
- Data Processing to be able to compare & complete loss estimates
 - Zonal Events
 - Normalizing by Number of Counties
 - Damage Inflation
- Ranking Methodology Discussed Later in Presentation

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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NCDC Data

- There are 3,164 events recorded for the NOVA region
- 797 are grouped in the "N/A" category

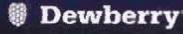
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Total	151	439	856	63	857	2,366

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Jurisdiction	Injuries	Fatalities	Total Events	Total Crop Damage	Total Property Damage
ALEXANDRIA (C)	0	0	239	\$2,860,525	\$4,759,842
ARLINGTON	5	1	279	\$2,860,525	\$10,502,311
FAIRFAIR	59	2	475	\$2,620,475	\$94,131
FAIRFAX (C)	0	1	25	\$0	\$160,088.25
FALLS CHURCH (C)	0	1	216	\$2,860,525	\$10,005,942
LOUDOUN	11	0	518	\$7,317,346	\$13,657,802
MANASSAS (C)	0	0	246	\$0,014,556	\$16,054,822
MANASSAS PARK (C)	5	0	4	\$0	\$12,041
PRINCE WILLIAM	18	2	364	\$3,080,631	\$26,141,926
Total	98	7	2,366	\$24,614,583	\$241,311,507

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

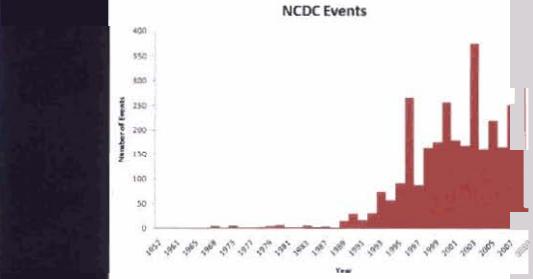
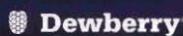


Hazard Ranking

- The purpose of the hazard identification and risk assessment is to provide a factual basis for developing mitigation strategies; to prioritize those jurisdictions which most threatened and vulnerable to natural hazards.
 - FEMA guidance indicates that the jurisdictions at *greatest risk* to specific hazards should be identified, considering both the characteristics of the hazard and the jurisdictions' degree of vulnerability.

A variety of analysis methods may be sufficient to meet these goals; FEMA does not mandate a specific analysis method.

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Hazard Ranking

- The purpose of the hazard identification and risk assessment is to provide a factual basis for developing mitigation strategies; to prioritize those jurisdictions which most threatened and vulnerable to natural hazards.
 - FEMA guidance indicates that the jurisdictions at *greatest risk* to specific hazards should be identified, considering both the characteristics of the hazard and the jurisdictions' degree of vulnerability.

A variety of analysis methods may be sufficient to meet these goals; FEMA does not mandate a specific analysis method.

2010 Ranking Parameters

- “Semi-Quantitative” Scoring System
 - Actual Data Values grouped in categories 1-4 based on statistics
 - NCDC Data with normalization (inflation ...)
 - Limitations wth probability & impact data
 - Parameters Used:
 - Population Vulnerability (weight 0.5)
 - Population Density (weight 0.5)
 - Geographic Extent (weight 1.5)
 - Annualized Deaths & Injuries (weight 1)
 - Annualized Crop & Property Damage (weight 1)
 - Annualized Events (weight 1)

Jurisdictional Risk (RS):

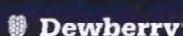
$$RS = (0.5 \cdot (PV + PN)) + ID + EV + PD + CD + (1.5 \cdot GE)$$



NCDC Ranking Spreadsheet



UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Population Vulnerability (PV)		Geographic Extent : Percentage of a jurisdiction impacted by the hazard (GE)		
Rank	Description	Hazard	Description	
1	<= 0.27% of VA population	Flood	Percent of a jurisdiction that falls within FEMA Special Flood Hazard Areas (SFHA).	
2	0.230% - 0.74% of VA population		Data: FEMA Floodplain (FIRM) Maps	
3	0.750% - 2.09% of VA population		Average number of days impacted throughout the entire jurisdiction.	
4	= 2.100% of VA population		Data: HAZUS 3-second Peak Gust Wind speeds	
Population Density (PN)		High Wind	Percent of jurisdiction that falls within a "high" risk zone.	
Rank	Description		Data: FDOF Wildfire Risk Assessment	
1	= 60.92 people/sq mi	Wildfire	Percent of jurisdiction where the risk is "high" for karst related events.	
2	60.93 - 339.10 people/sq mi		Data: USGS Engineering Aspects of Karst	
3	339.11 - 1,743.35 people/sq mi		Percent of jurisdiction where a high landslide risk exists.	
4	= 1,743.36 people/sq mi		Data: USGS Landslide Incidence & Susceptibility	
Annualized Events (EV)		Earthquake	Average 250-year return period max percent of gravitational acceleration (PGA).	
Rank	Definition		Data: HAZUS 2500 year PGA	
1	=< 0.09 events per year		Average annual number of days receiving at least 3 inches of snow, calculated as a weighted average for each jurisdiction.	
2	0.10 - 0.99 events per year		Data: NWS Snowfall statistics	
3	1.00 - 4.99 events per year	Landslide	Annual tornado fatality frequency (fatality rate one million), calculated as a weighted average for each jurisdiction.	
4	=> 5.00 events per year		Data: CDC Tornado fatality frequency statistics	
Annualized Deaths & Injuries (ID)			Average annual number of days receiving at least 3 inches of snow, calculated as a weighted average for each jurisdiction.	
Rank	Definition		Data: NWS Snowfall statistics	
1	=< 1.019 D&I per year		Annual tornado fatality frequency (fatality rate one million), calculated as a weighted average for each jurisdiction.	
2	1.020 - 6.279 D&I per year		Data: CDC Tornado fatality frequency statistics	
3	6.280 - 13.199 D&I per year	Winter Storms	Average annual number of days receiving at least 3 inches of snow, calculated as a weighted average for each jurisdiction.	
4	=> 13.200 D&I per year		Data: NWS Snowfall statistics	
Annualized Crop and Property Damage (CD, PD)			Average annual number of days receiving at least 3 inches of snow, calculated as a weighted average for each jurisdiction.	
Rank	Definition: Crop Damage	Definition: Property Damage	Data: NWS Snowfall statistics	
1	=< \$25,711 per year	=< \$136,129 per year	Annual tornado fatality frequency (fatality rate one million), calculated as a weighted average for each jurisdiction.	
2	\$25,712 - \$120,770 per year	\$136,130 - \$432,555 per year	Data: CDC Tornado fatality frequency statistics	
3	\$100,271 - \$256,384 per year	\$432,556 - \$1,111,067 per year	Average annual number of days receiving at least 3 inches of snow, calculated as a weighted average for each jurisdiction.	
4	=> \$291,385 per year	=> \$1,111,068 per year	Data: NWS Snowfall statistics	
Annualized Jurisdictional Risk (JR)		Jurisdictional Risk (RS):		
		$RS = (0.5^*(PV + PN)) + ID + EV + PD + CD + (1.5^*OE)$		



Potential Losses (annualized)

Requirement #201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate ...

2006 Local Plan Loss Estimates for:

Hurricanes (HAZUS-MH)	Earthquake (HAZUS-MH)
Flood (NCDC)	Winter Storm (NCDC)
Drought (NCDC)	Wildfire (NCDC)
Severe T-storms (NCDC)	
Tornado (NCDC)	

2010 Update Loss Estimates for:

Hurricane Wind (HAZUS-MH Annualized Loss)	High Wind (NCDC)
Flooding (HAZUS-MH Annualized Loss and 100-yr)	Earthquake (HAZUS-MH Annualized Loss)
Drought (NCDC)	Winter Storm (NCDC)
Tornado Wind (NCDC)	Wildfire (NCDC & VDOF)
	Landslide (NCDC)

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Hazard Specific Analysis

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HAZUS-MH Scenarios

• Level I Analysis

- Nationally-developed data for building square footage, building value, population characteristics, costs of building repair and economic data (broken down by census division units)
 - Flood
 - Earthquake
 - Hurricane Winds

- **HAZUS is not required in Local Mitigation Plans, communities are encouraged to use HAZUS to form a scientific basis for which the mitigation strategy is developed.**

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Flood

• Risk Assessment

- Probability (100-yr and Annualized)
 - HAZUS-MH
- Impact & Vulnerability
 - HAZUS-MH
- Risk
 - Critical Facility Risk
 - 2006 Analysis Results
 - HAZUS-MH
 - Jurisdictional Risk
 - 2006 Analysis Results
 - HAZUS-MH



UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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National Flood Insurance Program (NFIP)

NoVA region has more than 10,398 National Flood Insurance policies in-force

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

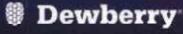
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Flood Map Status:

Community Name	Init FHBM Identified	Init FIRM Identified	Current Effective Map Date	Reg-Enter Date	DFIRM/Q3
Arlington County	10/1/1969	5/3/1982	12/31/1976		DFIRM
Fairfax County	5/5/1970	3/5/1990	3/5/1990 will be 9/7/2010	1/7/1972	
Town of Herndon	6/14/1974	8/1/1979	8/1/1979 will be 9/17/2010	8/1/1979	DFIRM
Town of Vienna	8/2/1974	2/3/1982	2/3/1982 will be 9/17/2010	2/3/1982	
Town of Clifton	3/28/1976	5/2/1977	will be 9/17/2010	5/2/1977	
Loudoun County	4/25/1975	1/5/1978	7/5/2001	1/5/1978	
Town of Leesburg	8/3/1974	9/30/1982	7/5/2001	9/30/1982	
Town of Purcellville	7/11/1975	11/19/1989	7/5/2001	1/15/1989	DFIRM
Town of Middleburg	7/5/2001		7/5/2001	7/5/2001	
Town of Round Hill	5/13/1977	7/5/2001	7/5/2001	1/10/2008	
Prince William County	1/10/1976	12/1/1981	1/5/1995	12/1/1981	
Town of Dumfries	6/18/1976	5/15/1980	1/5/1995	5/15/1980	
Town of Haymarket	8/9/1974	1/17/1990	1/5/1995	1/31/1990	DFIRM
Town of Occoquan	7/19/1974	9/1/1978	1/5/1995	9/1/1978	
Town of Quantico	11/1/1974	8/19/1978	1/5/1995	8/15/1978	
City of Alexandria	8/22/1969	8/22/1989	5/15/1991	5/8/1970	Q3
City of Fairfax	5/5/1970	12/23/1971	6/2/2006	12/17/1971	DFIRM
City of Falls Church	9/6/1974	2/3/1982	7/16/2004	2/3/1982	DFIRM
City of Manassas	5/31/1974	1/3/1979	1/5/1995	1/3/1979	DFIRM
City of Manassas Park	3/11/1977	9/29/1978	1/5/1995	9/29/1978	DFIRM

as of 7/6/2010 <http://www.fema.gov/cis/VA.html>

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



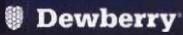
Repetitive & Severe Repetitive Loss

Repetitive Loss (RL) property = any insurable building for which 2 or more claims of >\$1,000 were paid by the NFIP within a rolling 10-year period

Severe Repetitive Loss (SRL) property = has at least 4 NFIP claim payments >\$5,000, and the cumulative amount >\$20,000 OR at least 2 separate claim payments exceed the market value of the building

- **63 Repetitive Loss Properties in NoVA totaling \$5,257,918 in total losses paid**
- **2 Severe Repetitive Loss Properties in NoVA planning district**
 - Prince William County (City of Manassas)
 - Loudoun County

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



HAZUS-MH MR4 Analysis

Flood Runs completed for the 100-yr and Probabilistic Scenarios

- \$3,405,921 could be expected from a 100-year event in NoVA
- **\$99,049,000 annually in damages due to flood events**
 - Fairfax County accounts for 47.7% of total losses
 - Property or "capital stock" losses make up about \$98,899,000 (building, content, and inventory)
 - Business interruption accounts for 0.15% of the annualized losses and includes income, rental, wage, and relocation costs.
 - Residential losses account for the majority of the estimated losses.

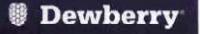
UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



NFIP Policy Statistics

County	Community Name	Policy Statistics (as of 3/31/2010)		Claim Statistics (as of 3/31/2010)	
		Policies In-Force	Insurance Premium	Total Claims	Total Payment
Arlington County	Arlington County	793	\$144,938,600	91	\$285,832
	TOTAL	793	\$144,938,600	91	\$285,832
Fairfax County	Town of Herndon	5,204	\$1,211,787,800	50	\$1,070,923
	Town of Vienna	84	\$16,064,300	1	\$1,070,923
	Town of Clifton	87	\$24,256,400	1	\$1,070,923
	Town of Round Hill	4	\$1,200,000	1	\$1,070,923
	TOTAL	5,466	\$1,233,309,200	52	\$1,070,923
Loudoun County	Town of Leesburg	514	\$1,355,200	87	\$1,070,923
	Town of Purcellville	14	\$20,400,000	1	\$1,070,923
	Town of Middleburg	16	\$2,623,000	1	\$1,070,923
	Town of Quantico	3	\$70,000	1	\$1,070,923
	TOTAL	614	\$188,727,100	91	\$1,071,093
Prince William County	Prince Williams County	1,091	\$273,058,600	237	\$3,615,233
	Town of Dumfries	16	\$3,965,100	6	\$34,841
	Town of Haymarket	2	\$700,000	1	\$1,070,923
	Town of Occoquan	36	\$12,128,600	16	\$86,912
	Town of Quantico	6	\$600,000	1	\$1,070,923
	TOTAL	1,149	\$380,448,300	258	\$3,708,595
City of Alexandria	City of Alexandria	1,050	\$371,645,100	221	\$3,677,309
	TOTAL	1,060	\$371,645,100	221	\$3,677,309
City of Fairfax	City of Fairfax	5,698	\$83,867,000	27	\$3,677,309
	TOTAL	5,698	\$83,867,000	27	\$3,677,309
City of Falls Church	City of Falls Church	141	\$39,887,300	18	\$111,260
	TOTAL	141	\$39,887,300	18	\$111,260
City of Manassas	City of Manassas	66	\$16,254,800	26	\$105,618
	TOTAL	66	\$16,254,800	26	\$105,618
City of Manassas Park	City of Manassas Park	24	\$5,579,400	1	\$105,618
	TOTAL	24	\$5,579,400	1	\$105,618
	NoVA TOTAL	10,391	\$2,352,673,800	1,253	\$17,152,566
	VIRGINIA TOTAL	109,712	\$224,557,793,200	38,036	\$548,246,841

Source: <http://ea.fema.gov/statistics/>



UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

*Town information included in the county totals

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



Critical Facilities

- **100-year Scenario**
 - Schools with moderate damage
 - SAMUEL W. TUCKER ELEMENTARY SCHOOL
 - LEES CORNER
 - ST MARY'S ELEMENTARY SCHOOL
 - HUTCHISON FARMS ELEMENTARY SCHOOL
 - Fire Stations with moderate damage
 - Aldie Volunteer Fire Department Inc.
 - Police Stations with moderate damage
 - Dumfries Police Dept

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



The figure consists of several panels. At the top left is a photograph of floodwaters. Next to it is a close-up of a red vehicle's bumper. To the right is a photograph of stacked blue barrels. Below these is a map of Prince William County, Virginia, showing census blocks color-coded by total annualized loss. The legend indicates four categories: < \$100,000 (light yellow), \$100,000 - \$1,000,000 (medium yellow), \$1,000,000 - \$10,000,000 (brown), and > \$10,000,000 (dark brown). The map shows significant flooding in the western and southern parts of the county. A scale bar and north arrow are included. At the bottom left is a smaller inset map of the county. The bottom right corner features the Dewberry logo.

HAZUS-MH NOVA Regional Total Annualized Loss Estimation

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

HAZUS Flood Model Total Annualized Loss

Map showing the Northern Virginia area with flood hazard zones (yellow) overlaid on county boundaries. The map includes labels for Arlington, Falls Church, Fairfax, and Prince William counties.

Announced Loss results for the Cities of Herndon and Falls Church are not available due to HAZUS flood model limitations. These two cities have more severe flooding areas than the surrounding rural areas. Flood studies elsewhere have confirmed the presence of flooding in each city.

Total Direct Economic Building Loss
Annualized, All Occupancies

Total per Census Block
\$0-\$50,000
\$50,001-\$1,000,000
\$1,000,001-\$2,500,000
\$2,500,001-\$4,000,000

Legend:

- Map Legend
- Water Bodies
- Major Roads
- Major Railroads
- Structures
- Structural Building Components
- Non-Structural Building Components
- Infrastructure
- Urban/Rural

Data Sources

- HAZUS Flood Model (HAZUS-MH)
- Census Data (Census 2010)
- City Boundaries (U.S. Census)
- Neighborhood (National Grid)

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Comparison with Commonwealth

- Based on the 2010 State plan the NOVA planning commission can expect \$15 Million in annualized loss due to flooding
- NCDC Property Damage** \$1,512,232
- NCDC Crop Damage** \$140,371

Planning Area	2010 State Plan	2006 Local Plan
Planning Area 1	\$308,235	\$1,236,000
Planning Area 2	\$10,035,232	\$1,240,000
Planning Area 3	\$2,157,842	\$555,000
Planning Area 4	\$3,323,349	\$880,000
Total	\$15,824,658	\$3,912,000

Population (rank in state)	Announced Loss
Fairfax County (2)	\$7,505,247
Prince William County (6)	\$3,069,348
Loudoun County (8)	\$2,157,842
Alexandria, City of (10)	\$1,997,414
Fairfax, City of	\$420,031
Arlington County	\$308,235
Manassas, City of	\$212,413
Gaines Church, City of	\$112,540
Manassas Park, City of	\$43,585
TOTAL	\$15,824,658



Flood Loss Estimate Variation		
Plan	Loss Estimate	Methodology
2006 NoVA HMP	\$3,912,000	Based on recorded historical events and applied loss estimation methodology.
2010 UPDATE	\$ 99,049,000	HAZUS-MH MR4 riverine analysis
NCDC Ann. Loss	\$1,652,603	Total reported property damages divided by total number of years of record
2010 VA HMP	\$15,824,658	Based on FIA Depth-Damage assumptions, DFIRMS, and census data for building exposure

Flood Hazard Ranking & Risk Map

A number of factors have been considered in this risk assessment to be able to compare between jurisdictions. These factors have been weighted and added together to calculate the overall total ranking for each hazard.

Factors & Weighting include:

- Population & Density & Density 0.5 weighting
- Injury & Death 1.0 weighting
- Impacts & Losses 1.0 weighting
- Ons & Offsiting 1.0 weighting
- Assessment 1.0 weighting
- Geographic Factor 1.5 weighting

Data Sources:

- NOAA NHC 2010-2012, 2013-2016
- USGS USGS 2010-2012, 2013-2016
- USGS National Elevation Dataset
- USGS National Hydrography Dataset

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Winter Storms

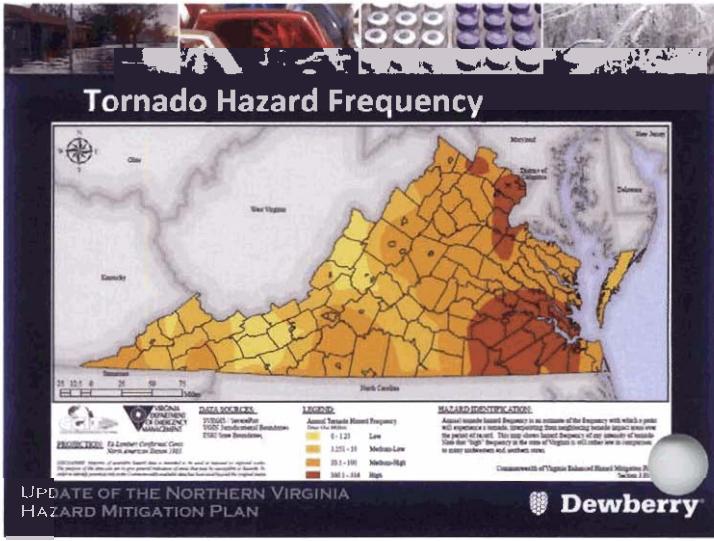
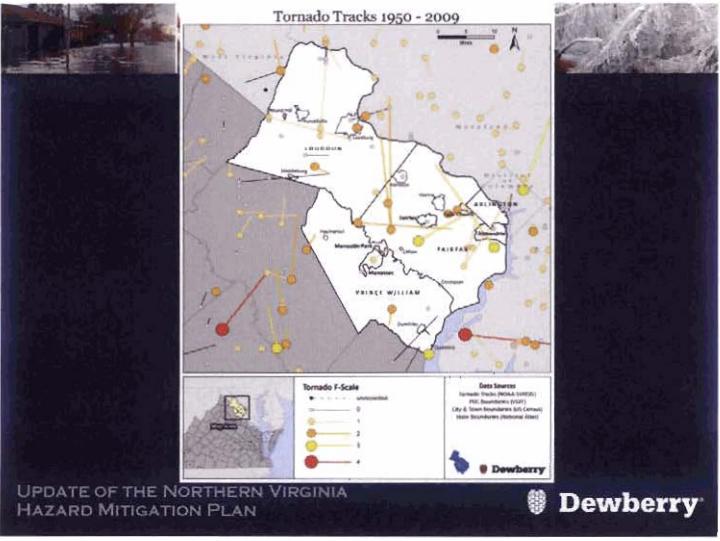
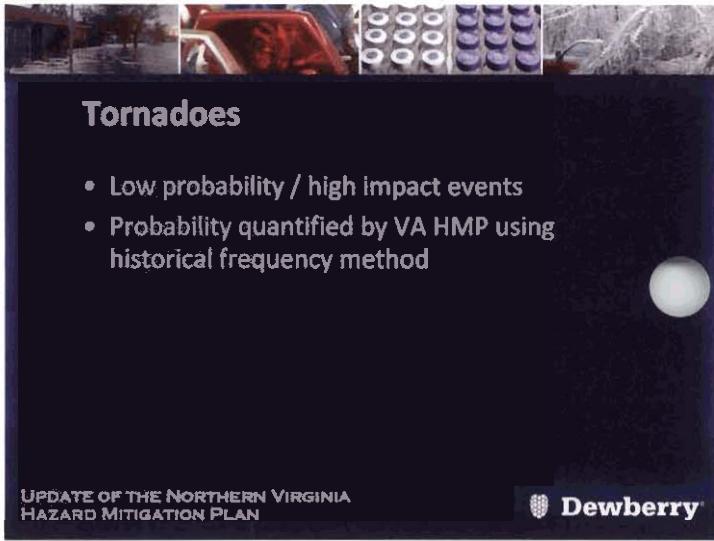
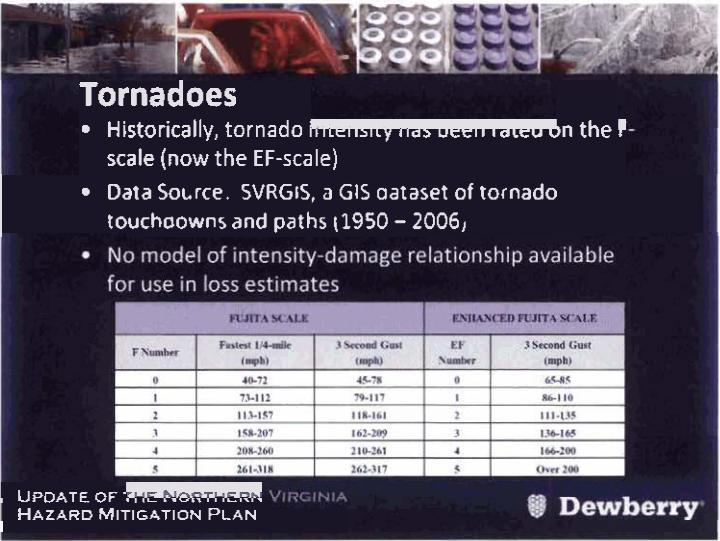
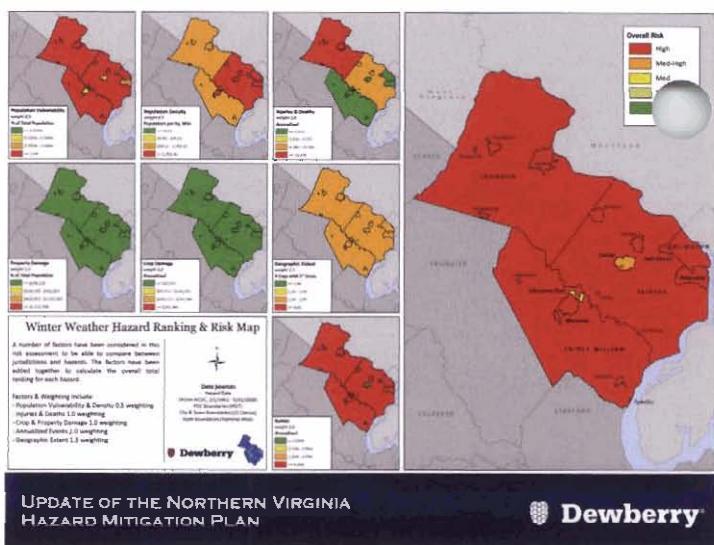
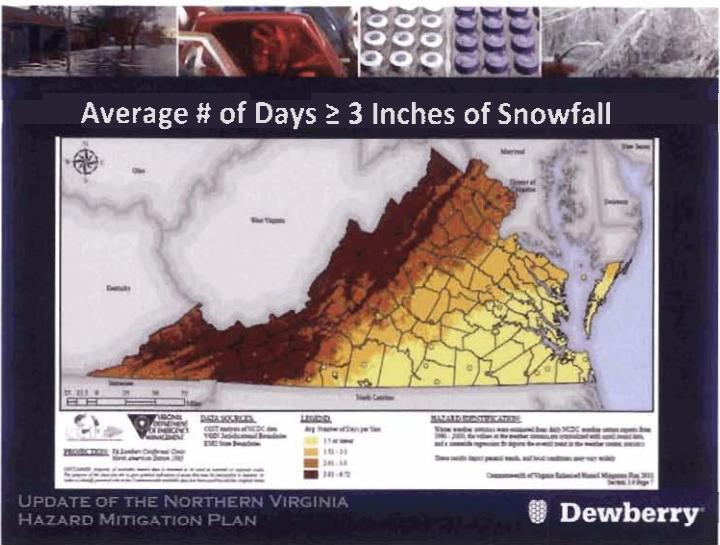
NCDC Annualized Loss
\$394,974

- **Impact and Vulnerability**
 - Transportation agencies and utility companies
- **VA HMP used weather station data to examine frequency of snowfall**

	Annualized Winter Storm Property & Crop Damages
Alexandria, City of	\$60,484
Arlington County	\$60,484
Fairfax, City of	\$0
Fairfax County	\$60,537
Falls Church, City of	\$60,484
Loudoun County	\$31,982
Manassas, City of	\$60,501
Manassas Park, City of	\$0
	\$394,974

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HAZARD MITIGATION PLAN

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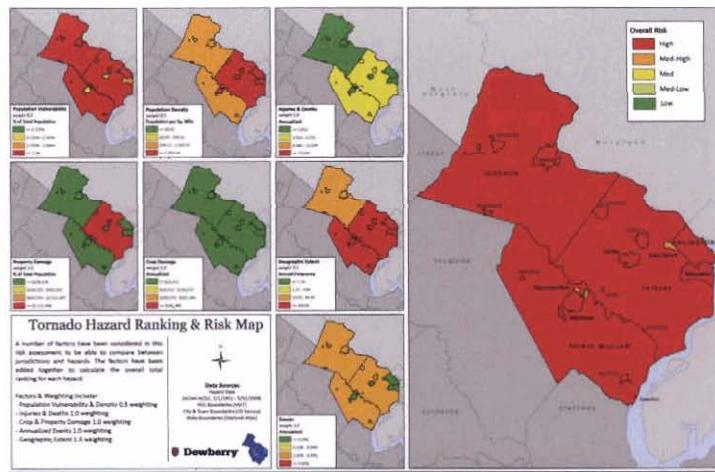
Tornado Loss Estimation

- NCDC Annualized Loss \$2,612,298

County	Annualized Tornado Property & Crop Damages
Fairfax County	\$2,265,041
Prince William County	\$117,080
Manassas, City of	\$0
Arlington County	\$22,033
Loudoun County	\$119,785
Falls Church, City of	\$88,210
Alexandria, City of	\$149,200
Fairfax, City of	\$0
Manassas Park, City of	\$0
Total	\$2,612,298

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Hurricanes and Tropical Storms

- Probability
- Impact & Vulnerability
- Risk
 - Critical Facility Risk
 - Jurisdictional Risk

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Hurricanes and Tropical Storms

- Data Source: NCDC & HAZUS
- NCDC Annualized Loss
- HAZUS Annualized Loss \$1,468,890

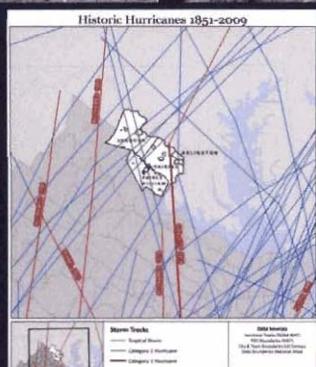
Hurricane Category	Wind Speed	Barometric Pressure	Damage Potential
1	75-95 mph	>980 Mb	Minimal
2	96-110 mph	965-979 Mb	Moderate
3	111-130 mph	945-964 Mb	Extensive
4	131-155 mph	920-944 Mb	Extreme
		<920 Mb	Catastrophic

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Historic Hurricane Tracks

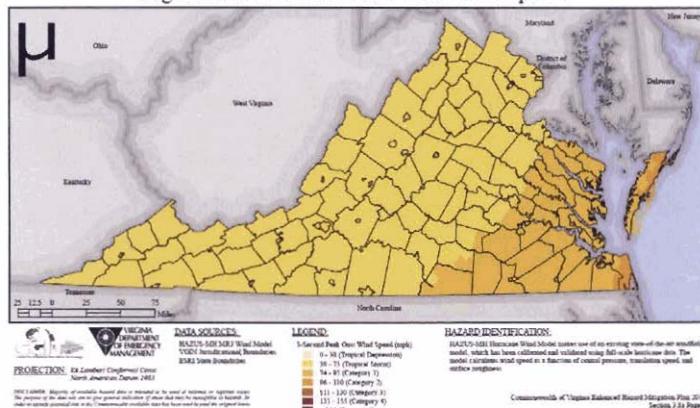


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Figure 3.8a-4: HAZUS 100-Year Wind Speeds



HAZUS-MRI Hurricane Wind Model makes use of an existing state-of-the-art inundation model, which has been calibrated and validated using field-scale bathymetric data. The model estimates peak wind speeds at a number of coastal points, inundation speeds, and surface heights.

Commonwealth of Virginia Natural Hazard Mitigation Plan 2010
Section 3.8a Page 20

HAZUS-MH MR4

Annualized Loss = \$ 4,795,691

- Probabilistic Annualized Loss = Expected value of loss in any one year, developed by aggregating the losses and exceedance probabilities.
- *Simulation Period is 100,000 years*
- Module estimates direct and indirect economic losses due to hurricane speed winds.
 - Damage to buildings & contents
 - Economic loss (business interruptions)
 - Social Impacts

UPDATE OF THE NORTHERN VIRGINIA
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100-year HAZUS Scenario

- 0.1% chance of happening in any given year
- Estimated losses from a 100-year event in NoVA \$806,589,749
- \$433 M in Fairfax County
- \$119 M in Prince William County

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



100-year HAZUS Scenario

- 1% chance of happening in any given year
- Estimated losses from a 100-year event in NoVA \$53,264,373
- \$29 M in Fairfax
- \$8 M in Prince William

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



1000-year HAZUS Scenario

- 0.1% chance of happening in any given year
- Estimated losses from a 1000-year event in NoVA \$806,589,749
- \$433 M in Fairfax County
- \$119 M in Prince William County

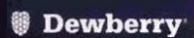
UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



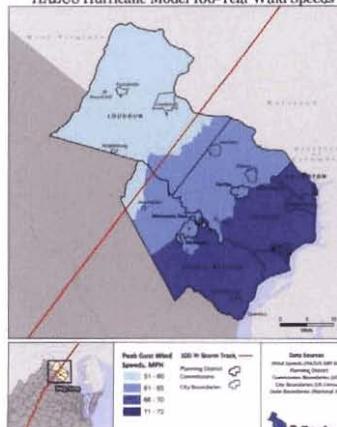
Critical Facilities

- 100-year Scenario
 - All essential facilities would have 100% functionality
- 1000-year Scenario
 - Day of event there would be 98% of hospital beds available for use
 - After one week, 100% of the beds will be back in service
 - All essential facilities would have functionality of >50% on day 1

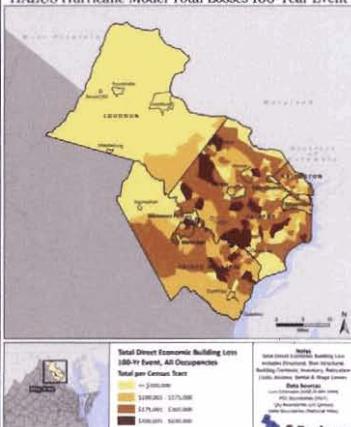
UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



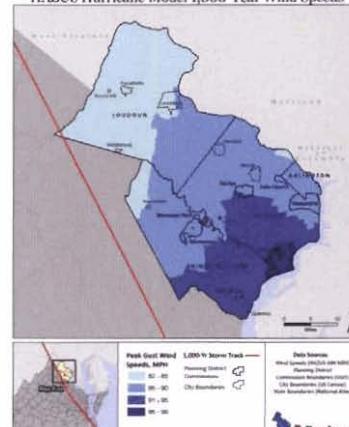
HAZUS Hurricane Model 100-Year Wind Speeds



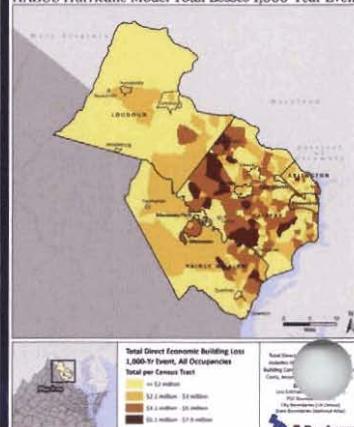
HAZUS Hurricane Model Total Losses 100-Year Event



HAZUS Hurricane Model 1,000-Year Wind Speeds



HAZUS Hurricane Model Total Losses 1,000-Year Event





Probabilistic Scenario

- Represent range of probable losses estimated from a 100,000-year simulation of expected hurricane activity
- \$4,795,691

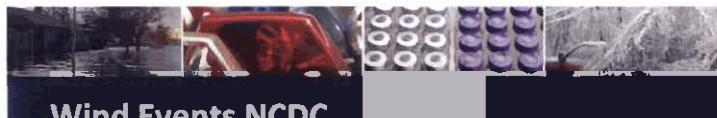
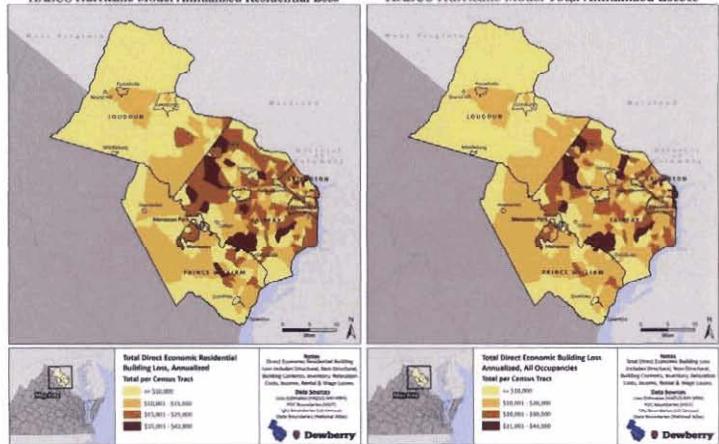
Hurricane Wind Annualized Loss:
total losses for simulation period divided by 100,000 years

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County	\$543,847	\$77,574	\$578	\$40,176	\$5,554	\$24,946	\$7,342	\$709,012
Fairfax County	\$2,086,176	\$212,519	\$1,643	\$119,367	\$11,790	\$50,745	\$18,512	\$2,495,750
Town of Herndon	\$36,458	\$4,273	\$68	\$2,479	\$458	\$1,098	\$558	\$45,353
Town of Vienna	\$86,154	\$9,379	\$48	\$2,263	\$407	\$779	\$460	\$144,098
Town of Clifton	\$504	\$26	\$0	\$228	\$14	\$7	\$12	\$506
Loudoun County	\$242,273	\$20,143	\$435	\$11,197	\$1,113	\$4,444	\$1,341	\$281,948
Town of Leesburg	\$24,607	\$1,807	\$20	\$1,312	\$163	\$612	\$238	\$27,745
Town of Purcellville	\$740	\$43	\$1	\$29	\$8	\$10	\$4	\$818
Town of Middleburg	\$89	\$5	\$0	\$4	\$1	\$2	\$1	\$201
Town of Round Hill	\$44	\$7	\$0	\$27	\$0	\$2	\$0	\$64
Prince William County	\$423,654	\$38,613	\$427	\$24,402	\$1,716	\$9,219	\$2,155	\$549,004
Town of Dumfries	\$4,644	\$453	\$4	\$383	\$78	\$181	\$41	\$56,547
Town of Haymarket	\$178	\$9	\$0	\$66	\$11	\$2	\$1	\$149
Town of Occoquan	\$698	\$84	\$5	\$57	\$6	\$21	\$6	\$1,005
Town of Quantico	\$2,050	\$370	\$4	\$211	\$48	\$151	\$40	\$2,465
City of Alexandria	\$387,214	\$57,616	\$427	\$30,477	\$4,703	\$17,598	\$6,277	\$504,342
City of Falls Church	\$45,380	\$5,279	\$98	\$3,158	\$731	\$1,460	\$770	\$56,677
City of Fairfax	\$26,561	\$3,810	\$33	\$2,137	\$401	\$3,034	\$488	\$57,440
City of Manassas	\$62,975	\$5,285	\$115	\$3,899	\$398	\$3,335	\$967	\$75,830
City of Manassas Park	\$16,418	\$1,395	\$30	\$903	\$47	\$275	\$78	\$19,145
Total	\$3,942,338	\$40,314	\$3,938	\$283,431	\$27,568	\$124,349	\$33,087	\$4,795,691



HAZUS Hurricane Model Annualized Residential Loss



Wind Events NCDC

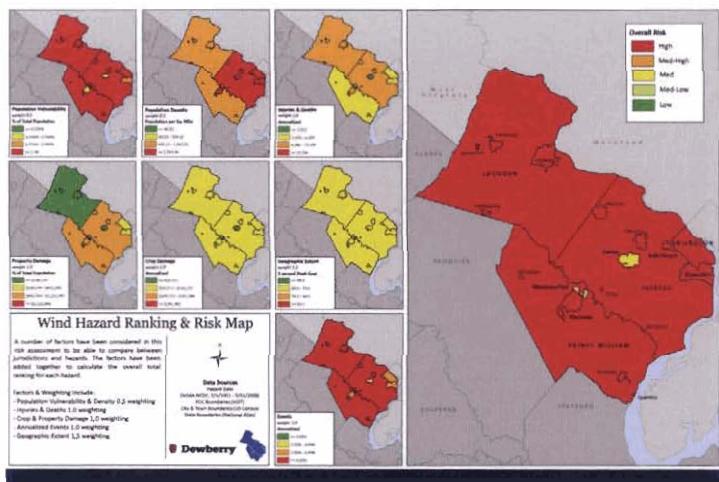
Annualized Loss Totals

- Tornado \$2,612,298
- High Wind (includes hurricane, thunderstorm) \$2,932,999
 - Hurricane/Tropical \$1,570,057

Jurisdiction	Hurricane/Tropical Storm	Annualized
Arlington County	\$2,019,524	\$96,168
Fairfax County	\$2,019,524	\$96,168
Loudoun County	\$66,158	\$3,150
Prince William County	\$12,413,476	\$591,113
City of Alexandria	\$2,019,524	\$96,168
City of Fairfax	\$0	\$0
City of Falls Church	\$2,019,524	\$96,168
City of Manassas	\$12,413,476	\$591,113
City of Manassas Park	\$0	\$0
Total	\$32,971,205	\$1,570,057

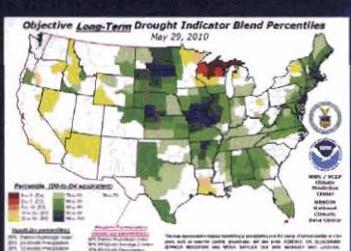
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Drought

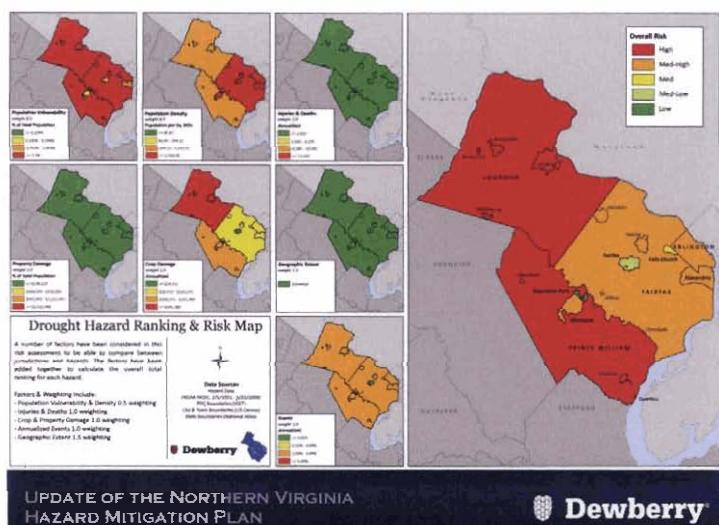
- Probability
- Impact and Vulnerability
 - Drought Monitor
- Risk
 - Critical Facility Risk
 - Jurisdictional Risk
- 168 recorded "droughts" in NCDC for NOVA; Loudoun County highest (31 events)



NCDC Annualized Loss \$942,971

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Wildfire

Risk Level	Probability	Impact	Spatial Extent	Warning Time	Duration
Highly Likely	Minor	Small	Less than 8 hours	Less than one week	

- Virginia Department of Forestry
- Probability
- Impact and Vulnerability
- Risk
 - Critical Facility Risk
 - Jurisdictional Risk

No NCDC records for Wildfire in NOVA

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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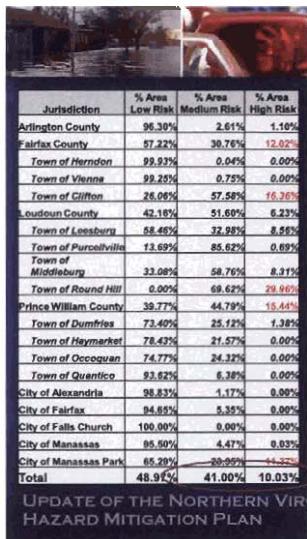


VDOF: Wildfire Causes and Events

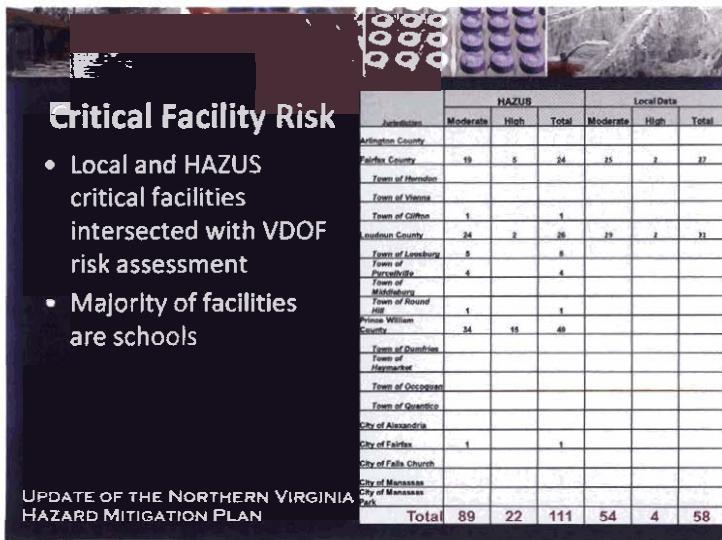
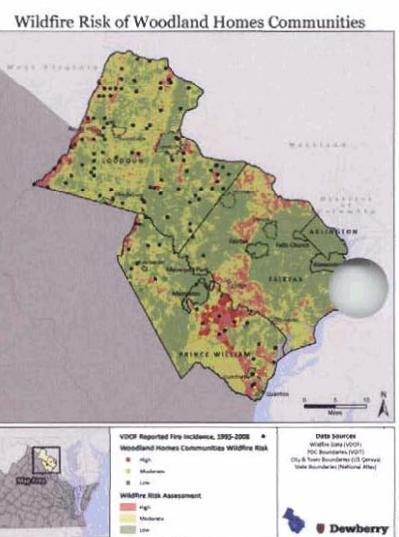
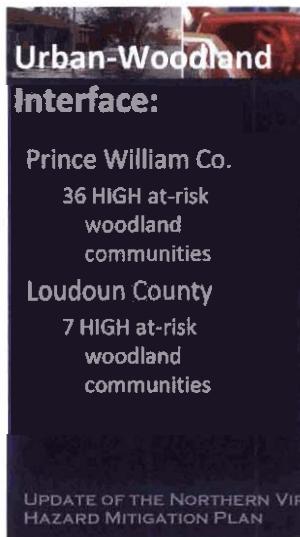
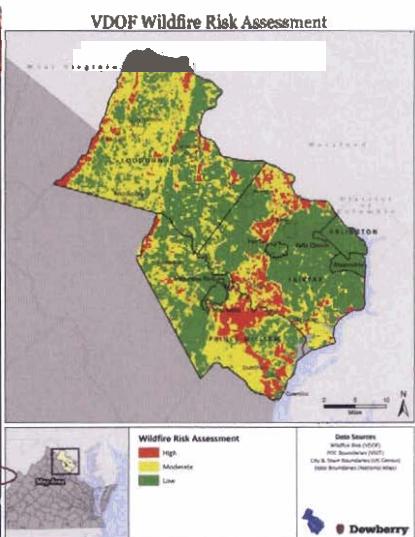
- Causes of wildfire in the NOVA region:
 - 29% Debris Burning
 - 20% Children
 - 19% Miscellaneous
 - 12% Incendiary
 - 10% Smoking
- There have been 120 wildfires burning 368 acres during 1995 – 2008 totaling \$180,895 in damages

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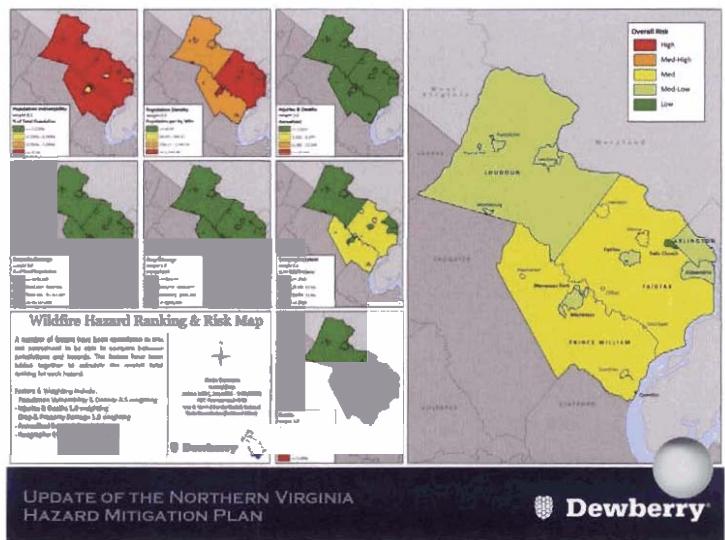
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UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



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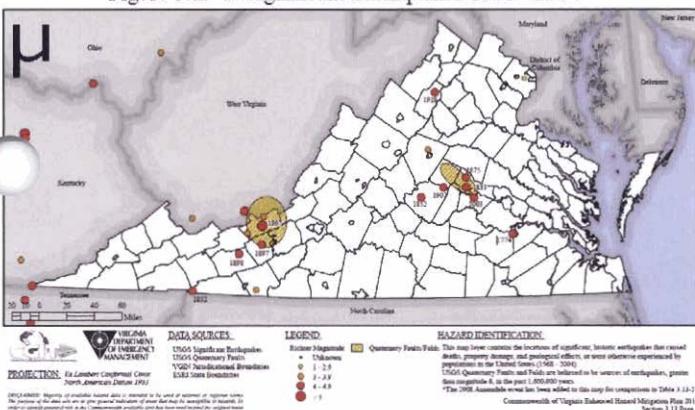
Building Fire

- Accidental building fires are relatively unpredictable
- Potential 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 (e.g., lighter, candle);
 - Heat from hot object (e.g., electric lamp, spark from friction);
 - Heat from natural source (e.g., lightning); and
 - Heat spreading from another hostile fire (exposure) (e.g., radiated heat, direct flame)
- Existing Fire Protection
 - Sprinkler Systems
 - Construction Materials

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Figure 3.13-1: Significant Earthquakes 1568 - 2004*



Earthquake

- Various visual & spatial representations of historical earthquakes and seismic hazard zones exist.
 - HAZUS Earthquake Module
 - USGS Significant Earthquake Locations
 - USGS Quaternary Fault Zones
 - Peak Ground Acceleration Mapping
- FEMA's HAZUS Earthquake module estimates damage and loss to buildings, lifelines and critical facilities.

No NCDC records for Earthquake in NoVA

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



HAZUS-MH MR4

NOVA regional commission can expect \$2,408,945 annually from Earthquake damage

ANNUALIZED LOSS

- Fairfax County accounts for 49.6%, with towns 52.2%
- Prince William County 12.7%, with towns 12.8%

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

HAZUS-MH MR4

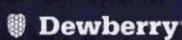
Correspondence with Dr. Martin Chapman director of the Virginia Tech Seismological Observatory (VTSO)

1. Probabilistic Scenario for Annualized Loss

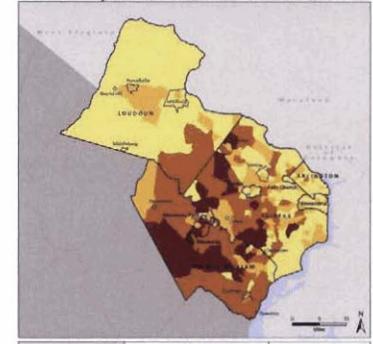
- Goochland 6.5 magnitude @ depth of 10: majority of continued EQ activity in this area and therefore is a reasonable and likely scenario.

MMI	PGA (%g)	Perceived Shaking	Potential Damage
I	<0.17	None Felt	None
II	0.17 - 1.4	Weak	None
III	0.17 - 1.4	Weak	None
IV	1.4 - 3.9	Light	None
V	3.9 - 9.2	Moderate	Very Light
VI	9.2 - 18	Strong	Light
VII	18 - 34	Very Strong	Moderate
VIII	34 - 65	Severe	Moderate to Heavy
IX	65 - 124	Violent	Heavy
X	> 124	Extreme	Very Heavy
XI	> 124	Extreme	Very Heavy
XII	> 124	Extreme	Very Heavy

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

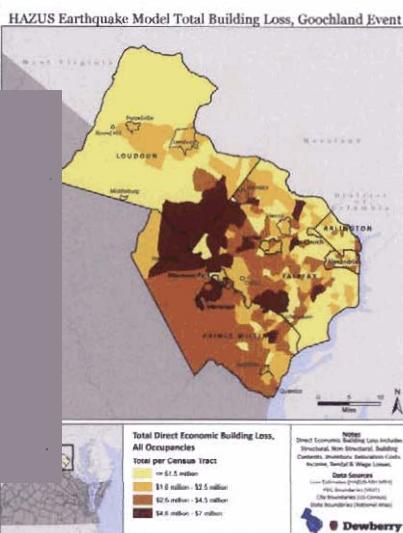


HAZUS Earthquake Model Residential Loss Goochland Event



HAZUS Earthquake Model Total Annualized Losses



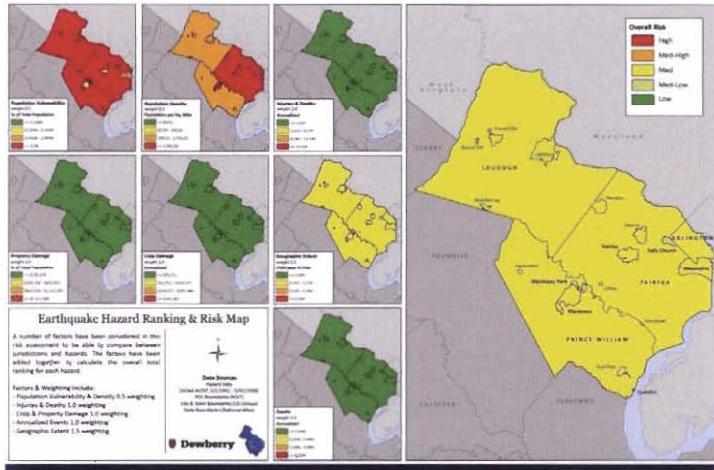


Critical Facilities

- **Goochland County, VA Scenario**
 - Day of Earthquake 85% of hospital beds available for use by patients already in the hospital and those injured by the earthquake would be available
 - After one week, 94% of the beds will be back in service
 - All essential facilities would have functionality of >50% on day 1

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Dam Failure

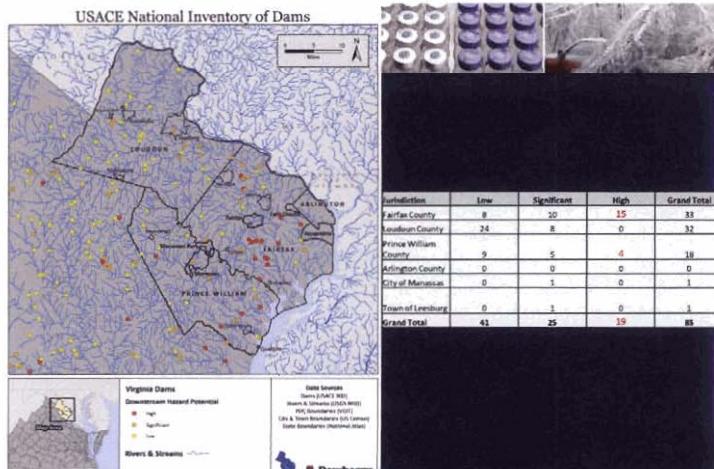
- Department of Conservation & Recreation monitors routine inspection and maintenance of dams presenting the greatest risk or that need structural repair.

Major Dams in the Northern Virginia Region				
Dam Name	Hazard Class	Drainage Area (sq mi)	Primary Purpose	Owner
Upper Occoquan	High	995	Hydroelectric	Fairfax County Water Authority
T. Nelson Elliott	High	74	Hydroelectric	City of Manassas
Barronoff	High	15	Recreation	Lake Barcroft Watershed Improv. Dist.
Lake Monticlar	High	11	Recreation	Monticlar Property Owners Association
Potomac Creek #1	High	6	Flood Control	Fairfax County Board of Supervisors
Lake Thoreau	High	1	Recreation	Reston Home Owners Association
Seawer Lake	Significant	10	Irrigation	Round Hill Associates
Beaverdam Creek	Significant	6	Water Supply	City of Fairfax
Kingstowne Lake	Significant	1	Recreation	Kingslawn Limited Partnership
Possum Point Ash	Significant	< 0	Debris Control	Virginia Power
Breckinridge	Significant	< 0	Water Supply	U.S. Department of Defense (USMC)
Horsepen	Low	23	Other	Metro-Washington Airport Authority

Source: U.S. Army Corps of Engineers

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

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Dam Failure

- Dam failure has not been included in the hazard ranking or analysis portion of the plan; it's addressed through text with a summary of National Inventory of Dams statistics & the current hazard potential.
- Predicting the probability of dam failure requires a detailed, site-specific engineering analysis for each dam in question. Failure may result from hydrologic and hydraulic design limitations, or from geotechnical or operational factors.

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

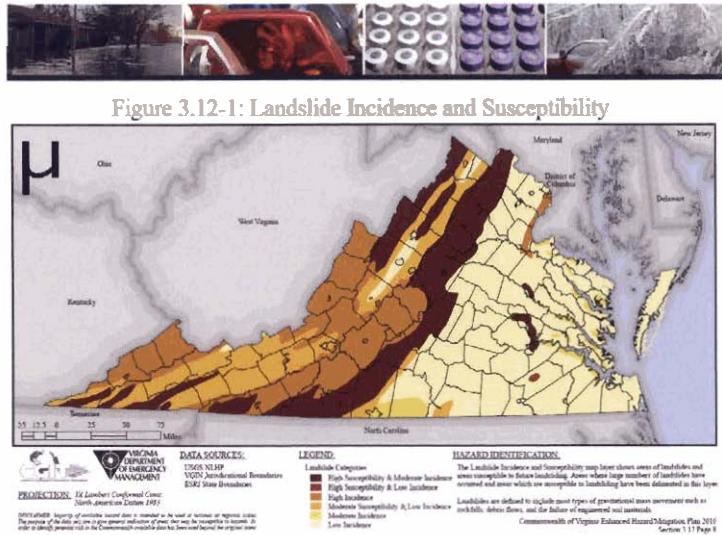
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Landslides

- **Data Sources:**
 - USGS Landslide Incidence and Susceptibility
 - **Probability has not been quantified; but a qualitative high/moderate/low rating has been derived from the USGS mapping.**
 - **NCDC Annualized Loss \$105,174**

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

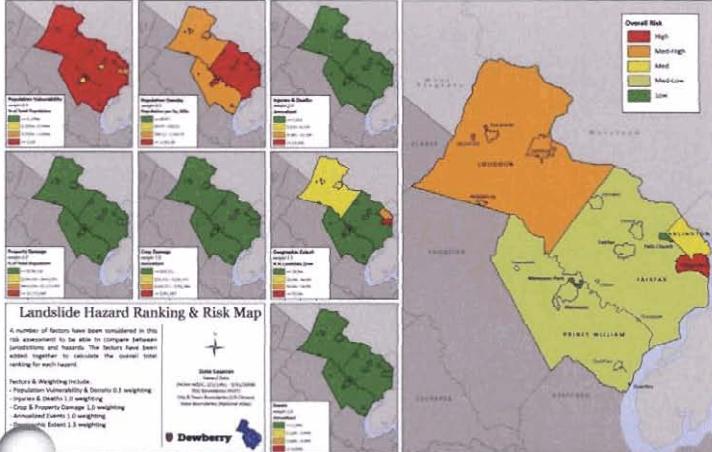
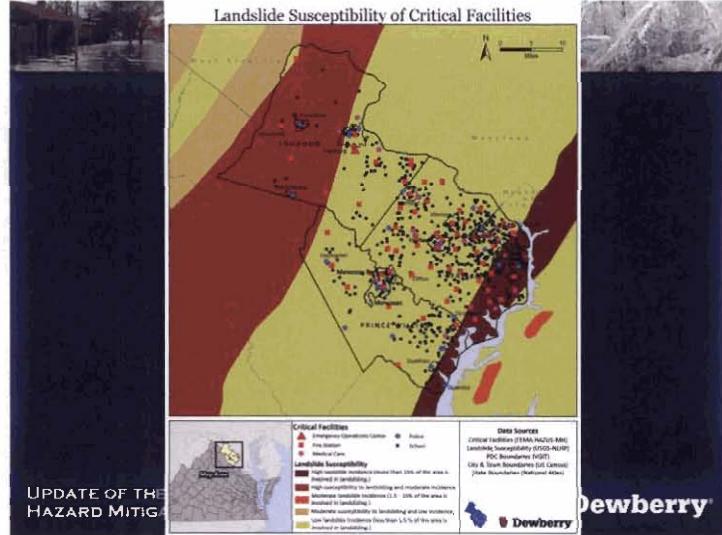


Landslide: Critical Facility Risk

- Facilities were intersected with USGS Susceptibility & Incidence Map

Landlide Susceptibility	EOC	Fire Station	Medical Care	Police	School	Total
High landslide incidence (more than 15% of the area is involved in landsliding)	0	5	4	5	92	110
High susceptibility to landsliding and moderate incidence	0	3	1	2	20	26
Low landslide incidence (less than 1.5 % of the area is involved in landsliding)	1	56	12	33	524	626
Total	1	68	17	40	636	762

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HAZARD MITIGATION PLAN

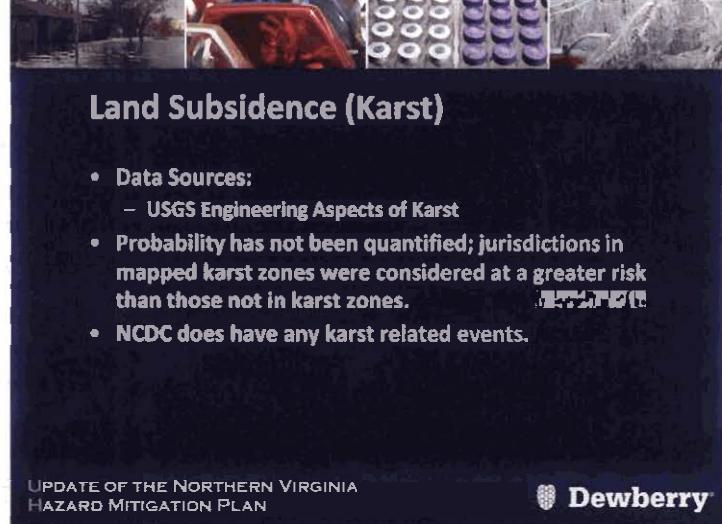
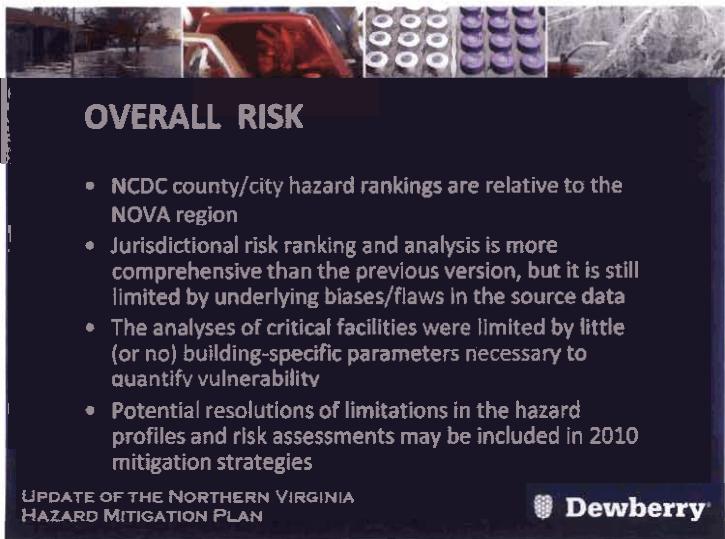
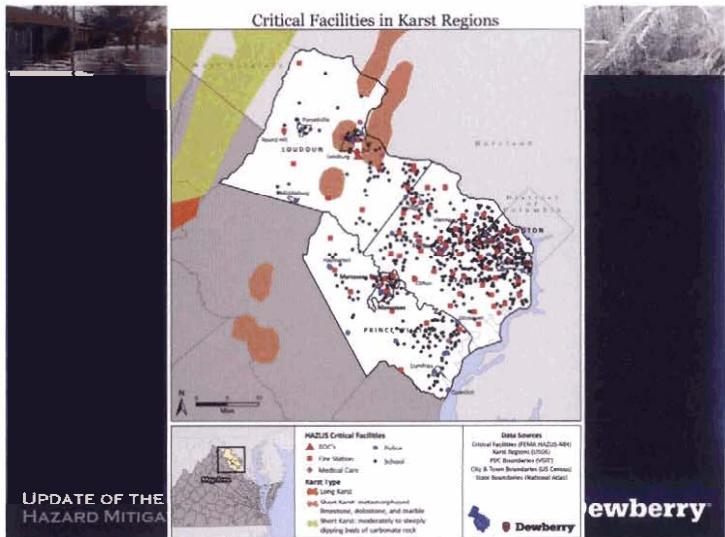
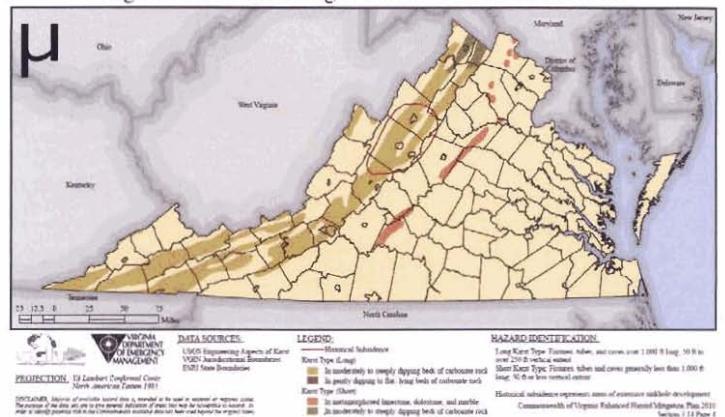




Figure 3.14-1: Karst Regions and Historical Subsidence



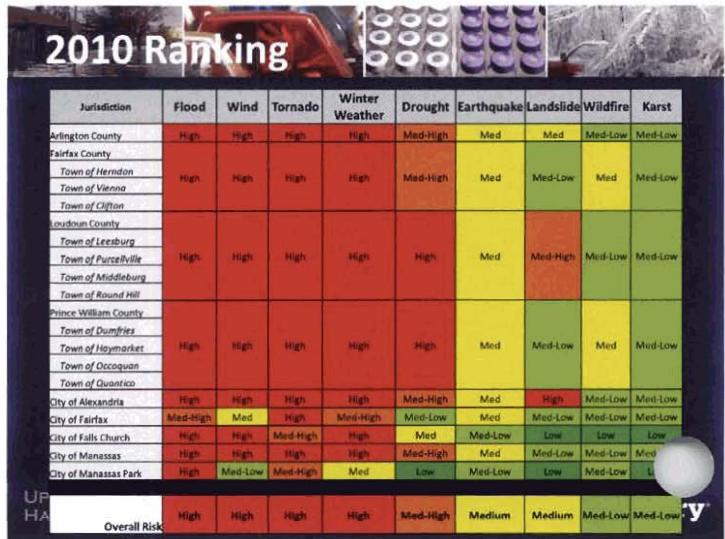
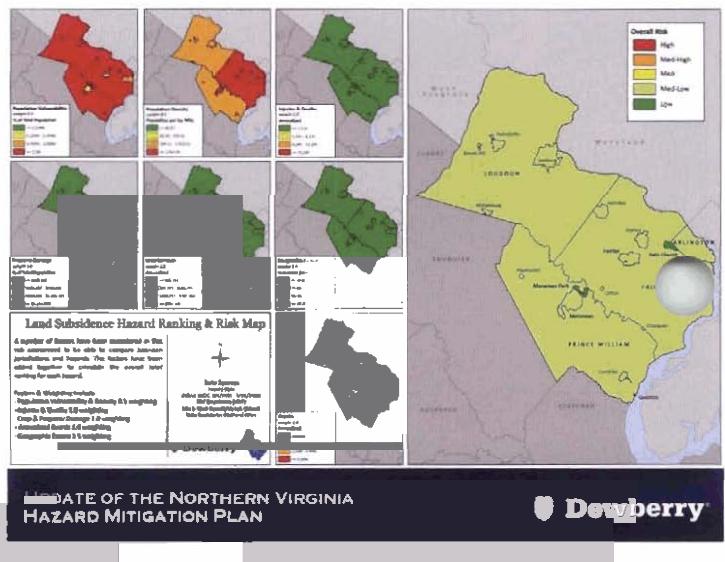
Karst: Critical Facility Risk

- Facilities were intersected with USGS Karst Map

Jurisdiction	Fire Station	Medical Care	Police	School	Total
Loudoun County	1	2	0	4	7
Town of Leesburg	0	0	3	12	15
Total	1	2	3	16	22

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Text Descriptions:

- Building Fires
 - Extreme Temperatures
 - Erosion
 - Dam Failure
 - Hail/Lightning

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Annualized Loss*

NCDC Storm Events		NOVA region can expect approximately \$7.5 Million in annualized losses from natural hazards				
1.	High Wind					
2.	Tornado					
3.	Flood					
4.	Winter Storm					
on NCDC						
Statistics		Annualized Loss (based on property and crop damages and number of years of record)				
County	Years of Record	Flood	High Wind	Tornado	Winter Storm	TOTAL
Fairfax County	17	\$801,908	\$636,046	\$2,265,042	\$460,317	\$3,743,537
Prince William County	155,044	\$799,145	\$117,086	\$60,501	\$1,131,797	
Maryland, City of	289,036	\$698,018	\$0	\$0	\$60,825	\$897,843
Arlington County	\$279,199	\$230,954	\$22,033	\$60,484	\$592,677	
Loudoun County	\$216,420	\$181,200	\$119,785	\$31,985	\$545,199	
Falls Church, City of	\$53,959	\$203,720	\$88,210	\$60,484	\$406,383	
Alexandria, City of	\$87,033	\$199,335	\$149	\$60,484	\$334,650	
Fairfax, City of	\$0	\$4,482	\$0	\$0	\$4,482	
Maryland Park, City of	\$0	\$673	\$0	\$0	\$673	
Total	\$1,652,603	\$2,932,999	\$2,612,298	\$384,674	\$7,592,874	

UPDATE ON HAZARD M



HUMAN-CAUSED HAZARDS

- Digital Sandbox

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Annualized Loss

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate

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Comparison of Annualized Loss

Hazard Type	NCDC				Other Source	
	Years of Record	Annualized Property Damage	Annualized Crop Damage	Total Annualized Loss	Total Annualized Loss	Data Source
Flooding	1993 - 2009	\$1,512,232	\$140,370.82	\$1,652,603	\$99,049,000	FEMA HAZUS MR4
Winter Weather	1993 - 2009	\$386,191	\$8,782.63	\$394,974		Not Available
Tornado	1950 - 2009	\$2,613,514	\$784.88	\$2,612,298		Not Available
High Wind	1955 - 2009	\$2,617,096	\$315,902.85	\$2,932,999	\$4,795,691	FEMA HAZUS MR4
Drought	1995 - 2009	\$0	\$942,971.35	\$942,971		Not Available
Earthquake		Not Available			\$2,408,945	FEMA HAZUS MRA
		Total		\$8,535,845	\$10,253,636	
Total Annualized Loss Estimate for major hazard in NoVA					\$110,203,879	

UPDATE OF THE NORTHERN VIRGINIA
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Using the HIRA Results

- Creating Mitigation Actions
 - What is the HIRA telling us?
 - Current Projects?
 - Potential Funding Sources?

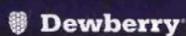


UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Review and Update of 2006 Plan Goals and Regional Objective(s)

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Verification of 2006 Plan Goals

Goal #1 *Improve the quality of best available data for conducting detailed hazard risk assessments and preparing meaningful mitigation action plans.*

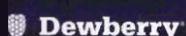
UPDATE OF THE NORTHERN VIRGINIA



Verification of 2006 Plan Goals

Goal #3 *Develop and maintain specific plans to minimize the potential affects of natural hazards, including the relevant local emergency preparedness, response and recovery plans.*

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Workshop Definitions

- **Goal:** general guideline that describes what West Virginia would like to achieve
- **Objective:** specific and measurable strategies that must be implemented to achieve the identified goals
- **Action:** more specific than an objective with identified responsible parties, timeframes, and potential funding sources

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



Verification of 2006 Plan Goals

Goal #2 *Increase the financial capability of local jurisdictions throughout the Northern Virginia region to implement hazard mitigation measures through maximizing grant funding opportunities as well as locally available fiscal resources.*

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Verification of 2006 Plan Goals

Goal #4 *Work to improve existing local policies, codes and regulations to reduce or eliminate the impacts of known natural hazards. This includes maintaining continued compliance with the National Flood Insurance Program (NFIP) for all participating jurisdictions.*

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Verification of 2006 Plan Goals

Goal #5 *Investigate and implement a range of structural projects that will reduce the effects of natural hazards on public and private property throughout the region.*

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Verification of 2006 Plan Goals

Goal #6 *Disseminate information to increase the general public's awareness of natural hazard risks in the Northern Virginia region, while also educating residents and businesses on the mitigation measures available to minimize those risks.*

UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN



2006 NOVA Plan Objective: NOVA Regional Commission Mitigation Action 1

Coordinate with participating local jurisdictions on the acquisition and/or development of improved GIS data layers for use in conducting enhanced risk assessment studies for future updates to the Northern Virginia Regional Hazard Mitigation Plan.

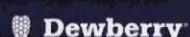
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2006 NOVA Plan Objective: ~~Coordinate with participating local jurisdictions on the acquisition and/or development of improved GIS data layers for use in conducting enhanced risk assessment studies for future updates to the Northern Virginia Regional Hazard Mitigation Plan.~~

NOVA Regional Commission Mitigation Action 2

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2006 NOVA Plan Objective:

NOVA Regional Commission Mitigation Action 3

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2006 NOVA Plan Objective:

NOVA Regional Commission Mitigation Action 4

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Next Steps:

- Local Plan Committee Scheduling
- Project Schedule
- Remaining Local Inputs Required
 - 2006 Evaluation
 - Capability Analysis

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN

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Northern Virginia Mitigation Plan Update HIRA Meeting

July 12, 2010 Sign-in Sheet

Name	Department/Organization	Phone	Fax	E-mail
✓ Becky McKinney	Fairfax County OEM	571-350-1009	571 350-1050	Elizabeth.mckinney@fairfaxcounty.gov
✓ Pat Collins	Prince William County OEM	703-792-5828	703-792-7149	pcollins@pwgov.org
✓ Alexa Hussar	Prince William County OEM	703-792-5254	703-792-7149	ahussar@pwgov.org
✓ Charlie McRorie	City of Alexandria 746-5257	703-838-3825	703-548-6952	Charlie.McRorie@alexandriava.gov
Beth Brown	VDEM	804-317-6685		Beth.brown@vdem.virginia.gov
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✓ Jane Sibley Frantz	Dewberry (contractor)	703-849-0473	703-206-0803	jfrantz@dewberry.com
✓ Bonnie Regan	Arlington County OEM	703-228-3464	703-228-3667	bregan@arlingtonva.us
Bill Everingham	Arlington GIS	703-228-3648	703-228-3606	weveringham@arlingtonva.us
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Rachael Herman	Dewberry	716-949-6327		rherman@dewberry.com
✓ Deborah Mills	Dewberry			dmills@dewberry.com
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Sam Kinzick	NVKC	703-642-4636	703-642-5072	SKinzick@novaregion.org
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KEVIN JOHNSON	Loudoun County OEM	703-737-8831	703-779-0012	Kevin.Johnson@loudoun.gov
DAVID SCHWENGEI	NVRC	703-642-4624	703-642-5077	dschwendel@novaregion.org
Mary Ann Welton	Fairfax County DPZ	703-324-1364	703-324-3056	mary.welton@fairfaxcounty.gov
Stephanie Jaffe	Arlington County OEM	703-228-4739	703-228-3667	Sjaffe@arlingtonva.us
JEFF STERN	NVRC	703-642-4628		JEFF.STERN@NOVAREGION.ORG

Northern Virginia Mitigation Plan Update HIRA Meeting

July 12, 2010 Sign-in Sheet

Update of the Northern Virginia Hazard Mitigation Plan



Agenda

Northern Virginia Hazard Mitigation Plan Update

Final Hazard Identification, Risk Assessment and Vulnerability Analysis

Development of Regional Strategies

Monday, October 18, 2010 1:00pm – 4:00 PM

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8403 Arlington Boulevard (rear Building), Fairfax VA 22031

Lobby Level Conference Rooms

Description	Lead	Time
Welcome, Introductions and Agenda	Deborah Mills	1:00pm-1:20pm
Final Hazard identification, Risk Assessment and Vulnerability Analysis	Ryan Towell	1:20pm-1:50pm
Results Presentation		
Social Vulnerability Appendix Review	Deborah Mills Ginni Melton	1:50pm-2:20pm
BREAK	Deborah Mills Ginni Melton	2:20pm-2:30pm
Develop Regional Mitigation Actions	Carrie Speranza	2:30pm-3:15pm
Outreach	Deborah Mills	3:15pm-3:45pm
Next Steps: Draft Plan Development	Deborah Mills	3:45pm-4:00pm

Dewberry Team:

Project Manager	Deborah Mills	703.849.0162 804.335.9946 (c)	dmills@dewberry.com
HIRA Lead	Rachael Herman	585-429-7448	rherman@dewberry.com
Planning Lead	Jane Sibley Frantz	703.849.0473	jfrantz@dewberry.com
Planning Support and Share Point Site	Carrie Speranza	703.849.0367	csperanza@dewberry.com
Climate Change and HIRA Support	Ryan Towell	703.849.0275	rtowell@dewberry.com
Local Plan Annex Lead	Carrie Speranza	703.849.0367	csperanza@dewberry.com
Structural Mitigation Project Scoping	Julia Moline Jennifer Holcomb	703.849.0610 703.849.0556	jmoline@dewberry.com jholcomb@dewberry.com

Arlington County Project Management Team:

Project Manager	Stephanie Jaffe	(703) 228-4739	sjaffe@arlingtonva.us
Financial Lead	Joanne Hughes	703.228.3560	jmhughes@arlingtonva.us
Senior Advisor	Bonnie Regan	703.228.3464	bregan@arlingtonva.us
Outreach Lead	TBD		

2010 Update of the Northern Virginia Hazard Mitigation Plan

Vulnerability Assessment Review Regional Mitigation Action Planning Outreach

October 18, 2010

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Hazard Ranking

- The purpose of the hazard identification and risk assessment is to provide a factual basis for developing mitigation strategies; to prioritize those jurisdictions which are most threatened and vulnerable to natural hazards.
- FEMA guidance indicates that the jurisdictions at greatest risk to specific hazards should be identified, considering both the characteristics of the hazard and the jurisdictions' degree of vulnerability.

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Data Sources

- Population
- Social Vulnerability
- Climate Change
- Land Use and Development
- Local Zoning
- Critical Facilities
- Building Inventory
- Disaster Data
 - Federally Declared
 - NCDC

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Meeting Agenda

- Welcome & Introductions
- Final Hazard Identification, Risk Assessment & Vulnerability Analysis Review
- Populations at Risk (Social Vulnerability) Appendix Review
- Break
- Develop Regional Mitigation Actions
- Outreach
- Next Steps:
Draft Plan Development

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Hazards Addressed

- Multiple hazards impact Fairfax County and NOVA; how do we determine priority hazards?
 - Previous Hazard Mitigation Plan (2006)
 - Declared Disasters
 - Availability of Data

Flood

Winter Storms

Severe Thunderstorms

Tornadoes

Hurricanes & Tropical Storms

Drought

Wildfire

Earthquakes

Extreme Temperatures

Dam Failure

Erosion

Landslides

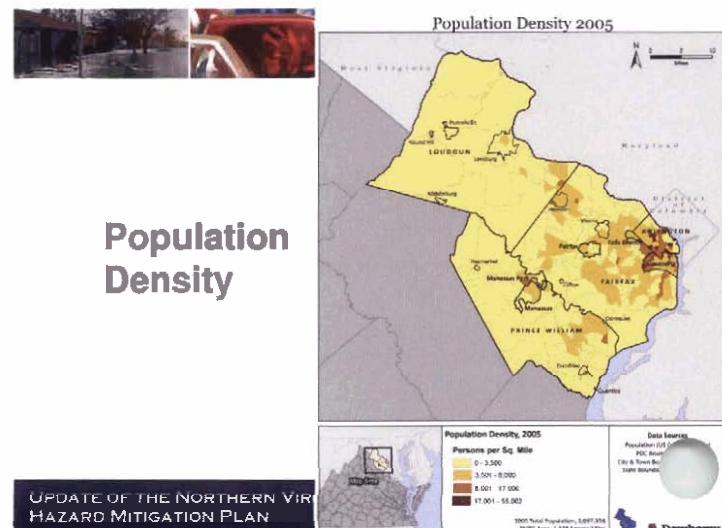
Sinkholes

Human-Caused (Digital Sandbox)

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Population Density





Climate Change

- Considered as a potential *amplifier* of existing natural hazards
- Discussion of projections as related to specific hazards (i.e. flooding, drought)
 - Potential future impact on hazard:
 - Frequency
 - Intensity
 - Distribution
- Sea Level Rise = Hot Spots (i.e. the lowest lying areas in the region)

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NOVA Areas at Risk – Sea Level Rise

- Sea Level Rise = Hot Spots (i.e. the lowest lying areas in the region)



Hot Spots for Sea Level Rise	
Arlington	<ul style="list-style-type: none"> National Airport Four Mile Run
Alexandria	<ul style="list-style-type: none"> Four Mile Run Dangerfield Island Old Town Jones Point
Fairfax County	<ul style="list-style-type: none"> Huntington Belle Haven/New Alexandria Dyke Marsh Tidal Embayments Hallowing Point
Prince William County	<ul style="list-style-type: none"> Occoneechee NWR Tidal Embayments Town of Quantico Occoneechee River

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City of Alexandria



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Arlington County

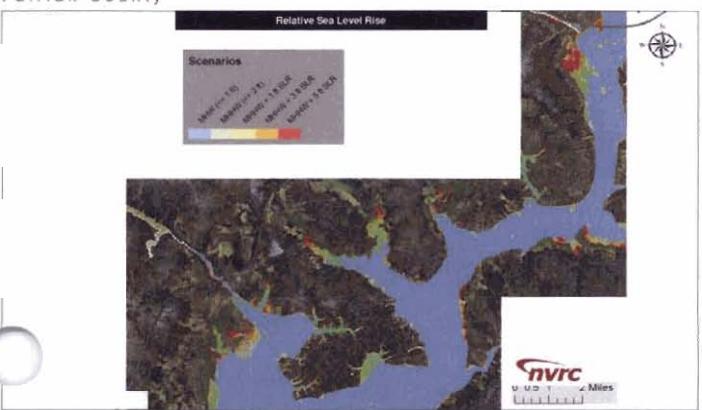


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Fairfax County



Prince William County

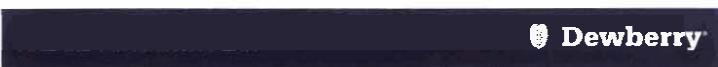


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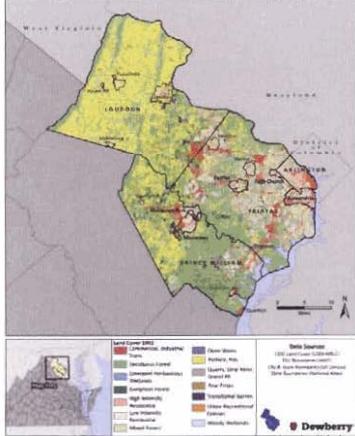


Land Use and Development

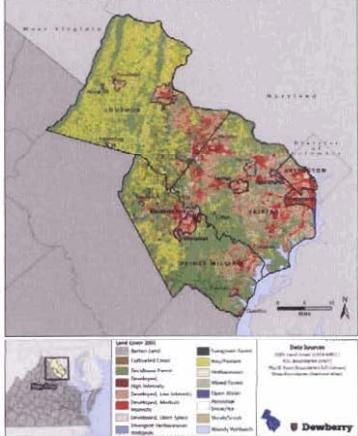
- Jurisdiction Provided Zoning Data and/or Maps discussed in report
 - National Land Cover Dataset (NLCD)
 - 1992 & 2001 datasets
 - Land Use types defined by the NLCD Land Use Change Project
 - Percent Change for:
 - Urban Land Cover
 - Forest Cover
 - Wetland Cover
 - Agricultural Land Cover



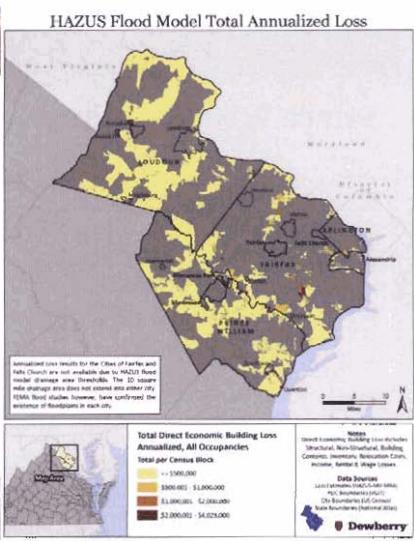
National Land Cover Dataset 1992



National Land Cover Dataset 2001



**HAZUS-MH
NOVA Regional Total
Annualized Loss
Estimation**



Land Use Changes

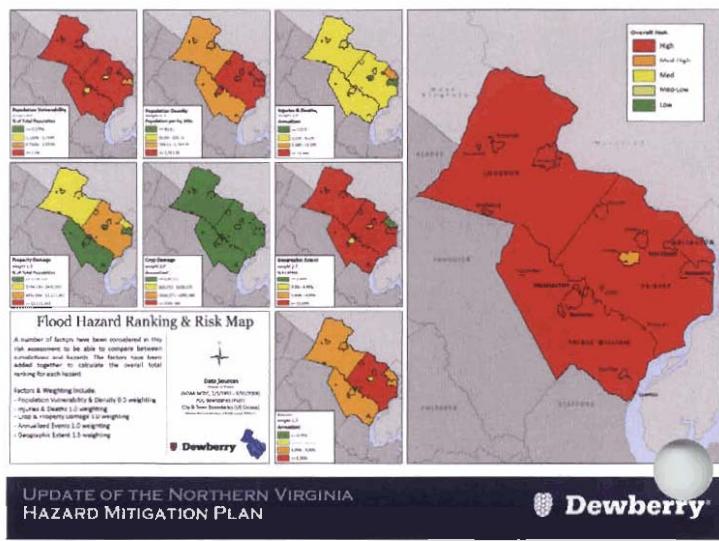
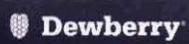
Jurisdiction	Urban Change (Acres)	Forest Change (Acres)	Agricultural Change (Acres)	Wetland Change (Acres)
Arlington County	(628.49)	(1,693.09)	385.19	
Fairfax County	(16,529.25)	(27,808.21)	13,700.61	(1,420.85)
Herndon	(84.73)	(228.18)	(72.06)	(28.91)
Vienna	(688.53)	(274.21)	111.20	9.56
Clifton	(43.59)	(12.23)	24.24	1.33
Loudoun County	9,838.96	(17,791.12)	(8,349.58)	72.95
Leesburg	1,596.13	(1,517.62)	(1,259.64)	(15.12)
Purcellville	215.95	(160.57)	(489.49)	0.00
Middleburg	(27.80)	(37.14)	(52.93)	0.00
Round Hill	22.68	(38.25)	(56.49)	(3.11)
Prince William	(1,350.38)	(16,364.01)	8,406.07	840.43
Dumfries	(65.61)	14.90	12.45	(41.37)
Haymarket	(44.92)	4.67	(45.59)	3.78
Occoquan	(17.57)	(4.23)	(4.89)	1.56
Quantico	(2.67)	(2.22)	6.23	(3.78)
Alexandria	(211.27)	(695.65)	(62.49)	(39.14)
Fairfax City	(555.10)	(640.05)	245.75	23.57
Falls Church	(288.89)	(48.93)	20.02	(0.44)
Manassas	(231.29)	(294.45)	(328.03)	10.01
Manassas Park	(121.65)	(86.73)	31.36	(1.33)
Total	9,218.03	(67,677.32)	12,221.91	(449.24)



Federally Declared Disasters

- Since 1972
 - 14 of the 52 Virginia Presidential declared disasters have included at least one community in the NoVA planning area
 - Disaster Types
 - 5 Severe winter storms, snowstorms or blizzards
 - 4 Hurricanes or tropical storms
 - 4 Severe storms (tornadoes) and flooding
 - 1 Terrorism

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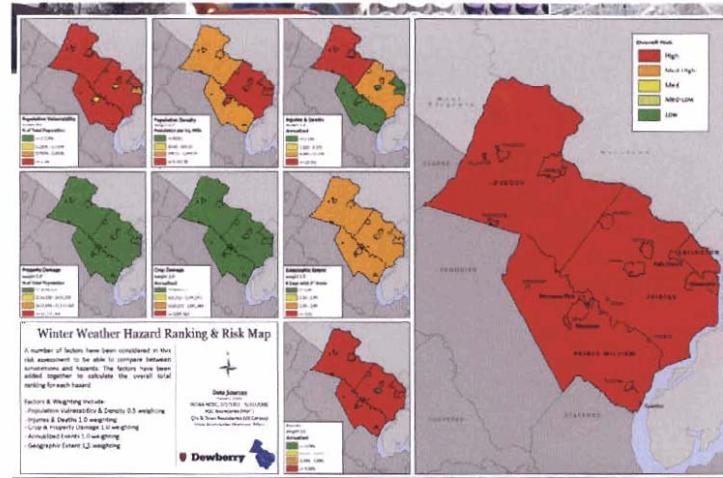


Winter Storms

- Impact and Vulnerability
 - Transportation agencies and utility companies
- VA HMP used weather station data to examine frequency of snowfall

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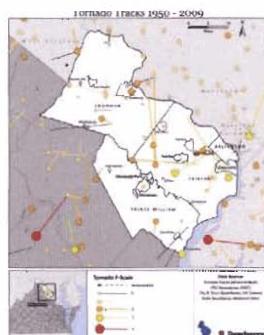
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Tornadoes

- Low probability / high impact events
- Probability quantified by Commonwealth of Virginia Hazard Mitigation Plan using historical frequency method

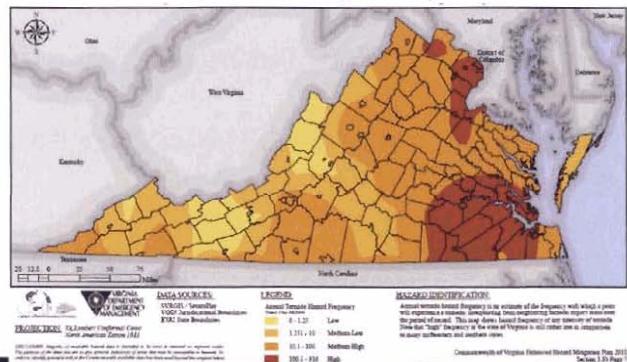


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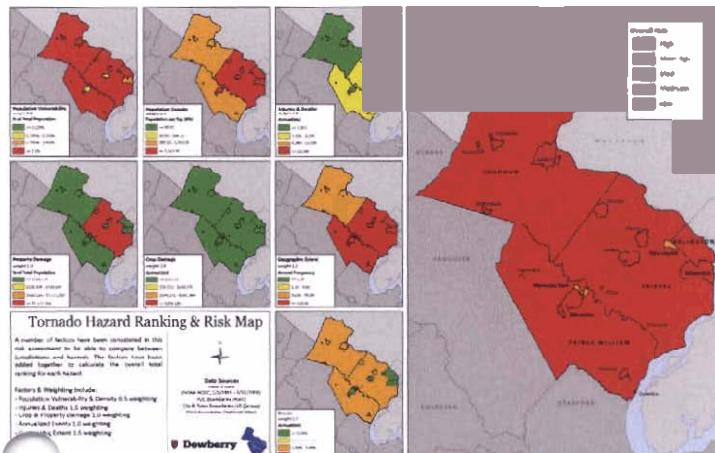


Tornado Hazard Frequency



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Hurricanes and Tropical Storms

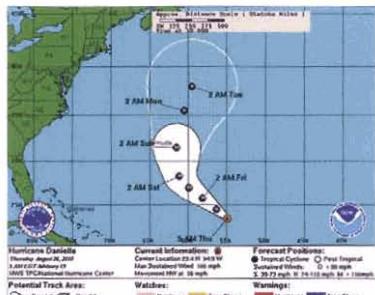
- Probability
- Impact & Vulnerability
- Risk
 - Critical Facility Risk
 - Jurisdictional Risk
- Data Source: NCDC & HAZUS
- NCDC Annualized Loss
- HAZUS Annualized Loss

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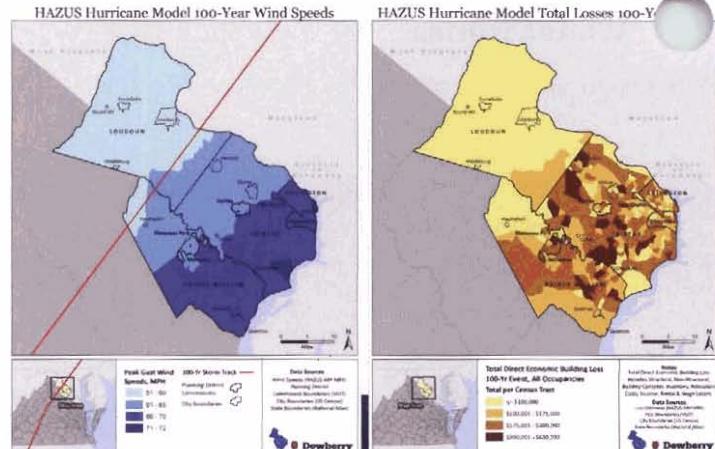
Historic Hurricane Tracks



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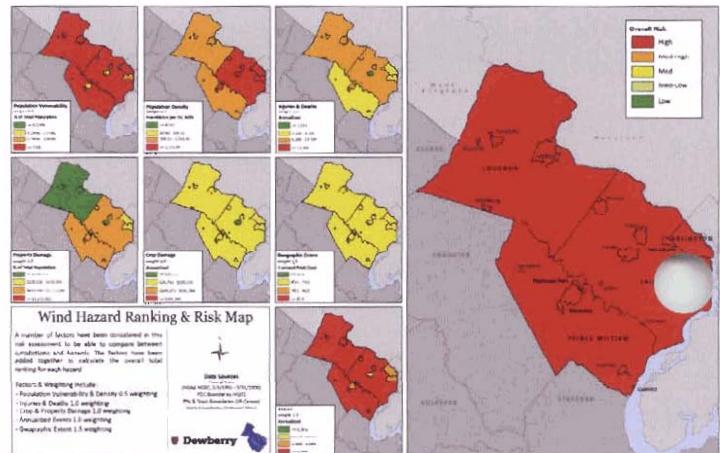
Hurricane Force Winds



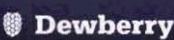
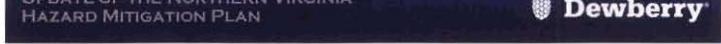
Wind Events

Tornado – Low Probability, High Damage

Hurricane and Thunderstorm – Medium Probability, Lower/Localized Damage (i.e. microburst)



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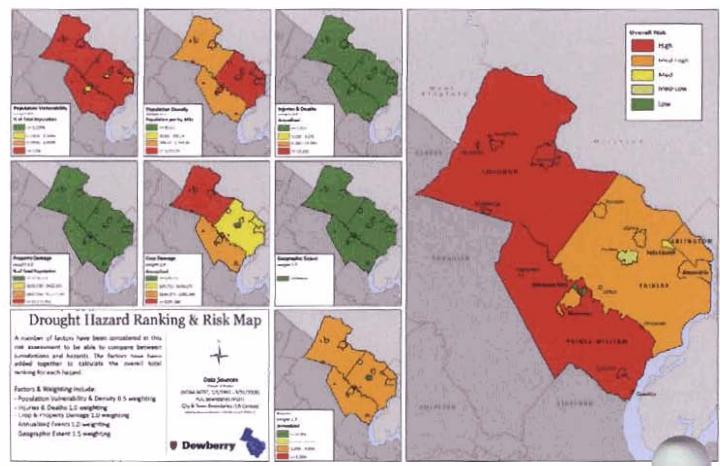
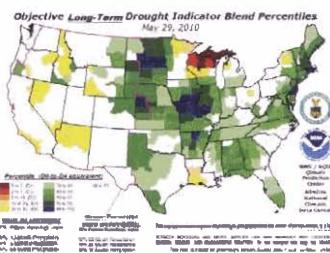
Drought

- Probability
 - Impact and Vulnerability
 - Drought Monitor
 - Risk
 - Critical Facility Risk
 - Jurisdictional Risk
 - 168 recorded “droughts” in NCDF for NOVA since 1990
Loudoun County highest (31 events)

Percentiles of the precipitation
-10% to -90% below average precipitation
Legend:
-10% to -10% below average
-10% to -20% below average
-20% to -30% below average
-30% to -40% below average
-40% to -50% below average
-50% to -60% below average
-60% to -70% below average
-70% to -80% below average
-80% to -90% below average
Source: USGS National Drought Monitor

NCDC Annualized Loss \$942.971

UPDATE OF THE NORTHERN VIRGINIA
HAZARD MITIGATION PLAN



UPDATE OF THE NORTHERN VIRGINIA HAZARD MITIGATION PLAN

