

HAZUS-MH: Flood Event Report

Region Name: BlairMR2

Flood Study Case: BlairMR2

Print Date: Friday, October 13, 2006

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

Table of Contents

Section	Page #
General Description of the Region	3
Building Inventory	4
General Building Stock	
Essential Facility Inventory	
Flood Scenario Parameters	5
Building Damage	6
General Building Stock	
Essential Facilities Damage	
Induced Flood Damage	8
Debris Generation	
Social Impact	8
Shelter Requirements	
Economic Loss	9
Building-Related Losses	
Appendix A: County Listing for the Region	10
Appendix B: Regional Population and Building Value Data	11

General Description of the Region

HAZUS is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of HAZUS is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Pennsylvania

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 526 square miles and contains 4,065 census blocks. There are over 52 thousand households in the region and has a total population of 129,144 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 39,335 buildings in the region with a total building replacement value (excluding contents) of 7,244 million dollars (2002 dollars). Approximately 98.64% of the buildings (and 81.47% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

HAZUS estimates that there are 39,335 buildings in the region which have an aggregate total replacement value of 7,244 million (2002 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Study Case respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure (\$1000)	Percent of Total
Residential	5,901,666	81.5%
Commercial	958,092	13.2%
Industrial	243,732	3.4%
Agricultural	27,620	0.4%
Religion	61,450	0.8%
Government	12,813	0.2%
Education	38,195	0.5%
Total	7,243,568	100.00%

Table 2
Building Exposure by Occupancy Type for the Study Case

Occupancy	Exposure (\$1000)	Percent of Total
Residential	1,304,398	77.3%
Commercial	249,252	14.8%
Industrial	97,754	5.8%
Agricultural	8,622	0.5%
Religion	14,663	0.9%
Government	4,988	0.3%
Education	8,657	0.5%
Total	1,688,334	100.00%

Essential Facility Inventory

For essential facilities, there are 8 hospitals in the region with a total bed capacity of 817 beds. There are 61 schools, 13 fire stations, 14 police stations and no emergency operation centers.

Flood Scenario Parameters

HAZUS used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	BlairMR2
Scenario Name:	BlairMR2
Return Period Analyzed:	100
Analysis Options Analyzed:	0

Building Damage

General Building Stock Damage

HAZUS estimates that about 290 buildings will be at least moderately damaged. This is over 67% of the total number of buildings in the region. There are an estimated 17 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the HAZUS Flood technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

Occupancy	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	3	50.00	3	50.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	223	67.78	45	13.68	16	4.86	28	8.51	0	0.00	17	5.17
Total	226		48		16		28		0		17	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Manuf-Housing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	66	67.35	15	15.31	4	4.08	8	8.16	0	0.00	5	5.10
Steel	2	66.67	1	33.33	0	0.00	0	0.00	0	0.00	0	0.00
Wood	156	67.24	32	13.79	12	5.17	20	8.62	0	0.00	12	5.17

Essential Facility Damage

Before the flood analyzed in this study case, the region had 0 hospital beds available for use. On the day of the study case flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	13	0	0	0
Hospitals	8	0	0	0
Police Stations	14	0	0	0
Schools	61	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

- (1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
- (2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

HAZUS estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 15,102 tons of debris will be generated. Of the total amount, Finishes comprises 54% of the total, Structure comprises 26% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 604 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

HAZUS estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. HAZUS also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 1,107 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1,831 people (out of a total population of 129,144) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 141.36 million dollars, which represents 11.02 % of the total replacement value of the study case buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 77.89 million dollars. 45% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 29.24% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	25.29	6.51	1.09	0.36	33.24
	Content	15.29	23.23	2.68	2.06	43.25
	Inventory	0.00	0.94	0.47	0.00	1.40
	Subtotal	40.57	30.67	4.23	2.42	77.89
Business Interruption						
	Income	0.09	15.16	0.11	0.40	15.76
	Relocation	0.34	2.03	0.04	0.28	2.69
	Rental Income	0.14	1.38	0.01	0.08	1.61
	Wage	0.20	19.91	0.20	23.10	43.41
	Subtotal	0.77	38.48	0.36	23.87	63.47
ALL	Total	41.34	69.15	4.59	26.28	141.36

Appendix A: County Listing for the Region

Pennsylvania
- Blair

Appendix B: Regional Population and Building Value Data

	Building Value (thousands of dollars)			Total
	Population	Residential	Non-Residential	
Pennsylvania				
Blair	129,144	5,901,666	1,341,902	7,243,568
Total State	129,144	5,901,666	1,341,902	7,243,568
Total Study Region	129,144	5,901,666	1,341,902	7,243,568



Direct Economic Losses for Buildings

October 13, 2006

Study Case Name: BlairMR2

Return Period: 100

Study Case Description:

Analysis Options: 0

All values are in thousands of dollars

	Capital Stock Losses			Loss Ratio %	Income Loss				Total Loss
	Cost Structural Damage	Cost Contents Damage	Inventory Loss		Relocation Loss	Capital Related Loss	Wages Losses	Rental Income Loss	
Blair	33,242	43,248	1,401	2.8	2,687	15,759	43,413	1,611	141,361
Pennsylvania Total	33,242	43,248	1,401	2.8	2,687	15,759	43,413	1,611	141,361
Study Case Total	33,242	43,248	1,401	2.8	2,687	15,759	43,413	1,611	141,361



Debris Summary Report

October 13, 2006

Study Case Name: BlairMR2

Return Period: 100

Study Case Description:

Analysis Options: 0

All values are in tons.

	Finishes	Structures	Foundations	Total
Pennsylvania				
Blair	8,152	3,889	3,061	15,102
Average for Pennsylvania	8,152	3,889	3,061	15,102
Study Case Total	8,152	3,889	3,061	15,102



Building Stock Exposure by General Occupancy

October 13, 2006

Study Case Name: BlairMR2

Return Period: 10

Study Case Description:

Analysis Options: 0

All values are in thousands of dollars

	Residential	Commercial	Industrial	Agriculture	Religion	Government	Education	Total
Pennsylvania								
Blair	5,901,666	958,092	243,732	27,620	61,450	12,813	38,195	7,243,568
Average for Pennsylvania	5,901,666	958,092	243,732	27,620	61,450	12,813	38,195	7,243,568
Study Region Total	5,901,666	958,092	243,732	27,620	61,450	12,813	38,195	7,243,568



Building Stock Exposure by Building Type

October 13, 2006

Study Case Name: BlairMR2

Return Period: 10

Study Case Description:

Analysis Options: 0

All values are in thousands of dollars

	Wood	Steel	Concrete	Masonry	Manuf. Housing	Total
Pennsylvania						
Blair	3,800,571	298,565	737,137	2,278,334	129,063	7,243,670
Average for Pennsylvania	3,800,571	298,565	737,137	2,278,334	129,063	7,243,670
Study Region Total	3,800,571	298,565	737,137	2,278,334	129,063	7,243,670

Transportation System Dollar Exposure



October 13, 2006

Study Case Name: BlairMR2

Return Period: 10

Study Case Description:

Analysis Options: 0

All values are in thousands of dollars

	Highway	Railway	Light Rail	Bus Facility	Ports	Ferries	Airport	Total
Pennsylvania								
Blair								
Segments	1,130,133.86	138,418.00	0.00	0.00	0.00	0.00	169,386.00	1,437,937.86
Bridges	253,688.07	0.00	0	0.00	0.00	0.00	0.00	253,688.07
Tunnels	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00
Facilities	0.00	9,504.80	0	3,564.30	0.00	0.00	23,762.00	36,831.10
County Total	1,383,821.93	147,922.80	0.00	3,564.30	0.00	0.00	193,148.00	1,728,457.03
Average for Pennsylvania	1,383,821.93	147,922.80	0.00	3,564.30	0.00	0.00	193,148.00	1,728,457.03
Study Region Total	1,383,821.93	147,922.80	0.00	3,564.30	0.00	0	193,148.00	1,728,457.03



Building Damage Count by General Occupancy

October 13, 2006

Study Case Name: BlairMR2

Return Period: 100

Study Case Description:

Analysis Options: 0

	Count of Buildings (#) by Range of Damage (%)							Total
	None	1-10	11-20	21-30	31-40	41-50	Substantial	
Pennsylvania								
Agriculture	0	0	0	0	0	0	0	0
Commercial	0	3	3	0	0	0	0	6
Education	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0
Residential	97	223	45	16	28	0	17	426
Average for Pennsylvania	97	226	48	16	28	0	17	432
Study Case Total	97	226	48	16	28	0	17	432

Special Notice Regarding Building Count:

Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution.

APPENDIX B
FIRM Dates

APPENDIX C

Alternative Hazard Mitigation Actions



Appendix C. Alternative Mitigation Actions

This appendix includes a discussion of alternative mitigation actions for all hazards.

Alternative Flood Mitigation Actions

In Blair County, flooding is caused by development in naturally occurring floodplains, therefore the following discussion of alternative flood hazard mitigation actions presents different possible property protection actions that can be taken to mitigate hazards and evaluates their feasibility based on characteristics of the flood hazard, characteristics of the affected structures, and accepted uses of the action.

There are several different categories of flood hazard mitigation measures possible for the neighborhood and structures within the flood hazard areas. The following mitigation measures were considered when deriving recommendations.

Acquisition

Acquisition involves the municipal government purchasing and demolishing or moving (referred to as **relocation**) structures in the floodplain. The land is permanently deed-restricted for open spaces uses in order to restore the natural and beneficial functions of the floodplain. Structures that have been repetitively flooded, or experience floods with high flood depths, velocities greater than five feet per second, or long duration tend to be the best candidates for acquisition. Acquisition is considered to be one of the most effective flood mitigation measures because it entirely removes structures from the pathway of floods.

Acquisition is an effective mitigation measure, but can be damaging to intact neighborhoods. It is cost-effective for structures with high flood vulnerability, however, the process of obtaining the homeowner's approval, managing the implementation of the project, and accessing funding to complete the project are sometimes difficult. After obtaining the elevations of structures in the hazard areas, municipalities and the County will have to further consider the appropriateness of acquisition as a strategy based on considerations listed in the table below.

Table C.1. Additional Considerations for the Acquisition Option

Historic Property?	Historic properties are community assets which should be saved if possible. Further investigation into other options should be made. See the historic property matrix below.
---------------------------	--

Attached/Semi-Detached Housing or other Closely spaced structure?	Acquiring one attached or semi-detached structure while leaving the other should be avoided. Attempt to acquire all at risk properties or find other alternative.
Adjacent to Open Space? Will It Leave A "Hole" In Neighborhood/Streetscape?	This criterion is related to the previous criterion. Acquiring a patchwork of homes is undesirable without a long-term plan to acquire a cohesive block of structures. Acquiring structures that are adjacent to open space is the preferred mitigation option.
In Poor Condition?	Structures that are in poor condition are also more suitable for acquisition and demolition.
County or Municipality Able to Maintain the Property?	When structures are acquired using federal funding, the jurisdiction acquiring the property is required to maintain the property as open space in perpetuity. The jurisdiction acquiring the parcel must decide whether to maintain it as a greenway/park or allow it to revert back to natural area or to be maintained by other residents.

Barriers

Barriers built of soil, called "berms", or concrete or steel, called "floodwalls" keep floodwaters from reaching a building. To be effective, earthen berms require three horizontal feet for each vertical foot. Concrete or steel floodwalls on the land of the property owner are flood barriers for properties that require only two feet or so of flood protection.

Dry Floodproofing

Dry floodproofing entails making all areas falling below the BFE impervious to water. Walls can be coated with a waterproofing compound or plastic sheeting. Openings such as doors, windows, sewer lines, and vents, are closed, either permanently or with removable shields. Dry floodproofing is appropriate for buildings on sound slab foundations that are subject to less than three feet of flooding. Most building walls and floors are not strong enough to withstand the hydrostatic pressure from more than three feet of water. However, this method does not remove the structure and its contents out of the path of floods.

Elevation

Raising a building above the BFE is the best on-site property protection method. Water flows under the building, causing little or no damage to the structure or its contents. Alternatives are to elevate on continuous foundation walls (creating an enclosed space below the building) or elevate on compacted earthen fill, which can be more costly than

elevating on an open foundation or continuous foundation walls. If raised eight or more feet, the lower area can be floodproofed and used for parking or storage.

Elevation is suitable where flood depths are less than 10 feet and have low velocity (less than 5 feet per second), and in areas that are not prone to ice floes or in “off-channel areas that have minimal potential for damage from floating debris. Elevation is not suitable for areas with long-duration flooding, since accessing the structures would be difficult or unsafe in flood situations.

The most common elevation methods include:

- Elevating in place using solid walls, piles, or post foundations (see table below for more information on appropriate uses of foundation types);
- Filling in the basement and replacing the space with an elevated first floor; and
- Abandoning the first floor and building a second floor.

Factors like foundation type, soil type and bearing capacity, weight of the house and lateral forces on the house from water (and other natural hazards such as winds and earthquake), condition of house, and height of the proposed elevation above the grade affect the actual method for elevating a specific house. These methods are best determined by the property owner and engineer on a case-by-case basis. Table C.2 shows broad guidelines for selecting one elevated foundation versus another.

Table C.2. Elevation Methods Based on Existing Foundation Types and Other Conditions

Condition	Existing Foundation Type			
	Basement	Crawlspace	Slab-on-grade	Open
Poor Soil				●
House is heavy or has lateral wind/earthquake /water forces	●	●		
Flood velocity greater than 5 ft/sec				●
Recommended Foundation Type for Elevated Structure	Solid Walls	Solid Walls	Solid Walls	Piles, piers, posts

Politically and socially, elevation may be the most feasible option because it leaves neighborhoods intact, allows residential structures used primarily for water-related recreation activities like fishing and boating to remain near the water, and prevents damage from floods.

Structural Projects

Dikes, levees, dams, channelization, channel widening, stream realignment, seawalls, groins, and jetties are structures located away from the flood vulnerable structures. Structural projects have fallen out of favor as mitigation options because they tend to be expensive to build and maintain and can often increase flooding downstream or on the opposite side of the waterway. Furthermore, *FEMA's mitigation programs emphasize nonstructural measures* for mitigation of flood hazard. These projects tend to be disruptive to the environment and can fail or be overtopped in sufficiently large flood events. Politically and administratively, structural projects require additional studies, public input, and can sometimes take a long time to implement.

Wet Floodproofing

Wet floodproofing entails letting flood waters inside the structure and moving any asset like furniture or household appliances out of harm's way. Wet floodproofing avoids the problems of pressure from floodwaters presented by dry floodproofing. Wet floodproofing is usually used for basements and garages and is not used for one-story houses because the flooded areas would be the living areas.

Property Protection Decision Matrix

Mitigation measures need to be evaluated based on the flooding conditions at the site and the characteristics of the structure. The recommended mitigation measures described in *Section Three* were determined in part by using the Property Protection Decision Matrix below. Structure information for analysis of appropriate mitigation measures may be collected from the Blair County tax assessment database. After first finding information about foundation types in the tax database, planners can use the estimated depth of flooding for each structure and the decision matrix to identify appropriate mitigation measures. Properties that are at or above BFE (other than those with basement foundations) are not considered in the following decision matrix because they are considered to be outside of the regulatory floodplain and are of low mitigation priority



compared to other flood structures.

Table C.3. Property Protection Decision Matrix

First Floor Flood Depth	First Recommendation	Second Recommendation
Slab		
<2 feet	Barrier	Dry Floodproof
>2 feet	Elevate	Relocate/Acquire
<9 feet	Relocate/Acquire	Relocate/Acquire
Crawlspace		
>0 feet	Elevate	Elevate
>9 feet	Relocate/Acquire	Relocate/Acquire
Basement		
>0 feet	Elevate, fill in basement	Relocate/Acquire
>9 feet	Relocate/Acquire	Relocate/Acquire
Pier / Pilings		
>0 feet	Elevate	Elevate
>9 feet	Relocate/Acquire	Relocate/Acquire

Another important consideration in certain areas is flood mitigation for historic properties. Historic properties are assets that help define communities and should be preserved where feasible. The table below presents additional considerations about the impact of hazard mitigation alternatives on historic properties. Local officials must further consider the impact of mitigation options like acquisition and demolition or relocation on local historic resources.

Table C.4. Considerations for Historic Properties

Hazard Mitigation Alternative	Reduction of Risk	Level of Impact to Historic Properties
Acquisition & Demolition	High	High
Relocation	High	Medium – High
Elevation	Medium	Medium

Hazard Mitigation Alternative	Reduction of Risk	Level of Impact to Historic Properties
Dry Floodproofing	Low – Medium	Low – Medium
Wet Floodproofing	Low	Low
Stream Channel Improvements	Low	High (archeology)
Levees & Floodwalls	Medium	Medium

Public Information Programs

Public information programs for flood mitigation can include outreach to homeowners in floodplains and encouraging communities to participate in the Community Rating System (CRS), operated under the NFIP.

NFIP provides flood insurance to homes and businesses located in floodplains at a reasonable cost, and encourages the movement of development away from floodplains. This program is based upon mapping areas of flood risk, and requiring local implementation to reduce that risk, primarily through restrictions on new development in floodplains. CRS recognizes community efforts that go beyond the minimum standards of the NFIP; this recognition is in the form of reduced flood insurance premiums for communities who adopt such standards. CRS encourages community activities that reduce flood losses, facilitate accurate insurance rating, and promote flood-insurance awareness. There are over 900 communities participating in CRS nationwide. Some of the benefits of CRS are as follows:

- Reduction of flood insurance premiums, ranging from 5% to 45%. The higher the CRS rating a community achieves, the greater the premium discount.
- Enhancement of public safety and reduction of damages to private property and public infrastructure through floodplain management.
- Evaluation of the effectiveness of community floodplain management program against a national benchmark.
- Implementation of some CRS activities makes communities eligible for other funding sources.

Participation in CRS is voluntary, but there are minimum requirements in order to participate:

- The community must be in compliance with the rules and regulations of NFIP.
- The community's Manager must appoint a CRS coordinator.



- Communities must require and keep all NFIP elevation certificates on file.
- Communities with 10 or more repetitive losses must develop and implement a floodplain mitigation plan.

The CRS rating system is based on the ranking of community activities within four categories: public information, mapping and regulations, flood damage reduction, and flood preparedness.

Communities engaging in these types of activities receive points according to a schedule developed for the CRS. CRS ratings are assigned based upon the number of points earned. The majority of CRS communities are in Class 8 or Class 9. A Class 8 rating earns about a 10 percent savings in flood insurance premiums. Only three communities out of 900 have achieved Class 5 status (which earns 25 percent premium reduction).

Flood Mitigation Strategy Priorities

From the following discussion, the STAPLE+E can be used to rate the options, as noted in the example table below. Methods receive a “1” or “fair” as the default rating if there are particularly notable poor or good potential consequences of the method.

Table C.5. Application of STAPLE+E Criteria

Type of Mitigation Action	Prevention		Property Protection			Emergency Services Measures	Structural Options	Natural Resource Protection	Public Information Programs
	Floodplain Ordinance*	Acquisition and Relocation	Elevation	Dry Floodproofing	Wet Floodproofing	Warning/Evacuation	Flood Control Projects (i.e., Dams)	Stormwater Management	Public Outreach to Homeowners
Social	2	0	2	3	3	2	1	2	2
Technical	3	3	3	1	2	0	1	1	0
Administrative	1	1	2	2	2	1	0	0	1

Action	Floodplain Ordinance*	Acquisition and Relocation	Elevation	Dry Floodproofing	Wet Floodproofing	Warning/Evacuation	Flood Control Projects (i.e., Dams)	Stormwater Management	Public Outreach to Homeowners
Political	1	1	2	2	1	2	1	1	1
Legal	1	0	2	1	1	2	1	2	3
Economic	3	1	2	2	2	2	0	1	2
Environmental	3	3	3	3	3	3	0	1	3
Totals	12	9	16	14	14	12	4	8	12

Where 0 = Poor, 1 = Fair, 2= Good, 3=Excellent
 * Only applicable if no floodplain ordinance has been adopted

From this example evaluation (assuming a floodplain ordinance exists), the preferred mitigation options are in order of priority:

1. Elevation
2. Dry floodproofing (tied with wet floodproofing)
3. Public outreach (tied with warning/evacuation)
4. Acquisition/relocation
5. Stormwater management
6. Flood control projects

Alternative Severe Weather Mitigations Actions

There are a number of mitigation actions that can be used to mitigate wind and weather hazards. Unlike flooding, these hazards affect the entire County, and there is no particular geographical hazard zone that may experience wind/weather damage more than other areas within the County. Therefore, wind and weather mitigation strategies usually involves identifying actions that affect individual structures with known/assumed vulnerability, particular critical facilities, or can reach the entire County, usually through public education, improving County implementation capabilities, or strengthening regulations.

The following is a list of wind hazard mitigation strategies with information about their suitability for use in Blair County. These strategies are technically feasible in Blair County and should be used in combination with each other. Other than regulations, most of these measures should be implemented by property owners with assistance from County and municipal governments.

Regulations

Properly constructed buildings are essential to resisting the force of winds and weather to structures, since ordinary construction methods produce a house that will stand up to 110 mph tornadoes and other wind storms. Model building codes are designed using wind-speed maps (see Figure 1.4) produced by the American Society of Civil Engineers (ASCE) based on a constant probability of occurrence in different parts of the county. These design wind speeds are high enough to resist the majority of tornadoes and other strong winds if the building is constructed properly. Building codes are also important to preventing collapse of buildings under heavy snow loads. (Source: Natural Hazard Mitigation Insights, Institute for Business and Home Safety) Most jurisdictions within Blair County already have building codes in place or will be implementing the statewide building code.

Building Strengthening

Manufactured home tie-downs: Manufactured homes (or “mobile” homes) are some of the most vulnerable structures to high winds, having thin walls that cannot withstand wind pressure and wind-blown projectiles. Manufactured homes have large surface area relative to their weight, making them susceptible to overturning. Furthermore, many manufactured homes are not adequately installed. Manufactured homes properly tied down with the correct number of anchors and the correct ground anchor for the soil type can reduce the vulnerability to high wind damages. Education and inspection programs can aid upgrading units to resist anticipated wind loads.

Blair County has a number of manufactured home parks and structures for which tie-downs may be appropriate. Manufactured homes installed on permanent foundations, especially double-wide manufactured homes on permanent foundations, are significantly less vulnerable to wind hazards than other manufactured homes and should be considered to have lower mitigation priority. The County or concerned property-owners will have to identify which manufactured homes are in need of tie-downs.

Retrofitted tie-downs cost about \$1000 to \$1500 to install. For low-income property owners, this can be a significant cost, and the County and municipal governments should assist with loans and grants where possible.

Retrofits: Building retrofits like safety glass, roof bracing, structural connectors, or storm shutters are methods of strengthening existing structures. Not every structure will need such measures. Buildings that were built to modern codes should be sturdy enough to withstand most strong winds. Therefore, buildings built before codes were in place are likely more susceptible to wind and snow damage and should be considered to have greater mitigation priority than those built to code. The County tax assessment database can be used to identify buildings built before municipalities used codes.

Landscaping

Structures, especially their roofs, can be protected by creating buffer spaces around buildings. Simply by pruning back overhanging or dead branches from trees, property owners can prevent damage to their property from falling limbs during strong winds.

On the other hand, planting tall trees on usually northern exposures serves as windbreak to strong winds, snow, and cold weather. The typical windbreak has several components:

- Dense conifer trees to reduce wind velocity;
- Tall broadleaf or conifer trees to extend the area of protection; and
- Low shrubs to trap snow, provide wildlife habitat and/or provide aesthetic value.

A “living snow fence” can be created with a windbreak with a density of 70 – 80 percent of multiple rows of dense conifer trees. A “field windbreak” to spread snow across cropland should have a density of 25 to 35 percent with one or two rows of mixed broadleaf or pine trees. Most farmstead or livestock windbreaks can be achieved with a density of 40 to 60 percent by planting multiple rows of conifer and broadleaf trees. The most effective protection is obtained by orienting windbreaks perpendicular to the prevailing wind. Windbreaks designed for winter protection are generally located north and west of farmsteads, livestock concentration areas, working facilities or other areas to be protected. Although often overlooked, protection from northeast storms should be considered when designing a windbreak (Source: NebGuide, Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, <http://www.ianr.unl.edu/pubs/forestry/g1304.htm>) Also, planting evergreen trees and shrubs as windbreaks can reduce winter heating costs. (Source: EPA, <http://www.epa.gov/reg3esd1/garden/heat.htm>)

Because most structures can benefit from simple attention to landscaping and vegetation matters, mitigation action items should focus on actions that will affect/reach all residents/properties in the County.



Warning Systems

Warning system like sirens can be used to alert residents when tornadoes or other hazards threaten vulnerable areas. Manufactured home parks (both for permanent residents and recreational/camping sites) are especially vulnerable to severe storms and residents may need the extra time to reach adequate shelter that sirens or NOAA weather radios may provide.

Sheltering

For extreme wind events like tornadoes and hurricanes, mitigation measures center on protecting residents from the storm. This is an especially important objective for manufactured housing since ordinary, in-house protection measures like basements or in-house safe rooms are not available. For manufactured home parks, community shelters can help protect residents and visitors from severe storm events. A community shelter is defined as a shelter that is designed and constructed to protect a large number of people from a natural hazard event. Community shelters include stand-alone shelters – separate buildings (i.e., not within or attached to any other building) designed to withstand high winds and the impact of windborne debris during tornadoes, hurricanes, or other extreme-wind events. Internal shelters, i.e., rooms or areas within or attached to larger buildings are designed to be structurally independent of the larger building and to provide the same wind and missile protection as a stand-alone shelter. These shelters are intended to provide protection during a short-term high-wind event (i.e., an event that lasts no more than 36 hours) such as a tornado or hurricane. They are not recovery shelters intended to provide services and housing for people whose homes have been damaged or destroyed by fires, disasters, or catastrophes.

Both stand-alone and internal community shelters may be constructed near or within school buildings, hospitals and other critical facilities, nursing homes, commercial buildings, disaster recovery shelters, and other buildings or facilities occupied by large numbers of people. Stand-alone community shelters may be constructed in neighborhoods where existing homes lack shelters. Community shelters may be intended for use by the occupants of buildings they are constructed within or near, or they may be intended for use by the residents of surrounding or nearby neighborhoods or designated areas. (Source: FEMA 361, Design and Construction Guidance for Community Shelters, http://www.fema.gov/pdf/firma/361_ch01.pdf).

Public Information And Education

Wind and weather hazards can affect the entire County, and many of the mitigation measures presented can be economically implemented by property owners, public information and education are essential to mitigating wind and weather hazards.

APPENDIX D

Federal Technical Assistance and Funding Matrix

Grant Name	Agency	Purpose	Sustainability and Hazard Mitigation Application	Contact
Emergency Management and Hazard Mitigation				
Emergency Management Performance Grants (EMPG)	Federal Emergency Management Agency (FEMA)	To encourage the development of comprehensive emergency management, including terrorism consequence management, at the State and local level and to improve emergency management planning, preparedness, mitigation, response, and recovery capabilities.	Funding provided to States, which can be used to educate people and protect lives and structures from natural and technological hazards.	Assistant Director, Administration and Resource Planning Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.2965 http://www.fema.gov
Flood Mitigation Assistance Program	Federal Emergency Management Agency (FEMA)	To help States and communities plan and carry out activities designed to reduce the risk of flood damage to structures insurable under the NFIP.	The program provides planning and grants for projects that include mitigation activities that are technically feasible and cost-effective.	Assistant Director, Federal Insurance and Mitigation Administration Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.2781 http://www.fema.gov/fima
Hazard Mitigation Grant Program (HMGP)	Federal Emergency Management Agency (FEMA)	To prevent future losses of lives and property due to disasters; to implement State or local hazard mitigation plans; to enable mitigation measures to be implemented during immediate recovery from a disaster; and to provide funding for previously identified mitigation measures to benefit the disaster area.	Project grants can be funded for such activities as acquisition, relocation, elevation, and improvements to facilities and properties to withstand future disasters.	Administrator, Federal Insurance and Mitigation Administration Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.2781 http://www.fema.gov/fima/mitgrant.shtm

Grant Name	Agency	Purpose	Sustainability and Hazard Mitigation Application	Contact
Housing				
Community Development Block Grant (CDBG)	Department of Housing and Urban Development (HUD)	To develop viable urban communities by providing decent housing and a suitable living environment. Principally for low-to moderate-income individuals.	Community development activities that meet long-term needs. These activities can include acquisition, rehabilitation, reconstruction of properties and facilities damaged by a disaster, and redevelopment of disaster affected areas.	State and Small Cities Division, Office of Block Grant Assistance CPD, HUD 451 7th Street, SW Washington, DC 20410-7000 Telephone: 202.708.3587 http://www.hud.gov/offices/cpd/about/cpd_programs.cfm
Economic Development and Adjustment Program, Sudden and Severe Economic Dislocation (Title IX)	Department of Commerce, Economic Development Administration (EDA)	To help States and localities to develop and/or implement strategies that address adjustment problems resulting from sudden and severe economic dislocation.	Project grants can be funded in response to natural disasters including improvements and reconstruction of public facilities.	Disaster Recovery Coordinator Economic Adjustment Division EDA, DOC Herbert C. Hoover Building Washington, DC 20230 Telephone: 800.345.1222 or 202.482.6225 http://www.doc.gov/eda/html/prgtitle.htm
Disaster Housing Program	Federal Emergency Management Agency (FEMA)	To provide assistance to enable households to address disaster-related housing needs.	Program assistance may include 1) Short-term Lodging; 2) Home Repair Assistance to restore the home to a livable condition; 3) Rental Assistance; 4) Mortgage and Rental Assistance; 5) Small minimization grants to incorporate hazard mitigation in home repair.	Assistant Director, Response and Recovery Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.3692 http://www.fema.gov/rrr
Infrastructure				
Sustainable Development Assistance	Department of Energy (DOE), Community Services Team	The Team works with communities to help them define and implement sustainable development strategies as part of their comprehensive community planning efforts.	The Team provides technical assistance to disaster-affected communities as they plan for long-term recovery by introducing a wide array of environmental technologies and sustainable redevelopment planning practices.	DOE, Office of Energy Efficiency and Renewable Energy, Denver Regional Support Office 1617 Cole Blvd Golden, CO 80401 Telephone: 303.275.4801 http://www.sustainable.doe.gov
Flood Control Works/Emergency Rehabilitation	Department of Defense, US Army Corps of Engineers (USACE)	To assist in the repair and restoration of public works damaged by flood, extraordinary wind, wave, or water action.	The Corps provides public works and engineering support to supplement State and local efforts toward the effective and immediate response to a natural disaster.	Program Manager PL 84-99 USACE 20 Massachusetts Ave., NW Washington, DC 20314 Telephone: 202.761.0001 http://www.spd.usace.army.mil/hqam.html

Grant Name	Agency	Purpose	Sustainability and Hazard Mitigation Application	Contact
Infrastructure (continued)				
Public Assistance Program	Federal Emergency Management Agency (FEMA)	To provide supplemental assistance to States, local governments, and certain private nonprofit organizations to alleviate suffering and hardship resulting from major disasters or emergencies declared by the President.	These grants allow State and local units of government to respond to disasters, recover from their impact and mitigate impact from future disasters.	Assistant Director, Response and Recovery Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.3692 http://www.fema.gov/rrr
Transportation: Emergency Relief Program	Department of Transportation, Federal Highway Administration (FHWA)	To provide aid for repair of Federal-aid roads.	The funds can be used to repair federal-aid roads by using new technologies that improve the quality and lifespan of the roads.	Director, Office of Engineering, FHWA, DOT 400 7th Street, SW Washington, DC 20590 Telephone: 202.366.4628 http://www.fhwa.dot.gov/////progadmin/erelief.html
Water Pollution Control	Environmental Protection Agency, Office of Water	To help establish and maintain adequate measures for prevention and control of surface water and groundwater pollution.	Protecting the quality of ground and surface water today will insure the safety of water sources for future generations.	Office of Water, EPA Washington, DC 20460 Telephone: 202.260.6742 http://www.epa.gov/OW/index.html
Water and Waste Disposal Loans and Grants	Department of Agriculture, Rural Utilities Service (RUS)	To develop, replace, or repair water and waste disposal (including storm drainage) systems in rural areas and towns with a population of 10,000 or less.	Use energy-efficient pumps and incorporate mitigation measures when restoring or replacing damaged water and sewer systems.	Administrator, Water and Waste, USDA, Rural Utilities Svs. 1400 Independence Ave., SW Washington, DC 20250-3200 Telephone: 202.690.2670 http://www.usda.gov/rus/water/programs.htm
National Dam Safety Program (NDSP)	Federal Emergency Management Agency (FEMA)	To provide financial assistance incentives to States so they can strengthen their dam safety program.	Funds may be used to enhance an existing dam safety program and provide training, annual maintenance and dam inspections.	Director, National Dam Safety Program, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.2704 http://www.fema.gov

Grant Name	Agency	Purpose	Sustainability and Hazard Mitigation Application	Contact
Historic Preservation				
Repair and Restoration of Disaster-Damaged Historic Properties	Federal Emergency Management Agency (FEMA)	To evaluate the effects of repairs to, restoration of, or mitigating hazards to disaster-damaged historic structures working in concert with the requirements of the Stafford Act.	Preservation of historic structures is an important link to our past. By providing assistance in mitigating future damages, historic structures can be saved for future generations to enjoy.	Assistant Director, Response and Recovery Directorate, FEMA 500 C Street, SW Washington, DC 20472 Telephone: 202.646.3692 http://www.fema.gov/nwz99/fldhistm.htm
Historic Preservation Fund Grants-in-Aid	Department of the Interior, National Park Service (NPS)	To provide matching grants to States to expand the National Register of Historic Places, the nation's listing of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture.	Grants-in-Aid are provided for the identification, evaluation, and protection of historic properties by such means as survey, planning, technical assistance, acquisition, development, and certain tax incentives available for historic properties.	USDA, NRCS, Deputy Chief for Management 14th & Independence Ave., SW Room 5110-S Washington, DC 20250 Telephone: 202.720.6297 http://www.cr.nps.gov/helpyou.htm#grant
Land Management				
Emergency Watershed Protection	Department of Agriculture, Natural Resource Conservation Services (NRCS)	To provide emergency technical and financial assistance to install or repair structures that reduce runoff and prevent soil erosion to safeguard life and property.	In preventing substantial run-off and erosion, the program helps prevent future property loss and preserves soil resources.	USDA, NRCS, Deputy Chief for Management 14th & Independence Ave., SW Room 5110-S Washington, DC 20250 Telephone: 202.720.6297 http://www.fw.nrcs.usda.gov/pl566/EWP/ewp.htm
Coastal Zone Management Administration Awards	Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)	To assist States in implementing and enhancing coastal zone management programs that have been approved by the Secretary of Commerce.	The program aids in the protection and preservation of sensitive coastal zones and provides the added benefit of reducing development in high coastal hazard areas.	Chief, Coastal Programs Division, Office of Ocean and Coastal Resource Management, National Ocean Service, NOAA, DOC 1305 East-West Highway Silver Spring, MD 20910 Telephone: 301.713.3155 http://www.ocrm.nos.noaa.gov/czm
Coastal Wetlands Planning, Protection, and Restoration Act	Department of the Interior, US Fish and Wildlife Service (USF&WS)	To grant funds to coastal States for restoration, enhancement, and management of coastal wetland ecosystems.	The program aids in the protection and preservation of sensitive coastal zones.	Chief, Division of Federal Program Activities US Fish & Wildlife Services Division of Habitat Conservation 4401 N. Fairfax Drive, Room 400 Arlington, VA 22230-1610 Telephone: 703.358.2156 http://www.fws.gov

Grant Name	Agency	Purpose	Sustainability and Hazard Mitigation Application	Contact
Land Management (continued)				
Land and Water Conservation Fund Grants	Department of the Interior, National Park Service (NPS)	To acquire and develop outdoor recreation areas and facilities for the general public, to meet current and future needs.	Project grants may be used for a wide range of outdoor recreation projects, such as picnic areas, campgrounds, tennis courts, boat launching ramps, bicycle trails, and support facilities .	Associate Director, Administrative Acting 1849 C Street, NW Washington, DC 20240 Telephone: 202.208.6953 http://www.doi.gov/news.states
Park and Recreation Recovery Program	Department of the Interior, National Park Service (NPS)	To provide for the rehabilitation of recreation areas and facilities, demonstration of innovative approaches to improve park system management and recreation opportunities, and development of improved recreation planning.	The program allows jurisdictions to provide recreational facilities in areas prone to natural disasters.	Associate Director, Administrative Acting 1849 C Street, NW Washington, DC 20240 Telephone: 202.208.6953 http://www.nps.gov/uprr
River Basin Program	Department of Agriculture, Natural Resource Conservation Services (NRCS)	To provide planning assistance to Federal, State, and local agencies for the development of coordinated water and related land resource programs.	Priority is given to projects designed to solve problems of upstream rural community flooding; water quality improvement that comes from agricultural nonpoint sources; wetland preservation; and drought management for agricultural and rural communities.	USDA, NRCS, Deputy Chief for Management 14th & Independence Ave., SW Room 5110-S Washington, DC 20250 Telephone: 202.720.6297 http://www.nrcs.usda.gov
Watershed Protection and Flood Prevention	Department of Agriculture, Natural Resource Conservation Services (NRCS)	To provide technical and financial assistance in planning and executing improvement projects to protect, develop, and use land and water resources in small watersheds.	Protecting watersheds enables future generations to enjoy those watershed land resources in the future.	USDA, NRCS, Deputy Chief for Management 14th & Independence Ave., SW Room 5110-S Washington, DC 20250 Telephone: 202.720.6297 http://www.nrcs.usda.gov/programs/ewp/factsheet.html