KENTUCKY STATE ENHANCED HAZARD MITIGATION PLAN

2010 EDITION

KENTUCKY DIVISION OF EMERGENCY MANAGEMENT

"A Team of Teams With One Mission - Protect Our Commonwealth"

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Executive Summary

In 2008 the Commonwealth of Kentucky successfully demonstrated its desire to obtain and the ability to implement an enhanced-status Hazard Mitigation Program. It is the intention of Kentucky Emergency Management to reiterate its commitment to the tenants of an aggressive, meaningful, and effective hazard mitigation program which can best be achieved through a strong partnership with the Federal Emergency Management Agency (FEMA) and an enhanced program designation. The following document is the 2010 update of the Kentucky Enhanced State Hazard Mitigation Plan.

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), requires all states to undertake a process to identify vulnerabilities to losses from natural hazards such as flooding, tornadoes, and earthquakes. This process must also include a thorough analysis of how available resources can be invested to mitigate future natural hazard damages. The resulting statewide mitigation plan must provide opportunities for active participation by applicable federal, state, and regional agencies as well as interested private entities.

The mitigation planning requirement introduced in the Disaster Mitigation Act of 2000 reemphasizes the need for state and local entities to closely coordinate mitigation planning and implementation efforts. The requirement, for an approved state mitigation plan as a condition of disaster assistance, created incentives for increased coordination and integration of mitigation activities at the state level. Section 322 of the Stafford Act authorizes up to 7% of Hazard Mitigation Grant Program funds are available to a state for use in the development of state, tribal, and local mitigation plans.

The most successful plans, which contain practical, meaningful mitigation actions, have two common elements:

1. Comprehensive risk and capability assessments which form a solid foundation for decision-making
2. Input from a wide range of stakeholders who would play a role during implementation of recommended mitigation actions at the federal, state, and local levels

The Disaster Mitigation Act of 2000 encourages greater interaction between state and local mitigation planning activities and highlights the need for improved linkage of hazard and capability analyses to state and local hazard mitigation strategies. The implementation of planned, pre-identified, cost-effective mitigation actions based on a sound hazard identification and risk assessment will have a profound impact on the capacity of the Commonwealth of Kentucky to reduce disaster losses.

The purpose of the 2010 Kentucky State Hazard Mitigation Plan update process was to review the previous state and local plans and to devise improved guidance for hazard mitigation in the Commonwealth of Kentucky. The updated plan identifies hazard mitigation goals and objectives and also recommends mitigation actions and initiatives for state government, which will reduce injuries and damages from natural hazards.

Hazard mitigation is defined by FEMA as any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards. Effective, logical hazard mitigation is crucial to protect the citizens of Kentucky. Because of the Commonwealth's exposure to many types of hazards and natural disaster events, specifically, floods, tornadoes, severe storms, and severe winter storms, the state clearly understands the need for improved information for decision making and planning.

As the impact and effects of most disaster events can be lessened by sound mitigation planning and preventative measures, this plan has been written as a mitigation mission guide for the Commonwealth of Kentucky. By properly identifying cost effective mitigation implementation measures, there is a greater probability for the reduction or elimination of risks to human life and property from natural hazards. This plan is the result of a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in the Commonwealth and includes actions needed to minimize future vulnerability to those hazards.

The Kentucky Hazard Mitigation plan has incorporated both state and local mitigation experiences, reviewed and listed a variety of mitigation projects, and examined the experiences of other states. The plan reflects the collective mitigation knowledge of many state, federal, and local officials, as well as representatives from both the public and private sectors and is designed to help safeguard the citizens of the Commonwealth. As such, the plan will significantly contribute to the mitigation of future Kentucky disaster damages. It is recognized and expected, that updates may be required to address specific issues arising from a given disaster.

The 2010 Kentucky State Hazard Mitigation Plan was developed through a partnership effort between Kentucky Emergency Management (KyEM), the University of Louisville Center for Hazards Research and Policy Development (CHR), the University of Kentucky Hazard Mitigation Support Office (UK), the Kentucky State Hazard Mitigation Team (SHMT), and hundreds of Kentucky mitigation stakeholders. All participants worked very hard to ensure the completeness of this document through the following steps.

Plan Update Process

1. Review of previous Kentucky State Hazard Mitigation Plans
2. Encourage enhanced Stakeholder participation during the planning process
3. Review local Hazard Mitigation Plans
4. Review and update the 2007 state plan's Identify/Profile Section
5. Review and update the 2007 state plan's Risk Assessment Section
6. Review and update the 2007 state plan's Mitigation Strategy Section

7. Review and update the 2007 state plan's Maintenance Section
8. Integrate stakeholder input
9. Develop a comprehensive update of the 2007 state plan

The various phases of the update process, while seemingly unrelated, often occurred in conjunction with other phases. Each phase was constantly revisited to reflect changes which occurred and new information obtained from stakeholders. A brief overview of each phase follows.

1. **Review of Previous Kentucky State Hazard Mitigation Plans -** The 2004 and 2007 plans were revisited by KyEM, UK, and CHR to identify areas requiring significant updating. Additionally, a review of the 2004 plan and more specifically the 2007 plan provided a blueprint for development of the 2010 plan.

2. **Encourage Increased Stakeholder Participation During the Planning Process -** Increased Stakeholder participation was encouraged throughout the planning process. KyEM, CHR, and UK clearly recognized the importance of participation by hazard mitigation stakeholders. Accordingly, through this process over 250 stakeholders were invited to and over 300 individuals participated in the three (3) stakeholder meetings.

3. **Review and update the Identifying Hazards and Profiles of Hazard Events Sections of Previous Plans -** Due to a number of significant disaster events since the 2007 plan, these hazard areas were carefully reviewed to ensure completeness.

4. **Review and update of the Assessing Vulnerability by Jurisdiction and Estimating Potential Losses Sections –** Technological advancements in data reliability and modeling associated with risk assessments are constantly evolving. CHR adjusted the Vulnerability Assessment Model to reflect the specific needs required by the crosswalk.

5. **Review and update of Mitigation Strategies -** Many stakeholders also provided information which was reflected in the updated Mitigation Strategy. The 2010 plan update presented an opportunity to review the Mitigation Strategy with the experiences gained through the multiple hazard occurrences experienced by the state over the last three (3) years.

6. **Review of Local Hazard Mitigation Plans –** It was vitally important for all 2010 KyEM plan participants to have a clear understanding of the mission and plans at the local level. To maximize mitigation effectiveness all plans must complement, augment, and support one another. It was decided in the 2007 plan update to reflect the goals and objectives of the Area Development Districts (ADDs) and city plans in the state plan, based on the relevance of the goal or objective to the state. Unfortunately during this iteration of the plan there were

no updated local hazard mitigation plans. This is an area in which the Commonwealth Hazard Assessment and Mitigation Planning System (CHAMPS) system will play a major role in the development of a comprehensive portal planning environment.

7. **Review of Plan Monitoring and Maintenance -** These topics were assessed to ensure the 2010 plan would have the capacity to identify strengths and weakness and provide the capacity to quickly react and adjust accordingly. This is another area in which CHAMPS will play a major role in as KyEM moves toward a comprehensive portal planning environment.

8. **Integrate Stakeholder Input -** Stakeholder meetings provided opportunities for mitigation partners statewide to provide mitigation activity information, identify needs, and express concerns. Information obtained regarding existing data, projects, relationships, and activities in the field of hazards and hazard mitigation were incorporated into this plan.

9. **Comprehensive Plan Update –** Through a thorough review of the original plan, the local hazard mitigation plans, university plans, along with the constant change of hazard mitigation activities and data occurring throughout the State, every section of the plan was evaluated, updated, and improved.

This plan is designed to guide the Commonwealth in fulfilling a state hazard mitigation mission and is structured to serve as a basis for hazard mitigation disaster-specific efforts. As required by the Disaster Mitigation Act of 2000, this plan will again be updated and submitted to FEMA for review and approval in 2013.

Introduction

1.1 Overview

The Disaster Mitigation Act of 2000 requires all states to undertake a process to identify vulnerability to losses from natural hazards such as flooding, tornadoes, and earthquakes. This process must also include a thorough analysis of how available resources can be invested to mitigate future natural hazard damages. The resulting statewide mitigation plan must provide opportunities for active participation by applicable federal, state, and regional agencies as well as interested private entities.

The original Kentucky State Hazard Mitigation Plan was completed on October 28, 2004. In accordance with Disaster Mitigation Act of 2000 requirements, this document represents the third update of the original plan.

This mitigation plan details the Commonwealth's commitment to reducing risks from natural hazards and will serve as a guide for all levels of statewide hazard mitigation decision making. This plan also details how Kentucky will address planning for natural hazards and the resources which will be committed to the process. The state plan demonstrates the following basic requirements:

- Planning Process
- Risk Assessment
- Mitigation Strategy
- Coordination of Local Mitigation Planning
- Plan Maintenance Process
- Adoption by the State

The state plan provides overall guidance to coordinate the planning efforts of all state agencies, local governments, and private and non-profit entities into one viable, comprehensive, and effective statewide mitigation program.

1.2 Plan Development Participants

The 2010 state plan was developed through the efforts of several significant partners. The resulting plan represents the collaborative work of the four major contributors.

Kentucky Emergency Management Hazard Mitigation Program: The KyEM Mitigation Program staff: Greg Shanks, Cassandra Royce-Sanderson, Doug Eades, Valerie Wallace, and Lacresha Peyton, led by Leslie Mahoney the KyEM Mitigation Program Coordinator and State Hazard Mitigation Officer, were actively involved in all phases of the plan development. Areas of particular emphasis were program execution, disaster data analysis, and quality control. In addition to KyEM Hazard Mitigation Program staff, there was extensive involvement by KyEM Division Director John Heltzel, KyEM Assistant Director Jimmy Richerson, Recovery Branch Manager Stephanie Robey, Intergovernmental Liaison Nancy Price, Regional Manager Jerry Rains, and various administrative support staff.

University of Louisville Center for Hazards Research and Policy Development: Under a contractual relationship between KyEM and the University of Louisville Center for Hazards Research and Policy Development (CHR); CHR performed extensive research, especially in the area of risk assessment, for incorporation into this State Hazard Mitigation Plan. CHR is a Board of Trustees-recognized research unit of the University which was established in 1989. Under the direction of Dr. David Simpson, the Center has performed numerous practitioner-oriented contracts and theoretical research regarding all phases and aspects of hazards, disasters, and homeland security issues, including work for the National Science Foundation, the United Nations, and various state and local governments. The plan's development and analysis were co-managed by Dr. Simpson, and the CHR Associate Director, Josh Human. Graduate students in the Masters of Urban Planning program, Sara Evans, Will Bruer, and Matthew Greer served as Project Leaders and contributed substantially to the completion of the 2010 State Hazard Mitigation Plan.

University of Kentucky Hazard Mitigation Program Support Office: KyEM also has experienced a strong and lengthy mitigation relationship with the University of Kentucky (UK). As subgrantees of KyEM's FEMA mitigation funding, UK staff members Esther White and Emily Frank who are assisted by two (2) graduate students and the UK Program Coordinator Brian Gathy, performed a vital role in the plan's development by providing extensive information regarding past practices, the development of local plans, and project identification.

State Hazard Mitigation Team: Another significant group involved in the planning process is the State Hazard Mitigation Team (SHMT). The team was established in 1995 and meets monthly to offer advice to and consult with the KyEM Mitigation Program staff. For nine (9) months, monthly meeting agendas included reviews of plan components in addition to extensive program updates from UK and CHR.

Statewide Mitigation Stakeholders: Most importantly, there was invaluable input from mitigation stakeholders throughout the Commonwealth in the development of Kentucky's 2010 State Mitigation Plan. Over three hundred stakeholders participated in three (3) meetings in which valuable data regarding mitigation initiatives was identified and captured.

1.3 Commonwealth of Kentucky Profile

Kentucky is located in the south central United States along the west side of the Appalachian Mountains. The Commonwealth is bordered by seven (7) states and is bounded by the Mississippi River on the west, the Ohio River on the north, the Big Sandy River, Pine Mountain, and Cumberland Mountain on the east, and the state of Tennessee on the south. The Ohio River separates Kentucky from Illinois, Indiana, and Ohio. West Virginia borders Kentucky to the northeast across the Big Sandy River, and Virginia borders Kentucky to the southeast, with Missouri adjoining to the western edge of the state across the Mississippi River.

Originally part of Virginia, Kentucky became the fifteenth state of the United States. in 1792. The name Kentucky is of Native American origin and has been attributed to numerous languages with several possible meanings, such as "land of tomorrow" and "meadow lands."

Kentucky is divided into 120 counties (the third largest number in the U.S.) which are the basic units of government in the state. County governments encompass the entire areas within their boundaries, including areas inside of incorporated cities. Both of Kentucky's largest cities, Lexington and Louisville, have merged with their respective county governments.

Frankfort, the capital city of Kentucky is centrally located in Franklin County. Seven (7) metropolitan areas are within, or extend into, Kentucky: Cincinnati, Ohio; Clarksville, Tennessee; Evansville, Indiana; Huntington, West Virginia; Lexington, Kentucky; Louisville, Kentucky; and Owensboro, Kentucky.

Cities in Kentucky encompass only those areas within the corporate limits. Kentucky's incorporated cities are divided into six (6) classes based upon population size. Cities in each class are required by state laws to provide certain levels of services and to perform specified governmental functions. The class of a city can be changed only by the state legislature, and typically this only occurs if requested by the city government. Louisville is Kentucky's only city of the first class. The Kentucky League of Cities reports the classification specifications and corresponding class numbers as follows:

CITY CLASS	POPULATION	NUMBER IN CLASS
1	100,000 or more	1
2	20,000 to 99,999	13
3	8,000 to 19,999	19
4	3,000 to 7,999	107
5	1,000 to 2,999	116
6	999 or less	163

Kentucky has 15 multi-county Area Development Districts (ADDs). The multicounty ADDs originated in the late 1960s through a combination of federal and state enabling legislation. ADDs are governed by boards of directors comprised of elected officials and private citizens within the district. ADDs provide technical planning and assistance to cities and counties and serve as local clearinghouses for federally-funded programs.

Population

The U.S. Census Bureau reports the 2009 estimated population for Kentucky to be 4,314,113. The projected population for Kentucky in 2020 is 4,669,801 according to the Kentucky State Data Center. The state's population density in 2007 was 106.8 persons per square mile. In 2008, there were an estimated 1,920,581 housing units in Kentucky with the average household size being 2.43.

In 2008, for people reporting one race alone, the largest minority group in the state, with approximately 7.5 percent of Kentucky's population, was Black or African Americans. White non-Hispanics made up 89.2 percent of the population. Approximately 23.7 percent of Kentucky's population is under the age of 18, and 13 percent of the population is over the age of 65. The median age for Kentucky is 37.5.

Population of Kentucky's Largest Cities

Louisville	563,498
Lexington	278,533
Owensboro	54,549
Bowling Green	53,851
Covington	38,624
Hopkinsville	34,991
Florence	28,673
Richmond	28,214
Henderson	27,810
Frankfort	27,286
Jeffersontown	26,734
Nicholasville	25,963
Georgetown	25,732
Paducah	25,095

Climate

Kentucky has a temperate climate with a mean annual temperature range from 52° F in the northeast to 58° F in the southwest. Typically, January is the coldest month and July is the warmest. Annual precipitation averages about 45 inches, ranging from about 40 inches in the north at Covington, to 53 inches in south central Kentucky. Snowfall is limited in many sections of the state ranging from 5 to 10 inches in the southwestern sections to 25 inches in the northeastern sections and up to 40 inches at higher elevations in the southeastern section of the state.

Kentucky Economy

Kentucky experienced historically significant economic prosperity during the 1990s. During this time frame, the state's economy advanced in virtually every category of economic development: gross state product, salaries and incomes, reduced unemployment, and population growth. In many ways, Kentucky's economic growth has been a reflection of the national economic expansion.

Kentucky's Gross State Product (GSP) has been steadily increasing over the last decade by an average annual absolute change of approximately $4.8 billion, with a GSP of $108.8 billion in 1998 and $156.4 billion in 2008.

Manufacturing remains Kentucky's largest industrial sector, but has declined as a percentage of Kentucky's economy over the past few years. During 1997, manufacturing represented 27.8% ($29.4 billion) of Kentucky's GSP. In 2004, manufacturing declined to 19.8% of Kentucky's GSP ($26.3 billion) and continued to decline in 2008, comprising only 18.4% of the Commonwealth’s GSP.

Governments and governmental activities, the second larges sector, account for 15.4% of the total GSP. The third largest contributor, health care and social assistance, represent a significantly lower portion at 8.3%.

Land Area and Geography

According to the United States Census Bureau, there are 39,728 square miles in Kentucky, ranking it 36th in land area among the 50 states. From mountains to river plateaus, Kentucky has a diverse geographic landscape. Eastern Kentucky, also known as the Eastern Coal Fields region, is characterized by forests and the Appalachian Mountains. The rolling hills of the Bluegrass Region comprise the north central portion of the state; with the Mississippian Plateau in the south, separated from the Bluegrass by a chain of low hills called the Knobs. The Western Coal Fields, bordered on the north by the Ohio River, lie in the Illinois basin; and the southwest corner of the state is a low, flat plain called the Jackson Purchase.

Agriculture

Farmland covers 13.6 million acres (54%) of the total acreage in the state. Kentucky has approximately 84,000 farms, ranking it fourth in the number of farms behind Texas, Missouri, and Iowa. The average size of a Kentucky farm is 164 acres. The horse industry is responsible for 22% of the total farm receipts followed by tobacco, poultry, cattle, and corn.

Kentucky is recognized globally for its signature equine industry. In addition to breeding and racing operations, the industry supports hay and grain production, veterinary services, and the most prominent thoroughbred auctions worldwide. Thoroughbred auctions in Kentucky annually account for the sale of over 9,000 breeding and racing stock with a total value in excess of $800 million.

Natural Resources

In 2003, the value of nonfuel mineral production in Kentucky was $638 million, ranking the state 29th among the 50 in this area of production. Crushed stone continues to be Kentucky's leading nonfuel mineral commodity, accounting for almost 55 percent of the state's nonfuel mineral production value. Other nonfuel mineral commodities produced in Kentucky include cement, ball clay, common clay, gemstones, lime, sand, and gravel.

Kentucky is the nation's third largest coal producer ranking behind Wyoming and West Virginia. More than 50 percent of the nation's electricity and more than 90 percent of Kentucky's electricity is generated in coal-fired power plants, making Kentucky one of the most coal-dependent states in the nation. Kentucky coal continues to be an important resource in meeting the nation's future energy needs, as well as the financial needs of Kentucky's citizens. Coal mining positions in Kentucky pay an average of $59,000 annually; 62% higher than the average wage in the state.

Natural gas production in Kentucky is just over 1% of the national average. In 2008 Kentucky had approximately 16,000 producing gas wells; most of which lie in the Big Sandy region of the state near the Eastern Kentucky coal fields.

Kentucky has two exceptional ground water regions; the alluvial valley along the Ohio River and the beach and gravel deposits of the Jackson Purchase region. Providing more miles of running water than in any other state except Alaska, Kentucky's rivers and water impoundments are valuable assets for industrial production. This system not only serves as a water supply, but also gives Kentucky a gateway of some 1,100 commercially-navigable miles to the inland waterway system of the eastern United States.

Kentucky has 12.7 million acres of commercial forest land accounting for 50% of the state's land area. The predominate species of trees are white oak, red oak, walnut, yellow poplar, white ash, hickory, beach, sugar maple, and other hardwood species. Kentucky ranks third among the hardwood producing states in the United States.

Tourism

Kentucky's abundant natural areas, preserved historical attractions, and cultural heritage and traditions make the Bluegrass State a travel destination for hundreds of thousands of visitors each year. Tourism and travel represent Kentucky's third largest revenue-producing industry. In 2009, the total economic impact of tourism in the state was $10.7 billion dollars, with 176,500 Kentuckians employed in the travel and tourism industry.

Kentucky is widely considered to have the nation's premier state park system. The Commonwealth's park system offers 17 state resort parks – more than any other state – and 24 state recreational parks. Within this system, visitors can enjoy a myriad of activities such as hiking, biking, camping, golfing, fishing, boating, and swimming.

Kentucky has six national recreation areas: Mammoth Cave National Park, Land Between the Lakes, Cumberland Gap National Historical Park, Daniel Boone National Forest, Big South Fork National River and Recreation Area, and Abraham Lincoln Birthplace National Historic Site. There are hundreds of other diverse attractions including the Oceanic Adventures Newport Aquarium, Muhammad Ali Center, Cumberland Falls, Churchill Downs, the Kentucky Horse Park, Shaker Village of Pleasant Hill, the National Corvette Museum, and the National Quilt Museum. Additionally, there are hundreds of annual local festivals and events.

Transportation

Kentucky is located at the center of a 32-state distribution area. Kentucky's transportation system facilitates the distribution of manufactured goods and raw materials to this massive industrial and consumer market. This 32-state area, which contains 67% of the nation's population, accounted for 67% of the personal income, 65% of the retail gross state product, and 72% of the manufacturing employment of the United States in 2002.

Kentucky's highway system encompasses approximately 79,000 miles of federal, state, and local roads. Five major interstate highways and nine state parkways contribute to 1,909 miles of multi-lane limited-access highways. This integrated system of highways connects Kentucky with all major commercial centers in the eastern and central United States.

Kentucky has approximately 1,100 miles of commercially navigable waterways which provide an expedient means of transportation to inland markets and major ports on the Gulf of Mexico. The Ohio River alone flows 664 miles along the northern border of Kentucky. Seven public river ports operate facilities at Henderson, Hickman, Louisville, Lyon County, Owensboro, Paducah and Wurtland. The largest inland port in the nation is located near Ashland, Kentucky.

Railroads serve Kentucky with 2,760 miles of track, including 2,299 miles of Class I track. Railroads operating in the state include CSX, Norfolk Southern, Canadian National Railway Company, and the Paducah and Louisville Railway. Intermodal service is becoming increasingly important to many distributors and is now available at several facilities in Kentucky. AMTRAK passenger service is available in Kentucky at Ashland, Maysville, South Shore, Louisville, and Fulton.

Commercial airports providing scheduled airline service in Kentucky are located in Erlanger (Covington/ Cincinnati area), Lexington, Louisville, Owensboro, and Paducah. Out-of-state airports near Kentucky are: Evansville, Indiana, serving the Henderson area; Huntington, West Virginia, serving the Ashland area; Nashville, Tennessee, serving the Bowling Green area; and the Tennessee cities of Bristol and Knoxville which serve the southeastern portion of Kentucky. International flights are available at the Cincinnati/Northern Kentucky International Airport, located at Erlanger in Northern Kentucky, and the Louisville International Airport. In 2003, customers ranked the Cincinnati/Northern Kentucky as the best airport in the United States in terms of customer satisfaction.

Kentucky's diverse regions, metropolitan areas, and unique geographic location are just a few of its many assets; however, these features also combine to produce a unique exposure to varying types of natural hazards. The Kentucky State Hazard Mitigation Plan is a vital tool to be used to protect the state's population and resources from a wide array of losses resulting from natural disasters.

Prerequisites

2.1 Plan Adoption

44 CFR 201. (C) (6) – The Plan must be formally adopted by the State prior to submittal to FEMA for final review and approval

The Plan was formally adopted by the Commonwealth of Kentucky on May 31, 2010, and approved by FEMA on **October 13, 2010**. This adoption of this plan demonstrates the Commonwealth of Kentucky's commitment to fulfilling the mitigation objectives outlined in the plan. This formalization of the plan authorizes the responsible agencies identified within the plan to execute their responsibilities.

EMERGENCY MANAGEMENT

Steven L. Beshear
Governor

100 Airport Road – Third Floor
Frankfort, KY 40601-6168

John W. Heltzel
Director

May 31, 2010

Major P. May, Regional Administrator
FEMA Region IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

Re: Adoption of 2010 Commonwealth of Kentucky Hazard Mitigation Plan

Dear Mr. May:

As provided by 44CFR 201.5, I endorse the above-referenced plan dated May 31, 2009.

Acting on behalf of Steven L. Beshear, Governor of the Commonwealth of Kentucky, I adopt this plan as the official Commonwealth of Kentucky Hazard Mitigation Plan.

This agency will assume responsibility to monitor, evaluate, and update this plan to reflect relevant changes and progress as required by emerging issues and federal regulation.

Sincerely,

John W. Heltzel, Director
Kentucky Division of Emergency Management

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EMERGENCY MANAGEMENT

Steven Beshear
Governor

100 Airport Road – Third Floor
Frankfort, KY 40601-6168

John W. Heltzel
Director

April 19, 2011

Major P. May, Regional Administrator
FEMA Region IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

RE: Adoption of 2010 Commonwealth of Kentucky Hazard Mitigation Plan

Dear Mr. May:

As provided by 44CFR 201.5, I endorse the above-referenced Standard State Hazard Mitigation Plan with the effective date of October 13, 2010, and the Enhanced State Hazard Mitigation Plan approved December 27, 2011.

Acting on behalf of Steven L. Beshear, Governor of the Commonwealth of Kentucky, I adopt this plan as the official Commonwealth of Kentucky Enhanced Hazard Mitigation Plan.

This agency will assume responsibility to monitor, evaluate, and update this plan to reflect relevant changes and progress as required by emerging issues and federal regulation.

Sincerely,

John W. Heltzel, Director
Kentucky Division of Emergency Management

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U.S. Department of Homeland Security
Region IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

October 18, 2010

BG John W. Heltzel, Director
Kentucky Division of Emergency Management
100 Minuteman Parkway, Bldg. 100
Frankfort, Kentucky 40601-6168

Attention: Leslie R. Mahoney

Reference: Approval of the 2010 Updated Kentucky Standard State Mitigation Plan Update

Dear General Heltzel:

We are pleased to inform you and the Kentucky State Hazard Mitigation Team that the revisions to the Updated State of Kentucky Standard Hazard Mitigation Plan are in compliance with the Federal hazard mitigation planning standards resulting from the Disaster Mitigation Act of 2000, as contained in 44 CFR 201.4. Effective October 13, 2010, the Updated 2010 Standard Plan is approved for a period of three (3) years to October 28, 2013.

We commend the State of Kentucky and the State Hazard Mitigation Team for developing a solid, workable plan that demonstrates commitment to reduce risks from natural hazards and that will guide mitigation activities over the coming years.

We acknowledge and support the State's intention to review and update the plan prior to the three year update if warranted based on annual evaluations or as may be necessary whenever a disaster or other circumstances significantly affects the State's mitigation priorities. We look forward to receiving the 2013 Updated Standard State Plan for review, which will capture the experiences gained over the subsequent three years.

The State also requested that its Plan Update be reviewed for reconsideration as an Enhanced State Plan. An analysis of the State's program performance for the last twelve (12) quarters, beginning June 1, 2007, and ending July 31, 2010, preceding the State's request for the Plan to be approved as an Enhanced State Plan, was conducted by the Hazard Mitigation Assistance Branch. The Programmatic Information Worksheet is enclosed. The program performance has been deemed sufficient to forward your request for re-certification as an Enhanced State Plan to the National Panel in FEMA Headquarters. We will be submitting the request for National Panel review soon.

A formal plan update is required at least once every three (3) years. If the Plan is amended or revised, it must be resubmitted to FEMA Region IV for formal review and approval. If the Plan is not amended or updated prior to the required three (3) year update, please ensure that a Draft update is submitted by April 28, 2013, at least six (6) months prior to the expiration of this plan approval.

www.fema.gov

By approval of this Plan, the State of Kentucky remains eligible after the November 1, 2004, Stafford Act last amended April 2007 to receive the following assistance provided by the Federal Emergency Management Agency:

- Public Assistance (Categories C-G),
- Fire Management Assistance Grants,
- Hazard Mitigation Grant Program,
- Pre Disaster Mitigation Competitive grant program (PDMC),
- Flood Mitigation Assistance program.

All requests for funding, however, will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs.

We commend the State of Kentucky for its close coordination and communication with our office in the review and subsequent approval of its Standard State Hazard Mitigation Plan. If you have any questions or need any additional information, please do not hesitate to contact Richard Flood of the Hazard Mitigation Assistance Branch, at (770)220-5390 or Linda L. Byers, of my staff, at (770) 220-5498.

Sincerely,

Major P. May
Regional Administrator

Enclosure

3

U.S. Department of Homeland Security
FEMA Region IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

FEMA

December 27, 2010

BG John W. Heltzel, Director
Kentucky Division of Emergency Management
100 Minuteman Parkway
Frankfort, Kentucky 40601-6168

Attention: Leslie R. Mahoney

Reference: Approval of the Updated 2010 Commonwealth of Kentucky Enhanced Mitigation Plan

Dear General Heltzel:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region IV has approved the 2010 Updated Commonwealth of Kentucky Enhanced Hazard Mitigation Plan. This approval modifies the prerequisite Updated 2010 Standard State Plan which was approved on October 28, 2010.

The Enhanced designation is effective as of the date of this correspondence through October 28, 2013 at which time an updated Standard State Plan including the Enhanced Section must be approved to maintain FEMA program eligibility. Per §201.5 and §206.432(b) (2) of Title 44 of the Code of Federal Regulations (44CFR), the Commonwealth of Kentucky is now eligible for up to 20% funding in the Hazard Mitigation Grant Program (HMGP).

FEMA approval of this Enhanced State Mitigation Plan was based partially on a review of your mitigation program management performance [44 CFR 201.5 (b) (2) (iii A-D)] over the last three years concluding on the last day of the month prior to submission of the plan to FEMA Region IV. The next review of your mitigation program management performance will also cover the full three years of this approved Plan. The Regional Mitigation office will continue to provide technical assistance and support through our Grants and Planning programs to the State. A draft comprehensive update of the Standard State Mitigation Plan, including the Enhanced Plan elements, must be submitted to Region IV by July 27, 2013, or no later than three months prior to the end of the three-year approval period of the Updated Standard and Enhanced plan.

Requirement 201.5 (b) (2) (i) and (ii) mandates that the Enhanced Plan must document the State's project implementation capability, identifying the ability to implement the following:

- Established eligibility criteria for multi-hazard mitigation measures.

- A system that determines cost-effectiveness of mitigation measures consistent with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost analysis for Federal programs and ranking of measures according to the State's eligibility criteria.

We look forward to continuing a productive relationship between FEMA Region IV and the Kentucky Division of Emergency Management. If this office can be of further assistance, please do not hesitate to contact me.

Sincerely,

Major P. May
Regional Administrator

2

2.2 Compliance

44 CFR 201.4 (C)(7) -**The Plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d). Amendments can be added as an annex to the plan and later incorporated into the appropriate section(s), when the plan is formally updated.**

Through the development and enforcement of this plan, the Commonwealth of Kentucky will comply with all provisions in 44 Code of Federal Regulations, Part 13, as well as Subchapter B - Insurance and Mitigation, Subchapter D - Disaster Assistance, and Subchapter F - Preparedness. Additionally, the assurances listed below are provided as documentation which the Commonwealth or any subsequent sub-grantee (subrecipients) receiving Federal grant funds will comply with all applicable Federal statutes and regulations. The Commonwealth of Kentucky will amend the plan whenever necessary to reflect changes in Federal statutes and regulations or material changes in State law, organization, policy, or state agency operations. It will also update the plan as required on a three-year rotation cycle as described in 44 CFR 201.

To the extent the following provisions apply to the award of assistance:

(a) Recipient possesses legal authority to enter into agreements, and to execute the proposed programs;

(b) Recipient’s governing body has duly adopted or passed as an official act, a resolution, motion, or similar action authorizing the execution of hazard mitigation agreements, including all understandings and assurances contained therein, and directing and authorizing the Recipient's chief administrative officer or designee to act in connection with any application and to provide such additional information as may be required;

(c) No member of or delegate to the Congress of the United States, and no Resident Commissioner, shall be admitted to any share or part of any agreement or to any benefit to arise from the same. No member, officer, or employee of the recipient or its designees or agents, no member of the governing body of the locality in which the program is situated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the program during his tenure or for one year thereafter, shall have any interest, direct or indirect, in any contract or subcontract, or the proceeds thereof, for work to be performed in connection with the program assisted under this plan. The Recipient shall incorporate or cause to be incorporated, in all such contracts or subcontracts a provision prohibiting such interest pursuant to the purpose stated above;

(d) All Recipient contracts for which the Kentucky Legislature is in any part a funding source, shall contain language to provide for termination with reasonable costs to be paid by the Recipient for eligible contract work completed prior to the date the notice of suspension of funding was received by the Recipient. Any cost incurred after a notice of suspension or termination is received by the Recipient may not be funded with funds provided under a grant agreement unless previously approved in writing by the Department. All Recipient contracts shall contain provisions for termination for cause or convenience and shall provide for the method of payment in such event;

(e) Recipient will comply with:

(1) Contract Work Hours and Safety Standards Act of 1962, 40 U.S.C. 327 et seq., requiring mechanics and laborers (including watchmen and guards) employed on federally assisted contracts be paid wages of not less than one and one-half times their basic wage rates for all hours worked in excess of forty hours in a work week; and

(2) Federal Fair Labor Standards Act, 29 U.S.C. Section 201 et seq., requiring covered employees be paid at least the minimum prescribed wage, and also be paid one and one-half times their basic wage rates for all hours worked in excess of the prescribed work-week.

(f) Recipient will comply with:

(1) Title VI of the Civil Rights Act of 1964 (P.L. 88-352), and the regulations issued pursuant thereto, which provides that no person in the United States shall on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Recipient receives Federal financial assistance and will immediately take any measures necessary to effectuate this assurance. If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the Recipient, this assurance shall obligate the Recipient, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the Federal financial assistance is extended, or for another purpose involving the provision of similar services or benefits;

(2) Any prohibition against discrimination on the basis of age under the Age Discrimination Act of 1975, as amended (42 U.S.C.: 6101-6107) which prohibits discrimination on the basis of age or with respect to otherwise qualified handicapped individuals as provided in Section 504 of the Rehabilitation Act of 1973;

(3) Executive Order 11246 as amended by Executive Orders 11375 and 12086, and the regulations issued pursuant thereto, which provide that no person shall be discriminated against on the basis of race, color, religion, sex or national

origin in all phases of employment during the performance of federal or federally assisted construction contracts; affirmative action to insure fair treatment in employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff/termination, rates of pay or other forms of compensation; and election for training and apprenticeship;

(g) The Recipient agrees to comply with the Americans With Disabilities Act (Public law 101-336, 42 U.S.C. Section 12101 et seq.), where applicable, which prohibits discrimination by public and private entities on the basis of disability in the areas of employment, public accommodations, transportation, State and local government services, and in telecommunications;

(h) Recipient will establish safeguards to prohibit employees from using positions for a purpose which is, or gives the appearance of, being motivated by a desire for private gain for themselves or others, particularly those with whom they have family, business, or other ties pursuant to Section 112.313 and Section 112.3135, FS;

(i) Recipient will comply with the Anti-Kickback Act of 1986, 41 U.S.C. Section 51 which outlaws and prescribes penalties for "kickbacks" of wages in federally financed or assisted construction activities;

(j) Recipient will comply with the Hatch Act (18 USC 594, 598, 600-605), which limits the political activities of employees;

(k) Recipient will comply with the flood insurance purchase and other requirements of the Flood Disaster Protection Act of 1973 as amended, 42 USC 4002-4107, including requirements regarding the purchase of flood insurance in communities where such insurance is available as a condition for the receipt of any Federal financial assistance for construction or acquisition purposes for use in any area having special flood hazards. The phrase "Federal financial assistance" includes any form of loan, grant, guaranty, insurance payment, rebate, subsidy, disaster assistance loan or grant, or any other form of direct or indirect Federal assistance;

(l) Recipient will require every building or facility (other than a privately owned residential structure) designed, constructed, or altered with funds provided under a grant agreement to comply with the "Uniform Federal Accessibility Standards," (AS) which is Appendix A to 41 CFR Section 101-19.6 for general type buildings and Appendix A to 24 CFR Part 40 for residential structures. The Recipient will be responsible for conducting inspections to ensure compliance with these specifications by the contractor;

(m) Recipient will, in connection with its performance of environmental assessments under the National Environmental Policy Act of 1969, comply with Section 106 of the National Historic Preservation Act of 1966 (U.S.C. 470), Executive Order 11593, 24

CFR Part 800, and the Preservation of Archaeological and Historical Data Act of 1966 (16 U.S.C. 469a-1, et seq.) by:

(1) Consulting with the State Historic Preservation Office to identify properties listed in or eligible for inclusion in the National Register of Historic Places which are subject to adverse effects (see 36 CFR Section 800.8) by the proposed activity; and

(2) Complying with all requirements established by the State to avoid or mitigate adverse effects upon such properties.

(3) Abiding by the terms and conditions of the "Programmatic Agreement Among the Federal Emergency Management Agency, the Kentucky State Historic Preservation Office, the Kentucky Department of Community Affairs and the Advisory Council on Historic Preservation, (PA)" which addresses roles and responsibilities of Federal and State entities in implementing Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. 470f, and implementing regulations in 36 CFR part 800.

(4) Notifying FEMA and the state if any project may affect a historic property. When any of Recipient's projects funded under a grant agreement may affect a historic property, as defined in 36 CFR 800. (2)(e), the Federal Emergency Management Agency (FEMA) may require Recipient to review the eligible scope of work in consultation with the State Historic Preservation Office (SHPO) and suggest methods of repair or construction which will conform with the recommended approaches set out in the Secretary of Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings 1992 (Standards), the Secretary of the Interior's Guidelines for Archeological Documentation (Guidelines) (48 Federal Register 44734-37), or any other applicable Secretary of Interior standards. If FEMA determines the eligible scope of work will not conform with the Standards, Recipient agrees to participate in consultations to develop, and, after execution by all parties, to abide by, a written agreement which establishes mitigation and recondition measures, including but not limited to, impacts to archeological sites, and the salvage, storage, and reuse of any significant architectural features which may otherwise be demolished.

(5) Notifying FEMA and the state if any project funded under a grant agreement will involve ground disturbing activities, including, but not limited to: subsurface disturbance; removal of trees; excavation for footings and foundations; and installation of utilities (such as water, sewer, storm drains, electrical, gas, leach lines and septic tanks) except where these activities are restricted solely to areas previously disturbed by the installation, replacement or maintenance of such utilities. FEMA will request the SHPO's opinion on the potential which archeological properties may be present and be affected by such

activities. The SHPO will advise Recipient on any feasible steps to be accomplished to avoid any National Register eligible archeological property or will make recommendations for the development of a treatment plan for the recovery of archeological data from the property.

If Recipient is unable to avoid the archeological property, it will develop, in consultation with the SHPO, a treatment plan consistent with the Guidelines and take into account the Advisory Council on Historic Preservation (Council) publication "Treatment of Archeological Properties". Recipient shall forward information regarding the treatment plan to FEMA, the SHPO and the Council for review. If the SHPO and the Council do not object within 15 calendar days of receipt of the treatment plan, FEMA may direct Recipient to implement the treatment plan. If either the Council or the SHPO object, Recipient shall not proceed with the project until the objection is resolved.

(6) Notify the state and FEMA as soon as practicable: (a) of any changes in the approved scope of work for a National Register eligible or listed property; (b) of all changes to a project which may result in a supplemental DSR or modify an HMGP project for a National Register eligible or listed property; (c) if it appears a project funded under a grant agreement will affect a previously unidentified property which may be eligible for inclusion in the National Register or affect a known historic property in an unanticipated manner. Recipient acknowledges FEMA may require Recipient to stop construction in the vicinity of the discovery of a previously unidentified property which may be eligible for inclusion in the National Register or upon learning construction may affect a known historic property in an unanticipated manner. Recipient further acknowledges FEMA may require Recipient to take all reasonable measures to avoid or minimize harm to such property until FEMA concludes consultation with the SHPO. Recipient also acknowledges FEMA will require, and Recipient shall comply with, modifications to the project scope of work necessary to implement recommendations to address the project and the property.

(7) Acknowledging, unless FEMA specifically stipulates otherwise, it shall not receive funding for projects when, with intent to avoid the requirements of the PA or the NHPA, Recipient intentionally and significantly adversely affects a historic property, or having the legal power to prevent it, allowed such significant adverse affect to occur.

(n) Recipient will comply with Title IX of the Education Amendments of 1972, as amended (20 U.S.C.: 1681-1683 and 1685 - 1686) which prohibits discrimination on the basis of sex;

(o) Recipient will comply with the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970, (42 U.S.C. 4521-45-94) relating to nondiscrimination on the basis of alcohol abuse or alcoholism;

(p) Recipient will comply with 523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records;

(q) Recipient will comply with Lead-Based Paint Poison Prevention Act (42 U.S.C.: 4821 et seq.) which prohibits the use of lead based paint in construction of rehabilitation or residential structures;

(r) Recipient will comply with the Energy Policy and Conservation Act (P.L. 94-163; 42 U.S.C. 6201-6422), and the provisions of the state Energy Conservation Plan adopted pursuant thereto;

(s) Recipient will comply with the Laboratory Animal Welfare Act of 1966, 7 U.S.C. 2131-2159, pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by an award of assistance under this agreement;

(t) Recipient will comply with Title VIII of the Civil Rights Act of 1968, 42 U.S.C. 2000c and 42 3601-3619, as amended, relating to non-discrimination in the sale, rental, or financing of housing, and Title VI of the Civil Rights Act of 1964 (P.L. 88-352), which prohibits discrimination on the basis of race, color or national origin;

(u) Recipient will comply with the Clean Air Act of 1955, as amended, 42 U.S.C. 7401-7642;

(v) Recipient will comply with the Clean Water Act of 1977, as amended, 42 U.S.C. 7419-7626;

(w) Recipient will comply with the Endangered Species Act of 1973, 16 U.S.C. 1531-1544;

(x) Recipient will comply with the Intergovernmental Personnel Act of 1970, 42 U.S.C. 4728-4763;

(y) Recipient will assist the awarding agency in assuring compliance with the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 270;

(z) Recipient will comply with environmental standards which may be prescribed pursuant to the National Environmental Policy Act of 1969, 42 U.S.C. 4321-4347;

(aa) Recipient will assist the awarding agency in assuring compliance with the Preservation of Archeological and Historical Preservation Act of 1966, 16 U.S.C. 469a, et seq.;

(bb) Recipient will comply with the Rehabilitation Act of 1973, Section 504, 29 U.S.C. 794, regarding non-discrimination;

(cc) Recipient will comply with the environmental standards which may be prescribed pursuant to the Safe Drinking Water Act of 1974, 42 U.S.C. 300f-300j, regarding the protection of underground water sources;

(dd) Recipients will comply with the requirements of Titles II and III of the Uniform Relocation Assistance and Property Acquisition Policies Act of 1970, 42 U.S.C. 4621-4638, which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally assisted programs;

(ee) Recipient will comply with the Wild and Scenic Rivers Act of 1968, 16 U.S.C. 1271-1287, related to protecting components or potential components of the national wild and scenic rivers system;

(ff) Recipient will comply with the following Executive Orders: EO 11514 (NEPA); EO 11738 (violating facilities); EO 11988 (Floodplain Management); EO 11990 (Wetlands); and EO 12898 (Environmental Justice);

(gg) Recipient will comply with the Fish and Wildlife Coordination Act of 1958; 16 U.S.C. 661-666.

(hh) Recipients will comply with applicable administrative requirements: OMB Circular A-102 – Uniform Administrative Requirements for Grant and Cooperative Agreements with State and Local Governments: or 2 CFR 215 – Uniform Administrative Requirements for Grants and Agreements with Institutions of High Education, Hospitals, and other Non-Profit Organization (OMB Circular A-110);

(ii) Recipients will comply with OMB Circular A-133 and Compliance Supplement – Audits of States, Local Governments and Non-Profit Organizations (if applicable).

(jj) With respect to demolition activities, recipient will:

1. Create and make available documentation sufficient to demonstrate the recipient and its demolition contractor have sufficient manpower and equipment to comply with the obligations as outlined in a grant agreement.

2. Return the property to its natural state as though no improvements had ever been contained thereon.

3. Furnish documentation of all qualified personnel, licenses and all equipment necessary to inspect buildings located in Recipient's jurisdiction to detect the presence of asbestos and lead in accordance with requirements of the U.S. Environmental Protection Agency.

4. Provide documentation of the inspection results for each structure to indicate:
   a. Safety Hazards present
   b. Health Hazards present
   c. Hazardous Materials present.

5. Provide supervision over contractors or employees employed by Recipient to remove asbestos and lead from demolished or otherwise applicable structures.

6. Leave the demolished site clean, level and free of debris.

7. Notify the proper authority promptly of any unusual existing condition which hampers the contractors work.

8. Obtain all required permits.

9. Provide addresses and marked maps for each site where water wells and septic tanks are to be closed, along with the number of wells and septic tanks located on each site. Provide documentation of closures.

10. Comply with mandatory standards and policies relating to energy efficiency which are contained in the State energy conservation plan.

11. Comply with all applicable standards, orders, or requirements issued under Section 112 and 306 of the Clean Air Act (42 U.S.C. 1857 (h), Section 508 of the Clean Water Act (33 U.S. 1368), Executive Order 11738, and the U.S. Environmental Protection Agency regulations: 40 CFR Part 15 and 61. This clause shall be added to any subcontracts.

12. Provide documentation of public notices for demolition activities.

Planning Process

3.1 Documentation of the Planning Process

§201.4(c)(1)- The State plan must include a description of the planning process used to develop the plan, including how it was prepared, who was involved in the process and how other agencies participated.

The 2010 Kentucky State Hazard Mitigation Plan was developed through the efforts of several significant partners. The resulting plan represents the collaborative work of the five (5) major contributors.

Kentucky Emergency Management Hazard Mitigation Program: The KyEM Mitigation Program staff: Greg Shanks, Cassandra Royce-Sanderson, Doug Eades, Valerie Wallace, and Lacresha Peyton, led by Leslie Mahoney the Mitigation Program Coordinator and State Hazard Mitigation Officer, were actively involved in all phases of the plan development. Areas of particular emphasis were program execution, disaster data analysis, and quality control. In addition to KyEM Hazard Mitigation Program staff there was extensive involvement by KyEM Division Director John Heltzel, KyEM Assistant Director Jimmy Richerson, Recovery Branch Manager Stephanie Robey, Intergovernmental Liaison Nancy Price, Regional Manager Jerry Rains, and various administrative support staff.

University of Louisville Center for Hazards Research and Policy Development: Under a contractual relationship between KyEM and the University of Louisville Center for Hazards Research and Policy Development (CHR); CHR performed extensive research, especially in the area of risk assessment, for incorporation into this State Hazard Mitigation Plan. CHR is a Board of Trustees-recognized research unit at the University which was established in 1989. Under the direction of Dr. David Simpson, the Center has performed numerous practitioner-oriented contracts and theoretical research regarding all phases and aspects of hazards, disasters, and homeland security issues, including work for the National Science Foundation, the United Nations, and various state and local governments. The plan's development and analysis were co-managed by Dr. Simpson, and the Center's Associate Director, Josh Human. Graduate students in the Masters of Urban Planning program, Sara Evans, Will Bruer, and Matthew Greer served as Project Leaders and contributed substantially to the completion of the 2010 State Hazard Mitigation Plan.

University of Kentucky Hazard Mitigation Program Support Office: KyEM also has experienced a strong and lengthy mitigation relationship with the University of Kentucky (UK). As subgrantees of KyEM's FEMA mitigation funding, UK staff members Esther White, Emily Frank, assisted by two (2) graduate students, and the UK Program Coordinator Brian Gathy, performed a vital role in the plan's development by providing extensive information regarding past practices, the development of local plans, and project identification.

(See Appendix 1 Plan Contributors)

State Hazard Mitigation Team: Another significant group involved in the planning process is the State Hazard Mitigation Team (SHMT) (See Appendix 2). The team was established in 1995 and meets monthly to offer advice to and consult with the KyEM Mitigation Program staff. For nine (9) months, monthly meeting agendas included reviews of plan components in addition to extensive program updates from UK and CHR.

Statewide Mitigation Stakeholders: Most importantly, there was invaluable input from mitigation stakeholders (See Appendix 3) throughout the Commonwealth in the development of Kentucky's 2010 State Mitigation Plan. Hundreds of stakeholders representing state and local governments, institutions of higher learning, and private and non-profit entities provided input during three meetings.

Since the completion of the 2007 Kentucky Hazard Mitigation Plan, KyEM has experienced a 100% staff turnover of its Hazard Mitigation Program, Division Director, and Branch Manager positions. Fortunately, the agency's long-standing relationships with CHR and UK ensured the continuance of institutional knowledge of the state's mitigation program.

The challenge for new staff to prepare an updated state hazard mitigation plan also offered a unique learning opportunity. The planning process was used as a tool to educate new employees regarding the importance of an effective mitigation plan and program. The examination of previous plans offered a historical prospective of state mitigation dangers and initiatives. FEMA, recognizing the challenges facing the new staff, provided more than 50 hours of classroom training over a six (6) week period**.** Additionally, the KyEM Mitigation Program staff has begun an exhaustive internal strategic planning process to identify the direction and priorities of daily activities. Staff has also begun the codification of program policies and procedures.

New divisional leadership has brought a wealth of knowledge and experience to the program. The new Division Director BG John Heltzel has a tremendous vision for KyEM and recognizes mitigation planning as a valuable asset for the Commonwealth. General Heltzel has provided the leadership necessary to evolve the Kentucky Hazard Mitigation Program to national prominence. The new Recovery Branch Manager, Stephanie Robey, brings an extensive knowledge of internal controls, risk minimization, Federal grant oversight, and audit requirements.

During the process of establishing a top tier mitigation program, KyEM is continually self evaluating internal and external procedures to identify program areas in need of improvement. It is KyEM's goal to deliver a comprehensive mitigation program to the Commonwealth of Kentucky in a manner which is not only efficient, but highly effective. The results of this assessment help KyEM to identify and prioritize goals for advancing Kentucky's Hazard Mitigation Program to the next level. These goals can be achieved in a manner which not only elevates the Commonwealth of Kentucky, but provides a model or template which can be leveraged by others.

A portion of General Heltzel's vision for the KyEM Hazard Mitigation Program involves the migration of the planning process into the digital world by using a mitigation software system where all phases of the mitigation plan will be a fluid and moving system. KyEM's has reinvested 2008 Pre Disaster Mitigation (PDM) grant funding to directly support a statewide enhanced hazard mitigation plan update and to develop a premier comprehensive mitigation program support system.

The Commonwealth Hazard Assessment and Mitigation Planning System (CHAMPS) (See Appendix 4) is a comprehensive solution for supporting emergency and hazard management, response, recovery, and mitigation activities. CHAMPS is database driven and serves to centralize development and distribution of statewide planning processes, products, and coordinated stakeholder efforts. The system is based upon connecting new and existing information subsystems, or modules, together in a manner which unites multiple agency workflows and decision making processes. While both activities interrelate and occur concurrently, each activity offers distinct benefits to the Commonwealth and the overall advancement of the FEMA and KyEM missions of hazard mitigation planning.

Specifically the update to the state plan addresses both standard and enhanced planning requirements. The various phases of the update process, while linear in appearance, often occurred in conjunction with other phases. Each phase was constantly revisited to reflect new changes which occurred and new information obtained from the stakeholders. A brief overview of each phase follows:

1. **Review of Previous Kentucky State Hazard Mitigation Plans -** The 2004 and 2007 plans were revisited by KyEM, CHR, and UK to identify areas requiring significant updating. Additionally, a review of the 2004 and more specifically the 2007 plan provided a blueprint for development of the 2010 plan.

2. **Encourage Increased Stakeholder Participation During the Planning Process -** Increased Stakeholder participation was encouraged throughout the planning process. KyEM, CHR, and UK clearly recognized the importance of participation by hazard mitigation stakeholders. Accordingly, through this process over 250 stakeholders were invited to and over 300 individuals participated in the three (3) stakeholder meetings.

3. **Review and update the Identifying Hazards and Profiles of Hazard Events Sections of Previous Plans -** Due to a number of significant disaster events since the 2007 plan, these hazard areas were carefully reviewed to ensure completeness. In addition, the layout of these sections was revised to provide more fluidity.

4. **Review and update of the Assessing Vulnerability by Jurisdiction and Estimating Potential Losses Sections –** Technological advancements in data

reliability and modeling associated with risk assessments are constantly evolving. CHR adjusted the Vulnerability Assessment Model to reflect the specific needs required by the crosswalk and data capture was updated to the census block level.

5. **Review and update of Mitigation Strategies -** Many stakeholders also provided information which was reflected in the updated Mitigation Strategy. The 2010 plan update presented an opportunity to review the Mitigation Strategy with the experiences gained through the multiple hazard occurrences experienced by the state over the last three (3) years.

6. **Review of Local Hazard Mitigation Plans –** It was vitally important for all 2010 KyEM plan participants to have a clear understanding of the mission and plans at the local level. To maximize mitigation effectiveness all plans must complement, augment, and support one another. It was decided in the 2007 plan update to reflect the goals and objectives of the ADDs and city plans in the state plan, based on the relevance of the goal or objective to the state. Unfortunately during this iteration of the plan there were no updated local hazard mitigation plans. This is an area in which the CHAMPS system will play a major role in the development of a comprehensive portal planning environment and synergizing planning data.

7. **Review of Plan Monitoring and Maintenance -** These topics were assessed to ensure the 2010 Plan would have the capacity to identify strengths and weakness and provide the capacity to quickly react and adjust accordingly. This is another area in which the CHAMPS system will play a major role in as KyEM moves toward a comprehensive portal planning environment.

8. **Integrate Stakeholder Input -** Stakeholder meetings provided opportunities for mitigation partners statewide to provide mitigation activity information, identify needs, and express concerns. Information obtained regarding existing data, projects, relationships, and activities in the field of hazards and hazard mitigation were incorporated into this plan.

9. **Comprehensive Plan Update –** Through a thorough review of the original plan, the local hazard mitigation plans, university plans, along with the constant change of hazard mitigation activities and data occurring throughout the State, every section of the plan was evaluated, updated, and improved.

The approach provided in the steps above integrate technologies and methods intended to enhance stakeholder input, local collaboration, the creation of risk assessments, accountable mitigation tracking, coordination with local planning activities, and plan maintenance responsibilities. Elements of the enhanced plan were addressed through the plan update process.

A 2008 Pre Disaster Mitigation (PDM) grant has been used to achieve two major goals.

1. Review and update the 2007 Kentucky Hazard Mitigation Plan
2. Develop a comprehensive system for supporting emergency and hazard management, response, recovery, and mitigation activities

CHAMPS is a database-driven software application which serves to centralize development and distribution of the statewide planning processes, products, and coordinated stakeholder efforts. The system is based upon connecting new and existing information subsystems, or modules, together in a manner which unites multiple agency workflows and decision making processes. CHAMPS is a fully secure, user-authenticated system residing in two locations and is being developed through the efforts of KyEM, CHR, and the engineering firm, Stantec.

This interactive, web-based information management system will be used to store and retrieve state and local mitigation data and to manage planning and project workflow between state and local applicants. It will also provide decision support tools for assessing and prioritizing mitigation activities. It is intended that CHAMPS will support the traditional elements of the planning process while also addressing key components of the enhanced planning process such as “Integration with Other Planning Initiatives” – 201.5(b)(1) – and “Project Implementation Capability – 201.5(b)(2)(i) and (ii).

The development of CHAMPS is expected to occur in multiple phases. Additional phases of the system are proposed under other funding mechanisms currently being explored (See Appendix 4).

Planning Meetings

The following meetings describe the planning meetings held between KyEM, CHR, UK, and Stantec representatives. These meetings served as the platform to familiarize all participants with the PDM plan update grant awarded to KyEM. These meetings provided the planning participants an understanding of their rolls during the update process clarified expectations of the PDM grant’s scope of work.

August 24, 2009 – Frankfort, KY

Overview:

1. This was the first formal meeting to discuss the 2010 Hazard Mitigation Plan process.
2. The KyEM Director, BG John Heltzel raised the issue of including man-made hazards in the plan as well as the importance of community involvement in the plan update process.
3. The KyEM Director also stated his desire for Kentucky “to be ahead of the curve”.
4. KyEM would prefer to have a clear vision of a more complete, updated planning system.

5. KyEM wants FEMA to consider Kentucky the benchmark for Hazard Mitigation planning and plan maintenance.
6. Time management and allocation of grant monies were also discussed.

Detailed Topics:

1. The 2010 plan update was of major importance for everyone involved in this meeting.
2. How to improve the existing plan and identify future needs were main topics of discussion.
3. Man-made hazards and infrastructure failures were important to KyEM, UK, and CHR.
4. Although not mandated by FEMA currently, talk of how to truly make a 'comprehensive' hazard mitigation plan was scheduled for a later date, thus, the meeting was geared toward management of time and efforts on the current plan update.
5. It was not clear when FEMA expected submittal of the final product.
6. It was also not clear as to what particular grant funds (DR-1818 dollars in one instance) could be used for creation and continuing enhancement of the CHAMPS system. Both the due date and the budget questions were queued for a meeting with FEMA taking place the following week.

August 31, 2009 – Frankfort

Overview:

1. This meeting was comprised of two sections: one discussing CHAMPS and another specifically set aside to meet with FEMA.
2. Members of Stantec were also present for this meeting. They participated in brainstorming activities for CHAMPS as well as provided technical clarifications on the system's development.
3. The first section of the meeting included a re-introduction of attendees and a summary of the previous week's meeting.
4. CHAMPS and the need for additional funding sources for added functionality were discussed.
5. The core functionality of CHAMPS and how it directly related to the 2010 plan update was thoroughly discussed.
6. As a possible addition to the FEMA crosswalk, it was suggested local entities (Kentucky's Area Development Districts for example) should be asked to include data and upload it into CHAMPS.
7. FEMA representatives participated in the second half of the meeting and identified the specific date for the plan approval as October 26, 2010.
8. FEMA also reviewed the important sections of the 2010 plan to retain enhanced status, which is the goal and major objective of all stakeholders present at the meeting.
9. FEMA noted it was important for the plan update to include as much data and research regarding Kentucky's most recent natural disasters as possible.

10. The meeting concluded with a question and answer session and contact information was exchanged among participants.

<u>Detailed Topics:</u>
FEMA Expectations:

1. Kentucky's main goal for the 2010 plan is not only to remain in enhanced status for the state plan, but also to set the stage for a completely dynamic and adaptive planning process.
2. Questions asked of FEMA during this meeting focused on FEMA requirements for approval and buy in.
3. FEMA viewed the CHAMPS presentation. FEMA seemed to be enthused with the project, but was mainly concerned with the plan itself.
4. FEMA mentioned it was very important for Kentucky's next plan to include as much data and research about the more recent natural disasters as possible. The wind and ice storms of 2008 and 2009 respectively, were chief among their concerns.
5. FEMA wanted to know about the state's plan maintenance practices, what the goals and strategies were for the plan, but also for such disasters, and if the plan was effective during recent disasters.
6. FEMA also encouraged KyEM to document as much as possible during the planning process and include notes and comments on the crosswalk.

Kentucky State Hazard Mitigation Team

The most powerful Enhanced Plan integration tool used by KyEM is the State Hazard Mitigation Team (SHMT). Since the approval of the 2007 Kentucky Enhanced Plan, there has been a concerted effort to also enhance this team. Membership has been carefully crafted to include representatives of various state and local entities with a vested interest in the work of the KyEM Hazard Mitigation Program and the federal programs managed by KyEM. KyEM recognized the need for regular, ongoing mitigation stakeholder involvement to ensure the maximization of mitigation efforts in the Commonwealth. Kentucky's State Hazard Mitigation Team (SHMT), which meets monthly, fulfills this need and is a valuable partner in mitigation planning and resource allocation.

Kentucky's county structure of 120 counties creates significant challenges in being able to efficiently communicate with such a large number of local governmental entities. Through the SHMT, KyEM is able to partner with members who, with varying areas of expertise, are for the most part working daily with the same stakeholders.

Prior to 2007, SHMT duties and immersion into mitigation information and opportunities were limited. In the past three years, great efforts have been made to ensure that team members receive extensive mitigation training. As is detailed in Appendix 5 beginning on page 22, each meeting includes presentations from the University of Louisville and the University of Kentucky. These presenters are subject matter experts in the areas of mitigation planning and risk. Most importantly, at every meeting SHMT members update the team as to their own mitigation efforts and experiences.

During 2009, the entire team reviewed the existing Enhanced State Mitigation Plan and during SHMT meeting they offered suggested additions, deletions, and edits for the new submission. Each SHMT member attended at least one of Hazard Mitigation Plan stakeholders meeting.

The team is comprised of 16 voting and eight (8) non voting members representing state and local governments as well as non-profit entities who are involved with mitigation and mitigation-related matters.

Current membership is as follows:

VOTING MEMBERS	**REPRESENTING**
Leslie Mahoney, Chair	KyEM Hazard Mitigation Program
BG John Heltzel	KyEM Director
Jimmy Richerson	KyEM Assistant Director
Stephanie Robey	KyEM Recovery Branch Manager
Lee Nalley	KY Department for Local Government
Michael Hale	KY Department for Local Government
Chris Hart	KY Division of Water, NFIP Coordinator
Carey Johnson	KY Division of Water, CTP Program Manager
Wendell Lawrence	Lincoln Trail ADD Executive Director
VOTING MEMBERS, Cont.	**REPRESENTING**
Jerry Rains	KyEM Area 9 Regional Manager
Jim McKinney	Louisville Metro Emergency Management
Susan Wilkerson	Office of the Governor Grants Director
Nancy Price	KyEM Intergovernmental Liaison
Angela Satterlee	Hopkinsville/Christian Co Planning Comm.
Joe Sullivan	National Weather Service
Chris Moberly	Kentucky Transportation Cabinet

NON VOTING MEMBERS	**REPRESENTING**
Brian Gathy	UK Mitigation Support Office Program Coor.
Jerry Ross	FEMA
Esther White	UK Mitigation Support Office Grant Mgr.
Josh Human	CHR Associate Director
Emily Frank	UK Mitigation Support Office Planning Coor.
Greg Shanks	KyEM Hazard Mitigation Grant Manager
Cassandra Royce-Sanderson	KyEM Hazard Mitigation Grant Manager
Doug Eades	KyEM Hazard Mitigation Grant Manager

Non-KyEM members of the SHMT and their link to mitigation efforts are as follows:

- **Kentucky Department for Local Government (DLG) (Lee Nalley and Michael Hale):** DLG, which is located within the Office of the Governor, provides financial help in the way of grant and loan assistance, as well as advising local government in fiscal matters and planning initiatives. Another important link is the designation of DLG as the Commonwealth's Clearinghouse.

DLG manages a disaster recovery grant program which receives funding from the Federal Department of Housing and Urban Development. This program assists local communities in long term recovery from unmet needs associated with presidentially-declared disasters. There are three (3) areas of emphasis which can be considered for funding. Two of the three can, and have, funded mitigation efforts such as increasing the ability of mobile homes to sustain high winds through the installing of tie downs or permanent foundation placement. Additionally, DLG has been very proactive in providing non-federal grant funding to communities in need of assistance in meeting the match requirements associated with mitigation and public assistance grants.

DLG has recently committed HUD funding to KyEM to assist with the expenditures associated with the development of the Phase II of CHAMPS. Through its SHMT participation, DLG has obtained increased awareness of the importance of mitigation and the need for local governments to have effective, meaningful hazard mitigation plans.

- **The Lincoln Trail Area Development District (Wendell Lawrence, Executive Director):** As is described in detail below, the Commonwealth is divided into fifteen area development districts (ADD) which develop district mitigation plans thus providing plan coverage to all 120 Kentucky counties and the governmental units contained therein. The primary integration of the Kentucky Enhanced Mitigation Plan into the efforts of the ADDs is through the planning process. To ensure Kentucky has 100% coverage in mitigation planning, each ADD has received either HMGP Planning or Pre Disaster Mitigation funding to develop a mitigation plan that encompasses its member counties, cities, towns, etc. In addition to serving on the SHMT, the current ADD representative, Mr. Lawrence, is a member of the Kentucky Council of Area Development Districts Board of Directors. He serves as an excellent conduit between the Council and the SHMT, sharing emerging mitigation issues with both groups.

In addition to the mitigation information shared with the ADD Council, ADD planners receive technical assistance and guidance from the KyEM Mitigation Program Support Office staff located at the University of Kentucky and all planners are advised as to the importance of HAZUS use.

- **Kentucky Division of Water (DOW) (Chris Hart and Carey Johnson):** Flooding is Kentucky's most costly natural disaster, both in terms of financial loss and personal suffering. One mission of DOW is to mitigate flood-related damages through proper floodplain management.

DOW is designated by Kentucky Revised Statute 151 as the state coordinating agency for the National Flood Insurance Program (NFIP) and Mr. Hart is the NFIP coordinator. As the NFIP coordinating agency, DOW assists local governments and state agencies in answering all questions concerning the program. The DOW representatives bring a wealth of knowledge to the SHMT and are able to advise team members on an array of issues concerning NFIP, flood mapping, etc.

As an agency response to mitigation opportunities, in 2008 DOW created and implemented the Kentucky Drought Mitigation and Response Plan which creates a state-level organizational structure which facilitates coordination of state and federal agencies in drought monitoring, response, and mitigation activities. Most importantly this plan encourages a long-term strategy of evaluating Kentucky's drought vulnerabilities and identifying actions which will mitigate the impacts of future droughts.

- **Louisville Metro Emergency Management (Jim McKinney):** As stated earlier, the entire state is blanketed with hazard mitigation plans developed at the Area Development District level. The two (2) major urban areas in Kentucky, Louisville-Jefferson Metro Government and Lexington-Fayette Urban County Government determined and addressed the need for hazard mitigation plans which more accurately reflected the risks associated with their populations and uniqueness. Using L-PDM funding awarded through the KyEM Hazard Mitigation Program, both urban areas have developed individual hazard mitigation plans.

As the Project Coordinator for the Louisville Metro Natural Hazards Mitigation Plan, Mr. McKinney was able to ensure not only that the state plan was considered in the Metro's planning initiatives, but also that KyEM was able to receive ongoing input and guidance from the state's largest urban area.

The Lexington Hazard Mitigation Plan was developed in partnership with the University of Louisville's Center for Hazards Research. The center is represented on the SHMT by non-voting member Josh Human. As Mr. Human has been closely involved in the development of the state plan, as well as the Lexington and Louisville plans, it is assured the plans are closely integrated.

- **Kentucky Office of Homeland Security (KOHS) (Susan Wilkerson):** The Kentucky Office of Homeland Security is responsible to ensure communities, first responders, and private citizens are properly resourced and prepared to deal with threats to security and welfare. In many instances the mission of this agency directly parallels the goals of the KyEM. It has been very important for the two agencies to collaborate through the SHMT. In many instances unsuccessful applicants to KyEM have been referred to KOHS where they were able to receive grant funding and vice versa. In some instances a community's projects have been segmented to achieve funding from both sources. KOHS, through SHMT participation has a full understanding of the Enhanced Plan and is able to incorporate the goals and objectives in its grant award process.

- **National Weather Service (NWS) (Joe Sullivan):** The partnership formed through the participation NWS on the SHMT has proved invaluable. Mr. Sullivan has gained and clear understanding of the Enhanced Hazard Mitigation Plan and his collaboration has proved invaluable in development of this plan – particularly in hazard and risk determinations. Because of this involvement, NWS has begun participating in other mitigation-focused groups such as the Silver Jackets and the Kentucky Association of Mitigation Managers.

- **Kentucky Transportation Cabinet (KYTC) (Chris Mobley):** Upon initial observation, the purpose of participation from this agency may not be apparent. However, since the inception of the previous Enhanced State Mitigation Plan, there has been a concerted effort by KyEM to encourage Public Assistance applicants to consider both 406 and 404 Hazard Mitigation projects.

Since the approval of the 2007 Enhanced Mitigation Plan, Kentucky has experienced six (6) presidential declarations as a result of flooding. The majority of damages associated with these events affected infrastructures. The majority of the infrastructure damages occurred on roads and bridges. Consequently, since 2007, KYTC has been the largest single recipient of disaster recovery funds under the Public Assistance Program.

With KYTC participation on the SHMT, the cabinet is embracing the importance of mitigating repetitive loss sites. This newly-developed collaboration has also elevated both public assistance and mitigation matters within the cabinet. As a result, KYTC has hired permanent staff to manage all disaster-related issues. Also, in its capacity of providing engineering expertise and consultation to counties and cities; local governmental entities are encouraged by KYTC to seek mitigation alternatives for repetitive damage sites with a particular emphasis on 406 Mitigation opportunities.

Over the last nine (9) months each meeting of the team has included progress reports and discussions regarding the status of the state and local plans (See Appendix 5). The team has also been actively involved in an analysis of CHAMPS and development of its components.

Every meeting also includes status reports presented by KyEM and UK. Team members receive detailed information regarding potential mitigation projects. The team determines the priority of Letters of Intent (LOI's) which provides KyEM with fair and impartial recommendations regarding the allocation of FEMA funding. Considerations during prioritization include a number of factors such as need, geographic location, prior mitigation grant experience, and most importantly: congruence with the state and local hazard mitigation plans.

3.2 Coordination Among Agencies

§201.4(b) requires the Plan to contain a discussion of how the planning process was coordinated with state agencies and appropriate federal agencies and interested groups.

Similar to the stakeholder meeting process conducted in the planning for the 2004 and 2007 state mitigation plans, the 2010 plan update process included three (3) meetings to allow for stakeholders an opportunity to gain an understanding of and participate in the planning process. In the 2004 state plan, the stakeholders only represented a few key government agencies and even fewer key non-government agencies. During the 2007 update, KyEM and CHR sought and received additional participation from other agencies and organizations within the governmental and non-governmental realms, thus enhancing the stakeholder process.

During the 2010 plan update process the 2007 extended stakeholder population was again invited to participate (See Appendix 6). Those contacted represent a broad spectrum of agencies, organizations, and institutions to provide mitigation outreach and education. Participation by these groups also allows KyEM to learn about mitigation needs, opportunities, and efforts throughout the state and in what areas is there a need to expand or cultivate mitigation partnerships.

Participants represented the following six (6) entities:

1. **Federal Government** - Includes federal entities with country and country-regional jurisdiction
2. **Kentucky State and Local Governments -** Includes state, state-region, and local government entities performing a variety of functions. All elected state senators and representatives were urged to participate or to send legislative staff in their place. To ensure solid local government participation, the KyEM Intergovernmental Liaison, Nancy Price, made personal contact with officials after the distribution of the invitation signed by General Heltzel (See Appendix 7)
3. **Non-governmental and Non-profit -** Includes professional associations, non-profit organizations, and other organizations with an interest in hazards, hazard mitigation, or disasters in all phases
4. **Kentucky Colleges and Universities -** Included all recognized Kentucky colleges and universities, regardless of public or private status, operating within the state
5. **Kentucky Utilities -** Includes all utilities predominately pertaining to water and electric cooperatives which operate plants, lines, or pipelines within the state.
6. **Transportation entities -** Includes roads, rail, and other transportation groups with business in the state.

(See Appendix 8 for a listing of the organizations which participated in each meeting.)

Upon identifying stakeholder representatives of these classifications, KyEM sent a letter (See Appendices 6 and 7) to the stakeholders requesting their attendance at each of the stakeholder meetings. A point of contact was established with each stakeholder liaison, or a designee, was invited to attend all stakeholder meetings. KyEM and CHR held three (3) stakeholder meetings in Frankfort at the Kentucky Transportation Cabinet Conference Center and the Capital Plaza Hotel. In 2004, only 32 of 65 invited stakeholders attended the meetings. In 2007, 94 of 163 invitees attended the stakeholder meetings, including 55 entities which were not previously invited to the stakeholder meetings. In 2010, 158 of 255 identified stakeholders attended at least one of the three stakeholder meetings. The enhanced effort to elevate stakeholder awareness and participation in the state's hazard mitigation effort was achieved with a 64% increase in invitation and a 59% increase in attendance.

Stakeholder Meetings

As previously mentioned, three (3) meetings were held in conjunction with the plan update process. The following describes the primary objectives and results of each workshop.

January 6, 2010 - Frankfort

Overview:

1. This meeting was the first stakeholder meeting for the 2010 plan update. The meeting invitation was extended to over 250 representatives of various organizations from across Kentucky
2. The primary purpose of the meeting was to maximize the number of organizations (ranging in attendance from mayors to EMS workers) participating in the planning process. It was also an opportunity to introduce these organizations and individuals to CHAMPS.
3. This meeting was used to gather information from the stakeholders and to understand what type of hazard mitigation efforts they have completed over the last three (3) years. This was accomplished through the "Mitigation Action Report." (See Appendix 9)
4. Each individual stakeholder was provided an overview of Hazard Mitigation Action Categories and Techniques (See Appendix 10)
5. Breakout sessions were held to obtain data and additional information for inclusion in the update process.
6. Four (4) groups were assigned to individual facilitators. The groups were asked about the availability of data, their use of the current state plan, and given another overview of the Mitigation Action Report.

Detailed Topics:

Attendance and Breakouts

1. 158 individuals from various organizations across the state attended this meeting.
2. After presenting a Power Point presentation regarding CHAMPS as well as the 2010 state plan update, four (4) breakout groups were created.
3. Members of KyEM and CHR facilitated the breakout sessions. The intent of the breakout session was to obtain as much information as possible and to include the maximum amount of stakeholders' data relevant to the 2010 update while receiving information on what type of mitigation activities have been occurring throughout the Commonwealth.
4. After providing each breakout group member with an opportunity to present or commit any data to the update process, general questions and concerns were addressed.
5. The classification and significance of universities (both private and state) as well as non-profit organizations under the state plan were among concerns from several groups.
   (See Appendix 11 for Agenda)

April 12, 2010 – Frankfort

Overview

1. This was the second stakeholder meeting for the 2010 plan. The meeting was attended by over 80 individuals.
2. The primary focus of this meeting was to provide an overview of the Risk Assessment and Mitigation Strategy sections.
3. This meeting was used to gather information regarding the capabilities of each state and local participating agency.
4. Each individual stakeholder was provided a State and Local Capability Survey (See Appendix 12)

Detailed Topics

1. Members of the CHR and KyEM team presented a detailed description of the Risk Assessment and Mitigation Strategy sections.
2. Each participant who provided feedback on the "Mitigation Action Reports" was thanked and a review of the data was presented.
3. An overview of the importance of the State and Local Capability Survey was provided and each attending stakeholder was e-mailed a survey to complete.
   (See Appendix 13 for Agenda)

May 26, 2010

Overview

1. This was the third and final stakeholder meeting for the 2010 plan. The meeting was attended by over 40 individuals.
2. The primary focus of this meeting was to provide an overview of each section of the plan.
3. The final draft of the plan was shared with the stakeholders who were solicited for comments.

Detailed

1. Members of CHR, KyEM, and UK staff detailed each phase of the plan and significant changes from the previous plan.
2. CHAMPS was unveiled to stakeholders and comments were received.
3. A discussion was held regarding the possibility of additional meetings to further review CHAMPS and maintain stakeholder group participation and momentum. (See Appendix 14 Agenda)

3.3 Program Integration

Requirement §201.4(b): [The State mitigation planning process should] be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.

CHR again reviewed the plans of several state agencies to identify programs and policies which currently promote or could potentially advance mitigation initiatives throughout the state. KyEM promotes the state mitigation plan to its agency partners and will continue to integrate with the mitigation programs and plans of its partners. Through the update process, CHR and KyEM identified new programs which were added to this section. Additionally, in this section, KyEM has identified the improved coordination between federal and state agencies. Also a detailed description of the Action Reports which provided CHR a view of what programs have been occurring throughout the state over the last three years was included. The State will work closely with these agencies to integrate and develop hazard mitigation planning initiatives throughout Kentucky.

State Mitigation Programs

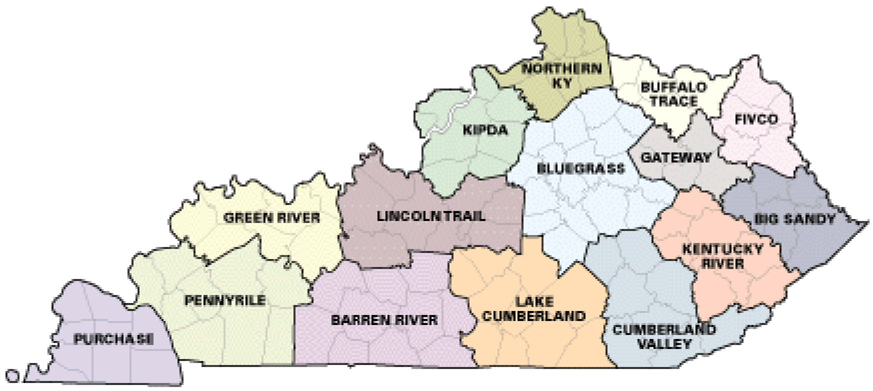
Area Development Districts (ADDs)

Kentucky Revised Statue 147A.050 creates and establishes 15 Area Development Districts. The ADDs provide the systematic linkage between the local leadership of a county, the Governor's Office, state and federal agencies, and private organizations. The ADD normally serves as a forum, clearinghouse, and technical center for a region. ADDs have both federal and state origin and have common characteristics with other regional councils throughout the United States. The ADDs within the Commonwealth are charged with the development of local multi-jurisdictional level hazard mitigation plans and serve as part of the State Clearinghouse process.

Although public bodies under Kentucky law, the ADDs are not considered state agencies nor any other level of government. Instead, ADDs are considered partnerships of local units of government. Locally-elected officials and citizen members comprise the ADDs' boards of directors. The ADDs' staffs include professionals with a wide range of backgrounds in areas such as economic development, human services, management, grant development, and planning. By sharing the ADDs' staffs, local governments are collectively able to access the professional expertise which many counties and cities could not individually afford.

Upon request by a local government, the ADD Projects Coordinators, Local Government Analysts, and Community Development Specialists assist local communities with the collection of data for benefit cost analysis and the application development process for hazard mitigation projects. If the project is approved and awarded, the ADD specialists may also assist the local government in project implementation and grant compliance.

Kentucky's Area Development Districts



ADDs are also a means by which local elected officials and citizens unite to provide for the planned growth of their area. An ADD is, therefore, a regional organization which assists in the formulation and implementation of human resource and infrastructure-related plans. It must be emphasized that the plans and recommendations developed by an ADD represent professional advice only. ADDs are not regulatory agencies. They do not have the power to enforce compliance with the plans.

Each ADD has developed a local multi-jurisdictional hazard mitigation plan, similar to the state's hazard mitigation plan which addresses hazard mitigation issues in the ADDs' respective areas. All ADD planners are provide with a copy of the approved state plan so they may become familiar with the state's object and integrate accordingly. To ensure the needs of the Kentucky regions are being addressed at the state level, each of the ADD's hazard mitigation plans were reviewed to determine cohesiveness with the Kentucky State Hazard Mitigation Plan. Particular attention was given to the goals and objectives of each ADD's local hazard mitigation plan, in addition to the identification and profiling of the hazards in their respective areas. The ADDs will continue to play a major role within local mitigation planning and the development of the CHAMPS system.

Dam Safety Program

The Kentucky Energy and Environment Cabinet's Division of Water Dam Safety Section periodically inspects all functional and operational dams. Each inspection starts with a complete file desk review to identify any deficiencies. The inspector also reviews all hydrologic evaluations. Some dams do not have hydrologic evaluations, or the evaluation needs to be updated.

When sufficient data is available, the inspector performs a field evaluation. In the field, the inspector conducts a complete visual inspection. Surveys are completed for dams with missing measurements. Photographs help provide a permanent record of observations. Following the inspection, a letter and report are prepared for the owner. The letter and report describe the observations and instruct the owner to remedy any deficiencies. As necessary, the inspector follows up to ensure required remedial work is completed. Sometimes it is necessary to take enforcement actions to prompt an owner to properly maintain or modify a dam. Approximately 300 dams are inspected each year.

The Dam Safety Section takes emergency action if a structure is in danger of failing and poses a threat to life or may cause serious property damage. KRS 151.297 empowers the Natural Resources and Environmental Protection Cabinet to take emergency action if an owner abandons a dam or refuses to take necessary action.

Dam failure has been identified as a potential hazard. However, many mitigation specialists across KY do not work directly with dam safety and may be uninformed regarding the dangers of dam failure and how dams are monitored for safety. To address this, educational opportunities are provided through cooperative efforts between the KY Association of Mitigation Managers (KAMM) and the Dam Safety Program of the KY Division of Water (DOW).

KAMM conducts an annual conference during which government officials and professionals involved in many aspects of hazard mitigation lecture and lead workshops which enhance participants' knowledge of KY's hazards and the various mitigation approaches used to address public safety and the protection of property. For example, past presentations by DOW's Dam Safety Program have included lectures on the *National Levee Safety Program* and *Dam Failures: Manmade Natural Hazard.* These lectures fully explained the overall potential hazard of dam failures and the ways in which the Dam Safety Program works to prevent losses and injuries. In this way, the partnership between KyEM and the Dam Safety Program integrates the hazard of dam failure with FEMA's mitigation programs to provide information and guidance to mitigation specialists and government officials statewide.

KyEM manages flood demonstration grants of which some projects were funded specifically for levee recertification efforts. In 2010 KyEM sponsored a statewide levee summit. This one-day meeting was held to discuss levee maintenance, certification, ownership, and other issues. Presenters included subject matter experts from the Kentucky Division of Water, Kentucky Department of Local Government, KyEM Hazard Mitigation Program, and the US Army Corps of Engineers. Attendance numbered over 100 stakeholders from across the Commonwealth. Recent reports indicate a replication of this workshop is being planned by the US Army Corps of Engineers for other states.

Floodplain Management

Floodplain Management is interwoven throughout KY's hazard mitigation efforts and is a crucial element of mitigating flood damages and injuries. Through state and local statutes and ordinances, NFIP participation, education and training, and implementation of flood control projects, floodplain management is an integral component of FEMA mitigation efforts in KY.

Chapter 151 of the Kentucky Revised Statues is the state statute which addresses the development of floodplain areas. The most pertinent sections of KRS 151 are (1) KRS 151.250 which establishes the requirements for obtaining a floodplain development permit; and (2) KRS 151.125 which establishes the authority and powers of the Secretary of the Kentucky Energy and Environment Cabinet to administer KRS 151.

Based on KRS 151, the Department for Environmental Protection's Division of Water is designated as the state's coordinating agency for the National Flood Insurance Program (NFIP). As the coordinating agency, the Division of Water assists local governments and state agencies by answering all questions concerning the program.

In general, to apply for FEMA mitigation funds, communities must be participants in good standing in the NFIP. As meeting this requirement is fundamental to the success of the mitigation program, KyEM partners with DOW to ensure communities understand this requirement as related to mitigation. During post-disaster Applicant Briefings, KyEM explains NFIP compliance as integral to local subgrantee eligibility. Additionally, KyEM has worked with local communities and DOW to inform communities on the steps necessary to move from NFIP non-compliance to compliance. While DOW works with local communities to ensure that all NFIP requirements have been met to maintain good standing, KyEM promotes the importance of compliance to all interested applicants. For example, during the application development process for DR1818, two communities which were applying for mitigation funds were found to have overlooked the completion of the adoption process of the local FIRMs. The DOW and KyEM worked with the communities to move the process forward, and the local applicants were reinstated as participants in good standing.

Floodplain Management education and training is offered for mitigation specialists through annual state (KAMM) and national Association of State Floodplain Managers (ASFPM) conferences, FEMA and DOW training opportunities, and the Emergency Management Institute (EMI) classes and workshops. Mitigation specialists statewide participate in many of these sessions as both trainers and attendees.

The Kentucky Association of Mitigation Managers (KAMM) was formed to promote floodplain management and mitigation in Kentucky. Its members represent local floodplain coordinators, planning and zoning officials, engineers, surveyors, GIS specialists, hydrologists, and local emergency managers.

The purpose of KAMM is to provide a means for state and local floodplain managers to join with others regarding floodplain management policies and activities. Additionally, KAMM exists to advance the study, research, and exchange of information on the technical aspects of floodplain management to reduce flood damage within the Commonwealth of Kentucky. KyEM Mitigation staff has a history of serving on the KAMM board and two mitigation staff currently serve on the board, helping to ensure mitigation is interwoven into floodplain management activities.

KAMM sponsors an annual conference to promote floodplain awareness and as a forum for local, state, and federal officials to educate the public. KAMM co-hosted the 2010 conference with Kentucky Stormwater Association (KSA). KSA provides a venue for governments to share knowledge and receive training on stormwater management and encourages sound stormwater management policy. KSA routinely coordinates with the Kentucky Division of Water (KDOW) regarding current and pending regulations and to support education and outreach. The co-hosted 2010 conference was KSA's first annual conference. It provided an excellent opportunity for KyEM mitigation staff to learn from stormwater management officials about a variety of topics including the new national stormwater rule, new Stormwater Phase II rules and program expectations and grants for training programs. Furthermore, this conference promoted partnerships between KyEM's mitigation staff and local stormwater officials and offered the opportunity for KyEM to outreach and education on mitigation to the stormwater management audience. KAMM is also a Chapter Member of the ASFPM.[1]

Past KAMM conference floodplain management topics have included, among others, *Working in KY's Floodplains* and *Floodways*, *Holistic Approach to Watershed Management,* and *Flood Reduction through Stream Restoration*. The annual ASFPM conference offers both general informational sessions on floodplain management and more technical training for floodplain managers and engineers including *Building Community Support for Floodplain Management, GIS Essentials, and CFM Refresher Courses.*

FEMA sessions offered to mitigation staff statewide, which enhanced floodplain management knowledge, include *KY Floodplain Management Basics* and *Residential Substantial Damage Estimator* training. KY DOW has also coordinated training sessions for mitigation specialists statewide on *Local Floodplain Managers Roles and Responsibilities.*

Mitigation specialists have also completed the EMI course *National Flood Insurance Program/Community Rating System (NFIP/CRS) (E278)*. This course covers the CRS, a nationwide initiative of FEMA's National Flood Insurance Program. It describes activities eligible for credit under CRS, how a community applies, and how a community modifies an application to improve its classification. This course assists those performing

[1] http://kyem.ky.gov/assistance/hazardmitigation/kamm.htm,

floodplain services for local governments in learning about the CRS in order to provide technical assistance to communities seeking to apply for CRS credit. Participants are required to work specifically with floodplain management.

KyEM works with communities across the State to develop and implement flood control projects. Several of these projects are funded through FEMA's HMA programs and have mitigated property damage, injuries, and loss of life in many floodprone areas. Past mitigation projects have included acquisition and demolition of structures damaged by flooding, drainage improvements and culvert upgrades, and the construction of detention and/or retention basins. KY has mitigated many Repetitive Loss and Severe Repetitive Loss properties through the use of FEMA mitigation funds, and through the implementation of flood control projects has reduced losses associated with flood damages to public and private property, swift water rescues and other emergency dispatches, injury accidents, and loss of life.

Kentucky Building Code

The Kentucky Building Code proactively addresses issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats. The Kentucky Department of Housing, Buildings, and Construction's Division of Building Codes Enforcement regulates the Kentucky Building Code as it pertains to the construction of new buildings and alterations, additions, and changes of occupancy to existing buildings.

Responsibilities for the enforcement of the Kentucky Building code are shared between the Division of Building Codes Enforcement and the local government building departments. The Division's Building Codes Section reviews architectural plans prior to construction and conducts field inspections to ensure compliance with the Kentucky Building Code. Inspections are conducted of approved projects to ensure construction is completed according to approved plans. Any variations must be approved. Upon successful completion of the final inspection, an occupancy permit is issued and the case file is transferred to the General Inspection Section of the Division of Fire Prevention for future inspections. All inspectors must be certified with the Kentucky Building Inspector Certification.

KY Building Codes support the overall goals of both State and FEMA mitigation efforts by helping to ensure that new construction statewide is resistant to damages from severe winds, tornados, and seismic activity, thus helping KyEM to meet the actions identified in its mitigation plan strategy.

Kentucky Division of Water (KDOW) - Business Plans and Grants

The DOW Business Plan addresses issues related to floodplain management and dam safety. The plan is a working document and changes yearly. DOW and KyEM have a strong relationship and continue to jointly plan projects which are focused on mitigating flood-related damages.

The Division of Water receives several federal grants which fund mitigation activities. These include:

- Cooperating Technical Partners (CTP) grants for scoping, production, and post-preliminary processing and mapping the floodplains of all the counties
- Map Modernization Management and Support (MMMS) grants for management, outreach, and public information purposes
- Community Assistance Program (CAP) grants used to further the provisions of the NFIP and increase statewide awareness of floodplain management
- Risk MAP activities have presented an opportunity for KyEM and the Division of Water to collaborate with a focus on mapping, assessment, and planning. The two agencies have been working with their respective local, state, and federal partners to create an overarching vision of complete hazard mitigation needs and opportunities through hazard mitigation planning and Risk MAP activities. Also, the CHAMPS system has been discussed in reference to its potential role in the Risk MAP process.

In addition to administering the NFIP for the State and monitoring dam safety, the DOW supports and enhances both State and FEMA hazard mitigation efforts through its plan, active participation and leadership in mitigation activities, and the use of grants to promote floodplain management awareness and techniques.

KyEM Mitigation has and continues to collaborate with KY DOW for the former Flood Map Modernization (Map Mod) and current Risk Mapping, Assessment, and Planning (Risk MAP) programs. DOW, with FEMA, has initiated the Risk MAP program in Kentucky. FEMA and DOW's vision for the Risk MAP program is to deliver quality data that increases public awareness and leads to mitigation actions that reduce risk to life and property. To achieve this vision, FEMA and DOW will transform its traditional flood identification and mapping efforts into a more integrated process of accurately identifying, assessing, communicating, planning for, and mitigating natural hazard related risks.

Building on the success of the Map Modernization effort, FEMA and DOW collaborate with Federal, State, and local community stakeholders, with KyEM Mitigation being a key stakeholder in the process. As such, KyEM Mitigation staff was selected to participate in Risk MAP focus groups to help create a Risk Communication Toolbox that will be used in Kentucky and potentially other states and communities nationwide to identify short and long-term outreach needs, define pertinent audiences, and develop potential tools to aid in enhancing risk mitigation. DOW has recognized KyEM

Mitigation's commitment to this effort as extremely valuable to helping to achieve the goals of Risk MAP.

The stated Risk MAP goals are:

1. Flood Hazard Data**:** Address gaps in flood hazard data to form a solid foundation for risk assessment, floodplain management, and actuarial soundness of the National Flood Insurance Program (NFIP).
2. Public Awareness/Outreach**:** Ensure that a measurable increase of the public's awareness and understanding of risk results in a measurable reduction of current and future vulnerability.
3. Hazard Mitigation Planning**:** Lead and support States and local communities to effectively engage in risk-based mitigation planning, resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards.
4. Enhanced Digital Platform**:** Provide an enhanced digital platform that improves communication and sharing of risk data and related products to all levels of government and the public.
5. Alignment and Synergies: Align Risk Analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.

In addition to its other mitigation activities, the Kentucky Division of Water (DOW), through FEMA funding, has compiled new digital federal insurance rate maps (DFIRMS) for the Commonwealth of Kentucky. The maps created through this process are invaluable to hazard mitigation activities.

During the benefit cost analysis and application development process for FEMA HMA grant proposals, DOW provides updated FIRMS and Flood Insurance Studies to KyEM mitigation staff and local communities working to develop hazard mitigation projects. Access to these resources is crucial to the accurate determination of project sites relative to mapped flood zones.

Kentucky Emergency Operations Plan (KyEOP)

The KyEOP establishes policies and provisions for coordinating state and federal emergency response to natural, technological, or war-related disasters and emergencies. The KyEOP also details preparedness actions to be taken by state and local governments prior to a disaster. The KyEOP provides concepts and procedures which are to be used by local governments through local plans written in conjunction with the state plan.

The Commonwealth of Kentucky conducts all response and recovery operations using an incident command system. The Integrated Emergency Management System is the cornerstone of Kentucky's emergency and disaster preparedness, response, recovery, and mitigation programs. Response activities include participation by both governmental and non-governmental organizations which play a role in saving lives, caring for the injured, recovering the dead, protecting the environment, mitigating property loss, and restoring services and facilities. The KyEOP, including updates, remains in effect from the time it was adopted until the Governor issues an Executive Order stating it is no longer valid.

KyEM Director John Heltzel has requested the KyEOP be transitioned into a more synergized process. The synergized approach will ensure linkage of the State Hazard Mitigation Plan and the KyEOP. It is intended for both plans to be housed within the CHAMPS system. Additionally proposed updates of certain sections of the KyEOP will be considered for approval during the next legislative session.

In its EOP, KyEM includes mitigation in its general Mission Statement as follows:

To coordinate and administer the state's Public Assistance, Individual Assistance and Hazard Mitigation Programs. [2]

Mitigation efforts are referenced in the general *Concept of Operations* section, part G:

As part of the recovery process, local jurisdictions should conduct Hazard Analysis and Vulnerability studies to determine if the jurisdiction can benefit from mitigation measures. [3]

And again in section D:

The Governor's request for a Presidential Declaration does not automatically include the Hazard Mitigation Grant Program authorized in PL 93-288, as amended. This program for mitigation must be specifically requested by the Governor's Authorized Representatives, if it is found necessary, within sixty days of the Presidential declaration.

Appendix V-8 of the KyEOP offers mitigation – specific guidance as follows:

HAZARD MITIGATION GRANT PROGRAM

I. <u>SITUATION AND ASSUMPTIONS</u>

A. The Hazard Mitigation Grant Program (HMGP) can provide matching funds (75% federal, 12% state and 13% local) to state and local governments, and certain private nonprofit organizations and institutions,

[2] http://kyem.ky.gov/NR/rdonlyres/4622F14F-3F77-4F42-87E4-C42B0BD74743/0/ANNEXVALL.pdf.

[3] Ibid.

for immediate and long term hazard mitigation measures following a Presidential Disaster Declaration.

B. The HMGP is administered by the KyEM with final approval of projects and technical support from the FEMA regional office.

C. Following a Presidential Disaster Declaration, all counties, cities or communities in the state may be designated as eligible for HMGP funding. If the community is unincorporated, the county shall act as the applicant.

II. MISSION To reduce the risk of future damages and losses as a result of major disasters by providing substantial financial support to implement cost-effective hazard mitigation measures.

III. DIRECTION AND CONTROL The State Hazard Mitigation Officer is responsible for administrating and coordinating the HMGP and State Hazard Mitigation Program. Volume Two of the State Emergency Operations Plan contains the State Administrative Plan for this program.

IV. CONCEPT OF OPERATIONS

A. The HMGP has the following objectives:

1. To prevent future losses of lives and property due to disasters;

2. To implement state and local hazard mitigation plans;

3. To enable mitigation measures to be implemented during the immediate recovery period;

4. To provide funding for previously identified mitigation measure that benefit the disaster area.

B. Eligible applicants are:

1. State and local governments.

2. Certain private nonprofit organizations or institutions.

3. Indian tribes or authorized tribal organizations and Alaska native villages or organizations.

C. The HMGP can be utilized to fund projects to protect either public or private property. Examples of projects include:

1. Structural hazard control, such as debris basins or floodwalls.

2. Retrofitting, such as flood proofing to protect structures from future damages.

3. Acquisition and relocation of structures from hazard prone areas.

4. Up to 5% of the total HMGP funds available to the state can be used for projects whose benefits are not clearly measurable. Examples include:

a. The use or evaluation of new, unproven mitigation techniques or products.

b. Public warning equipment and systems.

c. Hazard identification or mapping.

d. Projects eligible under the regular HMGP Program but fall below cost effectiveness thresholds.

5. Development of state and local standards to protect new and substantially improved structures from damages.

D. A Letter of Intent for a proposed project must be submitted to KyEM from the appropriate jurisdiction within 60 days of being included in the original disaster declaration. The application must be submitted within 60 days after the due date of the Letter of Intent.

E. The Hazard Mitigation Grant Program Administrative Plan governs how the projects are selected for funding. Proposed projects must meet certain minimum criteria which is designed to insure that the most cost effective and appropriate projects are selected for funding. Both federal law and regulations require that the projects are part of the overall mitigation strategy for the disaster area.

F. It is the responsibility of the State Hazard Mitigation Team to select and prioritize projects to be submitted to FEMA for funding. The team is designed/appointed by state agencies having hazard mitigation responsibilities and experiences.

G. Each application shall be reviewed for eligibility in accordance with the criteria contained in the Hazard Mitigation Grant Program State Administrative Plan and State Hazard Mitigation Plan. It is the responsibility of the State Hazard Mitigation Team to select and prioritize projects to be submitted to FEMA for funding. The State Hazard Mitigation Officer shall serve as the coordinator of the state team. The State Hazard Mitigation team also serves, as appropriate, as technical advisors to the State Hazard Mitigation Officer and applicants in preparing detailed or technical information that may be required before project submission to FEMA of for the administration of the program.

V. <u>ADMINISTRATIVE SUPPORT</u> Administrative support shall be provided by KyEM and/or state agencies as appropriate.

VI. <u>GUIDANCE PUBLICATIONS</u>

A. Hazard Mitigation Grant Program State Administrative Plan.

B. Local Hazard Mitigation Program Handbook.

C. Hazard Mitigation Grant Program Handbook.

D. Hazard Mitigation Grant Program Administrative Handbook [4]

Through its Emergency Operations Plan, KyEM promotes mitigation efforts with guidance which integrates mitigation with assessment and recovery processes. Agencies statewide are thus encouraged to partner with FEMA in mitigating hazards which have the potential to damage property and cause injury and loss of life.

[4] Ibid.

Kentucky Mine Subsidence Insurance Fund (KMSIF)

KMSIF is administered by the State Risk and Insurance Services Division of the Kentucky Department of Insurance. The fund provides insurance to property owners in 34 counties to protect property against possible loss from coal mine-related subsidence. The purpose of the KMSIF is to establish reasonable and fair policy endorsement terms and conditions which provide standard and uniform coverage and rates for all like risks, similarly situated, without regard to the primary direct insurer chosen by the property owner to provide other basic insurance coverage on structures eligible for mine subsidence coverage.

Mine subsidence has been identified as a hazard in KY. Examples of hazards that can be found on abandoned mine sites are landslides, water-filled pits, open mine portals and dilapidated equipment and buildings. The KMSIF exists to help property owners mitigate personal losses associated with abandoned mines.

Mitigation specialists are educated through annual KAMM conference sessions led by professionals from the Energy and Environment Cabinet Department for Natural Resources Division of Abandoned Mine Lands, including among others, *Hazards Caused by Mining* and *Reclaiming Hazards Caused by Mining.* Training such as this enables mitigation specialists to more fully assist local communities in developing mitigation projects which reduce the impacts of subsidence from abandoned mines and to more fully disseminate the KMSIF information statewide.

Repetitive Loss Property Buyouts

KyEM works to eliminate or reduce damages to property and the disruption of life caused by repeated flooding of the same properties. A specific target group of repetitive loss properties is identified and serviced separately from other NFIP policies.

The Kentucky Department of Water maintains a listing of properties which have experienced severe and repetitive losses due to flooding. On an ongoing basis, KyEM's UK Mitigation Program Support Office notifies the local official for these affected properties as to the availability of buyout opportunities. KyEM has mitigated numerous Repetitive Loss and Severe Repetitive Loss properties through the use of FEMA mitigation funds. When these property acquisitions occur, KyEM notifies DOW of the removal of the structure. DOW in turn updates its records accordingly.

Kentucky Weather Preparedness Committee (KWPC)

The KWPC operates under the support of the Kentucky Division of Emergency Management. KWPC is dedicated to raising the awareness of how weather events can impact Kentucky and demonstrating to all citizens how they can better prepare for and protect against potentially life-threatening weather events. The purpose of the committee is to bring attention to Kentucky's weather events and related consequences, educate and prepare Kentuckians for the weather event consequences, and engage in a variety of efforts (e.g., multi-media campaigns, workshops, conferences) designed to raise weather event awareness.

Through a FEMA HMGP-funded grant, the KWPC successfully completed an educational initiative which included the purchase and distribution of weather radios, production and distribution of educational materials on severe weather hazards and preparedness, and an exhibit at the KY State Fair. In this way, KWPC furthered the educational goals of the State mitigation plan in a partnership with FEMA.

Abandoned Mine Land Program

The Abandoned Mine Land (AML) program is 100% federally funded. All federal funds received for AML must be used solely for the administration of the AML program and on-ground reclamation. The program is authorized under Title IV of the Surface Mining Control and Reclamation Act of 1977, P.L. 95-87. KRS 350 contains mirror language to authorize the Kentucky AML program.

Each year the Commonwealth of Kentucky receives an annual AML federal grant of approximately $14 million. Each grant has a three year life. AML funds must be expended for program administration and projects which reduce hazards from mines abandoned prior to May 1982. Hazards caused by abandoned mines include landslides, dangerous highwalls, mine drainage, sedimentation and flooding, dangerous impoundments, open portals and shafts, open pits, dangerous piles and embankments, refuse piles, refuse fires, mine fires, hazardous facilities and equipment, and polluted water including surface and ground water pollution.

To promote the mitigation of abandoned mine hazards, mitigation specialists receive training at the annual KAMM conference conducted by AML professionals, including, among other topics, *Hazards Caused by Mining* and *Reclaiming Hazards Caused by Mining.* Training such as this enables mitigation specialists to more fully assist local communities in developing mitigation projects which reduce the impacts of subsidence from abandoned mines.

National Earthquake Hazards Reduction Program (NEHRP)

In October 1977, Congress passed the Earthquake Hazards Reduction Act to lessen the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program. To accomplish this goal, the act established the National Earthquake Hazards Reduction Program (NEHRP).

The four (4) participating NEHRP agencies are the

1. Federal Emergency Management Agency (FEMA),
2. National Institute of Standards and Technology (NIST),

3. National Science Foundation (NSF), and
4. United States Geological Survey (USGS).

The mission of NEHRP includes:

- improved understanding, characterization, and prediction of hazards and vulnerabilities
- improved model building codes and land use practices
- risk reduction through post-earthquake investigations and education
- development and improvement of design and construction techniques
- improved mitigation capacity
- accelerated application of research results

The Act designates FEMA as the program's lead agency and assigns several planning, coordinating, and reporting responsibilities.

Organizations such as the NEHRP assist KY communities through dissemination of information which may be useful in developing seismic mitigation projects.

Kentucky Earthquake Technical Workgroup

The group is comprised of members with an interest in earthquake-related issues on the state and local level as an effort to continue organization and an appropriate level of preparedness in Kentucky. The group will be crucial in implementing this shared responsibility and key to organizing earthquake efforts in the State of Kentucky.

This group (previously known as the Governor's Council on Earthquake Risk Reduction) was reestablished in September of 2007. The renewed goals of the group are:

- Setting goals and priorities in both public and private sectors for identified geological risks
- Requesting appropriate state agencies to devise criteria to promote geologic and disaster safety
- Scheduling a report on all disaster mitigation issues from KyEM
- Recommending program changes to state and local agencies and the private sector where such changes would improve geologic hazard reduction
- Gathering, analyzing, and disseminating earthquake-related information
- Sponsoring training to help improve statewide earthquake preparedness
- Helping to coordinate geologic safety activities of government at all levels
- Establishing and maintaining necessary working relationships with relevant boards, commissions, departments, and agencies or other public or private organizations
- Establishing a comprehensive program of geologic hazard reductions to save lives and mitigate damages to property in Kentucky

KETW is currently developing the group's objectives and has assisted with the state and local activities related to the NMSZ Catastrophic Planning Project. KETW also plans to play a major role in preparations for and the execution of the National Level Exercise in 2011 (NLE 2011).[5]

Efforts by KETW have been influential in the development of seismic mitigation projects in KY such as proposed safe room projects in Daviess County which will seek funding through FEMA's HMA programs. In this way, the mitigation goals of both FEMA and the State are being advanced through cooperative efforts.

Kentucky Department for Local Government: Long Term Recovery Plan

This project will create long-term economic redevelopment and mitigation strategies which address economic development challenges in areas impacted by federally declared disasters. This is a collaboration effort between the Department for Local Government, KyEM, the Federal Economic Development Administration, and CHR. The proposed deliverables of this plan will be directly linked to the CHAMPS system and build collaboration among multiple agencies. The goals of the project are as follows:

1. Development of a Long Term Recovery Council (LTRC) to broaden stakeholder awareness and strategies while uniting economic recovery leadership throughout the State
2. Development of a Long Term Recovery Plan, coordinated by LTRC, which evaluates past losses and best practices for economic and social recovery
3. Incorporation of resulting data products and strategies into the Commonwealth's Hazard Assessment and Mitigation Planning System (CHAMPS)
4. Development of comprehensive training and outreach of project findings to maximize stakeholder buy-in and participation.

The DLG Action Plan specifically references mitigation efforts statewide in the *Long Term Recovery Plan* section as follows:

> *Kentucky consistently promotes land use planning at the local level. The state believes that land use decisions must originate with local government with input from state and federal partners. In response to the flooding, state and federal agencies are providing tools such as enhanced floodplain mapping and mitigation analysis tools to aid local governments in making decision, particularly on home buy-out programs. Once plans are complete, the state is committed to expedite the regulatory requirements under its purview. In addition, with the Disaster Recovery funds, Kentucky is developing a comprehensive planning and assessment*

[5] http://www.cusec.org/publications/newsletter/summer2009.pdf.

tool that will be designed to integrate planning and mitigation project management into a comprehensive solution that supports local planning for mitigation with statewide management capabilities and transparency. The tool will support community planning, economic recovery and preparedness for the individual, including housing, and for the community including utilities and public infrastructure and local business.

The state through the Area Development Districts promotes the adoption of hazard mitigation plans for each local government.

Thus, the DLG long term recovery plan integrates common mitigation goals from the Enhanced State Mitigation Plan with its internal action plan for response and recovery.

Kentucky Silver Jacket Program

Kentucky recently initiated its Silver Jackets Program. This state-level program includes participation of the US Army Corps of Engineers (USACE), FEMA, other Federal agencies, and multiple state agencies. The goal of the program is to create an interagency team to develop and implement solutions to state natural hazard priorities. The Silver Jackets Program provides a formal and consistent strategy for an interagency approach to planning and implementing measures to reduce the risks associated with natural hazards. The program's primary goals are to leverage information and resources, improve public risk communication through a united effort, and create a mechanism to collaboratively solve issues and implement initiatives.

The Silver Jackets program provides communities with an opportunity to work with all appropriate state and Federal agencies to develop a comprehensive flood risk management program. The KyEM State Mitigation Officer and staff will promote mitigation project development through its representation on the Silver Jackets team, thereby integrating both FEMA and the State's goals to mitigate flood-related damages and losses statewide.

Section 406 Mitigation

The mission of the FEMA Public Assistance Program is to assist communities in recovering from the devastating effects of disasters by providing technical assistance and financial grants. Mitigation, if delivered effectively, can restore communities in a manner which prevents or reduces the threat of future damage.

Since approval of the 2007 Enhance State Mitigation Plan, the KyEM Public Assistance Officer has successfully completed the FEMA 406 Hazard Mitigation course. The training, which was shared with other KyEM staff, has proven invaluable in the recognizing and advancing of mitigation opportunities.

As required by FEMA, KyEM conducts disaster applicant briefings with all potential Public Assistance Program (PA) applicants. In addition to instructing potential applicants regarding PA matters, there is an in-depth discussion regarding hazard mitigation opportunities. Members of the Recovery Branch Hazard Mitigation Program Section attend each briefing and present information on both 404 and 406 Hazard Mitigation projects. Since the approval of the 2007 Enhanced Hazard Mitigation Plan, 114 of 120 counties have attended at least one of these briefings.

Potential applicants are encouraged to carefully review disaster damages prior to their first meeting with FEMA PA teams to determine if mitigation needs exist. The KyEM Recovery Branch Manager and Public Assistance Officer meet with FEMA prior to FEMA Kickoff Meetings and project worksheet development to ensure there will be a focused attempt by FEMA PA staff to identify, develop, and obligate 406 Mitigation projects.

There has been a definite increase in interest in 406 Mitigation as demonstrated in DR-1912, one of Kentucky's latest disaster declaration. This flood event has resulted, to date, in the development and obligation of 46 406 Mitigation projects.

In situations where a specific community has experienced intense, repetitive losses KyEM conducts a focused meeting to explore mitigation needs and potential for the community. In addition to KyEM staff, other attendees will include agencies such as community leaders, FEMA 404, FEMA 406, FEMA ESF, Natural Resource Conservation Service, KY Division of Water/NFIP, and the US Army Corps of Engineers.

FEMA Mitigation Programs and Initiatives

To ensure Kentucky's hazard mitigation strategy is truly comprehensive, a number of ongoing FEMA mitigation programs and measures have been integrated into the state hazard mitigation planning process.

The state's National Flood Insurance Program (NFIP) coordinators and the state Map Modernization coordinator have assisted in integrating floodplain management activities into the state's mitigation strategy. The State NFIP Coordinators are charged with coordinating the NFIP activities through the DOW. This includes overall NFIP program management, promotion and management of the Community Rating System (CRS), map modernization activities, and the state's Risk MAP program. The state mitigation strategy emphasizes promotion of the NFIP and CRS, as well as continued compliance for those participating communities in the NFIP.

KyEM administers five (5) FEMA hazard mitigation grant programs:

1. Hazard Mitigation Grant Program (HMGP)
2. Pre-Disaster Mitigation Program (PDM)
3. Flood Mitigation Assistance Program (FMA)

4. Repetitive Flood Claims Program (RFC)
5. Severe Repetitive Loss program (SRL)

These programs provide a significant portion of the resources used by state, local, university, and certain nonprofit organizations to implement mitigation strategies. Funding from the PDM and HMGP programs assist Kentucky's local governments and universities in developing and updating their local hazard mitigation plans. The state hazard mitigation plan serves as the foundation for project selection, which is submitted to FEMA for approval as funds become available. The plan contains the state's project selection criteria for these five programs. The state's mitigation strategy defines the goals, objectives, and activities of the state. Grant funds from these programs are used to help achieve some of those goals, objectives, and activities.

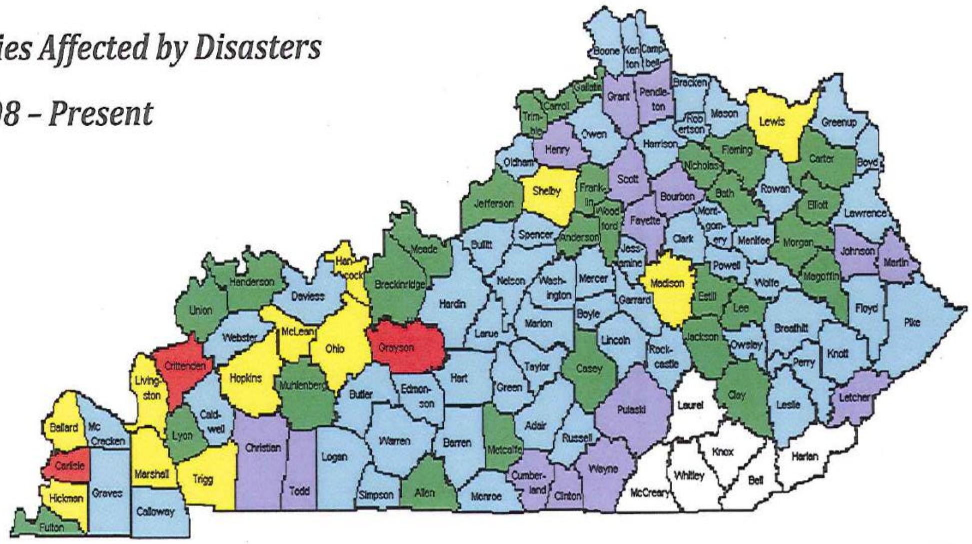
Past mitigation projects funded through FEMA HMA grants include acquisition and demolition of floodprone structures, installation of nonresidential safe rooms, undergrounding of overhead utility lines, drainage improvement and culvert upgrades, construction of detention and/or retention basins, relocation of floodprone utilities out of the flood zone, soil stabilization, installation of early warning systems, emergency backup power installation for critical facilities, and public educational campaigns. Current mitigation project proposals in development also include dry floodproofing of nonresidential structures, construction of residential safe rooms, elevation or relocation of floodprone structures, and seismic nonstructural retrofits.

Congressional Mitigation Project Support

Since the submission of Kentucky 2007 Hazard Mitigation Plan, the Commonwealth has experienced eight (8) disasters which resulted in Presidential declarations. The Public Assistance damages associated with these events exceeds $489 million for 1,447 applicants in 114 of Kentucky's 120 counties (See Appendix 15).

Kentucky Counties Affected by Disasters

2008 – Present



	0 Disasters	6 Counties	Population NOT Affected: 200,717
	1 Disaster	15 Counties	Population Affected: 603,224
	2 Disasters	56 Counties	Population Affected: 1,766,841
	3 Disasters	28 Counties	Population Affected: 1,160,059
	4 Disasters	12 Counties	Population Affected: 272,140
	5 Disasters	3 Counties	Population Affected: 38,788
			Total Population Affected: 3,841,052

It became increasingly apparent to both KyEM and the Commonwealth's congressional delegation that the need for mitigation projects exceeded FEMA's mitigation program funding capacity. In 2009, through a unique partnership between KyEM, local officials, FEMA, and Kentucky Congressman Hal Rogers, funding was designated by the congressman for hazard mitigation projects in his district.

This approach has created a winning solution for all participants. Congressman Rogers is able to aid constituents, local governments are able to address mitigation matters, and FEMA and KyEM are able to further their mitigation missions. The arrangement was particularly attractive to the congressman, as unlike typical congressional awards; these projects will be closely monitored, thus increasing the probability of success.

The seven (7) mitigation projects selected by Congressman Rogers and approved by FEMA are valued at $2,425,000. The final approvals were issued by FEMA in March of 2010, and work has begun.

In March of 2010, KyEM Director John Heltzel and Intergovernmental Liaison Nancy Price traveled to Washington D.C. and met with the entire Kentucky congressional delegation. The severe ice storm (DR-1818) of 2009 revealed the woefully deficient capacity of Kentucky's emergency electrical systems to maintain operation of critical infrastructure activities. In 2009, when KyEM announced the availability of FEMA mitigation grant funding, KyEM was inundated with hundreds of generator grant requests – far more than available funding could satisfy. The Congressmen were asked to explore congressional funding opportunities as a solution for their local governments. Interest in these projects is high, however; this type of funding is seemingly frozen for this Federal budget cycle.

KyEM will continue to aggressively lobby congressional opportunities on behalf of its stakeholders. KyEM will also continue to seek other innovative funding possibilities.

Currently, two (2) LPDM project applications are in development in Cumberland and Martin, KY which will further the mitigation goals of the enhanced state mitigation plan and will mitigate future damages from flooding and severe weather events in these areas.

Mitigation Action Reports

As with the 2007 state plan process, CHR distributed “Mitigation Action Reports” to the stakeholders during the first meeting in January 2010 (See Appendix 9). Each agency was asked to complete a report on a voluntary basis. These action reports gave stakeholders the opportunity to include the various mitigation activities they have completed since 2007. The action reports also allowed the authors of the state plan to compare the mitigation activities and programs of the stakeholders with the state mitigation strategy to see what goals, objectives, and actions were being addressed at the different agencies. The action reports also provided information pertaining to the type of hazard addressed by the project, the county/counties or region which was addressed by the project, and the money which was being spent on the completion of the project. The action reports allowed KyEM and CHR to have a more defined view of what types of mitigation had been taking place throughout the state over the last three (3) years.

A total of 19 agencies provided Mitigation Action Reports to CHR for review. From these reports, a total of 42 mitigation projects were identified with a value of $76,797,801. This information was a tremendous aid in the evaluation of the mitigation strategy section. The completion of the “Mitigation Action Reports” provided a better understanding of the mitigation activities which are occurring throughout the state. The reports allowed the planning team the ability to observe the following trends:

1. Stakeholders who complete mitigation projects
2. Types of projects
3. Hazards addressed
4. Counties involved
5. Money invested in mitigation

The use of Mitigation Action Reports aids in the evaluation of past mitigation efforts and in planning for the future use of FEMA HMA and other funding sources for mitigation projects statewide.

Planning Process Overview

During the update of the 2010 state hazard mitigation plan, KyEM has gone to great lengths to demonstrate it has documented the planning process, coordinated among agencies, and integrated its programs.

KyEM assembled a dynamic, diversified team to complete its state hazard mitigation plan update. The new staff at KyEM is fully committed to the important role of hazard mitigation, not only to the overall mission of the agency but also to the welfare of the citizens of the Commonwealth. CHR, represented by Josh Human, has again participated in this process. The University of Kentucky Hazard Mitigation Support Office staff has proven to be a great asset during this process and will continue to make an impact during the maintenance of this plan.

One of the main focal points of this plan update was to increase coordination and stakeholder involvement in the planning process. This effort to focus more stakeholders on hazard mitigation issues was proven successful through the 64% increase in invitation and the 59% increase in attendance. KyEM, UK, SHMT, and CHR have focused on developing intergovernmental agency mitigation partnerships. The coordination efforts within the Risk MAP program, the Long Term Recovery Planning efforts, the Silver Jackets program, the re-establishment of the Governors Emergency Management Conference, the congressional mitigation support, the KyEOP synergy movement, and the development of the CHAMPS system fully demonstrate KyEM's effort to integrate and coordinate with multiple agencies and programs.

A thorough planning process helps ensure that communities statewide will be eligible for FEMA HMA funds for local mitigation projects which aim to reduce damages from hazard events. Successful planning is the foundation upon which all communities may meet their mitigation goals and improve the quality of life for their constituents through reductions in property damage, injury, and loss of life.

Risk Assessment

4.1 Risk Assessment Overview

Requirement §201.4(c)(2)(i): [The state risk assessment shall include] an overview of the type… of all natural hazards that can affect the state.

The 2010 State Hazard Mitigation Plan update is a product of standardizing processes. The Risk Assessment section has been redesigned. The Identify and Profile Sections have been revised with a complete overview of the definitions within the identify section and a complete update to the data provided in the profile section.

The Assessing Vulnerability by Jurisdiction section received an updated vulnerability model. This model also played a role in improving the Assessing Vulnerability of State Facilities, Estimating Potential Losses by Jurisdiction, and the Estimating Potential Losses of State Facilities sections.

A revised format was used for the changes and for the update of the Risk Assessment section. New KyEM staff felt this section was disjointed and difficult to follow and thus it was decided to re-format this section to create better flow. This re-format created a “Hazard Risk Assessment Overview” for each hazard sequentially. These changes integrated each of the required steps of the crosswalk to each of the identified hazards. This format will allow the reader to see each step of the Risk Assessment associated with each hazard to improve flow and comprehension.

The overview for each identified hazard risk will contain these following components which address the CFR citations listed.

- Hazard Identification: 44 CFR §201.4(c)(2)(i)
- Hazard Profile: 44 CFR §201.4(c)(2)(i)
- Jurisdictional Vulnerability Assessment 44 CFR §201.4(c)(2)(ii)
- State Facility Vulnerability 44 CFR §201.4(c)(2)(ii)
- Jurisdictional Potential Loss Estimate 44 CFR §201.4(c)(2)(iii)
- State Facility Potential Loss Estimate 44 CFR §201.4(c)(2)(iii)

Due to its diversified geology and geographical setting, the state of Kentucky is vulnerable to a wide array of natural hazards which threaten life and property. The following thirteen hazards which are emphasized in this 2010 State Hazard Mitigation were identified through thorough assessment and consideration of:

- Historic impacts of past federal disaster declarations (See Appendix 15)
- Associated probability rates of past disasters
- Dollar losses to date attributable to past disasters
- Comparison to Local Plans (Appendix 16)

The identified hazards of the 2010 State Hazard Mitigation Plan are:

1. Dam Failure
2. Drought
3. Earthquake
4. Extreme Heat
5. Flood
6. Hailstorm
7. Karst
8. Land Subsidence
9. Landslide
10. Severe Storm
11. Severe Winter Storm
12. Tornado
13. Wildfire

The state was severely tested over the last three (3) years with numerous hazard events and six (6) presidential declarations. It was important to review the Risk Assessment Section with the current knowledge of hazards affecting the state today. Based upon the same criteria, the following hazards showed negligible impact, were not part of federal disaster declarations or are of lower risk to the state, and were not addressed in the plan:

- Hurricane
- Tsunami

Some of these hazards are interrelated and some consist of hazardous elements which are not listed separately. The Hazard Identify Section will begin the Hazard Risk Assessment Overview. A standardized data capture format was also introduced and each hazard will be defined in the follow manner:

1. Description
2. Type
3. Facts
4. Impacts

Hazard Profile

The profiling hazards section identifies the geographic locations affected by each hazard and identifies the historical occurrences, which in turn creates a probability (See Appendix 18) of future events for each hazard. A comprehensive evaluation of the profile section was complete by CHR to adjust to the new data which has been acquired over the last three (3) years. The process included updating occurrence data, reviewing hazard specific data information, talking with stakeholders, and reviewing the local hazard mitigation plans. CHR created a standardized "Risk Profile Table" for each of the hazards which captures the following data elements:

1. Period of Occurrence
2. Occurrence Data
3. Annual Chance Probability Ratio
4. Past Damages
5. Warning Time
6. General Potential Impacts

The hazards profiled are:

1. Dam Failure
2. Drought
3. Earthquake
4. Extreme Heat
5. Flood
6. Hailstorm
7. Karst
8. Land Subsidence
9. Landslide
10. Severe Storm
11. Severe Winter Storm
12. Tornado
13. Wildfire

Assessing Vulnerability by Jurisdiction

The jurisdictional hazard vulnerability section uses best available data from national, state, and local data sets. The vulnerability assessment methodology was created by the CHR team. This model was first created for the 2004 plan and was again used in 2007. This model conceived for the State Hazard Mitigation Plan has also been used by locals and universities to complete their vulnerability assessments. These estimates provide an understanding of relative risk and potential losses from hazards. Uncertainties are inherent in any vulnerability assessment and loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties can also result from approximations and simplifications that are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

The 2010 Vulnerability Assessment incorporates superlative models in use and integrates them into a specific model geared toward the questions asked by FEMA in this section. FEMA requires state partners to assess each jurisdiction's vulnerability to their population, property, infrastructure, critical facilities, and state owned facilities. The CHR team, using the best available data and methods, determined vulnerability of the state for a variety of hazards. CHR's model was developed to be flexible and relies on Geographic Information System (GIS) spatial analysis tools. CHR, recognized as a leader in the vulnerability assessment field created this model to be very flexible. In fact, over the years this model has been used by other countries, states, locals, and universities.

To gain an understanding of vulnerabilities and loss estimation throughout the state CHR completed a review of the current local plans. As mentioned before, there were no local plans updated from 2007 to 2010 which in turn did not allow CHR to review any updated data. As was the case during the 2007 update, CHR noted that several of the Local Plans had used the State's Risk Assessment model to complete the risk assessment sections of their plans. Comparing the risk/vulnerability assessments from the local plans also created a significant challenge. While a few of the local plans had good models and data, it proved impossible to combine all the different models and methods into one model.

It is important to note that CHR did use local exposure data created at the local level for the State's vulnerability model. This included several of the Exposure Score variables including: Essential Facility Rank, Utility Rank, and Transportation Rank. Several of the facilities identified for these ranks are maintained and updated by our local partners. This data is crucial for creating an accurate account of what is potentially exposed to each hazard and therefore an important part of the state's Vulnerability Assessment Model.

As mentioned above, CHR reviewed its model and determined it more advantageous for not only the state but also to standardize for local use in the future. This was one of the main reasons of moving toward a Census Block model from a Census Tract model.

A very important step in creating a Vulnerability Assessment Model is to define the planning area. During the creation of the 2007 plan CHR used its knowledge of creating local plan vulnerability assessments and created a statewide census tract level assessment. The census tract level modeling technique provided several advantages compared to the county model created in 2004. However, this approach still left some deficiencies in less populated counties which only had a few tracts in which to capture data. The 2010 plan has taken the next step by creating a vulnerability assessment at the census block level. This model produced the following improvements:

1. Better hazard scenario assumptions
2. Better dollar allocation
3. Better policy decisions
4. Better visuals
5. Better tools for locals

CHR used the census block boundary data provided in FEMA's HAZUS program to define the planning areas, which produced 120,320 separate planning areas across the state. Census Blocks are the smallest geographic unit used by the US Census Bureau for tabulation of 100-percent data (data collected from all houses).

The census block-based vulnerability assessment methodology allowed the state to provide enhanced data for use in local plans and provide policy and decision makers a refined view of where risk is located and what areas need mitigation. CHR and KyEM's goal is to provide local leaders with a useful assessment model. The model is also being developed to facilitate assessment standardization and with the realization of locals eventually populating the system with their local data. Positive feedback from the locals has encouraged KyEM and CHR to move forward with this model.

Vulnerability Assessment Methodology

There is no single way to determine hazard vulnerability. FEMA provides users with its HAZUS software to perform vulnerability assessments. There are some major limitations in using HAZUS for the state of Kentucky. The data in HAZUS poses limitations for Kentucky due to its lack of local data inventory and hazard assessment limitations. HAZUS only produces vulnerability assessments for flood, earthquake, and hurricane. The flood model is somewhat cumbersome to run for the entire state and the hurricane model is not germane to Kentucky. The earthquake model has been used for Kentucky in the past and was again used to determine vulnerability and loss estimates for earthquake.

Important definitions associated with this vulnerability assessment model:

- **Hazard Identification**: Anything which either threatens the residents of a community or the things that they value
- **Exposure**: A community's assets: people, property, essential facilities, and infrastructure potentially exposed to a hazard
- **Risk**: The hazard probability multiplied by the consequences and the probability based on geographic hazard layers
- **Vulnerability**: What part of an "exposure" is at "risk" to each "hazard"

The CHR team spent many hours of research and conducted test runs to develop its updated methodology. The final model relies heavily on GIS software and provides the user with several layers of integrated information which can also be used individually to display different planning scenarios. To facilitate data collection and analysis, the census block boundaries were used to organize the data inputs at the sub-state level. This approach enabled the creation of a vulnerability score for each census block and for each hazard and thus creating a very refined assessment.

Model

Hazard Vulnerability Score = Exposure Score X Risk Score

When measuring vulnerability, CHR first measured what would be exposed to each hazard. For this model the exposure score was comprised of these seven (7) rank variables:

1. Population Rank
2. Property Rank
3. Essential Facilities Rank
4. Utility Rank
5. Transportation Rank
6. Government-Owned Facilities Rank
7. Hazardous Materials Rank

Exposure Score

Exposure Score = Population Rank + Property Rank + Essential Facilities Rank + Utility Rank + Transportation Rank + Government-Owned Facilities Rank + Hazardous Materials Rank

Definition of Variables

1. Population Rank – Was derived from the total number of population per each census block. This data was captured from the HAZUS dataset.
2. Property Rank – Was derived from combining total number of households and their average value per each census block. This data was captured from the HAZUS dataset.
3. Essential Facilities Rank – Was derived from combining the total number of essential facilities located within each census block. This data was captured from KyEM, Kentucky Division of Geographic Information (DGI) and included fire stations, police station, prisons, primary schools, hospitals, emergency operation facilities, nursing homes, public health facilities, and emergency medical service facilities
4. Utility Rank – Was derived from combining the total numbers of utility infrastructure located within each census block. This data was captured from the Kentucky Infrastructure Authority, Public Service Commission, HAZUS and DGI and included water pumps, water treatment plants, sewage treatment plants, water tanks, length of water line, electric power plants, natural gas facilities, and oil facilities.
5. Transportation Rank - Was derived from combining the total numbers of transportation infrastructure located within each census block. This data was captured from DGI, KyEM, ESRI and the Kentucky Transportation Cabinet and included airport facilities, highway bridges, roads, railroads, and rail facilities

6. Government-Owned Facilities – Was derived from combining the total number of state-owned facilities located within each census block. The data was captured from the Division of State Risk and Insurance.
7. Hazardous Materials - Was derived from combining the total number of hazardous materials located within each census block. The data was captured from KyEM's dataset.

The Exposure Score places the asset variables into the Hazard Vulnerability Score. Each variable was calculated and then ranked 0 to 3 (0 = No data, 1 = low, 2 = moderate, and 3 = high), using the Natural Breaks (Jenks) method provided in ArcGIS as a classification choice. Next, the ranks were added to produce an Exposure Score, one of the variables used to equate the Hazard Vulnerability Score. A more detailed explanation of each "Rank" can be found in Appendix 17.

It is important to note this iteration of the Exposure Score was built to resemble the variable capture method within HAZUS. With the implementation of CHAMPS, data collection capture will occur at the local level using a form of HAZUS's Comprehensive Data Management System (CDMS). The CDMS provides users with the capability to update and manage statewide datasets which are currently used to support risk and vulnerability analysis.

Risk Score

The second variable created for the Vulnerability Score is the Risk Score.

Risk Score = Annualized Loss Rank and/or Layer Rank

Definition of Variables

Annualized Loss Rank (ALR) = Probability x Consequences

- The ALR is determined by capturing past occurrence and loss data and turning that into an Average Annualized Risk. Using the probability of hazard multiplied by the average consequence determines an average annualized loss estimate that was then ranked 0 to 3 (0 = No data, 1 = low, 2 = moderate and 3 = high). This process produced an ALR for each hazard at the county level. The rank for each county was then overlaid onto the census block layer and aggregated down to the block level to create an ALR Risk Score for each hazard at the census block level.
- The ALR also answers the crosswalk question of *Estimating Potential Losses by Jurisdiction.* This model produces a loss estimation using Actual Loss and Occurrence Data captured at the county level. Appendix 18 displays a state wide annualized loss estimation (ALR) for each hazard where data permitted.

- CHAMPS will include a functionality which will allow users to add occurrences and loss data at a specific area into the portal. This will create real time probability and consequence data for KyEM to use in future Risk Assessments. Capturing data in this format will begin creating ALR data into Layer Rank (LR) data with specific boundaries of loss and occurrences i.e. a building location. This type of data capture will also help develop better benefit cost ratio scores.

Layer Rank (LR) = Geographic Area Effected

- The LR is produced by calculating either the percent of the planning area (census block) affected by a hazard boundary and or the total number of hazard occurrences located inside the planning area. This model produces a geographic area (census block) displaying areas at risk.
- The LR also helps address the crosswalk questions regarding *Estimating Potential Losses and Assessing Vulnerability of State Facilities and Estimating Losses by Jurisdiction.* This model uses the geographic hazard boundary layers for flood, karst, landslide and mine subsidence to understand which census blocks' are the most vulnerable. This geographic hazard boundary layer data can also be used to assess and estimate losses on state facilities by overlaying the geo-referenced locations of the state facilities with the hazard boundaries. Running a select by location on the state facilities displays the facilities which are within the hazard boundaries and therefore can be assumed to be vulnerable and estimated to be damaged during an event. The hazard boundary census block areas created through the ALR process and through the LR geo-referenced occurrence data can also be used to display vulnerability and loss estimation for state facilities and jurisdictions. The census blocks that are ranked as a having high risk (3) are used as the hazard layer which can then be used as an overlay onto the state facility data points and the property rank exposure areas. This process captures the state facilities and property (property rank) which are located within hazard layers (at risk areas) and therefore, based on probability, can be assumed to be vulnerable and estimated to be damaged during an event. This loss estimation model while very granular does provide an attempt at capturing where potential losses can occur.

The Risk Score assigns a hazard/risk variable to the Hazard Vulnerability Score. The Hazard Score varies with each hazard due to the fact some hazards have area boundaries for analysis, like flooding, while numbers of occurrences are best for those hazards occurring anytime or anyplace, like severe storms. An ALR was created for each hazard where data permitted and was added to the hazards LR where data permitted to create Hazard Risk Score. Each variable was calculated and then ranked 0 to 3 (0 = No data, 1 = low, 2 = moderate, and 3 = high), using the Natural Breaks (Jenks) method provided in ArcGIS as a classification choice.

After the Exposure Score and the Risk Score were determined, the equation was set into motion to produce a Hazard Vulnerability Score for each identified hazard. The

Hazard Vulnerability Scores contain some bias toward the more populated areas in the state. This is due to a correlation between more populated areas and their tendency to have higher numbers of essential facilities, properties, transportation facilities, etc. This resulted in higher populated areas having greater exposure in general. However, with the data provided, other equations can be developed with or without one or more variables, or a different weighting system. The goal of this model was to assess the most vulnerable areas throughout the state. Given the most populated areas have the most at risk, this model achieved that goal.

Estimating Potential Losses by Jurisdiction

Loss Estimation Methodologies

Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their affects on the built environment. Uncertainties also result from approximations and simplifications which are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

Annualized Loss Rank (ALR) loss estimate model

The *ALR* was used to portray loss estimation based on probabilities for extreme heat, hail, tornado, severe storm, and severe winter storm per county. While an ALR was calculated for drought, flood, and landslide it was decided to use the *Hazard Layer Rank loss estimate model* for these hazards due to the fact that they have fairly defined hazard boundaries. The other hazards either had little to no traceable occurrence data and loss data or were determined through the *Hazard Layer Rank loss estimate model.*

Annualized Loss Rank (ALR) = Probability x Consequences

For the seven (7) hazard events listed the above equation was used to estimate future annualized losses for each county jurisdiction. For purposes of this plan, the probability of a future event occurring in any given year is calculated based upon the number of past events divided by the number of years of record. For example, if there have been 46 severe winter storms throughout a county over the last 58 years, there is an annual occurrence ratio of 0.79 (probability). Next, the average consequences of each event is calculated by dividing the total losses by the frequency of the event. Knowing both the annual occurrence probability ratio and the average damage (consequences) per occurrence gives the ability to predict an average annual risk (loss) for any given year by multiplying the two values together. Therefore, for any given year, it is likely that somewhere in that county, approximately x worth of damages will be sustained.

Hazard Layer Rank (LR) loss estimate model

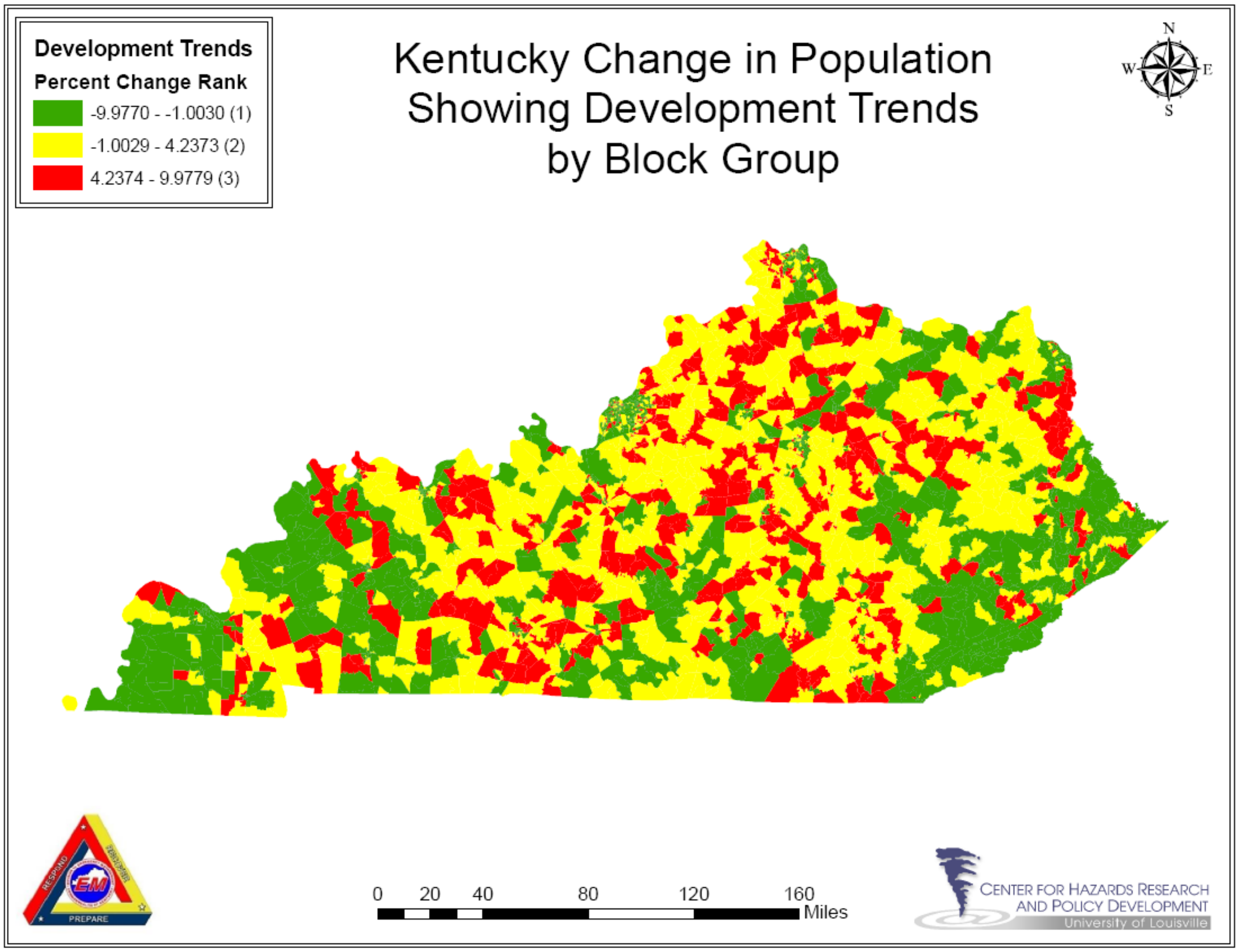
Due to the current lack of sufficient occurrence and loss data an ALR cannot be produced for dam failure, karst, mine subsidence, and wildfire. An ALR was produced for drought, flood, and landslide, however, it was determined that the Hazard Layer Rank (LR) would be a more efficient way to capture losses. In general CHR understands where these hazards are located (LR) which can produce a geographic boundary loss estimation. Potential loss for jurisdictions can be achieved by using the LR created from the Risk Scores overlaid onto the Property Rank scores from the Exposure Score. The Property Rank provides the baseline for understanding what is at risk within each census block. By multiplying the number of households by the average housing value, a total housing value for each census block is produced. Either the actual hazard boundary layer is used or the level (3) high probability census block Risk Scores are used as the hazard layer. The hazard boundary layers provide significant detail while the level (3) census blocks method produce a very granular loss estimation model based on GIS spatial analysis of a hazard layer compared to the dollar property exposure.

HAZUS-MH MR4

HAZUS-MH is a comprehensive tool that produces risk, vulnerability and loss estimation results for earthquake, flood, and hurricane. The flood model is still very cumbersome to use for large areas like state boundaries. FEMA is producing a national HAZUS level 1 flood run for each state as a part of the Risk MAP program. When complete, use of the flood layer will be reviewed for possible incorporation into the state plan. Again, the HAZUS hurricane model does not apply to Kentucky. HAZUS-MH MR4 was the risk assessment tool used for the state plan analysis of the earthquake hazard.

To gain a full understanding of the effects of changes in development of loss estimates, CHR and KyEM will need to rely on local plan updates. Unfortunately, during this plan update period, there were no updated local plans adopted. In absence of this type of data, the assumption has been made that changes in development will result in decreasing potential losses. As an example, communities can be identified which have joined the National Flood Insurance Program over the past three (3) years. To join the NFIP, a community must adopt and enforce a Floodplain Ordinance. This ordinance must include provisions for smart development in floodplains and no development in any floodway. The enforcement of these ordinances leads to a change in development and a reduction of potential flood losses. The same can be said for communities which are enacting land use planning or including hazard scenarios into comprehensive planning efforts. For example, Louisville Metro has used Karst Vulnerability data created in the Risk Assessments of its mitigation plan and promoted a Karst overlay zone. This zone promotes sound development in areas at risk to Karst. Kentucky expects to see more communities following Louisville’s lead in promoting zoning changes with the risk assessment data.

Another way to enhance the knowledge of areas with changing development is to identify them. CHR decided to identify areas which with significant growth using a similar model developed for the Vulnerability Score model. Using Census Block Group data (which is the best available data to show population trends at this time), CHR developed a map which depicts areas showing high development based on population percent change from 2000-2007 estimates. The following map is very useful for local and state officials to review high growth areas versus areas that have high risk for each hazard (Vulnerability Score Data). In turn, these maps will promote sounder development in identified high growth areas and keep future development less vulnerable and safer from potential loss.



Assessing Vulnerability and Estimating Potential Losses of State Facilities

The vulnerability assessment and potential loss estimate for state-owned facilities were determined using the same methodology. The Division of State Risk and Insurance which insures state-owned facilities provided CHR with an updated list of state owned facilities and the total insurance coverage on each structure. The database contained 6,881 state-owned addressed facilities. This data was geo-coded and used for the analysis. These estimates should be used to understand state-owned structures' vulnerability and potential loss from hazard events. Uncertainties are inherent in any vulnerability and loss estimation methodologies, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications which are necessary for a comprehensive analysis (such as incomplete inventories, demographics, or economic parameters).

Methodology

To work with the addressed state-owned facilities, each had to be geo-coded in a GIS system. Geo-coding is a GIS process where an address is assigned a geographic location according to addressed road coverage. This method gives the address from the database an x, y coordinate position in the world. The CHR team performed this geo-coding process using ArcGIS Street map.

Using the hazard boundary layer for flood, karst, mine subsidence, and landslide vulnerability assessments and loss estimates were performed on the state facilities. For the other hazards the level (3) high probability census block Risk Scores were used as the hazard layer. The high hazard blocks became the hazard boundary that was used to overlay on the geo-referenced state facility GIS file. The state facilities that were located within the hazard layers were then identified and assumed to be vulnerable and estimated to be damaged during an event.

4.1.1 Dam Failure

Hazard Identification: Dam Failure

Description

There are approximately 80,000 dams in the United States, the majority of which are privately owned. Other owners are state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous; providing water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power and create lakes for fishing and recreation. Most importantly, dams save lives by preventing or reducing floods.

Dams, though providing many benefits, can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if there are people downstream of the dam. The National Dam Safety Program is dedicated to protecting the lives of citizens and their property from the risks associated with the development, operation, and maintenance of America's dams.

Types

Manmade dams may be classified by: 1) the type of materials used; 2) the methods used in construction; 3) the slope or cross-section of the dam; 4) the way the dam resists water pressure forces; 5) the means for controlling seepage; and 6) the purpose of the dam. Materials used for dams may include earth, rock, tailings from mining or milling, concrete, masonry, steel, timber, and miscellaneous materials such as plastic or rubber.

- *Embankment dams,* the most common type of dam in use today, are made from materials which include natural soil or rock, or waste materials obtained from mining or milling operations. An embankment dam is termed an “earth-fill” or “rock-fill” dam depending on whether it is comprised of compacted earth or of dumped rock. The ability of an embankment dam to resist the reservoir water pressure is primarily a result of the mass weight and the type and strength of the materials from which the dam is made.

- *Concrete dams* may be categorized as gravity or arch dams according to the design used to resist the stress of reservoir water pressure. Concrete gravity dams use the mass weight of concrete and friction to resist reservoir water pressure. A buttress dam is a specific type of gravity dam in which the large mass of concrete is reduced, and the forces are diverted to the dam foundation through vertical or sloping buttresses.

- *Concrete arch dams* are typically thin in cross-section. The reservoir water forces acting on an arch dam are carried laterally into the abutments. The shape of the arch may resemble a segment of a circle or an ellipse, and the arch may be curved in the vertical plane as well. Such dams are usually constructed of a series of thin vertical blocks that are keyed together with barriers to stop water from flowing between the blocks.

- *Coal impoundments* are defined by the Mining Safety and Health Administration (MSHA) as any structure associated with coal mining operations built to impound water and, are either 20 feet high, or capable of impounding 20 acre feet of water. Coal impoundments store coal slurry comprised of wastewater and impurities that result from coal washing and processing. A bulkhead or embankment is made of coarse coal refuse and acts as a dam. Behind it lies a pond of coal slurry. Sediment settles out of this turbid mixture, filling the pond, while wastewater is recycled back into the coal washing process. The sizes of the ponds and bulkheads vary, but pond basins are often hundreds of feet deep and hold millions of gallons of slurry. As of this year, coal impoundment failures have resulted in property damage, environmental contamination and, in one case, loss of life.

Dam classifications are based on the evaluation of damage possible downstream. The FEMA guide to dam classifications uses the following system:

Classification of Dams	
Classification	Description
Class A (Low)	No loss of human life is expected and damage will only occur to the dam owner's property
Class B (Moderate/Significant)	Loss of human life is not probable, but economic loss, environmental damage, and/or disruption of lifeline facilities can be expected
Class C (High)	Loss of one or more human lives is expected

Source: FEMA 333; Federal Guidelines for Dam Safety, Hazard Potential Classifications

Facts

- There are 76,926 dams listed in the national inventory (1998-1999 edition).
- Only 2.7% of the dams are owned by the federal government.
- 81% of the dams in the inventory are earthen dams.
- 1,595 significant hazard dams are within one mile of a downstream city.
- The average age for a dam is 40 years.

Likelihood of Occurrence

Signs of Potential Dam Failure

- *Seepage.* The appearance of seepage on the downstream slope, abutments, or downstream area is cause for concern. If the water is muddy and is coming from a well-defined hole, material is probably being eroded from inside the embankment and a potentially dangerous situation can develop.

- *Erosion.* Erosion on the dam and spillway is one of the most evident signs of danger. The size of erosion channels and gullies can increase greatly with slight amounts of rainfall.

- *Cracks.* Cracks are of two types: traverse and longitudinal. Traverse cracks appear perpendicular to the axis of the dam and indicate settlement of the dam. Longitudinal cracks run parallel to the axis of the dam and may be the signal for a slide, or slump, on either face of the dam.

- *Slides and Slumps.* A massive slide can mean catastrophic failure of the dam. Slides occur for many reasons and their occurrence can mean a major reconstruction effort.

- *Subsidence.* Subsidence is the vertical movement of the foundation materials due to failure of consolidation. Rate of subsidence may be so slow that it can go unnoticed without proper inspection. Foundation settlement is the result of placing the dam and reservoir on an area lacking suitable strength, or over collapsed caves or mines.

- *Structural.* Conduit separations or ruptures can result in water leaking into the embankment and subsequent weakening of the dam. Pipe collapse can result in hydraulic failures due to diminished capacity.

- *Vegetation.* A prominent danger signal is the appearance of "wet environment" types of vegetation such as cattails, reeds, mosses and other wet area vegetation. These types of vegetation can be a sign of seepage.

- *Boils.* Boils indicate seepage water exiting under some pressure and typically occur in areas downstream of the dam.

- *Animal Burrows.* Animal burrows are a potential danger since such activity can undermine the structural integrity of the dam.

- *Debris.* Debris on dams and spillways can reduce the function of spillways, damage structures and valves, and destroy vegetative cover.

Types of Failures

- *Hydraulic Failure.* Hydraulic failures result from the uncontrolled flow of water over the dam, around the dam and adjacent to the dam, and the erosive action of water on the dam and its foundation. Earth dams are particularly vulnerable to hydraulic failure since earth erodes at relatively small velocities.

- *Seepage Failure.* All dams exhibit some seepage that must be controlled in velocity and amount. Seepage occurs both through the dam and the foundation.

If uncontrolled, seepage can erode material from the foundation of an earth dam to form a conduit through which water can pass. This passing of water often leads to a complete failure of the structure, known as piping.

- *Structural Failure.* Structural failures involve the rupture of the dam and/or its foundation. This is particularly a hazard for large dams and for dams built of low strength materials such as silts, slag, fly ash, etc. Dam failures generally result from a complex interrelationship of several failure modes. Uncontrolled seepage may weaken the soils and lead to a structural failure. Structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may lead to structural or piping failures.

Impacts

Dam failures cause flooding much different from natural flooding. A flood from a dam failure may arrive before any warning or evacuation can take place and the resulting wall-of-water makes evacuation based on limited environmental cues very problematic. The failure of large dams results in flooding with enough energy to damage or destroy residences and other structures

Hazard Profile: Dam Failure

Profile Risk Table

Period of Occurrence	Failure can occur at any time, but is often spurred by other events such as heavy flooding or seismic activity
Number of Events to Date: National Performance of Dams Program (NPDP) Data, 1973 to 2010	11
Past Damages	N/A
Annual Chance of Probability Ratio	0.3
Warning Time	Warning time is minimal and can often be directly related to frequency and thoroughness of inspections
Potential Impacts	Impacts on human life and public safety. Economic loss, environmental damage, and disruption of lifeline facilities.

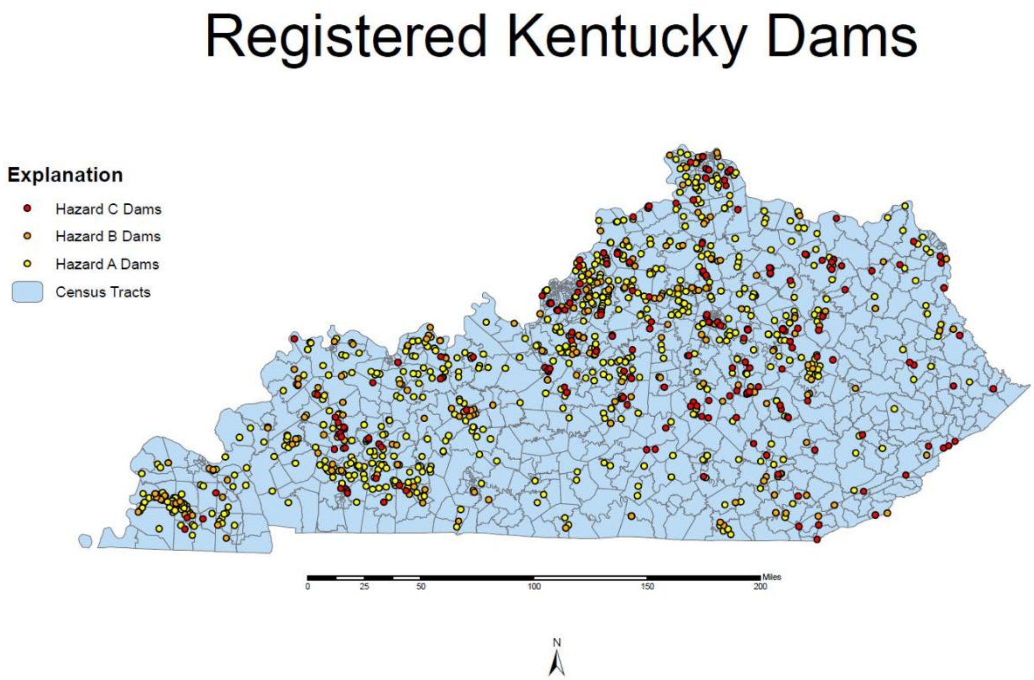
Geographic Locations Affected

The state of Kentucky has over 1,000 dams, with almost 200 dams being identified by FEMA as High Hazard - or Class C - dams. According to the National Performance of

Dams Program's database, eleven (11) dam malfunctions have been reported in the state of Kentucky since 1973, with seven of those being complete dam failures.

Dam malfunctions and failures can occur at any time during the year, day or night and certain types of damages can be prevented with regular inspection and maintenance.

Coal impoundments also pose a severe threat to the human populations and the environment in the event of failure.. According to the MSHA, of the 713 impoundments nationwide, 121 are found in Kentucky and 60 of those are high risk impoundments in terms of retaining failure.



Listed in the following table are the historical dam malfunction events for the state of Kentucky, as well as information on impoundment failure and current dam projects occurring in the state.

Previous Occurrences

Kentucky Dam Malfunctions, 1973-Present

Dam Name	Incident Date	Incident Type	Failure
Caulk Lake Dam	Dec. 16, 1973	Seepage	Yes
Camp Ernst Dam	Sept. 15, 1978	Embankment Slide	Yes
East Fork Pond River FRS No. 4.1	Dec. 8, 1978	Foundation Failure	Yes

Dam Name	Incident Date	Incident Type	Failure
Samsel	Feb. 2, 1979	Seepage	No
Eastover Mining Co Dam	Dec. 18, 1981	Sabotage-Other	Yes
Indian Lake Dam	1983	Piping	Yes
Unnamed Dam	1989	Inflow Flood/Hydrologic Event	Yes
Kincaid Creek Dam	Mar. 1, 1997	Inflow Flood-Hydrologic Event	No
Mud River MPS #6a	Mar. 1, 1997	Inflow Flood-Hydrologic Event	No
Guist Creek Lake Dam	Mar. 1, 1997	Inflow Flood-Hydrologic Event	No
Hematite	June 11, 1998	Seepage; Piping	Yes

(Source: NPDP Database, 2009)

On October 11, 2000, the Big Sandy River in Inez, Kentucky ran black with thick coal sludge. An abandoned mine below the coal impoundment near Inez collapsed, freeing 250 million gallons of refuse coal slurry from the impoundment pond. It flooded the mineshaft and spilled out into local rivers and streams, overflowing riverbanks and swamping backyards and roads with tar-like black muck.

Inez schools and businesses closed and some Kentucky towns advised residents to boil their water. Nearby communities in West Virginia rerouted drinking water pipelines to avoid slurry contamination.

The Environmental Protection Agency (EPA) calls the aftermath of the Inez impoundment collapse one of the worst environmental disasters to have ever occurred in the South.

Alternatives to coal impoundments include injecting the slurry underground, designing power plants to use impure coal, and cleaning coal using magnets and electrostatic forces, not water. With less coal slurry and fewer coal impoundments, the risk of dangerous impoundment failure is lessened.

The Wolf Creek Dam is on the Cumberland River in the Western part of Russell County, Kentucky. It was constructed to generate hydroelectricity and prevent flooding but is better known for creating Lake Cumberland, which has become a popular tourist attraction and is also the largest man-made lake, by volume, east of the Mississippi River. Lake Cumberland, along with Dale Hollow Dam, Center Hill Dam and J. Percy Priest Dam, provide an adequate supply of water to enhance navigation on the mainstream the Cumberland River from Celina, Tennessee, to the Ohio River. The lake is a source of recreation which has attracted more visitors (4.89 million) than Yellowstone National Park (2.87 million). Designed and constructed during the period 1938-1952, the 5,736 foot-long dam is a combination of rolled earth fill and concrete gravity structure.

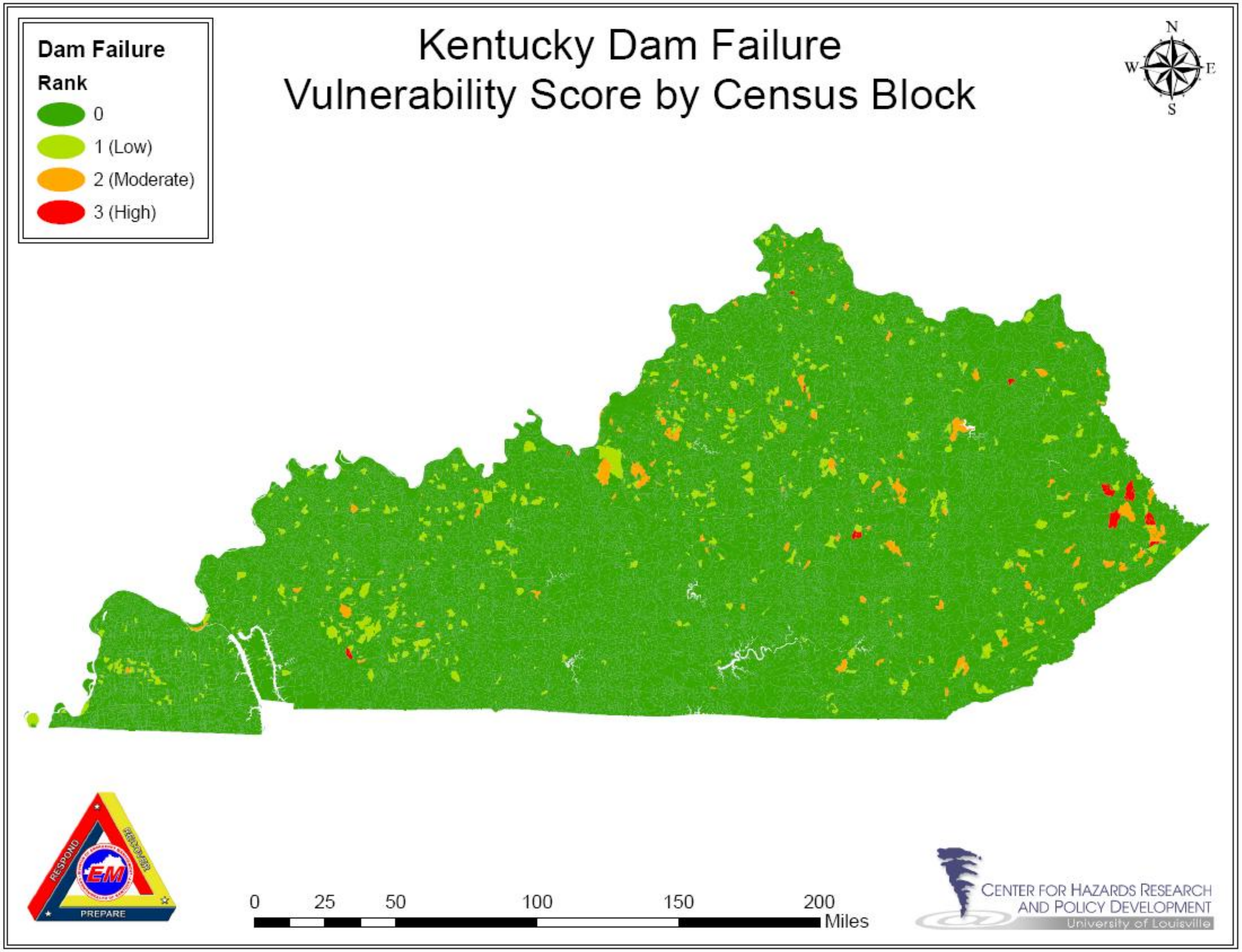
From 1968 through 1979, efforts were made to respond to technical issues affecting the dam with water undercutting the dam at its base. By the end of 1979 the Corps of Engineers had conducted a "grout" campaign as well as constructed a concrete dam in front of the earthen dam to assist in maintaining water in the Lake. In 2005, the dam was discovered to have developed leaks under the earthen part of the dam. The center of the earthen dam is filled with a concrete slab which has already been extended. Minor repairs were scheduled in 2006 with major repairs beginning in 2007 and extending into and continuing as of March 2010.

KyEM has been directly involved since 2005 with the development of a joint dam planning group, consisting of the Corps of Engineer, Federal Emergency Management Agency, and emergency management Representatives from Clint, Cumberland, Monroe, and Russell Counties. Evacuation and sheltering plans were developed in coordination with the Wolf Creek Dam Emergency Action Plan. The plans are reviewed and updated as required and will be in effect until such time as the rehabilitation projects managed by the Corps of Engineers is finished.

Assessing Vulnerability by Jurisdiction: Dam Failure

Dam Failure Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Dam Failure Risk Score employing the Layer Rank (LR) multiplied by the Exposure Score. The Dam Failure LR was determined by first counting and categorizing KDOW dams and USACE Dams within each census block. Each dam was rated as high, medium, and low hazard dams according to KDOW and USACE classifications. A high hazard dam was given a score of 3, medium a score of 2, and low a score of 1. Scores for high, medium, and low hazard dams were then added together to produce a total dam score for each census block. Census blocks with levees were assigned a 1 which was added to the dam score. Next, census blocks were ranked 0-3 (0=N/A, 1=low, 3=high) based upon their total dam score producing a Dam Failure Risk Score. The Dam Failure Vulnerability Score was calculated for each census block by multiplying the census block’s Exposure Score by its Dam Failure Risk Score.

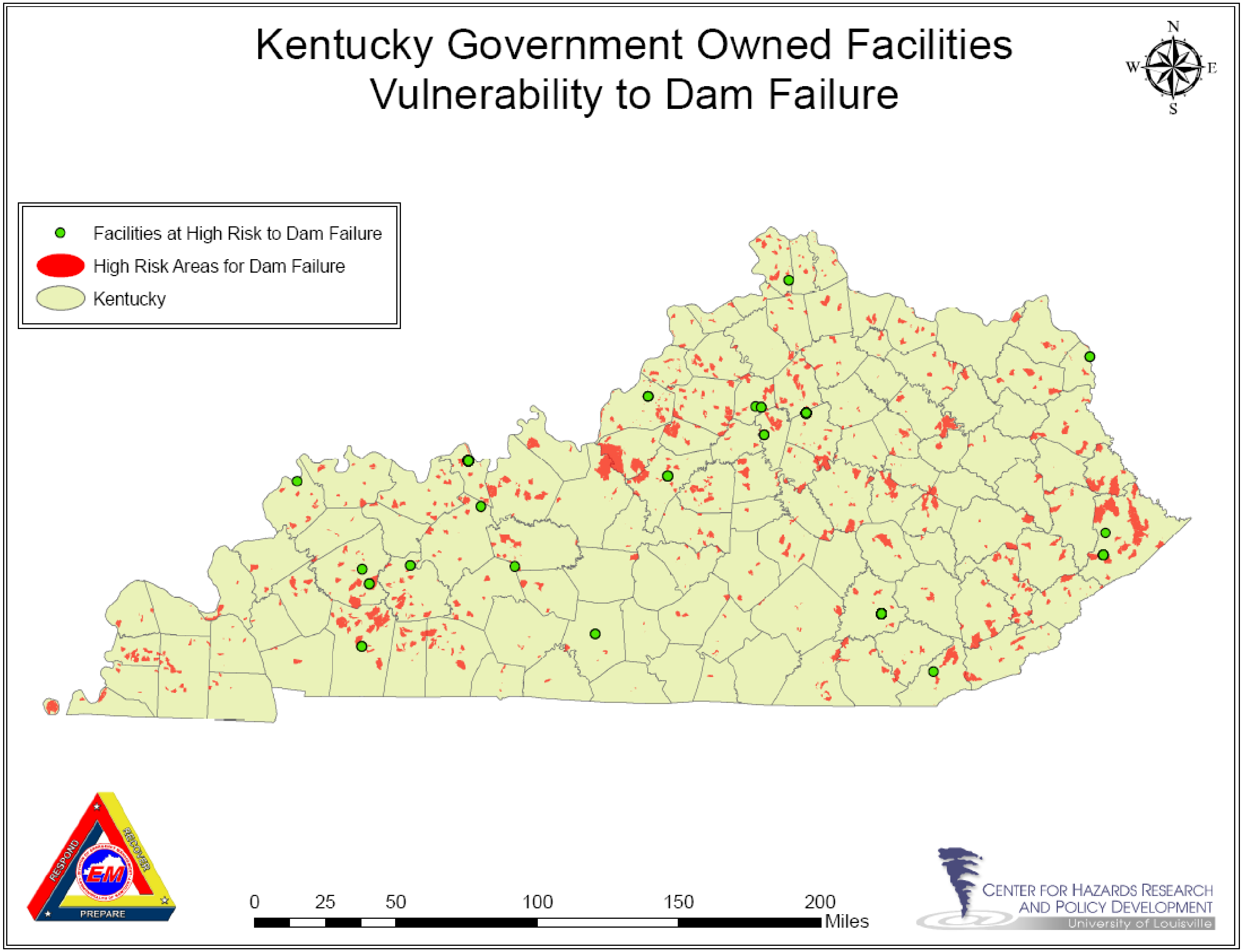

Dam Failure
Rank
0
1 (Low)
2 (Moderate)
3 (High)
Kentucky Dam Failure
Vulnerability Score by Census Block
N
W
E
S
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Dam Failure

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Dam Failure. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the census blocks that pertain to dams or levees. The Dam Failure Risk Scores were overlaid onto the Property Rank scores from the Exposure Score. This produces a very granular loss estimation model based on GIS spatial analysis of where hazards are compared to where you have dollar property exposure. See Appendix 19 for a jurisdictional (county) loss estimate for Dam Failure.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Dam Failure

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The census block Risk Scores were used as the hazard layer for Dam Failure. State facilities (point data) were placed into a GIS mapping session and overlaid onto the census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a dam failure event. Appendix 20 contains a county breakdown of how many state facilities are located within the dam failure hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Dam Failure
N
W
E
S
Facilities at High Risk to Dam Failure
High Risk Areas for Dam Failure
Kentucky
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
Center for Hazards Research
and Policy Development
University of Louisville

4.1.2 Drought

Hazard Identification: Drought

Description

Drought is a natural and recurring feature of Kentucky's climate that can be considered a "severe" weather event much like a tornado, a flood, or a hurricane. However, there are a few key differences which distinguish drought from other weather events, making it difficult to detect and track.

Part of the difficulty in detecting drought is in the lack of an obvious onset of drought conditions. A drought develops slowly and can appear to mimic a normal spell of dry weather in the summer, a time of the year when dry weather is accepted and expected. Short-term rainfall shortages create problems for agricultural crops, livestock, urban landscapes, and other activities that depend on stored soil moisture between rainfall events.

Despite all of the problems that droughts cause, drought has proven to be difficult to define. There is no universally accepted definition because drought, unlike flooding for example, is not a distinct event. Additionally, drought is often the result of many complex factors and has no well-defined start or end. The impacts of drought may again vary by affected sector, thus making definitions of drought specific to particular situations.

The most commonly used drought definitions are based on meteorological, agricultural, hydrological, and socioeconomic effects.

Meteorological drought is defined as a period of substantially diminished precipitation duration or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which the actual moisture supply at a given place consistently falls below the climatically appropriate moisture supply.

Agricultural drought occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought usually occurs after or during meteorological drought but before hydrological drought. It can also affect livestock and other dry-land agricultural operations.

Hydrological drought refers to deficiencies in surface and subsurface water supplies. There is usually a delay between lack of rain or snow and less measurable water in streams, lakes, and reservoirs. Therefore, hydrological measurements tend to lag other drought indicators.

Socioeconomic drought occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought begins to affect the supply and demand of an economic product.

Types

There are many different indices for measuring drought. Although none are superior to the others, some indices are better for certain situations. The Palmer Drought Severity Index (PDSI) is currently used by the U.S. department of agriculture to help determine when grant assistance is needed. This index is also helpful for areas of widely similar topography. As Kentucky has relatively similar topography (with exceptions in the eastern portion of the state) and also has a great deal of agriculture, the PDSI will be used in the state plan. The index measures the level of recorded precipitation against the average, or normal, amount of precipitation for a region.

Palmer Classifications System (PDSI)	
+4.0 in. or more	extremely wet
3.0 in to 3.99 in	very wet
2.0 in to 2.99 in	moderately wet
1.0 in to 1.99 in	slightly wet
0.5 in to 0.99 in	incipient wet spell
0.49 in to -0.49 in	near normal
-0.5 in to -0.99 in	incipient dry spell
-1.9 in to -1.99 in	mild drought
-2.0 in to -2.99 in	moderate drought
-3.0 in to -3.99 in	severe drought
-4.0 in or less	extreme drought

(Source: National Oceanic and Atmospheric Association (NOAA))

Facts

- High temperatures, prolonged high winds, and low relative humidity can aggravate drought conditions.

- Droughts can lead to economic losses such as unemployment, decreased land values, and agribusiness losses.
- In 2009, in Texas alone, over 4.1 billion dollars in livestock and crop loss was attributed to drought.

Primary Impacts

- Crop failure is the most crucial effect of drought. Drought has a direct impact on the economy and in many cases the health of the population that is affected. Due to a lack of water and moisture in the soil, many crops will not produce normally or efficiently and in many cases, may be lost entirely.
- Water shortage is a very serious effect of drought. The availability of potable water is severely decreased when drought conditions persist. Springs, wells, streams, and reservoirs have been known to run dry due to the decrease in ground water, and, in extreme cases, rivers have become unsafe for navigation as a result of drought.

Secondary Impacts

- Fire susceptibility is increased with the absence of moisture associated with a drought. Dry conditions have been known to promote the occurrence of widespread wildfires.

Tertiary Impacts

- Environmental degradation via erosion and ecological damage can be additional results of drought. As moisture in topsoil dissipates and the ground becomes dryer, the susceptibility to windblown erosion increases. In prolonged drought situations loss of habitat for certain species native to that particular environment is possible. Prolonged drought conditions may also result in loss of food sources for certain species.
- In prolonged drought situations the soil surrounding structures subsides, sometimes creating cracks in foundations and separation of foundations from above ground portions of the structure. Forest root systems may be damaged or destroyed through a similar process.

Hazard Profile: Drought

Profile Risk Table

Period of Occurrence	Drought can occur at any time of the year in any part of Kentucky.
Number of Events to Date: 1960 to 2009 SHELDUS data	2 (Very large events)

Past Damages: 1960 to 2009 SHELDUS data	$283,878,207
Annual Chance Probability Ratio	0.03
Warning Time	Warning times for drought are not applicable as they are for severe storms or winter weather. Drought is onset by a period of similar weather and precipitation conditions. Predictability and preparedness is based mostly on the awareness of populations drought conditions are affecting.
Potential Impacts	Impacts to human life, health, and public safety are possible. Utility damage and failure, infrastructure damage (transportation and communication systems), structural damage, potential increase in risk of wild fire, and the possibility of damaged or destroyed critical facilities are additional impacts. Most impacts result from wildfire, extreme dry conditions, or dust storms.

Historical Impact

Although bits and pieces of data on drought occurrence exist, most of the information is in the form of news reports and historical records. As referenced in the description section for drought (4.1.2) The Palmer Drought Severity Index (PDSI) is the most widely used measurement of drought severity. Unfortunately, significant figures and information regarding these periods of drought are difficult to find, if they even exist at all.

For example, NOAA data indicated 31 events of drought data, where SHELDUS showed only two (2) significant events since 1999. 2007 was recorded as being one of the driest years since the 1940's, yet no in depth data has been found on the effects of this particular drought. The CHAMPS project will ultimately rectify such deficiencies in available data. Information from Kentucky's 2007 plan is reiterated for drought instead as it is the best available data.

According to NOAA, there have been 16 recorded drought occurrences in Kentucky since 1996. Only two of those droughts caused serious damage to agricultural yields. The 1996 drought affected 20 counties in western Kentucky with crop damages assessed around $154 million. In 2002, 22 counties in Kentucky were affected with losses assessed at $70 million. There were no injuries or deaths reported as a result of these droughts.

During periods of drought in Kentucky, some activities which rely heavily on high water usage may be impacted significantly. These activities include agriculture, tourism, wildlife protection, municipal water usage, recreation, wildlife preservation, and electric power generation.

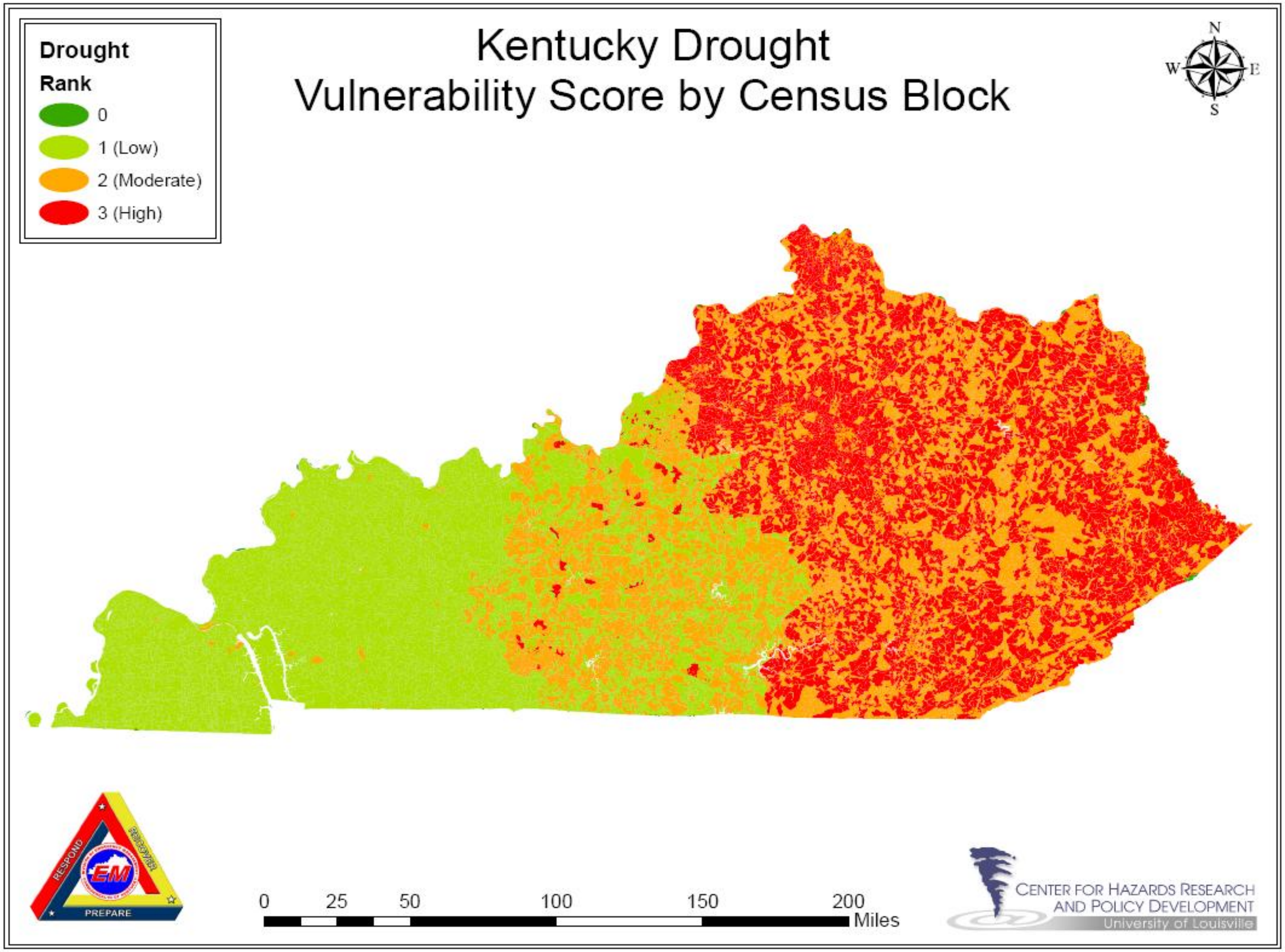
The severe summer drought of 1996 took a major toll on crops and plants across the state. Rainfall at Paducah, Kentucky was only one and a half inches from July through September of that year. Paducah usually receives around ten inches of rain for that period. Soybean crops sustained the greatest losses, estimated near $70 million. Additionally, tobacco losses amounted to $50 million and corn losses approached $35 million. Total crop losses in western Kentucky alone were near $155 million, which prompted an agricultural disaster declaration by state and federal governments. The root systems of many shrubs and young trees were damaged. Many died as a result of the drought.

Other, large-scale effects of the 1996 drought can be seen in fire damage and water shortages. During the drought, the danger of wild fire reached extreme levels. The largest fire occurred east of Central City in Muhlenberg County. It eventually covered close to 1,000 acres, prompting the closure of the Western Kentucky Parkway for several hours. Another large fire, estimated as having a burn area of around 500 acres, ignited in Hickman County. This fire, which may have been sparked by a passing train, burned numerous corn and soybean fields. Finally, a 100-acre cornfield fire near Henderson Kentucky closed the Pennyrile Parkway for about an hour and forced the brief evacuation of a local nursing home. The Kentucky Division of Water declared a water shortage warning for the Pennyrile area, which includes the cities of Owensboro and Hopkinsville. No mandatory water conservation measures were imposed however.

Assessing Vulnerability by Jurisdiction: Drought

Drought Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Drought Risk Score employing the Layer Rank (LR) and then multiplying it by the Exposure Score. The Drought LR was determined by averaging the Palmer Drought Severity Index from 1895-2009 for the four regions of in Kentucky (Bluegrass, Eastern, Central and Western). This historic drought data provided four (4) regions (layers) of identified risk. These four (4) regions were ranked 1-3 (1=low, 3=high) which produced the Drought Risk Score. Next, a Drought Vulnerability Score was calculated for each census block by multiplying the census block’s Exposure Score by its Drought Risk Score.

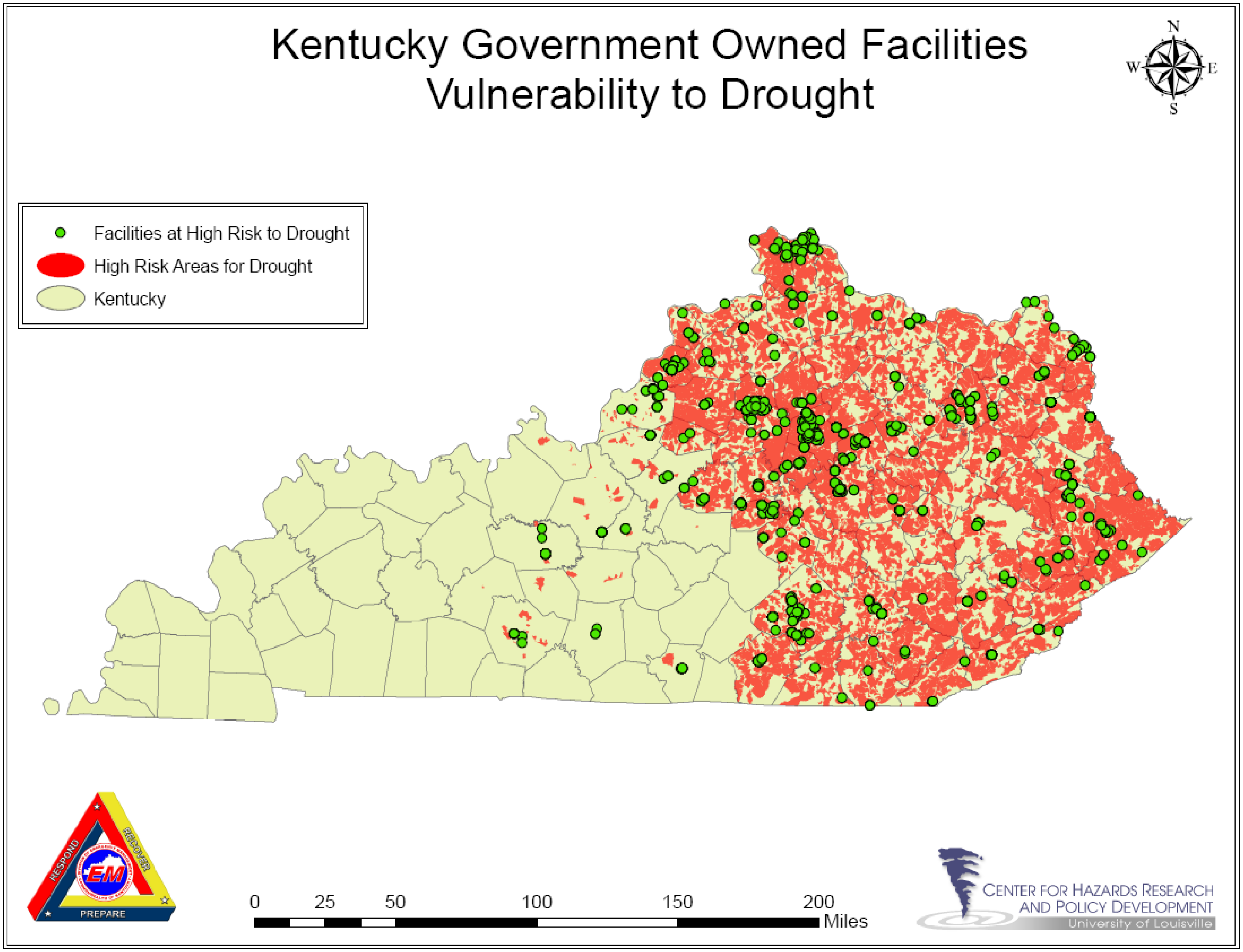

Kentucky Drought
Vulnerability Score by Census Block
Drought
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
W
E
S
RESPOND
PREPARE
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Drought

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Drought. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the level (3) block Risk Scores overlaid onto the Property Rank scores from the Exposure Score. This produces a very granular loss estimation model based on GIS spatial analysis of where a hazard layer is compared to where there dollar property exposure. See Appendix 21 for a jurisdictional (county) loss estimate for Drought.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Drought

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The level (3) block Risk Scores were used as the hazard layer for Drought. State facilities (point data) were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Drought event. See Appendix 22 for a county breakdown of how many state facilities are located within a level (3) Drought hazard layer and therefore considered vulnerable and estimated to be damaged.



Kentucky Government Owned Facilities
Vulnerability to Drought
N
W
E
S
Facilities at High Risk to Drought
High Risk Areas for Drought
Kentucky
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

4.1.3 Earthquake

Hazard Identification: Earthquake

Description

According to the U.S. Geological Survey, an earthquake is *a shaking of the ground caused by the sudden release of accumulated strain by an abrupt shift of rock along a fracture in the Earth or by volcanic or magmatic activity, or other sudden stress changes in the Earth*. For hundreds of millions of years, the forces of plate tectonics - massive, irregularly-shaped slabs of rock - have shaped the Earth as these huge plates that form the Earth's surface move slowly over time.

When a substantial amount of energy has accumulated during these tectonic interactions, the plates move in a way which releases stored energy and produce the seismic waves which generate earthquakes. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. However, some earthquakes do occur in the middle of plates for various reasons.

The movement of the earth‘s surface during earthquakes (or explosions) is the catalyst for most of the damage during an earthquake. Produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source, ground motion travels both through the earth and along its surface, amplified by soft soils overlying hard bedrock; a phenomenon referred to as ground motion amplification. Ground motion amplification can cause a great deal of damage during an earthquake, even to sites very far from the epicenter; the epicenter being the point on the Earth's surface that is directly above the area where rock has broken on the tectonic plate below. Earthquakes strike suddenly and without warning and can occur at any time of the year, any time of the day or night. Worldwide, 70 to 75 damaging earthquakes occur annually.

The Northridge, California, earthquake of January 17, 1994, struck a modern urban environment generally designed to withstand the forces of earthquakes. Its economic cost, nevertheless, has been estimated at $20 billion. Exactly one year later, Kobe, Japan, a densely populated community less prepared for earthquakes than Northridge, was devastated by the most costly earthquake ever to occur. Property losses were projected at over $100 billion, and at least 5,378 people were killed. These two earthquakes tested building codes and construction practices, as well as emergency preparedness and response procedures.

Over 75 million Americans in 39 states face a significant risk of experiencing the effects of a substantial earthquake. California experiences the greatest amount of damaging earthquakes in terms of effected infrastructure and damage to private property.

However, Alaska experiences the greatest actual number of large earthquakes, most of which occur in uninhabited areas of the state. The largest earthquake felt in the contiguous United States was along a 600 mile stretch of the Cascadia Subduction Zone between Vancouver, British Columbia and Northern California, where the oceanic Juan de Fuca plate is sliding beneath the North American plate. The earthquake leveled entire villages, collapsed structures in many others, and caused landslides, tsunamis, and devastating swells down much of the Northwest coast of North America. A tsunami produced by this earthquake travelled across the Pacific Ocean, also causing significant levels of devastation on coastal areas of Japan.

Types

Plate boundaries are characterized into four (4) distinct types:

1) Divergent boundaries – a new crust is created as two plates move away from another
2) Convergent boundaries – areas where tow plates are coming together and thus losing crust as one plate slides under another
3) Transform boundaries - two plates slide horizontally past one another without creating or destroying boundaries
4) Plate boundary zones – broad belts without well defined boundaries or plate interaction

Earthquakes are measured in terms of magnitude and intensity using the Richter Scale and Modified Mercalli Scale of Earthquake Intensity.

The Richter magnitude scale measures an earthquake‘s magnitude using an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. The earthquake‘s magnitude is expressed in whole numbers and decimal fractions. Each whole number increase in magnitude represents a 10-fold increase in measured wave amplitude, or a release of 32 times more energy than the preceding whole number value.

The Modified Mercalli Scale measures the effect of an earthquake on the Earth‘s surface. Composed of 12 increasing levels of intensity that range from unnoticeable shaking to catastrophic destruction, the scale is designated by Roman numerals. There is no mathematical basis to the scale; rather, it is an arbitrary ranking based on observed events. The lower values of the scale detail the manner in which the earthquake is felt by people, while the increasing values are based on observed structural damage. The intensity values are assigned after gathering responses to questionnaires administered to postmasters in affected areas in the aftermath of the earthquake.

Modified Mercalli Intensity Scale with Corresponding Richter Scale

Intensity	Verbal Description	Witness Observations	Maximum Acceleration (cm/sec^2)	Corresponding Richter Scale
I	Instrumental	Detectable on seismographs	<1	<3.5
II	Feeble	Felt by some people	<2.5	3.5
III	Slight	Felt by people resting	<5	4.2
IV	Moderate	Felt by people walking	<10	4.5
V	Slightly Strong	Sleepers awake; church bells ring	<25	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<50	5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<100	6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged	<250	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<500	6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<750	7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	<980	8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>980	>8.1

(Source: Author Compilation. See indexed sources in Appendix)

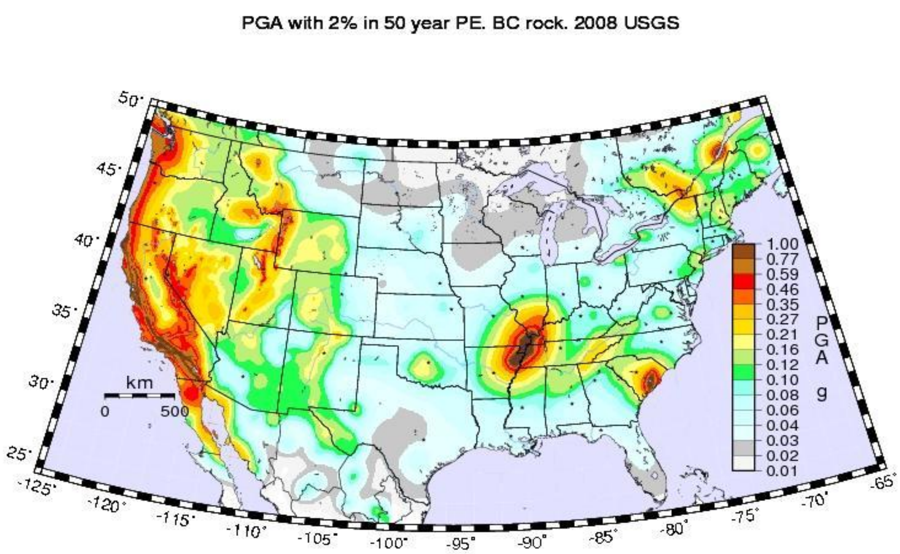
10 Largest Earthquakes in the Contiguous United States

Richter Scale Magnitude	Date	Location
>9.0	January 26, 1700	Cascadia Subduction Zone
8.1	December 16, 1811	New Madrid, MO
8.0	February 7, 1812	New Madrid, MO
7.9	January 9, 1857	Fort Tejon, CA
7.8	April 18, 1906	San Francisco, CA
7.8	February 24, 1892	Imperial Valley, CA
7.8	January 23, 1812	New Madrid, MO
7.4	March 26, 1872	Owens Valley, CA
7.3	June 28, 1992	Landers, CA
7.3	August 18, 1959	Hebgen Lake, MT

(Source: U.S. Geological Survey. 2005.http://earthquake.usgs.gov/regional/states/10_largest_us.php#48_states)

Facts

- Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California earthquake of 1906 (magnitude 7.8) was felt 560 miles away in the middle of Nevada, whereas the New Madrid earthquake of December 1811 (magnitude 8.0) rang church bells in Boston, Massachusetts, 1,600 miles away. Geology differences east and west of the Rocky Mountains account for this strong contrast.
- Earthquakes similar to the New Madrid earthquake series of 1811 -1812 and the San Francisco earthquake of 1906 could cause over $500 billion in damage.
- Annually, here are an average of six (6) earthquakes with a 6 or greater magnitude and fifty-seven earthquakes with magnitudes of 5 or greater in the United States.
- Currently, twenty-six urban and metropolitan areas in the U.S. are at risk of being affected by significant seismic activity.
- The largest earthquake ever recorded in the U.S. was a magnitude 9.2 in Prince William Sound, Alaska in March of 1964.
- Between January and September of 2009 over 2,500 earthquakes occurred in the United States.
- Between January and September of 2009 over 10,000 earthquakes occurred worldwide.



(Source: U.S. Geological Survey. 2008 http://earthquake.usgs.gov/research/hazmaps/products_data/2008/maps/)

Impacts

Ground shaking from earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone service among other disruptions, and sometimes trigger landslides, avalanches, dam failure, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to foundations are at risk of being shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths, injuries, and extensive property damage.

Between 2000 and 2008, an average of 28,600 people worldwide died annually due to earthquakes and other natural disasters triggered by an earthquake's occurrence. Small tremors that occur after the initial earthquake has dissipated often make it difficult for those participating in rescue and rebuilding efforts to aid the populations most affected. These delays cause further loss of life and prolong the displacement of families and individuals. The January 1994 earthquake in Northridge, California, for example, killed 33, injured 9,000, and displaced over 20,000 people.

FEMA has estimated future losses due to earthquakes in the United States at $5.6 billion each year, with more earthquakes occurring on the West coast than the East coast, though the Central and Eastern portions of the country remain at a high risk of damage due to geologic factors, magnified by the lack of structures built to withstand such disasters. Thus, the USGS has named earthquakes the natural disaster most likely to cause catastrophic casualties, property damage, and economic disruption.

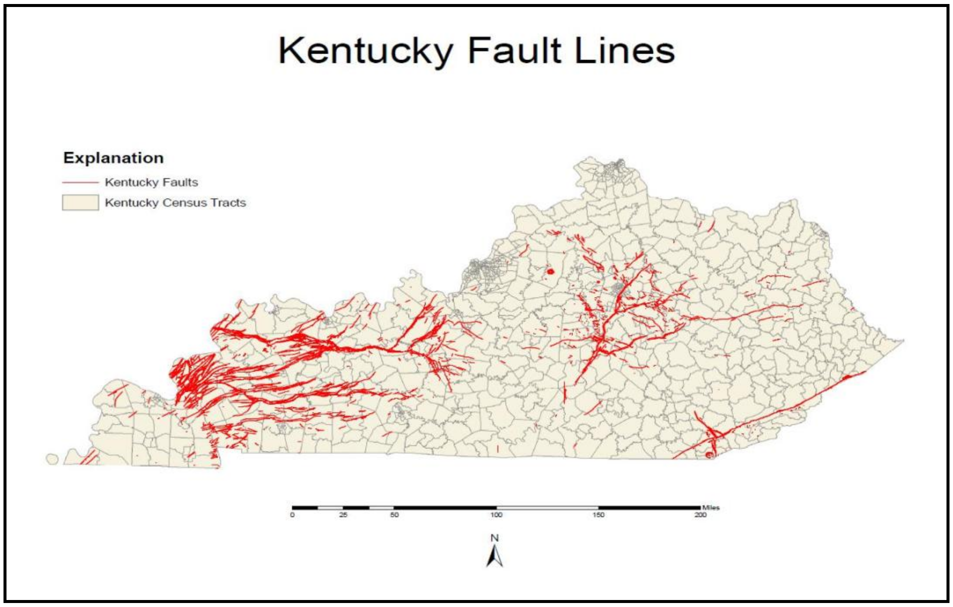
Hazard Profile: Earthquake

Profile Risk Table

Period of Occurrence	Earthquakes can occur year-round, at any time of the day or the night
Number of Events to Date:	Multiple small earthquakes happen all the time
Past Damages:	At this point there is very little real loss numbers from earthquake occurrences
Annual Change Probability Ratio	Currently there are no probability ratios determined for earthquakes because of its unpredictable nature.
Warning Time	Warning time is essentially non-existent, as geologic activity at fault lines in the earth's crust happen sporadically
Potential Impacts	Earthquakes can heavily impact human life, health, and public safety. Large events can cause infrastructure damage, utility damage, and critical facilities damage. Secondary events often trigger landslides, dam failure/flooding, and may facilitate the release of hazardous materials from containment structures.

Geographic Areas Effected

Fault lines run through much of Kentucky, with each of the fifteen area development districts (ADDs) containing at least one fault line or fault system. A number of these systems have remained geologically inactive for significant amounts of time, but others - scientists believe are overdue for a surge in activity.



(Source: U.S. Geological Survey. 2008 http://earthquake.usgs.gov/research/hazmaps/products_data/2008/maps/)

The three (3) seismic zones most likely to put Kentucky at risk are centered outside of the state, but pose a very real threat to the Commonwealth's citizens.

The Eastern Tennessee Seismic Zone extends from southwest Virginia to northeast Alabama and is one of the most seismically active fault systems in the Southeast. Although the zone has not experienced a large earthquake in historic times, a few minor earthquakes have caused slight damage. The largest recorded earthquake in this seismic zone was a magnitude 4.6 which occurred in 1973 near Knoxville. Sensitive seismographs have recorded hundreds of earthquakes too small to be felt in this seismic zone. Small, non-damaging, felt earthquakes occur about once a year. No evidence for larger prehistoric shocks has been discovered, yet the micro-earthquake data suggest coherent stress accumulation within a large volume. Physical processes for reactivation of basement faults in this region could involve a weak lower crust and increased fluid pressures within the upper to middle crust.

The New Madrid Seismic Zone (NMSZ), located in the central Mississippi Valley, is generally demarked on the north by the confluence of the Ohio and Mississippi Rivers. From this point in southern Illinois, the zone runs southwest, through western Kentucky (near Fulton), through eastern Missouri and western Tennessee and terminates in northeastern Arkansas, crossing the Mississippi River three (3) times.

The Wabash Valley Seismic Zone which threatens southern Illinois, Indiana, and Kentucky, shows evidence of large earthquakes in its geologic history. Since 1895, The Wabash Valley Fault Zone has experienced more moderate quakes than the New Madrid Seismic Zone. Some prehistoric quakes which occurred in this zone between 4,000 and 10,000 years ago may have been larger than M6.0. Earthquake ground shaking is amplified by lowland soils, and modern earthquakes of M5.5 to 6.0 in the Wabash Valley Fault Zone could cause substantial damage if they occur close to the populated river towns and cities along the Wabash River and tributaries.

Previous Occurrences

The most notable earthquake, or series of earthquakes, in Kentucky occurred along the New Madrid Seismic Zone from December 1811 to March 1812. Three of the largest earthquakes in the contiguous United States occurred along this zone over this period. An engineer in Louisville recorded approximately 1,850 quakes throughout the four-month timeframe. The shocks from these earthquakes could be easily felt as far away as Michigan and South Carolina. An area between the St. Francois River and Mississippi River running from New Madrid, Missouri to Marked Tree, Arkansas showed numerous sand-blows (a place where liquefacted alluvial soil has geysered through the surface).

Additional Previous Occurrences

Date	Location	Richter/Mercalli Value	Description
Nov. 20, 1834	Northern KY		Houses shook and plaster cracked
Dec. 27, 1841	Hickman, KY		Houses shook and Mississippi River was agitated, though no wind was blowing
January 4, 1843	Mississippi Valley		Small earthquakes were reported, but no damages or first-hand accounts of intensity were reported
Feb. 16, 1843	Mississippi Valley		Small earthquakes were reported, but no damages or first-hand accounts of intensity were reported.
March 12, 1878	Columbus, KY		A severe shock caused sections of bluff line along the Mississippi River to cave in
Dec. 7, 1915	Western Kentucky	Intensity V, VI	Buildings were strongly shaken, windows and dishes rattled, and loose objects were thrown to the floor
Oct. 26, 1916	Mayfield, KY	Intensity V	Pictures were shaken from walls
Dec. 18, 1916	Hickman, KY	Intensity VI, VII	Houses shook and chimneys partially toppled
March 2, 1924	Western Kentucky		No significant damages were reported
Sept. 2, 1925	Henderson, KY		Caused landslides and damage to a number of properties, including a chimney that was toppled in Louisville, over 100 miles away from the epicenter. Illinois, Indiana, and

Date	Location	Richter/Mercalli Value	Description
			Tennessee were also affected.
Jan. 1, 1954	Middlesboro, KY	Intensity VI	Slight damages were reported. The tremor was felt in Tennessee, North Carolina, and Virginia.
Nov. 9, 1958	Henderson, KY	Intensity VII	Substantial masonry damage was sustained in Henderson. Significant damage was also reported in Poole, Smith Mills, and Uniontown, as well as part of southern Illinois, Indiana, and Missouri.
Nov. 9, 1968	Statewide		Strongest earthquake reported in Kentucky since 1895; affected 23 states
1977	Statewide		Originating at the Wabash Valley Fault, at least one chimney in Louisville was destroyed. earthquake, was felt by most of the Midwest.

During the 1811-1812 earthquakes, notable geologic changes occurred on the landscape. Land masses along the Mississippi River were uplifted, while others subsided. Opposite New Madrid, Missouri for example, in the area around Tiptonville, Tennessee, a dome was formed that uplifted several yards. Immediately adjacent to the Tiptonville Dome, an area subsided to form a lake eighteen miles long and five miles wide, now known as Reelfoot Lake and used as a tourist and recreation area.

Ground failure and landslides were apparent throughout the Chickasaw Bluffs alongside the Mississippi River in Kentucky and Tennessee, with many fissures created throughout the region. One local observer reported that while watching the fissures form, the earth seemed to be rolling in waves several feet in height.

The damage to the area was so severe, Congress passed and President James Madison signed into law, the first disaster relief act which gave citizens in the affected area the option to obtain government lands in other territories due to the devastation that disaster had caused.

Assessing Vulnerability and Estimating Potential Losses of (Jurisdiction and State Facilities): Earthquake

HAZUS-MH MR4 was used for Earthquake to display vulnerabilities and loss estimations. HAZUS is a regional loss estimation tool that was developed by FEMA and the National Institute of Building Sciences. The primary purpose of the HAZUS software is to provide a methodology and software application to develop loss estimations at the regional (census tract) scale. CHR decided to use the HAZUS model to determine vulnerabilities and loss estimations for the Earthquake hazard. To review the results of the 100 Year Probability HAZUS Earthquake run see Appendix 42.

4.1.4 Extreme Heat

Hazard Identification: Extreme Heat

Description

Conditions of extreme heat are defined as temperatures that are substantially hotter or more humid than average for a location at a particular (usually summer) time of year. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground.

Wildfires and droughts are aggravated and sometimes caused by periods of extreme heat. As drought and wildfires have their own profiles, heat-related illness is the main focus of this hazard identification.

Heat-related illness most often occurs when the body's temperature control system is overloaded. The body normally cools itself by sweating, but sometimes lacks the capacity to keep the body cooled to a safe temperature. When the natural cooling process fails, a person's body temperature rises rapidly. Very high body temperatures may damage the brain or other vital organs. Several factors affect the body's ability to cool itself during extremely hot weather. When humidity is high, sweat will not evaporate as quickly, preventing the body from releasing heat quickly. This is a major concern in Kentucky as significant humidity levels are common year round.

Types and Impacts

(Listed in order of greatest to least severityt)

- **Heat Stroke:** Heat stroke occurs when the body is unable to regulate its temperature. The body's temperature rises rapidly, the sweating mechanism fails, and the body is unable to cool down. Body temperature may rise to 106°F or higher within 10 to 15 minutes. Heat stroke can cause death or permanent disability if emergency treatment is not provided.
- **Heat Exhaustion:** Heat exhaustion is a milder form of heat-related illness that can develop after several days of exposure to high temperatures and inadequate or unbalanced replacement of fluids. It is the body's response to an excessive loss of the water and salt contained in sweat. Those most prone to heat exhaustion are elderly people, people with high blood pressure, and people working or exercising in a hot environment.
- **Heat Cramps:** Heat cramps usually affect people who sweat a lot during strenuous activity. This sweating depletes the body's salt and moisture. The low salt level in the muscles may be the cause of heat cramps. Heat cramps may also be a symptom of heat exhaustion.
- **Sunburn:** Sunburn should be avoided because it damages the skin. Although the discomfort is usually minor and healing often occurs in about a week, more severe sunburns may require medical attention.

- **Heat Rash:** Heat rash is a skin irritation caused by excessive sweating during hot, humid weather. It can occur at any age but is most common in young children.

Facts

- In a normal year, approximately 175 Americans die from extreme heat. Young children, elderly people, and those who are sick or overweight are more likely to become victims.
- Sunburn can significantly slow the skin's ability to release excess heat.
- Because men sweat more than women, men are more susceptible to heat illness because they become dehydrated more quickly.
- Between 1936 and 1975, nearly 20,000 people succumbed to the effects of heat and solar radiation.

The following graphic depicts the National Weather Services' "Heat Index". The Heat Index is the temperature the body feels when heat and humidity are combined. Although there is only one type of extreme heat, there are several types of heat-related illness that result due to exposure to this hazard. Potential impacts are also assumed to only involve the human factor (an individual's health) as additional information on drought and wildfires are found in their respective identification sections.

Temperature (F) versus Relative Humidity (%)

°F	90%	80%	70%	60%	50%	40%
80	85	84	82	81	80	79
85	101	96	92	90	86	84
90	121	113	105	99	94	90
95		133	122	113	105	98
100			142	129	118	109
105				148	133	121
110						135

HI	Possible Heat Disorder:
80°F - 90°F	Fatigue possible with prolonged exposure and physical activity.
90°F - 105°F	Sunstroke, heat cramps and heat exhaustion possible.
105°F - 130°F	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
130°F or greater	**Heat stroke highly likely with continued exposure.**

(Source: http://www.crh.noaa.gov/pub/heat.php)

Hazard Profile: Extreme Heat

Profile Risk Table

Period of Occurrence	Extreme heat is most likely to occur in the months of July, August, or September. Extreme heat has been known to occur in May, June, and October. The likelihood of extreme heat occurring outside of these months is extremely small and unheard of December through March.
Number of Events to Date: 1960 to 2009 SHELDUS data	9 significant periods of extreme heat
Past Damages: 1960 to 2009 SHELDUS data	$1,083,330
Annual Chance Probability Ratio	0.35
Warning Time	The National Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°- 110°F (depending on local climate) for at least two consecutive days.
Potential Impacts	Impacts human life, health, and public safety. Fires due to extremely dry conditions are possible. Can lead to economic losses such as decreased land values and agribusiness losses.

Historical Impact

Extreme heat can affect any part of Kentucky given the appropriate conditions and the right time of year. The following information is taken directly from the Louisville National Weather Service Forecast Office. It recalls some of the worst cases of sustained high temperatures in Kentucky since 1950.

The average temperature for August in Kentucky is around 77 degrees, give or take a few points per location. In 2007, the average was 85 degrees. During 2007, there were 67 days of temperatures over 90 degrees and 5 reaching over 100 degrees recorded. A federal disaster designation by the U.S. Department of Agriculture was declared allowing farmers in the state's $4 billion-a-year industry to seek emergency assistance, including low-interest loans to help pay for essential farm and living expenses.

1990 and 1991 saw consecutive heat waves in which 1991 caused a statewide drought. 1991 is the third warmest year on record and also contained the third warmest summer as well as the second warmest spring.

The 1952 heat wave lacked the intensity of other heat waves but it did have duration. According to the Kentucky Division of Forestry, numerous acres burned in 1952 due to the lack of precipitation. In Louisville alone, there was not a single day below the average temperature.

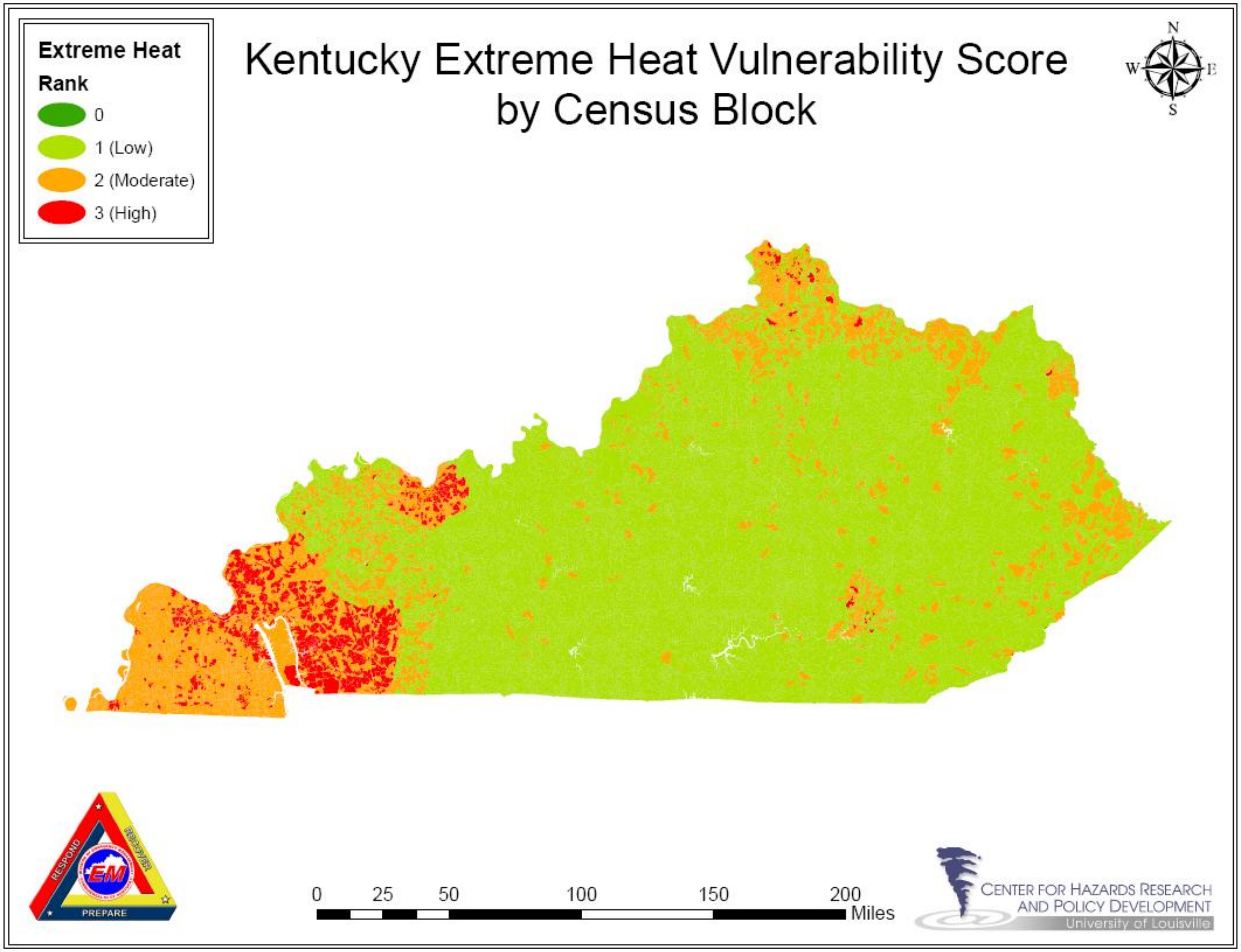
Although these events cover a broad time span, it is still important to note what accompanies extreme heat. Kentucky is always at risk for extreme heat during peak occurrence months. Extreme heat not only causes droughts and crop damage, but also the loss of human life. Several accounts of heat-related deaths populate headlines throughout warmer months for Kentucky. There was a case in Louisville, August 20, 2008, where a young man died due to heat-related complications resulting from football practice in 94 degree weather. As stated in the description section of the state plan, elderly people, young people, and persons who are of unhealthy weights are all at constant risk from the dangers of extreme heat. Unfortunately, hard data on heat-related deaths is difficult to come by for the state level. Still, the following is offered to solidify the serious risk extreme heat poses Kentucky's citizens:

"Heat is the number one weather-related killer. On average, more than 1,500 people in the U.S. die each year from excessive heat. This number is greater than the 30-year mean annual number of deaths due to tornadoes, hurricanes, floods, and lightning combined. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation." – NOAA

Assessing Vulnerability by Jurisdiction: Extreme Heat

Extreme Heat Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Extreme Heat Risk Score employing the Annualized Loss Rank (ALR) and multiplying it by the Exposure Score. The ALR for extreme heat was created by calculating extreme heat occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 50 year timeframe. Each county's ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. This process created the Extreme Heat Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Extreme Heat Vulnerability Score.



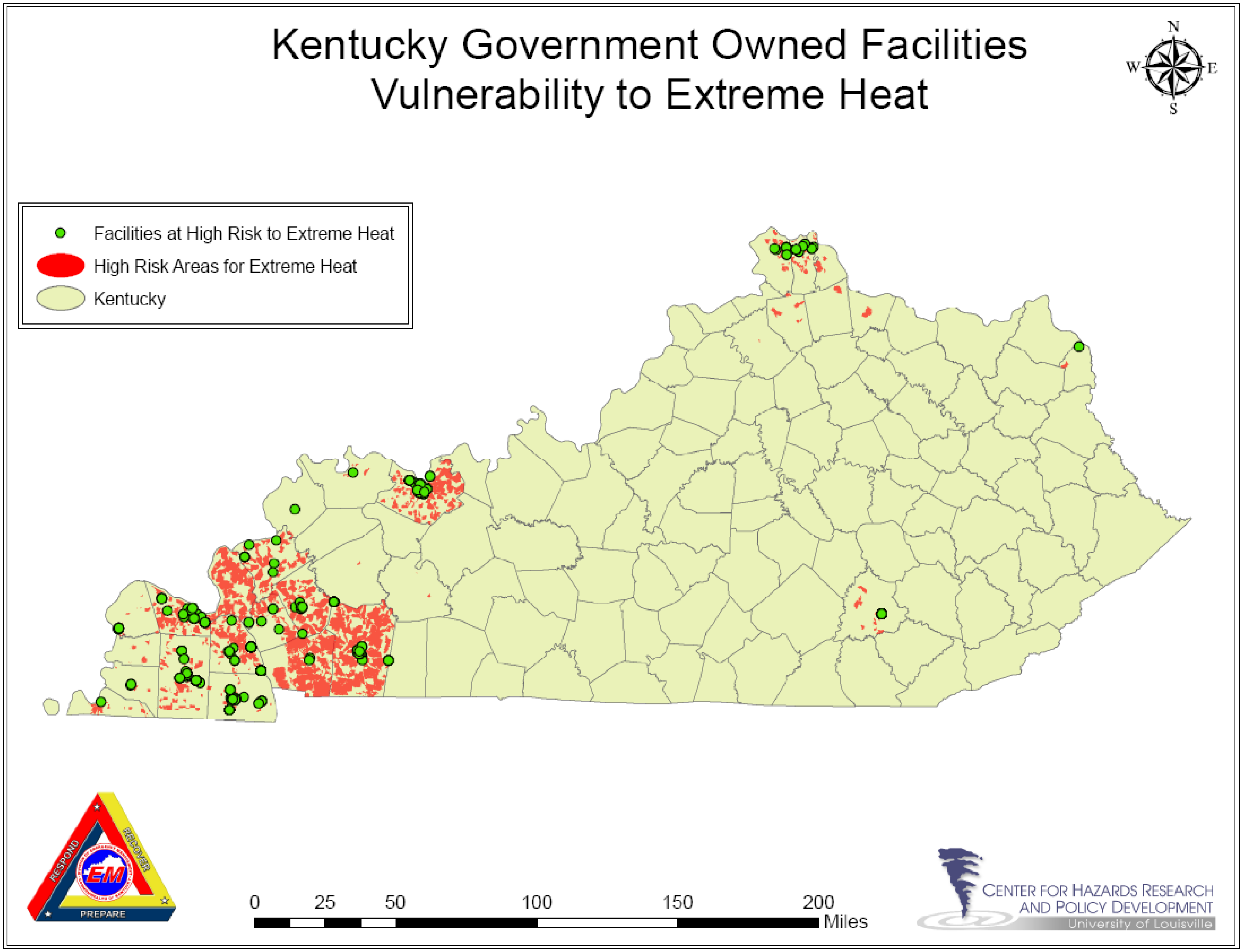
Extreme Heat Rank
0
1 (Low)
2 (Moderate)
3 (High)
Kentucky Extreme Heat Vulnerability Score by Census Block
N
W
E
S
RESPOND
PREPARE
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Extreme Heat

The *Annualized Loss Rank (ALR) loss estimate model* was used to estimate losses for Extreme Heat. Potential loss for jurisdictions are calculated by using the ALR created from the Average Annual Risk data captured for each county. This produces a loss estimation model based on actual loss and occurrence data that has occurred over a set period of time. See Appendix 23 for a jurisdictional (county) loss estimate for Extreme Heat.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Extreme Heat

This process was performed using level (3) block Risk Scores as the hazard layer for Extreme Heat. The state facilities were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a extreme heat event. See Appendix 24 for a county breakdown of how many state facilities are located within a level (3) extreme heat hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Extreme Heat
N
W
E
S
Facilities at High Risk to Extreme Heat
High Risk Areas for Extreme Heat
Kentucky
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
Center for Hazards Research
and Policy Development
University of Louisville

4.1.5 Flood

Hazard Identification: Flood

Description

As defined by USGS, flooding is *a relatively high stream flow that overflows the natural or artificial banks of a stream or that submerges land not normally below water level*, and, as a natural event, is caused in a variety of ways. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce flooding. The excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto lowlands, adjacent to rivers, lakes, and oceans which are subject to recurring floods; most commonly referred to as floodplains. Currently, floodplains in the U.S. encompass over nine million households.

Factors determining the severity of floods include:

- Rainfall intensity and duration
  - A large amount of rain over a short time can result in flash flooding.
  - Small amounts may cause flooding where the soil is already saturated.
  - Small amounts may cause flooding if concentrated in an area of impermeable surfaces.
- Topography and ground cover
  - Water runoff is greater in areas with steep slopes and little vegetation.

Frequency of inundation depends on the climate, soil, and channel slope. In regions without extended periods of below-freezing temperatures, floods usually occur in the season of highest precipitation.

Types

There are a multitude of reasons that floods may occur, with each type of flooding having a variety of environmental effects post-flood, and are generally grouped into seven (7) types; regional, river or riverine, flash, ice-jam, storm surge, dam and levee failure, and debris, landslide, and mudflow flooding.

- *Regional Flooding* can occur seasonally when winter or spring rains, coupled with melting snow, fill river basins with too much water too quickly. The ground may be frozen, reducing infiltration into the soil and thereby increasing runoff. Extended wet periods during any part of the year can create saturated soil conditions, after which any additional rain runs off into streams and rivers, until river capacities are exceeded. Regional floods are many times associated with slow-moving, low-pressure or frontal storm systems including decaying hurricanes or tropical storms.

- *River or Riverine Flooding* is a high flow or overflow of water from a river or similar body of water, occurring over a period of time too long to be considered a flash flood.

- *Flash Floods* are quick-rising floods that usually occur as the result of heavy rains over a short period of time, often only several hours or even less. Flash floods can occur within several seconds to several hours and with little warning. They can be deadly due to the rapid rises in water levels and devastating flow velocities produced.

- *Ice-Jam Flooding* occurs on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur. Backwater upstream from the ice dam can rise rapidly and overflow the channel banks. Flooding moves downstream when the ice dam fails, and the water stored behind the dam is released. At this time the flood takes on the characteristics of a flash flood, with the added danger of ice flows that, when driven by the energy of the flood-wave, can inflict serious damage on structures. An added danger of being caught in an ice-jam flood is hypothermia, which can quickly kill.

- *Storm-surge flooding* is water which is pushed up onto otherwise dry land by onshore winds. Friction between the water and the moving air creates drag which, depending upon the distance of water (fetch) and the velocity of the wind, can pile water up to depths greater than 20 feet. Intense, low-pressure systems and hurricanes can create storm-surge flooding. The storm surge is unquestionably the most dangerous part of a hurricane as pounding waves create very hazardous flood currents.

- *Dam-and Levee-Failure Flooding* are potentially the worst flood events. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a dam fails, an excess amount of water is suddenly released downstream, destroying anything in its path. Dams and levees are built for flood protection. They usually are engineered to withstand a flood with computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. If during the overtopping the dam or levee fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

- *Debris, Landslide, and Mudflow Flooding* is created by the accumulation of debris, mud, rocks, and logs in a channel, forming a temporary dam. Flooding occurs upstream as water becomes stored behind the temporary dam and then becomes a flash flood when the dam is breached and rapidly washes away. Landslides can create large waves on lakes or embankments and can be deadly. Mudflow floods can occur when volcanic activity rapidly melts mountain snow and glaciers, and the water mixed with mud and debris moves rapidly down slope.

Facts

- Floods caused by Hurricane Katrina resulted in over $200 billion in losses, resulting in the most costly natural disaster in U.S. history.
- The average annual losses due to flooding in the U.S. are about $6 billion.
- Flooding is the most common natural disaster in the United States.
- More than 2,200 lives were lost in the Johnstown, Pennsylvania flood of 1889, a flood that was caused by a dam failure.
- 80% of flood deaths occur in vehicles, and most happen when drivers try to navigate through flood waters.

States Incurring the Highest Number of Flood Fatalities 1960 – 1995

Texas	612
California	255
South Dakota	248
Virginia	241
West Virginia	240

[Source: Flood Safety, http://www.floodsafety.com/national/life/statistics.htm]

Effects on People

Though fatalities associated with flooding have steadily declined in the U.S. over the last half century, the average annual death toll is still over 200. Advanced warning systems are now commonplace and give residents time to plan, but an increase in urban and coastal development has caused the monetary losses associated with flooding to increase drastically.

Most homeowners' insurance policies do not cover floodwater damage, so homeowners without flood insurance are at a high risk for loss of private property. In the state of Texas alone, homeowners have received over $2,249,450,933 since 1978 in flood loss payments. Texas has the highest total collective flood loss payment in the United States, followed by Louisiana, Florida, New Jersey, the Carolinas, Missouri, New York, California, and Pennsylvania.

[Source: FEMA]

Hazard Profile: Flood

Profile Risk Table

Period of Occurrence	For river flooding - January through May For flash flooding - Anytime, but primarily during summer rains
Number of Events to Date: 1960 to 2009 Sheldus Data	49
Past Damages: Sheldus Data	$1,952,649,993
Annual Chance of Probability Ratio	5.39
Warning Time	River flooding - 3-5 days Flash flooding - minutes to several hours Out-of-bank flooding - several hours/days
Potential Impacts	Impacts human life, health, and public safety. Utility damages and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Can lead to economic

	losses such as unemployment, decreased land values, and agribusiness losses. Floodwaters are a public safety issue due to contaminants and pollutants.

Geographic Locations Affected

Flooding, which is one of the most significant natural hazards in Kentucky, occurs within the state every year, with several substantial floods occurring annually. Within the last three (three) years three (3) Presidentially-declared flood disasters have resulted in significant damages in over 80 counties across the state. Kentucky's topography contains 13 major drainage basins to accommodate 40-50 inches of average rainfall (maximum during winter and spring, minimum during late summer and fall), The state contains 89,431 miles of rivers and streams, 637,000 acres of wetlands, 18 reservoirs over 1,000 acres in size, and 228,382 acres of publicly-owned lakes and reservoirs.

It is no surprise, given the above statistics, approximately 300 communities statewide have identified flood-prone areas; and for many of the communities the economic, social, and physical damage caused by flooding can be severe.

Previous Occurrences

The following is a list of flood-related Presidential Declarations in Kentucky from 1970 to the present. Because only major disasters are included, a number of isolated, smaller events are not listed.

Kentucky Presidential Flood Disaster Declarations

Declaration Date	Counties Affected
February 2, 1970	12
June 5, 1970	13
May 15, 1972	10
March 29, 1975	17
April 6, 1977	15
December 12, 1978	37
May 15, 1984	23
February 24, 1989	67
June 30, 1989	12
October 30, 1989	11
January 29, 1991	19
March 16, 1994	68
June 13, 1995	69
March 3, 1997	101
August 15, 2001	20
April 4, 2002	30
May 7, 2002	32

August 19, 2004	26
March 10, 2005	27
May 25, 2007	9
February 21, 2008	23
May 19, 2008	15
February 5, 2009	104
May 29, 2009	24
August 14, 2009	2
May 11, 2010	85

(Source: Kentucky Division of Emergency Management)

A number of significant flooding incidences occurred in late 19th and early 20th centuries within the state, including an event in February 1884 lasting almost two weeks. On February 14, 1884, the Ohio River crested at 48 feet in Louisville; 24 feet above the base flood stage. Towns as far away as Paducah were also inundated for long periods of time.

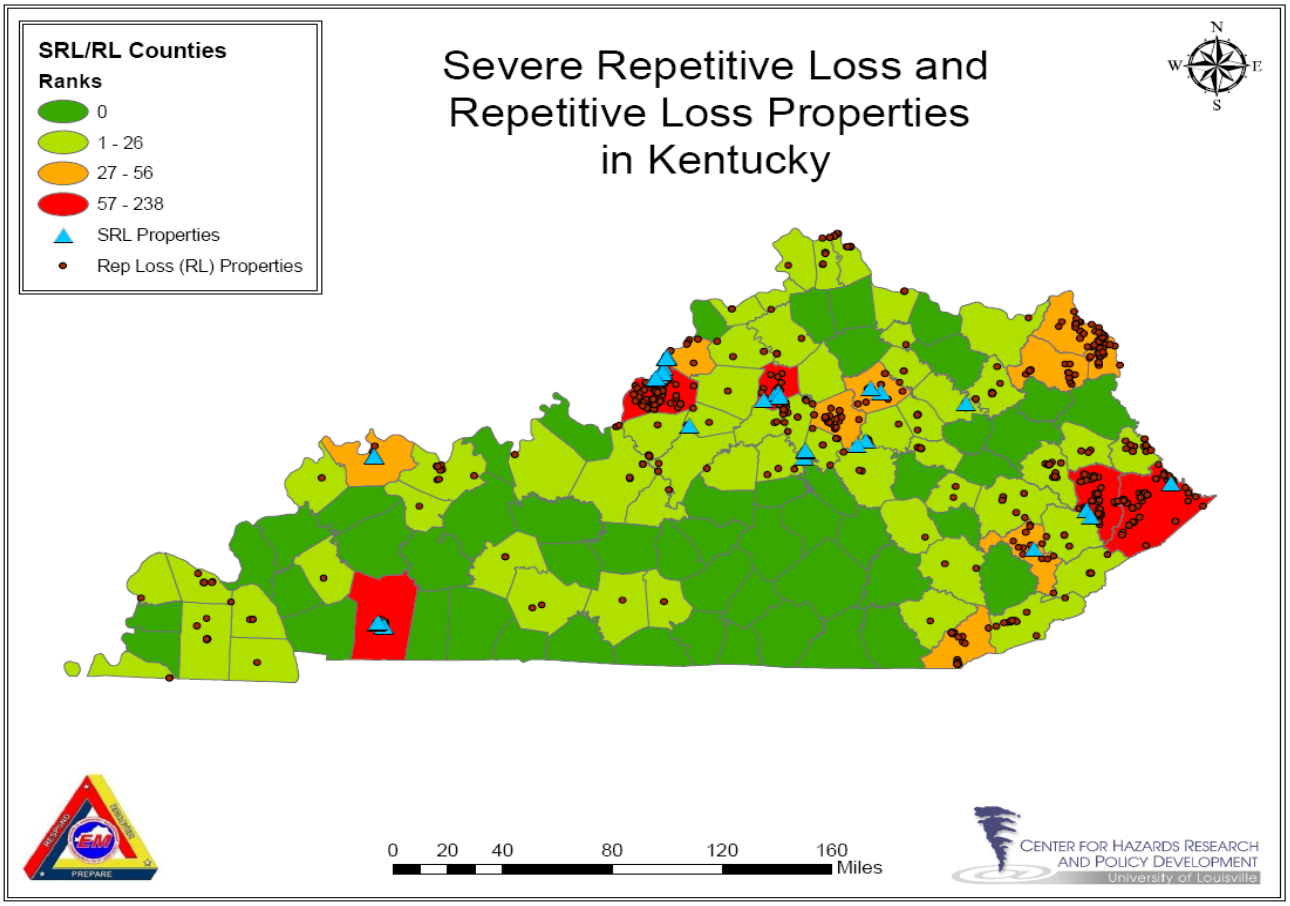
In January of 1913, unseasonably high amounts of rain in Kentucky, Indiana, and Ohio caused almost every major river and stream in the state to flood, leading to what U.S. Weather Bureau officials referred to as “vast inland seas”. In the Louisville area alone property damages were estimated at over $200,000 and crop losses totaling over $50,000.

The flood of 1937 is one of the most devastating floods in Kentucky history. In the month of January the state incurred four times the normal amount of precipitation. With the river crested at over 57 feet in Louisville, 75% percent of the city was underwater and over 175,000 residents were evacuated. Further downstream in Paducah, where the river crested at over 60 feet, residents were evacuated as well. The damages incurred by the entire state were estimated at $250 million, an extremely large sum for the economic climate of the 1930s.

In August 2009, a record high rainfall for a single day occurred in the Louisville area; a record unbroken since 1879. During this event 4.53 inches of rain fell at Louisville International Airport, with 3 inches falling within one hour. The Louisville Free Public library sustained $1 million dollars in damages and the University of Louisville alone sustained upward of $20 million in damages.

Beginning on Derby Day May 1, 2010 the entire state was inundated with a torrential rain event. A similar deluge in Tennessee impacted rivers flowing into Kentucky. In all 84 Kentucky counties were impacted by this event and a Presidential declaration is issued on May 11, 2010. Three weeks after the storm, the far western areas of the Commonwealth were still submerged. FEMA resources were deployed to implement both the Public Assistance Program and the Individuals and Households Assistance Program. It is estimated that Public Assistance projects will exceed $60 million.

The Commonwealth has identified numerous Severe Repetitive Loss (SRL) and Repetitive Loss (RL) properties which both KyEM and KDOW considered to be of high priority for mitigation measures. KyEM and KDOW partnered in the fall of 2007 to initiate an effort to obtain accurate locations of SRL and RL properties. This project, funded by KDOW, focused on the identification of properties for potential acquisition and to define risk areas. Letters and AW501 forms were sent to local floodplain administrators. Administrators were asked to examine their respective communities to verify SRL and RL properties identified. This processed enhanced the SRL/RL database with improved addresses which were used to create the following map.

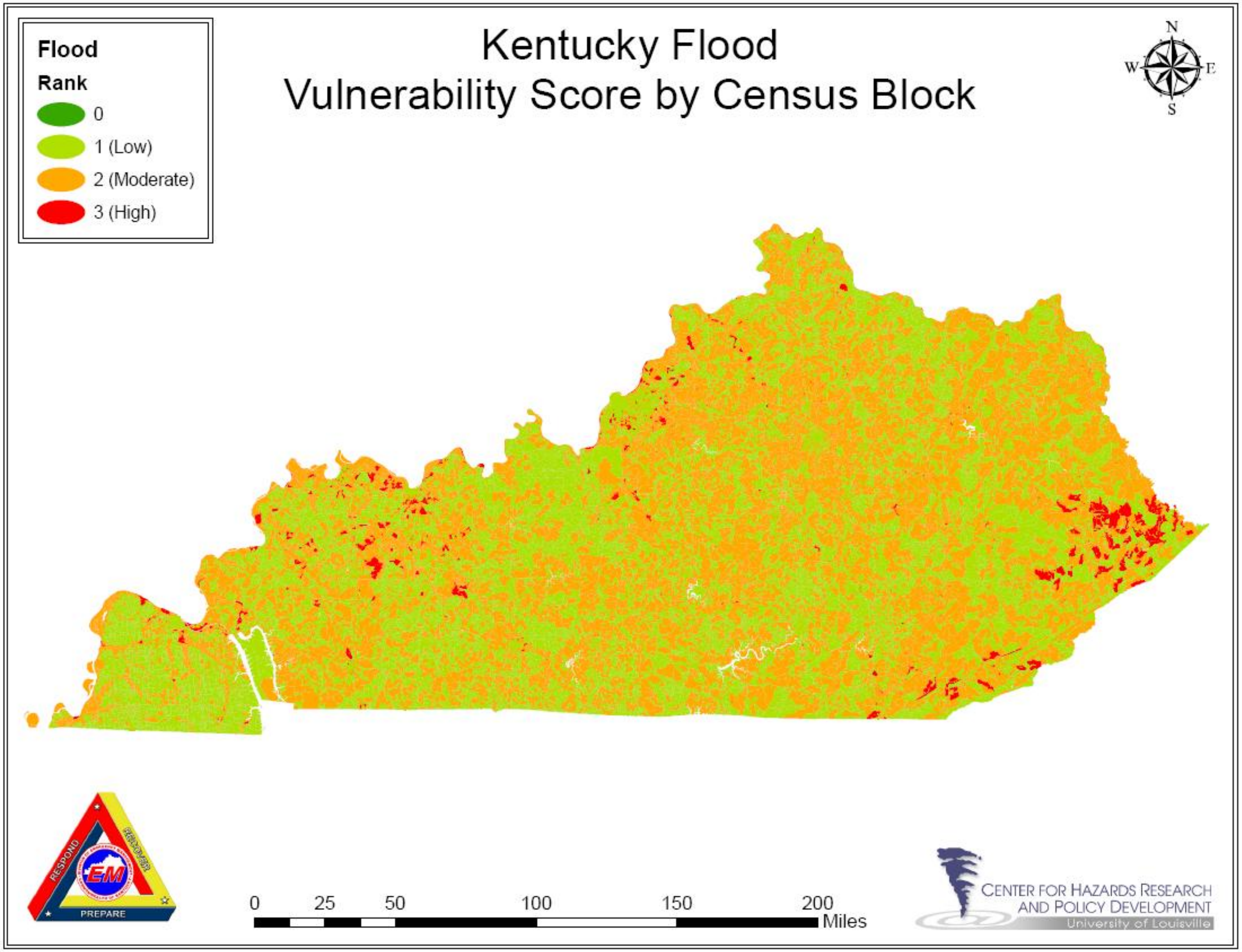


Assessing Vulnerability by Jurisdiction: Flood

Flood Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Flood Risk Score by combining the Layer Rank (LR) and the Annualized Loss Rank (ALR), then multiplying it by the Exposure Score. The Flood LR was determined by calculating the percent of the census block affected by the hazard boundary layer. The hazard boundary layer was created from the new Digital Flood Insurance Rate Maps (DFIRM) for the state. Once the percent of the areas were calculated they were ranked

0-3 (0=N/A, 1=low, 3=high) and then multiplied by two (2) to provide more weight to the LR. This process produced the LR for the Flood Risk Score. The ALR for flood was created by calculating flood occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 60-year timeframe. Each counties ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. The Flood LR and ALR were combined to create the Flood Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Flood Vulnerability Score.


Flood
Rank
0
1 (Low)
2 (Moderate)
3 (High)
Kentucky Flood
Vulnerability Score by Census Block
N
W
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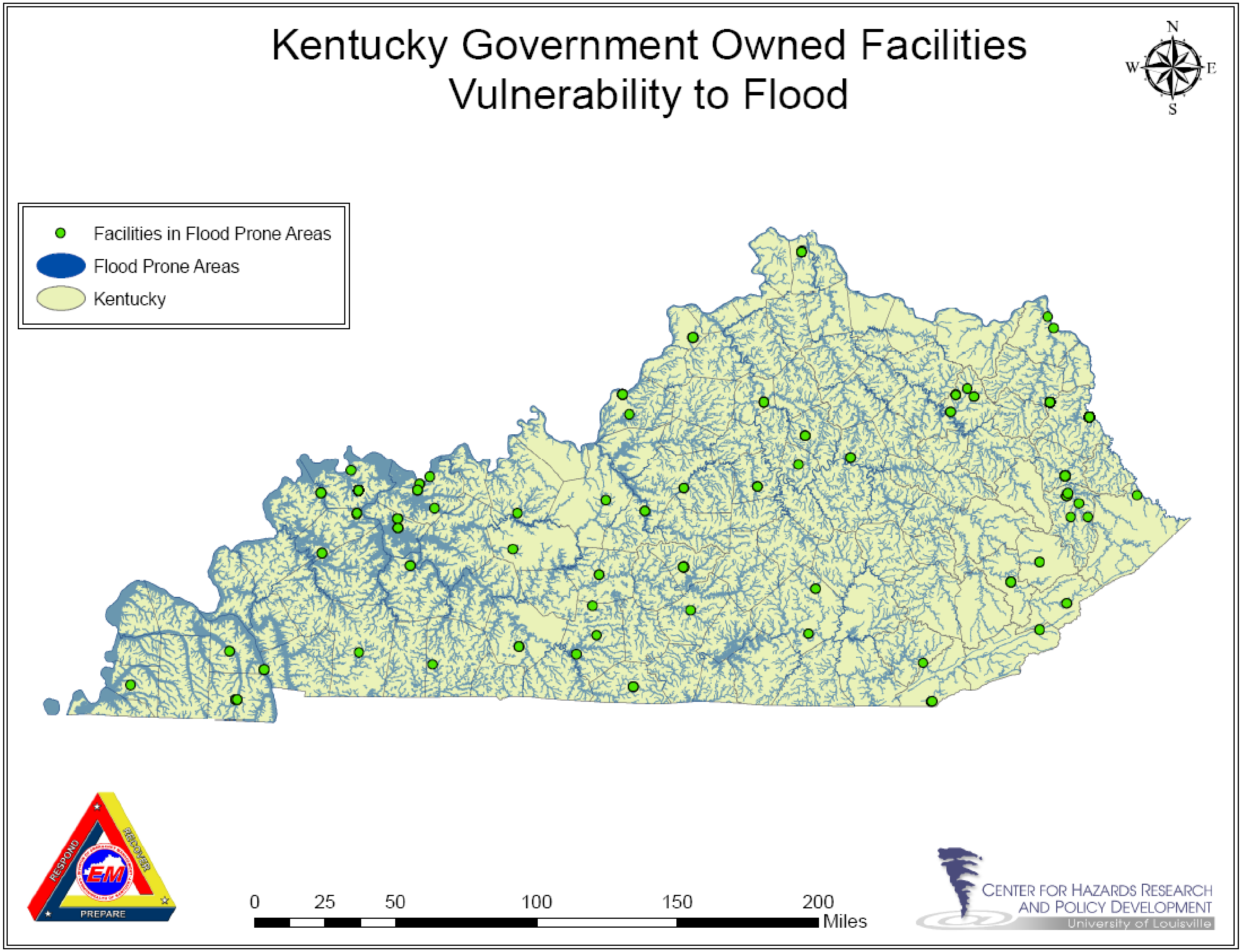
S
PREPARE
RESPOND
RECOVER
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Flood

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Flood. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the actual flood hazard boundary maps (DFIRMS) overlaid onto the Property Rank scores from the Exposure Score. The Property Rank census blocks that are intersected with the flood hazard boundary maps are pulled out and are estimated to be damaged from a flood event. This produces a hazard boundary specific loss estimation model based on the GIS spatial analysis of a hazard boundary layer compared to dollar property exposure. See Appendix 24 for a jurisdictional (county) loss estimate for Flood.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Flood

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The flood hazard boundary maps (DFIRMS) were used as the hazard layer for Flood. The state facilities were placed into a GIS mapping session and overlaid onto the DFIRMS. The state facilities captured within each flood hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Flood event. See Appendix 25 for a county breakdown of how many state facilities are located within a flood hazard boundary layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Flood
N
W
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S
Facilities in Flood Prone Areas
Flood Prone Areas
Kentucky
RESPOND
RECOVER
PREPARE
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25
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200
Miles
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AND POLICY DEVELOPMENT
University of Louisville

4.1.6 Hail

Hazard Identification: Hail

Description

Hail is a type precipitation which is formed when updrafts in thunderstorms carry raindrops into extremely cold areas of the atmosphere and freezes them. These frozen raindrops grow by colliding with super-cooled water drops creating ‘hailstones’. Thunderstorms which have a strong updraft keep lifting the hailstones up to the top of the cloud, increasing the amount of moisture they collect. The hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft, the larger the hailstone can grow.

Types

Hail is commonly associated with severe storms. While severe storms and super cell storms usually produce the most damaging hail occurrences, many non-super cell storms have produced golf ball size hail. Storms which produce hail are more frequent during the late spring and early summer months.

Although there is no scientific classification of hail, the NOAA provides the following comparisons to identify hail sizes with common items.

Non-Severe Sizes	**Measurement**
Pea	1/4 inch diameter
Marble	1/2 inch diameter

Severe Sizes	**Measurement**
Dime/Penny	3/4 inch diameter
Nickel	7/8 inch
Quarter	1 inch
Ping-Pong Ball	1 1/2 inches
Golf Ball	1 3/4 inches
Tennis Ball	2 1/2 inches
Baseball	2 3/4 inches
Tea Cup	3 inches
Grapefruit	4 inches
Softball	4 1/2 inches

It is important to note that the severe designation for hail is based on a 1952 study of the "smallest size of hailstones which cause significant damage at airplane speeds between 200 and 300 mph”.

Facts

- The **largest** hailstone fell on June 23, 2003 in Aurora, Nebraska and had a diameter of 7.0 inches, a circumference of 18.75 inches, and weighed slightly less than 1 lb. The **heaviest** hailstone fell in Coffeeville, Kansas on September 3, 1970 and weighed 1.67 lbs. It had a diameter of 5.7 inches and a circumference of 17.5 inches.
- Hailstones scan fall at speeds of up to 120 miles an hour.
- In the United States, hail is responsible for nearly $1 billion in damage to crops and property each year.

Impacts

- The primary impacts of hail are mainly property and infrastructure damages and personal injuries. Although extensive damage occurs as a result of hail, the event by itself causes few if any additional hazards.

Hazard Profile: Hail

Profile Risk Table

Period of Occurrence	Frequented with severe storms which are most prevalent in Kentucky from April to June. Severe storms can occur whenever conditions are favorable however. As such, hail can occur at anytime of the year, although it is a rarity in off season months.
Number of Events to Date: 1960 to 2009 Sheldus data	49
Past Damages: 1960 to 2009 Sheldus data	$881,973,477
Annual Chance Probability Ratio	3.88
Warning Time	Prediction of hail as a contained event is very difficult. Providing any warning in advance for a threat of hail relies mostly on tracking storm systems which are capable of producing hail. Assuming hail is a possibility, when severe storms are approaching the best warning for hail is this point in time.
Potential Impacts	Impacts to human life, health, and public safety are possible. Utility damage and failure, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases are additional impacts.

Historical Impact

SIGNIFICANT HAIL EVENTS IN KENTUCKY SINCE 1993

Date	Location (County)	Magnitude	Property Damage (Rounded)	Crop Damage
4/16/1998	Warren	2.75 in	$510 M	0
5/01/2002	Pulaski	4.5 in	$5 M	$1 M
5/01/2002	Laurel	4.5 in	$30 M	$2 M
5/01/2002	Rockcastle	2.75 in	$4.5 M	$1 M
5/04/2003	McCracken	2.5 in	$20 M	0
5/04/2003	Marshall	2.75 in	$10 M	0

(Data obtained from SHELDUS DATA and 2007 State Plan; no record of devastating hail events since the 2007 plan**)**

The effects of hailstorms range from minimal to severe damage, to anything from personal property to community infrastructure. According to SHELDUS data obtained from the Hazards & Vulnerability Research Institute at the University of South Carolina, Kentucky has experienced only 19 significant hail events in the past 3 years. None of these events however surpass the damages resulting from those listed in the table above. This is a curious number for the past three years, considering that the NOAA reported approximately 493 in 2002 and 2003. The difference hopefully helps to show not only the unpredictability of the storms, but also how important it is to acquire accurate occurrence data.

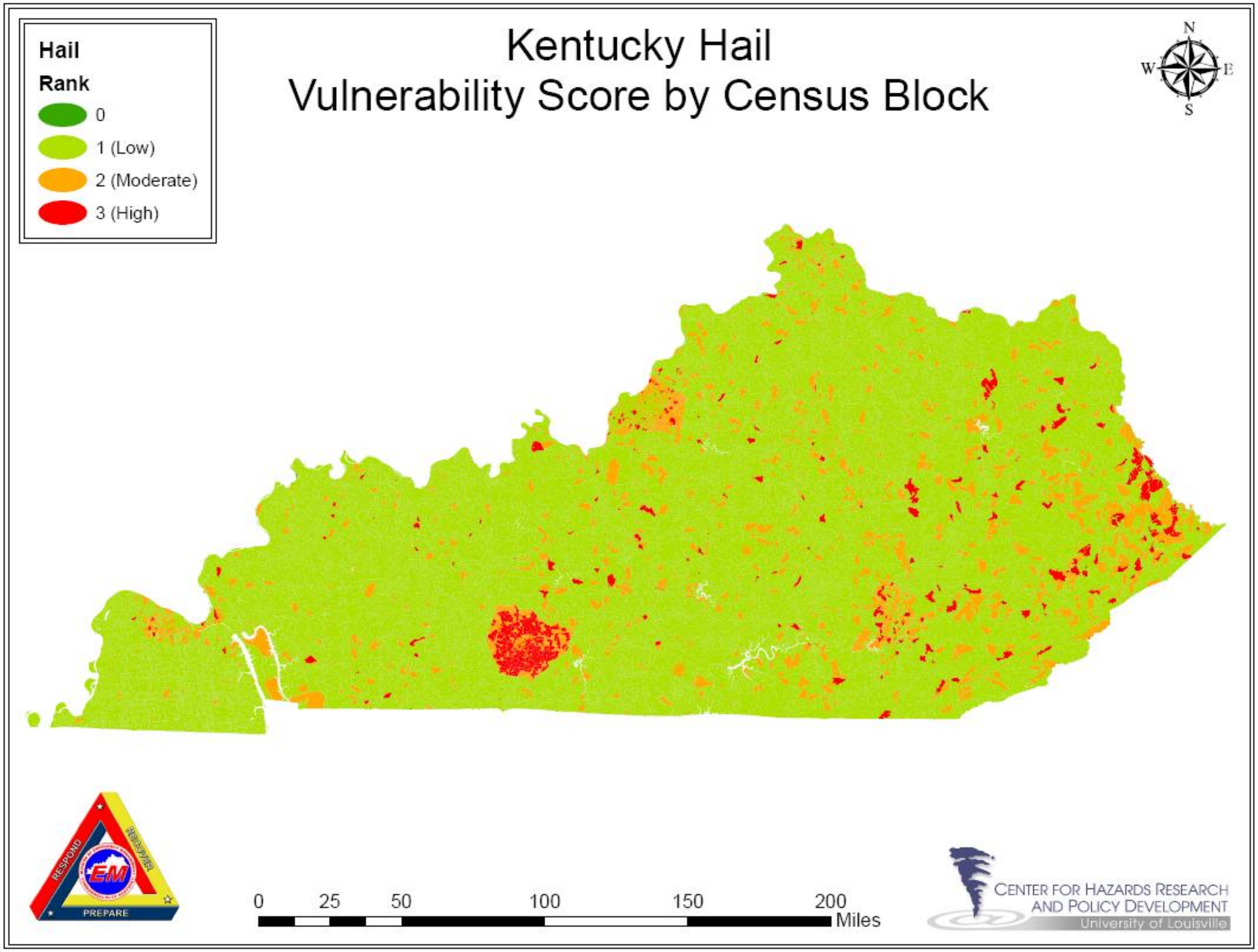
Specific Instances in Kentucky

There has been one instance in Kentucky that best demonstrates the destructive capacity of hailstorms. On April 16, 1998 a severe line of storms passed through Adair, Warren, Barren, and Metcalfe counties in Kentucky. This storm system created hail in some areas which was recorded as baseball-size. The city of Bowling Green was devastated by the massive amounts of hail falling from the line of storms. There were 8,300 homes, 900 mobile homes, 4,000 vehicles, 37 businesses, and 14 apartments which sustained major damage. Minor damage was reported for 1,300 homes, 6,000 vehicles, 42 business, and 4 churches. The total damage in the Micropolitan Statistical Area was estimated at $510 million. Additionally, several people received minor injuries after being struck by falling hail.

Assessing Vulnerability by Jurisdiction: Hail

Hail Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Hail Risk Score employing the Annualized Loss Rank (ALR) and Layer Rank (LR) multiplied by the Exposure Score. The ALR for Hail was created by calculating Hail occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 50 year timeframe. Each counties ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. The LR for Hail was determined by taking data provided from the NOAA SVRGIS database (geo-referenced hail location data) and cumulating how many occurrences have occurred in each census block. The number of occurrences for each block were then calculated and ranked 0-3 (0=N/A, 1=low, 3=high). The Hail ALR and LR were then added together and ranked 0-3 (0=N/A, 1=low, 3=high) which created the Hail Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Hail Vulnerability Score.


Kentucky Hail
Vulnerability Score by Census Block
Hail
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
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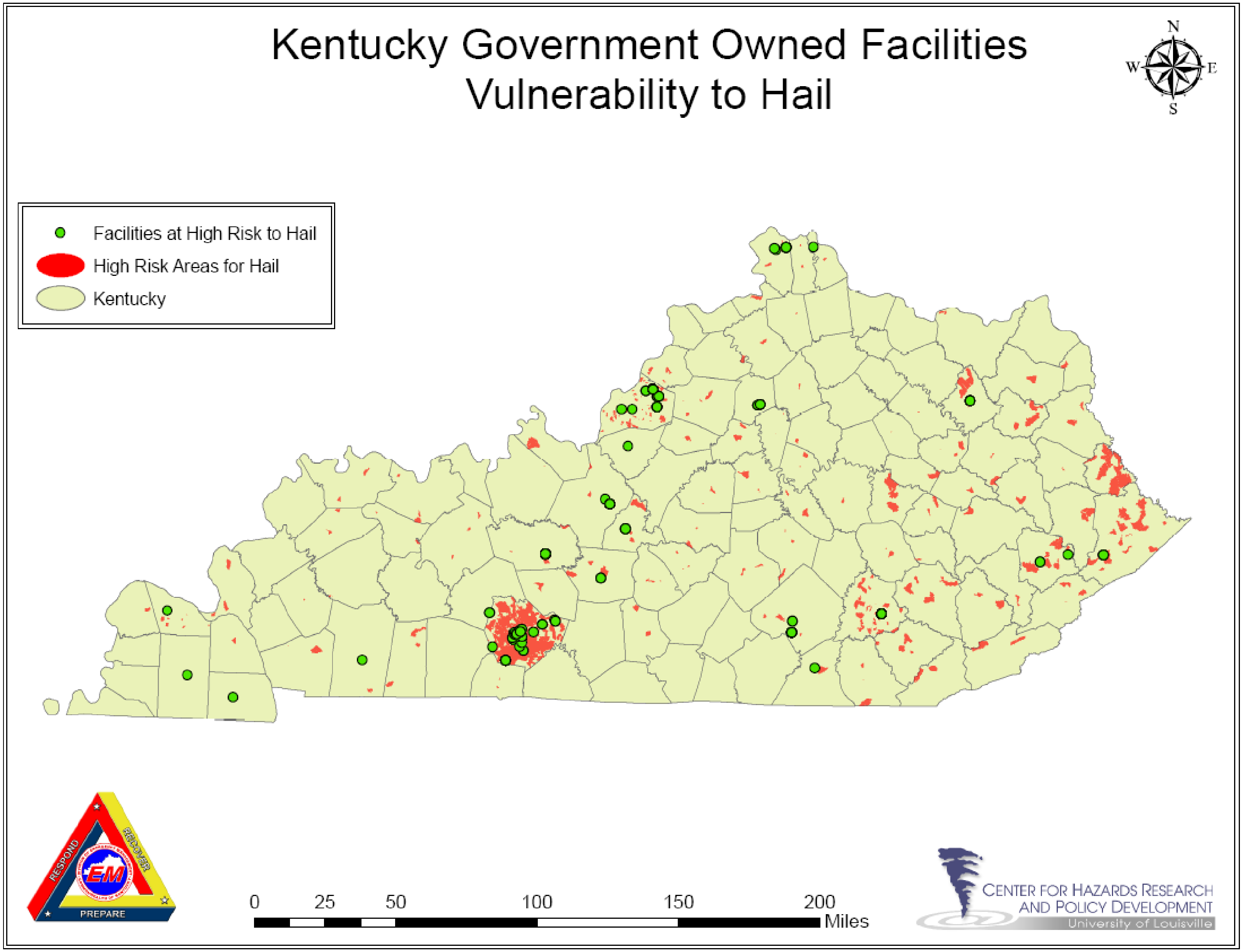
0
25
50
100
150
200
Miles
RESPOND
PREPARE
EM
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Hail

The *Annualized Loss Rank (ALR) loss estimate model* was used to estimate losses for Hail. Potential loss for jurisdictions can be calculated by using the ALR created from the Average Annual Risk data captured for each county. This produces a loss estimation model based on actual loss and occurrence data that has occurred over a set period of time. See Appendix 26 for a jurisdictional (county) loss estimate for Hail.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Hail

This process was performed using level (3) block Risk Scores as the hazard layer for Hail. The state facilities were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Hail event. See Appendix 27 for a county breakdown of how many state facilities are located within a level (3) Hail hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Hail
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Facilities at High Risk to Hail
High Risk Areas for Hail
Kentucky
RESPOND
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Miles
Center for Hazards Research and Policy Development
University of Louisville

4.1.7 Karst/Sinkhole

Hazard Identification: Karst/Sinkhole

Description

A term stemming from a Slavic word meaning "barren, stony ground", Karst refers to *a terrain with distinctive landforms and hydrology created from the dissolution of soluble rock—such as limestone and other carbonate rocks—and is characterized by springs, caves, sinkholes, and a unique hydrology*.

Karst topography is formed by the erosion of rock due to rain and underground water and is primarily characterized by closed depressions or sinkholes and underground drainage. During the formation of karst terrain, water percolating underground enlarges subsurface flow paths by dissolving the rock. As some subsurface flow paths are enlarged over time, water movement beneath the surface changes character from one in which ground water flow is initially through small, scattered openings in the rock, to one where the majority of the flow is concentrated in a few, well-developed conduits. As the flow paths continue to enlarge, caves may be formed and the ground water table may drop below the level of surface streams and these streams may then begin to lose water to the subsurface. As more of the surface water is diverted underground, surface streams and stream valleys become a less conspicuous feature of the land surface, and are replaced by closed basins. Funnels, or circular depressions called sinkholes, often develop at some places in the low points of these closed basins.

Most commonly seen in karst landscapes, sinkholes are defined as *concentrated areas of depressed landscape due to spaces and caverns that have developed underground in soluble rocks by the groundwater running through them*. Sinkholes may vary in area from a just a few square feet to over 100 acres and may vary in depth from just under one (1) foot to over 100 feet deep; though they typically average ten to thirty feet in depth. Most often sinkholes develop slowly over very long periods of time, but occasionally the collapse of large sinkholes cause substantial changes to the landscape and pose a threat to human populations and structures in the immediate area. The presence of karst topography and sinkholes poses a threat not only to populations and built structures, but poses a significant threat to groundwater supplies as well. For the purposes of this document, however, the focus will remain on the potential risk caused by the development of karst topography and sinkholes in terms of potential damage sustained by structures and harm posed to human populations.

Due to unique geological composition, Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania are the most at-risk states in the U.S. in terms of experiencing karst/sinkhole related events.

Because sinkholes are often very large in size, many are improperly classified as other geologic phenomena and structures are built on them. Agencies in some states are working jointly to assess the geologic composition of the terrain in conjunction with zoning laws in regions where karst/sinkholes appears to be a problem.

Sinkhole plain before a rain. Sinkhole plain after a rain.

Good indicators of the development of sinkholes include; circular and linear cracks in soil, asphalt, and concrete paving and floors; depressions in soil or pavement which commonly result in ponds of water; slumping, sagging, or tilting of trees, roads, rails, fences, pipes, poles, sign boards, and other vertical or horizontal structures; downward movement of small-diameter vertical or horizontal structures; fractures in foundations and walls, often accompanied by jammed doors and windows; small conical holes that appear in the ground over a relatively short period of time; sudden muddying of water in a well which has been producing clear water; and sudden draining of a pond or creek.

Types

Sinkholes develop in a number of ways and can be categorized into five types.

1. *Collapse sinkholes* occur when the bridging material over a subsurface cavern cannot support the overlying material. The cover collapses into the cavern and a large, funnel-shaped depression forms.

2. *Solution sinkholes* result from increased groundwater flow into higher porosity zones within the rock, typically through fractures or joints within the rock. An increase of slightly acidic surface water into the subsurface continues the slow dissolution of the rock matrix, resulting in slow subsidence as surface materials fill the voids.

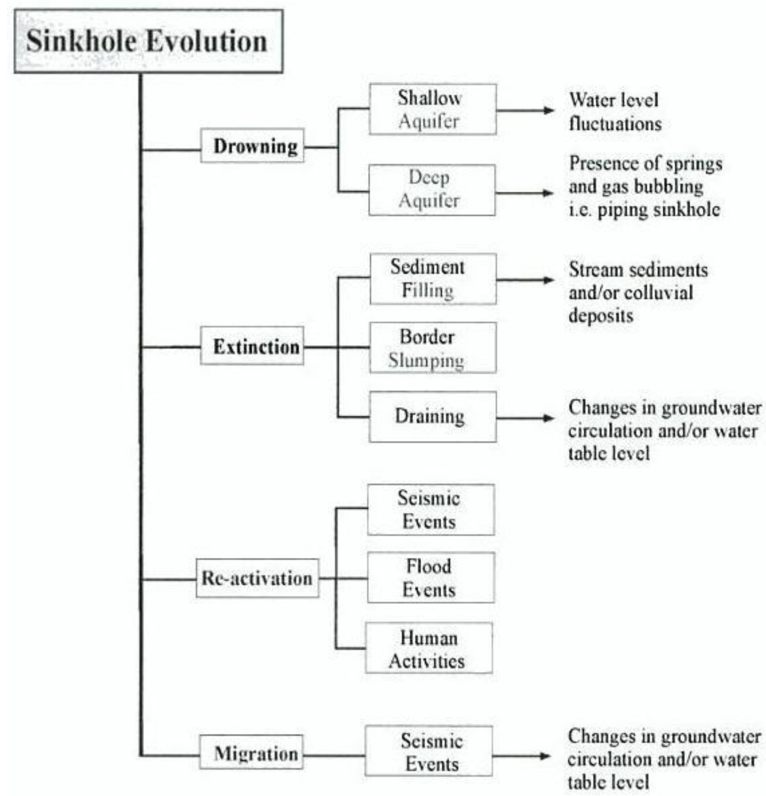
3. *Alluvial sinkholes* are older sinkholes which have been partially filled with marine, wetland, or soil sediments. These features are common in places like Florida, where the water table is shallow, and typically appear as shallow lakes, cypress domes, and wetlands.

4. *Raveling sinkholes* form when a thick overburden of sediment over a deep cavern caves into the void and pipes upward toward the surface. As the overlying material or plug erodes into the cavern, the void migrates upward until the cover can no longer be supported and then subsidence begin

5. *Cover-Collapse sinkholes* occur in the soil or other loose material overlying soluble bedrock. Sinkholes that suddenly appear form in two ways. In the first way, the bedrock roof of a cave becomes too thin to support the weight of the bedrock and the soil material above it. The cave roof then collapses, forming a bedrock-collapse sinkhole. Bedrock collapse is rare and the least likely way a sinkhole can form, although it is commonly incorrectly assumed to be the way all sinkholes form. The second way sinkholes can form is much more common and much less dramatic. The sinkhole begins to form when a fracture in the limestone bedrock is enlarged by water dissolving the limestone. As the bedrock is dissolved and carried away underground, the soil gently slumps or erodes into the developing sinkhole. Once the underlying conduits become large enough, insoluble soil and rock particles are carried away too. Cover-collapse sinkholes can vary in size from 1 or 2 feet deep and wide, to tens of feet deep and wide. The thickness and cohesiveness of the soil cover determine the size of a cover-collapse sinkhole.

Facts

- Evaporite rock common to karst landscapes underlie 35% to 40% of the U.S., though sometimes they are buried deep below the surface.
- Karst landscapes make up one-fifth of the world's land surface. The American Southeast has a proportion almost doubling that of other karstic regions of the world.
- Sixty times more fresh water lies beneath the Earth's surface then on it, so karst landscapes and their underground streams, springs, and aquifers play a key role in supplying water to various populations for thousands of years.
- A few famous karst areas in the United States include Carlsbad Caverns in New Mexico, the many springs of Florida, and the Mammoth Cave system in Kentucky.
- Some geologists believe that sinkhole activity increases after periods of prolonged drought.
- The evolution of a sinkhole is proposed as looking like:



Impacts

The effects of sinkholes and other features typically present in karst terrain vary from the mild to the extreme and can, no doubt wreak havoc on infrastructure in urban areas. Storm-water drainage is of major concern in urban areas underlain by karst geology, as the ground surface area necessary for the even infiltration of rainwater into the groundwater supply system is covered with impervious substances such as blacktop and cement. This imbalance can often have serious consequences, leading to movement of the ground which may rupture sewer lines, natural gas lines, or effect underground utility lines.

In 2009, a fire truck in a Los Angeles suburb, for example, was pulled into a sinkhole which was caused by a series of pipe ruptures which stemmed from geologic phenomena. And in 1994, an area underlain by karst produced a sinkhole the size of a small house that jeopardized Allentown, Pennsylvania's newest office building and thoroughfare. Allentown filled the sinkhole using over 700 cubic yards of concrete.

Groundwater contamination is also more prevalent in acres of karst geology, as percolation occurs more quickly. Contaminants such as oil from automobiles in parking lots, pesticides and herbicides from lawns, and urine and feces from cattle feed lots end up in water supplies used by surrounding communities. This type of contamination is particularly dangerous in areas where private wells are used instead of water that comes from public works. If allowed to filter naturally, an underground water source will take up to 100 human generations to filter its impurities.

Some states now have enacted insurance legislation which provides property owners affected by sinkholes some piece of mind, but many states have yet to specifically address the issue.

Hazard Profile: Karst/Sinkhole

Profile Risk Table

Period of Occurrence	At any time
Number of Events to Date	N/A
Past Damages	N/A
Annual Chance of Probability Ratio	N/A
Warning Time	Weeks to months, depending on monitoring and maintenance
Potential Impacts	Economic losses such as decreased property value and agribusiness losses, and may cause minimal to severe property damage and destruction, may cause geological movement, causing infrastructure damages.

Geographic Areas Affected

Kentucky contains one of the world‘s largest karst-ridden topographies. About 38% of the state has sinkholes which are recognizable on topographic maps, and 25% has obvious and well-developed karst features.

Much of the state‘s beautiful scenery, particularly the horse farms of the Bluegrass, is a direct result of the development of karst landscapes. Many of Kentucky‘s cities are built on karst including Frankfort, Louisville, Lexington, Lawrenceburg, Georgetown, Winchester, Paris, Versailles, and Nicholasville in the Bluegrass and surrounding areas. In the Western Pennyroyal region, the communities of Fort Knox, Bowling Green, Elizabethtown, Munfordville, Russellville, Hopkinsville, and Princeton are affected, and in the Eastern Pennyroyal region affected communities include Somerset, Monticello, and Mount Vernon.

Springs and wells in karst areas supply water to tens of thousands of homes. Much of Kentucky‘s prime farmland is underlain by karst, as is a substantial amount of the Daniel Boone National Forest with its important recreational and timber resources. Caves are also important karst features, providing recreation and unique ecosystems. Mammoth Cave is the longest surveyed cave in the world, with more than 350 miles of passages. Two (2) other caves in the state stretch more than 30 miles, and nine (9) Kentucky caves are among the 50 longest caves in the United States.

Because of these formations, Kentucky is ranked fifth in the nation of states affected by sinkholes. The most noticeable hazards in Kentucky in regards to sinkholes are sinkhole flooding and cover collapse. Damage to infrastructure from these two (2) causes is so common in Kentucky, in fact, that it is typically dealt with by local authorities as a routine matter and collapses are seldom reported to any central agency.

Past Occurrences

In Kentucky, infrastructure damage from karst is common, as a number of dams are built in karst areas. The Wolf Creek Dam, for example, on Cumberland Lake in southeastern Kentucky was constructed in the 1940s on permeable Lower Mississippian calcareous siltstones interbedded with reef carbonates, Devonian black shale, and Upper Ordovician dolomites. The Wolf Creek Dam is on the Cumberland River in the Western part of Russell County, Kentucky. It was constructed to generate hydroelectricity and prevent flooding but is better known for creating Lake Cumberland, which has become a popular tourist attraction and is also the largest man-made lake, by volume, east of the Mississippi River. Lake Cumberland, along with Dale Hollow Dam, Center Hill Dam, and J. Percy Priest Dam provide an adequate supply of water to enhance navigation on the mainstream of the Cumberland River from Celina, Tennessee, to the Ohio River. The lake is a source of recreation that has attracted more visitors (4.89 million) than Yellowstone National Park (2.87 million). Designed and constructed during the period 1938-1952, the 5,736 foot-long dam is a combination rolled-earth fill and concrete gravity structure.

Although karst conduits and caves were encountered and remediated, the extent of karst development at the site was not fully recognized during construction. In the late 1960s, sinkholes developed near the downstream toe of the dam where reservoir water was passing beneath the cutoff trench. The problem was solved with a diaphragm cutoff wall nearly 4,500 feet long and up to 278 feet deep. The repairs cost millions of dollars and could have been avoided if the original builders had obtained better on-site geological data.

From 1968 through 1979, efforts were made to respond to technical issues affecting the dam with water undercutting the dam at it's base. By the end of 1979, the Corps of Engineers had conducted a "grout" campaign as well as constructed a concrete dam in front of the earthen dam to assist in maintaining water in the Lake. In 2005, the dam was discovered to have developed leaks under the earthen part of the dam. The center of the earthen dam is filled with a concrete slab that has already been extended. Minor repairs began in 2006, with major repairs beginning in 2007, and extending into and continuing as of March 2010.

The Division of Emergency Management has been directly involved since 2005 with the development of a joint dam planning group, consisting of, the Army Corps of Engineers, Federal Emergency Management Agency, and Emergency Management Representatives from Clint, Cumberland, Monroe, and Russell Counties. Evacuation and sheltering plans were developed in coordination with the Wolf Creek Dam Emergency Action Plan. The plans are reviewed and updated as required and will be in effect until such time as the rehabilitation projects managed by the Corps of Engineers is finished.

Throughout the state, many other reservoirs of all sizes have leaking dams or leakage through carbonate bedrock around the dam, including leakage through caves passing under the dam of Shanty Hollow Lake in Warren County and leakage through bedrock that forms the abutment bank of Spa Lake in Logan County.

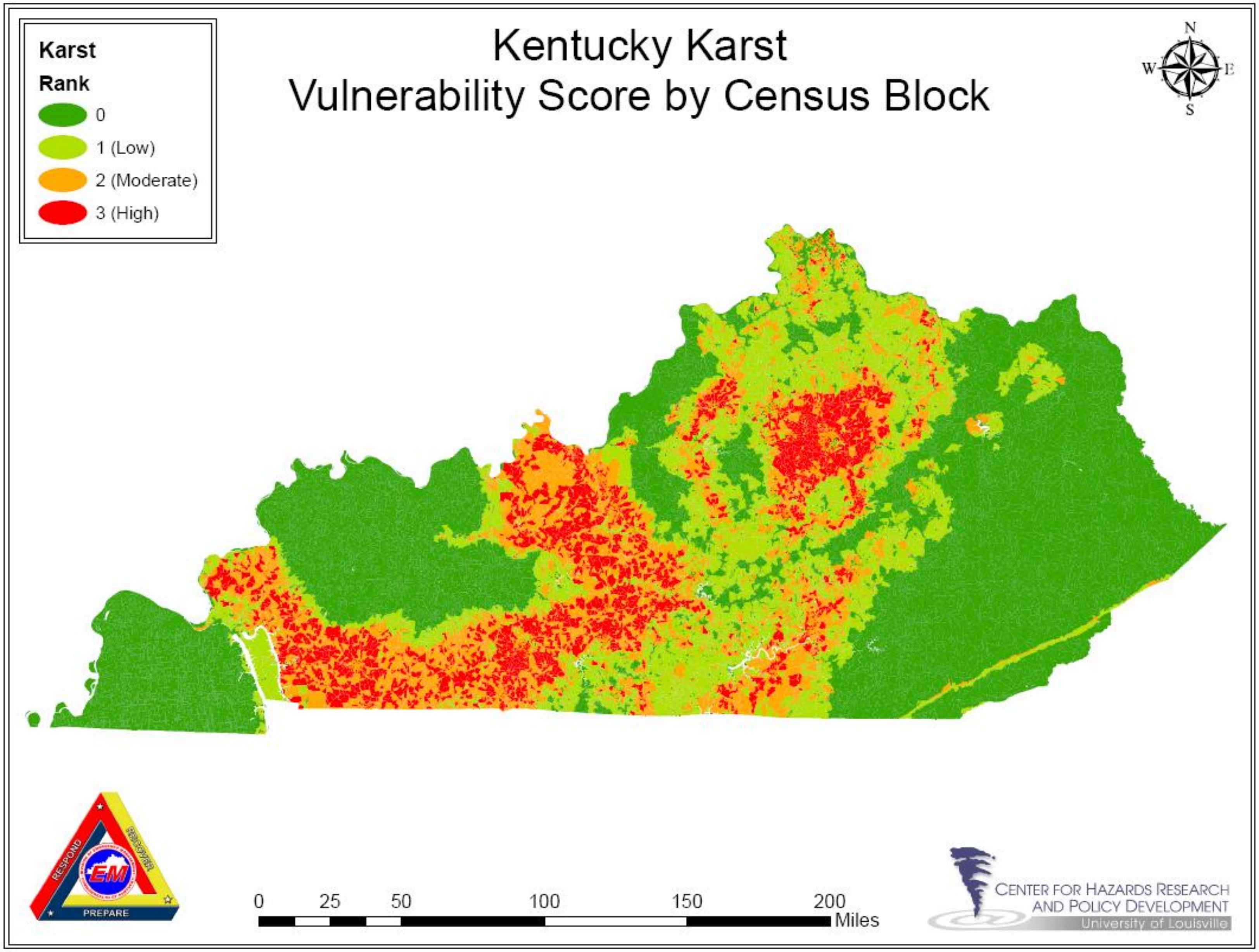
Highways are also vulnerable. In the mid-1990s, a cover-collapse sinkhole appeared overnight in the northbound lane of Interstate 65 near Elizabethtown. Fortunately, no one drove into it, but it did require extensive repairs. Exceptional costs for highway construction projects and repairs to existing roadways since 1995 are estimated to exceed a half million dollars a year.

In 2008, Louisville Metro Government introduced local karst regulations which were adopted by Louisville Metro Government Council. These regulations are now part of the Louisville Development Code. The new regulations assigns responsibility to the Louisville Metro Government Planning and Design Services for the receipt and reporting of information regarding karst/sinkhole locations indicated on development plans.

Assessing Vulnerability by Jurisdiction: Karst

Karst Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Karst Risk Score employing the Layer Rank (LR) and multiplying it by the Exposure Score. The Karst LR was determined by calculating the percent of the census block affected by the hazard boundary layer. The hazard boundary layer was created from the Kentucky Geological Survey (KGS) Karst boundary map. Once the percent of the areas were calculated they were ranked 0-3 (0=N/A, 1=low, 3=high). This process produced the Karst Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Karst Vulnerability Score.



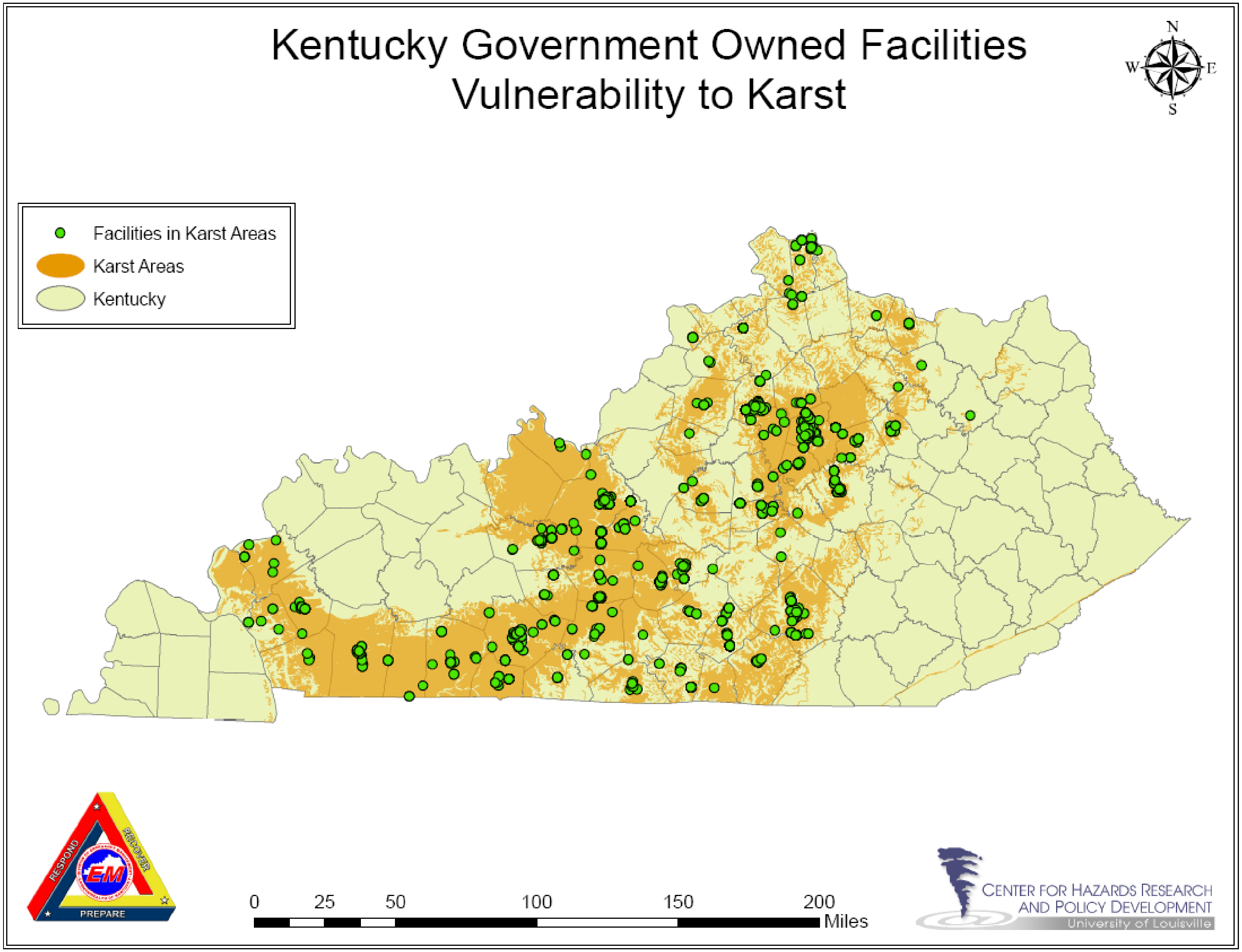
Kentucky Karst
Vulnerability Score by Census Block
Karst
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
W
E
S
0
25
50
100
150
200
Miles
RESPOND
PREPARE
EM
Center for Hazards Research
and Policy Development
University of Louisville

Estimating Potential Losses by Jurisdiction: Karst

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Karst. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the KGS Karst boundary map overlaid onto the Property Rank scores from the Exposure Score. The Property Rank census blocks that are intersected with the Karst hazard boundary maps are pulled out and are estimated to be damaged from a Karst event. This produces a hazard boundary specific loss estimation model based on the GIS spatial analysis of a hazard boundary layer compared to dollar property exposure. See Appendix 28 for a jurisdictional (county) loss estimate for Karst.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Karst

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The KGS Karst boundary map was used as the hazard layer for Karst. The state facilities were placed into a GIS mapping session and overlaid onto the KGS Karst boundary map. The state facilities captured within each Karst hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Karst event. See Appendix 29 for a county breakdown of how many state facilities are located within a Karst hazard boundary layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Karst
N
W
E
S
Facilities in Karst Areas
Karst Areas
Kentucky
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

4.1.8 Mine Subsidence

Hazard Identification: Mine Subsidence

Description

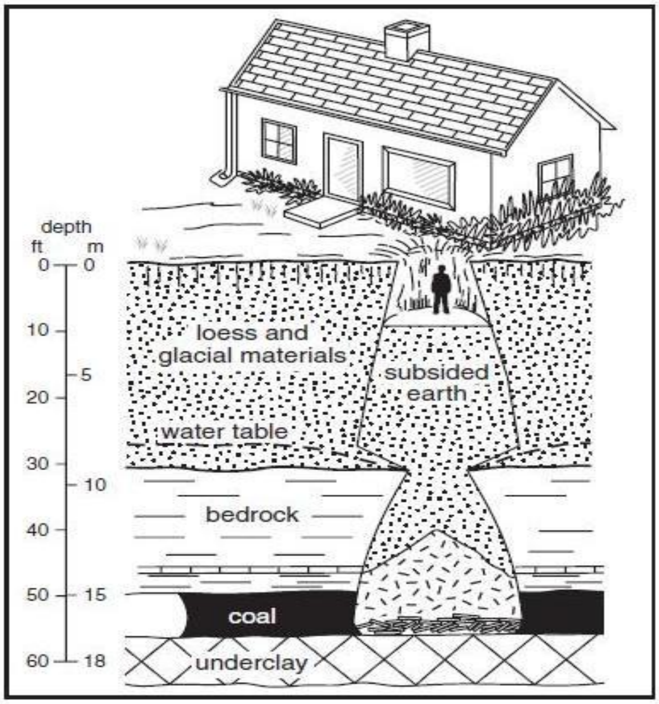
General forms of land subsidence most often occur when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts as voids form in place of the water. As more water is withdrawn, the rock falls in on itself. The occurrence of land subsidence may easily go unnoticed because it generally covers large areas and develops gradually.

Mine subsidence, a more specific type of land subsidence, can be defined as *movement of the ground surface as a result of readjustments of the overburden due to collapse or failure of underground mine workings*. Surface subsidence features usually take the form of either very large sinkholes referred to as pits or troughs.

Mine subsidence is most often associated with coal mines, but can also be attributed to the mining of other minerals such as lead and zinc. Subsidence caused by these prior operations can wreak havoc on structures, causing large cracks in foundations, walls, and ceilings, separation of chimneys, porches, and steps from the structure, and the breakage of water, sewer, and gas lines. Popping and cracking can be heard as the structure settles and often, windows will break as well while settlement occurs. Many of the problems may occur simultaneously.

Types

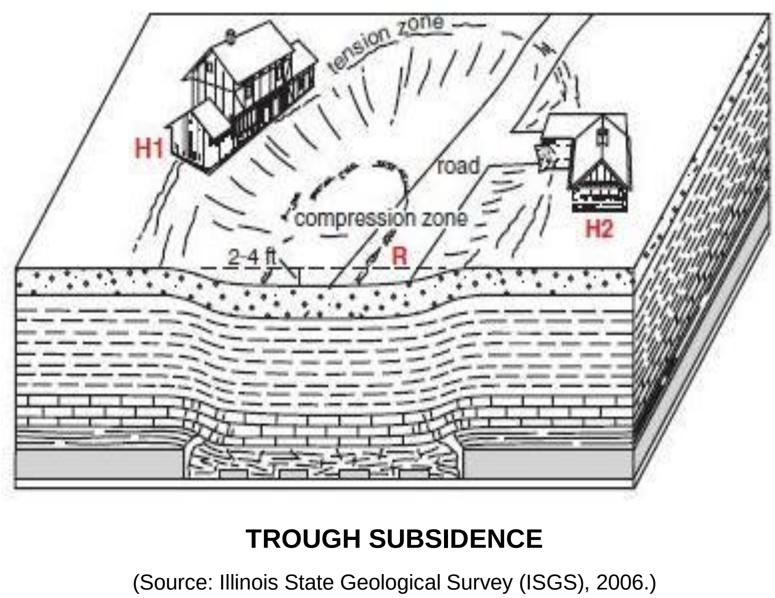
As depicted in the following drawing, pit subsidence occurs most commonly over mines that are considered fairly shallow, at less than 100 feet deep. Collapse of a mine roof causes a pit on the surface that generally ranges in depth from six (6) to eight (8) feet and in diameter from tow (2) to 40 feet, although on average, a pit will reach less than 16 feet across. Just as new sinkholes, new pits have steep sidewalls that present an added to danger to humans and wildlife in the area. Pit subsidence usually occurs more rapidly than trough subsidence.



PIT SUBSIDENCE

(Source: Wildanger et al, 1980)

As shown below, trough subsidence forms gentle, more linear depressions over a broad area and most often is caused by the disintegration or collapse of coal pillars, resulting in depressions that sometime span the entire length of a whole mine panel which may be up to several hundred feet long and a few hundred feet wide.



TROUGH SUBSIDENCE

(Source: Illinois State Geological Survey (ISGS), 2006.)

Facts

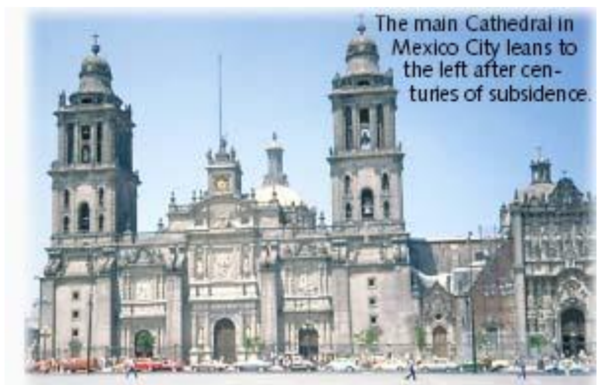
- Nationwide, the most common cause of land subsidence is the extraction of water from underground aquifers.
- Mine subsidence is controlled by a number of factors, including:
  - Height of mined-out area
  - Width of unsupported mine roof
  - Thickness of overburden
  - Competency of bedrock
  - Pillar dimensions
  - Hydrology
  - Fractures and joints
  - Time
- Between 1995 and 2001, the Ohio Department of Transportation spent $26.6 million to repair mine subsidence damage on eight highway projects.
- An estimated 320,000 housing units in the state of Illinois are built over or adjacent to underground mines.
- In the state of Kentucky, the room-and-pillar mining technique responsible for most trough subsidence is still the most commonly used practice for underground mining.

(Early longwall mine. Source: ISGS, 2006)

Impacts

In areas where mining occurs, it is strongly suggested that homeowners acquire insurance coverage which specifically addresses mine subsidence. In some states property owners are required by law to possess such policies. It is for these reasons, annual out-of-pocket expenses for private landowners is much lower than that of other natural disasters, such as landslides.

Land subsidence, in general, is experienced throughout the country and the world each year, even in areas where mining isn't prevalent. The Jefferson Memorial in Washington, DC has been a sight of significant subsidence, as has the main Cathedral in Mexico City and the 15th century Inca settlement of Machu Picchu, in the Peruvian Andes.



(Source: USGS, 2009)

In terms of loss of human life, the potential risk associated with land/mine subsidence is substantially lower than it is for other disasters such as tornadoes, earthquakes, and landslides, but it is important to keep in mind that the ground at the bottom of a pit or trough is often times not as stable as it appears. It is also important to ensure that the public is aware of the risks associated with inappropriate accessing of mine shafts, particularly those that have been abandoned for a number of years.

Hazard Profile: Mine Subsidence

Profile Risk Table

Period of Occurrence	At any time. Chance of occurrence increases after heavy rainfall, snow melt, or construction and mining activity.
Number of Events to Date	N/A
Past Damages	N/A
Annual Chance of Probability Ratio	N/A
Warning Time	Warning times vary greatly and are often dependent upon inspection for weaknesses in rock and soil. Most subsidence problems move slowly and cause damage gradually; however some events can move very quickly.

Potential Impacts	Economic losses such as decreased land values, agribusiness losses, disruption of utility and transportation systems, and costs for any litigation. May cause geological movement, causing infrastructure damages ranging from minimal to severe. May cause injury or death and shut down critical facilities for days or weeks.

Geographic Areas Affected

In Kentucky, land subsidence is often used interchangeably with mine subsidence, as abandoned subterranean mining operations are the most common cause of subsidence events. For this reason, subsidence is most likely to occur in the Eastern and Western coalfield regions of the state.

Kentucky coal mining has suffered more roof fall accidents and production loss due to roof collapse problems than any other coal-producing state. The geologic factors related to roof collapse commonly include faults, fractures, weak and disturbed roof strata, and rider coals (thin coals separated from the main coal seam, often by a weak shale-ridden zone).

Past Occurrences

Although the greatest number of abandoned mines runs in a belt through western Pennsylvania, eastern Kentucky, and central West Virginia, data on past occurrences isn't maintained in any single database for the state of Kentucky.

Dozens of people of all ages die each year in accidents that occur in and around abandoned mines, with many of these deaths occurring in Kentucky. Victims of such accidents have encountered deadly odorless gasses, fallen down holes that open under their weight, drowned in near-freezing pools of water at the bottom of shafts, and have been buried in unpredictable cave-ins.

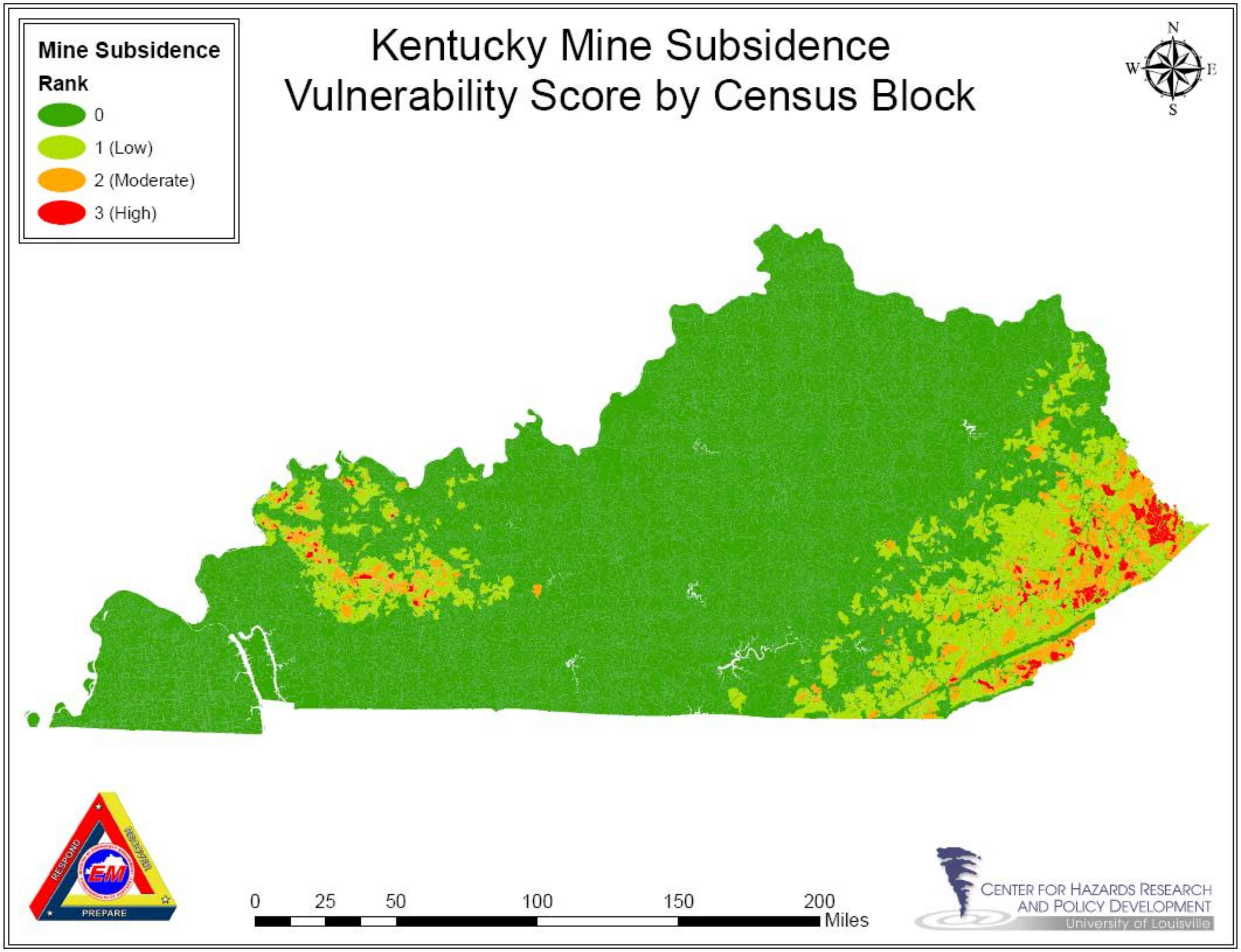
Each year Kentucky receives an Annual Abandoned Mine Land (AML) Grant with a three year lifespan that totals approximately $13.5-14 million. With this funding an average of 25 to 35 reclamation projects are performed each year and costs for the projects vary from a few thousand to several million dollars.

The goal of these AML grants is to mitigate the hazards associated with subsidence and abandoned mines including landslides, dangerous highwalls, mine drainage, sedimentation and flooding, dangerous impoundments, open portals and shafts, open pits, dangerous piles and embankments, refuse piles, refuse fires, mine fires, hazardous facilities and equipment, and polluted water including surface and ground water pollution.

Assessing Vulnerability by Jurisdiction: Mine Subsidence

Mine Subsidence Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Mine Subsidence Risk Score employing the Layer Rank (LR) and multiplying it by the Exposure Score. The Mine Subsidence LR was determined by calculating the percent of the census block affected by the hazard boundary layer. The hazard boundary layer was created from the Kentucky Geological Survey (KGS) Mine Subsidence boundary map. Once the percent of the areas were calculated they were ranked 0-3 (0=N/A, 1=low, 3=high). This process produced the Mine Subsidence Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Mine Subsidence Vulnerability Score.

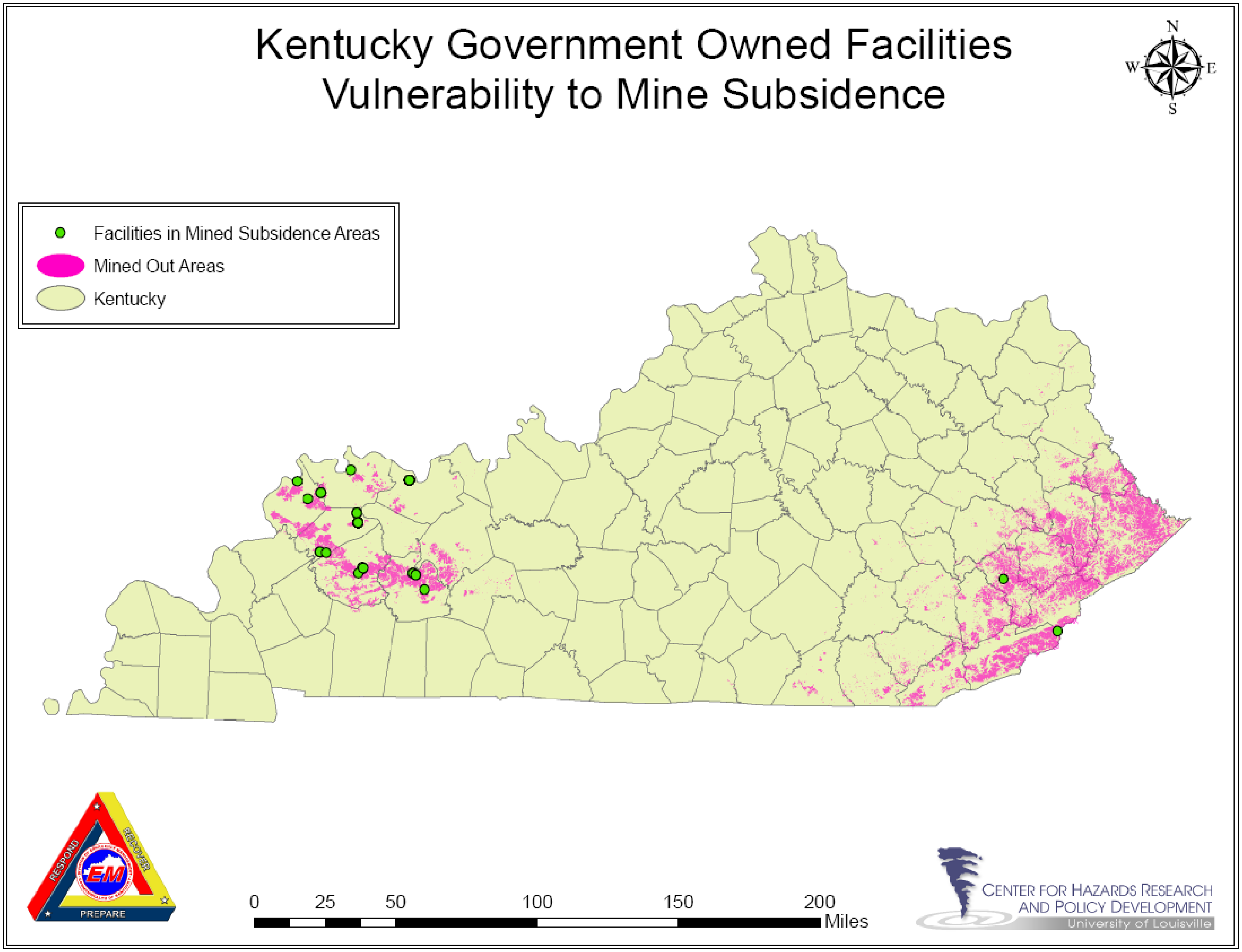

Kentucky Mine Subsidence
Vulnerability Score by Census Block
Mine Subsidence
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
W
E
S
0
25
50
100
150
200
Miles
RESPOND
PREPARE
EM
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Mine Subsidence

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Mine Subsidence. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the KGS Mine Subsidence boundary map overlaid onto the Property Rank scores from the Exposure Score. The Property Rank census blocks that are intersected with the Mine Subsidence hazard boundary maps are pulled out and are estimated to be damaged from a Mine Subsidence event. This produces a hazard boundary specific loss estimation model based on the GIS spatial analysis of a hazard boundary layer compared to dollar property exposure. See Appendix 30 for a jurisdictional (county) loss estimate for Mine Subsidence.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Mine Subsidence

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The KGS Mine Subsidence boundary map was used as the hazard layer for Mine Subsidence. The state facilities were placed into a GIS mapping session and overlaid onto the KGS Mine Subsidence boundary map. The state facilities captured within each Mine Subsidence hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Mine Subsidence event. See Appendix 31 for a county breakdown of how many state facilities are located within a Mine Subsidence hazard boundary layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Mine Subsidence
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Facilities in Mined Subsidence Areas
Mined Out Areas
Kentucky
RESPOND
RECOVER
PREPARE
EM
0
25
50
100
150
200
Miles
Center for Hazards Research
and Policy Development
University of Louisville

4.1.9 Landslide

Hazard Identification: Landslide

Description

A landslide is *the* downslope movement of rock, soil, or artificial fill under the influences of gravity. Landslides are most often activated by storms and rapid snow melt, where water is considered the catalyst, but landslides are also a result of fires, volcanic eruptions, and human modification of the landscape.

Landslides in which water is the catalyst are commonly called *mudflows* that may be defined as debris flows; rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud, often referred to as slurry. Slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. A slurry, often used interchangeably with the term mudslide, can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way.

Because a slide can travel many miles from its source, most of the damage done by both mudslides and landslides in general is often a fair distance from the source; usually in the valleys and small, rolling hills that lie beneath larger source mountains where the expansion of urban and recreational development has encroached upon the hilly terrain surrounding the urban center.

Landslides are triggered by a number of events such as earthquake activity, construction activity that changes critical aspects of the geology, weaknesses in the rock and soil, and—as previously mentioned—heavy rainfall or snowmelt, and are commonly occur in areas that have experienced sliding in the past.

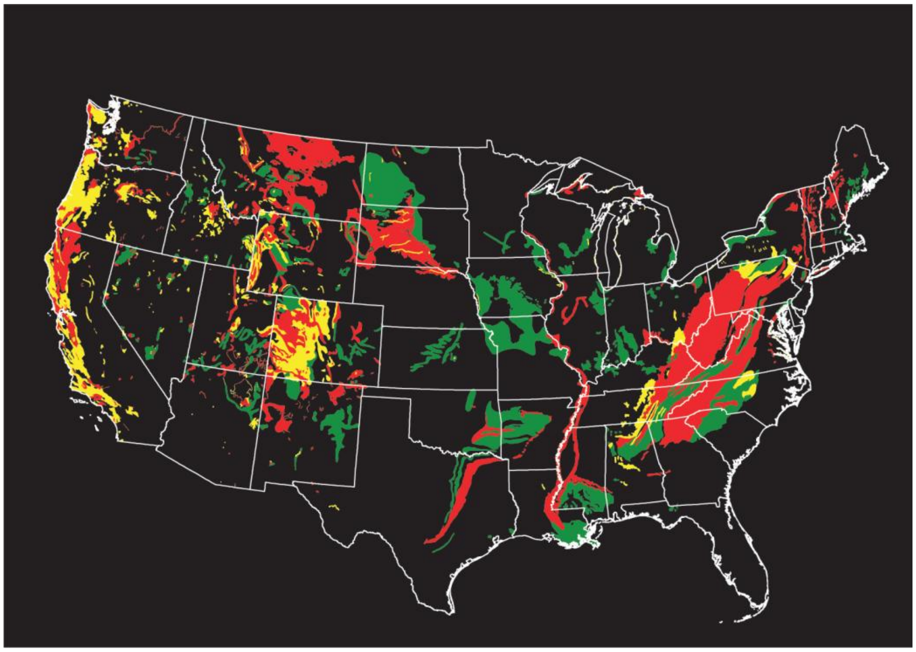
A number of factors increase the risk of landslides, namely:

- Building structures on steep slopes
- An abundance of water moving into the soil from roof runoff, septic systems, gutter down spouts, and site grades that cause water to pond
- A change to the natural slope by creating level areas which didn't previously exist
- Improper placement of fill material
- The removal of large numbers of trees and other vegetation that help reduce the water content of soil and thus stabilize the soil with their root systems

Types

- *Slides* of soil or rock involve downward displacement along one of more failure surfaces. The material from the slide may be broken into a number of pieces or remain a single, intact mass. Sliding can be rotational, where movement involves turning about a specific point. Sliding can be translational, where movement is down slope on a path roughly parallel to the failure surface. The most common example of a rotational slide is a slump, which has a strong, backward rotational component and a curved, upwardly-concave failure surface.
- *Flows* are characterized by shear strains distributed throughout the mass of material. They are distinguished from slides by high water content and distribution of velocities resembling that of viscous fluids. Debris flows are common occurrences in much of North America. These flows are a form of rapid movement in which loose soils, rocks, and organic matter, combined with air and water, form slurry which flows down slope. The term debris avalanche describes a variety of very rapid to extremely rapid debris flows associated with volcanic hazards. Mudflows are flows of fine-grained materials, such as sand, silt, or clay, with high water content. A subcategory of debris flows, mudflows contains less than 50 percent gravel.
- *Lateral spreads* are characterized by large elements of distributed, lateral displacement of materials. They occur in rock, but the process is not well-documented and the movement rates are very slow. Lateral spreads can occur in fine-grained, sensitive soils such as quick clays, particularly if remolded or disturbed by construction and grading. Loose, granular soils commonly produce lateral spread through liquefaction. Liquefaction can occur spontaneously, presumably because of changes in pore-water pressures, or in response to vibrations such as those produced by strong earthquakes.
- *Falls* and *Topples*. Falls occur when masses of rock or other material detach from a steep slope or cliff and descend by free fall, rolling, or bouncing. These movements are rapid to extremely rapid and are commonly triggered by earthquakes. Topples consist of forward rotation of rocks or other materials about a pivot point on a hill slope. Toppling may culminate in abrupt falling, sliding, or bouncing, but the movement is tilting without resulting in collapse. Data on rates of movement and control measures for topples is sparse.

USGS United States Landslide Susceptibility Map



(Source: U.S. Geological Survey. 2005. http://pubs.usgs.gov/fs/2005/3156/2005-3156.pdf)

- Landslides can occur and cause damage in all 50 states.
- There is a concentration of landslide losses in the Appalachian, Rocky Mountain, and Pacific Coastal regions.
- An estimated 40% of the U.S. population has been exposed to the direct or indirect effects of landslides.

(Source: M&C, The World in Pictures, 2008: www.monstersandcritics.com/blogs/theworldinpictures/2008/05/)

- Worldwide, landslides cause thousands of casualties and billions of dollars in damages annually.
- Tsunamis can be caused by submarine landslides that occur on the ocean floor.
- The largest known prehistoric landslide occurred in southwestern Iran on the Kabir Kuh anticline. It is estimated 50 billion tons of rock moved in this event which had a volume of 12.4 cubic miles, a depth of almost 1,000 feet, and measured 8.7 miles in length and 3.1 miles across.
- The largest landslide in recent history occurred in conjunction with the 1980, 24-megaton eruption of Mount St. Helens in the Cascadia Mountain Range in Washington State.
- The most expensive landslide in U.S. history occurred in 1983 at Thistle, Utah. Costing over $200 million dollars, the landslide covered railroad tracks, a major highway, and dammed a river which caused a massive flood in the town of Thistle. The Thistle landslide is still moving, though at a slow rate.

Effects on People

Landslides cause over $3.5 billion in damages annually in the U.S. and, on average, are responsible for 25 to 50 deaths each year. Public and private economic losses from landslides include not only the direct costs of replacing and repairing damaged facilities, but also the indirect costs associated with lost productivity, disruption of utility and transportation systems, reduced property values, and costs for any litigation. Some indirect costs are difficult to evaluate, thus estimates of total costs associated with landslides are usually conservative. If indirect costs were realistically determined, they likely would exceed direct costs.

Much of the economic loss is borne by federal, state, and local agencies responsible for disaster assistance, flood insurance, and highway maintenance and repair. Private costs primarily involve damage to land and structures. A severe landslide can result in financial ruin for property owners, as landslide insurance (except for debris flow coverage) or other means of offsetting the damage costs are often unavailable.

Hazard Profile: Landslide

Profile Risk Table

Period of Occurrence	At any time. Chance of occurrence increases after heavy rainfall, snow melt, or construction and mining activities.
Number of Events to Date: 2002 to 2009 KYTC Road Landslide data	1,113 (On roads)
Past Damages	$44,458,799 (On roads)
Annual Chance of Probability Ratio	159 (On roads)
Warning Time	Warning times vary greatly and are often dependent upon inspection for weaknesses in rock and soil. Some landslides move slowly and cause damage gradually, whereas others

	move so rapidly which they can destroy property and take lives suddenly and unexpectedly.
Potential Impacts	Economic losses such as decreased land values, agribusiness losses, disruption of utility and transportation systems, and costs for any litigation. May cause geological movement, causing infrastructure damages ranging from minimal to severe and may cause injury or death and shut down critical facilities for days or weeks.

Historical Impacts

Many landslides which were triggered by the 1811-1812 New Madrid series of earthquakes have been documented in western Kentucky. The resulting instability still causes problems today.

Landslide problems are usually related to certain rock formations on yield soils which are unstable on moderate to steep slopes. Often, slopes are cut into or oversteeped to create additional level land for development. For example, a landslide which occurred on a connector road from Alexandria to Ashland Highway in northern Kentucky cost the state millions of dollars to repair; and an effort to create several acres of level land for a shopping complex in Laurel County triggered a landslide which created damage to a subdivision upslope from the complex and threatened a major highway below.

Landslide problems can be compounded when unrecognized ancient slides are excavated during construction. The most spectacular and well-documented reactivation of an ancient landslide in Kentucky occurred during construction of U.S. Highway 119 between Pineville and Harlan. When the contractor inadvertently excavated through an ancient landslide in this area, several slope failures were triggered. The problems caused by these failures delayed completion of the highway, significantly increased costs, and caused time-consuming and expensive ongoing maintenance for the Kentucky Transportation Cabinet.

Similarly, part of the business district of Hickman was destroyed when a contractor for the U.S. Army Corps of Engineers, in an attempt to construct a ground water cutoff wall in front of the existing floodwall, cut through an old landslide which was a resulted of the 1811-1812 earthquakes.

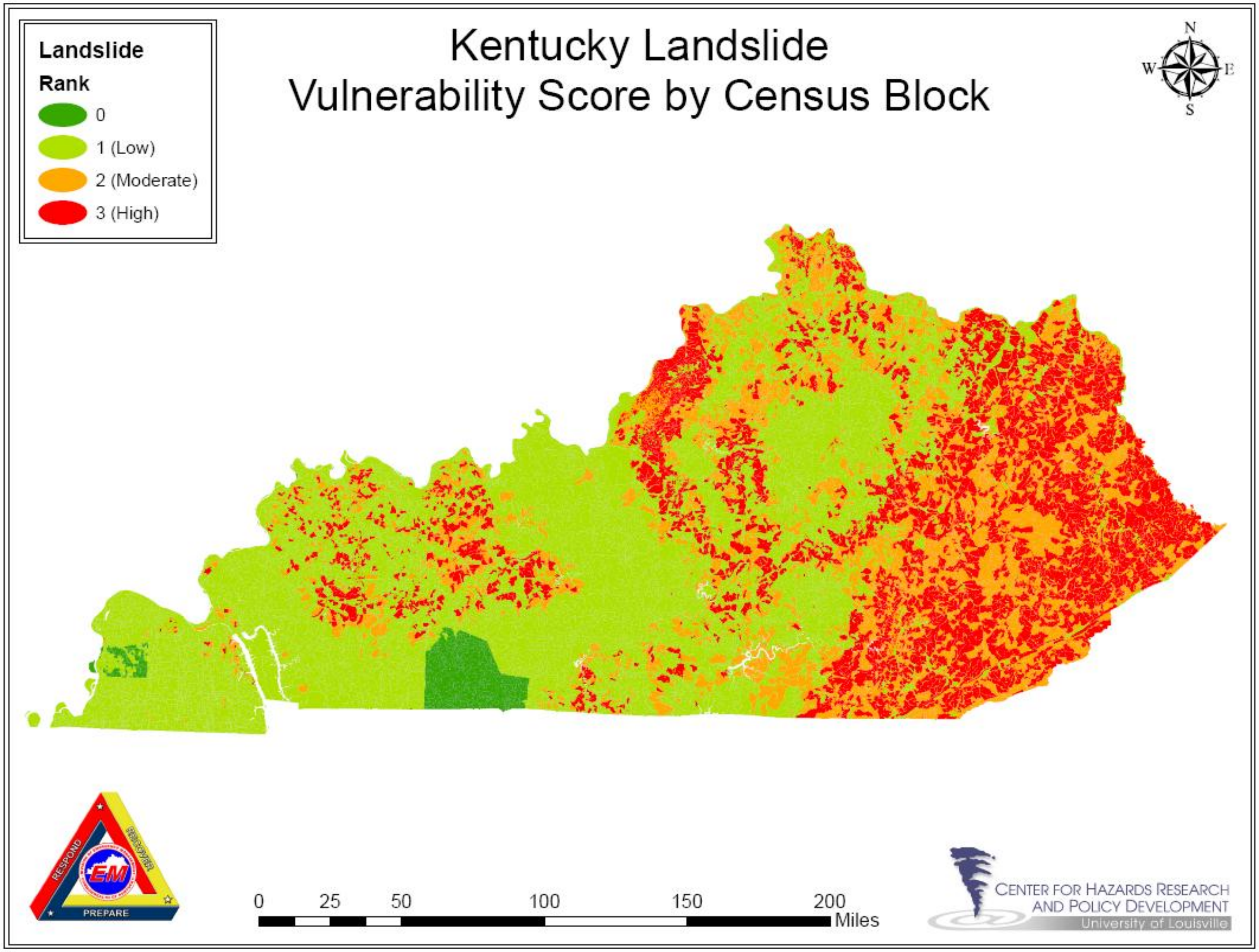
Many homes have been damaged or destroyed in eastern and southeastern Kentucky because they were constructed on unstable geologic formations, or because of a combination of unstable soil and rock and the subsidence of abandoned underground mines.

Due to the high level of landslide events throughout the state, KyEM has spent $617,466 on acquisitions of landslide-prone homes over the last three (3) years.

Assessing Vulnerability by Jurisdiction: Landslide

Landslide Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Landslide Risk Score by combining the Layer Rank (LR) and the Annualized Loss Rank (ALR), then multiplying it by the Exposure Score. The Landslide LR was determined by calculating the percent of the census block affected by the Landslide hazard boundary layer. The hazard boundary layer was created from the KGS Landlside prone area map for the state. Once the percent of the areas were calculated they were ranked 0-3 (0=N/A, 1=low, 3=high) and then multiplied by two (2) to provide more weight to the LR. This process produced the LR for the Landslide Risk Score. The ALR for Landslide was created by calculating Landslide occurrences and loss data captured by the Transportation Cabinet. This data is being collected by KGS and aggregated to the county level. The Landslide and Rockfall data captured in this data set deal with road maintenance issues. This is the best available ALR data for landslides at this time. Each counties ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. The Landslide LR and ALR were combined to create the Landslide Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Landslide Vulnerability Score.

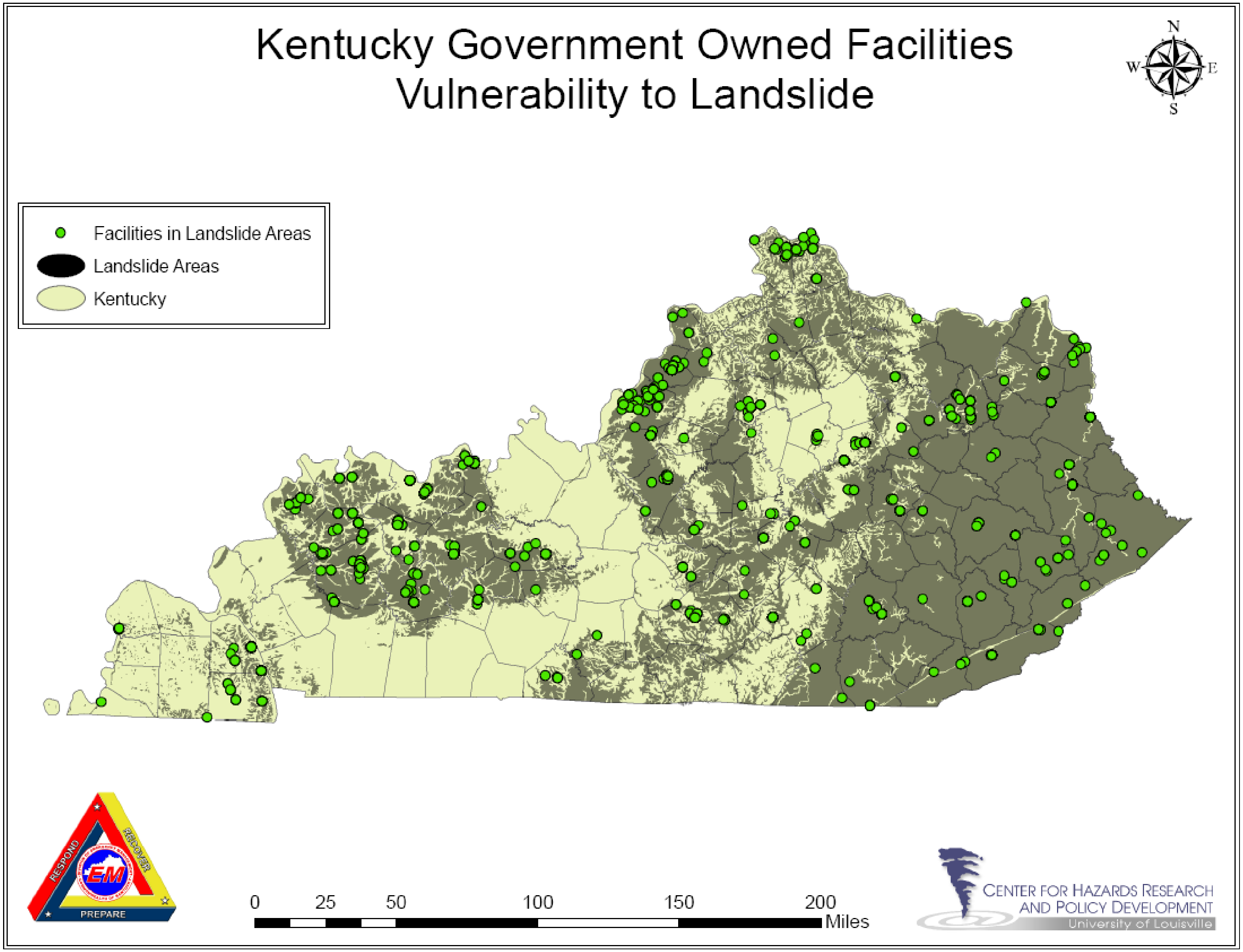

Kentucky Landslide
Vulnerability Score by Census Block
Landslide
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
W
E
S
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville
RESPOND
PREPARE
EM

Estimating Potential Losses by Jurisdiction: Landslide

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Landslide. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the actual KGS Landslide prone area map overlaid onto the Property Rank scores from the Exposure Score. The Property Rank census blocks which are intersected with the Landslide hazard boundary maps are pulled out and are estimated to be damaged from a Landslide event. This produces a hazard boundary specific loss estimation model based on the GIS spatial analysis of a hazard boundary layer compared to dollar property exposure. See Appendix 32 for a jurisdictional (county) loss estimate for Landslide.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Landslide

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The KGS Landslide prone area map was used as the hazard layer for Landslide. The state facilities were placed into a GIS mapping session and overlaid onto the Landslide geographic boundary layer. The state facilities captured within each Landslide hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Landslide event. See Appendix 33 for a county breakdown of how many state facilities are located within a Landslide hazard boundary layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Landslide
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Facilities in Landslide Areas
Landslide Areas
Kentucky
RESPOND
RECOVER
PREPARE
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150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

4.1.10 Severe Storm

Hazard Identification: Severe Storm

Description

Thunderstorms are typically caused by convection that occurs when the sun has heated a large body of moist air near the ground. This air rises and is cooled by expansion. The cooling condenses the water vapor present in the air, forming a cumulus cloud aggregation of minute particles of water or ice suspended in the air. If this process continues, the summit of the cloud often attains a height of 4 miles above the base, and the top spreads out in the shape of an anvil.

The turbulent air currents within the cloud cause a continual breaking up and reuniting of the raindrops, which may form hail, and builds up strong electrical charges that result in lightning. As the storm approaches an area, the gentle flow of warm air feeding the cloud gives way to a strong, chilly gust of wind from the opposite direction, blowing from the base of the cloud. Intense rain begins and then gradually diminishes as the storm passes.

Lightning is a component of all thunderstorms and is a potential hazard to infrastructure as well has human life. Cloud-to-ground lightning can injure or kill people and destroy objects with the dangerously abundant energy it carries. Lightning may cause fires in structures or in nature given favorable conditions. Flash flooding, hail, and serious wind damage are also potential dangers associated with severe thunderstorms.

Types of Thunderstorms

(Listed in increasing danger to the public and aviation activities)

- **Single Cell (Pulse Storms):** These storms typically last anywhere from 20 to 30 minutes. Pulse storms often produce severe weather elements such as downbursts, hail and heavy rainfall. Occasionally, weak tornadoes are spawned from these storms.
- **Multi-Cell Clusters:** These storms consist of a cluster of single cell storms, each in varying stages of development. Multi-cell storms are capable of producing moderate size hail, flash flooding and low class tornadoes.
- **Multi-Cell Line (Squall Line):** The multi-cell line storm, or squall line, consists of a long line of storms with a continuous well-developed gust front at the leading edge of the line. The line of storms can be solid, or there can be gaps and breaks in the line. Squall lines can produce hail up to golf-ball size, heavy rainfall, and weak tornadoes, but they are best known as the producers of strong downdrafts. Occasionally, a strong downburst will accelerate a portion of the squall line ahead of the rest of the line. This produces what is called a bow echo.

Bow echoes can develop with isolated cells as well as squall lines. Bow echoes are easily detected on radar but are difficult to observe visually.

- **Supercell:** The supercell is a highly organized thunderstorm. Supercells are rare, but pose a high threat to life and property. A supercell is similar to the single-cell storm because they both have one main updraft. The difference in the updraft of a supercell is that the updraft is extremely strong, reaching estimated speeds of 150-175 miles per hour. The main characteristic which sets the supercell apart from the other thunderstorm types is the presence of rotation. The rotating updraft of a supercell (called a mesocyclone when visible on radar) helps the supercell to produce extreme severe weather events, such as hail measuring more than tow (2) inches in diameter, strong downbursts of 80 miles an hour or more, and strong to violent tornadoes.
- **Supercell (Additional Info):** The surrounding environment is a big factor in the organization of a supercell. Winds are coming from different directions to cause the rotation. As precipitation is produced in the updraft, the strong upper-level winds blow the precipitation downwind. Hardly any precipitation falls back down through the updraft, so the storm can survive for long periods of time. The leading edge of the precipitation from a supercell is usually light rain. Heavier rain falls closer to the updraft with torrential rain and large hail immediately north and east of the main updraft. The area near the main updraft (typically towards the rear of the storm) is the area at greatest risk for severe weather.

Additional types of severe storms include **straight line winds**. There are several terms that mean the same as straight-line winds and they are convective wind gusts, outflow and downbursts. Straight-line wind is wind that comes out of a thunderstorm. If these winds meet or exceed 58 miles per hours then the storm is classified as severe by the National Weather Service. These winds are produced by the downward momentum in the downdraft region of a thunderstorm. An environment conducive to strong straight-line wind is one in which the updrafts and thus downdrafts are strong, the air is dry in the middle troposphere and the storm has a fast forward motion

Facts

- There are approximately 1,800 thunderstorms occurring at any moment across the world.
- All thunderstorms produce lightning which often strikes outside of the area where it is raining and is known to occur more than 10 miles away from the rainfall area.
- Severe thunderstorms have the potential to produce winds which rival weak tornadoes. Along with hail that may reach three-fourths of an inch in diameter, these winds can turn severe thunderstorms into life threatening hazards.
- Lightning is very dangerous and causes nearly 100 deaths and 500 injuries each year in the United States.

Impacts

- There is a great risk for infrastructure damage or total loss associated with severe thunderstorms. Depending on the severity of the storm, several million dollars worth of damage is possible.
- Loss of life is a risk associated with severe storms as well. Lightning, potential fire hazards, structural failure due to winds, and flash flooding are all potential hazards which may result from a severe storm, putting the public at risk.

Hazard Profile: Severe Storm

Profile Risk Table

Period of Occurrence	Peek months for severe storm events are April through August. These storms can occur at any time of the year, although the period mentioned above is when severe storms are most likely to occur and cause significant damage.
Number of Events to Date: 1960 to 2009 Sheldus Data	71
Past Damages: 1960 to 2009 Sheldus Data	$290,877,244
Annual Chance Probability Ratio	1.45
Warning Time	*Monitored Storm Systems (NOAA 2008)* – Anywhere from 20 to 60 minutes in advance
Potential Impacts	Impacts human life, health, and public safety. Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroy critical facilities, and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and agribusiness losses.

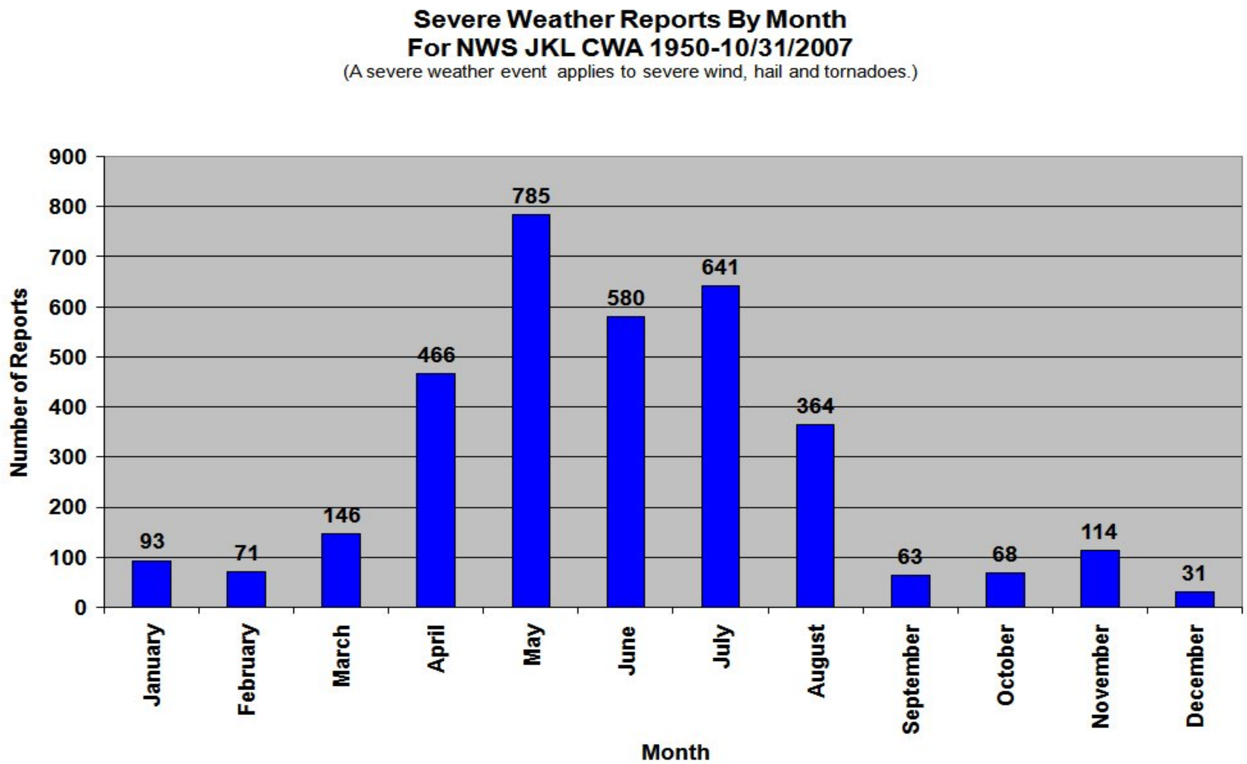
Historical Impact

Kentucky is affected every year by severe thunderstorm systems which move across the region. As climate change and global warming continue to be areas of debate, one thing is certain: severe weather is more destructive and dangerous with each passing year. In September 2008, Kentucky experienced a rare weather event which was of hurricane origin.

The remnants of Hurricane Ike moved across the Ohio Valley on the morning and afternoon of September 14, 2008. This system, along with an upper level trough and a surface cold front approaching the region, combined to bring very strong surface wind gusts to the area. Widespread damage occurred with measured wind gusts up to 75 mph, along with seven (7) known injuries and two (2) fatalities across parts of central

Kentucky. Seventy-five percent of all Louisville Metro electrical customers - more than 300,000 homes and businesses - lost power for up to a week due to the storm, leaving many businesses and schools closed during the week. Statewide, nearly 600,000 customers lost power due to the storm. Cost estimates were reported as approximately $10 million across the Commonwealth, including $4.2 million in the Louisville Metro area alone. In Kentucky, 33 counties were declared major disaster areas by President Bush.

The following graph depicts NOAA's most recent assessment of peek severe storm periods in Kentucky.



The following table shows other significant disaster declarations due to severe storms for Kentucky over the last decade.

DR #	Date	Disaster Description	Applicants	Amount
1310	1/10/2000	Tornadoes, Severs Storms	27	$4,574,624
1320	2/28/2000	Severe Storms and Flooding	34	$5,528,207
1388	8/15/2001	Severe Storms and Flooding	26	$11,532,230
1407	4/4/2002	Severe Storms and Flooding	66	$11,088,325
1414	5/7/2002	Severe Storms and Flooding	39	$8,062,168
1454	3/14/2003	Severe Winter Storms	157	$36,400,813
1471	6/3/2003	Severe Storms and Flooding	65	$4,961,620
1475	7/2/2003	Severe Storms and Flooding	41	$8,719,387

DR #	Date	Disaster Description	Applicants	Amount
1523	6/10/2004	Tornadoes, Severs Storms	116	$16,780,406
1537	8/6/2004	Severe Storms and Flooding	76	$3,436,038
1578	2/8/2005	Winter Storm, Record Snow	83	$2,630,107
1703	5/25/2007	Severe Storms and Flooding	18	$3,036,293
1746	2/21/2008	Severe Storms, Tornadoes, Straight-Line Winds, Rockslides	32	$4,552,605
1757	5/19/2008	Severe Storms, Tornadoes, Straight-Line Winds, Mudslides	62	$6,144,051
1802	10/9/2008	Severe Wind Storm Associated w/Tropical Depression Ike	256	$25,132,077
1818	1/28/2009	Severe Winter Storm and Flooding	786	$330,791,449
1841	5/29/2009	Severe Storms, Tornadoes, Flooding, and Mudslides	62	$44,175,855
1855	8/14/2009	Severe Storms, Straight-line Winds, and Flooding	47	$27,299,856
1912	5/11/2010	Severe Storms and Flooding	84	$60,000,000 (est.)
		TOTALS	2,077	$614,846,111

(FEMA (http://www.fema.gov/news/disasters.fema)

The following narrative provides more detailed information on severe storms that resulted in Presidential Declarations in Kentucky since 2007.

- **DR-1746 February 5-6, 2008**: More than $4.5 million in federal disaster public assistance was approved in association with tornadoes and severe storms. The intense thunderstorms and tornadoes resulted in seven (7) fatalities, widespread damages to public and private property, power outages, and road closures. This line of severe weather ran from southwest to northeast spawning 22 tornadoes in 17 counties across western and central Kentucky. In addition to the public assistance grants made available to governmental units and qualifying non-profit entities, this declaration provided assistance to individuals and households in the amount of $1.4 million dollars.

- **DR-1757 April 3-4, 2008:** During this event the Commonwealth was impacted by severe thunderstorms which produced tornadoes, floods, flash floods, hail, mudslides, and landslides. This line of severe weather resulted in the loss of life and personal injury, power outages, downed trees, road closures, and widespread damage to public and private property. Records show that four (4) to six (6) inches of rain fell in a 24-hour period, with some locally higher observations exceeding eight (8) inches. The heavy rains caused widespread flash flooding, road closures, evacuations, stranded motorists, vehicle-related water rescues, and mudslides. Power outages were reported throughout the Commonwealth for several days due to damages or power being shut off as a safety measure. Waters remained high along rivers through mid-April. A number of communities resorted to sandbagging to protect homes and schools from flooding and the continuing rising waters.

- **DR-1802 September 14, 2008:** On this date the remnants of Hurricane Ike, strengthened by a cold front crossing the Ohio Valley, caused extremely strong surface winds to blow across the Commonwealth resulting in widespread damage to public and private property and effecting 1.8 million residents. Hurricane-force wind gusts caused an immense number of trees to fall and power outages in numerous counties of the Commonwealth, leaving citizens in the dark and without essential services for weeks after the storm. One (1) fatality occurred when a tree limb fell on a 10-year-old boy.

- **DR-1841 May 3 - 20, 2009:** Starting on May 3, 2009, strong storms producing tornadoes, severe thunderstorms, heavy rainfall, flash flooding, and generalized flooding moved across the central and eastern parts of the Commonwealth resulting loss of live and private property and road closures and these conditions endangered public health and safety and threatened public and private property. There were over half a million citizens impacted by this event. FEMA estimates that total public assistance for this event will exceed $44 million. Over 5,543 applicants in four (4) counties were awarded approximately $15 million in individual and household assistance.

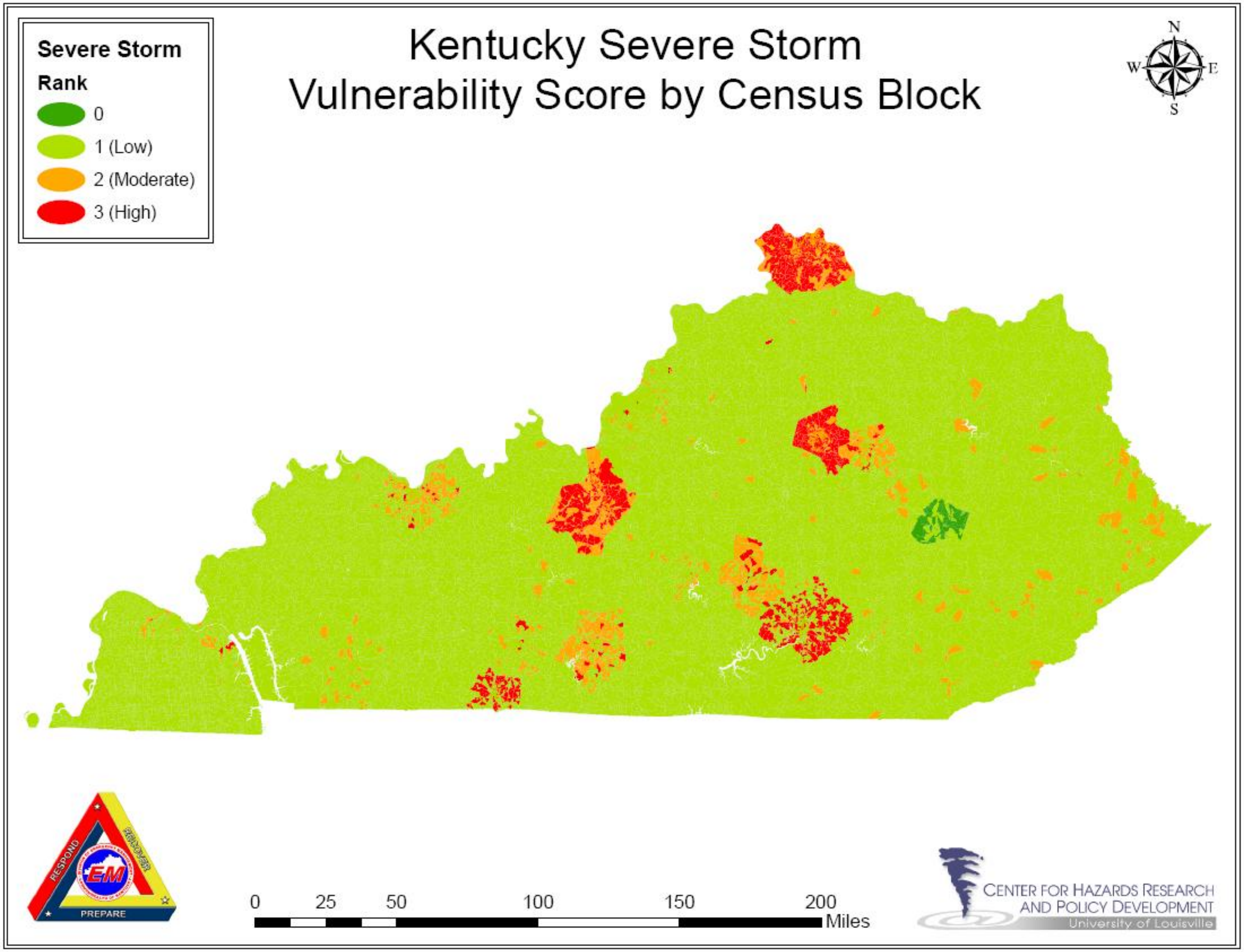
- **DR-1855 August 14, 2009:** On August 14, 2009, the counties of Jefferson and Trimble experienced a severe storm which contained straight-line winds and flooding. The flooding in Louisville was centralized in the downtown resulting in significant damages to the University of Louisville, the Louisville Public Library, several hospitals, and over a thousand private residences. Public Assistance is estimated to exceed $27 million dollars and over $17 million has been distributed in individual and household assistance.

- **DR-1912 May 11, 2010:** On Derby Day, May 1, 2010 and continuing, the Commonwealth was inundated with a severe rain event as was also Tennessee. Flooding which occurred across Kentucky was exacerbated by massive flooding in Tennessee rivers (the Cumberland and Tennessee) which flow into Kentucky. Eighty-four Kentucky counties were impacted by this disaster which was declared by President Obama on May 11, 2010.

Assessing Vulnerability by Jurisdiction: Severe Storm

Severe Storm Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Severe Storm Risk Score employing the Annualized Loss Rank (ALR) and Layer Rank (LR) multiplied by the Exposure Score. The ALR for Severe Storm was created by calculating Severe Storm occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 60 year timeframe. Each counties ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. The LR for Severe Storm was determined by taking data provided from the NOAA SVRGIS database (geo-referenced Severe Storm location data) and cumulating how many occurrences have occurred in each census block. The number of occurrences for each block were then calculated and ranked 0-3 (0=N/A, 1=low, 3=high). The Severe Storm ALR and LR were then added together and ranked 0-3 (0=N/A, 1=low, 3=high) which created the Severe Storm Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Severe Storm Vulnerability Score.

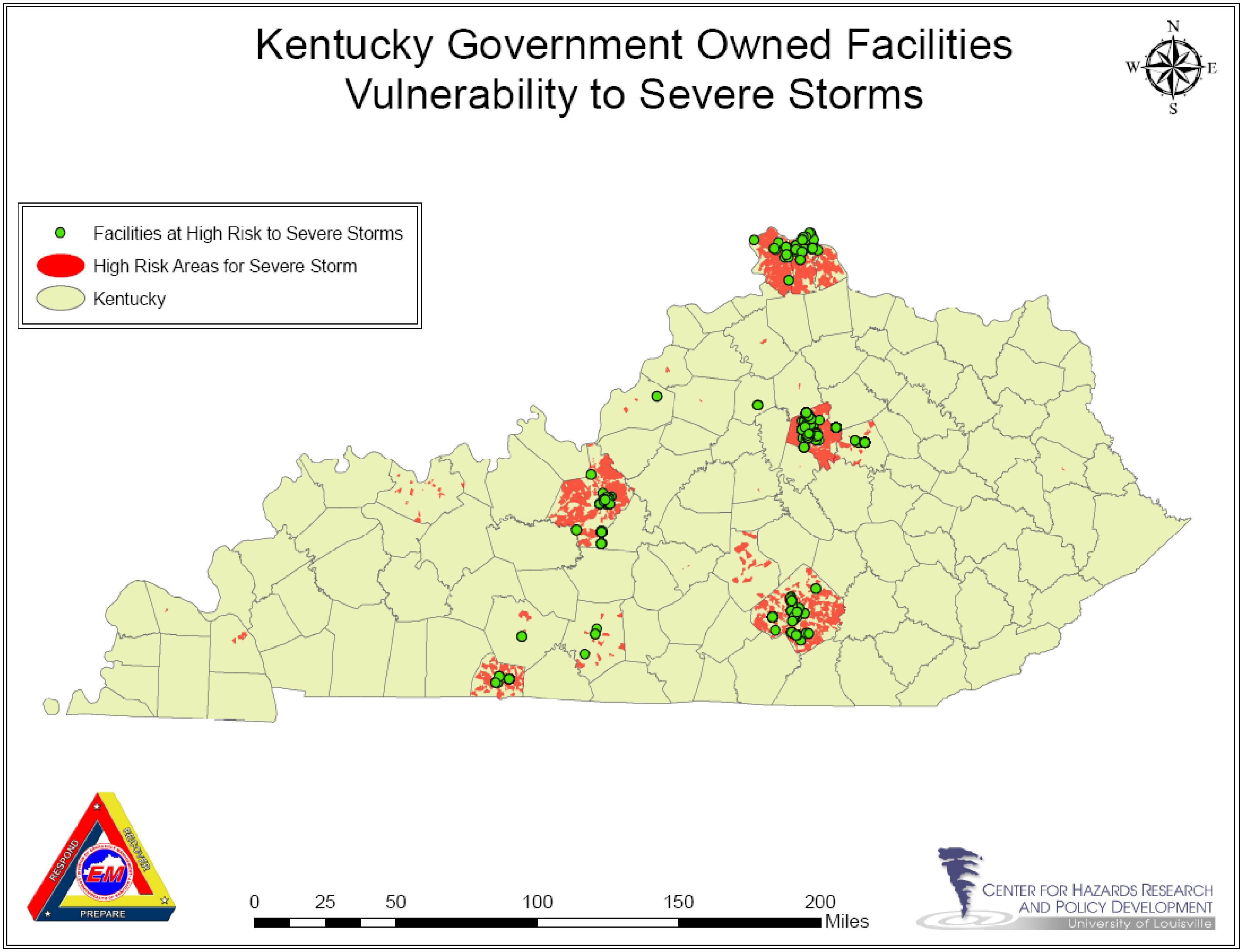

Kentucky Severe Storm
Vulnerability Score by Census Block
Severe Storm
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
W
E
S
0
25
50
100
150
200
Miles
PREPARE
RESPOND
RECOVER
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Severe Storm

The *Annualized Loss Rank (ALR) loss estimate model* was used to estimate losses for Severe Storm. Potential loss for jurisdictions can be calculated by using the ALR created from the Average Annual Risk data captured for each county. This produces a loss estimation model based on actual loss and occurrence data that has occurred over a set period of time. See Appendix 34 for a jurisdictional (county) loss estimate for Severe Storm.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Severe Storm

This process was performed using level (3) block Risk Scores as the hazard layer for Severe Storm. The state facilities were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Severe Storm event. See Appendix 35 for a county breakdown of how many state facilities are located within a level (3) Severe Storm hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Severe Storms
N
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Facilities at High Risk to Severe Storms
High Risk Areas for Severe Storm
Kentucky
RESPOND
RECOVER
PREPARE
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Miles
Center for Hazards Research
and Policy Development
University of Louisville

4.1.11 Severe Winter Storm

Hazard Identification: Severe Winter Storm

Description

A severe winter storm is defined as an event which produces four (4) or more inches of snow during a 12-hour period or six (6) or more inches during a 24-hour span. Winter storms range from weather systems producing moderate snow fall over a few hours to blizzards producing wind-driven snow, sleet, and ice that lasts several days. Some winter storms may be large enough to affect several states while others may affect only a single community. All winter storms are accompanied by low temperatures and blowing snow, which can severely reduce visibility. Winter storms make driving and pedestrian activity extremely hazardous. The aftermath of a winter storm can impact a community or region for days, weeks, or months.

Types

There are four (4) main types of winter storm classifications: 1. Blizzard, 2. Lake Effect, 3. Ice Storms, and 4. Nor'easter. Due to Kentucky's location, blizzards and ice storms are main concerns. Lake Effect storms do not directly impact the state and Nor'easter winter storms only affect areas along the east coast of the United States thus Lake Effect and Nor'easter storms are omitted from this identification section.

- **Blizzards:** Blizzards are characterized by low temperatures (usually below 20 degrees Fahrenheit) and accompanied by winds that are at least 35 miles per hour or greater. Blizzards also have sufficient falling or blowing snow which reduces visibility to 1/4 mile or less for at least three (3) hours. A severe blizzard is considered to have temperatures near or below 10 degrees Fahrenheit, winds exceeding 45 miles per hour, and visibility reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of these storm systems.
- **Ice Storms**: Ice storms result when freezing rain accumulates on surfaces to at least 1/4 inch or more in thickness. Freezing rain is caused by rain droplets which encounter freezing or sub-freezing temperatures at the surface. The rain freezes on contact with the ground or objects near the surface. As the rain freezes, ice accumulates on roads, tree limbs, power lines, etc., creating dangerous driving conditions and potential power outages.

Facts

- Heavy snowfall and extreme cold can immobilize an entire region. Even areas which normally experience mild winters can be hit with a major snow or ice storm or by extreme cold.
- Every state in the continental United States and Alaska has been impacted by severe winter storms.
- Everyone is potentially at risk during winter storms. In terms of death due to severe winter storms, 70% of the deaths are related to automobile accidents. 25% of those deaths occur when people are caught out in the storm and die from exposure. Of all the deaths related to exposure to cold, 20% occur at home.

Primary Impacts

- Power outages can result when snow and ice accumulation on trees cause branches and trunks to break and fall onto vulnerable power lines. Blackouts vary in size, possibly affecting one street or an entire city.
- Snow and ice accumulation on roadways can cause severe transportation problems in the form of extremely hazardous roadway conditions. Vehicles begin losing control, collisions occur frequently, and road closures are common.

Secondary Impacts

- After the immediate threat of the storm has passed, critical infrastructure failure may cause additional hazards or hardships for people. Frozen or broken water mains stifle the supply of water. Power outages make it difficult for people to stay warm and in contact with emergency services. Transportation issues may persist and prevent access to shelters or individuals in need of emergency services.
- Flooding may occur after precipitation has accumulated and then temperatures rise once again, melting the snow and ice. The risk of flood is directly proportional to the amount of snow and ice that accumulated due to the storm.

Hazard Profile: Severe Winter Storm

Profile Risk Table

Period of Occurrence	Historically, severe winter weather is generally experienced from December through March in Kentucky. Situations of extreme circumstance (such as snow during summer months) have occurred but are not common enough to list any other months in this period.

Number of Events to Date: 1960 to 2009 Sheldus Data	49
Past Damages: 1960 to 2009 Sheldus Data	$227,744,117
Annual Chance Probability Ratio	0.96
Warning Time	Winter storms tend to develop and move at varying speeds across the region. Unlike thunderstorms and tornadoes, severe winter weather is less spontaneous. It is not unheard of however, for a severe winter storm system to develop quickly. Warning times vary from several days to a matter of hours, depending on weather conditions.
Potential Impacts	Impacts human life, health, and public safety, utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, damaged or destroy critical facilities (caused by weight of precipitation: snow/ice), and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and agribusiness losses.

Historical Impact

Kentucky's location makes it vulnerable to heavy snowfall. Its proximity to the Gulf of Mexico provides a necessary moisture source for precipitation all year. Kentucky is also north enough to be influenced by polar air masses. Depending on atmospheric conditions during the winter, Kentucky can have cool, wet winter or suffer the ill effects of heavy snow fall and ice accumulation.

On January 27, 2009, Kentucky's worst modern day, natural disaster occurred in the form of a severe winter storm. A storm system moving across the Midwest dropped a devastating amount of ice on the state. As rain continued and temperatures fluctuated above and below freezing temperatures, ice formed on all surfaces, several inches thick in some places. Eventually the weight of the ice was too much for trees and utility lines which broke under the tremendous strain.

President Barack Obama declared Kentucky in a state of emergency on January 28, 2009, through Emergency Declaration 3302 and declared disaster DR-1818 on February 5, 2009. After the freezing rain ended, trees and utility lines continued to fall causing extensive damage and power outages. The situation was so severe that 4,600 members of the National Guard were called to Kentucky. They helped to clear debris, deliver food to those without power, as well as tend to people stranded or in need of help. Five thousand utility workers, some from as far away as Texas, worked around the clock to restore power. There were more than 769,000 power outages reported.

Many of these outages lasted as long as four weeks in areas which remained difficult to reach because of debris and heavy ice accumulation. As a result of power loss and ineffective preparedness in some areas, 36 deaths were recorded and several injuries occurred due to falling debris and extreme temperatures. Around $616 million worth of damage and loss resulted because of this severe winter storm. As a result of this event, federal assistance was available for 104 of the state's 120 counties.

The following information reviews other significant severe winter events which have affected Kentucky since 1993.

1818	1-28-2009	Severe Winter Storm
1578	2-8-2005	Severe Winter Storm Record Snow
1454	3-14-2003	Severe Winter Storm
1207	3-3-1998	Severe Winter Storm
1089	1-13-1996	Blizzard
1018	3-16-1994	Severe Winter Storm (Precipitation, high winds)
3104	3-16-1993	Severe Winter Storms

(Federal Emergency Management Agency Declarationsas of 2009 (http://www.fema.gov/news/disasters.fema))

- **January 25, 2009 and continuing into mid February:** Ice, snow, and rain paralyzed the Commonwealth. Fallen trees, debris, and power outages left extremely large groups of people, including the elderly and medically fragile, without essential services. Fatalities occurred in multiple counties as a result of this event. Communication services failed cutting off contact with numerous communities. The National Guard was activated and along with emergency workers and law enforcement, thousands of house-to-house checks were performed to identify and rescue those citizens at medical risk. Downed trees necessitated extensive road closures and created power outages that, in some areas, exceeded four (4) weeks. This event represents the largest Commonwealth disaster in modern history.

- **February 3-6, 1998:** A major snowstorm affected 33 counties in eastern Kentucky. Snowfall totals for the storm ranged from around four (4) inches in valley locations near the Virginia border to as much as two (2) feet in other areas. Power outages were widespread as falling trees brought down by the weight of an unusually wet snow disabled utility lines. Nine thousand customers of various utility companies were still without power on February 9, 1998, and some areas were without power for two (2) weeks.

  Numerous roads were blocked by debris. Bulldozers had to be used to reach people who were stranded. Numerous buildings, including trailer homes, houses, barns, and commercial buildings collapsed under the weight of the snow. Many people remained in unheated homes during the extended power outages. A woman in McCreary County died in her home as a result of a hypothermia-induced heart attack. A man in Wolfe County died from similar circumstances.

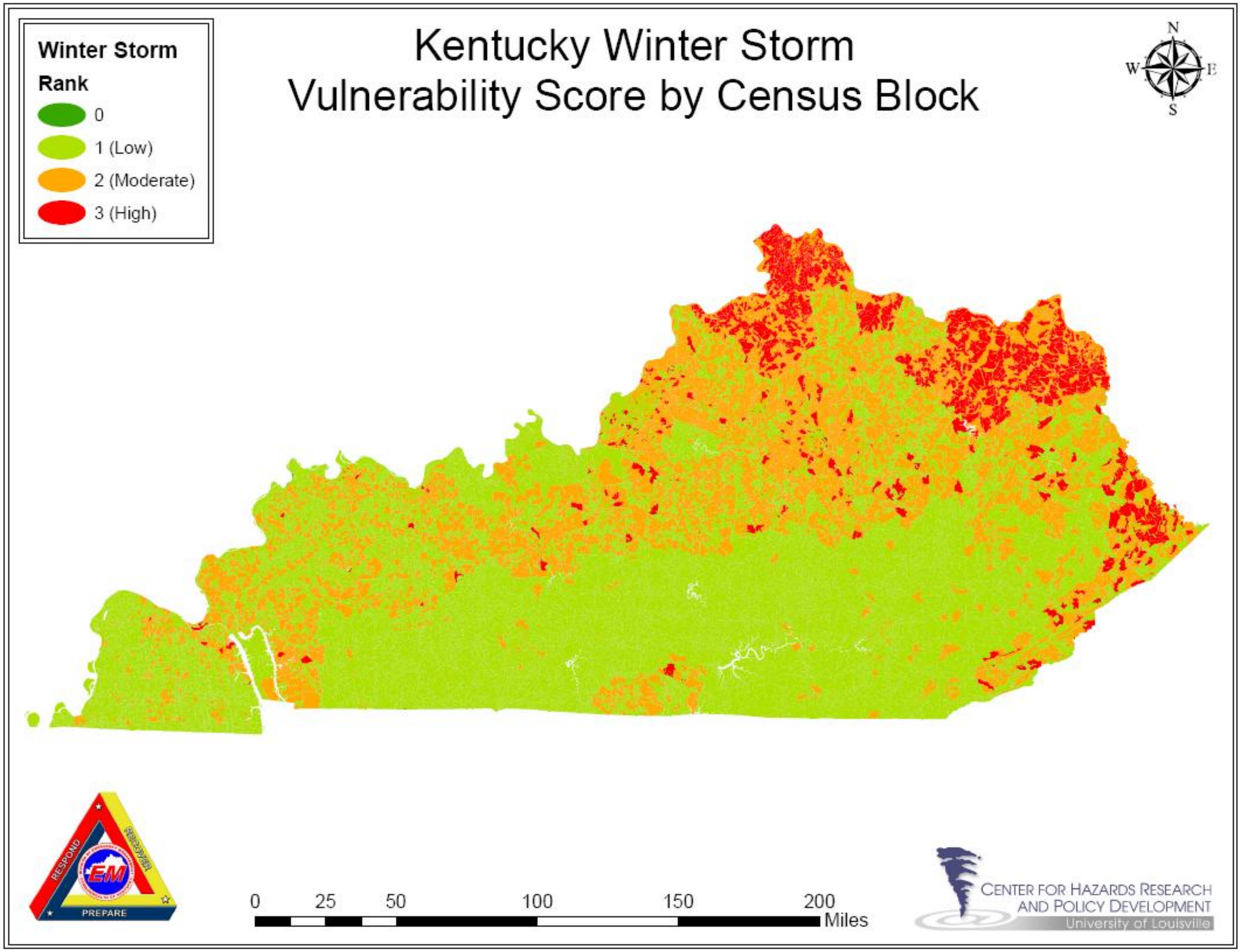
- **January 8, 1996:** The notorious "Blizzard of 96'" brought a significant amount of snowfall to the Greater Cincinnati/Northern Kentucky area and was the largest 24-hour snowfall on record. Total snowfall from the storm accumulated to 14.3 inches, over half the amount the area receives in an entire season (23 inches). Many homes and businesses experienced partial or total roof collapses due to the weight of the snow. Road conditions remained hazardous in some locations for many days.

- **March 3, 1993:** One of the strongest winter storms ever (it is sometimes referred to as "the storm of the century") dumped 30 inches of snow in some areas of eastern and southeastern Kentucky. The snow accompanied high winds, produced snow drifts from six (6) to 10 feet high. For two days Interstate 75 was closed from Lexington, Kentucky to the Tennessee border. Interstate 64 was closed from Lexington to the West Virginia border. Between 3,000 and 4,000 motorists were stranded along the highways. Some of the heavier snow amounts with respective locations were: 30 inches in Perry County, 24 inches in Pikeville, 22 inches in Ashland, and 22 inches in London.

Assessing Vulnerability by Jurisdiction: Severe Winter Storm

Severe Winter Storm Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Severe Winter Storm Risk Score employing the Annualized Loss Rank (ALR) and multiplying it by the Exposure Score. The ALR for Severe Winter Storm was created by calculating Severe Winter Storm occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 60 year timeframe. Each county's ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. This process created the Severe Winter Storm Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Severe Winter Storm Vulnerability Score.

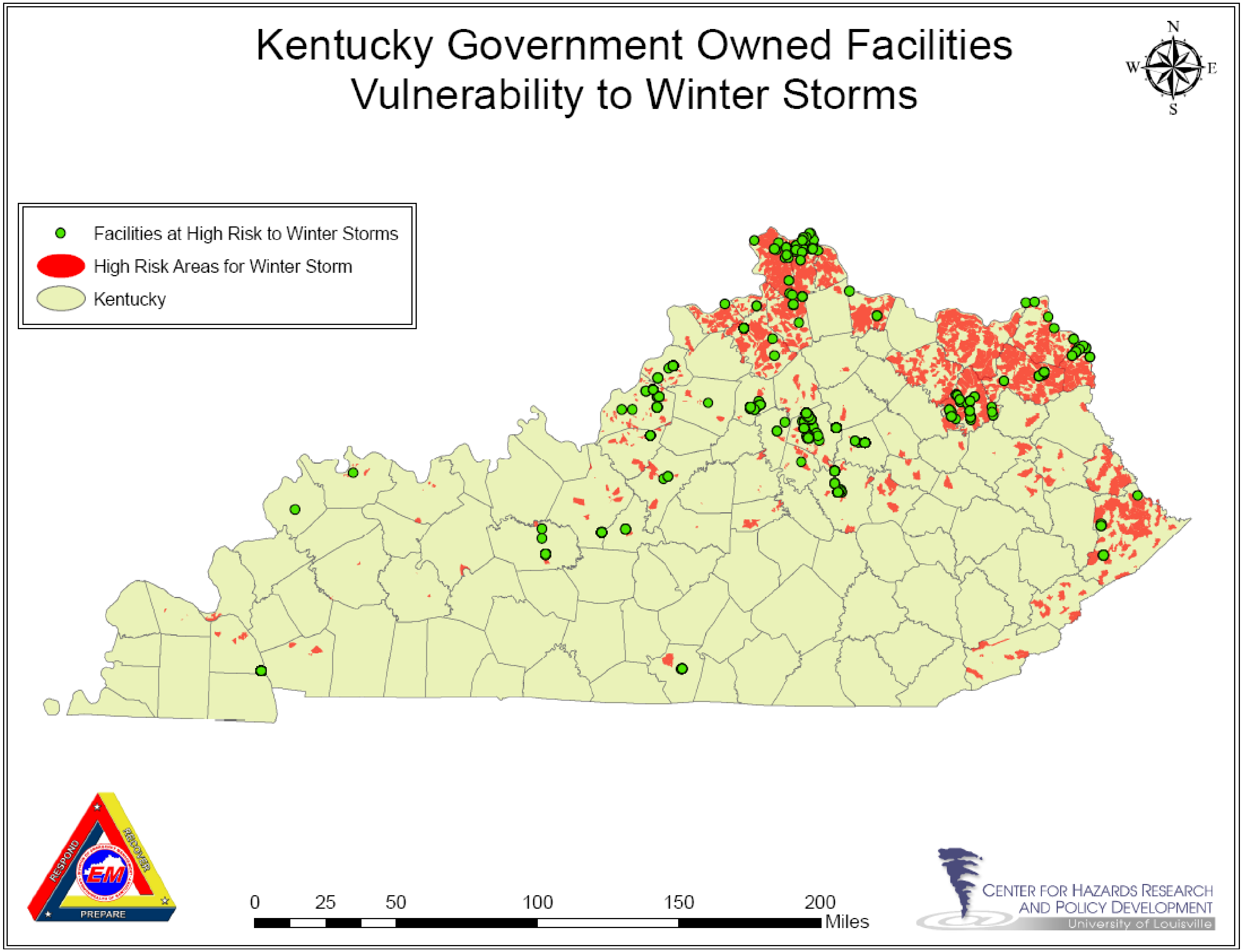

Winter Storm Rank
0
1 (Low)
2 (Moderate)
3 (High)
Kentucky Winter Storm
Vulnerability Score by Census Block
N
W
E
S
PREPARE
RESPOND
0
25
50
100
150
200
Miles
CENTER FOR HAZARDS RESEARCH AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Severe Winter Storm

The *Annualized Loss Rank (ALR) loss estimate model* was used to estimate losses for Severe Winter Storm. Potential loss for jurisdictions can be calculated by using the ALR created from the Average Annual Risk data captured for each county. This produces a loss estimation model based on actual loss and occurrence data that has occurred over a set period of time. See Appendix 36 for a jurisdictional (county) loss estimate for Dam Failure.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Severe Winter Storm

This process was performed using level (3) block Risk Scores as the hazard layer for Severe Winter Storm. The state facilities were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Severe Winter Storm event. See Appendix 37 for a county breakdown of how many state facilities are located within a level (3) Severe Winter Storm hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Winter Storms
N
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Facilities at High Risk to Winter Storms
High Risk Areas for Winter Storm
Kentucky
0 25 50 100 150 200
Miles
RESPOND
RECOVER
PREPARE
EM
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

4.1.12 Tornado

Hazard Identification: Tornado

Description

A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth.

Tornadoes are generally spawned by thunderstorms, though they have been known to occur without the presence of lightning. Stronger tornadoes may attain awe-inspiring intensity, with wind speeds that exceed 200 mph and in extreme cases approaching 300 mph.

The United States has the highest incidence rate of tornadoes worldwide, with more than 1,000 occurring every year. Peak months of tornado activity for Kentucky and south central Indiana are usually April, May, and June. However, tornadoes have occurred in every month and at all times of the day or night.

Types

Tornadoes are categorized by the damage pattern exhibited by the actual tornado occurrence. Tornado wind speeds are estimated after the fact based on the damage they produce. Individual occurrences are categorized on a scale of 0 (weakest) to 5 (strongest) according to the Enhanced Fujita Scale.

Originally, the Fujita-Pearson Tornado Scale was the measurement for tornado intensity. For use in this iteration of the state hazard plan, the enhanced Fujita Scale will be referenced.

The original Fujita scale had several deficiencies in addition to the limitations of weak structures in conveying strong tornado damage:

- Rankings are subjective and based solely on the damage caused by a tornado
- Difficult to apply with no damage indicators (if a tornado does not hit structures, large trees, etc.)
- No account of construction quality and variability
- Subject to biases of the surveyors
- No definitive correlation between damage and wind speed

On February 1, 2007, the Enhanced Fujita scale replaced the original Fujita scale in all tornado damage surveys in the United States. It is important to note that, despite the improvements, the EF-scale still remains a set of wind estimates based on eight (8) levels of damage to 28 different types of structures and vegetation. The typical damage associated with the different degrees of tornado remains the same.

FUJITA SCALE		OPERATIONAL EF SCALE	
F Number	**3 Second Gust (mph)**	**EF Number**	**3 Second Gust (mph)**
0	45-78	0	65-85
1	79-117	1	86-110
2	118-161	2	111-135
3	162-209	3	136-165
4	210-261	4	166-200
5	262-317	5	Over 200

Facts

- About 1,000 tornadoes occur in the US each year. However, this number is a rough estimate, as many tornadoes go unreported.
- There is no world-wide system to track and record tornadoes, or even to compare data.
- On average, 60 people are killed by tornadoes each year, mainly due to flying debris.
- The “Tri-State Tornado” of March 18, 1925, killed 695 people in Missouri, Illinois, and Indiana.
- The path of a single tornado can be dozens of miles long, but tornadoes rarely last longer than 30 minutes
- Effects of tornadoes may include crop and property damage, power outages, environmental degradation, injury, and death.
- Powerful tornadoes have lifted and moved objects weighing more than 300 tons a distance of thirty feet and have tossed homes greater than 300 feet away from their foundations.

Primary Impacts

- The primary impacts of tornado outbreaks affect infrastructure and human life most directly. Catastrophic damage may result from tornadoes leaving houses, businesses, and even streets destroyed.

Secondary Impacts

- Loss of critical infrastructure may result in hazards and additional problems well after a tornado has passed. Citizens may be without shelter, power, or running water for several days, depending on the severity of the tornado.

- Loss of critical infrastructure may also impact local or regional economies by inhibiting transportation of goods and the availability of certain services.

Hazard Profile: Tornado

Profile Risk Table

Period of Occurrence	According to the 2008 National Weather Forecasting Service, peak months of tornado activity for Kentucky and south central Indiana are usually April, May, and June. However, tornadoes can occur at any given time throughout the year.
Number of Events to Date: 1960 to 2009 Sheldus Data	239
Past Damages: 1960 to 2009 Sheldus Data	$764,591,124
Annual Chance Probability Ratio	4.05
Warning Time	*Storm-Based Tornado Warning Time* (NOAA 2008) – 14 minutes *Monitored Storm Systems or Weather Systems w/History of Tornadoes* – Anywhere from 20 to 60 minutes in advance
Potential Impacts	Impacts human life, health, and public safety. Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroy critical facilities, and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and agribusiness losses.

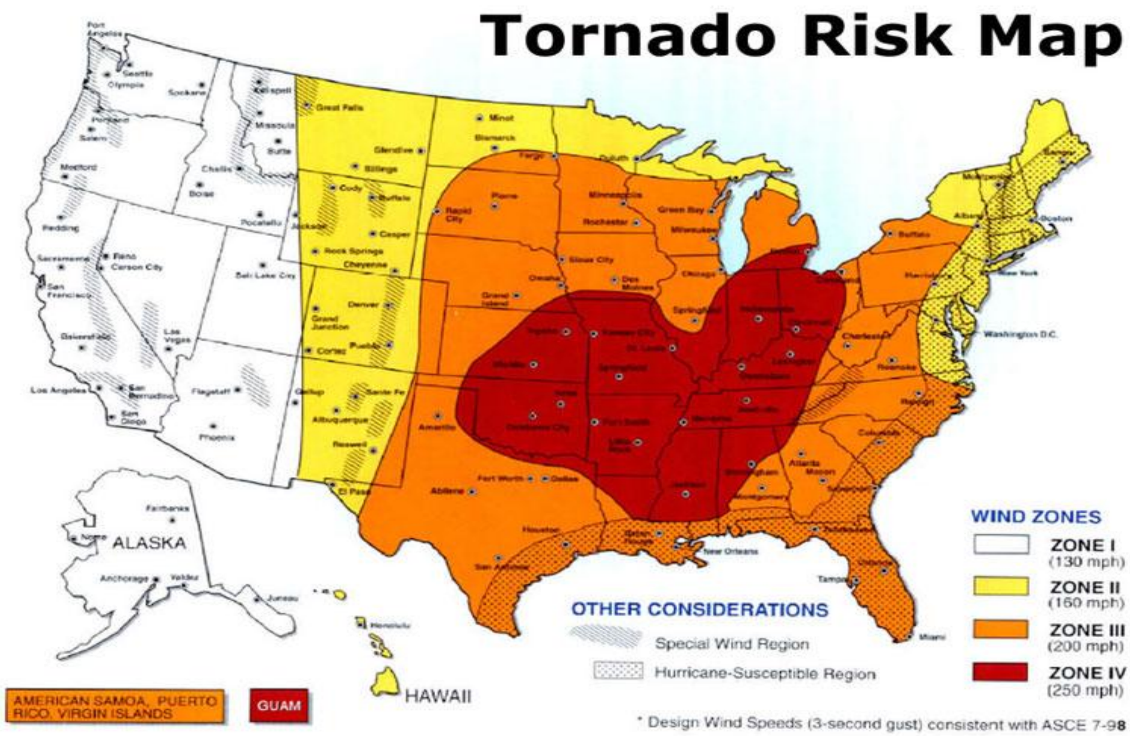
Tornadoes are somewhat common throughout Kentucky and have occurred in every month of the year. Unfortunately, the occurrence of a tornado is highly unpredictable. Forecasting the exact time and location a tornado will touch down and the path it will take is nearly impossible.

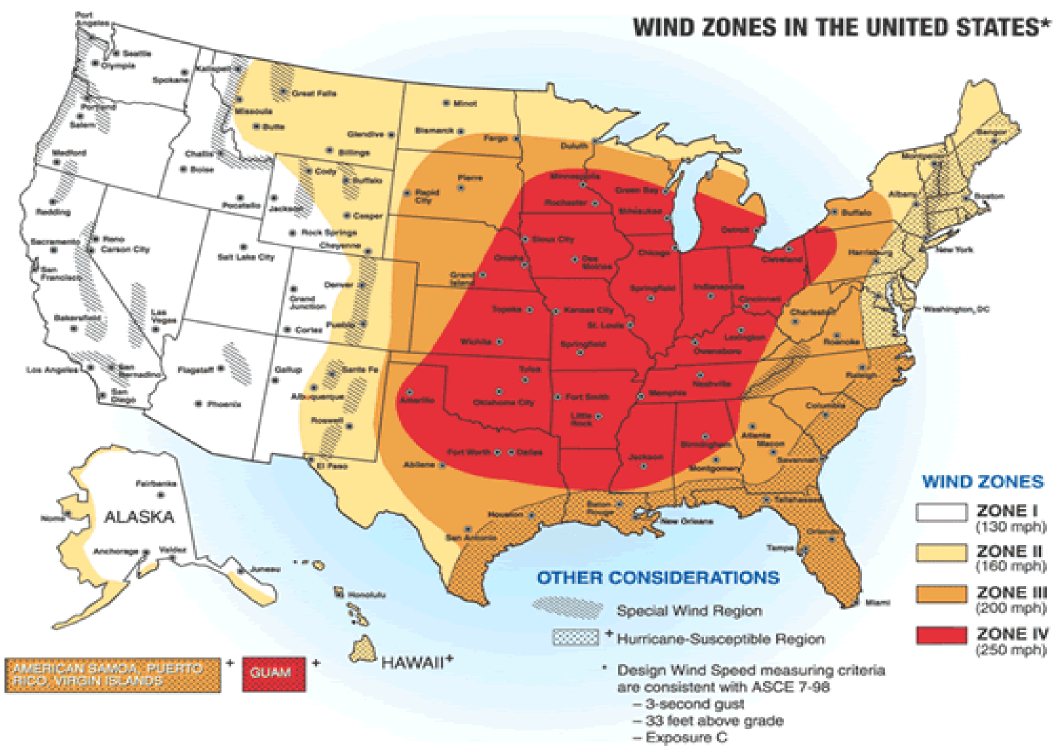
It is possible however to create a valuable risk assessment based on historic occurrences of tornados and the damage resulting from such events. Also, it is important to consider the majority of Kentucky is located in the most severe wind zone (ZONE IV 250 mph) in the country. The state is historically highly vulnerable to tornado-related weather.

To gain a better understanding of the magnitude of tornado impacts on the state, information regarding tornado events in Kentucky follows.

- **May 8 2009:** A tornado touched down in eastern Garrard County south of Nina on Bethel Road. The first damage observed was of EF1 intensity and the tornado grew to EF2 before reaching the Madison County line. The tornado peaked EFE intensity in Madison County where a mobile home was picked up, thrown, and disintegrated. Two (2) adults were killed and thrown into a nearby pond. Five (5) other occupants of the mobile home were injured. On May 29, 2009, Federal Disaster DR-1841 was declared.

- **February 5, 2008:** On this date a prolific tornado outbreak took place. There were at least 16 tornados which crossed central Kentucky. The outbreak included two EF3 tornadoes in three counties. There were four (4) deaths in Allen County near Amos. The storm also included straight-line winds and gust which exceeded 100 mph in Nicholas County. On February 21, 2008 Presidential Disaster Declaration1746 was issued.
- **November 6, 2005**: On this date a long-track F3 tornado killed over 20 people in the Evansville, IN area**.** Two more deadly tornadoes occurred later that month, each of which killed one person. They were in Marshall County (KY) on **November 15,** 2005, and Ripley County (MO) on **November 27, 2005.** The most recent killer tornado in the Paducah County Warning Area was in Perry County, Missouri on **March 11, 2006.** Two persons were killed in this tornado. All the 2005-06 killer tornadoes were rated F2 or F3.
- **January 3, 2000:** F3 tornadoes struck Owensboro, Kentucky and Crittenden County, Kentucky on this date. These tornadoes demonstrate just how vulnerable this region is during the winter. These two tornadoes caused about 70 million dollars in damage, along with a couple dozen injuries. **January 1999** was another active winter month, with tornadoes on **January 21, 1999** and destructive severe thunderstorms on **January 17, 1999**.
- **March 18, 1925:** One of the most infamous tornadoes in U.S. history occurred in northern parts of the Paducah Warning Area. The Great Tri-state Tornado of March 18, 1925, was perhaps the deadliest and longest-lived in American history. This F5 tornado tracked an estimated 219 miles, killing 695 persons in its path. The tornado began near Ellington, Missouri and finally dissipated near Petersburg, Indiana. Jackson and Franklin Counties in southern Illinois suffered some of the most concentrated damage. Along a path from Gorham to West Frankfort, IL, 541 people were killed and 1,423 seriously injured in just 40 minutes. Despite the fact there was a continuous damage track, it is possible the Tri-state Tornado could have been a series of tornadoes instead of one single tornado.

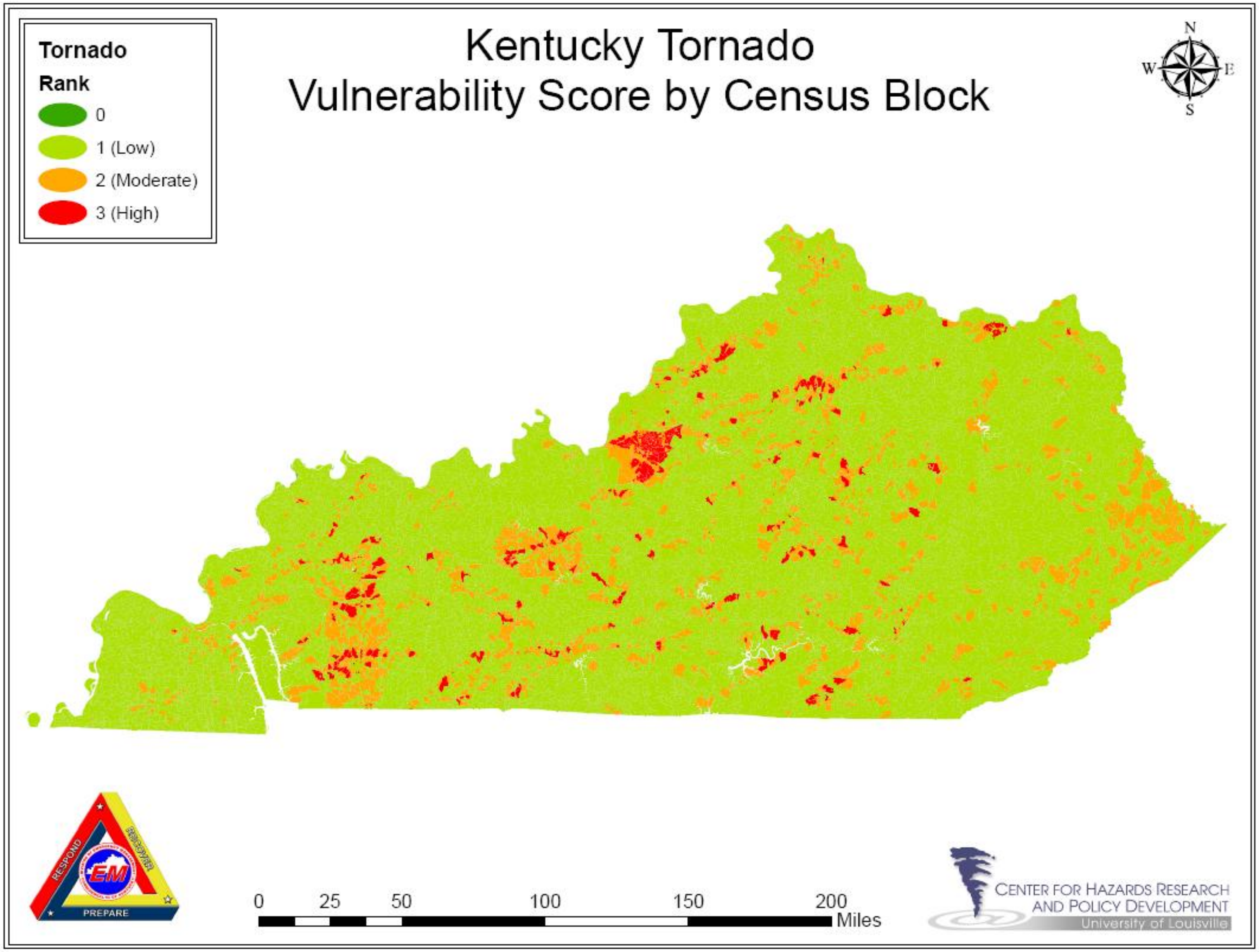




Assessing Vulnerability by Jurisdiction: Tornado

Tornado Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Tornado Risk Score employing the Annualized Loss Rank (ALR) and Layer Rank (LR) multiplied by the Exposure Score. The ALR for Tornado was created by calculating Tornado occurrences and loss data (crop and property) gathered from the Sheldus dataset over a 60 year timeframe. Each county's ALR was calculated from this data and ranked 0-3 (0=N/A, 1=low, 3=high) and then aggregated down to the census blocks of each county. The LR for Tornado was determined by taking data provided from the NOAA SVRGIS database (geo-referenced Tornado location data) and cumulating how many occurrences have occurred in each census block. The number of occurrences for each block were then calculated and ranked 0-3 (0=N/A, 1=low, 3=high). The Tornado ALR and LR were then added together and ranked 0-3 (0=N/A, 1=low, 3=high) which created the Tornado Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Tornado Vulnerability Score.


Kentucky Tornado
Vulnerability Score by Census Block
Tornado
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
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RESPOND
PREPARE
EM
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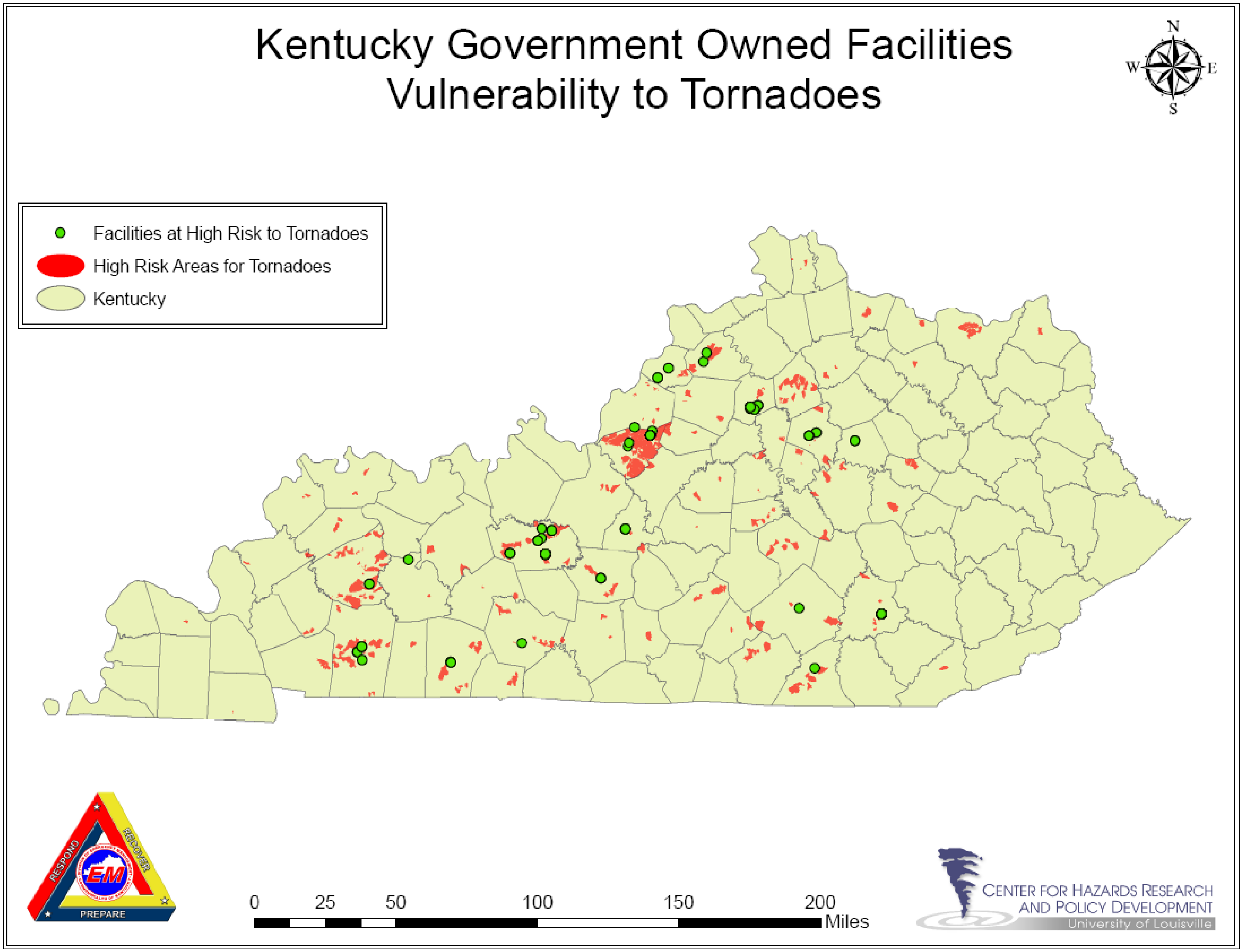
150
200
Miles
CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Tornado

The *Annualized Loss Rank (ALR) loss estimate model* was used to estimate losses for Tornado. Potential loss for jurisdictions can be calculated by using the ALR created from the Average Annual Risk data captured for each county. This produces a loss estimation model based on actual loss and occurrence data that has occurred over a set period of time. See Appendix 38 for a jurisdictional (county) loss estimate for Tornado.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Tornado

This process was performed using level (3) block Risk Scores as the hazard layer for Tornado. The state facilities were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Tornado event. See Appendix 39 for a county breakdown of how many state facilities are located within a level (3) Tornado hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Tornadoes
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S
Facilities at High Risk to Tornadoes
High Risk Areas for Tornadoes
Kentucky
RESPOND
RECOVER
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Miles
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AND POLICY DEVELOPMENT
University of Louisville

4.1.13 Wildfire

Hazard Identification: Wildfire

Description

According to USGS, a wildfire is defined as combustion, marked by flames or intense heat, in natural, settings, often ignited by lightning or human activities and poses a growing threat to most regions of the United States. Though often a beneficial occurrence, fires are frequently suppressed by various agencies to prevent structural loss. This suppression of wildfires, however, eventually leads to more severe fires, as vegetation becomes denser.

Though structures may be destroyed or heavily damaged by wildfire, the long-term secondary effects may be of more consequence. These include erosion, landslides and flooding, the introduction of invasive species, and changes in water quality in the surrounding areas.

Wildfires in areas of the Northeast and the eastern Midwest can occur at any time in the year without warning, but are more likely to occur during droughts in the spring and early summer. The wildfire season is generally defined as March thru November, with most wildfires occurring in April or May when large amounts of dry, winter debris are left are still present as fuel. As plants become greener late into May and June, the risk of wildfire is reduced. Uncontrollable fires which burn during this “green-up” time of year and are not associated with drought or lightening are almost always anthropogenic in nature, being started by campers or homeowners burning lawn debris who don’t properly extinguish fires.

Types

There are three (3) classifications of wildfires:

1. *Ground fires*, sometimes called bog fires, are a slow-spreading, smoldering fire which burns dry, decomposed leaves, and twigs on the ground.
2. A *surface fire*, or brush fire, is a faster moving fire which burns in vegetation such as grass, grain fields, scrub oak, hemlock, pine, chaparral, or marsh weed (cat tails). Surface fires however, are considered easily controllable
3. The *crown fire* is often considered the traditional forest fire, which spreads flame from treetop to treetop and are most often caused by vertically spreading brush fires.

In terms of fuel for fires, four (4) characteristics of biomass fuels significantly affect wildfire behavior and fire effects:

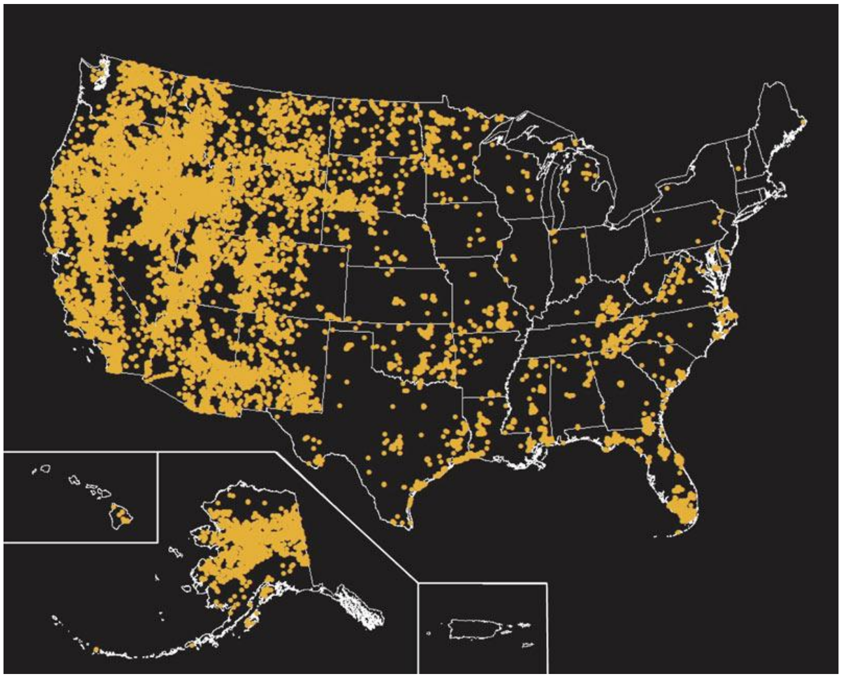
1. Moisture content may be the most important property in terms of controlling flammability because moisture in biomass requires heat to evaporate the moisture so the biomass can burn.
2. The second characteristic, fuel size, is generally described by the time in hours it takes for the moisture content of the fuel to decline by about two-thirds. Fuels are divided into the following classifications.
   a. **1-hour time lag fuels** are also called fine fuels or flash fuels and include needles, leaves, and grass. They're the most important type of fuel in terms of spreading fires, but contribute very little to fire intensity or damage.
   b. **10-hour time lag fuels** include woody twigs and branches up to a quarter-inch in diameter, which is about the diameter of a pencil, and lose two-thirds of their moisture content in about 10 hours. The types of fuel are also important in the spreading of fires because they ignite and burn quickly, but can also continue to burn when carried by wind (called a firebrand) and can begin burning in areas ahead of the larger fire.
   c. **100-hour lag time fuels** are substantially larger than the 1-hour and 10-hour fuels, ranging up to three (3) inches in diameter. On occasion fuels of this size can also be firebrands, but are most often contributors to fire intensity and not fire spread.
   d. **1,000-hour time lag fuels** are classified as anything above three (3) inches in diameter and generate the majority of the damage caused by fire due to their high levels of burn intensity. They don't contribute much, however, to the rate of speed of the fire because they're slow to ignite and are too heavy to be carried as firebrands by the wind.
3. Distribution of fuels is measured by compactness and continuity.
   a. Compactness, or porosity, refers to how closely packed together fuels are. Highly compacted fuel is more resistant to burning because ventilation is reduced (fires need oxygen to burn) and moisture loss is slowed in dry conditions.

b. Continuity refers to the amount of continuous fuels available for a fire to burn and spread. For a fire to burn successfully, the fuel must be readily available and consistent in geographic distribution. It is for this reason firelines, or manmade breaks in the fuel supply, are often used to contain wildfires.

4. The fourth and final characteristic is fuel quantity, which refers directly to the amount of dead biomass (needles, leaves, and branches that have fallen) and undergrowth (grasses and forbs, shrubs, and small trees).

Facts

- In 2006, 96,385 wildfires burned 9,873,745 acres nationwide.
- During the past 200 years wildfire frequency has decreased, while wildfire intensity has increased.
- Many land management agencies use controlled “prescribed fires” to manage forested areas.
- Wildfires have a number of positive impacts on the environment by improving habitat, recycling nutrients, and maintaining diverse forest communities.
- The map shown below indicates the areas which have experienced wildfires covering more than 250 acres, from 1980 to 2003.



(Source: NASA, 2006)

- A large wildfire (often referred to as a conflagration), has the ability to modify local weather.

Impacts

Each year in the U.S. fire injures 23,000 and kills 4,000, making America among the highest in per capita death rate due to fire in the industrialized world. Sadly, approximately 100 firefighters are killed in the United States as well.

Mitigation and prevention efforts have had a positive impact on fatalities and loss of property, as can be seen by the numbers of fatalities in 1971; 12,000 citizens lost their lives to fire (three times the current level), along with 250 firefighting personnel (150% greater than today's number). Still though, losses associated with wildfire exceed $8.5 billion each year and 9,000 homes have been lost to fire across the United States since 1985.

Because smoke from wildfires is a mixture of gases and fine particles from burning trees and other plant materials, it can irritate eyes and cause damage to respiratory systems causing shortness of breath, chest pain, headaches, asthma exacerbations, coughing, and death. For those with heart disease, rapid heartbeat and fatigue may be experienced more readily under smoky conditions.

Hazard Profile: Wildfire

Profile Risk Table

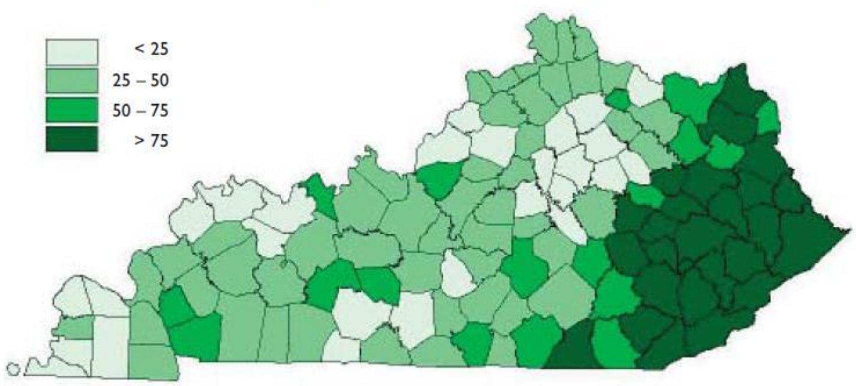
Period of Occurrence	According to the Kentucky Division of Forestry, fire hazard seasons occur mid February through April and October 1st through mid December.
Number of Events to Date:	N/A
Past Damages	N/A
Annual Chance of Probability Ratio	N/A: The above sections are very hard to determine for the Wildfire hazard because of its unpredictable nature.
Warning Time	None, unless associated with drought
Potential Impacts	Impacts on human life, health, and public safety. Loss of wildlife habitat, increased soil erosion, and degraded water quality. Utility damages and outages, infrastructure damage (transportation and communication systems), structural damage, damaged or destroyed critical facilities, and hazardous material releases.

Geographic Locations Affected

Forests cover approximately 12 million acres of land in Kentucky, representing 47 percent of the state's land cover. The Cumberland Plateau and the Appalachians in the eastern part of the state account for 50 percent of the state's forest cover, with 25 contiguous counties having a forest cover percentage of greater than 75 percent.

Oak-hickory is the dominant forest cover and covers 8.4 million acres, or 72 percent of the state's forested land. Oak-pine forests make up 9 percent, maple-beech-birch and aspen-birch make up 7 percent, oak-gum-cypress and elm-ash-cottonwood make up 6 percent, softwood makes up 5 percent, and non-stocked, 1 percent.

Percentage of land in forest by county



(Source: Kentucky Division of Forestry, 2004)

Previous Occurrences

Division of Forestry Districts

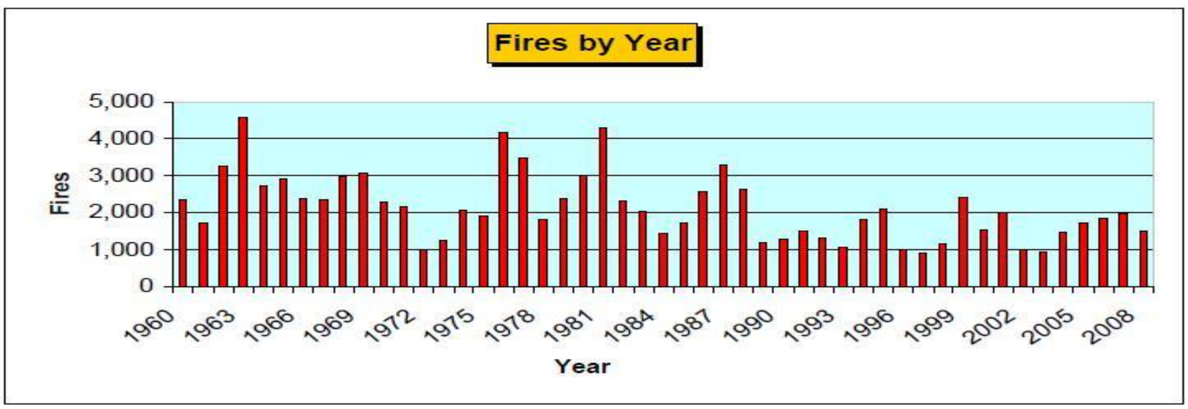
(Source: Kentucky Division of Forestry, 2009)

From 1945 to the present, Kentucky has experienced over 126,000 wildfires which burned 5,003,952 acres statewide. Fire most threatens the eastern districts because if their extensively forested areas and because of the poor accessibility to many areas that makes fire suppression more difficult. Though this is the region most affected by wildfire, fires do occur throughout the state. Less than a dozen counties have not experienced wildfire in the last decade.

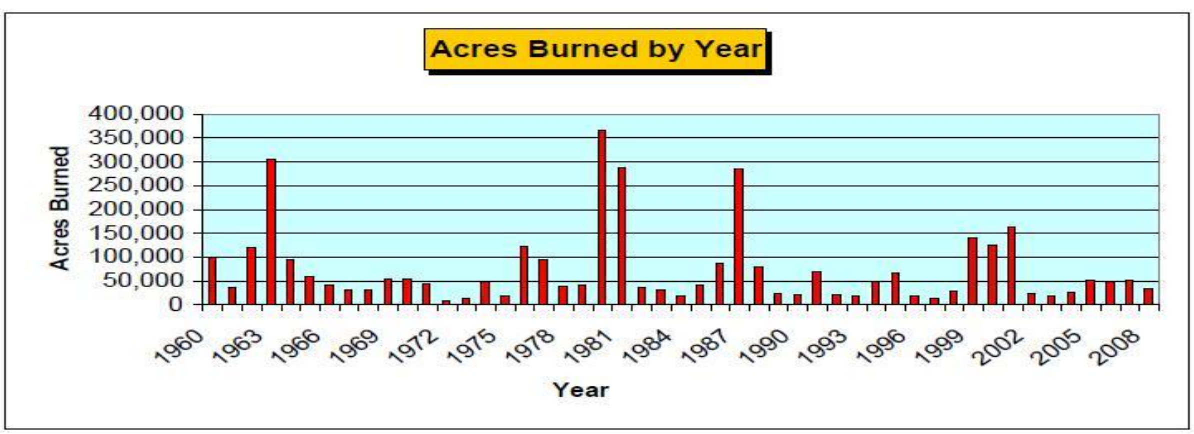
Fire Suppression Authorizations 1990-2009

Date	District
December 1, 1995	Western District Complex
November 4, 1999	Eastern District Complex
November 2, 2001	Eastern District Complex
November 2, 2001	Kentucky River Complex
November 2, 2001	Southeastern District Complex
November 7, 2001	Eastern District Complex

The following graphs detail the number of fires by year and the number of acres burned by year between 1960 and 2008, indicating that predicting wildfire is made difficult due to sporadic spikes and lulls from season to season.



(Source: Kentucky Division of Forestry, 2008)

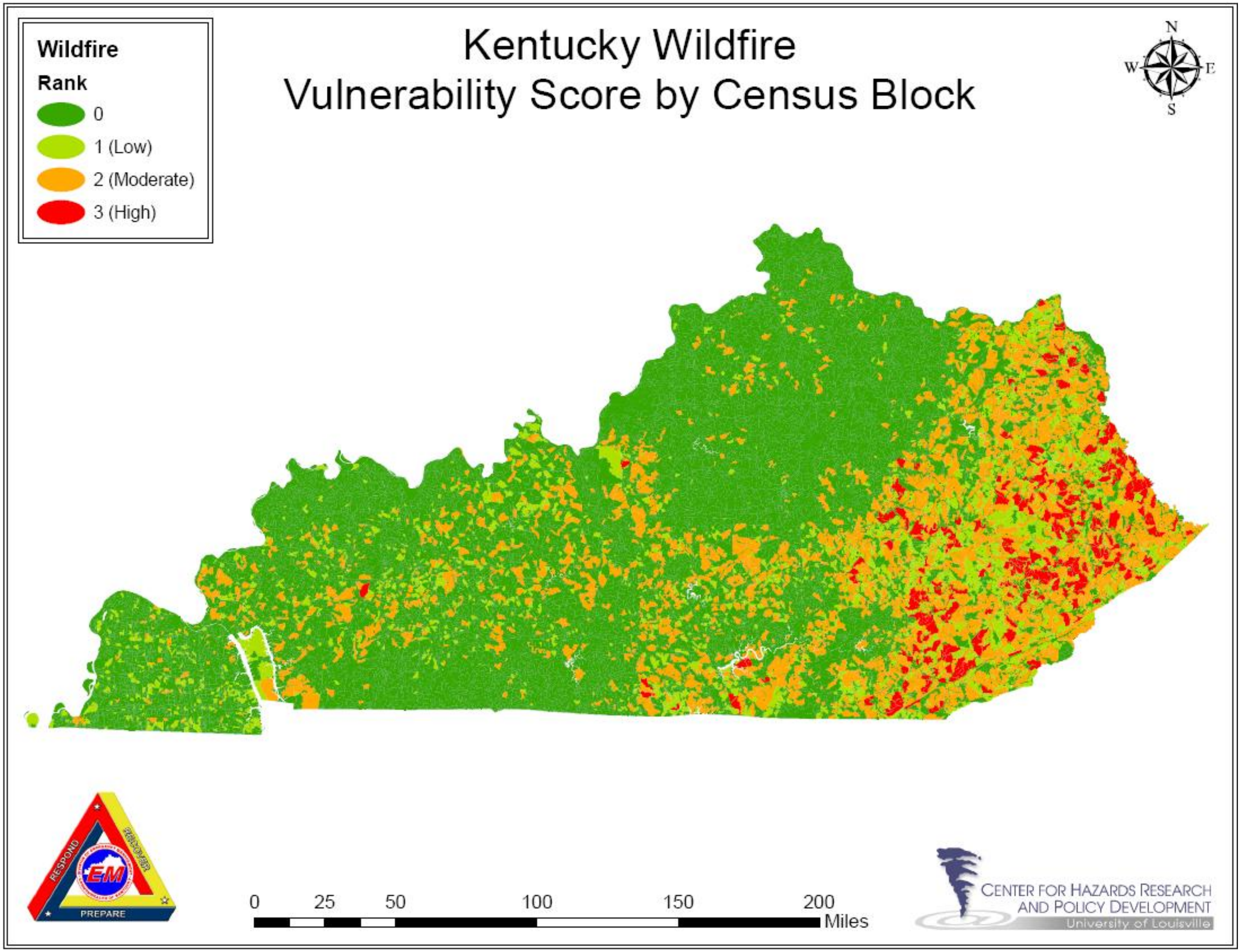


(Source: Kentucky Division of Forestry, 2008)

Assessing Vulnerability by Jurisdiction: Wildfire

Wildfire Vulnerability Score = Exposure Score X Risk Score

Assessing vulnerability by jurisdiction (census block) was determined through creating the Wildfire Risk Score by determining the Layer Rank (LR) and multiplying it by the Exposure Score. The LR for Wildfire was determined by taking data provided from the Kentucky Division of Forestry database (geo-referenced Wildfire location data) and cumulating how many occurrences have occurred in each census block. The number of occurrences for each block were then calculated and ranked 0-3 (0=N/A, 1=low, 3=high) which created the Wildfire Risk Score. The Risk Score was then multiplied by the Exposure Score to produce the Wildfire Vulnerability Score.


Kentucky Wildfire
Vulnerability Score by Census Block
Wildfire
Rank
0
1 (Low)
2 (Moderate)
3 (High)
N
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RESPOND
PREPARE
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100
150
200
Miles
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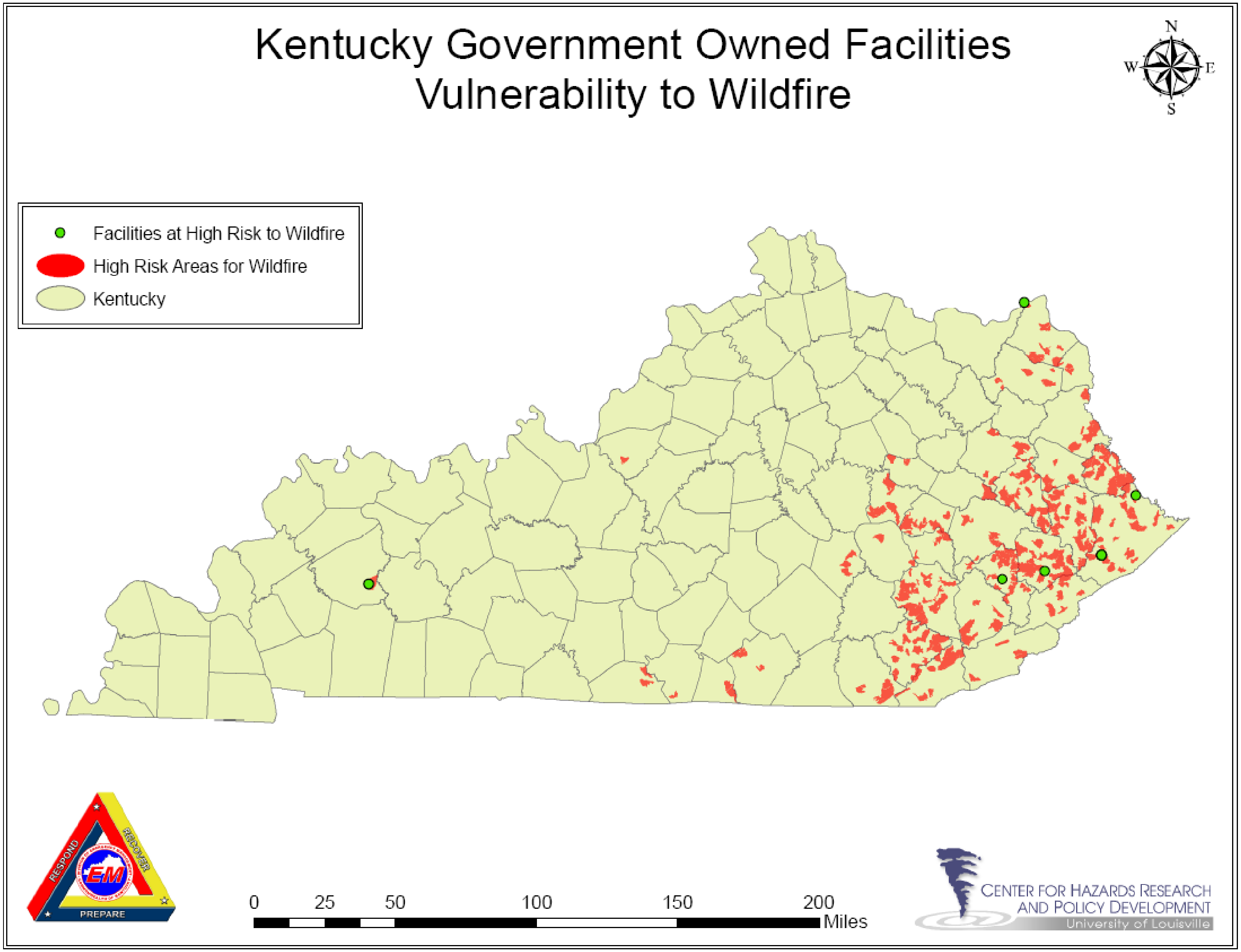
AND POLICY DEVELOPMENT
University of Louisville

Estimating Potential Losses by Jurisdiction: Wildfire

The *Hazard Layer Rank (LR) loss estimate model* was used to estimate losses for Wildfire. Potential loss for jurisdictions can be achieved by using the Layer Rank (LR) created from the level (3) block Risk Scores overlaid onto the Property Rank scores from the Exposure Score. This produces a very granular loss estimation model based on GIS spatial analysis of where you have a hazard layer compared to where you have dollar property exposure. See Appendix 40 for a jurisdictional (county) loss estimate for Wildfire.

Assessing Vulnerability and Estimating Potential Losses of State Facilities: Wildfire

The process for determining state facility vulnerability and loss estimation is very similar to the process explained above. The level (3) block Risk Scores were used as the hazard layer for Wildfire. State facilities (point data) were placed into a GIS mapping session and overlaid onto the level (3) census block Risk Scores. The state facilities captured within each hazard layer were pulled out of the database and deemed vulnerable and estimated to be damaged during a Wildfire event. See Appendix 41 for a county breakdown of how many state facilities are located within a level (3) Wildfire hazard layer and therefore considered vulnerable and estimated to be damaged.


Kentucky Government Owned Facilities
Vulnerability to Wildfire
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Facilities at High Risk to Wildfire
High Risk Areas for Wildfire
Kentucky
RESPOND
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CENTER FOR HAZARDS RESEARCH
AND POLICY DEVELOPMENT
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Mitigation Strategy

5.1 Hazard Mitigation Goals

***Requirement* §201.4(c)(3)(i): [The State mitigation strategy shall include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses.**

The Mitigation Strategy was thoroughly reviewed and revised for the update of the 2007 Kentucky Hazard Mitigation Plan. KyEM, CHR, and UK had a unique opportunity provided through the seven (7) Presidential Declarations which occurred over the last three (3) years. The team considered these events during the review of this section. The last three (3) years provided an opportunity for a real time evaluation of the mitigation plan strategies. This assessment proved to be insightful and helped KyEM to identify critical updates to the overall mitigation strategy.

Evaluation of the State Mitigation Goals and Objectives

The mitigation goals and objectives in this section reflect the goals and objectives of the 2010 state plan. The 2007 state plan provided an opportunity to incorporate the local goals and objectives into the state mitigation strategy. The 2010 plan proved even more advantageous for KyEM with the opportunity to review the goals and objectives through the eyes of an emergency management agency which has experienced seven (7) Presidential Declarations in three (3) years.

The following was taken into consideration when evaluating and updating the goals and objectives for 2010:

- Mitigation goals, objectives, and actions of the stakeholders who participated in plan update
- Stakeholder's Mitigation Action Reports
- State priority hazards identified as dam failure, drought, earthquake, extreme heat, flood, hailstorm, karst/sinkhole, land subsidence, landslide, severe storm, severe winter storm, tornado, and wildfire
- The goals and objectives represented in the mitigation project applications
- The accomplishments of the 2007 Goals and Objectives over the last three (3) years

A 100% turnover of KyEM Mitigation Program staff since the 2007 plan submission provided CHR, UK, and KyEM a fresh vision for the mitigation strategy section. Mitigation Goals was the first area reviewed. The 2010 state plan goals are as follows:

Goal 1
Reduce or eliminate injuries or risks to people from natural hazard events

Goal 2
Reduce or eliminate damages or risks to property from natural hazard events

Goal 3
Promote sustainable communities

Goal 4
Enhance state capability to implement a statewide comprehensive hazard mitigation strategy

Goal 5
Increase public and private sector awareness of and support for hazard mitigation education practices as a means of developing a culture of hazard mitigation in Kentucky

Goal 6 Conduct scientific research to promote hazard mitigation

Meaningful goals should be overarching and very achievable. KyEM, CHR, and UK staff reviewed the 2007 goals to determine if the goals addressed the needs of the state. KyEM, UK, CHR, and the SHMT have been inundated with mitigation project applications associated with recent disasters which provided the perfect opportunity to compare the goals with the type of applications being received.

A Goal Matrix was created which defines how many of the 222 project applications have addressed each goal (See Appendix 43). This comparison matrix displays which goals were being met by current applications. The Action Reports also provided insight toward updating mitigation strategies and goals. Through review of Action Reports, a better understanding was gained of mitigation projects occurring throughout the state. The evaluation process specifically broke down who is completing mitigation projects, the types of projects, hazards being addressed, counties involved, and the money being spent **(**See Appendix 44**)**. The last step was to complete a thorough review of the goals over the last three (3) years to determine if they have accomplished the needs of the Commonwealth. This evaluation process proved the 2010 goals to be overarching and provide the state with achievable mitigation opportunities.

The objectives of the plan were reviewed in a very similar process as the goals. The objectives for the 2010 state plan are listed with their associated goals:

Goal 1 Reduce or eliminate injuries or risks to people from natural hazard events
- Objective 1.1 – Promote the use of early alert systems to warn citizens of all natural hazard events

- Objective 1.2 – Reduce the impacts of hazards on vulnerable populations
- Objective 1.3 – Train public officials regarding natural hazard preparedness
- Objective 1.4 – Promote the installation of tornado safe rooms in homes and construction of community tornado shelters

Goal 2 Reduce or eliminate damages or risks to property from natural hazard events
- Objective 2.1 – Reduce property losses from flooding
- Objective 2.2 – Reduce severe repetitive loss and repetitive loss properties, thus reducing the amount of money being paid from the National Flood Insurance Program (NFIP) fund
- Objective 2.3 – Increase the number of communities participating in the National Flood Insurance Program (NFIP) and promote compliance with the NFIP for communities already participating
- Objective 2.4 – Promote involvement of local governments in the Community Rating System (CRS) program to promote better floodplain management while offering the incentive of lower flood insurance premiums
- Objective 2.5 – Reduce the vulnerabilities of state-owned facilities and infrastructure to natural hazards
- Objective 2.6 – Reduce the vulnerability of Kentucky's structures and infrastructure to the effects of geologic hazards including landslides, earthquakes, sinkhole collapse, other natural subsidence, and subsidence caused by coal mining
- Objective 2.7 – Encourage the enforcement of Kentucky's building codes as related to the construction of engineered and residential structures
- Objective 2.8 – Make existing manufactured housing more resistant to movement from their sites by high winds and swift floodwaters.
- Objective 2.9 – Improve the safety of high-hazard dams to minimize the threats associated with dam failure.

Goal 3 Promote sustainable communities
- Objective 3.1 – Provide incentives for mitigation planning and actions
- Objective 3.2 – Form partnerships to leverage and share resources
- Objective 3.3 – Support efforts which will assist with the continuity of critical and business operations

Goal 4 Enhance state capability to implement a statewide comprehensive hazard mitigation strategy
- Objective 4.1 – Determine if existing state agency programs, plans, and policies are efficient in reducing risk and vulnerability to natural hazards.
- Objective 4.2 – As a means of enhancing intra and inter-governmental coordination, establish and support an on-going liaison between federal, state, regional, and local governments as well as the private sector and general public through the State Hazard Mitigation Team.
- Objective 4.3 – Integrate the pre- and post disaster mitigation functions with the response and recovery functions of the state

- Objective 4.4 – Review and update the state risk and vulnerability assessment at a minimum of every three (3) years
- Objective 4.5 – Coordinate funding resources and opportunities among state agencies to assist both state and local sub-grantees to meet the non-federal match requirements for federal mitigation-related funding sources
- Objective 4.6 – Support the development and use of disaster loss reduction-related building codes and standards designed to reduce vulnerability and risk to all hazards
- Objective 4.7 – Support the development and enhancement of local capability to practice hazard mitigation
- Objective 4.8 – Promote new policies to enhance hazard mitigation initiatives

Goal 5 Increase public and private sector awareness of and support for hazard mitigation education practices as a means of developing a culture of hazard mitigation in Kentucky

- Objective 5.1 – Develop a hazard mitigation information dissemination tool
- Objective 5.2 – Develop and promote outreach strategies designed to educate about Kentucky's hazards, risks, vulnerabilities, and the applicable mitigation actions
- Objective 5.3 – Identify and encourage the incorporation of available hazard mitigation education and outreach programs/products
- Objective 5.4 – Improve public knowledge of hazards and protective measures so individuals can appropriately respond during hazard events

Goal 6 – Conduct scientific research to promote hazard mitigation

- Objective 6.1 – Leverage existing relationships with CHR and UK in addition to continuing to establish partnerships with other public and private research universities in Kentucky to enhance and support efforts to secure funding, contracts, and opportunities; enhance research infrastructure; and to assess Kentucky's vulnerability to natural hazards
- Objective 6.2 – Collaborate with FEMA's Emergency Management Institute and Kentucky's public and private universities in the development of higher education curricula primarily designed to educate professionals in emergency management, as well as to integrate hazard mitigation curricula into existing career programs
- Objective 6.3 – Foster the continued development and improvement of existing research centers and laboratories within Kentucky's public research universities by supporting efforts to secure funding and research contract opportunities to enhance in-state capabilities for conducting hazard mitigation-related research
- Objective 6.4 – Improve hazard information, including databases and maps

An Objective Matrix was created which denotes how many applications are relevant to each objective (See Appendix 45). CHR reviewed the "Action Reports" to gain an understanding of what other types of mitigation activities/objectives are being addressed by other agencies (See Appendix 44). Next, KyEM, UK, and CHR reviewed each objective's fulfillment over the last three (3) years to determine if each objective was still viable.

The above mentioned steps determined that the 2007 objectives had provided the state with a successful mitigation blueprint. The evaluation process did produce some alterations of a few of the objectives to meet the current administration's goals and objectives. However, in large the goals and objectives from the 2007 plan remained valid and will continue to promote a culture of hazard mitigation throughout the state.

5.2 State Capability Assessment

Requirement §201.4(c)(3)(ii): [The State mitigation strategy shall include a] discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and] a discussion of State funding capabilities for hazard mitigation projects.

Reducing the risk of negative consequences resulting from all types of hazard is a priority for the Commonwealth of Kentucky. KyEM, CHR, and UK evaluated state regulations, policies, and state-funded programs which benefit hazard mitigation activities. This is an important portion of any mitigation plan as it helps to develop a better understanding of state government activities relating directly to hazard mitigation. An analysis of the state's regulatory functions, with respect to mitigation and hazards planning, was also conducted. Programmatic and policy evaluation of the state's activities in those areas was also considered.

Kentucky State Hazard Mitigation Team (SHMT) – KyEM recognized the need for regular, ongoing mitigation stakeholder involvement to ensure the maximization of mitigation efforts in the Commonwealth. The (SHMT) is a valuable partner in mitigation planning and resource allocation and provides KyEM with multiple partners representing mitigation capabilities throughout the state. The relationships built from this dedicated working group have already proved beneficial. KyEM and CHR have partnered with the Kentucky Department for Local Government (DLG) and the Kentucky Division of Water (KDOW) on two (2) projects which will continue to promote Kentucky as a leader in the field of mitigation and bring additional mitigation funding into the state. DLG, KyEM, and CHR are working together to develop a long term recovery plan within the CHAMPS system. KDOW, KyEM, and CHR are also working together to develop the vision of Risk MAP for the state.

The team is comprised of 16 voting and eight (8) non-voting members representing state and local governments as well as non-profit entities involved with mitigation and mitigation-related matters. Current membership includes voting representation from KyEM, DLG, KDOW, Area Development Districts, local emergency managers, Office of the Governor, the National Weather Service, the Kentucky Office of Homeland Security, and the Kentucky Transportation Cabinet. The team receives technical guidance from non-voting representatives from UK, CHR, FEMA, and KyEM.

Over the last nine (9) months each meeting of the SHMT has included progress reports and discussions of the status of the state and local plans. The team has also been actively involved in an analysis of CHAMPS and component development.

Each meeting includes status reports presented by CHR and UK. Team members receive detailed information regarding potential mitigation projects. The team determines the priority of Letters of Intent (LOIs) which provides KyEM with fair and impartial recommendations regarding the allocation of FEMA funding. Considerations during prioritization include a number of factors such as need, geographic location, prior mitigation grant experience, and most importantly: congruence with the state and local hazard mitigation plans.

State Regulatory Analysis Summary

Kentucky Pre- and Post- Disaster Legislation

The Kentucky General Assembly realizes that the Commonwealth is subject to disasters or emergency occurrences at all times. These instances can range from events affecting limited areas to widespread catastrophic events. Immediate and effective response to these occurrences is a fundamental responsibility of elected government. Therefore, the General Assembly established a statewide comprehensive emergency management system to provide assessment and mitigation of threats to public safety and the negative externalities resulting from all major hazards.

The Kentucky Revised Statutes (KRS) were enacted in 1942 to eliminate provisions no longer in force or effect and to compile the remaining laws into a comprehensible form. In July of 1998, KRS 39A.010 established the Kentucky Division of Emergency Management (KyEM) and local emergency management agencies, replacing Kentucky Disaster and Emergency Services. In addition, the emergency powers provided in KRS Chapter 39A through 39F were conferred upon the Governor, the county judges/executives, the mayors of cities and urban-county governments, and the chief executives of local governments. Provisions were also established for mutual aid among the cities, counties, and urban-county governments of the Commonwealth.

There are a number of sections in KRS which address the issues of emergency systems, hazard safety, and hazard mitigation (See Appendix 46).

Most of the citations contained in Appendix 46 refer to post-disaster response. There are however several statutes which specifically pertain to pre-disaster mitigation:

KRS 39 - The Division of Emergency Management shall coordinate for the Governor all matters pertaining to the comprehensive emergency management program and disaster and emergency response of the Commonwealth. The division shall be the executive branch agency of state government having primary jurisdiction, responsibility, and authority for the planning and execution of disaster and emergency assessment, mitigation, preparedness, response, and recovery for the Commonwealth… (KRS 39A.050).

KRS 147 - Any general fund appropriations made for the Local Match Participation Program may be used for flood control planning and mitigation activities and straight sewage pipe removal and mitigation activities… (KRS 147A.029).

KRS 151 - The Energy and Environment Cabinet shall administer KRS 151 and establish the requirements for obtaining a floodplain development permit (KRS 151.250). The water resources authority shall develop a public information program for use by local units of government which will assist them in the development of floodplain management and flood hazard mitigation programs… (KRS 151.600).

KRS 158 The board of each local school district, and the governing body of each private and parochial school or school district, shall establish an earthquake and tornado emergency procedure system in every public or private school building in its jurisdiction having a capacity of 50 or more students, or having more than one classroom (KRS 158.163). The earthquake and tornado emergency procedure system shall include, but not be limited to:

- A school building disaster plan, ready for implementation at any time, for maintaining the safety and care of students and staffs;
- A drop procedure - an activity by which each student and staff member takes cover under a table or desk, dropping to his or her knees, with the head protected by the arms, and the back to the windows;
- A safe area - a designated space including an enclosed area with no windows, a basement or the lowest floor using the interior hallway or rooms, or taking shelter under sturdy furniture;
- Protective measures to be taken before, during, and following an earthquake or tornado;
- A program to ensure the students and the certificated and classified staff are aware of and properly trained in, the earthquake and tornado emergency procedure system.

KRS 198B - The Uniform State Building Code (KRS 198B.050) addresses issues concerning seismic and severe wind construction in response to the Commonwealth's potential earthquake and wind threats.

KRS 211 - The Cabinet for Health Services shall develop and conduct programs for evaluation and control of activities related to radon including laboratory analyses, mitigation, and measurements (KRS 211.855).

In addition to KRS legislation, the following are other initiatives which address state hazard mitigation:

- When purchasing a home located within the boundary of a special flood hazard area (SFHA), the buyer is required to purchase flood insurance.

- Jurisdictions which participate in the National Flood Insurance Program (NFIP) have established ordinances related to floodplain development.

State Hazard Mitigation Capability Matrix

The state hazard mitigation capability matrix evaluates pre and post disaster programs in the state in the same manner as in the 2007 state plan. The following matrix identifies the most significant state-funded or state-administered programs involving hazard mitigation or loss reduction.

To evaluate the state capability matrix, CHR compiled the state capability reports (See Appendix 12). These state capability reports were distributed to the stakeholders who were asked to provide CHR with information on what programs they provide. CHR also performed a complete evaluation of the entire matrix and updated all information. The evaluation produced an updated list for the 2010 plan.

For the 2010 update, action reports were distributed out at the first stakeholder meeting on January 6, 2010, for attendees to complete and return to CHR. The purpose was to capture any new or outstanding mitigation actions for state and local levels. This data facilitated the review of the capability matrix as well.

The State Hazard Mitigation Capability Matrix provides an evaluation of the state's programs by identifying:

1. If the program relates to pre or post disaster mitigation actions
2. If the program is currently capable of funding those actions
3. If the actions affect development in hazard-prone areas
4. If the actions affect repetitive loss properties and mitigation activities
5. How the application of the program relates to mitigation actions

Definitions

Pre-Disaster-Programs - Plans, policies, regulations, funding, or practices which include an evaluation of the state's pre-disaster mitigation measures.

Post-Disaster - Programs, plans, policies, regulations, funding, or practices which include an evaluation of the state's post-disaster mitigation measures

Development in Hazard Prone Areas - Programs, plans, policies, regulations, funding, or practices which include an evaluation of the state's programs for mitigation measures in hazard prone areas

Capable of funding mitigation Initiatives - Programs, plans, policies, and regulations which are currently capable of funding mitigation initiatives

Repetitive loss properties and mitigation activities - Programs, plans, policies, regulations, funding, or practices which include an evaluation of the state's programs that affect repetitive loss properties.

Hazard Mitigation Application - Actions the program currently employs in hazard mitigation planning.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Warning Coordinator Meteorologist	**X**	**X**		All activities performed by the NWS are funded by NOAA	**X**	Educating the local population regarding storm safety, flood safety, and lightning safety. 'Turn Around - Don't Drown' is a national effort to help reduce drowning from flash floods. Partner with county and area Emergency Managers to ensure counties are prepared for severe weather events. The Storm Ready Program is a national program which certifies counties are ready to handle severe weather emergencies. Maintains and trains a cadre of weather spotters, to include ham radio operators, who call in a give damage reports and information which can help forecasters to issue better and more timely severe weather and flood warnings.
The KACo Leasing Trust Program (CoLT),	**X**			**X**	**X**	Formed in 1989, was designed to offer county governments and related political subdivisions an efficient method of financing for a wide variety of capital projects, including construction, renovation, equipment purchases or even grant anticipation. Since 1996, CoLT has offered general obligation leases for any governmental purpose. Leases can be made for any amount needed and for terms of 30 days up to 30 years
KY Interchurch Disaster Recovery Program	**X**	**X**				Coordinate responses to disasters occurring in the Commonwealth of Kentucky through the Kentucky Interchurch Disaster Recovery Program.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Department for Facilities Management Division of Historic Properties (DHP)	X		X	X	X	All state-owned buildings of fifty years and older are documented in a database. The goal is to ultimately use this information to recommend needed appropriations for the preservation and conservation needs of the most historic structures. Currently, there are over 1,000 entries in the database. DHP is responsible to administer this database.
Renaissance Kentucky	X		X	X	X	Is an effort to unite communities and resources necessary to revitalize and restore the Commonwealth's downtown areas. The Kentucky Department for Local Governments, the new lead agency, partners with the Kentucky Heritage Council, the Kentucky League of Cities, and the Kentucky Housing Corporation and the Kentucky Transportation Cabinet to implement this program.
Federal Housing Subsidy Programs				X	X	HUD administers housing and community development programs statewide. Programs include single family, multifamily, public housing, Housing Choice Vouchers, homeless, etc.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
						Assistance grants and Community Development Block Grant funds. It also administers and monitors Disaster Recovery Assistance grants.
KY Dpt. Of Mines and Minerals Design Branch & Construction Branch	X		X	X		Oversees the day-to-day construction activity on all Abandoned Mine Lands (AML) reclamation projects in the state, provides engineering services and develops plans for reclamation projects, KRS 350 includes the statutes governing the environmental regulation of surface mining of coal and other minerals and the surface effects of underground mining.
KY Abandoned Mine Land Reclamation Program	X			X		Program is authorized pursuant to PL95-87 and KRS 350 to mitigate the hazards caused by abandoned coal mines. Division funds contracts for reclamation of on-ground mine hazards and executes Memoranda of Agreement with local entities to fund waterlines into areas where past mining has contaminated the groundwater. Projects focus on mitigating hazards to: 1) public health and safety and 2) the environment.
Floodplain Management	X	X	X		X	Based on KRS 151, KY Division of Water (KDOW) has been designated as the state coordinating agency for the National Flood Insurance Program (NFIP). As the coordinating agency, the KDOW assists local governments and state agencies in answering all questions concerning the program.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Floodplain Development Permit Program	X		X		X	This program has the primary responsibility for the approval or denial of proposed construction and other activities in the 100-year floodplain of all streams in the Commonwealth. Typical activities permitted are dams, bridges, culverts, residential and commercial buildings, placement of fill, stream alterations or relocations, small impoundments, water, and wastewater treatment plants.
Dam Construction Permit Program	X		X		X	The Dam Safety and Floodplain Compliance Section shares responsibility with the Floodplain Management Section for the review and permitting of dams and hazardous impoundments as defined in KRS 151.100 and 401 KAR 4:030.
Dam Safety Program	X				X	Conducts safety inspections (approximately 300 annually) and initiates emergency action if a structure is in danger of failing, poses a threat to life or may cause serious property damage. KRS 151.297 empowers the Kentucky Energy and Environment Cabinet to take emergency action if an owner abandons a dam or refuses to take necessary action.
KY Watershed Management Initiative Education	X		X		X	The watershed approach is a coordinating framework for environmental management that focuses public and private sector efforts on selected priority problems within hydrologically defined geographic areas, taking into consideration both ground and surface water flow.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Fire Management Program	X					The Division of Forestry is responsible for fighting wild land fires on private lands. Since 1977, the Division of Forestry has averaged 2,031 fires that burned 81,025 acres annually. Almost 90 percent of these fires are caused by humans, with over 55 percent caused by arson. The damage to the Commonwealth's timber resources is valued at $85.58 per acre.
KY Firewise Program	X			X		Grants may be awarded for projects to reduce the wildfire risk and hazard in Kentucky's wild land/urban interface communities. Grant priority will be given based on community-at-risk level, establishment of a local Firewise Council or Board, and type of project submitted.
Urban Forestry Program	X					This program promotes the proper management of the urban forest including citizen support and a properly trained work force.
Forest Education Program	X			X		This program works to educate the citizens of the Commonwealth about the value of our forests by providing leadership, technical assistance and financial support.
Reforestation Program	X			X		There are more than a million acres of land in KY which could benefit from tree planting. This program grows and provides trees to certain companies and individuals.
Equipment Loan revolving program	X	X		X		This program was established by the 1948 General Assembly to provide loans to Kentucky's conservation districts for heavy and specialized conservation equipment. Through loan/lease agreements with local contractors and farmers, the districts ensure that this

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
						equipment is available at the local level to perform conservation work.
KY Soil Erosion & Water Quality Cost Share Program	**X**			**X**		This program was established to assist landowners address existing soil erosion, water quality, and other environmental problems associated with farming or woodland operations.
KY Dpt. Of Housing, Buildings, and Construction KY Building Code KRS 198B.020.	**X**					The Kentucky Building Code became effective February 15, 1980, completing Phase I of a three-phase implementation plan. This plan was fully implemented on August 15, 1982. This code is updated annually.
Plan Review Division	**X**				**X**	Architectural plans are reviewed prior to construction to ensure compliance with the Kentucky Building Code. There is a plan review fee, which is based on total square footage.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Inspection Division	X					Inspections are made on approved constructions periodically to ensure construction is done according to approved plans. Any variations must be approved. Upon final inspection, an occupancy permit is issued and the case file is transferred to the General Inspection Section in the Division of Fire Prevention for future inspections. The plan review fee includes charges for inspections.
State Fire Marshal Fire Prevention	X					Enforces various codes to ensure that all public structures, facilities, and regulated vehicles are maintained in such a manner that all occupants and users of these facilities will be protected from fire, explosion, or other similar hazard.
KyEM Hazard Mitigation Grant Program		X	X	X	X	Following a Presidential disaster declaration, the Hazard Mitigation Grant Program (HMGP) provides funding to the State for projects to reduce damages, losses and suffering in future disasters. The intent of HMGP is to provide a federal, state and local partnership in developing and funding mitigation projects. Funding is available from the FEMA (up to 75% of the project) and State (up to 12% of the project).

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
KyEM Public Assistance Program		X		X	X	The Public Assistance Program provides supplemental Federal disaster grant assistance for the repair, replacement, or restoration of disaster damaged, publicly-owned facilities and the facilities of certain private non-profit organizations. The Federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The state determines how the non-federal share is split among the applicants. The program also allows for mitigation measures to be completed during the restoration phase so that future damages are reduced. The mitigation measure must be identified before repair begins and must be cost effective.
KyEM KY Emergency Operations Plan	X	X				The KyEOP establishes policies and provisions for coordinating state and federal emergency response to natural, technological, or war related disasters and emergencies. The KyEOP also details preparedness actions to be taken by state and local governments prior to a disaster. This plan provides concepts and procedures, which are to be utilized by local government through local plans written in conjunction with the state plan.
Earthquake Preparedness Program	X		X			Provides coordination and oversight of seismic safety programs, supports public education and mitigation planning, and provides tools to support hazard reduction.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
KyEM Flood Mitigation Assistance Grant Program	X		X	X	X	The Flood Mitigation Assistance (FMA) grant program provides funding to the Commonwealth for cost-effective measures which reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA program is funded on an annual cycle. Each year the state receives a target allocation of funding for which local communities can apply. The FMA program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.
Pre-Disaster Mitigation Grant Program	X		X	X	X	The Pre-Disaster Mitigation Program (PDM) provides funds to the State for pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event. The PDM program is a nationally competitive program. There is no state allocation and no national priority for projects. The PDM program is funded on an annual cycle. The PDM program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.
KyEM Severe Repetitive Loss Grant Program	X		X	X	X	The Severe Repetitive Loss (SRL) grant program provides funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the National Flood Insurance Program (NFIP). SRL Properties are residential properties that have at least four NFIP claim payments over $5,000 each, when at least two such claims have

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
						occurred within any ten-year period, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two separate claims payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any ten-year period. The purpose of the program is to reduce or eliminate claims under the NFIP through project activities that will result in the greatest savings to the National Flood Insurance Fund (NFIF). Eligible flood mitigation project activities include: flood-proofing (historical properties only); relocation; elevation; acquisition; mitigation reconstruction (demolition rebuild); and minor physical localized flood control projects.
KyEM Repetitive Flood Claims Grant Program	**X**		**X**	**X**	**X**	The Repetitive Flood Claims (RFC) grant program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) that have had one or more claim payment(s) for flood damages.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
						RFC funds may only be used to mitigate structures which are located within a State or community that is participating in the NFIP that cannot meet the requirements of the Flood Mitigation Assistance (FMA) program because they cannot provide the non-Federal cost share or do not have the capacity to manage the activities. The long-term goal of the RFC grant program is to reduce or eliminate the number reoccurring flood insurance claims, through mitigation activities which are in the best interest of the National Flood Insurance Fund (NFIF). All RFC grants are eligible for up to 100 percent Federal cost assistance. RFC grants are awarded to Applicants on a nationwide basis without reference to State allocations, quotas, or other formula-based allocations.
Advice on landslide susceptibility of selected regions in Kentucky	**X**					KGS geologists have sponsored workshops for local officials in northern Kentucky on the susceptibility of the region to landslides and provided expertise on recognizing landslide features, mitigating the effects of landslides and responding in the event of a landslide.
Mapping	**X**					Several current and planned mapping programs at KGS can provide information for careful development. These include sinkhole maps and databases, land-use planning maps, and landslide susceptibility maps.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
Earthquake monitoring	X					The Kentucky Seismic and Strong-Motion Network is a series of earthquake-monitoring devices which, over time, are gathering detailed information about earthquake motions in Kentucky. This helps to determine the actual earthquake risk and assists in enacting appropriate building codes.
Professional consultations and evaluations of land-slide damaged homes	X					Geologists from KGS have the capability of assessing the damages to homes threatened or damaged by landslides and providing professional assessments to help qualify some homes for buyout under FEMA mitigation programs.
Division of State Risk, RISK System	X	X			X	RISK system is a database that identifies the construction, value, and risk exposures (Flood plain denotation, fire prevention, etc) for all owned properties, both personal and real properties, of the Commonwealth. With this information, insurance is procured on all subject properties to minimize financial loss to the Commonwealth in the event of a catastrophe.
The State Fire and Tornado Insurance Fund	X	X		X		Provides insurance for real property, office contents, computers, telephones, etc. It is a self-insurance program that provides all risk form coverage on an actual cash basis (ACV) or replacement cost basis (RCV) for state buildings and contents.

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
KY Dept. of Mines and Minerals Mine Subsidence Program		X	X	X		Provides assistance to property owners in 34 qualified counties which have experienced property damage resulting from collapsed underground coalmines.
Kentucky Transportation Cabinet - Rural and Municipal Aid Program		X		X		Under Emergency and Emergent Provisions, the program provides funding for temporary or permanent restoration work on rural roads.
Kentucky Transportation Cabinet County Bridge Replacement Program	X			X		Two phase program. First phase, between 1989-1994 all county bridges on school bus routes identified by a county judge were replaced. The second phase works with remaining state bridges on a case-by-case basis.
Kentucky Transportation Cabinet SAFE Patrol Program		X				SAFE Patrol operators are be available through the Transportation Operations Center to assist local, state, and federal authorities in establishing and controlling routes of ingress and egress via the limited-access highway system to affected areas. Possibility exists to bring Roadway Security Branch assets from other geographic regions of the

Programs, Plans, Policies, Regulations, Funding or Practices	Pre-Disaster	Post-Disaster	Affects Development in Hazard prone areas	Capable of funding mitigation initiatives	Affects Repetitive Loss Properties and mitigation activities	Hazard Mitigation Application
						Commonwealth to assist.
The Center for Cave and Karst Studies	X		X			The Center for Cave and Karst Studies, established in 1978 at Western Kentucky University (WKU), was the first center established primarily to deal with karst problems in the United States. The Center's offices and laboratories are located within the Department of Geography and Geology in the Environmental Science and Technology building at WKU.
The Kentucky Climate Center	X					Historical record of climatic events in Kentucky

5.3 Local Capability Assessment

Requirement §201.4(c)(3)(ii): [The State mitigation strategy shall include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.

KyEM, CHR, and UK have re-examined the authorities and capabilities of local entities to develop and implement successful mitigation strategies.

Legal Authority of Counties in Kentucky

Different types of disasters affect communities differently, so to successfully implement mitigation strategies, capabilities must exist at the local level to react in a manner which best serves the citizenry. Local governments in Kentucky have a wide range of powers available to implement mitigation programs, policies, and actions. A county may use any or all of the four (4) broad types of government authorities granted by the Commonwealth of Kentucky: (1) Regulation; (2) Acquisition; (3) Taxation; and (4) Spending for hazard mitigation purposes.

Though Kentucky Revised Statutes (KRS) affect the state in its entirety, KRS also empowers local jurisdictions to properly address appropriate mitigation actions.

<u>1. Regulation</u>

General Police Power

KRS assigns general police power to local governments, allowing them to enact and enforce ordinances which define, prohibit, regulate, or abate acts, omissions, or conditions detrimental to the health, safety, and welfare of the people, and to define and abate nuisances.

Hazard mitigation measures are also included under police power as protection of public health, safety and welfare. Towns, cities, and counties may include requirements for hazard mitigation in local ordinances. Jurisdictions within the local hazard mitigation plan areas have enacted and enforced regulatory ordinances designed to promote the public health, safety and general welfare of its citizenry.

Building Codes and Building Inspection

Many structural mitigation measures involve constructing and retrofitting homes, businesses, and other structures according to standards designed to make the buildings more resistant to the impacts of natural hazards. These standards are most often imposed through the enforcement of building codes through building inspections.

Jurisdictions have the power to develop and enforce such building codes, ensuring that mitigation strategies are optimized in terms of structural stability when facing natural hazards.

Land Use

KRS have also provided for power over land use at the local level. Through various statutes concerning land use, local jurisdictions can control the quantity, timing, density, quality, and location of new development; all of which ultimately determine the level of vulnerability of the community in the event of a natural hazard. Land use regulatory powers include the power to engage in planning, enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls.

Planning

Local jurisdictions have the authority to perform a number of duties related to planning, including: conducting studies of the area; determining local objectives; preparing and adopting plans for achieving those objectives; developing and recommending policies, ordinances and administrative means to implement plans.

Zoning

Zoning is the most traditional and commonly used tool available to local governments for the control of land use. The statutory purpose for zoning power is to promote health, safety, morals, or the general welfare of the community. Land uses controlled by zoning include the type of use (e.g., residential, commercial, industrial) as well as minimum specifications for use such as lot size, building height, setbacks, density of population, etc.

Subdivision Regulations

Subdivision regulation authority controls the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require subdividers to install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. They prohibit the subdivision of land subject to flooding, unless flood hazards are overcome through filling or other measures, and prohibit filling of floodway areas. Subdivision regulations require plans be approved prior to the division or sale of land. Subdivision regulations are a more limited tool than zoning and only indirectly affect the type of use made of land or minimum specifications for structures.

Floodplain Ordinance

The purpose of a local floodplain ordinance is to (1) minimize the extent of floods by preventing obstructions that inhibit water flow and increase flood height and damage; (2) prevent and minimize loss of life, injuries, property damage, and other losses in flood hazard areas; and (3) promote the public health, safety and welfare of citizens of the jurisdiction in flood hazard areas. The ordinance also makes certain that areas meet the minimum requirements of participation in the National Flood Insurance Program (NFIP).

The incentive for local governments adopting such ordinances is to afford residents the ability to purchase flood insurance through the NFIP and be eligible for state Hazard Mitigation funding.

2. Acquisition

The power of acquisition can be a useful tool for pursuing local mitigation goals. Local governments may find the most effective method for completely hazard proofing a particular piece of property or area is to acquire the property (either in fee or a lesser interest, such as an easement), thus removing the property from the private market and eliminating or reducing the possibility of inappropriate development occurring. The state law empowers cities, towns, and counties to acquire property for public purpose.

3. Taxation

The power to levy taxes and special assessments is an important tool delegated to local governments by the Commonwealth of Kentucky. The power of taxation extends beyond merely the collection of revenue and can have a profound impact on the pattern of development in a community.

4. Spending

The fourth major power delegated by the Kentucky General Assembly to local governments is the authority to make expenditures in the public interest. Hazard mitigation principles can be made a routine part of all spending decisions made by the local government, including the adoption of annual budgets.

Jurisdictional Support

Most residents have a general knowledge regarding potential hazards facing their community. However, residents typically have received little education concerning mitigation actions which increase or decrease the community‘s vulnerability to certain hazards. Ensuring citizens have a working knowledge of mitigation strategies and potential losses are a key planning factor for all jurisdictions.

KyEM, in an effort to reach both the general public and local officials, has participated in numerous seminars, conferences, and other events. Specific outreach has been made to elected officials at periodic meeting of mayors and judge/executives.

During the annual 2010 County Judge/Executive Conference, the SHMO, UK, and the KyEM Intergovernmental Liaison conducted several mitigation workshops. The focus of these workshops was to introduce new county officials to the Kentucky Hazard Mitigation Program and to field any questions they might have.

KyEM, on behalf of the Governor, sponsors an annual Governor's Emergency Management Workshop at which there are multiple sessions regarding hazard mitigation. The several hundred attendees include mayors, judge/executives, local emergency managers, and university representatives. The focus of this year's presentations will be identifying quality mitigation projects and the grant application process.

Each year KyEM's director and the SHMO participate in a live severe weather program hosted by Kentucky Educational Television. Citizens are able to call in and ask weather and mitigation-related questions. Other participants include the National Weather Service and local television weather personalities.

To reach the general populace, the KyEM Hazard Mitigation Program recently co-hosted a severe weather information booth at the Kentucky State Fair which draws more that 600,000 visitors.

Recognizing issues associated with the mapping, certification, and safety associated with Kentucky levees, in April 2010, KyEM spearheaded and hosted the Commonwealth Levee Summit. All elected officials representing levee constituents were invited to attend. Levee grant assistance possibilities were discussed in addition to site mapping, certification, and management issues. Presenters included representatives from FEMA Region IV, KyEM, the Kentucky Department for Local Government, and four (4) regions of the Corps of Engineers.

Because of the Commonwealth‘s recent experiences with multiple natural disasters, there is generalized support for advancing hazard mitigation strategies. Only nine (9) Kentucky counties have avoided inclusion in a presidential declaration in the past three (3) years. Increased numbers of jurisdictions have attended and participated in the mitigation planning process and training opportunities, largely due to the fact that the state has been widely affected by these natural disaster events.

Local Hazard Mitigation Plans

Completion of the local hazard mitigation plans has provided elected officials with the catalyst to develop and implement effective local mitigation policies, programs, and capabilities. The local mitigation plans have been used to prioritize funding for hazard mitigation projects prior to a disaster even, as well as being used in a post disaster setting to identify potential mitigation projects and activities.

The following table analyzes resources currently available to counties. The table below depicts the existing authorities, policies, programs, and resources, and how they affect the hazard mitigation process. A detailed analysis was completed at the county level depicting which authorities, policies, programs, and resources are currently in place (See Appendix 47).

Authorities	Pre-disaster	Post-disaster	Affects Development in Hazard prone areas	Capable of Funding Mitigation Initiatives	Affects Repetitive Loss Properties and Mitigation Activities	Hazard Mitigation Applications
Floodplain Management Ordinances	X	X	X	X	X	County level floodplain ordinances regulate development within floodplains through special permitting. These regulations allow a county to receive funding from the National Flood Insurance Program
Community Rating System	X	X		X	X	The rating system rewards communities which voluntarily take measures beyond the minimum requirements of the NFIP to reduce flood risk and increase the effectiveness of flood insurance protection. Such activities can fall under one or more of the following categories: Flood Preparedness; Flood Damage Reduction; Mapping and Regulations; and Public Awareness.
Zoning Regulations	X		X		X	KRS 100.201(2) enables local jurisdictions to enact permanent land use regulations, including zoning and other growth management regulations to promote public health, safety, morals, and general welfare of the jurisdiction.

Authorities	Pre-disaster	Post-disaster	Affects Development in Hazard prone areas	Capable of Funding Mitigation Initiatives	Affects Repetitive Loss Properties and Mitigation Activities	Hazard Mitigation Applications
Subdivision Regulations	X	X	X		X	Subdivision regulations control the division of land into parcels for the purpose of building development or sale. Flood-related subdivision controls typically require that developers install adequate drainage facilities and design water and sewer systems to minimize flood damage and contamination. Regulations prohibit the subdivision of land subject to flooding unless flood hazards are overcome through filling or other measures, and prohibit filling of floodway areas. Subdivision regulations require approval of subdivision plans prior to the division/sale of land. Subdivision regulations are a more limited tool than zoning and only indirectly affect the type of use made of land or minimum specifications for structures.
KY Dept of Housing, Building, and Construction Fire Prevention	X		X			KRS 227.320 Local authorities will adopt and enforce the standards of safety promulgated by the Commissioner. Rules and regulations set up by the commissioner prescribes a standard of safety from fire loss, these rules and regulations establish a minimum requirement concerning the

Authorities	Pre-disaster	Post-disaster	Affects Development in Hazard prone areas	Capable of Funding Mitigation Initiatives	Affects Repetitive Loss Properties and Mitigation Activities	Hazard Mitigation Applications
Codes (State)						matters covered.
Stormwater Management Plans	X	X	X		X	Federal mandated program for urban areas as designated by the 2000 Census. The plans must provide five minimum controls on the management of storm water runoff to include; 1. Public education and outreach on storm water impacts, 2. Public Involvement and Participation, 3. Illicit discharge detection and elimination, 4. Construction site storm water runoff control, and 5. Post-construction storm water management in new development and redevelopment.
Programs						
NWS StormReady Program	X	X		X	X	StormReady helps community leaders and emergency managers strengthen local safety programs through education and preparedness training.

Authorities	Pre-disaster	Post-disaster	Affects Development in Hazard prone areas	Capable of Funding Mitigation Initiatives	Affects Repetitive Loss Properties and Mitigation Activities	Hazard Mitigation Applications
Local Emergency Operations Plan	X	X	X	X		Establishes policies and provisions to coordinate local and state emergency response to natural, technological, or war-related disasters and emergencies. This plan is reviewed and approved annually.
Mine Subsidence Fund		X	X	X		Provides assistance to property owners in 34 qualified counties which have experienced property damage resulting from collapsed underground coalmines.
Resources						
Local Economic Development Agencies				X	X	A possible resource for supporting growth and development throughout the county. Some counties have economic development authorities some only have foundations.
Area Development Districts				X	X	Regional resource which assists in the development of a local hazard mitigation plan, grant writing, and potential funding sources
Local Emergency Management Agency	X	X		X	X	Conduit for the local authorities to manage and disseminate actions in pre-disaster and post-disaster localities throughout the state.

Authorities	Pre-disaster	Post-disaster	Affects Development in Hazard prone areas	Capable of Funding Mitigation Initiatives	Affects Repetitive Loss Properties and Mitigation Activities	Hazard Mitigation Applications
Local Emergency Planning Committees	X		X	X	X	Review of local emergency operations plan identifies resources and capabilities at the local level to support emergency management and assistance during disasters

5.4 Mitigation Actions

Requirement §201.4(c)(3)(iii): [State plans shall include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.

To compile effective mitigation goals, objectives, and actions during the development of the Mitigation Strategy subsection, KyEM, CHR, and UK identified specific areas requiring an in-depth, focused assessment.

Action Assessment Areas

1. The mitigation goals, objectives, and actions of the stakeholders who participated in the plan update

2. The goals, objectives, and actions expressed in the stakeholder Action Reports

3. The state's priority hazards identified as dam failure, drought, earthquake, extreme heat, flood, hailstorm, karst/sinkhole, land subsidence, landslide, severe storm, severe winter storm, tornado, and wildfire

4. The actions accomplishments over the last three (3) years

It is also important to note that during the 2007 plan update CHR developed an Actions Assessment Matrix which clearly identified similarities and differences between the local plans and the State plan. The matrix attempts to identify realistic time frames and responsible stakeholders. The matrix was carefully reviewed during the 2010 update process and amended as necessary. This process influenced the current Goal and Objective arrangement. During the 2013 update CHR and KyEM will once again go through this process to evaluate the local plans mitigation strategy sections.

A thorough review was completed to determine the validity of each current objective and action. The hazard mitigation actions listed in the Mitigation Action Table were framed during the four-phase assessment process as indicated above and prioritized in the following manner:

Priority	Description
A	Projects or activities which permanently eliminate damages or deaths and injuries across the State from any hazard.
B	Project or activities which reduce the probability of damages, deaths, and injuries across the State from any hazard.
C	Project or activities which educate the public on the subjects of hazard mitigation, hazard research, and disaster preparedness.
D	Project or activities which warn the public to the approach of a natural hazard threat across the State.

The following table details the Mitigation Actions of the 2010 plan. In an effort to evaluate each action over the last three (3) years a team from KyEM, CHR, and UK reviewed each action to determine its current merit. After this review, each action deemed relevant for the 2010 plan was placed in the Mitigation Action Table. Each action was then assigned a short, mid, and long term time frame, a responsible stakeholder, a hazard designation, and priority. This new table format will aid in future reviews of this section.

Mitigation Actions and Objectives Assessment

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
OBJECTIVE 1.1 Promote the use of early alert systems to warn people of all natural hazard events.			X	KyEM, UK, and Intergovernmental Liaison		
ACTION 1.1.1 - Use eligible funds from the HMGP and other sources to assist communities in the purchase and installation of indoor and outdoor warning systems, including, but not limited to, weather-alert radios, telephone "ring-down" systems and outdoor warning sirens.			X	KyEM and UK	Severe Storm, Dam Failure, Earthquake, Hail, Tornado	D
OBJECTIVE 1.2 - Reduce the impact of hazards on vulnerable populations.			X	KyEM, UK, and CHR		
ACTION 1.2.1 Identify vulnerable populations through the risk assessment.	X			KyEM and CHR	All Hazards	C
ACTION 1.2.2 - When funding permits target FEMA mitigation funds for projects that benefit vulnerable populations.			X	KyEM and UK	All Hazards	A, B, C and D
OBJECTIVE 1.3 - Train public officials on the subjects of natural hazard preparedness.		X		KyEM, UK, and Intergovernmental Liaison		
ACTION 1.3.1 - Assist where possible to include mitigation activity in emergency management training.		X		KyEM, UK, and Intergovernmental Liaison	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
OBJECTIVE 1.4 - Promote the installation of tornado safe rooms in homes and construction of community tornado shelters.			X	KyEM and UK		
ACTION 1.4.1 - Provide information to the general public and the housing industry through publications and electronic resources about the value of residential and non-residential safe rooms, as well as guidelines and criteria for their construction.			X	KyEM and UK	Tornado, Severe Storm, Hail	C
ACTION 1.4.2 - Where resources permit and eligibility criteria can be met, make FEMA mitigation funds and other funding sources available for grants to communities interested in construction of residential and non-residential safe rooms.			X	KyEM and UK	Tornado, Severe Storm, Hail	C
OBJECTIVE 2.1 - Reduce property losses from flooding.			X	KyEM and UK		
ACTION 2.1.1 - Promote the purchase of flood insurance for structures vulnerable to flooding.			X	KyEM and UK	Flood, Dam Failure	B
ACTION 2.1.2 - Where communities and citizens express a desire to participate, and as funding resources permit, prevent or reduce damages to structures through elevation, acquisition/demolition or other flood protection means, using available FEMA and other mitigation funds.			X	KyEM and UK	Flood	A and B

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 2.1.3 - Where communities express a desire to participate and as funding resources permit, prevent or reduce flood prone property though the design and construction of minor engineered water management projects, using available FEMA and other mitigation funds.			X	KyEM and UK	Flood	B
OBJECTIVE 2.2 - Reduce Severe Repetitive Loss and Repetitive Loss Properties, thus reducing the amount of money being paid from the National Flood Insurance Program.			X	KyEM, UK, and KDOW		
ACTION 2.2.1 - Improve the information on the repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.			X	KyEM, UK, and KDOW	Flood	C
ACTION 2.2.2 - Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.			X	KyEM, UK, and KDOW	Flood	C
ACTION 2.2.3 - Improve the information on the severe repetitive-loss list by visiting the sites of these properties to verify and correct the data on the list.			X	KyEM, UK, and KDOW	Flood	C
ACTION 2.2.4 - Provide information through outreach to floodplain managers and local officials about the repetitive losses suffered at these locations.			X	KyEM, UK, and KDOW	Flood	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
OBJECTIVE 2.3 - Increase the number of communities participating in the National Flood Insurance Program. Promote compliance with the NFIP for communities already participating.			X	KyEM, UK, and KDOW		
ACTION 2.3.1 - Educate community leaders and floodplain managers about the program, its value to a community, and how to manage and enforce it.		X		KyEM, UK, and KDOW	Flood	
ACTION 2.3.2 - Conduct community assessment visits and floodplain audits on a regular basis, including after major flooding events to promote the value of quality participation in the programs.		X		KyEM, UK, and KDOW		
ACTION 2.3.3 - Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the NFIP and floodplain management and to tap the expert resources of other agencies for these efforts.			X	KyEM, UK, and KDOW	Flood	C
OBJECTIVE 2.4 - Increase the number of communities involved in the Community Rating System (CRS) program. This will promote better floodplain management while offering the incentive for lower flood insurance premiums.			X	KyEM and KDOW		
ACTION 2.4.1 - Prioritize communities with a greater flood hazard, more flood insurance policies and population growth, as well as enforcement and program management capabilities.			X	KyEM, CHR, and KDOW	Flood	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 2.4.2 - Continue a partnership with University of Louisville and the CHR to provide outreach, development of floodplain management publications, and promotional materials.	X			CHR currently KyEM	Flood	C
ACTION 2.4.3 - Increase inter-agency communication to create better understanding among state and federal agencies about the impact of the CRS and to tap the expert resources of other agencies for these efforts.		X		KyEM, CHR, and KDOW	Flood	C
OBJECTIVE 2.5 - Reduce the vulnerabilities of state owned facilities and infrastructure to natural hazards.			X	KyEM, CHR, and UK		
ACTION 2.5.1 - Establish hazard mitigation priorities for retrofitting of existing state critical facilities and infrastructure based upon risk and vulnerability assessment.	X			CHR and KyEM	Earthquake, Flood, Hail, Karst/Sinkhole, Mine Subsidence, Landslide, Severe Storm, Severe Winter Storm, Tornados, Extreme Heat	B

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 2.5.2 - Ensure that state facilities and infrastructure are located, designed and constructed to complement / support local priorities as defined in the Local Mitigation Strategies.			X	KyEM, CHR, and UK	All Hazards	A and B
OBJECTIVE 2.6 - Reduce the vulnerability of Kentucky's structures and infrastructure to the effects of geologic hazards including landslides, earthquakes, sinkhole collapse, other natural subsidence, and subsidence caused by coal mining.			X	KyEM, CHR, and UK		
ACTION 2.6.1 - Visit sites of interest, such as landslide location after heavy rains, when requested by individuals or agencies affected by geologic hazards in order to gather information on the hazard and disseminate it to other agencies with regulatory or programmatic interests in mitigating the effects of these hazards.			X	KyEM, UK, and Intergovernmental Liaison	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	C
ACTION 2.6.2 - Use funds available through HMGP, the Pre-Disaster Mitigation Program and any other available funding source for the following types of projects: The voluntary acquisition and demolition of geologically-threatened structures which meet the required benefit and cost analysis, and other requirements of the funding agency, and the restriction of future development on the land. Such projects permanently eliminate damages in the areas of the project.			X	KyEM, UK, and Intergovernmental Liaison	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	A and B

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 2.6.2 PART II. - The retrofitting of existing structures, which meet any required benefit / cost analysis and other requirements of the funding agency, against structural or non-structural damages from geologic hazards, particularly earthquakes.			X	KyEM and UK	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	A and B
ACTION 2.6.3 - Promote land use planning for geologically high risk areas.			X	KyEM and UK	Earthquake, Karst/Sinkhole, Mine Subsidence, Landslide	C
OBJECTIVE 2.7 - Ensure that Kentucky's building codes addressing the construction of engineered and residential structures are properly enforced.		X		KyEM and UK		
ACTION 2.7.1 - Where funding permits, conduct outreach activities with local jurisdictions to provide technical assistance in the proper enforcement of building codes.		X		KyEM and UK	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	C
ACTION 2.7.2 - Where funding permits, conduct training seminars and workshops for local building enforcement officials.		X		KyEM and UK	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 2.7.3 - Through outreach and education, encourage the creation of local building enforcement capabilities in communities that currently do not have them.		X		KyEM and UK	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	C
ACTION 2.7.4 - Explore the possibilities of a state-required builder-licensing program to include continuing education, insurance or builders and mediation of disputes over the quality of construction.	X			Planning and Zoning, Local Building Code Officials	Earthquake, Flood, Severe Storm, Severe Winter Storm, Tornado, Wildfire	B
OBJECTIVE 2.8 - Make existing manufactured housing more resistant to movement from their sites by high winds and swift floodwaters.		X		KyEM, KDOW, Planning & Zoning, Local Building Code Officials		
ACTION 2.8.1 - Explore possible opportunities for financial incentives for owners of manufactured housing to secure their homes to their sites.		X		KyEM, KDOW, Planning & Zoning, Local Building Code Officials	Flood, Severe Storm, Severe Winter Storms, Tornado	B

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
OBJECTIVE 2.9 - Improve the safety of high-hazard dams to minimize the threat to that would be impacted by their failure.			X	USACE, KDOW, and KyEM		
ACTION 2.9.1 - Examine and evaluate the need for emergency action plans, including impact area / inundation maps , for KY's high hazard dams.			X	USACE, KDOW, FEMA, and KyEM	Dam Failure, Flood	C
ACTION 2.9.2 - Examine the issues related to how unregulated development below a dam can change its designation form low or moderate to high hazard, thus necessitating an improvement to the dam or its removal.			X	USACE, KDOW, FEMA, and KyEM	Dam Failure, Flood	C
OBJECTIVE 3.1 Provide objectives for mitigation planning and actions.			X	KyEM, CHR, UK, & Intergovernmental Liaison		
ACTION 3.1.1 - Investigate the use of tax incentives to promote smart development in hazard-prone locations.				Unassigned	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 3.1.2 - Provide FEMA mitigation grant opportunities for communities who develop, maintain, and update their hazard mitigation plans.			X	KyEM and UK	All Hazards	C
OBJECTIVE 3.2 - Form partnerships to leverage and share resources.			X	KyEM, CHR, UK, and Intergovernmental Liaison		
ACTION 3.2.1 Establish a working system in which local governments can work together to promote and encourage smart development.		X		KyEM, CHR, UK, and Intergovernmental Liaison	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence, Wildfire	C
OBJECTIVE 3.3 - Support efforts that will assist with the continuity of critical and business operations.						

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 3.3.1 - As funding permits; provide grants to communities for utility protection measure projects including electrical, water, and sanitary sewer.			X	KyEM, CHR, UK, and Intergovernmental Liaison	Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Land, Dam Failure, Drought, Earthquake, Flood, Hail, Karst/Sinkhole, Landslide, Mine Subsidence, Severe Storm, Severe Winter Storm, Tornado, Wildfire	B
ACTIONS 3.3.2 - As funding permits, provide grants to communities for mitigation activities involving transportation systems.			X	KYTC, KyEM, and UK	Dam Failure, Earthquake, Flood, Karst/Sinkhole, Landslide, Mine Subsidence	B

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 3.3.3 - As funding permits; provide grants to communities for the purchase of generators and generator hook ups for critical facilities.			X	KyEM, CHR, UK, and Intergovernmental Liaison	Dam Failure, Earthquake, Flood, Hail, Severe Storm, Severe Winter Storm, Tornado	B
OBJECTIVE 4.1 - Determine existing state agency programs, plans and policies efficiency in reducing risk and vulnerability to natural hazards.		X		KyEM, and CHR		
ACTIONS 4.1.1 - Review the existing state agency programs, plans and policies every three years.			X	KyEM and UK	All Hazards	C
ACTION 4.1.2- Incorporate State policies into the State Hazard Mitigation Plan.			X	KyEM, UK, and CHR	All Hazards	C
OBJECTIVE 4.2 - As a means of enhancing intra and inter-governmental coordination, establish and support an on-going liaison between federal, state, regional, and local governments as well as the private sector and general public through the State Hazard Mitigation Team.			X	KyEM, UK, CHR, and Intergovernmental Liaison		
ACTION 4.2.1 - Invite interested or needed agencies to join the State Hazard Mitigation Team.			X	KyEM, UK, CHR, and Intergovernmental Liaison	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 4.2.2 - Hold bi annual meetings of the State Mitigation Team or in post disaster setting as necessary.			X	KyEM, UK, CHR, SHMT, and Intergovernmental Liaison	All Hazards	C
OBJECTIVE 4.3 - Integrate the pre and post disaster mitigation functions with the response and recovery functions of the state.			X	KyEM, UK, CHR, and Intergovernmental Liaison		
ACTION 4.3.1 - Promote the gathering and archiving of data by local governments on the types and amount of damages after a natural hazard event.			X	KyEM, UK, and CHR	All Hazards	C
OBJECTIVE 4.4 - Recommend the design of a mediation process to resolve conflicts between state agencies' existing plans, programs and mitigation related policies, and integrate them into the State Hazard Mitigation Plan.			X	KyEM, UK, and CHR		
OBJECTIVE 4.5 Review and update the state risk and vulnerability assessment at a minimum of every three years.			X	KyEM and CHR		
ACTION 4.5.1 - Establish criteria for risk and vulnerability assessment of state-owned critical facilities and infrastructure.	X			KyEM and CHR	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 4.5.2 - Update the inventory of state-owned facilities.			X	KyEM and CHR	All Hazards	C
ACTION 4.5.3 - Inventory critical facilities and infrastructure that are leased.		X		KyEM and CHR	All Hazards	C
ACTION 4.5.4 - Inventory identified vulnerable structures from the ADD's structure point data sets when complete.		X		KyEM and CHR	All Hazards	C
OBJECTIVE 4.6 - Coordinate funding resources and opportunities among state agencies to assist both state and local sub-grantees to meet the non-federal match requirements for federal mitigation related funding sources.			X	KyEM and CHR		
ACTION 4.6.1 - Continue the state's cost-share on the Hazard Mitigation Grant Program.			X	KyEM and CHR	All Hazards	A, B, C and D
OBJECTIVE 4.7 Support the development and use of disaster loss reduction related building codes and standards designed to reduce vulnerability and risk to all hazards.			X	KyEM and CHR		
OBJECTIVES 4.8 - Support the development and enhancement of local capability to practice hazard mitigation.			X	KyEM, UK, and Intergovernmental Liaison		
ACTION 4.8.1 - Develop guidelines for enhancing local community risk and vulnerability assessments.			X	KyEM and CHR	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 4.8.2 - Where resources permit, provide technical assistance to local governments in establishing, enhancing, standardizing, and implementing local mitigation strategies.			X	KyEM and UK	All Hazards	C
ACTION 4.8.3 - Identify effective local regulatory approaches to hazard mitigation.			X	KyEM and UK	All Hazards	C
ACTION 4.8.4 - Identify pre and post disaster mitigation related funding opportunities for local communities throughout the state.			X	KyEM and UK	All Hazards	C
ACTION 4.8.5 - Identify mitigation best practices for pre and post disaster hazards mitigation activities.			X	KyEM and UK	All Hazards	C
ACTION 4.8.6 - Encourage the integration of applicable hazards mitigation objectives from the local mitigation strategies into local comprehensive plans.			X	KyEM, CHR, and UK	All Hazards	C
ACTION 4.8.7 - Review and update local hazard mitigation plans at a minimum of every five (5) years.			X	KyEM, CHR, and UK	All Hazards	C
OBJECTIVE 4.9 - Promote new policies to enhance hazard mitigation initiatives.			X	KyEM, CHR, and UK		
OBJECTIVE 5.1 - Develop a hazard mitigation information dissemination tool.			X	KyEM and CHR		

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 5.1.1 - Build a website for KyEM and local planners to use during plan updates that could be used for data transfer, public outreach, and project management.			X	KyEM and CHR	All Hazards	C
OBJECTIVE 5.2 - Develop and promote outreach strategies designed to educate about KY's hazards, risks, vulnerabilities, and the applicable mitigation actions.			X	KyEM and CHR		
ACTION 5.2.1 - Develop brochures defining hazards and mitigation funding opportunities.			X	KyEM and CHR	All Hazards	C
ACTION 5.2.2 - As resources permit, develop a public awareness campaign on the benefits of pre and post disaster mitigation through the dissemination of mitigation success stories or best practices.			X	KyEM and CHR	All Hazards	C
ACTION 5.2.3 - Develop a strategy for working with the print, electronic and broadcast media to disseminate mitigation education and outreach material.			X	KyEM, UK, and CHR	All Hazards	C
ACTION 5.2.4 - As requested hazard mitigation staff will conduct workshops, training, and seminars on hazard mitigation techniques, grant program funding, planning, and benefit cost analysis.			X	KyEM and UK	All Hazards	C
OBJECTIVE 5.3 - Identify and encourage the incorporation of available hazard mitigation education and outreach programs and products.			X	KyEM and UK		

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 5.3.1 - As resources allow, maintain an ongoing education and outreach effort to educate public and private schools about the importance of hazard mitigation.			X	KyEM and UK	All Hazards	C
ACTION 5.3.2 - As resources allow, maintain an ongoing education and outreach effort to educate elected officials about the importance of hazard mitigation to include in an annual report to the legislature and other appropriate officials.			X	KyEM, UK, and Intergovernmental Liaison	All Hazards	C
ACTION 5.3.3 - As resources allow, maintain an ongoing education and outreach effort to educate the general public about the importance of hazard mitigation.			X	KyEM, UK and Intergovernmental Liaison	All Hazards	C
OBJECTIVE 5.4 - Improve public knowledge of hazards and protective measures so individuals can appropriately respond during hazard events.			X	KyEM, UK, and Intergovernmental Liaison		
ACTION 5.4.1 - Promote the design of a functional statewide emergency responders communication system.			X	KyEM and Intergovernmental Liaison	All Hazards	C
ACTION 5.4.2 - Promote NIMS compliancy so that local governments communicate more efficiently during large scale, multi-jurisdictional events.			X	KyEM, UK and Intergovernmental Liaison	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
OBJECTIVE 6.1 - Leverage existing expertise and relationships through CHR at the University of Louisville, and continue to establish partnerships with all interested public and private research universities in KY in order to enhance and support efforts to secure funding, contracts and opportunities; enhance research infrastructure; and to assess KY's vulnerability to natural hazards.			X	KyEM, UK, CHR, SHMT, and Intergovernmental Liaison		
ACTION 6.1.1 - Establish a catalog of KY's hazards and mitigation research studies.			X	KyEM, UK ,and CHR	All Hazards	C
ACTION 6.1.2 - Establish access and / or interchange privileges with pertinent resource centers throughout the country and internationally.			X	KyEM, UK, CHR, and FEMA	All Hazards	C
OBJECTIVE 6.2 - Collaborate with FEMA's Emergency Management Institute and KY's public and private universities in the development of higher education curricula primarily designed to educate professionals in emergency management, as well as to integrate hazard mitigation curricula into existing career programs.			X	KyEM, UK, CHR, and FEMA		
ACTION 6.2.1 - Recommend the creation of a memorandum of collaboration with FEMA and Ky public and private universities for designing higher ed. Curriculum for EM professionals, including the hazard mitigation and related fields.		X		KyEM, UK, CHR and FEMA	All Hazards	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 6.2.2 - Participate in education program course development.		X		KyEM, UK, KDOW, FEMA	All Hazards	C
OBJECTIVE 6.3 - Foster the continued development and improvement for existing research centers and laboratories within KY's public research universities by supporting their efforts to secure funding and research contract opportunities in order to enhance in-state capabilities for conducting hazard mitigation related research.		X		KyEM and CHR		
OBJECTIVE 6.4 - Improve hazard information, including databases and maps.		X		KyEM, KDOW, CHR, and FEMA		
ACTION 6.4.1 - Update and modernize KY's flood maps and flood insurance studies in order to improve the information on current maps and studies, and to provide mapping where there currently is none.			X	KyEM, KDOW, FEMA	Dam Failure. Flood	C
ACTION 6.4.2 - Continue to work with FEMA to prioritize communities for new mapping based on population growth and number of flood insurance policies.			X	KyEM, KDOW, FEMA	Dam Failure, Flood	C

OBJECTIVES & ACTIONS	Short-Term (1-3 years)	Mid-Term (3-6 years)	Long-Term (6-10 years)	Responsible Stakeholder(s)	Hazard	Priority
ACTION 6.4.3 - Continuously update the database of information and knowledge of KY's geologic hazards through research work such as that done by KGS, the University of KY, Dept. of Geological Sciences and USGS.			X	KyEM, CHR, KGS, and USGS	Earthquake, Karst/Sinkhole, Landslide, Mine Subsidence	C
ACTION 6.4.4 - Monitor, update, and maintain seismic activity using the KY Seismic and Strong Motion Network.			X	KyEM, CHR, KGS and USGS	Earthquake	C

To evaluate the importance of each hazard, an examination was completed to determine which hazards were addressed in the most action items. This process allowed KyEM and CHR to analyze the hazards identified and are prioritize hazards according to the mitigation actions.

Hazard	Total Action Items
Flood	63
Earthquake	52
Dam Failure	47
Tornado	47
Severe Storm	47
Landslide	46
Mine Subsidence	46
Karst/Sinkhole	45
Severe Winter Storm	44
Wildfire	43
Hail	42
Drought	37
Extreme Heat	37

This process identified the top five (5) hazards as flood, earthquake, dam failure, tornado, and severe storm.

5.5 Funding Sources

Requirement §201.4(c)(3)(iv): [The State mitigation strategy shall include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.

KyEM implements several FEMA-funded programs which are explained in detail on the following pages. Other current and potential federal sources of funding are listed in the table that follows.

Hazard Mitigation Grant Program (HMGP)

Following a Presidential disaster declaration, the FEMA Hazard Mitigation Grant Program (HMGP) provides the affected state with funding for projects to reduce damages, losses, and suffering in future disasters. The intent of HMGP is to create a federal, state, and local partnership in developing and funding mitigation projects. Funding associated with a specific disaster requires KyEM to provide FEMA with an Administrative Plan which details how the funds will be managed and protected from fraud. (See Appendix 48)

Eligible applicants for HMGP include local governments, state agencies, and certain nonprofit organizations.

HMGP may fund up to 75% of the mitigation expenditures for projects such as:

- Voluntary acquisitions and demolition or elevations of flood-prone structures to conversion to open space in perpetuity
- Voluntary acquisitions and demolitions of landslide-prone structures for conversion to open space in perpetuity
- Infrastructure protection measures against windstorms or earthquakes
- Dry flood proofing of commercial property
- Minor structural flood control projects
- Tornado safe rooms and community shelters
- Utility protection measures

The remaining 25% of funds must come from non-federal sources. In Kentucky, the state provides up to 12% of the project costs and the applicant must provide the remaining 13%.

The local cost share may be cash or provided through in-kind donations of labor, services, or materials related to the project. The applicant's community may also apply to other agencies for funds which can be used as "local match." These funds, in some cases, may also be money originating from the federal government but which lose its federal identity at the state level.

Eligible projects must meet a FEMA-approved benefit-cost analysis, in which the applicant must demonstrate for every dollar spent on a project at least a dollar's worth of future damage protection will be realized.

Projects must also meet other criteria. The Kentucky State Clearinghouse, comprised of a group of state regulatory agencies, must review projects to identify any adverse impact on environmental, archeological, and historic resources. These agencies may provide guidance on permits which must be obtained before the project may proceed or actions the applicant's community must take to reduce the effects on such resources.

Up to ten percent (10%) of the HMGP funds allocated to the state after a disaster declaration may be spent on projects in which a benefit-cost analysis is difficult or impossible to perform. Applications for this subset of the HMGP often involve initiatives such as:

- Outdoor or indoor warning systems
- Hazard mitigation education programs
- NOAA weather radios
- Generators

Up to seven percent (7%) of the HMGP funds allocated to the state after a declared disaster may be used for local or state mitigation planning activities. Mitigation planning is mandated by the Disaster Mitigation Act of 2000 as a condition for receiving mitigation grants. A community receiving an HMGP grant for any project assumes responsibility to maintain, at its own expense, any equipment or property acquired with the grant.

A community interested in applying for an HMGP grant must file a Letter of Intent (LOI) (See Appendix 49) with KyEM and complete an application provided by KyEM (See Appendix 50).

The LOI's and applications are examined by KyEM and UK for completeness and the SHMT prioritizes' applications for submission to FEMA for possible funding.

Application Framework for HMGP Grant Program

1. Notice of Funding Availability (NOFA) is issued.
2. Applicant briefings are presented to all affected areas.
3. Letters of Intent are submitted.
4. Benefit Cost Analysis (BCA) is mailed to the applicant's project manager
5. KyEM conducts the BCA to determine if the project is cost effective.
6. If cost effective, the state offers technical assistance to structure and develop the application. If not cost effective, the application is closed.
7. KyEM reviews the completed application.
8. Following approval from KyEM, the application is submitted to FEMA.

Pre-Disaster Mitigation Grant Program (PDM)

The Pre-Disaster Mitigation Program (PDM) provides funds to the State for pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event.

The PDM program is a nationally competitive program. There is a $500,000 state allocation and no national priority for projects. The PDM program is funded on an annual cycle.

The PDM program is funded by FEMA with a funding split of up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

Eligible applicants include local governments, state agencies and public universities. Types of eligible projects include:

- Voluntary acquisitions and demolition or elevations of flood-prone structures to conversion to open space in perpetuity
- Structural retrofitting and non-structural retrofitting of existing public or private structures to meet or exceed applicable building codes
- Construction of tornado safe rooms and community shelters
- Protective measures for utilities, water, and sanitary sewer systems and/or infrastructure
- Storm water management projects to reduce or eliminate long-term risk from flood hazards
- Localized flood control projects, such as certain ring levees, bank stabilization, and floodwall systems which are designed specifically to protect critical facilities
- Planning

If a community is identified as located in a special flood hazard area, it must be a participant in good standing in the National flood Insurance program. Also, the applicant must have a FEMA-approved Local Hazard Mitigation Plan.

Eligible projects must achieve a FEMA benefit-cost analysis which demonstrates for every dollar spent on a project; at least a dollar's worth of future damage protection will be realized.

Flood Mitigation Assistance Program (FMA)

The Flood Mitigation Assistance (FMA) grant program provides funding to the State for cost-effective measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.

The FMA program is funded on an annual cycle. Each year the state gets a target allocation of funding for which local communities can apply. The FEMA program is split with up to 75% of the project funded by federal funds. The remaining 25% must be paid by the local community.

The State of Kentucky's priority for this fund is to reduce the number of properties located on the National Flood Insurance Program's Repetitive Loss List. Other eligible projects include:

- Voluntary acquisition of insured real property to conversion to open space in perpetuity
- Elevation of insured public or private structures to avoid flooding
- Dry flood proofing of insured non-residential structures
- Structural retrofitting and non-structural retrofitting of existing public or private structures to meet or exceed applicable building codes relative to floodplain management

Eligible applicants must have an approved FEMA FMA plan or a dual-approved standard mitigation plan. If a FEMA-approved FMA plan is not in place, a community may apply for FEMA funding during any grant cycle, to underwrite the cost of compiling a plan.

Repetitive Flood Claims Grant Program

The Repetitive Flood Claims (RFC) grant program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured under the National Flood Insurance Program (NFIP) which have had one or more claim payment(s) for flood damages. RFC funds may only be used to mitigate structures located within a State or community which is participating in the NFIP and can prove inability to meet Flood Mitigation Assistance (FMA) program requirements because it cannot provide the non-Federal cost share or does not have the capacity to manage the program activities.

The long-term goal of the RFC grant program is to reduce or eliminate the number reoccurring flood insurance claims through mitigation activities which are in the best interest of the National Flood Insurance Fund (NFIF).

All RFC grants are eligible for up to 100 percent Federal cost assistance. The RFC grants are awarded to applicants, on a nationwide basis, without reference to State allocations, quotas, or other formula-based allocations.

The priority is to fund the acquisition of severe repetitive loss properties, as well as non-residential properties which meet the same claims thresholds as severe repetitive loss properties. As determined by the Flood Insurance Reform Act of 2004, to meet a small repetitive loss designation, a property must be insured under the NFIP and have incurred flood losses that resulted in either:

- Four (4) or more flood insurance claims payments which each exceeded $5,000, with at least two (2) of those payments occurring in a 10-year period, and with the total claims paid exceeding $20,000; or
- Two (2) or more flood insurance claims payments which together exceeded the value of the property.

Acquisitions include the demolition or relocation of flood-prone structures and deed restricting the vacant land for open space uses in perpetuity.

Delivery Method for PDM, FMA, and RFC Grant Programs

1. State issues an announcement
2. Notice of Funding Availability (NOFA) is issued
3. Letter of Intent is submitted
4. Benefit Cost Analysis (BCA) is mailed
5. KyEM conducts the BCA and determines if the project is cost-effective
6. If cost effective, the state offers technical assistance to structure and develop the application. If not, the application is closed
7. KyEM reviews completed application
8. Following approval from KyEM the application is submitted to FEMA

Severe Repetitive Loss (SRL) Program

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to SRL structures insured under the National Flood Insurance Program (NFIP).

SRL properties are residential properties which have at least four (4) NFIP claim payments over $5,000 each, when at least two (2) such claims have occurred within any ten-year period, and the cumulative amount of such claims payments exceeds $20,000; or for which at least two (2) separate claims payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two (2) such claims have occurred within any ten-year period.

The purpose of the program is to reduce or eliminate claims under the NFIP through project activities which will result in the greatest savings to the National Flood Insurance Fund (NFIF). Eligible flood mitigation project activities include:

- Floodproofing (historical properties only)
- Relocation
- Elevation
- Acquisition
- Mitigation reconstruction (demolition rebuild)

- Minor physical localized flood control projects.

Communities with FEMA-approved standard or enhanced mitigation plans may receive up to 90 % in Federal cost-share funding for projects.

The program was approved to begin funding at the start of the Fiscal Year 2008 grant cycle. For each of the above flood-related grant programs (FMA, RFC, and SRL) a riverine-limited data module can be used to assist with the needed Benefit-Cost Analysis. See (Appendix 51) for an example of the BCA template.

Delivery Method: SRL Grant Program

1. Email notification distributed by UK
2. Phone calls from KyEM are placed
3. Letter of Intent is submitted
4. Workshops are conducted (SRL information is also conveyed in all mitigations seminars, briefings, and meetings)
5. Technical assistance is provided by the state through Benefit Cost Analysis, consultation, and application development

Full Use of Available Mitigation Funding

Full use of the FEMA mitigation grant programs is a constant goal of KyEM. There are unique challenges both on the state and federal sides of this equation.

Since the approval of Kentucky's Enhance Mitigation plan in 2007, there have been massive changes in both KyEM and its Recovery Branch where the Mitigation Program is housed. In 2007 the KyEM Mitigation Program was staffed by only a State Hazard Mitigation Officer and the UK support office. Between June 2003 and May 2008, Kentucky experienced eight (8) disasters. However, the total Public Assistance value of those disasters was only $50,260,507. The subsequent associated mitigation grants awarded to Kentucky totaled $10,512,976. Given that KyEM does not receive any state funding, by 2008 there was very little money left to support a full KyEM Mitigation Program staff. By April 2008 the State Hazard Mitigation Officer had resigned and the program was held together by the UK Mitigation Program Support Office.

# DR	Declared	Disaster Description	# of RPA		Original Amount
1310	**1/10/2000**	**Tornadoes, Severs Storms**	**27**	**$**	**4,574,624**
1320	**2/28/2000**	**Severe Storms and Flooding**	**34**	**$**	**5,528,207**
1388	**8/15/2001**	**Severe Storms and Flooding**	**26**	**$**	**11,532,230**
1407	**4/4/2002**	**Severe Storms and Flooding**	**66**	**$**	**11,088,325**
1414	**5/7/2002**	**Severe Storms and Flooding**	**39**	**$**	**8,062,168**
1454	**3/14/2003**	**Severe Winter Storms**	**157**	**$**	**36,400,813**
1471	**6/3/2003**	**Severe Storms and Flooding**	**65**	**$**	**4,961,620**

1475	**7/2/2003**	**Severe Storms and Flooding**	**41**	**$**	**8,719,387**
1523	**6/10/2004**	**Tornadoes, Severs Storms**	**116**	**$**	**16,780,406**
1537	**8/6/2004**	**Severe Storms and Flooding**	**76**	**$**	**3,436,038**
1578	**2/8/2005**	**Winter Storm, Record Snow**	**83**	**$**	**2,630,107**
1703	**5/25/2007**	**Severe Storms and Flooding**	**18**	**$**	**3,036,293**
1746	**2/21/2008**	**Severe Storms, Tornadoes, Winds, Slides**	**32**	**$**	**4,552,605**
1757	**5/19/2008**	**Severe Storms, Tornadoes, Winds, Mudslides**	**62**	**$**	**6,144,051**
1802	**10/9/2008**	**Severe Wind Storm (Ike)**	**256**	**$**	**25,132,077**
1818	**1/28/2009**	**Severe Winter Storm and Flooding**	**786**	**$**	**330,791,449**
1841	**5/29/2009**	**Severe Storms, Tornadoes, Flooding, Slides**	**62**	**$**	**44,175,855**
1855	**8/14/2009**	**Severe Storms, Straight-line Winds, Flooding**	**47**	**$**	**27,359,451**
1912	**5/11/2010**	**Severe Storms, Flooding, Slides, Tornadoes**	**182**	**$**	**37,667,172**
1925	**7/23/2010**	**Severe Storms, Flooding, Slides**	**31**	**$**	**11,551,302**
		TOTALS	**2,206**	**$**	**604,124,180**

As depicted in the preceding data, since approval of the state's plan in 2007 the Commonwealth has experienced eight (8) new declarations with damages totaling $487,373,962. Beginning in October 2008 the Recovery Branch, with new leadership has recognized the need for long term budgeting and implemented strategic measures to ensure the capacity to fund adequate staff should there again be periods of funding downturns.

These personnel and funding issues created a situation where KyEM lost all of its institutional mitigation knowledge and was forced to rebuild the program from ground zero in a very short timeframe. Staffing levels at KyEM rebounded beginning in 2009 and now there are five (5) full time, filled positions. The KyEM work is supported by the three (3) employees at the UK office. Current funding will ensure these positions will exist through approximately eight years even if no new funding becomes available. The mitigation program budget is reviewed on a monthly basis and adjustments implemented as warranted.

Improved stewardship of management funds will ensure KyEM is positioned to appropriately oversee mitigation efforts in Kentucky. This oversight will most importantly ensure that there is a full use of all available federal mitigation funding.

Other issues which have presented a challenge of maximizing available funding are attributed to the development and submission of applications. In several instances KyEM submitted applications with values only equal to the available funding. During

FEMA reviews, some applications were deemed ineligible and there were no additional applications to be considered.

The current economic climate has also created a challenge as so many applicants have less resources which can be used for funding matches.

Another significant challenge facing KyEM is the rebuilding of a potential applicant pool. Past experiences by various counties and cities were not positive and officials have been reluctant to try again. Issues cited as problematic include laborious application reviews, ongoing requests for additional information, and the length of time between submission and the ultimate award or rejection. In many instances the process took so long that leadership (and thus priorities) changed or the fiscal capacity to provide the match no longer existed.

In spite of these challenges, KyEM is committed to the tenants of it Hazard Mitigation Program. Staff continues to enthusiastically promote the mitigation programs and benefits.

The following charts detail the use of federal mitigation opportunities by HMA grant programs by funding type for the time periods noted. It should be noted that this information will not include program data for ongoing funding efforts of applications still in a development phase.

Flood Mitigation Assistance

Fiscal Year	Available: Federal Share - Planning	Available: Federal Share - Projects	Available: Federal Share - Total	Planning Projects Awarded: Federal Share	Regular Projects Awarded: Federal Share	Total Award: Federal Share
2010	$25,100	$279,700	$304,800	$0	$0	$0
2009	$22,400	$245,700	$268,100	$0	$0	$0
2008	$24,800	$233,500	$258,300	$24,765	$1,268,509	$1,293,274
2007	$22,900	$225,720	$248,620	$22,900	$0	$22,900
2006	$22,400	$216,360	$238,760	$22,400	$0	$22,400

Pre-Disaster Mitigation

Fiscal Year	Planning Projects Awarded: Federal Share	Regular Projects Awarded: Federal Share	Total Award: Federal Share
2010	$98,146	$99,900	$198,046
2009	$812,854	$0	$812,854
2008	$890,279	$0	$890,279
2007	$60,000	$959,782	$1,019,782
2006	$192,265	$517,050	$709,315
2005	$0	$331,500	$331,500

Legislative Pre-Disaster Mitigation

Fiscal Year	Planning Projects Awarded: Federal Share	Regular Projects Awarded: Federal Share	Initiative Projects Awarded: Federal Share	Total Award: Federal Share
2010	0	0	0	0
2009	0	0	0	0
2008	$200,000	$495,000	$694,994	$1,389,994

Severe Repetitive Loss Mitigation

Fiscal Year	Available: Federal Share - Projects	Regular Projects Awarded: Federal Share	Total Award: Federal Share
2010	$864,376	$0	$0
2009	$1,615,470	$0	$0
2008	$1,481,000	$1,831,441	$1,831,441

Congressional Flood Demonstration Projects

Fiscal Year	Regular Projects Awarded: 100% Federal Share	Total Award: Federal Share
2009	$2,186,763	$2,186,763

HMGP Funding (Federal Funds Only)

Disaster	Declaration Date	Disaster Description	Budget Category	Available	Awarded	Balance	Project Types
DR-1703	5/25/2007	Severe Storms Flooding, Mudslides, and Rockslides	Total	$401,848	$401,822	$26	Acquisition (2), Drainage (3), Siren (1).
			Regular	$379,552	$379,526	$26	
	Declared Counties = 9		Initiative	$22,296	$22,296	$0	
		Disaster Amount $5,340,481	Planning	$0	$0	$0	
As demonstrated, 99.9 % of the available funds associated with DR-1703 were awarded.							
DR-1746	2/21/2008	Severe Storms, Tornados, Straight-line Winds, Flooding	Total	$2,381,625	$1,575,162	$806,463	Acquisition (2), Communication (2), Drainage (1), Generator (2), Soil Stabilization (1), Siren (3).
			Regular	$2,143,462	$1,349,809	$793,653	
	Declared Counties = 23		Initiative	$238,163	$225,353	$12,810	
		Disaster Amount $3,560,300	Planning	$0	$0	$0	
KyEM was notified after the application submission period closed that there was an additional amount available of approximately $1 million, additional applications were submitted which are now under review.							
DR-1757	5/19/2008	Severe Storms, Tornados, Mudslides, and Landslides	Total	$509,501	$500,055	$9,446	Acquisition (1), Generator (1), Siren (1).
			Regular	$458,551	$450,440	$8,111	
	Declared Counties = 13		Initiative	$50,950	$49,615	$1,335	
		Disaster Amount $5,045,740	Planning	0	0	0	
95% of all funding was awarded for applications submitted in conjunction with DR-1757							
DR-1802	10/9/2008	Severe Storm Associated Tropical Depression Ike	Total	$3,716,405	$1,593,301	$2,123,104	Acquisition (1), Drainage (3), Generator (4), Planning (1), Safe Room (1), Siren (1).
			Regular	$3,275,813	$1,274,959	$2,000,854	
	Declared Counties = 34		Initiative	$325,336	$203,086	$122,250	

		Disaster Amount $25,009,940	Planning	$115,256	$115,256	$0	
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1802.							
DR-1818	2/5/2009	Severe Winter Storms and Flooding	Total	$48,743,504	$1,203,300	$47,540,204	Acquisition(11),Drainage(15),Elevation(2),Floodproofing(6),Generator(80),Planning(3),SafeRoom(29),Utility(8), Other(5)
			Regular	$43,109,856	$0	$43,109,856	
	Declared Counties = 103		Initiative	$4,874,350	$1,142,102	$3,732,248	
		Disaster Amount $330,791,449	Planning	$759,298	$61,198	$698,100	
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1818.							
Disaster	Declaration Date	Disaster Description	Budget Category	Available	Awarded	Balance	Project Types
DR-1841	5/29/2009	Severe Storms, Flooding, Tornados, and Mudslides	Total	$9,859,588	$0		Acquisition (5), Drainage (1), Generator (11), Safe Room (10), Siren (11).
			Regular	$8,873,629	$0		
	Declared Counties = 22		Initiative	$985,959	$0	Open	
		Disaster Amount $46,396,972	Planning	$0	$0		
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1841.							
DR-1855	8/14/2010	Severe Storms, Flooding and Straight-line Winds	Total	$7,335,686	$0		
			Regular	$6,455,404	$0		
	Declared Counties = 2		Initiative	$366,784	$0	Open	
		Disaster Amount $27,359,451	Planning	$513,498	$0		
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1855.							
DR-1912	5/11/2010	Severe Storms, Flooding, Mudslides, and Tornados	Total	$9,837,393	$0		
			Regular	$8,656,905	$0		
	Declared Counties =81		Initiative	$491,870	$0	Open	
		Disaster Amount $37,667,172	Planning	$688,618	$0		
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1912.							

DR-1925	7/23/2010 Declared Counties = 8	Severe Storms, Flooding, and Mudslides Disaster Amount $11,551,302	Total Regular Initiative Planning	5,338,267 4,697,675 266,913 373,679	0 0 0 0	Open	
FEMA has not completed reviewing or awarding project applications submitted in conjunction with DR-1925.							

See Appendix 52 which contains a copy of a spreadsheet used by KyEM to project applications, thus providing a capsulated and ongoing life history from development to funding. This tool captures, among other items, the project number, type, cost, BCA score, and description; name of subgrantee; and status of application process milestones.

Federal Funding and Technical Assistance

The federal government offers a wide range of funding and technical assistance programs to help with mitigation efforts throughout the State (See Appendix 53)

State Funding and Technical Assistance

The state government offers a wide range of funding and technical assistance programs to help with mitigation efforts within the State (See Appendix 54)

Benefit Cost Analysis Assistance and Training

The state provides Benefit Cost Analysis assistance to applicants. Following the LOI process, potential grant applications move to the second stage of the application development process: the Benefit Cost Analysis. This stage only applies to mitigation project applications which are required to contain a Benefit Cost Analysis.

Using the completed LOI, phone calls, emails, and site visits the State determines which FEMA Benefit Cost Module is applicable to the type of mitigation action proposed. The State then directs the applicant to complete a Data Documentation Template which is used to run the Benefit Cost Analysis. The applicant will also receive a BCA Toolkit and a deadline for submission of the requested information.

Upon receiving a completed Data Documentation Template from the applicant, the state runs the analysis and produces a BCA methodology report. The SHMO reviews the analysis and the applicant is notified of the results.

Coordination of Local Mitigation Planning

6.1 Local Funding and Technical Assistance

Requirement §201.4(c)(4)(i): [The section on the Coordination of Local Mitigation Planning must include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

The Commonwealth of Kentucky has taken a multi-jurisdictional approach to the hazard mitigation planning process for jurisdictions within the state's boundaries. The state has provided Hazard Mitigation Plan development grant funding to the:

- Fifteen Area Development Districts (ADDs) which are regional organizations which provide the planning and coordination function for the jurisdictions contained in their boundaries
- Combined metro governments of Louisville and Jefferson County (Louisville Metro), and Lexington and Fayette County (Lexington Fayette Urban County Government)
- University of Louisville
- University of Kentucky
- Kentucky Community and Technical College System

This funding has been provided through the Hazard Mitigation Grant Program (HMGP) or the Pre-Disaster Mitigation (PDM) program (See Appendix 55). KyEM, CHR, and UK have provided technical assistance, data coverages, and hazard-related information to all planning partners.

As of December 28, 2006, all ADDs plus Louisville Metro and Lexington/Fayette Urban County Government have FEMA-approved hazard mitigation plans. One hundred percent of Kentucky's jurisdictions, if in good standing with the NFIP, have an approved plan. This process was completed through the coordinated efforts of KyEM, UK, CHR, and the local planners. Various workshops, review sessions, funding seminars, and other activities were held to assist with the local planning process. State staff has attended many meetings of the local hazard mitigation plan committees as well. See Appendix 56 for examples of workshops which KyEM has conducted over the last three (3) years to promote mitigation.

While the use of ADDs is a tremendous mechanism for ensuring every community in Kentucky is represented by a quality plan and eligible to apply for FEMA Hazard Mitigation Program grants, ADDs and local communities are faced with a difficult dilemma. Currently, PDM funds are awarded for the development and update of plans; however, these grants cap indirect costs at a level of 5% and HMGP project have 0% indirect costs. The estimated average rate of indirect cost attributable to these projects by ADDs is 25%. The effect of underfunding the indirect costs is dire, particularly in the current economic climate. Local officials have been approached to fund these shortfalls. It is feared that locals will not realize the importance of the plans and the ADDs will no longer want to undertake the planning process at an economic loss.

The state is strongly committed to assisting local planning partners in the required five-year update process, both through funding and technical assistance. It is the goal of the state to provide grant funding to all local planning partners for update purposes (See Appendix 55). The State will prioritize plan update funding based on expiration to ensure 100% plan coverage is maintained. The state provides periodic local planning update workshops to ensure local planners are informed of current requirements and emerging issues. Training agenda topics include the State Plan Update, Possible Funding Sources for Updates, FEMA Update Guidance, How to Write a Successful Plan Update Application, Integrating into other Planning Mechanisms, and HAZUS training. The state is confident that its plan will be an invaluable resource for local planning partners in their endeavors. The census block-based vulnerability assessment is another tool available to local planners in completion of risk assessments sections. The state mitigation strategy should also provide a framework for the updating of local mitigation strategies. State staff will continue to attend meetings of local hazard mitigation plan committees and answer questions or present training as requested.

KyEM has included hazard mitigation training sessions in the annual Governor's Emergency Management Workshop which is attended by mayors, county judge/executives, local emergency managers, university emergency teams, and emergency equipment industry representatives. Training provided to local leaders is designed to emphasize the critical need for mitigation activities and participation in local and state mitigation planning initiatives.

The state also provides funding and technical assistance to universities to assist in their mitigation planning efforts. In November 2005 the state hosted a mitigation planning and projects workshop for Kentucky's universities which was attended by all but one public university. To date, mitigation planning grants have been awarded to both the University of Louisville and the University of Kentucky and the Kentucky Community and Technical College System. The University of Louisville's plan was approved July 2, 2007 and the University of Kentucky's plan was approved on February 9, 2010. The state invited all public and private universities in Kentucky to attend the state hazard mitigation plan stakeholder meetings with several in attendance. The state has identified two (2) additional universities who will be seeking mitigation grant funding to complete hazard mitigation plans. KyEM considers this a great achievement and will be reaching out to other universities regarding the importance of hazard mitigation planning.

KyEM, using FEMA management cost funds, sponsored a G318 Mitigation Planning Workshop for Preparing and Reviewing Local Plans on October 28, 2008, hosted by and held at the Bluegrass ADD. Working with FEMA, UK, Kentucky Association of Mitigation Managers (KAMM), and the Kentucky Association of Mapping Professionals (KAMP), KyEM hosted HAZUS training open to all state applicants at the UK William T. Young Library in Lexington, Kentucky the week of March 29, 2010 (See Appendix 56).

Technical assistance is also provided through Applicant Briefings following all disasters and upon request. The state responds to all inquiries and follows with technical assistance geared toward the needs of individual applicants. Applicants and others needing additional mitigation information may easily contact staff via a toll free telephone number, a widely-published Recovery Branch email address, or through a link imbedded in the program's web pages.

Planning and project development is an ongoing process affording participants continuous application development, in conjunction with the competitive and disaster programs timelines. KyEM, serving as point of contact, assigns KyEM or UK staff to provide assistance to specific applicants regarding all phases of planning, project application, and grant management. All grant recipients are provided with a Hazard Mitigation Grants Reference Manual which details contact information, forms, and program details necessary for successful HMGP project management.

KyEM Regional Managers are assisting the mitigation staff in efforts to improve mitigation program outreach, compliance, and sub recipient monitoring. Area managers are located throughout the state and the program is able to realize economies and efficiencies by reducing travel costs and including mitigation activities with their local contacts.

By using electronic technology advances and increased staff participation, KyEM plans to further expand the participation processes while simplifying access for all local entities, improving data access, and improving project management for all stakeholders statewide. Web-based initiatives such as CHAMPS, video links, and other tools will be employed to expand Kentucky's mitigation network.

The CHAMPS system development is addressing many needs of local mitigation partners. CHAMPS will provide locals the opportunity to access state data sets and view and download the state plan. CHAMPS will also contain a MyPlan section which will provide local planners a location in which to develop and maintain their local mitigation plans. CHAMPS will also provide locals a portal to track their mitigation actions and LOIs. These two functions are being combined inside the system to provide a direct link from the mitigation actions developed in planning and the LOIs. These will be called Mitigation Action Forms (MAFs). The MAF will allow locals to continually update the local mitigation needs and thus update the mitigation strategy with pre-defined projects. CHAMPS will provide a forum for mitigation planners across the state to exchange data and ideas. Most importantly CHAMPS will allow KyEM to more efficiently manage its mitigation programs.

6.2 Local Plan Integration

Requirement §201.4(c)(4)(ii): [The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.

Local planning remains a process coordinated and completed through the 15 Area Development Districts and the two (2) merged city-county governments. Preparation of local plans is a precondition for receipt of Hazard Mitigation Grants. Since the approval in 2007 of the state plan, only one of the 17 local plans has been updated, and is now pending local adoption. Therefore, linkages highlighted in the 2007 plan update were reviewed against the revised Mitigation Strategy for the updated state plan. Local plan updates are anticipated to be completed near the end of 2011, allowing the Commonwealth the opportunity to review, examine, and determine linkages for the state plan update of 2013.

For the 2010 state plan update, a new process to coordinate with local plans is under development. CHAMPS will create the opportunity for new and in-depth links between the state and local plans. The development of CHAMPS will better organize and improve the state's tracking of local hazard mitigation planning activities. With the development of mitigation plans in and through the CHAMPS system, KyEM seeks to reinforce the concept of local plans as living documents and tools that increase the local capacity to mitigate hazards. Additionally, CHAMPS will foment the development of linkages between the local and state plans. With plans housed within CHAMPS common repository, cross referencing of goals, objectives, and actions of the local plans with those of the state plan will be easier, as well as the scoring of local actions by state goals.

Navigation between both local and state plans will be facilitated through searchable databases contained within CHAMPS. With CHAMPS as a tool for mitigation planning in the Commonwealth, KyEM will continue to maintain a high standard of planning and increase effectiveness.

Coordination and Review of Local Hazard Mitigation Plans

An essential part of the local plan update process is the coordination between the local plan point of contact and KyEM. KyEM and UK review all local plans prior to submittal to FEMA. While FEMA is the final approval authority on local plans, KYEM and UK review draft plans and coordinate the revisions to ensure compliance with 44 CFR 201.6. Plans are queued upon receipt by KyEM and plan reviews are accomplished according to their respective submittal dates. This process facilitates, streamlines, and expedites the review of the local plans.

At time of application for local plan update funding and during the grant award briefing, KYEM and UK explain the plan review process and establish a plan review timeline. There is a 60 day period for draft plan reviews. Local planners are required to submit a completed crosswalk (the FEMA plan review tool) with the plan. During the state's review, a new crosswalk is completed. Upon completion of the state's review, the local and state crosswalks are compared. Areas overlooked or unnoted in the state review are reexamined to ensure a comprehensive crosswalk is prepared for FEMA. If the plan meets requirements, it is forwarded with the completed crosswalk to FEMA for review and approval. Plans which do not meet the requirements or have some other deficiencies are returned to the local planner with a detailed narrative highlighting concerns and required revisions.

The FEMA Blue Book, the Local Multi-Hazard Mitigation Planning Guidance, G-318, Mitigation Planning Workshops for Preparing and Reviewing Local Plans course materials, how-to guides, and approved local plans are frequently citied resources that support local plan development and the revision process. The state requires plans be submitted to FEMA to allow a minimum of 45 days for review. If the plan is not approved by FEMA, KyEM notifies the local plan point of contact of required revisions. If the plan is designated as approvable pending adoption by FEMA, notification is made to the local plan POC by KyEM. All participating jurisdictions must resolve to adopt the plan within one (1) year of the designation. Local plan adoptions are received by KyEM and transferred to FEMA. At least one (1) jurisdiction within the plan's coverage area must adopt the plan for FEMA to deem it approved.

The CHAMPS system will also provide KyEM and UK a new tool to use during the review process. Standardizing processes was identified as a major concern in the 2007 update. CHAMPS intends to standardize the Risk Assessment, the prioritization of actions processes (MAFs), and the general layout of the plans.

Not having a standardized Risk Assessment section has proved to be detrimental to mitigation planning. If there are two (2) different methods of assessing risk and vulnerabilities there is the possibility of end up with two different assumptions of risk for the same area. CHAMPS will provide the standardized models to be used for the Risk Assessments with direct links for the locals to add local hazard data. This process promotes the standardization of identifying areas of risk with the benefits of adding local data into the system. Synergizing this data in a standard format and within a risk repository will allow for improved state and local collaboration and review functionality.

Creating a direct link from mitigation actions to mitigation grants was another area which CHAMPS phase one intends to improve. Again, not having a standardized format to capture mitigation actions from plans has proved to be detrimental to the state planning process. In the past KyEM has waited for a disaster to occur and then made a request to its partners for hazard mitigation LOIs. This process has promoted poor submittals, increased stress on the application developers, reviewers, and no direct link to mitigation plans. The MAF will improve this process with pre-identified projects located in a grant repository which will be extracted directly from the mitigation actions identified inside hazard mitigation plans. The MAFs will also help standardize the submittals of grant applications and the prioritization process.

KyEM, CHR, and Stantec are currently developing a function inside CHAMPS called “MyPlan” (See Appendix 4). MyPlan is standardizing the plan development and review submittal process. CHAMPS will provide mitigation planners a standard formatted location to upload there mitigation plans and important data elements. MyPlan is designed to make it easier for mitigation planners to develop hazard mitigation plans as well as to improve the efficiency of plan review.

6.3 Prioritizing Local Assistance

***Requirement* §201.4(c)(4)(iii): [The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures. Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.**

Hazard mitigation grant project LOIs and applications are evaluated by the State Hazard Mitigation Officer to determine the capacity of the project to meet the state's hazard mitigation goals, actions, and objectives.

The State Hazard Mitigation Team meets monthly to prioritize projects for each of the five (5) FEMA hazard mitigation programs. KyEM recognized the need for regular, ongoing mitigation stakeholder involvement to ensure the maximization of mitigation efforts in the Commonwealth. Kentucky's State Hazard Mitigation Team (SHMT) fulfills this need and is a valuable partner in mitigation planning and resource allocation.

The team is comprised of 16 voting and eight (8) non-voting members representing state and local governments as well as non-profit entities who are involved with mitigation and mitigation-related matters. Current membership is as follows:

VOTING MEMBERS	**REPRESENTING**
Leslie Mahoney, Chair	KyEM Hazard Mitigation Program
BG John Heltzel	KyEM Director
Jimmy Richerson	KyEM Assistant Director
Stephanie Robey	KyEM Recovery Branch Manager
Lee Nalley	KY Department for Local Government
Michael Hale	KY Department for Local Government
Chris Hart	KY Division of Water, NFIP Coordinator
Carey Johnson	KY Division of Water, CTP Program Manager
Wendell Lawrence	Lincoln Trail ADD Executive Director
Jerry Rains	KyEM Area 9 Regional Manager
Jim McKinney	Louisville Metro Emergency Management
Susan Wilkerson	Office of the Governor Grants Director
Nancy Price	KyEM Intergovernmental Liaison
Angela Satterlee	Hopkinsville/Christian Co Planning Comm.
Joe Sullivan	National Weather Service
Chris Moberly	Kentucky Transportation Cabinet

NON VOTING MEMBERS	REPRESENTING
Brian Gathy	UK Mitigation Support Office Program Coor.
Jerry Ross	FEMA
Esther White	UK Mitigation Support Office Grant Mgr.
Josh Human	CHR Project Manager
Emily Frank	UK Mitigation Support Office Planning Coor.
Greg Shanks	KyEM Hazard Mitigation Grant Manager
Cassandra Royce-Sanderson	KyEM Hazard Mitigation Grant Manager
Doug Eades	KyEM Hazard Mitigation Grant Manager

Every meeting includes status reports presented by KyEM and UK. Team members receive detailed information regarding potential mitigation projects. The team prioritizes LOIs, which provides KyEM with fair and impartial recommendations regarding the allocation of FEMA funding. Considerations during prioritization include a number of factors such as need, geographic location, prior mitigation grant experience, and most importantly: congruence with the state and local hazard mitigation plans.

The prioritization criteria for each of the five (5) FEMA-funded hazard mitigation grant programs are as follows:

Hazard Mitigation Grant Program Prioritization

Upon receipt, KyEM categorizes LOIs as Regular Program, Initiative Program, or Mitigation Planning Program initiatives. Each category is then subcategorized as to the project location as being either inside a declared disaster area or outside a declared area. Projects within a declared disaster area are given funding prioritization. The LOIs are then evaluated against the following, “Action Priority Matrix” and chosen based on their priority ranking.

Priority	Description
A	Projects or activities that permanently eliminate damages or deaths and injuries across the State from any hazard.
B	Project or activities that reduce the probability of damages, deaths, and injuries across the State from any hazard.
C	Project or activities that educate the public on the subjects of hazard mitigation, hazard research, and disaster preparedness.
D	Project or activities that warn the public to the approach of a natural hazard threat across the State.

Should the value of project applications exceed the available funding, the regular program project applications are ranked in the following manner:

1. Is the project protecting a critical facility?
    a. Benefit Cost Ratio will be ranked (1=low, 3=high) using 3 equal intervals
    b. Hazard type: ranked by probability table, where (1=low, 3=high)
    c. If projects have the same rank, the project with higher BCR will receive top priority.
2. Is the project mitigating severe repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio
3. Is the project mitigating repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio.
4. For non-critical facility or non-repetitive loss projects
    a. Benefit Cost Ratio will be ranked (1=low, 3=high) using 3 equal intervals
    b. Hazard type: ranked by probability table on**,** where (1=low, 3=high)
    c. If projects have the same rank, the project with the higher Benefit Cost Ratio score will receive top priority.

Applications for the mitigation planning program are ranked in the following manner:

1. Updating Plans
    a. Based on expiration date of state, local, and university plans
    b. If multiple plans have the same expiration date, priority is given to the plan with highest population coverage.

2. New Plans
    a. Will be based on highest population coverage

Competitive Grant Programs: PDM, FMA, SRL, RFC

All regular projects selected for competitive grant submission are analyzed for cost effectiveness and total benefits using the FEMA BCA. The eGrants applications for competitive funding are prioritized in the following manner:

1. Is the application for planning?
    a. Updating Plans
        i. Based on expiration date state, local, and university plans
        ii. If multiple plans have the same expiration date, priority is giving to plan with highest population coverage.
    b. New Plans
        i. Will be based on highest population coverage
2. Is the project protecting a critical facility?
    a. Hazard type: ranked by probability, where (1=low, 3=high)
    b. Frequency of Occurrence
    c. Cost Effectiveness and Total Benefits
3. Is the project mitigating Repetitive Loss property?
4. What is the subapplicant's Hazard Vulnerability Score?
5. How do the overall cost effectiveness and total benefits compare with other projects?
6. Does the subapplicant have the capacity to manage the project?
7. Have past OMB A-133 audits revealed any negative performance results?

Additional Considerations: Flood Mitigation Assistance

The applications for FMA funding are prioritized in the following manner:

1. Is the project mitigating severe repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio
2. Is the project mitigating repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio
3. Other: non repetitive loss property
    a. Based on receiving the highest Benefit Cost Ratio.

Additional Considerations: Repetitive Flood Claims

The applications for RFC funding are prioritized in the following manner:

1. Is the project mitigating severe repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio

2. Is the project mitigating repetitive loss property?
    a. Based on receiving the highest Benefit Cost Ratio
3. Other: non repetitive loss property

Additional Considerations: Severe Repetitive Loss (SRl)

The applications for SRL funding are prioritized in the following manner:

1. Property is on FEMA's SRL list
2. Project is cost effective
3. Ranked according to BCA ratios

The prioritized actions and project criteria allow the SHMO and SHMT to effectively identify suitable hazard mitigation grant projects that maximize resources, reduce damages, and lessen the probability of death and injuries. Although the mitigation action list (Section 5.4) may not include every possible type of mitigation, it is important to note all eligible mitigation proposals will be considered under the criteria listed here and prioritized internally according to the state plan.

Plan Maintenance Process

7.1 Monitoring, Evaluating, and Updating the Plan

***Requirement* §201.4(c)(5)(i): [The Standard State Plan Maintenance Process must include an] established method and schedule for monitoring, evaluating, and updating the plan.**

Kentucky Emergency Management (KyEM) is responsible for managing tasks associated with the monitoring, evaluating, and updating of the State Hazard Mitigation Plan. This responsibility is achieved through close collaboration with mitigation partners, specifically the Center for Hazards Research at the University of Louisville, the University of Kentucky Hazard Mitigation Grant Program Office, and the State Hazard Mitigation Team. Collectively, these groups will monitor and evaluate the status and progress of plan elements on a continual basis.

Plan Maintenance through the State Hazard Mitigation Team

The current primary avenue for proactive plan maintenance is through monthly State Hazard Mitigation Team (SHMT) meetings. As stated elsewhere in this document, staff and agencies associated with the SHMT and thereby participating in monitoring, evaluating, and updating the plan generally include:

- Governor's Office for Local Development
- State Clearinghouse
- Transportation Cabinet
- Kentucky Division of Emergency Management
  - Director, or his designee
  - Governor's Authorized Representative
  - State Hazard Mitigation Officer
  - Recovery Section Supervisor
  - Area Manager
- Area Development District Representative
- Natural Resources and Environmental Protection Cabinet
- Other agencies and organizations as required
- Technical Advisors
  - University of Kentucky
  - University of Louisville

By achieving the requirements of plan maintenance through these meetings, KyEM is able to encourage the participation and collaboration of a wide range of state and local agencies in the monitoring, evaluating, and updating process. Historically, SHMT meetings had been coordinated and called on an as-needed basis, most commonly following disaster declarations to select which letters of intent would be prioritized to move to application. This method changed in October of 2009 when monthly meetings began in reaction to the increased frequency of disaster events and the need to continually monitor and include the SHMT on the progress of the State Plan Update. Through monthly meetings, KyEM seeks to ensure that the mitigation program and its guiding document, the State Plan, hold value for comprehensive risk reduction across state and local agencies. A list of monthly meetings covering the conclusion of 2009 and all of 2010 was provided to SHMT members in the fall of 2009. The scheduled dates of these meeting were:

- October 21, 2009
- November 25, 2009
- December 17, 2009
- January 21, 2010
- February 18, 2010
- March 25, 2010
- April 22, 2010
- May 26, 2010
- June 16, 2010
- July 22, 2010
- August 26, 2010
- September 23, 2010
- October 28, 2010
- December 9, 2010

While the majority of meetings were held as scheduled and carried out with strong participation from SHMT stakeholders, this schedule was also responsive and reactive to the needs of participants. As such, a small number of meetings were cancelled, rescheduled, or converted from face-to-face meetings to conference calls. Stakeholders will receive another annual schedule of meetings near the conclusion of 2010 to help ensure their consistent and continued participation in mitigation, including in the plan maintenance process. Additionally, seeking to maximize input, participation, and engagement, meeting notes from monthly SHMT meetings are posted on KyEM's website, available for public viewing.

In terms of *currently* monitoring, evaluating, and updating the plan, the SHMT plays multiple roles. First, project tracking sheets are prepared and presented by project managers during meetings. These tracking sheets, which cover developing and developed/funded projects, offer monthly reviews of mitigation actions and allow for review of the State Plan and respective local plans. The monthly review of mitigation actions allows the SHMT to participate in the process of determining which actions have been completed and encourages stakeholders to consider if the outcomes of the actions have occurred as expected. More broadly, it allows for the review of the goals and objectives the State is undertaking. Furthermore, it facilitated KyEM's process of determining which actions have been completed, deleted, or deferred during for future plan updates.

The SHMT's role in reviewing letters of intent and in setting priorities for which projects are selected to move forward is also strongly linked to their role in plan maintenance. Most significantly, when this process occurs post-disaster, the SHMT reviews letters of intent in relationship to the State Plan and plays key role in determining if the goals, objectives, and actions still meet the needs of the State. When deemed necessary, the SHMT is entrusted with the authority to collaboratively work to reprioritize the mitigation strategy to reflect current conditions.

In terms of *future* monitoring, evaluating, and updating the plan, the SHMT will continue to participate in the process in ways beyond the current roles described above. Primarily, the future plan maintenance will include monthly reviews of local plans via a prepared report. Recognizing that mitigation plans provide the foundation for effective emergency management and establish eligibility according to the Disaster Mitigation Act of 2000, it is a priority of KyEM to ensure that SHMT members are aware the status of local plans, including any new or emerging issues. As necessary, these issues will be compared to, and potentially integrated within, the State Plan. Beginning in October 2010 and continuing until all plan updates are completed (anticipated January 2012), the Planning Grants Manager will present this information monthly.

While each SHMT meeting's content includes some element of Plan Maintenance (see aforementioned descriptions), annually a monthly meeting will be dedicated to a comprehensive review of the State Plan. During 2010, due to the update process, multiple meetings were primarily dedicated to this process. In non-update years, the process is no less important. The annual review will encompass all sections of the State Plan. This meeting will be lead by the SHMT's Technical Advisors: KyEM, UK, and CHR staff. The meeting will be held annually during the spring. The Technical Advisors will present overviews of all sections of the plan and then discuss significant events or potential changes from the previous year that could affect the plan. The SHMT members will discuss potential changes to the plan in light of the previous year and determine if and how these changes should be integrated into the State Plan.

If at any point over the next three (3) years this schedule for maintaining the plan no longer reflects the needs and requirements of the responsible agency, KyEM, it will be adjusted and this section of the plan will be amended.

Plan Maintenance through CHAMPS

The development of the CHAMPS system is scheduled to be on-line in the fall of 2010 and will provide a framework for a living planning document. As described previously, most of CHAMPS' primary functions are specifically designed for the monitoring, evaluating, and updating of the mitigation plans.

The CHAMPS development team is comprised of KyEM, CHR, and the engineering firm Stantec. The system is a comprehensive set of databases and frameworks which is synergized for all users. CHAMPS will exist on-line in a portal system. The portal will be the avenue for authorized users to enter and review data. This portal will be housed at KyEM with a back up at CHR. Upon completion of CHAMPS, KyEM will be the manager of the portal.

Within CHAMPS there will be functionalities to monitor the plan. Housing the plan in a linked set of databases and forms provides KyEM, CHR, UK, and planning partners the easy access to plan components and the functionality to evaluate and update the plan on a daily basis.

To further discuss the monitoring, evaluating, and update processes the following sections will describe how CHAMPS will enhance the plan maintenance process.

Planning Process

Within the CHAMPS system there will be added functionality to capture the roles of the planning partners. Each planning partner will be assigned a role from KyEM through a system called ITEAMS (See Appendix 4). The roles will indicate who is involved in the preparation of each plan and thus allow KyEM to monitor and evaluate the participants in each plan update. Also, within CHAMPS the team is building a function which captures attendance at each meeting thus providing a direct link to understanding how other agencies participated in plan updates and who is involved in mitigation activities across the state. This functionality will also describe coordination among agencies and will provide a database to ensure this information is current. To assist with the program integration, CHAMPS will provide a direct link to the most current state mitigation planning programs and products. Again, with this information being linked into a database in a digital format, program integration data can be evaluated and updated on a daily basis. For example, if a new mitigation program (federal, state, or local) is developed, the end user can access their planning document and update the mitigation program database and thus update their plan.

These monitoring and evaluating functions will be provided to each identified planning partner as assigned by KyEM. An identified area of concern over the years has been the issue of high staff turnover. With the data being housed inside CHAMPS the end users can assume new job requirements and have a baseline to review inside the system. This will drastically improve the quality of every phase of the plans and thus improve the update process.

With the capacity to update the plans on a daily basis, it was necessary to add an iteration tracking system inside CHAMPS. Iteration tracker is a utility which manages plan and data versioning to support historical reporting and compliance with the Disaster Mitigation Act 2000 update requirements

Risk Assessment

Some of the key elements of CHAMPS will be housed in the risk assessment section of the system. Using this database technology, KyEM will be able to capture real time hazard occurrence and loss data. This data will feed directly into capturing the probabilities and consequences from actual events and thus build the Annualized Loss Rank (ALR). KyEM, CHR, and Kentucky's mitigation partners are enthused about the possibilities this function will provide. The capturing of real-time hazard data will drastically improve Kentucky's understanding of risk and vulnerabilities. This real-time feed of hazard data will allow for a continual update to the risk assessment models. KyEM staff will monitor the capturing of data.

The data capture will also provide the information needed to produce high benefit cost ratios (BCR). One area which has eliminated several projects in the past, is the lack of accurate loss and occurrence data. The data capture will allow local users to add loss and occurrence information into a CHAMPS. This process will result in an improved risk assessment while also amassing the data needed to perform a BCA, and improving the chances of receiving mitigation funding for a specific area. Capturing of the data within CHAMPS will also promote efficient monitoring and evaluation capabilities for the project application reviewers.

Another functionality which will be developed in CHAMPS is the capacity to capture exposure data to improve the assessment of vulnerability and estimation of losses. Again, an identified area of need has been the enhancement of exposure data. KyEM and CHR have reviewed the efforts of other states and based on those observations are developing CHAMPS database formats. This repository will allow end users to add data on population, property, essential facilities, and infrastructure. This type of data will vastly improve the risk assessment section and overall emergency management planning. As mentioned in the planning process, KyEM will be responsible for the tracking any necessary system upgrades.

Mitigation Strategy

The Mitigation Strategy section will realize significant improvements through the use of CHAMPS for monitoring, evaluating, and updating. This section will have several linked database tables developed to promote integration, prioritization, and evaluation. Database forms will be provided in CHAMPS for use by each planning partner to add mitigation goals, objectives, and actions. This will allow KyEM, UK, and CHR to easily review and integrate local mitigation goals, objectives, and actions into the state plan. The review of 2007 plan update revealed the need for CHAMPS to facilitate the integration of local plan strategies into the state plan. The database capture will provide a resource which can be monitored, evaluated, and updated on a continual basis.

Another important CHAMPS addition is the development of Mitigation Action Forms (MAFs). The MAFs will combining two (2) current functions, 1) the Letter of Intent (LOI) and 2) the mitigation actions located within the mitigation strategy section. The current process of capturing LOIs after a presidential declaration has proven cumbersome, especially in light of the multiple disaster occurrences experienced by Kentucky over the last three (3) years. The urgency of potential applicants to deliver LOIs and the application review process at the state level has become overwhelming. Also, KyEM and UK noticed, with the increased volume, it was increasingly difficult to accurately track projects represented in local mitigation plans. CHAMPS is designed to improve this process through the use of MAFs. Within the mitigation action section of the plans, the end user will enter their mitigation actions into a standardized format. That format is a combination of what was captured from the LOIs and what needs to be captured from the mitigation action crosswalk questions. Capturing the data in this database format will allow KyEM to easily sort, prioritize, and pre-identify projects for disaster areas. KyEM will also be able to transition the MAFs into the project application process and track the workflow of the grant from start to finish.

Through CHAMPS, the monitoring, evaluating, and updating of the state and local capabilities section will also be enhanced. These capabilities sections will be entered into a database which can be monitored and updated on a continual basis. KyEM will be able to track which mitigation capabilities are being used throughout the state. Using the data capture capabilities of CHAMPS will provide KYEM a tool by which to perform program oversight in a more efficient manner.

Lastly, one of the most important aspects of CHAMPS will be the ability to track avoided losses. By capturing and tracking mitigation projects through the portal, KyEM and its partners will finally have of the capacity to identify avoided losses. Each mitigation action and project will be housed inside CHAMPS. After a project is complete, the geo-location and project details will be maintained in the database. This data will be used to locate where mitigation has occurred over time, thus providing a blueprint of where the state has avoided losses. This functionality will allow KyEM to showcase the true benefits of mitigation to stakeholders. KyEM will be the lead agency to monitor and evaluate the projects from start to finish.

Coordination of Local Mitigation Planning

CHAMPS was designed primarily for this section of the plan. CHAMPS will provide locals with the opportunity to search data, apply for grants, and to update their plans. The CHAMPS database structure was developed to create a synergized flow between local mitigation plans and state mitigation plans. Capturing critical components for the risk assessment and mitigation strategy sections, local mitigation planners will be able to review and update their plans.

The CHAMPS MyPlan component is developed to provide a local planner a blueprint to follow in the development of the local mitigation plan. MyPlan will follow the crosswalk steps allowing the locals to complete their plans in a standardized and correct format. With the iteration tracking function, KyEM and UK will be able to monitor and evaluate each plan's life span and understand in which phase the plan is on a continual timeframe. Adding prioritization functionality is also a major focal point in CHAMPS. With the standardization of the risk assessment and the mitigation strategy sections, KyEM and its partners will have a better understanding of the priorities set forth in a plan and how those priorities might justify funding.

Plan Maintenance

The CHAMPS system will completely change how plan maintenance is achieved in the future. KyEM realized that the current maintenance schedule of updating plans every three (3) years was not an efficient and comprehensive methodology. CHAMPS is designed to provide KyEM and its partners a comprehensive planning system. Monitoring, evaluating, and updating functions are major components of CHAMPS. KyEM's vision of CHAMPS is to develop a comprehensive solution for supporting emergency and hazard management, response, recovery, and mitigation activities.

Plans will be monitored in a variety of ways in CHAMPS. Plans move through a structured workflow in CHAMPS and the system organizes plans according to their position in the workflow, quickly indicating to users the plan's development progress. During the development process, users and reviewers will work collaboratively to address outstanding concerns and disparities to make sure the most complete plan is produced. Users will be able to monitor any open comments as well as view the history of each review comment and whether or not it is addressed in the current iteration.

After plans are adopted, CHAMPS will indicate when plans are nearing their expiration and need to be updated. This whole process again will occur on a continual basis but the system is built with monitoring benchmarks which enhance the planning process and products. This system is created to connect new and existing information subsystems, or modules, together in a manner that unites multiple agency workflows and decision making processes. CHAMPS allows for constant plan maintenance by KyEM and for its partners. See screenshot of CHAMPS Plan review screen.

CHAMPS Timeline and Milestones

Milestone/Progress Point	Time Line
5 Modules/Function Points of CHAMPS defined	February 2010
Disaster Management/Planning GIS info given to software programmers	March 2010
State Mitigation Team begins presenting mock ups to programmers	March 2010
Hazard Mitigation Plan Workflow defined & given to programmers	April 2010
14 major points of project management defined	April 2010
Core information needed for generic HMGP application identified	May 2010
Development of "step table" approach with SHMO & KyEM Director	May 2010
Evaluation meeting with Stantec (software programmers)	June 2010
Project reporting elements identified	June 2010
Final development of screen shots by Mitigation staff	June 2010
Presentation of award management, project tracking, period of performance, & reporting components to programmers	June 2010
programmers deliver Disaster Management, Briefings, Planning & Mitigation Action sections for review	July 2010
programmers start to integrate system roles with KyEM ITEAMS database	August 2010
Weekly meetings/briefings between programmers & KyEM start	August 2010
Disaster thresholds identified and provided to programmers	August 2010
Promotion of CHAMPS to local & regional levels	September 2010
Testing of first 3 modules take place	Sept. - Oct. 2010
Project application module developed & available for testing	November 2010
Final review and analysis of system by KyEM Mitigation staff delivered to programmers	November 2010
Purchase of CHAMPS servers & loading of CHAMPS on KyEM network	November 2010
Testing of CHAMPS on KyEM network, integration of ITEAMS take place	November 2010
Potential users identified, entered into KyEM ITEAMS & KyEM Active Directory	November 2010
Final adjustments/coding changes made to CHAMPS - Phase I complete	December 2010
Training program developed & launched	January 2011
Roll-out of training program to local & regional levels	February 2011
PHASE II system enhancements identified & delivered to programmers	Spring 2011

7.2 Monitoring Progress of Mitigation Activities

Requirement §201.4(c)(5)(ii): [The Standard State Plan Maintenance Process must include a] system for monitoring implementation of mitigation measures and project closeouts.

The State Hazard Mitigation Officer (SHMO) and KyEM staff will continue to evaluate the implementation of mitigation measures on a local, regional, and statewide basis.

For projects funded by HMGP, PDM, FMA, RFC, and SRL, monitoring will include, at a minimum, quarterly progress reports (See Appendix 57) and project tracking spreadsheets. The staff will also maintain regular contact with the local project managers (subgrantees) through phone calls and email. State staff will continue to travel to each project site a minimum of two (2) times, once for an award briefing and initial site visit and again to conduct a final site visit. Other site visits may be conducted if requested by the subgrantee or if the state determines a need.

The auditing of payment requests also serves as a tool for monitoring implementation. Each payment request is audited financially and programmatically for grant compliance. This serves as a check of the implementation progress of the project.

For projects occurring outside the five (5) federal grant programs monitored by the State Hazard Mitigation Office, the Mitigation Action Reports were created for an update process and will continue to be used on an annual basis.

Quarterly Reports

Quarterly reports must be submitted by subapplicants at the end of each fiscal quarter. The report includes information on the latest quarter's activities, expenditures, accomplishments, and shortcomings (See Appendix 58). This allows the State to predict any extension request or project underrun or overruns. It also provides an update on the progress of the project.

The State will review the quarterly reports and combine all the information on a single spreadsheet. Once the spreadsheet is reviewed for accuracy it is then submitted to FEMA Region IV within 30 days of the end of the quarter.

Project Tracking Sheets

Due to the volume of disasters over the past few years, KyEM has created a "Project Tracking Sheet" (See Appendix 52 which contains a copy of a spreadsheet used by KyEM to project applications, thus providing a capsulated and ongoing life history from development to funding. This tool captures, among other items, the project number, type, cost, BCA score, and description; name of subgrantee; and status of application process milestones.) This project tracking spreadsheet includes the status of all projects that are approved as well as those in the development stages. This allows any staff member to update or view the status of any project at any given time. The tracking sheet is also being formatted for posting on the KyEM website for the convenience of the subapplicants. The project tracking sheet is updated weekly.

Additional Subrecipient Monitoring

In 2009, KyEM created a Subrecipient Monitoring Section within its Administrative Branch. This section is responsible for the ongoing monitoring of all federal grant activities associated with KyEM programs.

Routinely, the Subrecipient Monitoring Section requests and reviews all OMB A-133 audits from KyEM subrecipients expending more than $500,000 in federal awards during a fiscal year. If there are material weaknesses or conditions which jeopardize the federal funds subgranted by KyEM, actions are implemented to ensure program goals and requirements are met. Such instances are handled on a case-by-case basis and may include corrective action plans, additional site visits, decelerated reimbursement schedules, etc.

The Subrecipient Monitoring Section routinely performs site visits, and while on location assesses all KyEM-related program involvement. Site visits include review of documentation and visual inspection of projects.

The KyEM Mitigation Program has also enlisted the assistance of KyEM regional managers to assist with subrecipient monitoring. An inventory of all previously funded projects is being entered into the KyEM ITEAMS repository. Projects will be sorted according to KyEM regions and each region will be asked to perform visual inspections on an annual basis for projects which received funding for items such as emergency generators and land acquisitions with deed restrictions.

Closeout Process

Project closeout worksheets are created by state staff while performing both a programmatic and financial audit of the project file during closeout activities (See Appendix 59 for a spreadsheet presentation of Kentucky disaster declarations over the last decade and the level of damages incurred. The chart clearly depicts a significant upswing in available funding opportunities associated with declarations over the past three years.). The SHMO compares the program file financials against the state's accounting system. After the amounts are reconciled, the SHMO prepares a Request to Close Letter. This letter is reviewed by KyEM's Administrative Branch Pre-Audit Section to ensure accuracy. The letter is then submitted to FEMA Region IV. After a Final Claim Letter is received from FEMA, a concurrence letter is prepared, verified by both the SHMO and Administrative Branch Pre-Audit Section, and submitted to FEMA Region IV. This is the last documentation of the project.

Since the 2007 update of the State Plan, the KyEM Hazard Mitigation Program has completely closed five (5) disasters:

1. DR-1388
2. DR-1471
3. DR-1475
4. DR-1578
5. DR-1617

As mentioned in section 7.1, the CHAMPS system is being developed to effectively manage KyEM Hazard Mitigation Program projects and plans. This will enhance the capabilities of the staff and subrecipients during the life cycle of the mitigation activity. CHAMPS allows for continuous access to monitor, update, and evaluate projects and plans. This database will also enable the mitigation staff to achieve maximum efficiency and accountability for every project which is submitted in each of the five (5) programs. It will also provide for more effective use of federal and state funds, as well as track avoided losses.

Cost Avoidance Reports

Since the approval of the 2007 Enhanced State Hazard Mitigation Plan, Kentucky has experienced eight presidentially declared disasters. KYEM has created Cost Avoidance Reports for Disasters 1746, 1757, 1802, 1818, 1841, 1855, and 1912. DR-1925 which was declared in July of 2010 is the Commonwealth's most recent disaster and the full scope of damages has yet to be determined.

To complete this report, all mitigation projects that were completed in disaster-declared areas were assessed for cost avoidance potential. This list was reviewed to exclude any projects that were initiative type projects, projects that had been withdrawn, and management costs. This cost avoidance assessment reduced the total *benefits* of the projects by the total *project cost* to arrive at the Total Cost Avoided.

Total Project Benefits – Project Costs = Total Project Cost Avoided

Some projects did not include the necessary information to determine mitigation success. For projects which did not include Benefit Cost information KYEM used the NIBS methodology (every one dollar of mitigation spent there is a benefit equaling four dollars) (See Appendix 63).

Kentucky will continue to refine the cost avoidance process to include project data in the future.

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