Chapter 9
McCracken County Hazard Mitigation Plan 2023 Update

9:4 Risk Assessment

All components of this Risk Assessment were revised using the best available data in the Purchase Region. GIS resources and public input were used to identify which hazards, of those listed below, affect the Purchase Region. The Purchase Area Development District (PADD) staff compiled this information to identify hazards and the Jackson Purchase Mitigation Council (JPMC) reviewed the definitions and discussed their occurrence in and impact on the region. This review identified all hazards to the region and consequently McCracken County.

For this revision the Mitigation Planning Team (MPT) for McCracken County reviewed the previous prioritization of hazards from the perspective of how they impacted their jurisdiction, The resulting prioritization and risk assessment are contained in this county annex.

9:4.1 Identifying Hazards

FEMA recognizes many forms of natural hazards. Major natural hazards that may occur include:

- Geologic hazards
  - Tsunami
  - Volcano
  - Earthquake
  - Land Subsidence/Karst Topography
  - Landslide
- Weather generated hazards
  - Avalanche
  - Hurricane
  - Severe Thunderstorm
  - Hailstorm
  - Windstorm/Microburst
  - Severe Winter storm
  - Tornado
- Wildfire
- Flooding
  - Flashfloods
  - General Flooding
  - Coastal
  - Riverine
- Urban
- Climatological
  - Drought
  - Extreme Heat
- Failure of Man-made structures from the impact of natural forces
  - Dam Failure
  - Levee/flood Wall Failure

Natural Hazards Addressed by the Regional Plan

The regional planning process identified hazards that significantly impact the entire Purchase Region and eliminated from consideration those natural hazards that do not. Natural hazards where a historical record of damage to people and property exists, or the potential for such damage to occur, are addressed in the plan. This determination does not preclude from including more hazards in future updates. The McCracken County MPT agreed that the identification process was sufficiently thorough to serve all the signatory counties of the plan and need not be repeated for the McCracken County Chapter Update. Table 9.1 summarizes

why these hazards were identified.

Table 9.1 Hazards Identified and Reasons for Identification

Hazard	How Identified	Why Identified
Tornado	Review of past disaster damage Review of FEMA hazard maps Public Input	Several past occurrences Hazard maps show all jurisdictions affected
Flood **Flash Flood** **River Erosion**	Review of past disaster damage (FEMA & National Climatic Data Center) Local Emergency Management Public Input Review of FIRM maps	Affects the region frequently. Maps show many floods prone areas * Public identified several regions not mapped affected by flooding * Repetitive flooding has led to the deposit of enormous amounts of silt in Kentucky's
Thunderstorm Wind **Hail**	Review of past disaster damage Public Input Review of past occurrences from National Climatic Data Center	Many events in the past Widespread: affects all jurisdictions High wind zone
Earthquake	* Review of Ground Motion Maps * Review of the New Madrid and Wabash Seismic Zone Maps Public Input	Proximity to New Madrid/Wabash Seismic Zones Historic accounts of 1812 disaster. Potential for destructive impact in some
Winter Storm / Ice Storm	* Review of past disaster damage * Review of past occurrences from National Climatic Data Center * Public Input * Local Emergency Management/KYTC	Several past occurrences Variety of events including snow/ ice Can affect all jurisdictions
Excessive Heat / Drought	* Review of past disaster damage Public Input Review of Palmer Drought Severity	Losses have occurred in past. Large impact of agriculture on the region
Dam Failure	* Review of High-Risk Dams in the region	* Potential for flooding * Number of High-Risk dams in region
Wildfire	* Review of State Mitigation Plan * Public Input	* Potential for loss at Wildland/urban interface,

9:4.2 Hazard Profiles

The McCracken County MPT reviewed its previously profiled hazards by using historical evidence gathered from the National Center for Environmental Information (NCEI), Kentucky State Climatology Center, Federal Emergency Management Agency's (FEMA) Hazard Mapping website, the Commonwealth of Kentucky Enhanced Mitigation Plan and the Kentucky Geological Survey. PADD staff gathered GIS information and historical data to provide to the MPT. There are some limitations to the best available GIS and historical data pertaining to hazards. All components of this risk assessment were revised using the best available data in the Purchase Region. GIS resources and public input were used to identify which hazards, of those are listed below, affect the Purchase Region. The JPHMC reviewed the definitions and discussed their occurrence in and impact on the region. This review identified all hazards to the region and consequently all hazards that affect McCracken County.

Summary of Hazard Profiles

Several overall conclusions can be drawn from the information gathered in the Hazard Profiles. Based on historical frequency and past disaster damages, several hazards identified in the regional plan, stand out as more significant threats to McCracken County, while several others appear to be less significant.

According to frequency and damage figures, Tornado, Flooding, Thunderstorm Wind, and Winter/Ice Storms, stand out as the most significant threats to McCracken County. Earthquake is a hazard rated by committee members as one of the biggest potential threats though there is no historical data on actual earthquake damages in McCracken County to analyze the threat. There is considerable debate regarding the severity of the damage even imagining the "worst case scenario".

Hail is a hazard that threatens the county, having caused considerable property and crop damage. Excessive heat is a concern based primarily on the impact on the very young and old. Drought is mainly a threat to the agricultural segment of the county economy but also has a significant impact on water and wastewater systems, especially those with cast iron piping, as soil shrinkage causes pipes to snap. Wildfire is a potential risk however there have been very few events resulting in no documented damage. Each of these hazards was deemed to be of moderate risk by the MPT.

Dam Failure is perceived as a threat, yet historic frequency and damage data do not suggest that these are significant. There is no historical occurrence of damage or injury due to a dam failure in McCracken County. Dam failure is considered a hazard due to the location of Kentucky Dam and the impounded Kentucky Lake, upstream of the City of Paducah on the Tennessee River.

Table 9.2 is a summary of past Declared Disasters as provided by FEMA for McCracken County. This table is limited to providing information only related to declared disasters on the county level and does not list each jurisdiction.

Table 9.2 Presidential Disaster Declarations that Affected PADD Counties

DR#	Declaration Date	Disaster Type	Total Declared Counties	Declared Counties	Counties Declared for Public Assistance and Individual Assistance	Counties Declared for Public Assistance Only	County	DH Approved Funding	IFG Approved
381	5/11/1973	Severe Storms, Flooding	5	Ballard, Carlisle, Fulton, Hickman, McCracken	Ballard, Carlisle, Fulton, Hickman, McCracken	0			
461	3/29/1975	Severe Storms, Flooding	17	Ballard, Calloway, Fulton, Graves, Hickman, Marshall, McCracken	Ballard, Calloway, Fulton, Graves, Hickman, Marshall, McCracken	0			
821	2/24/1989	Severe Storms, Flooding	67	Ballard, Carlisle, Graves, Hickman, Marshall, McCracken	Ballard, Carlisle, Graves, Hickman, Marshall, McCracken	0			
1089	1/13/1996	Blizzard	120	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
1163	3/4/1997	Flooding	101	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	Ballard, Carlisle, Fulton, Hickman, Marshall, McCracken	Calloway	McCracken	$137,084.85	$78,709.00
1802	10/9/2008	Severe Windstorm	36	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			

3302	1/28/2009	Severe Windstorm	114	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
1818	2/5/2009	Severe Winter Storm, Flooding	117	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	0	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken,			
1976	5/4/2011	Severe Storms, Tornadoes, Flooding	22	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken		Calloway			
4057	3/6/2012	Severe Storms, Tornadoes, Straight-line Winds, Flooding	1	Ballard		Ballard			
4216	4/30/2015	Severe Winter Storms, Snowstorms, Flooding, Landslides, Mudslides	3	Ballard, Marshall, McCracken		Ballard, Marshall, McCracken			
4218	5/12/2015	Severe Winter Storms, Snowstorms, Flooding, Landslides, Mudslides	3	Calloway, Fulton, Marshall		Calloway, Fulton, Marshall			
4278	8/26/2016	Severe Storms, Tornadoes, Flooding, Landslides, Mudslides	2	Calloway, Marshall		Calloway, Marshall			
4358	4/12/2018	Severe Storms, Flooding, Landslides, and Mudslides	22	None		None			
4361	4/26/2018	Severe Storms, Tornadoes, Flooding,	35	Carlisle, Graves, Hickman, Fulton, McCracken		Carlisle, Graves, Hickman,			

		Landslides and Mudslides				Fulton, McCracken			
4428	4/17/2019	Severe Storms, Straight-line Winds, Flooding, Landslides, and Mudslides	60	Ballard, Carlisle, Fulton, Hickman, Marshall, McCracken		Ballard, Carlisle, Fulton, Hickman, Marshall, McCracken			
3469	3/13/2020	Covid-19	120	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken		Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken			
4497	3/28/2020	Covid-19 Pandemic	120	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken	Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, Marshall, McCracken				
4540	4/24/2020	Severe Storms, Flooding, Landslides, and Mudslides	27	Hickman, McCracken		Hickman, McCracken			
4592	3/31/2021	Severe Winter Storms, Landslides, and Mudslides	45	None		None			
4595	4/23/2021	Severe Storms, Flooding, Landslides, and Mudslides	44	Ballard, Graves, Calloway		Ballard, Graves, Calloway			
3575	12/11/2021	Severe Storms, Straight-line Winds, Flooding and Tornadoes	16	Fulton, Graves, Hickman, Marshall					
4630	12/12/2021	Severe Storms, Straight-line Winds, Flooding and Tornadoes	23	Fulton, Graves, Hickman, Marshall	Fulton, Graves, Hickman, Marshall				
4643	2/27/2022	Severe Storms, Straight-line Winds, Tornadoes, Flooding, Landslides	13	None		None			

Source:https://www.fema.gov/disasters?field_state_tid_selective=49&field_disaster_type_term_tid=All&field_disaster_declaration_type_value=All&items_per_page=20&=GO

According to State Department of Emergency Management records McCracken County was eligible for Public Assistance because of the above declarations. For this revision, MPT for McCracken County reviewed the prioritization of Hazards from the 2018 Plan using updated climatic/event data, revised flood zones, local events occurring since the previous plan, 2020 Census data and the 2020 American Community Survey. The resulting prioritization and risk assessments area contained in this county annex.

Table 9.3 McCracken County Hazard Summary Table

PLAN VERSION	2022	2017
HIGH RISK HAZARDS	TORNADO FLOOD FLASH FLOOD THUNDERSTORM WIND WINTER STORM/ICE STORM EARTHQUAKE	TORNADO FLOOD FLASH FLOOD THUNDERSTORM WIND WINTER STORM/ICE STORM EARTHQUAKE
MODERATE RISK HAZARDS	HAIL EXCESSIVE HEAT DROUGHT WILDFIRE	HAIL EXCESSIVE HEAT DROUGHT WILDFIRE
LOW RISK HAZARDS	DAM FAILURE	DAM FAILURE

SOURCE: McCracken County MPT 2022

Table 9.4 represents a summary of the events on record in the NCEI Storm Events Database occurring in McCracken County for the period January 1, 1950 through March 31, 2022. Data is available as early as 1950, but depending on reporting for some events, the first event on record may come at a much later time. The detailed, disaggregated listing of these events are included in Appendix 1.

Please see NCEI (formerly the National Climatic Data Center) contact page if you have questions at https://www.ncdc.noaa.gov/customer-support

Table 9.4 Summary of Hazard Previous Occurrences and Impacts
January 1, 1950 – March 31, 2022

Event	Events	Death	Injury	Property Damage ($)	Crop Damage ($)
Tornado	21	0	12	$1.463M	$0
Flood	52	1	4	$10.165M	$30K
Flash Flood	54	0	1	$3.424M	$0
Thunderstorm	172	0	5	$3.332M	$2K
Wind					
Winter Storm	19	0	0	$575K	$0
Ice Storm	6	0	0	$27.200M	$0
Hail	58	0	1	$20.079M	$.05K
Excessive Heat	7	0	13	$0	$0
Drought	31	0	0	$0	$9.2M
Wildfire	3	0	0	$0	$0
Dam Failure	No History				
1 class A structure = no loss of life anticipated, only damage to dam owner's property					
2 class B structures = loss of life not probable, some economic loss & environmental damage					

Source : https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

For the purpose of the update to the 2023 JPHM Plan, the events will be reviewed from April 1, 2017, through March 31, 2022. The storm events database maintained by the NCEI will be utilized for as the source for the best available data for the Purchase Region.

Tornado

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. It is most often generated by a thunderstorm when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly and upper-level winds, especially the jet stream runs at an angle relative to the prevailing surface winds. These conditions occur with regularity over the Purchase Region in the spring, but as evidenced recently, can occur at any time of the year. Tornadoes are often accompanied by large hail and damage is most often the result of the high wind velocity and wind-blown debris. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction. They have the power to uproot trees, structures, and turn harmless objects into deadly flying debris.

Most tornadoes aren't very wide and touch down only briefly. However, a highly destructive tornado may carve a path over a mile wide and several miles long. Tornadoes typically cause the most damage to lightly or poorly built structures, such as residential homes. An average of 800-1000 tornadoes are reported nationwide and they are more likely to occur during the spring and early summer months. Tornadoes can occur at any time of the day but are more likely to form in the late afternoon or early evening.

In 2007 the Enhanced Fujita (EF) Scale was introduced to better reflect wind speed and the amount of damage produced by tornadoes. It replaced the Fujita-Pearson Scale that defined every tornado on record in the United States since 1950. EF rankings are assigned after a tornado event has occurred and the National Weather Service has inspected the damage.

Table 9.5 The Enhanced Fujita Tornado Measurement Scale

Scale	Estimated Wind Speed	Typical Damage
EF0	65-85 mph	Light Damage - Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
EF1	86 – 110 mph	Moderate Damage - Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
EF2	111 – 135 mph	Considerable Damage - Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light object missiles generated; cars lifted off ground and thrown.
EF3	136 – 165 mph	Severe Damage - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
EF4	166 – 200 mph	Devastating Damage - Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
EF5	>200 mph	Incredible Damage - Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Table 9.6 Tornado Events and Impacts in McCracken County
April 1, 2017 – March 31, 2022

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
ST JOHNS	2/24/2018	19:37	CST-6	EF1	0	0	85.00K	0.00K
CAMMELIA	3/14/2019	8:23	CST-6	EF2	0	1	1.300M	0.00K
CAMMELIA	6/23/2019	15:35	CST-6	EF1	0	0	500.00K	0.00K
TOTALS:					**0**	**1**	**1.885M**	**0.00K**

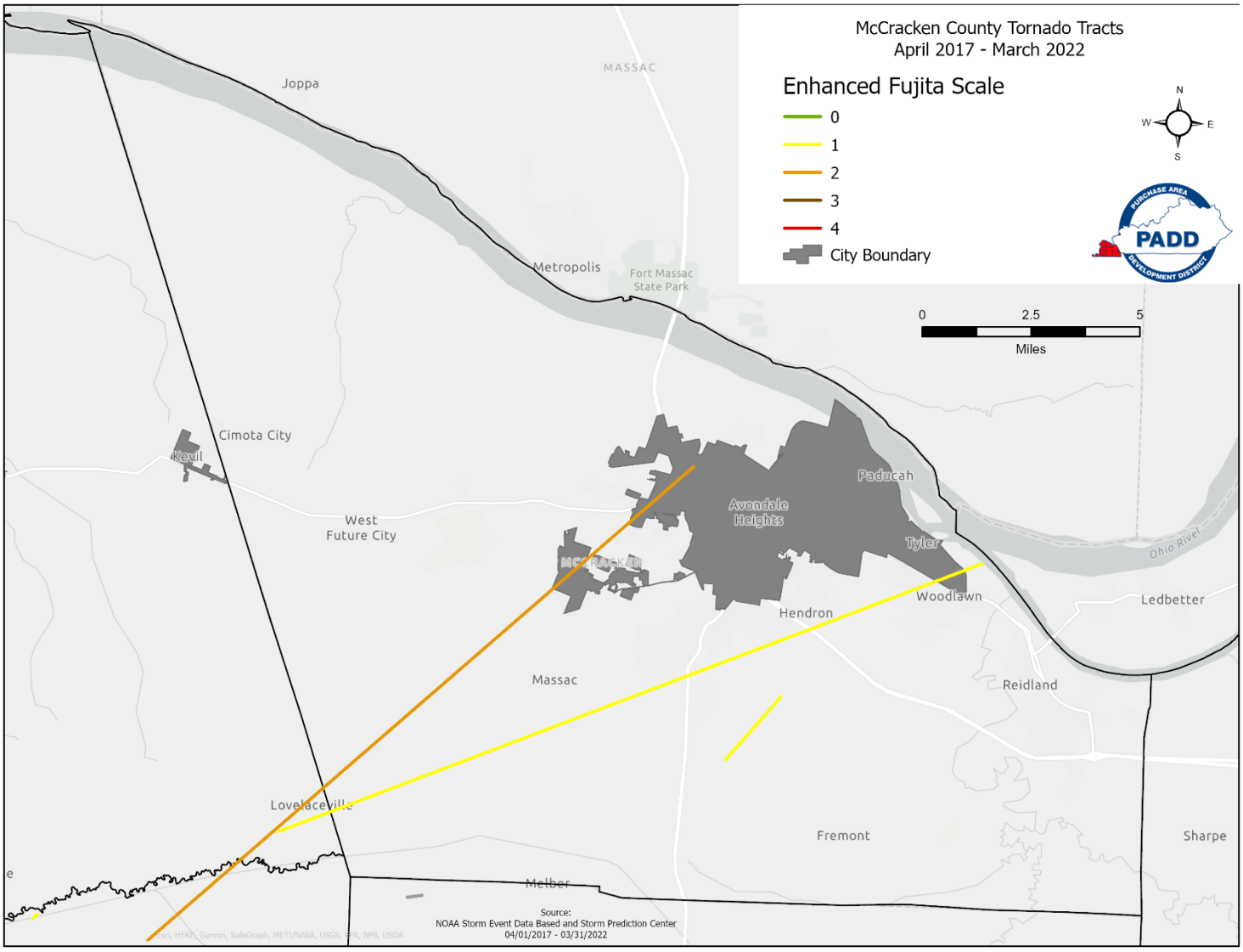
Source: National Oceanic and Atmospheric Administration, National Centers for Environmental Information, Storm Events Database: https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event descriptions are typical of the type of tornado events experienced in McCracken County:

- On February 24, 2018, an outbreak of severe thunderstorms and tornadoes occurred across western Kentucky. Most of the severe weather was along and south of Paducah to Madisonville line. This EF-1 tornado began just south of Kentucky Highway 999 and moved northeast for about two miles. A barn was destroyed. Debris from the barn damaged a nearby house and was embedded into a small trailer over 100 yards away. Some debris was buried up to three feet deep. Another outbuilding was destroyed. As the tornado crossed Highway 999, it damaged the roofs of two homes. A garage between the two homes had windows broken, and the west side of the building was pushed out. Numerous trees were snapped and uprooted along the path of the tornado. There was an eyewitness account of the tornado. Peak winds were estimated near 100 mph.

- On March 14, 2019, a strong low-pressure system produced multiple weather hazards. Scattered supercell thunderstorms developed ahead of a cold front on the morning and early afternoon of the 14th, producing isolated wind damage, large hail, and several tornadoes. This multi-county tornado entered McCracken County from Ballard County near the community of Lovelaceville. The tornado tracked within a couple of miles either side of U.S. Highway 62 for most of its path in McCracken County. The tornado intermittently reached EF-2 intensity from the Ballard County line to about two miles southeast of Barkley Regional Airport. A total of 25 dwellings were damaged along the path in McCracken County. Five businesses were damaged, and 20 residences were damaged. The damage was categorized as minor for 14 of the residences, major for one, and five were destroyed. Major structural damage included partial loss of roofs or walls. Minor damage to homes included the loss of shingles. Dozens of barns, outbuildings, garages, or grain bins were destroyed. The tornado dissipated shortly after crossing Interstate 24 between exits 3 and 4.

Figure 9.1 Vulnerability to Tornados through Identification of Tornado Tracks April 1, 2017 – March 31, 2022



Source: NOAA Storm Database

SUMMARY AND CONCLUSIONS OF TORNADO PROFILE

For the period covered by this update (April 1, 2017, through March 31, 2022, there were three occurrences of tornadoes in McCracken County reported by the NCEI. These occurrences injured one person and totaled $1,885,000 in reported personal property damage.

Information from Table 9.6 and Figure 9.1 related to tornadoes can be used to define the frequency of tornado events and the impact of these events. Data on tornado event magnitude is provided in the form of the Enhanced Fujita Scale as shown on the map.

McCracken County experienced 3 reported events over a 5-year period, which indicates 0.6 reported tornado events per year, or a 60 % probability that such an event will occur in any given year. The cost of a tornado event can be calculated as:

- $1,885,000 total damage divided by 3 events = $ 628,333 damage per event on average
- $628,333 times 0.6 events per year = $376,999.8 damage per year on average

Of critical concern to the McCracken County MPT, and the main contributing factor to its consideration of risks and vulnerability, is the human cost from tornado events. Although there are no recorded fatalities, tornados this period caused one person to be injured and $1,885,000 in property damage in three different events. Tornados represent a significant potential risk to McCracken County.

Flash Flood / Flood

As can be seen Table 9.7, Long Term flooding is the most common form of flooding in McCracken County. This is usually temporary conditions of partial or complete inundation of two or more acres of normally dry land area of two or more properties from overflow of water. The cause, being too much rainwater, delivered in too short of time. However, rather than steep slopes and narrow valleys channeling and concentrating the runoff from heavy rains, the runoff is too great in volume for the County's characteristic low lying, meandering streams, to carry away. This slow drainage is often exacerbated by stream blockages of tree limbs and trunks, which form effective check dams and barrages.

River basin flooding is common among Kentucky's major streams and bodies of water during the winter and early spring months. The major drainage systems in McCracken County are; the Ohio River, the Tennessee River, the Clarks River, Massac Creek, and Mayfield Creek. The Ohio and Tennessee Rivers delivered catastrophic flooding to the area in the past, most memorably in 1937, but has since been contained, if not controlled by levees, floodwalls, dams and by the controlled release of waters from Kentucky Dam on the Tennessee River and Barkley Dam on the Cumberland. Even so, a river such as the mighty Ohio will sometimes have its way. The event record below is a description of a typical, major, Purchase Region flood event and its impact on McCracken County and the City of Paducah.

Between April 1, 2017, and March 31, 2022, there were 11 flash floods and 31 river basin floods recorded in McCracken County. The flash flood events did not cause any deaths or injuries however there were $50,000 in property damages. The river basin floods did result in one injury and one death along with $1,201,000 in property damage.

Table 9.7 Flash Flood / Flood Events and Impacts in McCracken County April 1, 2017 – March 31, 2022

Location	Date	Time	Time Zone	Event Type	Deaths	Injuries	Property Damage	Crop Damage
WOODLAWN	5/9/2017	1:00	CST-6	Flood	0	0	0.00K	0.00K
REIDLAND	6/18/2017	16:15	CST-6	Flash Flood	0	0	0.00K	0.00K
RAGLAND	2/19/2018	15:00	CST-6	Flood	0	0	0.00K	0.00K
WOODLAWN	2/21/2018	13:30	CST-6	Flood	0	0	0.00K	0.00K
RAGLAND	3/1/2018	0:00	CST-6	Flood	0	0	150.00K	0.00K
SHADY GROVE	3/1/2018	0:00	CST-6	Flood	0	0	25.00K	0.00K
PADUCAH	4/5/2018	7:00	CST-6	Flood	0	0	0.00K	0.00K
MELBER	4/23/2018	19:00	CST-6	Flood	0	0	0.00K	0.00K
TYLER	5/25/2018	13:00	CST-6	Flash Flood	0	0	25.00K	0.00K
FUTRELL	5/30/2018	6:20	CST-6	Flash Flood	0	0	0.00K	0.00K
PADUCAH	7/15/2018	11:26	CST-6	Flood	0	0	0.00K	0.00K
LONE OAK	11/1/2018	2:00	CST-6	Flood	0	0	0.00K	0.00K

ROWLANDTOWN	1/1/2019	6:00	CST-6	Flood	0	0	0.00K	0.00K
RAGLAND	1/26/2019	20:00	CST-6	Flood	0	0	0.00K	0.00K
CECIL	2/1/2019	0:00	CST-6	Flood	0	0	0.00K	0.00K
RAGLAND	2/10/2019	16:00	CST-6	Flood	0	0	1.000M	0.00K
PADUCAH	2/20/2019	2:42	CST-6	Flood	0	0	20.00K	0.00K
RAGLAND	3/1/2019	0:00	CST-6	Flood	1	0	0.00K	0.00K
MELBER	3/14/2019	4:20	CST-6	Flood	0	0	0.00K	0.00K
CECIL	6/24/2019	3:00	CST-6	Flood	0	0	0.00K	10.00K
CECIL	7/1/2019	0:00	CST-6	Flood	0	0	0.00K	0.00K
PADUCAH	7/10/2019	15:25	CST-6	Flash Flood	0	0	0.00K	0.00K
PADUCAH	7/22/2019	13:45	CST-6	Flood	0	0	0.00K	0.00K
ROSSINGTON	1/12/2020	23:30	CST-6	Flood	0	0	0.00K	0.00K
HEATH	2/4/2020	9:39	CST-6	Flood	0	0	0.00K	0.00K
RAGLAND	2/10/2020	18:00	CST-6	Flood	0	0	0.00K	0.00K
GRAHAMVILLE	3/20/2020	21:00	CST-6	Flood	0	0	4.00K	0.00K
ROWLANDTOWN	4/1/2020	0:00	CST-6	Flood	0	0	0.00K	0.00K
CECIL	6/30/2020	14:30	CST-6	Flash Flood	0	0	0.00K	0.00K
CAMMELIA	7/20/2020	15:08	CST-6	Flash Flood	0	0	0.00K	0.00K
PADUCAH	7/29/2020	13:03	CST-6	Flash Flood	0	0	0.00K	0.00K
PADUCAH	1/25/2021	7:44	CST-6	Flood	0	0	0.00K	0.00K
HARDMONEY	1/25/2021	10:30	CST-6	Flash Flood	0	0	0.00K	0.00K
ROWLANDTOWN	3/2/2021	16:00	CST-6	Flood	0	0	2.00K	0.00K
PADUCAH	4/1/2021	17:00	CST-6	Flood	0	0	0.00K	0.00K
PADUCAH	7/18/2021	10:20	CST-6	Flash Flood	0	0	25.00K	0.00K
REIDLAND	8/21/2021	6:00	CST-6	Flash Flood	0	0	0.00K	0.00K
LONE OAK	1/1/2022	9:00	CST-6	Flood	0	0	0.00K	0.00K
TYLER	1/9/2022	11:00	CST-6	Flood	0	1	0.00K	0.00K
PADUCAH	2/17/2022	8:55	CST-6	Flash Flood	0	0	0.00K	0.00K
ROWLANDTOWN	2/22/2022	0:10	CST-6	Flood	0	0	0.00K	0.00K
PADUCAH	3/1/2022	0:00	CST-6	Flood	0	0	0.00K	0.00K
TOTALS					**1**	**1**	**1.251M**	**10.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information Storm Events Database: https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following events are typical of the type of **flooding** experienced in McCracken County:

- On March 1, 2018, the large mainstem rivers remained well above flood stage following several rounds of heavy rain in late February. February monthly precipitation was 4 to 7 inches above normal, with monthly totals of 8 to 10 inches common. The mainstem rivers

such as the Ohio and Mississippi crested early in March, and then fell below flood stage around mid-month. Moderate flooding continued the Ohio River from late February. At the Paducah River gage, the river crested at 51.43 feet on the 2nd. Flood stage is 39 feet. This crest was just several inches lower than the Flood of March 1997. A number of homes were evacuated in the county, including an area along Highway 1420 west of Paducah. This area is affected by backwater flooding of Massac Creek, which prompted the closure of Highways 1420 and 305. Numerous other roads were flooded and closed, mainly county roads. The floodgates were installed in the floodwall protecting the city of Paducah. Parks, roads, and boat ramps that were not protected by the floodwall were inundated.

- On February 10, 2019, Moderate to major river flooding developed during the month. After a wet January, the active weather pattern continued into February. Frequent moderate to heavy rain events continued pushing not only the monthly and seasonal precipitation totals higher but also the rivers. The winter of 2018-19 ended up being the fourth wettest winter on record at Paducah, where records go back to 1937. February was the second wettest February on record at Paducah. The monthly rainfall total at Paducah was 10.42 inches. A prolonged major river flood damaged about 50 homes in McCracken County. At Paducah, the Ohio River crested at 53.27 feet on the 25th. This was tied with the 1950 flood for the second worst flood since the Flood of 1937. Since 1937, only the flood crest of 2011 was higher. The flood crest reached 60.60 feet in the winter of 1937. Levee and flood wall gates were installed in the Paducah area. This action along with heavy rainfall in west Kentucky and backwater from the Ohio and Tennessee Rivers caused widespread flooding in the southeast part of McCracken County. Smaller rivers and creeks such as the Clarks River had nowhere to drain and kept rising with each successive round of heavy rain. A damage assessment indicated 35 residences sustained minor damage and 15 sustained major damage. Numerous roads were closed around the county, especially in the flood plain west of Paducah and the Clarks River basin in eastern McCracken County. Some of the largest state roads that were closed included Highway 131 south of Reidland, Highway 305 in West Paducah, and Highway 284 between Reidland and Paducah. A Red Cross shelter was opened in Paducah. The City of Paducah declared a state of emergency and installed most of the floodgates in the floodwall. The city's convention center was inaccessible for over a week due to its location outside the floodwall. A makeshift barrier was installed around the convention center to prevent flooding.

The following events are typical of the type of **flash flooding** experienced in McCracken County:

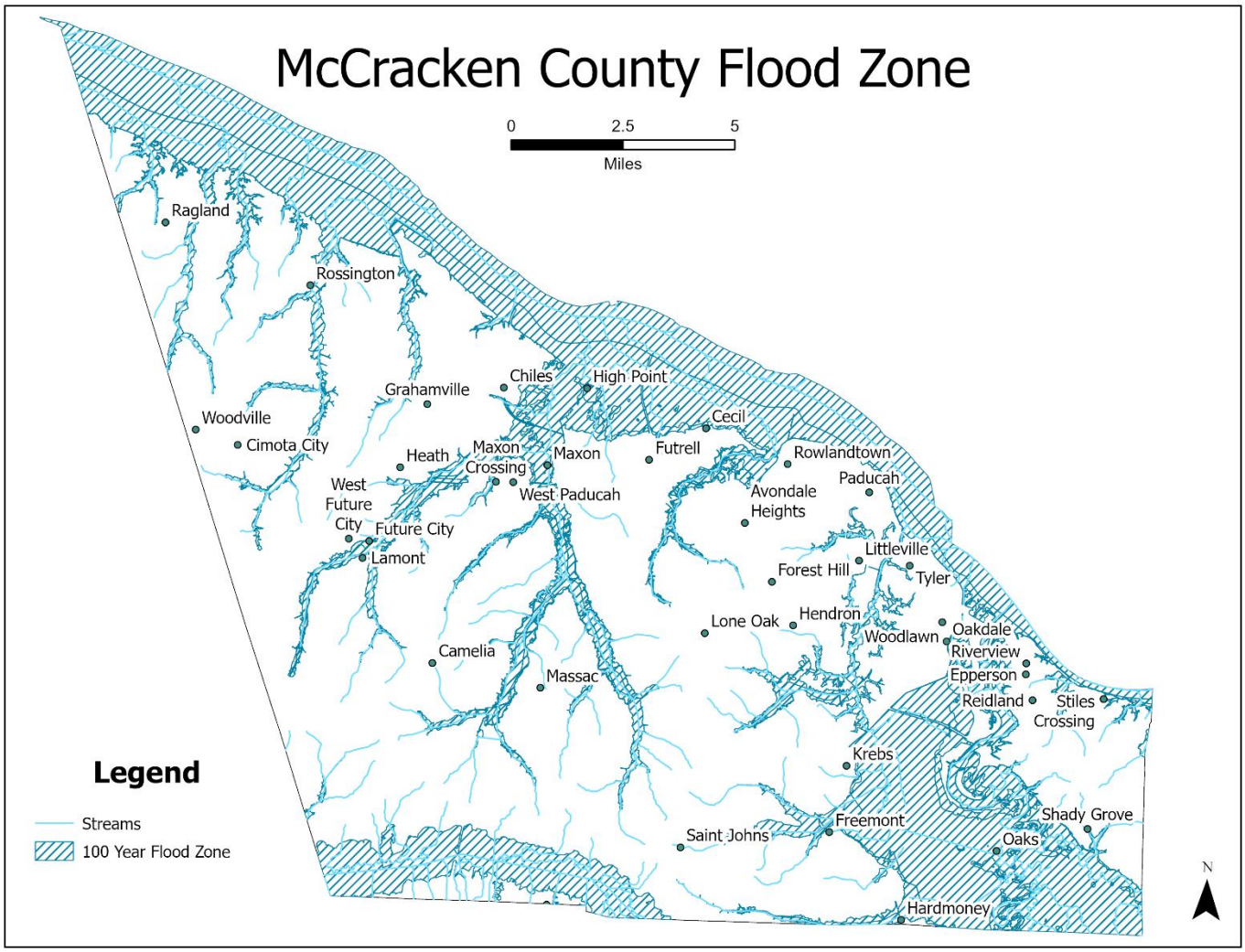
- On July 18, 2021, Thunderstorms produced isolated flash flooding. The storms occurred in the vicinity of a 500 mb trough that extended from the eastern Great Lakes southwest across the lower Ohio Valley. The convection itself was induced by a remnant mesoscale vorticity center that moved eastward from Missouri. The storms formed in an increasingly moist and unstable air mass. The wind flow aloft was weak, causing the storm motion to be driven by mesoscale processes. The storms generally propagated east to southeast at a

slow rate. Considerable flooding of streets and creeks was reported. A state road was undermined near Lone Oak. County emergency management personnel utilized all available personnel to block flooded roads.

- On May 25, 2018, A very slow-moving warm front moved northeast across western Kentucky during the daytime hours. The air mass along and behind the front was moist and unstable, setting the stage for locally heavy rain. In the Hendron community, a basement collapsed due to excessive runoff down a hillside. A vehicle water rescue was conducted in Paducah, within a few miles of the Hendron incident. A Paducah city street intersection was blocked to traffic, and spotty road closures were reported in the county.

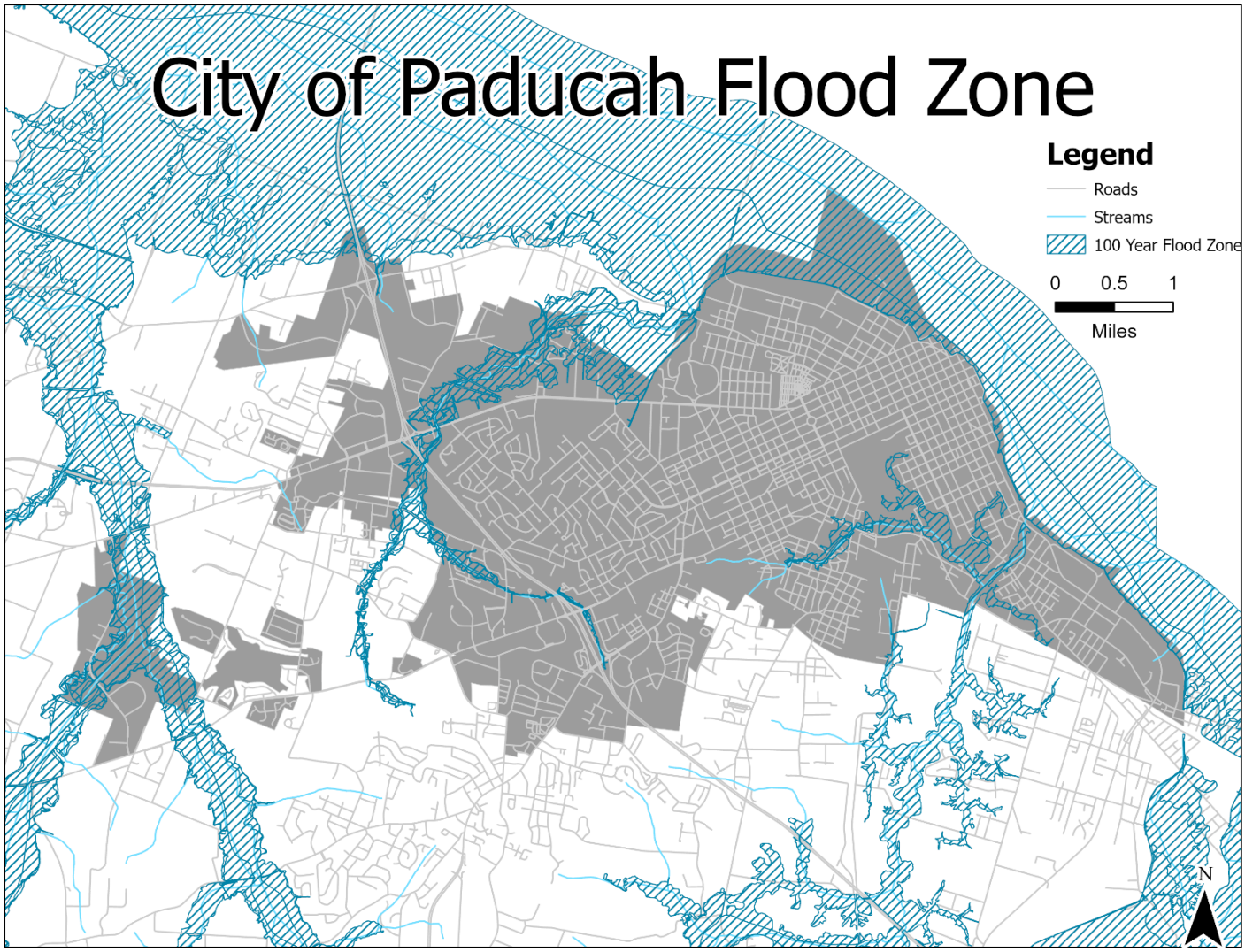
Figures 9.2 and 9.3 show the Flood Hazard Areas in the McCracken County and City of Paducah jurisdiction. All flood zone maps were created using digital data from FEMA's Map Data Center.

Figure 9.2 McCracken County 100 Year Floodplain



Source : Flood Hazard Zone Layer

Figure 9.3 City of Paducah Flood Zone



Source : Flood Hazard Zone Layer

Table 9.8 National Flood Insurance Program Participation by Jurisdiction

Jurisdiction	Floodplain Management Ordinance	SFHA in Jurisdictional Limits	Comments	City Class
Ballard County	X	X		
City of Barlow			No mapped SFHA	6
City of Kevil			No mapped SFHA	6
City of La Center		X	SFHA mapped in 2009, NFIP under consideration	5
City of Wickliffe	X	X		5
Calloway County	X	X		
City of Murray	X	X		3
City of Hazel			No mapped SFHA	6
Carlisle County	X	X		
City of Bardwell	X	X		5
City of Arlington	X	X		6
Fulton County	X	X		
City of Fulton	X	X		4
City of Hickman	X	X		4
Graves County	X	X		
City of Mayfield	X	X		3
City of Wingo		X		6
Hickman County		X	Mapped SFHA, non-participant	
City of Clinton	X	X		5
City of Columbus			No mapped SFHA	5
Marshall County	X	X		
City of Benton	X	X		4
City of Calvert City	X	X		4
City of Hardin	X	X		5
McCracken County	**X**	**X**		
City of Paducah	**X**	**X**		**2**

Information from the FEMA Community Status Book as of 03-17-22

SUMMARY AND CONCLUSIONS OF FLOODING PROFILE

Between April 1, 2017, to March 31, 2022, there were 31 river basin floods and 11 flash floods recorded in McCracken County. The river basin floods resulted in one death and one injured and $1,201,000 in property damage. Flash Floods resulted in no injuries or deaths and $50,000 in property damage.

Information from the above tables and maps related to flooding can be used to define the frequency of Flood Events and the impact of these events. Data on flood event magnitude was not available. On avera the frequency of occurrence indicates a more than 100% probability that such an event will occur in any given year.

- 42 events / 5-year plan update period = 8.4 events per year
- $1,251,000 property damage / 42 events = $29,785 average damage per event.
- $29,785 average damage per event x 8.4 events per year = $3,545 average damage per year.

Thunderstorm Wind

A thunderstorm is formed from a combination of moisture, rapidly rising, warm air, or a force capable of lifting air, such as the meeting of a warm and cold front, a sea breeze, or a mountain. Thunderstorms can produce tornados, flash flooding and large hail (all of which will be addressed individually in the plan). Thunderstorms can generate heavy rain which can cause flash flooding.

The National Weather Service considers a thunderstorm as severe if it develops 1 inch hail or 58 mph winds. Straight line winds during thunderstorms can exceed 100 miles per hour and are responsible for wind damage associated with thunderstorms. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Thunderstorms affect relatively small areas when compared with Winter Storms, as the average storm is 15 miles in diameter and lasts an average of 30 minutes. All thunderstorms are dangerous and capable of threatening life and property in localized areas. Every thunderstorm produces lightning, which results from the buildup and discharge of electrical energy between positively and negatively charged areas.

Thunderstorms are quite frequent in McCracken County. They have produced damage and injuries, but no recorded fatalities over the update period. Numerous severe thunderstorms have been recorded that produce high winds, lightning, and hail, in the county. Many of these thunderstorms have caused property or crop damage. These storms, although relatively short in duration when compared to other weather events, are often long lived enough to track across the entire county before dissipating their energy or exiting the region.

Table 9.9 Thunderstorm Wind Events and Impacts in McCracken County April 1, 2017 – March 31, 2022

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
HEATH	4/16/2017	14:37	CST-6	61 kts. MG	0	0	1.00K	0.00K
LONE OAK	4/26/2017	18:37	CST-6	61 kts. EG	0	0	3.00K	0.00K
WEST PADUCAH	11/18/2017	14:05	CST-6	52 kts. EG	0	0	5.00K	0.00K
PADUCAH	6/28/2018	19:10	CST-6	65 kts. EG	0	0	75.00K	0.00K
CECIL	12/31/2018	11:47	CST-6	70 kts. EG	0	0	50.00K	0.00K
(PAH)BARKLEY ARPT PA	2/7/2019	10:39	CST-6	52 kts. MG	0	0	0.00K	0.00K
CECIL	2/7/2019	10:40	CST-6	52 kts. EG	0	0	3.00K	0.00K
(PAH)BARKLEY ARPT PA	6/21/2019	16:16	CST-6	65 kts. EG	0	0	100.00K	0.00K
PADUCAH	6/23/2019	15:49	CST-6	54 kts. MG	0	0	15.00K	0.00K
REIDLAND	6/23/2019	15:53	CST-6	56 kts. EG	0	0	3.00K	0.00K

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
(PAH)BARKLEY ARPT PA	6/26/2019	17:40	CST-6	50 kts. MG	0	0	0.00K	0.00K
(PAH)BARKLEY ARPT PA	7/10/2019	14:46	CST-6	57 kts. MG	0	0	2.00K	0.00K
(PAH)BARKLEY ARPT PA	3/2/2020	21:46	CST-6	52 kts. EG	0	0	0.00K	0.00K
LONE OAK	3/20/2020	0:30	CST-6	52 kts. EG	0	0	0.00K	0.00K
CECIL	6/30/2020	14:10	CST-6	61 kts. EG	0	0	20.00K	0.00K
CAMMELIA	10/23/2020	14:22	CST-6	56 kts. EG	0	0	3.00K	0.00K
TYLER	10/23/2020	14:50	CST-6	52 kts. EG	0	0	3.00K	0.00K
PADUCAH	7/10/2021	19:45	CST-6	52 kts. EG	0	0	3.00K	0.00K
(PAH)BARKLEY ARPT PA	3/30/2022	15:59	CST-6	52 kts. MG	0	0	0.00K	0.00K
TOTALS					**0**	**0**	**286.00K**	**0.00K**

Wind Magnitude Definitions:
Measured Gust:'MG', Estimated Gust:'EG', Measured Sustained:'MS', Estimated Sustained:'ES' Source: Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event descriptions are typical of thunderstorm wind experienced in McCracken County:

- On June 28, 2018, A severe thunderstorm complex raced southward across western Kentucky during the early evening hours. Widespread wind damage occurred with this long-lived complex, which met the definition of a derecho. Widespread damaging winds occurred over the county. Numerous trees and power lines were down. Some roads were blocked by downed trees and power lines, especially Highway 2187 on the south side of Paducah. The roof was partially torn off a downtown office building in Paducah, and windows were blown out. A power pole was down in Paducah. Thousands of people lost power. Some of the power outages lasted through the following day. The peak wind gust at the National Weather Service at Barkley Regional Airport was 62 mph.

- On June 21, 2019, A severe weather outbreak occurred during the afternoon and early evening hours. An organized line of severe thunderstorms formed over the central Plains states during the night of the 20th. Strong damaging winds struck parts of McCracken County, mainly around the city of Paducah. A semi was blown over on the Interstate 24 bridge across the Ohio River. On the north side of Paducah, about 175 feet of a 400-foot-tall broadcasting tower was knocked down. Large trees were down in the city of Paducah, and bricks were blown off an historic building downtown. Just outside the city, several trees were blown down in Lone Oak. At the Barkley Regional Airport west of Paducah, a trailer was shifted off its foundation.

SUMMARY AND CONCLUSIONS OF THUNDERSTORM WIND PROFILE

From April 1, 2017, through March 31, 2022, there have been 19 occurrences of Severe Storms in McCracken County reported by the NCEI. These occurrences totaled over $286,000 in reported personal property damage with no injuries reported.

The number of Thunderstorm Wind events were combined to look at the frequency of occurrence. McCracken County experienced 19 Reported Events over the 5-year update period, which divides out to 3.8 reported events per year, a more than 100% probability that such an event will occur in any given year. For McCracken County the cost of a Thunderstorm Wind Event could be calculated as:

- $286,000 in damages / 19 events = $15,052 per event on average.
- $15,052 damage per event x 3.8 events per year = $57,197.6 damage per year.

Of critical concern to the McCracken County MPT and the main contributing factor in their consideration of risks and vulnerability, is the human cost of Severe Storm Events.

Winter Storms/Ice Storm

Winter Storms can produce an array of hazardous weather conditions that include heavy snow, freezing rain, sleet, high winds, and extreme cold. Ice Storms occur when freezing rain accumulates on surfaces and the ground. When a quarter inch or more of ice builds up, severe impacts can result. Winter storms are fueled by strong temperature gradients and an active upper-level cold jet stream. An Ice Storm can develop when warmer air above the freezing mark above the ground moves over subfreezing air near the ground. Snow aloft falls through the warmer air and melts into rain, then the rain droplets fall into the subfreezing air and freeze upon contact creating a glaze of ice. Winter and Ice storms can paralyze a community by shutting down normal everyday operations. Accumulating snow and ice can result in downed trees and power lines and may block transportation routes or make them hazardous. Heavy snow can lead to the collapse of weak roofs or unstable structures. Often, the loss of electricity results in the loss of heat in some homes and buildings. This presents a threat to human life, especially the elderly population.

The level of impact Winter Storms have is greatly determined by a community's ability to manage and control the affect, for example, the rapid mobilization of snow removal equipment. Because winter storms are sporadic in western Kentucky, many communities cannot afford the expensive equipment and maintenance of snow removal. This increases the potential damage a Winter Storm may cause. Depending on the severity of Ice Storms, impacts can persist for days. If more than a half-inch of accumulation occurs and damage is widespread, it can take a while to remove trees and repair power lines. This can result in a loss of electricity and heat for several days. During the planning period for this update there have been seven Winter Storms recorded in McCracken County and zero ice storms. The last Ice Storm on record happened in January 2009.

Table 9.10 Winter Storm / Ice Storm Events and Impacts in McCracken County, April 1, 2017 – March 31, 2022

Location	Date	Time	Time Zone	Event Type	Deaths	Injuries	Property Damage	Crop Damage
MCCRACKEN (ZONE)	1/12/2018	1:00	CST-6	Winter Storm	1	0	0.00K	0.00K
MCCRACKEN (ZONE)	2/15/2019	17:00	CST-6	Winter Storm	0	0	0.00K	0.00K
MCCRACKEN (ZONE)	2/10/2021	1:00	CST-6	Winter Storm	0	0	0.00K	0.00K
MCCRACKEN (ZONE)	2/14/2021	20:00	CST-6	Winter Storm	0	0	0.00K	0.00K
MCCRACKEN (ZONE)	2/2/2022	19:00	CST-6	Winter Storm	0	0	0.00K	0.00K
TOTALS					**1**	**0**	**0.00K**	**0.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event is typical of the type of winter storms experienced in McCracken County:

- On January 12, 2018, An Arctic cold front moved southeast across western Kentucky on the night of the 11th. Rain changed to a brief period of freezing rain, then to sleet during the overnight hours. The sleet changed to snow on the 12th as the Arctic air flooded in. A vigorous disturbance in the upper levels of the atmosphere prolonged the snow through the day on the 12th. Total accumulations of sleet were from one-half to one inch in most areas. On top of the sleet, snow accumulated from 3 to 4 inches in most places. An overturned tanker truck prompted the closure of U.S. Highway 62 at Highway 286 in western McCracken County. There was one winter storm fatality in Paducah that occurred during the storm. An elderly man was found dead outside his house. The coroner determined hypothermia was the primary cause of his death. Very cold temperatures in the wake of the storm reduced the effectiveness of melting agents such as salt. Dangerous travel conditions persisted well after the end of the precipitation.

SUMMARY AND CONCLUSIONS OF WINTER STORMS / ICE STORM PROFILE

From April 1, 2017, through March 30, 2022, there have been five occurrences of Winter Storms in McCracken County reported by the National Climate Data Center. These occurrences had no reported personal property damage.

While no Ice Storm events were recorded during this update period, such events are considered a significant risk due to the 2009 ice storm which produced significant damage to the entire Purchase Region. Ice Storm events, such as the one in 2009, have had a major impact on the region in the past however for this reporting period this specific type of event had no impact.

The number of Winter Storm and Ice Storm events for the McCracken County and the City of Paducah were considered jointly to look at the frequency of occurrence. McCracken County experienced five reported Winter Storm Events over the 5-year plan update period, which divides out to 1 reported Winter Storm events per year, or a more than 100% probability that such an event will occur in any given year.

As there were no damages reported for the update period the annualized cost could not be calculated.

Earthquake

An earthquake is a geologic event that involves movement or shaking of the earth's crust. Earthquakes are usually caused by the release of stresses accumulated as a result of the rupture of rocks along borders of the earth's ten tectonic plates. Earthquakes can affect hundreds of thousands of square kilometers, causing damage to property, resulting in loss of life and injury, and disrupting the social and economic functioning of the affected area.

According to the New Madrid Seismic Zone Catastrophic Earthquake Response Planning Project Volume 1 all Purchase Region counties will be severely impacted:

"The largest number of damaged buildings occurs in McCracken County where 24,100 structures are damaged. Graves and Marshall Counties also incur substantial building damage at 9,000 and 5,100 buildings, respectively. Conversely, over 90% of all buildings in Ballard and Hickman Counties are expected to experience damage. Additionally, 80% to 90% of buildings in McCracken and Carlisle Counties are damaged."

Based on the scenario conducted in the study

"Various modes of transportation are also compromised in western Kentucky following the NMSZ scenario event. Over 250 bridges are damaged; numerous bridges along US-51, US-60 and US-45 are heavily damaged and likely impassible the day after the earthquake. Additionally, damage to major river bridges during the event severely limits traffic between Kentucky and Illinois, Tennessee and Missouri."

To review more information regarding this study, refer to appendix 3.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends on the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site and regional geology. Earthquakes may also cause landslides and liquefaction. Landslides are the down-slope movement of soil and rock in mountainous regions and along hillsides. Liquefaction occurs when the ground soil loses the ability to resist shear and flows much like quicksand. When liquefaction occurs, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a ten-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale. It is a twelve-level scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, with an "I" corresponding to imperceptible

(instrumental) events, “IV” corresponding to moderate (felt by people awake), to “XII” for catastrophic (total destruction).

Table 9.11 provides the Mercalli Intensity scale for earthquakes compared to the Richter Scale

Table 9.11 Modified Mercalli Intensity Scale for Earthquakes Compared to the Richter Scale

Scale	Intensity	Description of Effects	Maximum Acceleration (mm/sec)	Richter Scale
I	Instrumental	Detected only on seismographs	<10	
II	Feeble	Some people feel it	<25	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	<50	
IV	Moderate	Felt by people walking	<100	
V	Slightly Strong	Sleepers awake; church bells ring	<250	<4.8
VI	Strong	Trees sway: suspended objects swing, objects fall off shelves	<500	<5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<1000	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	<2500	
IX	Ruinous	Some houses collapse; ground cracks; pipes break	<5000	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7500	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards	<9800	<8.1
XII	Catastrophic	Total Destruction: trees fall; ground rises and falls in waves	>9800	>8.1

The New Madrid Seismic Zone is located in southeastern Missouri, northeastern Arkansas, Western Tennessee, Western Kentucky and Southern Illinois. This area is the most active seismic area east of the Rocky Mountains.

Every Year hundreds of small earthquakes occur in the New Madrid Seismic Zone but are typically too small to be felt by humans and can only be detected by sensitive instruments. The last major earthquake in the state of Kentucky was in 1812. The probability of a large magnitude earthquake impacting the Purchase Region is about 10% based on 50 years of research. Though Earthquakes

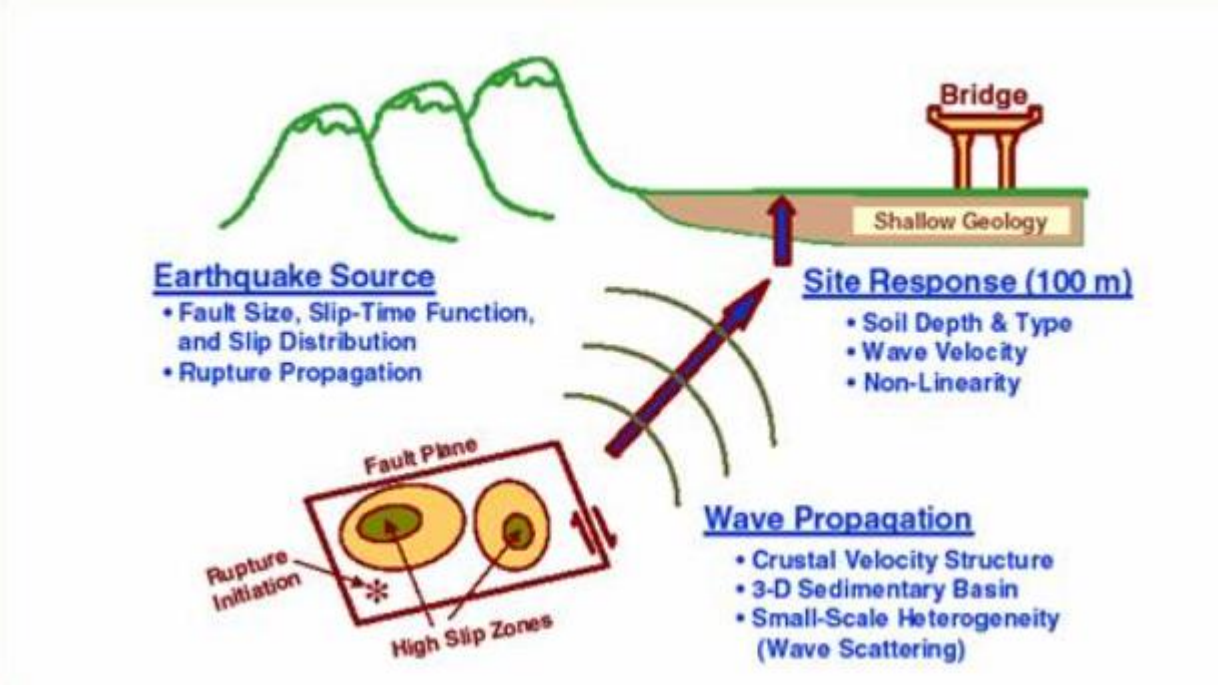
are hard to predict, and scientists are taking great strides to understand the New Madrid Seismic Zone.

Due to the nature of the bedrock that is present in the New Madrid Seismic Zone the geographic impact in the asking of the ground and be 20 times larger than the earthquakes that impact California. If a large magnitude Earthquake is to occur in the Purchase Region area the damages will be significant.

The primary cause for damage and injuries during an earthquake is because of the destruction of manmade structures. These structures are particularly susceptible 1. Tall Structures (Buildings, Bridges, Dams), 2. Large Open Structures, 3. Brittle Structures, 4. Complex Structures with odd shapes and lots of corners, and 5. Unanchored building contents. Damage will vary depending on the magnitude, zone location, geologic nature of material and degree of urbanization. More information can be found on the Missouri Department of Natural Resources facts page of the New Madrid Seismic Zone https://dnr.mo.gov/land-geology/hazards/earthquakes/science/facts-new-madrid-seismic-zone.

Figure 9.4 collected from the Kentucky Geological Survey interprets ground motion.

Figure 9.4 Kentucky Geological Survey Ground Motion

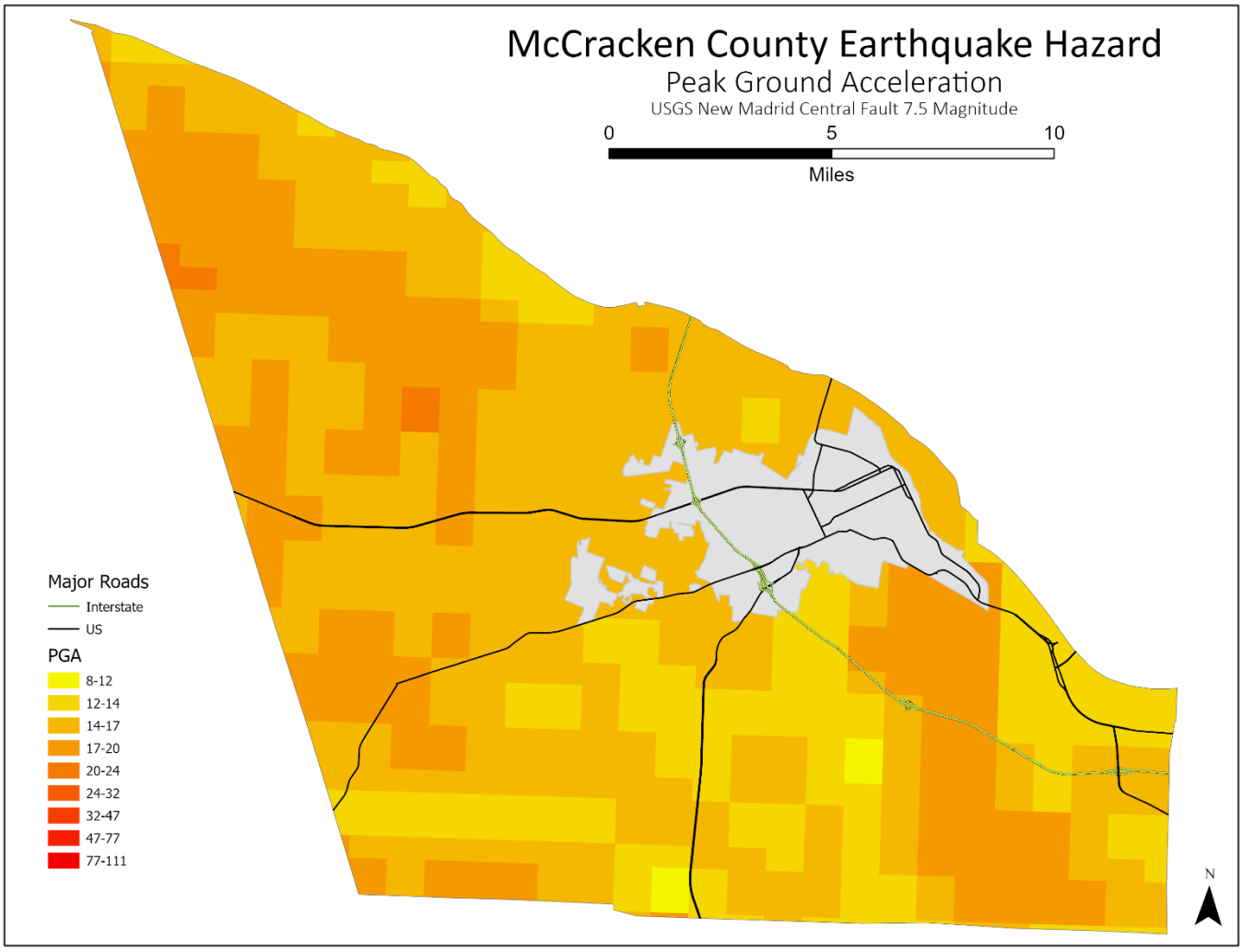


Source: Kentucky Geological Survey

While Figure 9.5 shows the Peak Ground Acceleration for McCracken County based on the USGS Shake map simulator at an earthquake of 7.5 magnitude. Figure 9.6 shows the Peak Ground

Velocity for McCracken County based on the USGS Sake Map simulator for an earthquake of 7.5 magnitude.

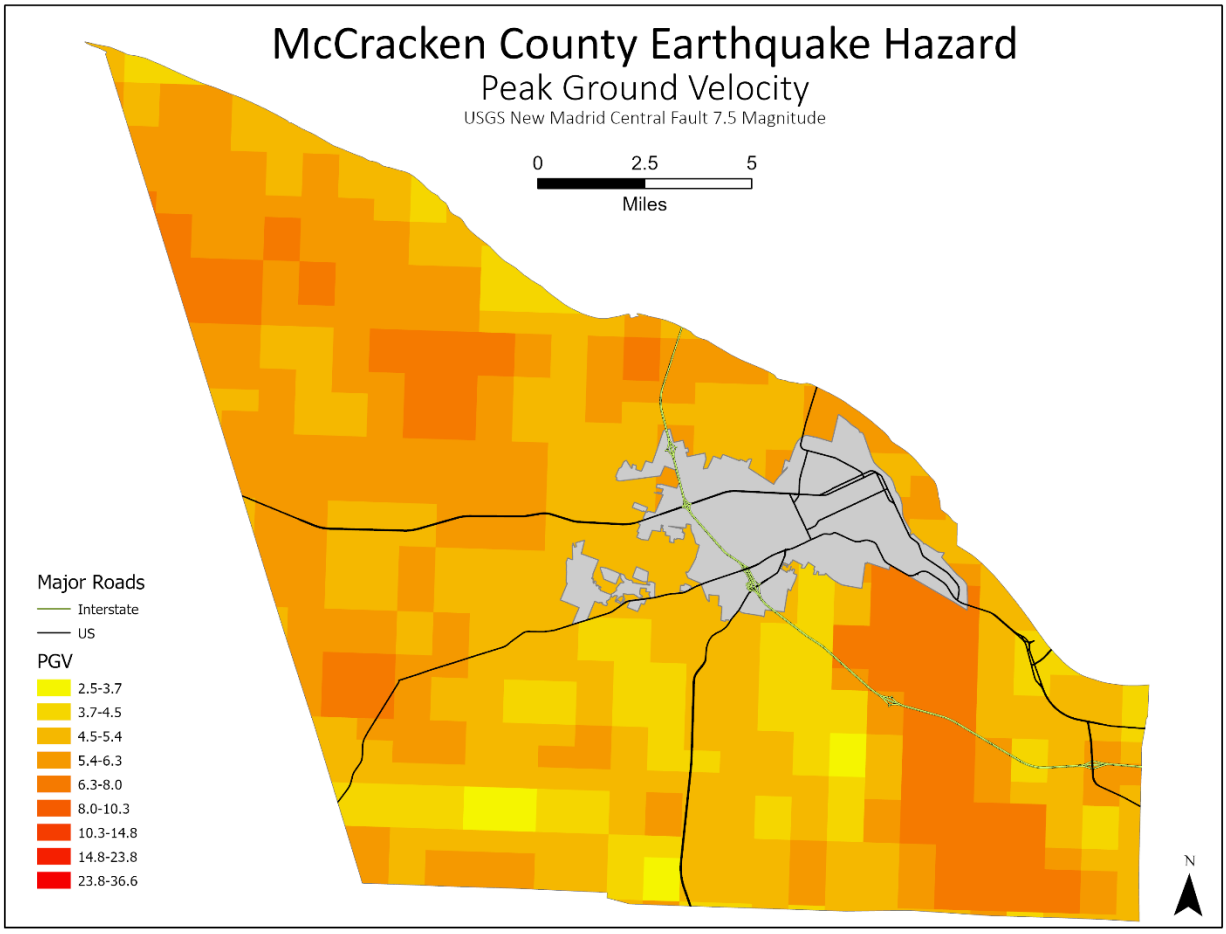
Figure 9.5 USGS New Madrid Central Fault 7.5 Magnitude Peak Ground Acceleration



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Figure 9.6 USGS New Madrid Central Fault 7.5 Magnitude Peak Ground Velocity



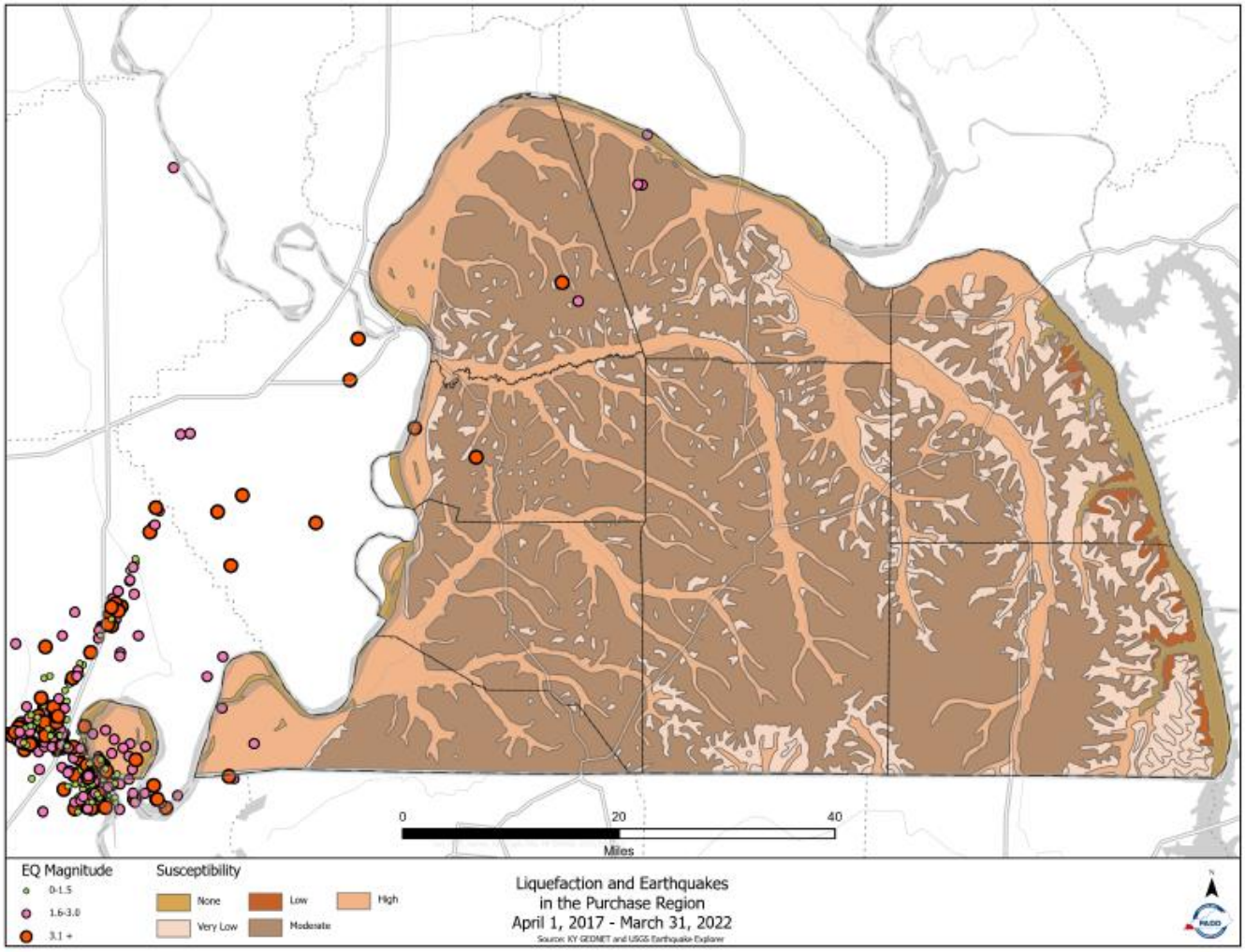
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends on the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Earthquakes may also cause liquefaction. Liquefaction occurs when the ground soil loses the ability to resist shear and flows, much like quicksand. When liquefaction occurs, anything relying on the substrate for support can shift, tilt, rupture, or collapse.

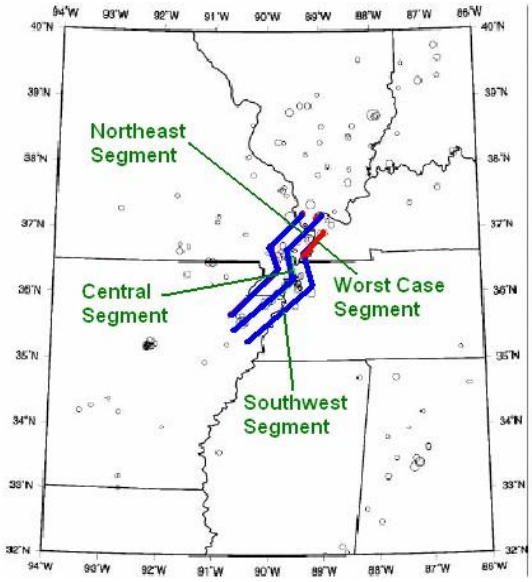
Figure 9.7 describes the underlying soil structure for McCracken County. It indicates that virtually the entire county is underlain by beds of sediment, not bedrock. This increases the potential for ground shaking and liquefaction.

Figure 9.7 Generalized Liquefaction Susceptibility & Earthquake Magnitude of the Purchase Region



Source: USGS Map was derived from the USGS Earthquake Catalog, and the Liquefaction data was retrieved from Kentucky Geonet

Figure 9.8 Scenario Fault Location for the State of Kentucky



SUMMARY AND CONCLUSIONS OF EARTHQUAKE HAZARD PROFILE

Low magnitude earthquakes occur constantly in the New Madrid Seismic Zone. Depending on the depth and magnitude, some of the stronger tremors, 3 and above, are felt throughout the entire region. Damages amount to the rare instance of a picture being knocked off a wall or items shaken from shelves.

The potential for an earthquake of catastrophic proportions is not open to debate. Historic and geologic evidence are proof. However, the probability of such an event in any given time frame is open to interpretation and the effects are still a matter of discussion.

McCracken County experienced three low magnitude earthquakes between April 1, 2017, to March 31, 2022. Most of the Earthquakes that occurred were near or in Fulton County. A full figure of earthquake occurrences will be found in the appropriate county annexes.

Hail

Hail is one of four types of precipitation that falls from the sky. It's also the most dangerous, damaging type, occurring during severe storms. If hail measuring larger than 1 inch in diameter falls during a thunderstorm, it is classified as severe weather. Sometimes damaging winds accompany this type of storm as well. According to the National Oceanic and Atmospheric Administration, hail causes over one billion dollars of damage in the United States each year.

Generally, hail must be 1 ¼ inches in diameter (Half-Dollar size) before it causes damage to heavy composite shingles or wood shake shingles. Lightweight composite shingles may show damage after being struck by 1-inch diameter (Quarter size) hail. Only deteriorated composite shingles will show hail damage due to hail less than 1 inch in diameter, and the hail generally must be more than ¾ inch in diameter (Dime size).

TORRO Hailstorm Intensity Scale

The Torro Hailstorm Intensity Scale was introduced by Jonathan Webb of Oxford, England, in 1986 as a means of categorizing hailstorms. The scale extends from H0 to H10 (See Table 9.12) with its increments of intensity or damage potential related to hail size, texture, numbers, fall speed, speed of storm translation, and strength of the accompanying wind.

An indication of equivalent hail kinetic energy ranges (in joules per square meter) has now been added to the first six increments on the scale, and this may be derived from radar reflectivity or from hail pads. The International Hailstorm Intensity Scale recognizes that hail size alone is insufficient to accurately categorize the intensity and damage potential of a hailstorm, especially towards the lower end of the scale. For example, without additional information, an event in which hail of up to walnut size is reported (hail size code 3: hail diameter of 21-30 mm) would be graded as a hailstorm with a minimum intensity of H2-3. Additional information, such as the ground wind speed or the nature of the damage the hail caused, would help to clarify the intensity of the event. For example, a fall of walnut-sized hail with little or no wind may scar fruit and sever the stems of crops but would not break vertical glass and so would be ranked H2-3. However, if accompanied by strong winds, the same hail may smash many windows in a house and dent the bodywork of a car, and so be graded an intensity as high as H5.

However, evidence indicates that maximum hailstone size is the most important parameter relating to structural damage, especially towards the more severe end of the scale. It must be noted that hailstone shapes are also an important feature, especially as the "effective" diameter of non-spheroidal specimens should ideally be an average of the co-ordinates. Spiked or jagged hail can also increase some aspects of damage.

Table 9.12

?	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m^2	Typical Damage Impacts
H0	Hard Hail	5	0-20	No damage
H1	Potentially Damaging	5-15	>20	Slight general damage to plants, crops
H2	Significant	10-20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75		Severe roof damage, risk of serious injuries
H8	Destructive	60-90		(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Size codes are presented in Table 9.13. The Size Code is the maximum reported size code accepted as consistent with other reports and evidence.

Table 9.13

Hail size and diameter in relation to TORRO Hailstorm Intensity Scale		
Size code	**Maximum Diameter mm**	**Description**
0	5-9	Pea
1	10-15	Mothball
2	16-20	Marble, grape
3	21-30	Walnut
4	31-40	Pigeon's egg > squash ball

Hail size and diameter in relation to TORRO Hailstorm Intensity Scale		
Size code	**Maximum Diameter mm**	**Description**
5	41-50	Golf ball > Pullet's egg
6	51-60	Hen's egg
7	61-75	Tennis ball > cricket ball
8	76-90	Large orange > Soft ball

From April 1, 2017, through March 31, 2022, there have been nine occurrences of Hail events in McCracken County reported by the NCEI. There were no injuries or deaths and $20,000 in reported property damage associated with these events for the plan update period.

Table 9.14 Hail Events and Impacts in McCracken County
April 1, 2017 – March 31, 2022

Location	Date	Time	Time Zone	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
(PAH)BARKLEY ARPT PA	5/27/2017	15:00	CST-6	1.25 in.	0	0	0.00K	0.00K
LAMONT	9/5/2017	5:00	CST-6	1.25 in.	0	0	0.00K	0.00K
PADUCAH	5/6/2018	13:45	CST-6	0.88 in.	0	0	0.00K	0.00K
WEST PADUCAH	5/31/2018	14:52	CST-6	1.00 in.	0	0	0.00K	0.00K
PADUCAH	3/2/2020	17:49	CST-6	1.75 in.	0	0	0.00K	0.00K
PADUCAH	6/30/2020	14:20	CST-6	0.75 in.	0	0	0.00K	0.00K
PADUCAH	6/12/2021	23:33	CST-6	0.88 in.	0	0	0.00K	0.00K
LONE OAK	12/5/2021	19:29	CST-6	1.50 in.	0	0	20.00K	0.00K
PADUCAH	12/5/2021	19:35	CST-6	0.75 in.	0	0	0.00K	0.00K
TOTALS					**0**	**0**	**20.00K**	**0.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event is typical of the type of winter storms experienced in McCracken County:

- On December 5, 2021, a strong cold front moved through the region, preceded by numerous thunderstorms during the evening hours on December 5th and into the early morning on the 6th. Large hail, a few tornadoes, and an isolated damaging wind event accompanied the strongest storms. There were four tornadoes that touched down in the Tennessee border counties of western Kentucky. A loose clustering of storms and embedded supercells caused most of the severe weather in the evening. Overnight, the severe weather was mostly in the form of a convective line with embedded mesoscale circulations. The severe storm environment was characterized by weak instability but very strong wind shear. Hail was reported a few miles northwest through southwest of Lone

Oak. Most of the hail was dime sized, but the largest stone was 1.5 inches. Some hail damage was reported to vehicles near Lone Oak.

SUMMARY AND CONCLUSIONS FOR HAIL PROFILE

There were nine hail events during the 5-year update planning period. On average this means that 1.8 hail events occur in McCracken County on any given year. There was $20,000 in reported property damage. The primary hazard associated with such events is typically property damage in the form of vehicle and crop damage.

- 9 events / 5-year period update = 1.8 events per year
- $20,000 in damages / 9 events = $2,222 per event on average
- $2,222 per event on average x 1.8 events per year = $3,999 average per damage per year

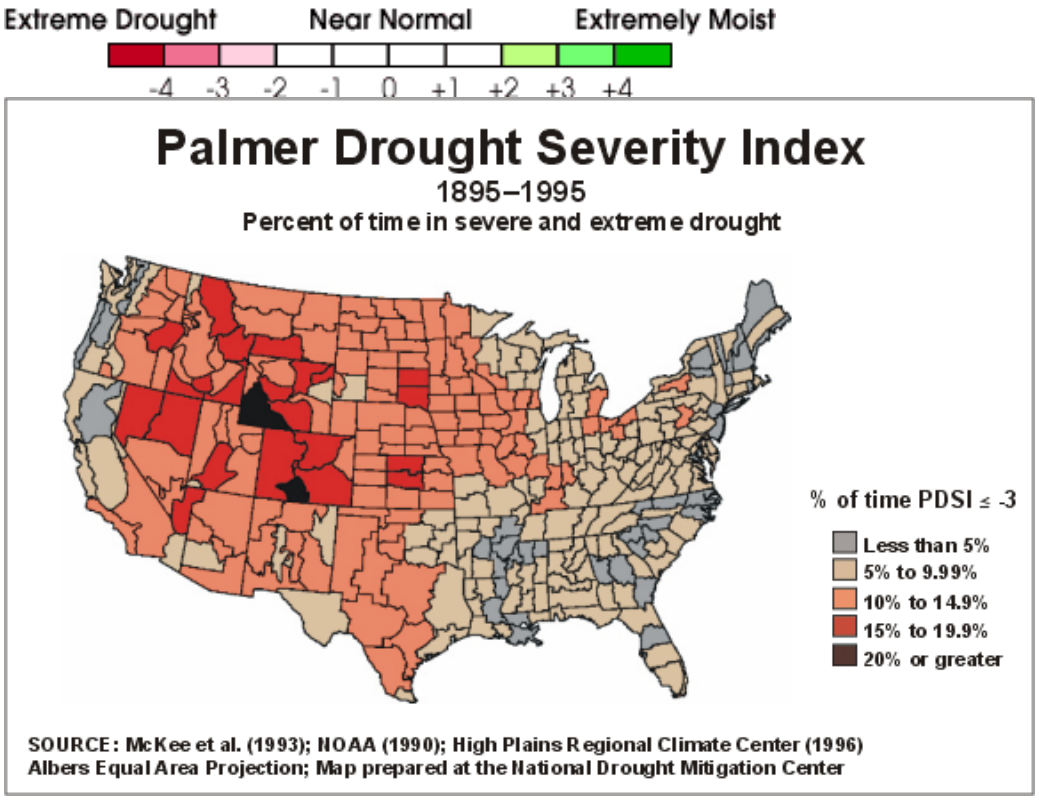
Excessive Heat / Drought

Excessive heat is defined as temperatures that hover 10 degrees or more above the average high temperatures for the region and last for several weeks. 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. Excessively dry and hot conditions can provoke dust storms and low visibility.

Droughts occur when a long period passes without substantial rainfall. Drought conditions can cause significant crop damage, but there is little property damage from excessive heat. Due to the historical occurrences of drought and excessive heat in the Purchase Region, these hazards present a threat not only to the agriculture of the region, but to the aged, and chronically ill population.

The Palmer Drought Severity Index (PDSI) is used to show the relative dryness or wetness in an area and indicates prolonged and abnormal moisture deficiency or excess. The PDSI is used for evaluating the scope, severity and frequency of prolonged periods of abnormally wet or dry weather. Figure 9.9 shows the PDSI scale.

Figure 9.9 Palmer Drought Severity Index



During the planning period for this update there have been a combined total of 14 events recorded in McCracken County. Of those 3 events, three have been Excessive Heat and zero Drought. There were no injuries / fatalities or damages (property or crop) recorded during these events.

Table 9.15 Excessive Heat / Drought Events and Impacts in McCracken County January 1, 2012 – March 31, 2017

Location	Date	Time	Time Zone	Event Type	Deaths	Injuries	Property Damage	Crop Damage
MCCRACKEN (ZONE)	7/21/2017	11:00	CST-6	Excessive Heat	0	0	0.00K	0.00K
MCCRACKEN (ZONE)	7/5/2018	10:00	CST-6	Excessive Heat	0	0	0.00K	0.00K
MCCRACKEN (ZONE)	7/14/2018	10:00	CST-6	Excessive Heat	0	0	0.00K	0.00K
TOTALS					**0**	**0**	**0.00K**	**0.00K**

Source: National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information (NCEI), Storm Events Database
https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=21%2CKENTUCKY

The following event description is typical type of excessive heat / drought events experienced by McCracken County:

- On July 5, 2018, the prolonged period of hazardous heat and humidity that began on June 29th persisted through the first several days of July. The most dangerous heat index values occurred on July 5th, when afternoon heat indices peaked from 110 to 115 degrees. Otherwise, the peak heat index was from 105 to 110 on the 4th, and near 105 on the 1st, 2nd, and 3rd. Actual air temperatures were mostly in the mid to upper 90's. South winds ahead of a cold front brought heat and humidity on the 1st. The front stalled over the lower Ohio Valley on the 2nd, then returned northward. Another cold front approached on the 5th, preceded by hot and humid southwest winds.

SUMMARY AND CONCLUSIONS OF EXCESSIVE HEAT / DROUGHT PROFILE

Combined there have been three heat related events in the county during the 5-year planning period. This divides out to roughly one event every other year. Common sense would dictate that the conditions that generated a heat type event in one county could have generated a heat type event in another. One in every ten events could prove deadly and almost four heat injuries result from every event. From a county perspective the cost of an Excessive Heat Event is difficult to assess as there are no monetary damages available. Of critical concern to the McCracken County MPT was the potential for human casualties in the form of heat stroke and heat exhaustion causing injury and even deaths.

Information from the above table can be used to define the frequency of Drought Events and the impact of these events throughout the region. McCracken County experienced zero droughts over the 5-year update period. Drought is mainly a threat to the agricultural segment of the county economy, but it is also having a significant impact on water and wastewater systems.

Based on historic records, there have been no deaths or injuries attributed to excessive heat in McCracken County. Likewise, there has been no drought impact recorded for individuals or property over this same period. As there are no reported damages or injuries for the planning update period, the annualized cost of a heat related event could not be calculated.

Wildfire

A wildfire is an uncontrollable burning of grasslands, brush or woodlands. The potential for wildfire depends on surface fuel characteristics, weather conditions, recent climate conditions, and topography and fire behavior. There are three different types of wildfire classes:

- *Surface fires* are the most common type. These fires burn along the forest floor moving slowly and will damage and kill trees.
- *Ground fires* are usually started by lightening. These fires burn on or below the forest floor.
- *Crown fires* spread quickly by wind. These fires will move quickly by jumping along treetops.
  - *Spotting* can be produced by crown fires as well as wind and topography conditions. Large burning embers are thrown ahead of the main fire. Once spotting begins, the fire will be very difficult to control.

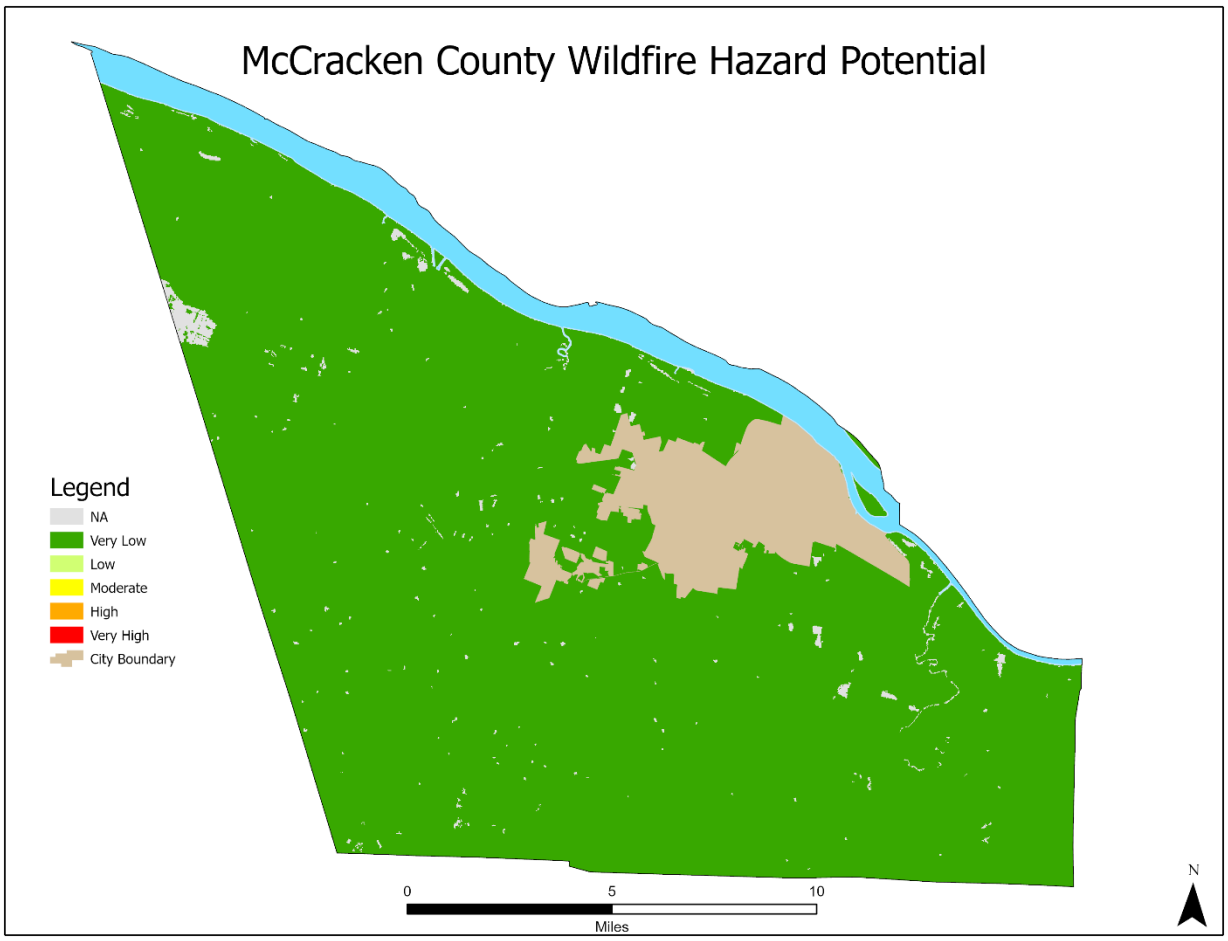
Kentucky has two defined wildfire seasons: in the spring, February 15 – April 30 and in the fall, October 1 – December 15. These two seasons are separated by periods of higher moisture and colder, less conducive fire weather. When leaves begin to fall from deciduous hardwood trees a thick litter layer forms in wooded areas creating a fuel source for rapidly expanding wildfires. Also, during the fall season, or periods of drought, tall grasses can become very flammable. It is possible for wildfires to occur outside the defined fire seasons during prolonged periods of drought.

Specific outdoor burning laws have been established to lessen the wildfire occurrence during these fire seasons. Kentucky Revised Statute 149.400 prohibits outdoor burning during the defined fire seasons between 6 am and 6 pm unless at a distance of at least 150 feet from woodlands or brushland. In Kentucky, wildfire risks are compounded by the state's extremely high arson rate. Sixty-two percent of Kentucky's wildfires are deliberately set by arsonists.

In the State Hazard Mitigation Plan, the Purchase Region is shown as having a moderate fire danger class, but there are no significant historical occurrences. Wildfires have not been a threat to the Purchase Region as a whole. Nowhere in the region is there higher than "Low" Wildfire danger.

Figure 9.10 exhibits the wildfire potential in McCracken County based on the USDA and the US Forestry Service Wildfire Risk to Community's database.

Figure 9.10 McCracken County Wildfire Risk



The United States Department of Agriculture, United States Forestry Service data indicates that McCracken County has a low wildfire probability threat. This is supported by the fact that there are no significant historical occurrences. Wildfires have not been a threat to the Purchase Region as a whole. Nowhere in the region is there higher than "Low" Wildfire danger.

McCracken County has a low risk of wildfires in the county lower risk than 74% of counties in the United States. Figure 9.11 represents the wildfire exposure McCracken County communities face.

Figure 9.11 McCracken County Community Wildfire Exposure

Source : https://wildfirerisk.org/explore/exposure-type/21/21039/

SUMMARY AND CONCLUSIONS FOR WILDFIRE PROFILE

From April 1, 2017, through March 31, 2022, there have been zero occurrences of Wildfire Events reported in McCracken County by the NCEI and likewise zero events for the entire Purchase Region. In a search of the NCEI Storm Events Database there are only 11 reported events for the entire region. These occurred between February 1996 and January 2006.

With no historic data for damages to support wildfire as a hazard in McCracken County, does not mean that there have not been instances of brush fires that had or will have the potential to grow out of control, especially during periods of drought events. It is therefore included as a Hazard in the risk assessment, albeit a low risk, but a risk that needs to be continually assessed and planned for and perhaps anticipated.

The ice storm of 2009 generated massive amounts of fuel, in the form of fallen limbs, and that this risk is greatly diminished at this time. It is likely that there were some number of small field fires during this period however that expense was not documented. According to information found in the 2018 State Hazard Mitigation Plan, McCracken County has an estimated loss of $5,111,587,459.00.

Dam Failure

There is no historical occurrence of damage or injury due to a dam failure in McCracken County. However, dam failure is considered a hazard. There are approximately 80,000 regulated dams in the United States. In Kentucky the Division of Water regulate 81dams in the Purchase Region. Dams are classified based on the evaluation of damage possible downstream. The FEMA guide to dam classifications is as follows:

Table 9.16 FEMA Dam Classification

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 on one or more human life is expected. Economic loss, environmental damage, and/or disruption of lifeline facilities can be expected but are not necessary for this classification.

Source: FEMA 333; Federal Guidelines for Dam Safety Hazard Potential Classification System for Dams

Table 9.17 Dam Classification by County

The chart below lists the existing dams in the area by classification. McCracken County has seven structures, five evaluated as Class A and two evaluated as Class B.

County	Class A (low)	Class B (moderate)	Class C (high)
Ballard	3	1	0
Calloway	7	1	0
Carlisle	22	0	1
Graves	23	2	6
Hickman	5	1	0
Marshall	3	1	2
McCracken	**3**	**0**	**0**
Total	**66**	**6**	**9**

Figure 9.12 shows the approximate location of the State rated dams in McCracken County. Please note that due to scaling, multiple dams may appear as a single structure. For planning purposes, the McCracken County MPT can only speculate that the area inundated by failure of one of these structures would be at least equal to the 100-year flood zone.

Figure 9.12 McCracken County Dams by Downstream Hazard Potential

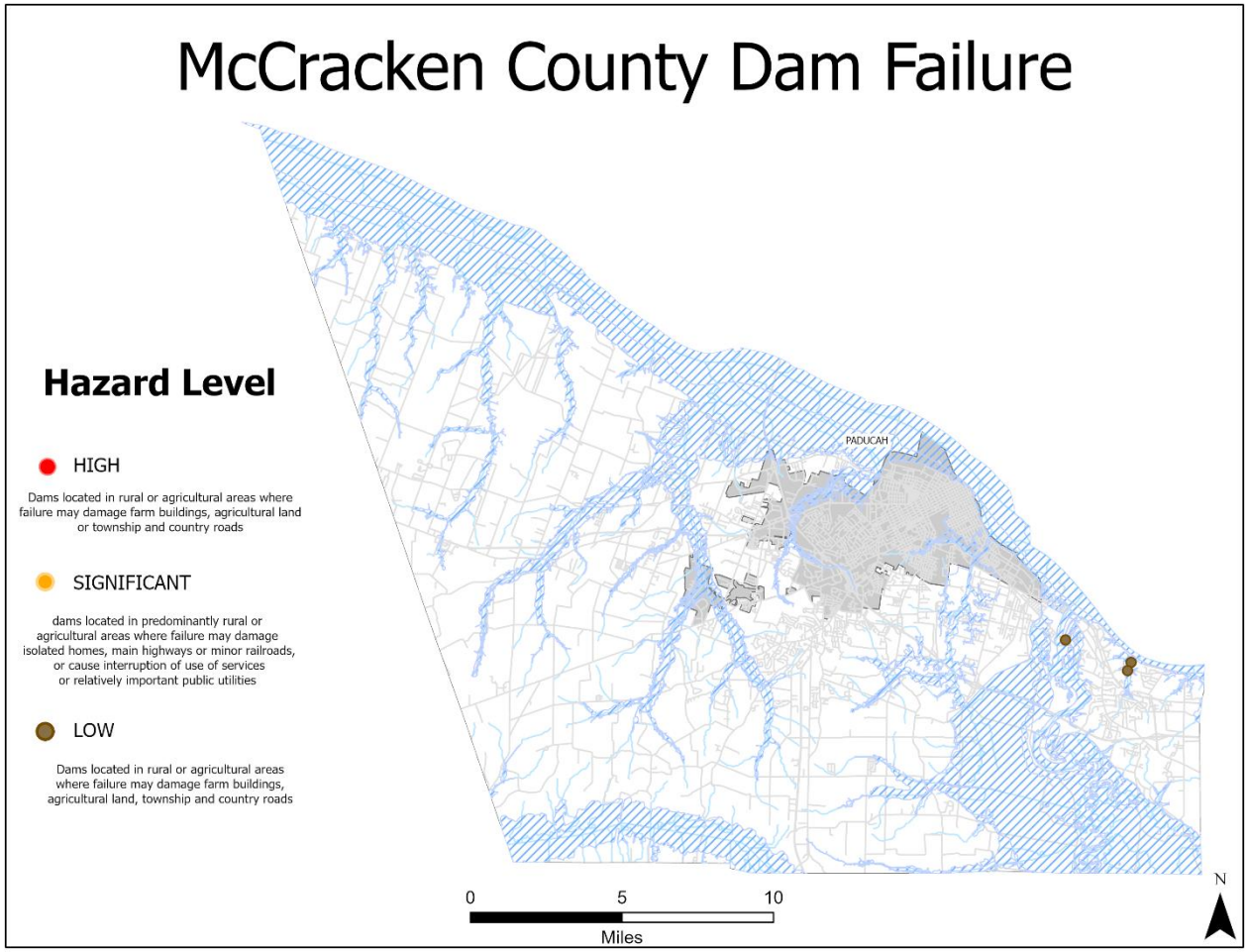


Figure 9.12 shows the approximate location of the State rated dams in McCracken County. Please note that due to scaling, multiple dams may appear as a single structure.

Not included in this plan update are two large dams, Kentucky Dam and Barkley Dam, which impound the Tennessee and Cumberland Rivers upstream of McCracken County. Kentucky Dam is operated by the Tennessee Valley Authority (TVA) while Barkley Dam is operated by the U.S. Army Corps of Engineers. For security reasons information regarding these structures is not available however the probability of an earthquake affecting either dam is low based on regular maintenance and monthly inspection of all components of this flood control system.

For planning purposes, the McCracken MPT can only speculate that the area inundated by failure of one or the other or both of these structures would be at least equal to the 100 year flood zone. The result of the failure of either, or both at a time when the Ohio River was already at flood stage or higher, needs to be explored in future revisions of this plan.

SUMMARY AND CONCLUSIONS FOR DAM FAILURE HAZARD PROFILE

The main question regarding Dam Failure in McCracken County is the concern for a possible catastrophic failure of Kentucky Dam on the Tennessee River, and/or Barkley Dam on the Cumberland. Inundation maps or projections for the effects for this scenario were not made available to the McCracken MPT and are not included in this plan.

9:4.3 Assessing Vulnerability: Identifying Assets Overall Summary Vulnerability

The vulnerability of structures to Severe Weather and Earthquake Hazards in McCracken County is equal to the total structure value of the county. These hazards are not limited to a particular geographic region. All critical facilities in the county were determined to be vulnerable to Severe Weather and Earthquake Hazards.

McCracken County's vulnerability to flooding was determined by GIS analysis. A GPS derived database on Critical Facilities, and the Kentucky Infrastructure Authority database for Water and Wastewater facilities were brought into GIS. FEMA revised Flood Hazard Areas were added as an overlay and where the data intersected those structures/facilities were deemed vulnerable to a 100-year flood. The vulnerability of critical facilities was determined by a similar method, laying the Flood Hazard Areas over imagery, to identify which structures were in the flood plain.

Impact & Frequency

The impact and frequency of each hazard has been identified in the previous section through maps and frequency tables. Impact is addressed further in the charts and narrative discussions found in the following asset identification and vulnerability sections of this plan.

Identification of Assets

This section of the plan identifies what can be affected in each jurisdiction by the different hazard events that occur in the Purchase Region. The information to complete this section was collected from a variety of sources including local jurisdictions, HAZUS 4.0 Kentucky Data, the NOAA NCEI, the 2020 Census, U.S Census Bureau 2020 American Community Survey 5 Year Estimates and the Kentucky Revenue Cabinet. The information was collected, mapped, and summarized by the PADD staff and reviewed and analyzed by the McCracken County MPT.

This section was prepared using the best available data for identifying the number of buildings, infrastructure and critical facilities and costs associated with them. Point data for flood vulnerability and critical facility locations were developed by the PADD. For this version of the plan, PADD GIS staff analyzed data from flood prone areas of the county and extracted points of critical facilities within the hazard areas. Location data of community structures facilities was collected from the United States Building Blueprint though the structures collected are a combination of commercial and residential properties. Critical Facility data was collected from HAZUS and reviewed by local mitigation planning teams and mapped by PADD GIS staff.

McCracken County MPT members reviewed the information to determine the vulnerability in each community. For the hazards of Tornado, Thunderstorm Wind, Earthquakes, and Winter Storm. MPT members were not able to identify specific hazard areas for such events which were determined to potentially affect anything within McCracken County. These hazards and their occurrence is not limited to any particular area based on past historical events.

Critical Facilities and Infrastructure

For the purpose of this plan, the JPHMC adopted the definitions of the FEMA HAZUS Loss Estimation Model according to FEMA publication 386-1, version 4.0, pages 3-9 that state the following definitions of critical facilities and infrastructure. HAZUS separates critical facilities into five categories based on their loss potential.

All the following elements are considered critical facilities except Hazardous Materials Facilities. It was determined by the regional council that Hazardous Materials Facilities would not be addressed as critical facilities. Rationale: Hazardous Materials facilities are addressed in existing Emergency Operations Plans at the Facility and jurisdictional level, which are deemed by the committee as being both sufficient and beyond the expertise of the committee.

FEMA Critical Facilities Definitions

- Transportation Facilities include airways – airports, heliports; highways – bridges, tunnels, roadbeds, overpasses, transfer centers; railways – track segments, tunnels, bridges, rail yards, depots; waterways – canals, locks, seaports, ferries, harbors, docks, and piers.

- Lifeline Utility Systems such as potable water, wastewater, oil, natural gas, electric power and communication systems.

- Essential Facilities are essential to the health and welfare of the whole population and are especially important following hazard events. Consider not only their structural integrity and content value, but also the effects on the interruption of their functions because the vulnerability is based on the service they provide rather than simply their physical aspects. Essential Facilities include hospitals and other medical facilities, police and fire stations, emergency operations systems, evacuation shelters, schools, and health and human services to the PADD.

- High Potential Loss Facilities are facilities that would have a high loss associated with them, both physical and economical, such as nuclear power plants, dams, and military installations.

- Hazardous Materials Facilities include facilities housing industrial/hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials, and toxins. (Note: Not considered in this Plan)

Critical Facilities Estimated Replacement Value Methodology

Due to a software compatibility problem between FEMA's HAZUS program. Cost replacement values were collected by PADD staff from local mitigation planning teams for each county. County and City facilities KACO and KLC insurance values were collected. While cost replacement values for other critical facilities data was collect by reaching out to different organizations (Schools, Water and Sewer companies, airports, hospital, etc.) head of company or

finance officers to receive values. If values were unable to be determined HAZUS facility values were used.

Addresses for critical facilities were updated by the Mitigation Planning Teams for each corresponding county and cost replacement values were collected from various resources.

PADD staff used a combination of GIS data sources and local GIS data layers to build a map of the critical facilities and infrastructure for each jurisdiction found in the hazard area. Estimates were done on a county basis.

Types and Numbers of Buildings for Severe Weather and Earthquake Hazards

Severe Weather Hazards and Earthquakes have been determined to potentially affect anything within each jurisdiction depending on the path of the hazard event. Severe Weather Events: Winter Storm, Thunderstorm Wind, Tornado, Hail, and the potential of Earthquake Events, are five of the top six priorities identified and ranked by the McCracken County MPT. These hazards and their occurrences are not limited to any particular area based on past historical events and documentation is provided in the hazard profiles.

Table 9.18 identifies the total number of structures vulnerable to Severe Weather Hazards and Earthquakes. This table represents structures only and was derived from the U.S. Building Blueprint shapefile. Due to data limitations, the number of commercial and residential structures could not be individually determined from the data provided. Future updates of the plan should have a separation of commercial and residential properties if data is available.

Table 9.18 McCracken County Severe Weather/Earthquake Hazard Vulnerable Assets

County	Number of Structures		
	Structures in County	Structures in Hazard Area	% In Hazard Area
Ballard	7,041	7,041	100%
Calloway	22,328	22,328	100%
Carlisle	4,476	4,476	100%
Fulton	4,091	4,091	100%
Graves	25,720	25,720	100%
Hickman	3,777	3,777	100%
Marshall	24,216	24,216	100%
McCracken	**36,549**	**36,549**	**100%**
Total	**128,198**	**128,198**	**100%**

Sources: https://github.com/Microsoft/USBuildingFootprints, PADD GIS

Critical Facilities and Infrastructure at Risk to Severe Weather and Earthquake Hazards

Using the HAZUS MH definition for critical facilities and infrastructure, the PADD staff identified types and numbers of critical facilities and infrastructure that are vulnerable to Tornados, Thunderstorm Wind, Winter Storm, and Earthquakes in McCracken County.

Table 9.19 shows the number of critical facilities vulnerable to severe storms and earthquakes in McCracken County. Due to the unpredictability with severe storms and earthquakes all critical facilities are at risk during the hazardous events.

Table 9.19 McCracken County Critical Facilities & Infrastructure Severe Weather and Earthquake

Type of Facility	# Of Existing Buildings	Current Replacement Value	# In Hazard Area
County EOC	1	$5,406,700.00	1
Communication-Radio	7	$686,000.00	7
Fire Stations	17	$42,311,470.00	17
Police Stations	9	$42,990,970.00	9
Railways	2	$5,326,000	2
Government Buildings	9	$53,609,443.30	9
Hospitals	3	$100,532,580.00	3
Electric Power Plants	1	$774,229,170.00	1
Package Treatments Plants	11	$400,000.00	11
Sewage Plants (Lagoons Included)	5	$100,000,000	5
Water Plants	2	$32,787,825.00	2
Pumping Stations	10	$21,998,150.00	10
Lift Stations	87	$28,000,000.00	87
Flood Control Pump Station	15	$74,205,000	15
Wells	4	$6,003,000	4
Storage Tanks	14	$18,009,000	14
Schools	27	$295,021,261.00	27
Airport	1	$162,442,130.00	1
Natural Gas Facilities	1	$774,229,170.00	1
Dams	3		3
Bridges	46	$31,956,136.9	46
TOTAL	**273**	**$2,470,244,005.9**	**273**

Sources: When available local data was used, and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System and the costs were calculated based on standard planning costs.
*** If values were not provided the best estimate was given based on other facilities in McCracken, and the HAZUS Program.*
*** Cost replacement values left blank were hard to determine due to many factors involved*

Critical Facilities and Infrastructure at Risk to Flooding

The PADD GIS staff produced tables which provide an accurate estimate of the number of structures that are vulnerable to flooding. PADD GIS staff collect Purchase Region Structure Blueprints from US Building Blueprints on Microsoft for the state of Kentucky and clipped out the structures for the Purchase Region. GPS structure points, overlain with the Flood Hazard Areas were the primary source of at-risk data, and for all counties the PADD's data and Water Information System data base were used to determine at risk Critical Facilities.

Table 9.20 summarizes the numbers of structures in the Flood Hazard area for each county. The highlighted areas indicate the data for McCracken County. These figures by default are also applicable to the vulnerability of structures to Dam Failure.

Table 9.20 McCracken County Flood Hazard Vulnerable Assets

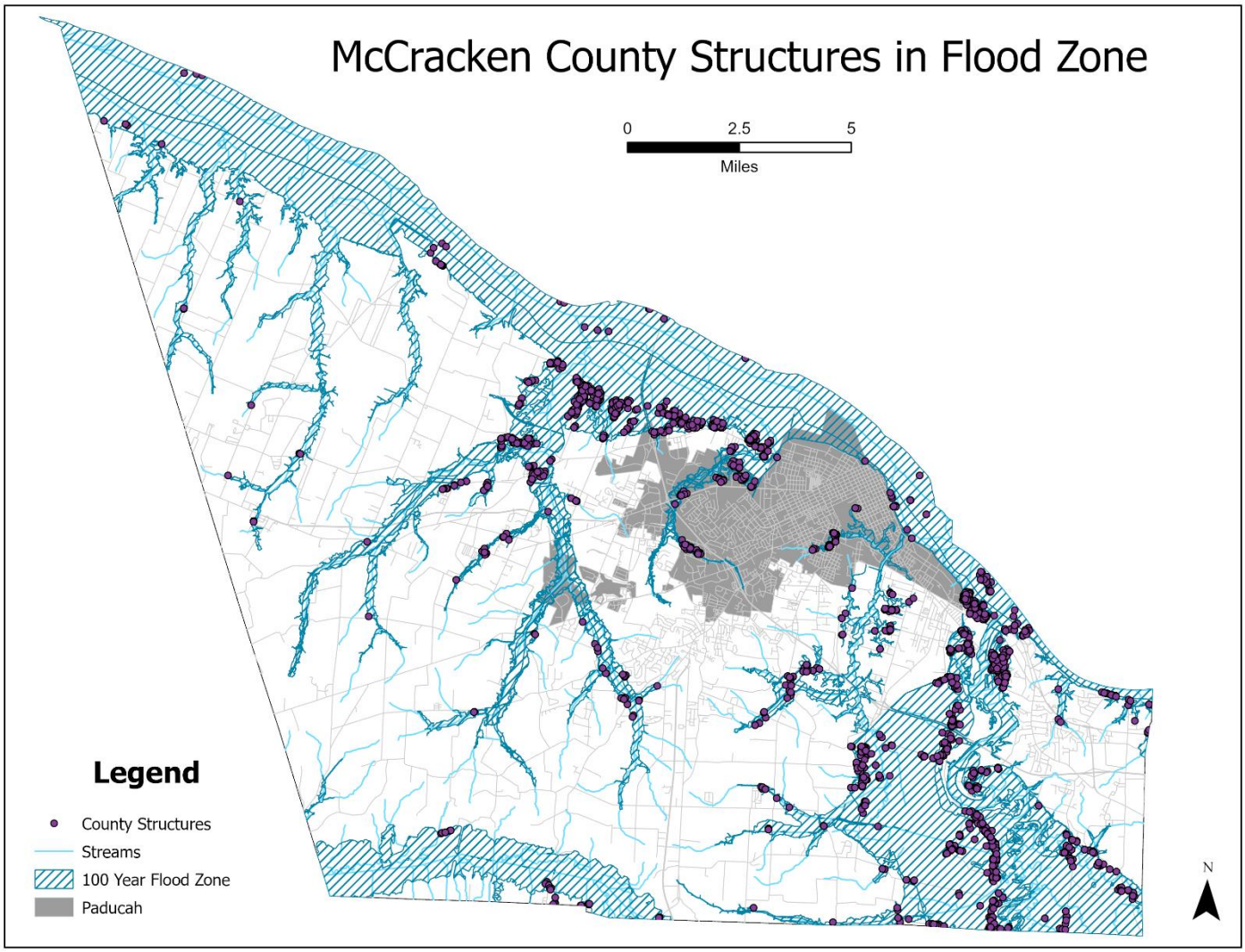
County	Estimated Number of Structures in Flood Hazard Areas		
	Number of Structures in County	Percentage of Structures in Flood	Number of Structures in Flood Hazard Zone
Ballard	7,041	4.6%	327
Calloway	22,328	1.6%	359
Carlisle	4,476	2.4%	108
Fulton	4,091	4.7%	193
Graves	25,720	1.6%	404
Hickman	3,777	2.3%	85
Marshall	24,216	6.7%	1624
McCracken	**36,549**	**4.3%**	**1586**
Total	**128,198**	**3.7%**	**4,686**

Sources: https://github.com/Microsoft/USBuildingFootprints, Purchase Area Development District GIS Database

The PADD GIS staff produced tables which provide an accurate estimate of the number of structures and Critical Facilities that are vulnerable to flooding. At risk structures were then identified by the PADD's GIS personnel.

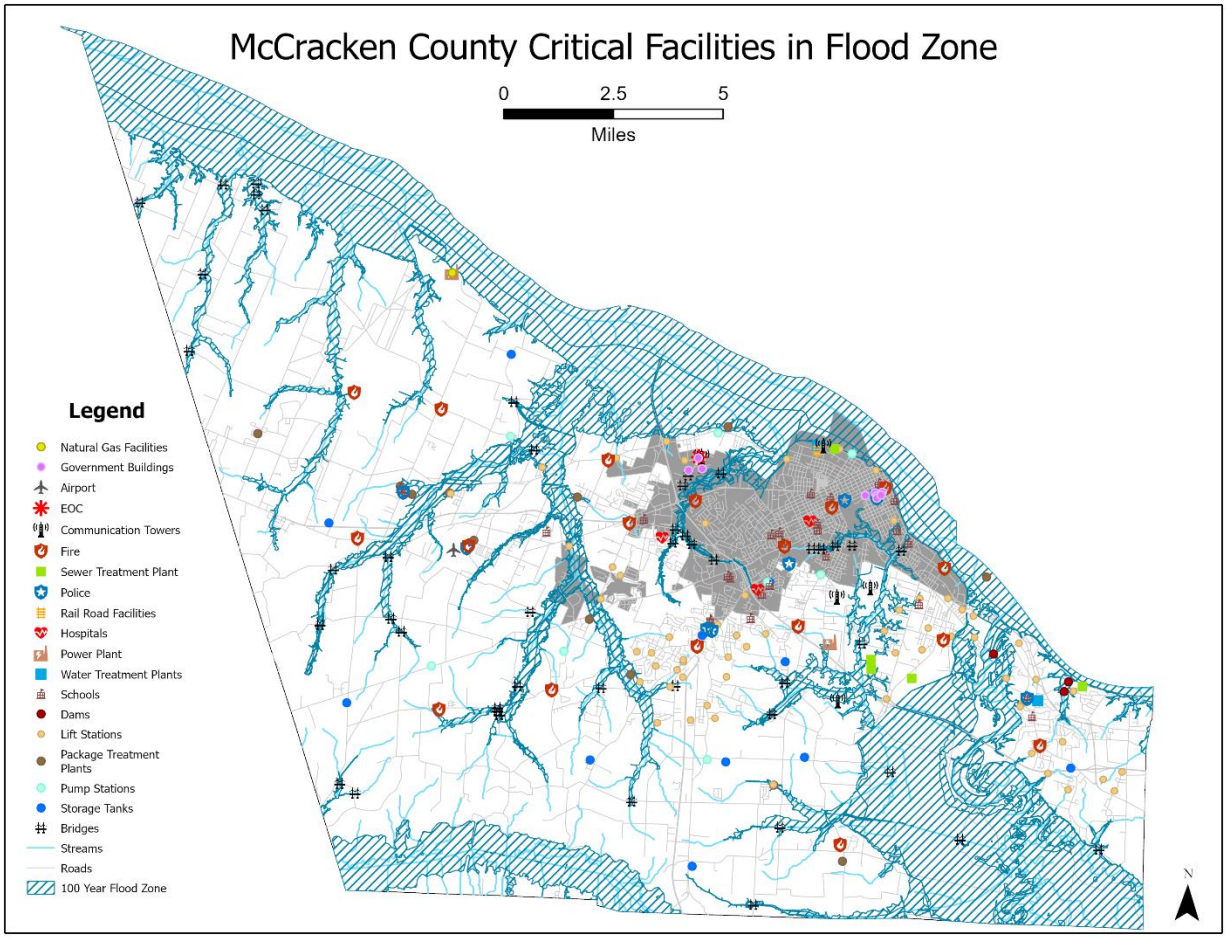
Figures 9.14 and 9.15 identify the location of critical facilities in each jurisdiction relative to the Flood Hazard areas.

Figure 9.13 McCracken County Flood Zones and Structures



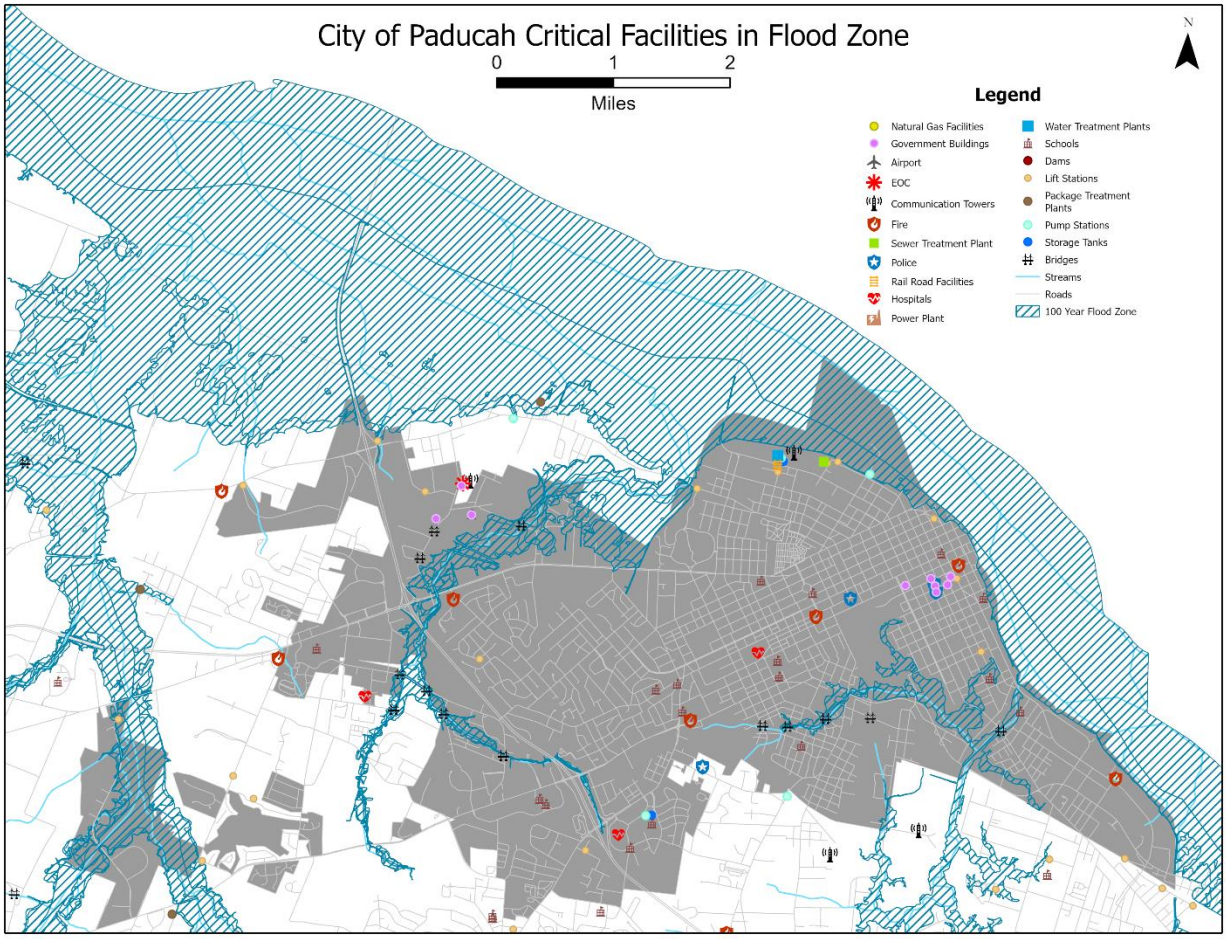
Source: Flood Hazard Layer

Figure 9.14 McCracken County Flood Zone Including Industry and Critical Facilities



Source: Flood Hazard Layer, PADD GIS

Figure 9.15 City of Paducah Flood Hazard Area Including Critical Facilities



Source: Flood Hazard Layer

Table 9.21 summarizes the types and number of critical facilities and infrastructure in the identified Flood Hazard areas. These figures, by default are also applicable to the vulnerability of structures to Dam Failure. These charts were created using the mapped information above. Ownership issues provided some limitation in distinguishing what critical facilities belonged to a particular jurisdiction; therefore, asset vulnerability was determined on a county level.

Table 9.21 McCracken County Flood Vulnerability: Critical Facilities and Infrastructure

Type of Facility	# Of Existing Buildings	Current Replacement Value	# In Hazard Area
County EOC	1	$5,406,700.00	0
Communication-Radio	7	$686,000.00	1
Fire Stations	17	$42,311,470.00	0
Police Stations	9	$42,990,970.00	0
Railways	2	$5,326,000	0
Government Buildings	9	$53,609,443.30	0
Hospitals	3	$100,532,580.00	0
Electric Power Plants	1	$774,229,170.00	0
Package Treatments Plants	11	$400,000.00	4
Sewage Plants (Including Lagoons)	5	$100,000,000	0
Water Plants	2	$32,787,825.00	0
Pumping Stations	10	$21,998,150.00	0
Lift Stations	87	$28,000,000.00	6
Flood Control Pump Station	15	$74,205,000	15
Wells	13	$6,003,000	13
Storage Tanks	14	$18,009,000	0
Schools	27	$295,021,261.00	0
Airport	1	$162,442,130.00	0
Natural Gas Facilities	1	$774,229,170.00	0
Dams	3		3
Bridges	46	$31,956,136.9	36
TOTAL	**273**	**$2,470,244,005.9**	**78**

Sources: When available local data was used, and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System and the costs were calculated based on standard planning costs.
*** If values were not provided the best estimate was given based on other facilities in McCracken, and the HAZUS Program.*
*** Cost replacement values left blank were hard to determine due to many factors involved*

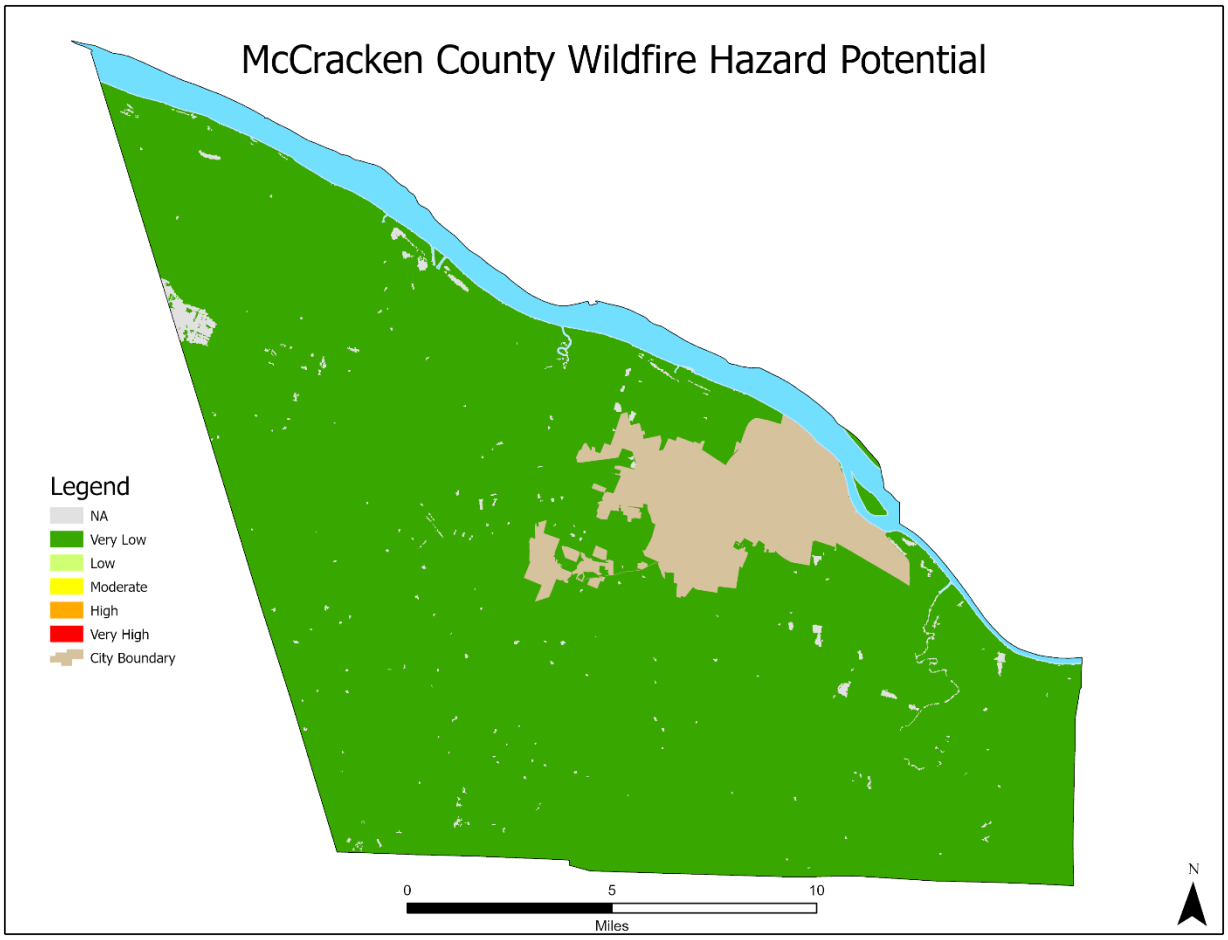
McCracken County is a member of the NFIP. It has a Flood Plain Management Ordinance IAW the appropriate State Revised Statutes. Therefore, development is not likely to occur in flood regions identified on the FIRMS and by the flood data used in this plan.

Some industrial expansion that takes place will be in existing industrial parks. Much of the industry in McCracken County is dependent upon the National Waterway Transportation System. Industrial expansion will occur in the 100-year floodplain, but in accordance with all State and Local ordinances. These facilities are largely engineered out of the flood zones of the Ohio and Tennessee River.

Critical Facilities and Infrastructure at Risk in the Wildland/Urban Interface

Wildfire was rated by the McCracken MPT as a Moderate Risk Hazard. Portions of the county are heavily forested. These areas are being encroached upon by urban growth, creating a danger area known as the Wildland/Urban Interface. In the image below, the critical facilities of the county are mapped against the Wildfire Risk as determined by the State, and the urban boundary.

Figure 9.16 Wildfire Probability and Impacts in McCracken County



Source: United States Department of Agriculture, United States Forestry Service

Table 9.22 identifies the structures only within the wildfire potential areas in Fulton County was derived from U.S. Building Blueprint shapefile. Due to data limitations, the types of building structures were not available at the time of this plan.

Table 9.22 McCracken County Wildland/Urban Interface Wildfire Risk:

County	Estimated Number of Structures in Flood Hazard Areas		
	Number of Structures in County	Percentage of Structures in Flood	Number of Structures in Flood Hazard Zone
Ballard	7,041	4.6%	327
Calloway	22,328	1.6%	359
Carlisle	4,476	2.4%	108
Fulton	4,091	4.7%	193
Graves	25,720	1.6%	404
Hickman	3,777	2.3%	85
Marshall	24,216	6.7%	1624
McCracken	**36,549**	**4.3%**	**1586**
Total	**128,198**	**3.7%**	**4,686**

Sources: https://github.com/Microsoft/USBuildingFootprints, Purchase Area Development District GIS Database

Critical Facilities and Infrastructure at Risk in the Wildland/Urban Interface

Using the HAZUS MH definition for critical facilities and infrastructure, the PADD staff identified types and numbers of critical facilities and infrastructure that are in or adjacent to the Wildland/Urban interface, and consequently at risk to wildfires.

Table 9.23 McCracken County Wildfire Vulnerability

Type of Facility	# Of Existing Buildings	Current Replacement Value	# In None to Very Low Hazard Area	# In Low Hazard Area
County EOC	1	$5,406,700.00	1	
Communication-Radio	7	$686,000.00	7	
Fire Stations	17	$42,311,470.00	17	
Public Safety Buildings	9	$42,990,970.00	9	
Railways	2	$5,326,000	2	
Government Buildings	9	$53,609,443.30	9	
Hospitals	3	$100,532,580.00	3	
Electric Power Plants	1	$774,229,170.00	1	
Package Treatment Plant	11	$400,000.00	11	
Sewage Plants (including lagoons)	5	$100,000,000	5	
Water Plants	2	$32,787,825.00	2	
Pumping Stations	10	$21,998,150.00	10	
Lift Stations	87	$28,000,000.00	87	
Flood Control Pump Station	15	$74,205,000	15	
Wells	13	$6,003,000	13	
Storage Tanks	14	$18,009,000	14	
Schools	27	$295,021,261.00	27	
Airport	1	$162,442,130.00	1	
Natural Gas Facilities	1	$774,229,170.00	1	
Dams	3		3	
Bridges	46	$31,956,136.9	46	
TOTAL	**273**	**$2,470,244,005.9**	**273**	

Sources: When available local data was used, and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System and the costs were calculated based on standard planning costs.
*** If values were not provided the best estimate was given based on other facilities in McCracken, and HAZUS Program.*
*** Cost replacement values left blank were hard to determine due to many factors involved*

Future Development: Types and Numbers of Future Buildings, Critical Facilities, and Infrastructure

McCracken County is expected to grow very slowly or not at all in population over the next ten years. There will likely be little increase in the number of residential structures, or critical facilities and infrastructure. The Flood Plain Management ordnance will restrict building of residential structures in mapped flood prone areas.

Table 9.24 Census Projections for the Purchase Region of Kentucky

County	Census 2000	Census 2010	Census 2020	Census Projections		
				2030	2040	2050
Kentucky	4,041,769	4,339,367	4,505,836	4,461,150	4,721,118	4,785,233
Ballard	8,286	8,249	7,728	7,180	6,558	5,979
Calloway	34,177	37,191	37,103	38,298	38,626	38,424
Carlisle	5,351	4,874	4,826	4,445	4,090	3,765
Fulton	7,752	6,238	6,515	6,132	5,697	5,349
Graves	37,028	37,421	36,649	36,582	36,163	35,758
Hickman	5,262	4,612	4,521	4,094	3,621	3,139
Marshall	30,125	31,101	31,659	31,430	30,794	30,218
McCracken	**65,514**	**65,018**	**67,875**	**69,450**	**70,529**	**71,761**
Purchase	**193,495**	**195,819**	**196,876**	**197,611**		

Source: Kentucky State Data Center Projection Report for 2022 http://ksdc.louisville.edu/

There are no significant changes in land use anticipated for McCracken County. Should land use changes occur, they will be included in future updates of the plan where applicable.

County Structures – Tornado, Earthquake, Severe Thunderstorm, Severe Winter Storm

The PADD staff calculated the estimated future residential structure growth by multiplying the existing number of residential structures by the expected growth rate for each county. Results of these calculations are represented in the following table.

These numbers would represent the approximate number of future residential structures vulnerable to tornadoes, earthquakes, thunderstorm wind, and winter storms. The limitation of this data is that it was only available at the county level.

Table 9.25 Household Projections

County	2010	2020	Projections		
			2030	2040	2050
Ballard	3,397	3,228	3,060	2,772	2,478
Calloway	15,530	15,108	16,126	16,569	16,616
Carlisle	2,116	2,003	1,845	1,681	1,532
Fulton	2,864	2725	2,578	2,368	2,157
Graves	14,978	14,742	14,697	14,396	14,180
Hickman	2,028	1,916	1,725	1,512	1,290
Marshall	13,073	13,359	13,301	13,003	12,693
McCracken	**28,227**	**28,932**	**30,250**	**30,563**	**30,828**
Purchase Region	**82,2213**	**82,013**	**83,582**	**82,864**	**81,774**

Source: Kentucky State Data Center https://louisville.box.com/s/rh39adf5ou0cd0aduxe5dnodanj3ftf0

The PADD staff and McCracken County MPT members discussed the potential increase in numbers of vulnerable critical facilities, industry and infrastructure; however, there was no consensus for making a reliable calculation. In future updates, involvement from the local planning process may assist in estimating the increase of critical facilities and infrastructure based on projected population growth.

9:4.4 Assessing Vulnerability: Estimating Potential Losses

Winter Storm, Thunderstorm Wind, Tornado, Earthquake

The total valuation of adjusted property as provided by the Kentucky Department of Revenue was used to estimate the potential dollar loss for all vulnerable structures for the following hazards: Severe Winter Storm, Severe Thunderstorm, Tornado, and Earthquake.

Table 9.26 summarizes the total value of adjusted property as provided by the Kentucky Department of Revenue, and the population for each county as provided by 2020 American Community Survey 5 Year Estimate. These values were used to determine potential dollar losses and the number of people at risk in a county and all its jurisdictions, for those hazards that have no defined area: Severe Winter Storm, Severe Thunderstorm, Tornado, and Earthquake. The figures for McCracken County are highlighted.

Table 9.26 Total Value of Adjusted Property for the Purchase Region

County	County Square Miles	Population 2020 Census	Total Property Value 2021($)
Ballard	246.7	7,728	$562,799,918
Calloway	385.0	37,103	$2,670,699,673
Carlisle	189.4	4,826	$268,513,078
Fulton	205.9	6,515	$285,685,821
Graves	551.8	36,649	$2,221,703,207
Hickman	242.3	4,521	$295,853,256
Marshall	301.3	31,659	$2,801,935,108
McCracken	**248.7**	**67,875**	**$5,629,613,526**
Purchase Region	**2,371.1**	**196,876**	**$14,736,803,587**

Source: United States Census Bureau County Summary, 2020 Census Data, Kentucky Revenue Cabinet, Year Estimate, Kentucky Revenue Cabinet, https://revenue.ky.gov/Property/Pages/default.aspx , Statewide Certified Property Values 2021

During the estimation of potential dollar losses, MPT members reviewed the HAZUS data as used in this plan in addition to the values. Council members completed dollar estimates where no data was available. Future updates of this plan may include new GIS information for loss estimation where available.

Table 9.27 Severe Weather/Earthquake Hazard Vulnerable Asset

County	Structures in County	Structures in Hazard Area	% In Hazard Area
Ballard	7,041	7,041	100%
Calloway	22,328	22,328	100%
Carlisle	4,476	4,476	100%
Fulton	4,091	4,091	100%
Graves	25,720	25,720	100%
Hickman	3,777	3,777	100%
Marshall	24,216	24,216	100%
McCracken	**36,549**	**36,549**	**100%**
Purchase Region	**128,198**	**128,198**	**100%**

Source: Microsoft U.S Building Blueprint

PADD staff and the McCracken County MPT determined that all 36,549 structures in the county are vulnerable to the "area" threats of weather and earthquake. According to the 2020 American Community Survey 5-Year Estimates, the median household income for McCracken County is $64,082.

Critical Facilities and Infrastructure for Severe Weather and Earthquakes

Table 9.28 summarizes vulnerable critical facilities and infrastructure to the non-geo specific hazards of Severe Weather and Earthquakes, as well as the potential dollar losses associated with structures in the high priority hazard areas. It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with critical facilities and infrastructure was to use insurance replacement values when available for those structures provided by the jurisdictions, or default to values from the HAZUS tables.

Table 9.28 McCracken County Critical Facilities & Infrastructure Severe Weather and Earthquake

Type of Facility	# Of Existing Buildings	Current Replacement Value	# In Hazard Area
County EOC	1	$5,406,700.00	1
Communication-Radio	7	$686,000.00	7
Fire Stations	17	$42,311,470.00	17
Police Stations	9	$42,990,970.00	9
Railways	2	$5,326,000	2
Government Buildings	9	$53,609,443.30	9
Hospitals	3	$100,532,580.00	3
Electric Power Plants	1	$774,229,170.00	1
Package Treatments Plants	11	$400,000.00	11
Sewage Plants (Lagoons Included)	5	$100,000,000	5
Water Plants	2	$32,787,825.00	2
Pumping Stations	10	$21,998,150.00	10
Lift Stations	87	$28,000,000.00	87
Flood Control Pump Station	15	$74,205,000	15
Wells	4	$6,003,000	4
Storage Tanks	14	$18,009,000	14
Schools	27	$295,021,261.00	27
Airport	1	$162,442,130.00	1
Natural Gas Facilities	1	$774,229,170.00	1
Dams	3		3
Bridges	46	$31,956,136.9	46
TOTAL	**273**	**$2,470,244,005.9**	**273**

Sources: When available local data was used, and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System and the costs were calculated based on standard planning costs.

*** If values were not provided the best estimate was given based on other facilities in McCracken, and HAZUS Program.*

*** Cost replacement values left blank were hard to determine due to many factors involved*

Flood

County Structures: After the vulnerability maps were created for the flood hazard areas, the cost associated with replacing those structures was evaluated. It was the determination of the PADD staff that the best way to estimate the potential dollar loss associated with the flood hazard areas was to use Total Property value in the county and the 4.3% of structures within the Hazard Area

Table 9.29 Summarizes The total number of structures in the county were determine by the Microsoft U.S. Building Blueprint. This value allowed us to determine 1,586 structures in the county were within the flooding hazard area. Table 9.29 shows the total property value for the Purchase Region counties from the Kentucky Revenue Cabinet and the property value within the flood Hazard Areas. McCracken County is highlighted.

Table 9.29 Flood Hazard Vulnerable Structures by County

County	Number of Structures			Total Property Value	
	Structures in County	Structures in Hazard Area	% In Hazard Area	Total Value in County	Value in Hazard Area
Ballard	7,041	327	4.6%	$562,799,918	$25,888,796
Calloway	22,328	359	1.6%	$2,670,699,673	$42,731,194
Carlisle	4,476	108	2.4%	$268,513,078	$6,444,313
Fulton	4,091	193	4.7%	$285,685,821	$13,427,233
Graves	25,720	404	1.6%	$2,221,703,207	$35,547,251
Hickman	3,777	85	2.3%	$295,853,256	$6,804,624
Marshall	24,216	1624	6.7%	$2,801,935,108	$187,729,652
McCracken	**36,549**	**1586**	**4.3%**	**$5,629,613,526**	**$242,073,381**
Total	**128,198**	**4686**	**3.7%**	**$14,736,803,587**	**$545,261,843**

Sources: Kentucky Revenue Cabinet, https://revenue.ky.gov/Property/Pages/default.aspx , Statewide Certified Property Values 2021 and Microsoft U.S. Building Blueprint

Table 9.30 2020 ACS Selected Housing Characteristics

Subject	Ballard	Calloway	Carlisle	Fulton	Graves	Hickman	Marshall	McCracken	Purchase Region
Total Housing Units	3,915	18,924	2,471	3,336	16,862	2,367	16,229	**32,237**	96,341
Occupied Housing Units	3,052	15,942	1,925	2,550	14,402	1,724	13,119	**27,787**	80,501
Vacant Housing Units	863	3,432	546	786	2,460	643	3,110	**4,450**	16,290
Mobile Homes	676	2,555	512	164	2,508	307	2,370	**3,005**	12,097
Owner- occupied	2,403	9,730	1,573	1,680	10,690	1,383	10,926	**17,930**	56,315
Renter- occupied	649	5,762	352	870	3,712	341	2,193	**9,857**	23,736
Household Size – Owner	2.60	2.44	2.45	2.19	2.56	2.34	2.39	**2.46**	2.43
Household Size– Renter	2.39	1.99	2.34	2.24	2.47	3.21	2.04	**2.03**	2.34
Median House Value -	$103,800	$141,200	$83,200	$63,800	$109,000	$85,000	$138,000	**$145,200**	$106,638

Source: U.S. Census Bureau 2020 ACS 5-Year Estimates Data Profile Table DP04

Table 9.31 McCracken County Critical Facilities & Infrastructure Flood Vulnerability

Type of Facility	# Of Existing Buildings	Current Replacement Value	# In Hazard Area
County EOC	1	$5,406,700.00	0
Communication-Radio	7	$686,000.00	1
Fire Stations	17	$42,311,470.00	0
Police Stations	9	$42,990,970.00	0
Railways	2	$5,326,000	0
Government Buildings	9	$53,609,443.30	0
Hospitals	3	$100,532,580.00	0
Electric Power Plants	1	$774,229,170.00	0
Package Treatments Plants	11	$400,000.00	4
Sewage Plants (Including Lagoons)	5	$100,000,000	0
Water Plants	2	$32,787,825.00	0
Pumping Stations	10	$21,998,150.00	0
Lift Stations	87	$28,000,000.00	6
Flood Control Pump Station	15	$74,205,000	15
Wells	13	$6,003,000	13
Storage Tanks	14	$18,009,000	0
Schools	27	$295,021,261.00	0
Airport	1	$162,442,130.00	0
Natural Gas Facilities	1	$774,229,170.00	0
Dams	3		3
Bridges	46	$31,956,136.9	36
TOTAL	**273**	**$2,470,244,005.9**	**78**

Sources: When available local data was used, and all other values were determined using HAZUS MH. The numbers of water treatment facilities are derived from Kentucky Infrastructure Authority, Water Resource Information System and the costs were calculated based on standard planning costs.

*** If values were not provided the best estimate was given based on other facilities in McCracken, and HAZUS Program.*

*** Cost replacement values left blank were hard to determine due to many factors involved*

Wildfire

After determining the vulnerability of critical facilities to the wildfire hazard the wildfire relative risk and exposure risk in McCracken County were collected from the USDA and US Forestry Service. Table 9.32 represents the wildfire risk McCracken County faces compared to the United States. Table 9.33 represent homes exposure percentage to wildfires in McCracken County compared to the United States.

Table 9.32 McCracken County Wildfire Risk

Relative Wildfire Risk	
Statewide Percentile Rank	
Risk to Homes	**31**
Wildfire Likely Hood	**32**
Nationwide Percentile Rank	
Risk to Homes	**17**
Wildfire Likely Hood	**18**

Source : *https://wildfirerisk.org/explore/overview/21/21145/*

Table 9.33 McCracken County Wildfire Exposure

Wildfire Exposure		
	McCracken County	**United State**
Percent Total		
Homes Directly Exposed	**57.0%**	**33.0%**
Homes Indirectly Exposed	**43.0%**	**30.0%**
Homes not Exposed	**0.0%**	**37.0%**

Source : https://wildfirerisk.org/explore/overview/21/21145/

Figure 9.17 Represents the Vulnerable Populations in McCracken County at risk if a wildfire hazard was to occur. Collected from the USDA and US Forestry Service wildfire risk to community's database.

Figure 9.17 Wildfire Hazard: McCracken County Vulnerable Population

Potentially Vulnerable Populations

Populations, 2021*	McCracken County, KY	United States
Families in poverty	1,854	7,181,779
Households with no car	1,906	10,349,174
Mobile Homes	1,807	6,509,758
People under 5	4,089	19,423,121
People over 65	13,364	52,888,621
People with disabilities	9,942	41,055,492
People with language barriers	~135	12,736,062
Percent of Total**		
Families in poverty	10.9%	8.9%
Households with no car	7.0%	8.3%
Mobile Homes	6.7%	5.2%
People under 5	6.1%	5.9%
People over 65	19.8%	16.0%
People with disabilities	15.0%	12.6%
People with language barriers	0.2%	4.1%

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

** Each measure on this page comes from a different subset of the overall population. For example, "poverty status" is not determined for all families. "Households with no car" is determined only for occupied households. "People with disabilities" includes only those people in civilian, noninstitutionalized settings. "Language barriers" is determined only for people five years or older.

9:4.5 Assessing Vulnerability: Analyzing Development Trends

The Purchase Region grew 0.54 % in population between 2010 and 2020 compared to a growth of 3.8 % for the state of Kentucky. McCracken County is projected to exhibit low (2.3%) growth between 2020 and 2030.

McCracken County is the most urban county in the region. Most residential construction occurs in developments. The county can expect an increase in residential development over the next ten years to replace existing housing stock. Essential facilities and services may increase due to demand rather than population pressure.

Table 9.34 outlines growth trends in the PADD as reported by the Kentucky State Data Center using Census information.

Table 9.34 Population Projections for the Purchase Region

County	Census 2000	Census 2010	Census 2020	Census Projections		
				2030	2040	2050
Kentucky	4,041,769	4,339,367	4,505,836	4,641,150	4,721,118	4,785,233
Ballard	8,286	8,249	7,728	7,180	6,558	5,979
Calloway	34,177	37,191	37,103	38,298	38,626	38,424
Carlisle	5,351	4,874	4,826	4,445	4,090	3,765
Fulton	7,752	6,238	6,515	6,132	5,697	5,349
Graves	37,028	37,421	36,649	36,582	36,163	35,758
Hickman	5,262	4,612	4,521	4,094	3,621	3,139
Marshall	30,125	31,101	31,659	31,430	30,794	30,218
McCracken	**65,514**	**65,018**	**67,875**	**69,450**	**70,529**	**71,761**
Purchase	**193,495**	**195,819**	**196,876**	**197,611**	**196,078**	**194,393**

Source: Kentucky State Data Center Projection Report for 2022 http://ksdc.louisville.edu/

Land Use

Farmland is the principal land use in McCracken County. Land use for commercial purposes is primarily concentrated in the downtown areas of incorporated cities. Industrial development takes place primarily in industrial parks and along the river fronts. McCracken County also makes use of land for recreation and greenspace. McCracken County has both city and county parks for recreational purposes.

Economic and Social Growth Trends

The economy in the Purchase Region is experiencing trends like those of the state averages, both in growth and decline. There have been new businesses and industries to open in the region, but in turn there have been layoffs and closures within the market. Especially during the COVID-19 pandemic which is addressed in the 2022 – 2027 Comprehensive Economic Development Strategy (CEDS) where it was listed as a threat to the region, and the Disaster Resiliency Plan is supplement to that update. The CEDS update mentioned some of the impacts of COVID-19 on the Purchase Region communities while the Disaster Resiliency Plan goes into greater depth and addresses short-term and long-term approaches to rebuild resilient and sustainable communities throughout the Purchase Region. Data for this portion of plan was collected from the US Census and Purchase Region Community Economic Development Strategy.

McCracken County and the City of Paducah promotes diversity, equity and inclusion and works diligently to highlight its historical past and rich culture. McCracken County and the City of Paducah work diligently to discover and create innovative solutions to complex challenges. The City of Paducah is working to identify new infill development opportunities. While also looking for new urban territories to expand development and services to. McCracken County and the City of Paducah has a diversified economic base and workforce.

Table 9.35 represents the 2010 and 2020 Employment Rate for the Purchase Region with McCracken County being highlighted.

Table 9.35 Employment Rate for 2010 and 2020 for the Purchase Region

Employment Rate	2010	2020
Kentucky	55.3 %	55.90 %
Ballard	52.10 %	49.50 %
Calloway	57.30 %	55.10 %
Carlisle	47.30 %	46.50 %
Fulton	47.30 %	46.50 %
Graves	52.00 %	53.30 %
Hickman	45.9 %	44.50 %
Marshall	54.9 %	51.30 %
McCracken	**53.8 %**	**55.90 %**

Source: U.S. Census 2010 and 2020 Table DP03

Table 9.36 McCracken County Labor Force

MCCRACKEN COUNTY LABOR FORCE	
Labor Force	Unemployment Rate
29,655	5.3%

Source: Purchase Area CEDS 2022-2027

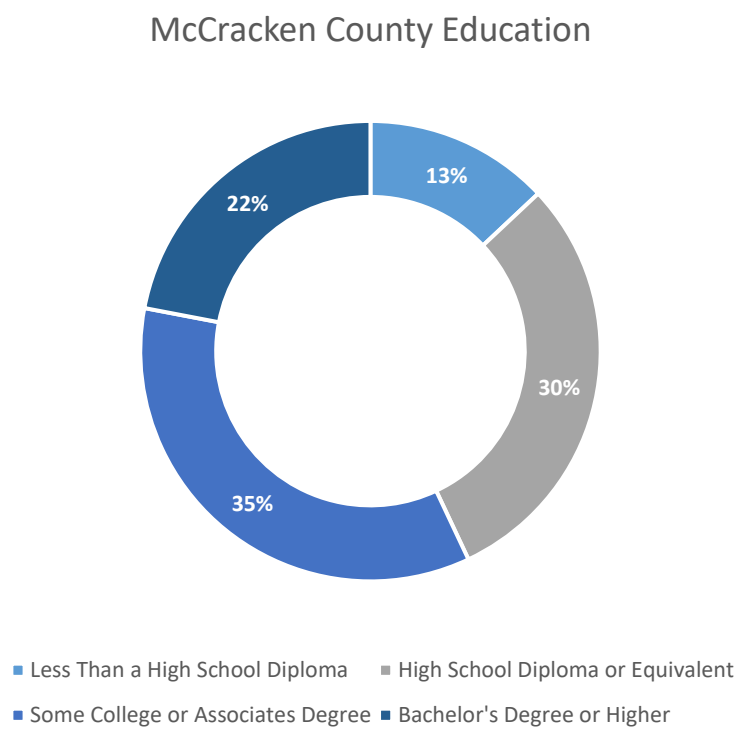
Table 9.37 McCracken County Income Data

INCOME	
Per Capita Income	$30,044
Median Household	$47,011
Poverty Rate	15.50%

Source: Purchase Area CEDS 2022-2027

Figure 9.18 Represents the level of education within McCracken County based on the Purchase Region 2020-2027 CEDS Plan.

Figure 9.18 McCracken County Education



Source: Purchase Area CEDS 2022-2027

Table 9.38 Top 5 Industries in McCracken County

Top 5 Industries	
Industries	**Percentage of Total Employment by Industry**
Healthcare and Social Assistance	27.0 %
Retail Trade	21.0%
Accommodation and Food Service	17.0%
All Government (Including Education)	14.0%
Construction	7.0%

While manufacturing and service sectors are important to the region's economy, agriculture proves to be a vital part of the economy as a whole. The changes, both hazard related and non-hazard related, that affect farming greatly impact the Purchase Region. Hazards such as hail, flooding, tornadoes, and high wind damage crops and thus have an effect on the economy of the region.

Farming is the most prevalent land use, by area in McCracken County. Table 9.37 is a summary of the farmland located in the Purchase Region and the land use for those acres. This data was retrieved from the United States Department of Agriculture.

Table 9.39 Total Farmland Located in Purchase Region

County	Number of Farms	Land in Farms(acres)	Avg. Farm Size(acres)
Ballard	295	94,340	320
Calloway	710	135,521	191
Carlisle	273	88,015	322
Fulton	146	97,615	669
Graves	1,104	251,192	228
Hickman	246	118,474	482
Marshall	699	84,676	121
McCracken	**318**	**62,082**	**195**
Total	**3,791**	**931,915**	**2,528**

Source: U.S. Department of Agriculture, National Agricultural Statistics Service
2017 Census of Agriculture
https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Kentucky/

Social growth trends also play an important role in the economy of the Purchase Region. Median income and housing characteristics of the region are valuable tools in analyzing these growth trends. Tables 9.38 and 9.39 describe the median income and housing characteristics retrieved from the Kentucky State Data Center Census 2020 information.

Development is not likely to occur in flood regions identified in each jurisdiction, because the threat of flooding is known and occurs on an annual basis. McCracken County is an exception because much of its current industrial capacity, recent expansion, and likely future growth takes place at or near Riverports. McCracken County is a Member of the NFIP and has implemented a Flood Plain Ordinance in accordance with the applicable paragraphs of the Kentucky Revised Statues.

Table 9.40 2010 Census and ACS 2020 Median Household Income

	Median Household Income		
Area	**2010 ACS**	**ACS 2020**	**Percent Change**
Kentucky	$41,476	$52,238	25.64
Ballard	$41,228	$45,517	10.40
Calloway	$39,194	$41,841	6.75
Carlisle	$33,909	$41,222	21.57
Fulton	$31,965	$31,587	-1.18
Graves	$35,277	$45,614	29.30
Hickman	$31,836	$44,063	38.41
Marshall	$43,326	$57,348	32.36
McCracken	**$41,630**	**$47,011**	**12.93**

*Source: Kentucky State Data Center; **U.S. Census Bureau, 2020 American Community Survey 5 Year Estimate and 2020 ACS 5-year estimates*

Table 9.41 2020 ACS Census: Selected Housing Characteristics for the Purchase Region

Subject	Ballard	Calloway	Carlisle	Fulton	Graves	Hickman	Marshall	McCracken
Total Housing Units*	3,915	18,924	2,471	3,336	16,862	2,367	16,229	**32,237**
Occupied Housing Units*	3,052	15,942	2,550	2,550	14,402	1,724	13,119	**27,787**
Vacant Housing Units*	863	3,432	546	786	2,460	643	3,110	**4,450**
Mobile Homes*	676	2,555	512	164	2,508	307	2,370	**3,005**
Owner- occupied*	2,403	9,730	1,573	1,680	10,690	1,383	10,926	**17,930**
Renter- occupied*	649	5,762	352	870	3,712	341	2,193	**9,857**
Household Size – Owner*	2.60	2.44	2.45	2.19	2.56	2.34	2.39	**2.46**
Household Size – Renter*	2.39	1.99	2.34	2.24	2.47	3.21	2.04	**2.03**
Median House Value – Owner Occupied*	$103,800	$141,200	$83,200	$63,800	$109,000	$85,000	$138,000	**$145,200**

*Source: Source * U.S. Census Bureau, 2020 5-Year Estimates table DP04*

Non-Ambulatory / Communal Living Facilities

During the update process PADD staff met with the JPMC and agreed upon recognizing Non-Ambulatory / Communal Living Facilities as vulnerable populations. The facilities under this category are important to communities during a disaster but do not fall under FEMA's definition of a critical facility.
While critical facilities keep the government functioning and benefit the community, Non-Ambulatory / Communal Living Facilities protect a percentage of the population that relies on assistance.
The facilities listed below are funded locally or by the state, no private entities were included. The list below includes nursing homes, non-urgent care medical facilities, senior centers, etc.

Table 9.42 Non-Ambulatory / Communal Living Facilities in McCracken County

Name of Facility	Type of Facility
McCracken County Senior Center	**Senior Center**
Gaither Suites at West Park	**Personal Home Care**
Parkview Nursing and Rehabilitation	**Nursing Facilities**
Providence Pointe Health Care	**Nursing Facility**
River Haven Nursing and Rehabilitation Center	**Nursing Facility**
Stone creek Health and Rehabilitation	**Nursing Facility**

Climate Change and Kentucky

Kentucky's climate is changing. Although the average temperature did not change much during the 20th century, most of the commonwealth has warmed in the last 20 years. Average annual rainfall is increasing, and a rising percentage of that rain is falling on the four wettest days of the year. In the coming decades, the changing climate is likely to reduce crop yields and threaten some aquatic ecosystems. Floods may be more frequent, and droughts may be longer, which would increase the difficulty of meeting the competing demands for water in the Ohio, Tennessee, and Cumberland rivers. Our climate is changing because the earth is warming. People have increased the amount of carbon dioxide in the air by 40 percent since the late 1700s. Other heat trapping greenhouse gases are also increasing. These gases have warmed the surface and lower atmosphere of our planet by about one degree (F) during the last 50 years. Evaporation increases as the atmosphere warms, which increases humidity, average rainfall, and the frequency of heavy rainstorms in many places—but contributes to drought in others. Natural cycles and sulfates in the air prevented much of Kentucky from warming during the last century. Sulfates are air pollutants that reflect sunlight back into space. Now sulfate emissions are declining, and the factors that once prevented Kentucky from warming are unlikely to persist.

Kentucky Issues due to Climate Change

- Precipitation and Water Resources
    - Annual precipitation in Kentucky has increased approximately 5 percent since the first half of the 20th century. But rising temperatures increase evaporation, which dries the soil and decreases the amount of rain that runs off into rivers. Although rainfall during spring is likely to increase during the next 40 to 50 years, the total amount of water running off into rivers or recharging ground water each year is likely to decline 2.5 to 5 percent, as increased evaporation offsets the greater rainfall. Droughts are likely to be more severe because periods without rain will be longer and very hot days will be more frequent.

- Flooding
    - Flooding is becoming more severe in the Southeast. Since 1958, the amount of precipitation during heavy rainstorms has increased by 27 percent in the Southeast, and the trend toward increasingly heavy rainstorms is likely to continue. The Tennessee Valley Authority (TVA) and the U.S. Army Corps of Engineers operate Kentucky Dam, Wolf Creek Dam, and other dams to prevent serious floods on the Ohio, Tennessee, and Cumberland rivers. The agencies release water from the reservoirs behind these dams before the winter flood season. By lowering water levels, these releases provide greater capacity for the reservoirs behind those dams to prevent flooding. Nevertheless, dams and other flood control structures cannot prevent all floods. The Ohio River has flooded Louisville several times, for example, and flash floods have caused property destruction and deaths throughout Kentucky.

- Agriculture
    - Longer frost-free growing seasons and increased concentrations of atmospheric carbon dioxide tend to increase yields for many crops during an average year. But more severe droughts and more hot days are likely to reduce yields, especially in the western half of Kentucky, which in seventy years is likely to have 15 to 30 more days with temperatures above 95°F than it has today. Even on irrigated fields, higher temperatures are likely to reduce yields of corn, and possibly soybeans. Higher temperatures are also likely to reduce livestock productivity: hot weather causes cows to eat less, grow more slowly, and produce less milk, and it can threaten their health.

- Human Health
    - Hot days can be unhealthy—even dangerous. High air temperatures can cause heat stroke and dehydration, and affect people's cardiovascular and nervous

systems. Certain people are especially vulnerable, including children, the elderly, the sick, and the poor. Higher temperatures can also increase the formation of ground-level ozone, a key component of smog. Ozone has a variety of health effects, aggravates lung diseases such as asthma, and increases the risk of premature death from heart or lung disease. EPA and the Kentucky Department for Environmental Protection have been working to reduce ozone concentrations. As the climate changes, continued progress toward clean air will require even more reductions in the air pollutants that contribute to ozone.

-

Actionable Climate Change responses, in the Purchase Region, for reducing the impacts of climate change.

- Restoration of natural systems, increases in the use of green infrastructure, and targeted conservation efforts, especially of groundwater aquifers, can help protect people and nature from climate change impacts.
- Improving urban storm water infrastructure to deal with the increase of flooding, as well as limiting nonporous surfaces. Using Green infrastructure is reducing some of the negative impacts by using plants and open space to absorb storm water.
- Improved basic health services and increased public health measures—including surveillance and monitoring of local trends—can prevent or reduce the impacts of the anticipated increased frequency and intensity of poor air quality days. Establishing cooling and heating stations through the year at a local level for extreme high temperature events.
- Integrating climate adaptation into planning Local processes offers an opportunity to better manage climate risks now. Developing knowledge for decision-making in cooperation with vulnerable communities will help to build adaptive capacity and increase resilience. Scaling unban development and Industrial farming that's sustainable for local aquifers

9:5 McCracken County Mitigation Strategy

9:5.1 Capability Assessment

Mitigation strategies were developed in response to the hazard profiles and vulnerability of the assets in each jurisdiction. These strategies provide each jurisdiction with a blueprint for reducing potential losses identified in the risk assessment. These strategies are based on existing authorities, policies, programs, resources, and the ability to expand on and improve the existing tools.

The capability assessment has been divided into three sections:

(A) Existing Authorities, Policies, Programs, and Resources
(B) Existing Governmental Structure
(C) Existing Professional Staff Departments

The purpose of the capability assessment is to identify potential hazard mitigation opportunities available to each jurisdiction through daily operations as a local unit of government. This assessment will highlight the positive measures already in place in the jurisdiction as well as identify weaknesses that could increase vulnerability in a jurisdiction. The capability assessment serves as the foundation for an effective hazard mitigation strategy by establishing goals and objectives for jurisdictions.

(A) Existing Authorities, Policies, Programs, and Resources

The PADD, along with MPT members, evaluated existing authorities, policies, programs, and resources in each jurisdiction. Table 9.40 is a summary of each jurisdiction and the status of these authorities. Local committee members evaluated this information to determine what goals, objectives, and actions would be necessary to effectively mitigate the vulnerability of a jurisdiction and what resources they currently have that can be used to implement the mitigation strategies identified in this plan.

Table 9.43 Existing Authorities, Policies, Programs, and Resources in the Purchase Region

Jurisdiction	Floodplain Management Ordinance	CRS & FMA Plans	Zoning Regulations	Subdivision Regulations	Land Development Plans	Fire Prevention Code	Comprehensive Plan	Capital Improvement Plan	Stormwater Management Plan	CERT Team	NWS Storm Ready Program	Local Economic Development	Regional Economic Development	City Class
Ballard County	X							X		X		X	X	
City of Barlow								X				X	X	6
City of Kevil								X				X	X	6
City of La Center					X		X	X				X	X	5
City of Wickliffe	X							X				X	X	5
Calloway County	X		X	X						X	X	X	X	
City of Murray	X		X	X	X		X		X			X	X	3
City of Hazel												X	X	6
Carlisle County	X									X	X	X	X	
City of Bardwell	X											X	X	5
City of Arlington	X											X	X	6
Fulton County	X									X	X	X	X	
City of Fulton	X		X	X	X		X	X				X	X	4
City of Hickman	X		X		X		X					X	X	4
Graves County	X									X		X	X	
City of Mayfield	X		X	X	X		X		X			X	X	3
City Wingo												X	X	6
Hickman County										X	X	X	X	
City of Clinton	X											X	X	5
City of Columbus												X	X	5
Marshall County	X					X				X	X	X	X	
City of Benton	X		X	X	X	X	X		X			X	X	4
City of Calvert City	X		X	X	X		X	X	X			X	X	4
City of Hardin	X											X	X	5
McCracken County	**X**		**X**	**X**	**X**	**X**	**X**			**X**	**X**	**X**	**X**	
City of Paducah	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**			**X**	**X**	**2**

All jurisdictions are members of the PADD. Services are provided by the district in GIS/GPS, Economic Development, Community Development, Aging Services, Workforce Development, and Fiscal Management. McCracken County is exceptional in that it has its own GIS Consortium which provides GIS and GPS Professional Service to the county and member jurisdictions.

The existing authorities, policies, and programs are further explained in relation to the existing governmental structure and powers of the local jurisdiction. It is the responsibility of each local jurisdiction to develop, enact, and enforce the above referenced authorities and programs.

(B) Existing Governmental Structure

Tables 9.44 (county government) and 9.45 (city government) summarize the governmental structure for each jurisdiction in the PADD. Each jurisdiction is responsible for the implementation of mitigation strategies in their community. These governmental structures were reviewed by the JPHMC to determine the capability of implementing and enforcing existing and future authorities, policies, programs, and resources.

Table 9.44 County Government Structure in the Purchase Region

County	Type of Government
Ballard County	Judge/Executive and 5 magistrates
Calloway County	Judge/Executive and 4 magistrates
Carlisle County	Judge/Executive and 3 magistrates
Fulton County	Judge/Executive and 4 magistrates
Graves County	Judge/Executive and 3 commissioners
Hickman County	Judge/Executive and 3 magistrates
Marshall County	Judge/Executive and 3 commissioners
McCracken County	**Judge/Executive and 3 commissioners**

Table 9.45 Governmental Structure and Class of Incorporated Cities

City	Class	County	Type of Government
City of Barlow	6	Ballard	Mayor and 4 commissioners
City of Kevil	6	Ballard	Mayor and 6 council members
City of La Center	5	Ballard	Mayor and 4 commissioners
City of Wickliffe	5	Ballard	Mayor and 6 council members
City of Murray	3	Calloway	Mayor and 12 council members
City Hazel	6	Calloway	Mayor and 6 council members
City of Bardwell	5	Carlisle	Mayor and 6 council members
City of Arlington	6	Carlisle	Mayor and 4 commissioners
City of Hickman	4	Fulton	Mayor and 4 commissioners
City of Fulton	4	Fulton	Mayor and 4 commissioners
City of Mayfield	3	Graves	Mayor and 10 council members
City of Wingo	6	Graves	Mayor and 4 commissioners
City of Clinton	5	Hickman	Mayor and 6 council members
City of Columbus	5	Hickman	Mayor and 6 council members
City of Benton	4	Marshall	Mayor and 6 council members
City of Calvert City	4	Marshall	Mayor and 6 council members
City of Hardin	5	Marshall	Mayor and 6 council members
City of Paducah	**2**	**McCracken**	**Mayor and 4 commissioners**

Legal Authority of Local Jurisdictions

There are many tools available to local governments in Kentucky that may help them implement mitigation programs, policies and actions. Any hazard mitigation program can utilize any or all of the five types of government powers granted by the State of Kentucky: Regulation; Acquisition; Taxation; Spending, and Education.

Regulation

- Police Power: Local governments have been granted broad regulatory powers in their jurisdictions. Kentucky Revised Statutes grant the general police power to local governments, allowing them to enact and enforce ordinances and laws that define, prohibit, regulate or abate acts, omissions, or conditions detrimental to the health, safety and welfare of the citizens of their jurisdiction. The general police power also has the ability to define and abate nuisance ordinances, including those related to public health.

- Jurisdictions can include hazard mitigation requirements in their ordinances as protection of public health, safety and welfare. They may also use this power to enforce nuisance ordinances identifying nuisances that threaten the general health and safety of the public.

- Building Codes and Inspection: The construction and rehabilitation of homes, business and other structures according to standards that will make the structures more resistant to the impact of natural hazards is a big part of mitigation activity in a jurisdiction. These standards

can be enforced in a jurisdiction through building codes. Through the adoption and enforcement of building codes in each jurisdiction, it can be assured that mitigation strategies are in place for the planning area.

- Land Use: Local governments can control the use of land in the jurisdiction through regulatory powers granted to them by the State of Kentucky. Jurisdictions can control certain aspects of development under these powers. The amount and type of growth in a jurisdiction can greatly affect the vulnerability of the community in the event of a natural hazard. Land use powers include the power to enact and enforce zoning ordinances, floodplain ordinances, and subdivision controls, as well as the power to engage in planning.

  - Acquisition**:** The State of Kentucky Revised Statutes allows for jurisdictions to acquire property for public purpose. Acquisition can be a useful tool for mitigation goals in that property in hazard prone areas may be acquired so that future development is prohibited in a hazardous area.

  - Taxation**:** Local governments have been given the power to levy taxes and special assignments by the State of Kentucky. Taxation extends beyond the collection of revenue and can provide the means by which the community develops in the future.

  - Spending**:** Local governments have also been given the power to make expenditures on behalf of the public in their interest. Hazard mitigation principles should be incorporated in the spending decisions made by the local government in a jurisdiction.

- Education**:** Although most residents in a jurisdiction have some knowledge of the natural hazards that potentially threaten their community, most of them have had little formal education about what they as individuals can do to reduce their vulnerability to a natural hazard event. Education involving mitigation strategies and potential vulnerability will be essential for all jurisdictions in the planning area.

(C) Existing Professional Staff Departments

Members of McCracken County MPT reviewed their existing capabilities based on their current professional staff departments. During the public input meetings, participants determined that the implementation of Mitigation Strategies and Projects would depend on the capability of that department in each jurisdiction.

Table 9.46 Capabilities Assessment: Existing Professional Staff Departments

Jurisdiction	Board of Education	Building Inspectors	Court Clerk	Emergency Management	County/City Treasurer	Mayor /County Judge/Executive	Health Department	Road Department	Sheriff Department	City Police Department	PVA (Tax Assessment)	Social Services	Utilities Department	Churches	Fire Departments	Kentucky State Police
Ballard County	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Wickliffe				X	X	X							X	X	X	X
Barlow				X	X	X							X	X	X	X
Kevil				X	X	X							X	X	X	X
LaCenter				X	X	X							X	X	X	X
Calloway County	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Murray	X	X		X	X	X		X		X			X	X	X	X
Hazel				X	X	X			X				X	X	X	X
Carlisle County	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**
Bardwell		X		X	X	X		X		X			X	X	X	X
Arlington		X		X	X	X		X					X	X	X	X
Fulton County	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Hickman				X	X	X		X		X			X	X	X	X
Fulton	X			X	X	X		X		X			X	X	X	X
Graves County	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Mayfield	X	X		X	X	X		X		X			X	X	X	X
Wingo				X	X	X							X	X	X	X
Hickman County	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Clinton				X	X	X				X			X	X	X	X
Columbus				X	X	X							X	X	X	X
Marshall County	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Benton		X		X	X	X		X		X			X	X	X	X
Calvert City		X		X	X	X		X		X			X	X	X	X
Hardin				X	X	X							X	X	X	X
McCracken County	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**
Paducah	**X**	**X**		**X**	**X**	**X**		**X**		**X**			**X**	**X**	**X**	**X**

The following definitions summarize the duties and responsibilities of the professional staff departments listed in Table 9.46.

The **Board of Education** maintains the operations of the county school system. This board is elected at large by the people of the community. County funds usually maintain the buildings and provide for other capital projects. State funds usually pay for salaries and the purchase of textbooks and supplies.

The **Building Inspectors** are responsible for enforcing the State Building Code, the National Flood Insurance Program, the Community Rating System, and other applicable local codes. These items are enforced through an inspection and permitting program.

The **PVA, Court Clerk,** and **Sheriff** are elected every four years by the citizens in the county. The PVA is responsible for the valuation of property for tax purposes. The Court Clerk is the custodian of the court system in each county. This office is financed through the State of Kentucky. The Sheriff operates on a budget approved annually by the magistrates (fiscal court) of each county and is responsible for the enforcement of state and local laws.

The **City Police Departments** are responsible for enforcing local and state laws in their designated jurisdiction.

The **Kentucky State Police** are responsible for enforcing local and state law in the entire state of Kentucky.

The **Fire Departments** are responsible for responding to emergencies / medical emergencies, helping with search and rescue after and extinguishing fires in areas where fires have occurred.

The **Road Departments** are responsible for the care and maintenance of the public roadways in their designated jurisdiction.

The **Utility Departments** are responsible for providing water, gas, electric and sewer services to the public.

The **Emergency Management Service** is responsible for the mitigation, preparedness, response and recovery operations for both natural and man-made disasters. The formation of an emergency management office in each county is mandated under the Kentucky Revised Statutes.

The **County/City Treasurers** are responsible for the management of the budget and fiscal programs for their jurisdiction. This also includes the administration of state and federal grants.

The **Mayor or County Judge/Executive** is responsible for overseeing the daily operations of county or city government in their respective jurisdictions. They are also responsible for the enforcement of county/city policies and regulations.

The **Health Departments** and **Social Services** have separate boards appointed by commissioners. Employment in these departments is approved by the commissioners with state personnel policies applying. These agencies protect and promote public health and provide social services for medical care and governmental social programs for displaced families.

The **Churches** provide shelters, food and water to community members. Provide locations for emeregcny response teams to set up, help with search and rescue, help with clean up, etc. They are a fundamental part of the communities in the Purchase Region.

The **Emergency Management, Road Department, Building Inspectors, and Utilities Department** have been identified as the specific departments that will be responsible for carrying out mitigation activities. Each of these departments has been involved in the hazard mitigation planning process by participating in the JPHMC meetings.

It has been determined by the committee that each of these departments has limited available staff that are responsible for multiple duties within their departments. All jurisdictions have limited funding resources available to hire additional staff. Each staff member is adequately trained to cover their current workload. Increase in work activities, including hazard mitigation activities, will increase the need for additional staff to effectively perform tasks.

The PADD, as a regional planning agency, has become a primary resource for technical assistance for all jurisdictions in the region. The PADD staff are trained in planning, GIS/GPS, financial management and project development.

SUMMARY: Capability Assessment

The available staff and financial resources of the departments in each jurisdiction determine the ability for expansion and improvement of existing authorities, policies, programs, and resources to reduce potential losses. Each county in the PADD has equal ability to enforce and implement mitigation strategies.

The capability of cities in the Purchase Region varies so communities often work cooperatively with county government to perform projects that improve the quality of life for residents, including mitigation projects and activities. Because counties have more resources available to implement mitigation activities, it has been suggested that the goals and objectives be prioritized at a county level. City jurisdictions will have the opportunity at any given time to implement mitigation activities if their capabilities expand and the opportunity exists.

The jurisdictions that have participated in the mitigation planning process are identified in this plan. In addition to local participation, the PADD staff has provided professional assistance in GIS and plan development to help enhance the ability of the local jurisdictions to implement mitigation activities. Based on the above information, the Local Hazard Mitigation Goals, Objectives and Actions were compiled at a county level, taking city jurisdiction public input into consideration.

9:5.2 Hazard Mitigation Goals

The McCracken County MPT along with PADD staff, analyzed the loss estimates in the risk assessment to establish goals and objectives for loss reduction. The goals were established with input from local city participants. The goals and objectives will serve as a guide to develop specific actions to reduce potential losses caused by hazard events. These goals and objectives concur with existing community goals and the goals set forth by the Kentucky State Hazard Mitigation Plan.

Mitigation Goals – The mitigation goals were set to be general, long-term guidelines for hazard mitigation in jurisdictions.

Mitigation Objectives – The mitigation objectives define the strategies and process of implementation to achieve the identified goals. The objectives are specific, measurable, and have a defined completion.

The following goals and objectives were determined to have the greatest influence on hazard loss reduction in McCracken County.

Goal 1: Improve the survivability of critical facilities and infrastructure in order to preserve their capabilities to provide essential services during a hazard event, by reducing the vulnerability of these facilities.

Purpose of Goal in Relation to the Risk Analysis: Events such as the 2015 and 2016 flooding underscored the vulnerability of critical facilities and infrastructure during natural hazards. Loss of these capabilities directly affect public health and public safety in part or all of McCracken County. During a natural hazard event, roadways can be damaged, and utility services knocked out. These types of damages hinder emergency first responders from being able to effectively get help to those in need.

The following objectives have been developed as a result of this goal:
1.1: Enhance the rapid restoration of transportation systems.
1.2: Enhance the rapid restoration of utility systems.
1.3: Where possible, move the critical facilities out of flood prone areas.
1.4: Enhance the resistance of/harden critical facility structures to the effects of natural hazards.
1.5: Enhance the capability to maintain essential public health and public safety services by providing back-up sources of power and redundant communications to critical facilities.

Goal 2: Reduce the potential damaging effects of natural hazards through development policies without limiting the goals for growth of the community.

Purpose of Goal in Relation to the Risk Analysis: It has been determined that potential losses associated with development in the McCracken County may be greatly reduced by enforcing or developing county and city policies that regulate development in hazard prone areas. Policies that regulate and guide the development of future infrastructure, residential, and industrial projects will reduce the vulnerability of these facilities.

The following objectives have been developed as a result of this goal:

2.1 Enforce existing policies and authorities.
2.2 Develop new policies such as ordinances and building codes that require new structures to meet standards that will resist natural hazards.
2.3 Develop land use planning policies that restrict development in hazard prone areas such as flood zones.
2.4 Develop subdivision requirements to protect utilities, such as buried power and phone lines.

Goal 3: Protect public health and safety by increasing public awareness of natural hazards that affect McCracken County and by fostering a sense of responsibility within the public for mitigating risks associated with those natural hazards.

Purpose of Goal in Relation to the Risk Analysis: It has been determined that the general public in McCracken County needs to be aware of the high-risk areas, and potential harm associated with the natural hazards that affect their area. While policies can be developed to reduce the development in hazard prone areas, public education will ensure that those policies are utilized to their fullest to reduce the number of existing and future structures in those areas. Through public education, individuals may realize the seriousness of potential hazards and act upon this realization by taking steps to secure their property and protect their families against the risks of natural hazards.

The following objectives have been developed as a result of this goal:

3.1 Educate the public on potential natural hazards that affect their McCracken County.
3.2 Increase public understanding and support of the hazard mitigation process.
3.3 Educate the public on how they can take personal responsibility for their own health, safety and property protection.
3.4 Develop and maintain emergency evacuation routes. Educate the public to the location and use of evacuation routes.
3.5 M a i n t a i n McCracken County's status as a Storm Ready Community.
3.6 Pursue Firewise Community status for McCracken County and the City of Paducah.

Goal 4: Efficiently make use of public and private funds to increase the capabilities of local jurisdictions to reduce potential losses associated with flood hazard events.

Purpose of Goal in Relation to the Risk Area: It has been determined that potential losses can be reduced in McCracken County by their ability to effectively communicate, plan, and implement mitigation projects. Efficiently using public or private money to improve communication, planning, and implementation capabilities for the general public as well as key critical facilities can reduce the impact a hazard has on McCracken County.

The following objectives have been developed as a result of this goal:

4.1 Promote inter-agency and inter-local cooperation for the use of mitigation funds and activities.
4.2 Take advantage of State Hazard Mitigation grants associated with Disaster Declarations, Pre-Hazard Mitigation Grant announcements, and other grants to fund Mitigation Projects.
4.3 Leverage State and local funding, local match sources and in-kind match resources to get the maximum utility from available Mitigation Funds.

Goal 5: Protect McCracken County's most vulnerable populations, buildings and critical facilities and infrastructure through the implementation of cost-effective and technically feasible mitigation projects.

Purpose of Goal in Relation to the Risk Area: During the review of the risk analysis, council members determined several structures and critical facilities and infrastructure that will need to have specific mitigation actions taken in order to be effective in reducing the vulnerability. Some identified structures and critical facilities and infrastructure need to be removed from the flood hazard area completely or built to appropriate standards to reduce the potential losses.

The following objectives have been developed as a result of this goal:

5.1 Increase the availability of adequate shelters and community shelters for protection from the direct and indirect effects of severe weather events.
5.2 Continue to improve early warning of impending severe weather events.
5.3 Reduce the number critical facilities and infrastructure in identified flood hazard areas.
5.4 Utilize available mitigation measures to reduce the number of vulnerable structures in the flood hazard areas.
5.5 Utilize available mitigation measures such as structure elevation to reduce the vulnerability of structures in the flood hazard areas.
5.6 Identify and remove stream blockages of tree limbs and trunks, form effective check dams and barrages, and result in the pooling of water during flood events.

Goal 9: Protect dwellings, structures and their occupants along the Wildland/Urban interface from the potential of Wildfire.

While there is not historic data to support damaging wildfires in McCracken County, small field fires and brush fires do occur, especially during periods of drought. These events, historically, have been very small threats and generally not considered a risk. Although considered a low risk, it should be continually planned for and perhaps, anticipated.

The following objectives have been developed as a result of this goal:

6.1 Ensure the protection of first responders.
6.2 Enhance the response capability to brush fires to mitigate their growth into wildfires.
6.3 Facilitate communities/neighborhoods participation in the State's "Firewise" program.
6.4 Reduce the quantity of available wildfire fuels in proximity to critical facilities and to any/all structures in McCracken County
6.5 Incorporate fire buffer planning into the design considerations for any new critical facility.

Goal 7: Support and participate in regional Hazard Mitigation Planning.

Purpose of the Goal in Relation to the Risk Area: McCracken County, the City of Paducah, and representatives of various groups and organizations represented the county and participated in the JPHMC and the development of the regional portion of the plan. Because a regional authority does not exist, the realization of the goals and objectives of the JPHMC Multi-Jurisdictional Plan depends on the support and cooperation of McCracken County and the City of Paducah. This is especially true in that; the regional goals and objectives affect all jurisdictions in the Purchase Region, damage to or destruction of the regional critical facilities identified in the plan affect all jurisdictions in the region, the strategies and mitigation projects that will evolve from these goals require the participation of all the jurisdictions in the region and the results will benefit all the participants. In the same vein, McCracken County, and the City of Paducah will require the cooperation and assistance of other jurisdictions, both neighboring and region wide, and the assistance of regional organizations such as the PADD, the Kentucky State Police, KYTC District One, Purchase District Health Department to help plan, fund and implement Hazard Mitigation projects.

The following objectives have been developed as a result of this goal:
7.1 Request Kentucky Geological Survey and the University of Kentucky to conduct/expand further studies into seismicity, soils and ground shaking potential within the region.
7.2 Develop a regional high resolution, spatially accurate imagery database to extract precise point locations and structure footprints for buildings and other critical facilities.
7.3 Adopt an All-Hazard Week public awareness campaign to include earthquake, flood, tornados and severe storms.

Goal 8: Obtain the best data and analysis available to assess the downstream hazard posed by Kentucky and Barkley Dams in the event of the failure of one, or the other, or both.

Purpose of Goal in Relation to the Risk Area**:** Potential losses can be reduced in a jurisdiction by their ability to effectively plan and implement mitigation projects. In order to do so, an accurate assessment of the threat posed by Dam Failure must be made to determine the geographic extent of the hazard and the potential impact of the Hazard in terms of threat to the populace and property.

The following objectives have been developed as a result of this goal.
8.1 Acquire inundation maps for both Kentucky and Barkley Dams.
8.2 Identify and map vulnerable structures, critical facilities, and risk prone areas.
8.3 Update County EOP as required
8.4 Support and participate in simulations and preparedness exercises relating to dam failure.

8.5 Monitor other existing dams in cooperation with the State Department of Water.

9:5.3 Identification and Analysis of Mitigation Measures

The intention of this section is to identify, evaluate, and analyze a range of mitigation actions that will help reduce the potential effects of hazard events identified in the risk assessment section of the plan. These actions were derived based on the analysis of the risk assessment and support the goals and objectives identified in the plan.

The following list of general actions describes potential loss reduction mitigation actions and techniques identified for mitigation of hazard events. These actions and objectives were determined to have the greatest influence on hazard loss reduction in McCracken County. Hazard specific mitigation actions are listed in order of priority in accordance with the High Risk Hazards for the county as identified and prioritized by the McCracken County MPT.

- Prevention activities are designed to keep current problems from getting worse and to eliminate the possibility of future problems. Prevention activities reduce a jurisdiction's vulnerability to hazard events. This type of activity is especially effective in hazard prone areas where development has not occurred. Prevention activities include the following:
  - Planning and Zoning
  - Floodplain regulations
  - Stormwater management
  - Building codes
  - Capital improvement programs
  - Open space preservation
  - Dam inspection and monitoring

- Property protection activities are designed to adapt existing structures to withstand natural hazards or to remove structures away from hazard prone areas. Property protection activities include the following:
  - Acquisition
  - Relocation
  - Foundation elevation
  - Insurance – flood and homeowner's
  - Retrofitting (includes activities such as wind-proofing, flood-proofing, and seismic design standards)

- Structural projects lessen the impact of a natural hazard by changing the natural progression of the hazard. These types of projects are usually designed by engineers. Structural projects include the following:
  - Storm sewers
  - Floodwalls
  - Highway Projects
  - Retention Basins
  - Reservoirs
  - Dams
  - Levees
  - Dredging
  - Minor flood control projects
  - Culvert resizing
  - Retaining walls
  - Safe rooms
- Emergency services minimize the impact that a natural hazard has on the residents of a jurisdiction. Usually, actions are taken by emergency response services immediately before, during, or in response to a hazard event. Emergency service activities include the following:
  - Warning systems: sirens / automated calling system
  - Evacuation planning and management
  - Sandbagging for flood protection

- Emergency response services
- Protection of critical facilities
- Emergency generators
- Specifically replace aged generator at County EOC.

- Public information and awareness activities are used to educate the residents of a jurisdiction about the potential hazards that affect their area, hazard prone areas, and mitigation strategies they can take part in to protect themselves and their property. Public information and awareness activities include the following:
  - Public speaking events
  - Outreach projects
  - Availability of hazard maps
  - School programs
  - Library materials
  - Hazard Awareness Weeks
  - Real estate disclosure
  - Storm Ready Community Program
  - Firewise Community Program
  - CERT Teams and CERT Training
  - Citizens Corps Organizations

- Natural resource protection activities include those that minimize hazard losses and preserve or restore the functions of natural systems. Natural resource protection actions include the following:
  - Sediment and erosion control
  - Stream corridor restoration
  - Watershed management
  - Forest and vegetation management
  - Wetlands preservation and management

Hazard specific mitigation activities defined for each goal and objective are listed by priority of risk, and partly based on the capability of the county to acquire funding for such activities. Specific projects included in this plan are either under consideration; Paducah City Floodwall Renovation, Property Acquisition, evolving during this planning process; enhanced early warning throughout the county, or completed; Paducah to become "Storm Ready Community".

Table 9.47 McCracken County Hazard Summary Table

HIGH RISK HAZARDS	TORNADO FLOOD FLASH FLOOD THUNDERSTORM WIND WINTER STORM/ICE STORM EARTHQUAKE
MODERATE RISK HAZARDS	HAIL EXCESSIVE HEAT DROUGHT WILDFIRE
LOW RISK HAZARDS	DAM FAILURE

SOURCE: McCracken County MPT 2022

Tornado Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Develop a plan of action for a tornado event – include home, work, school, and outdoor situations.
- Have tornado drills on a regular basis
- Encourage all households to maintain a disaster supply kit:
  - A 3-day supply of water (1 gallon per person per day)
  - Non-perishable food items
  - One change of clothing and shoes per person
  - One blanket or sleeping bag per person
  - A first-aid kit, including all prescription medicines
  - A battery-powered NOAA weather radio with warning alarm and extra batteries
  - A flashlight and extra batteries
  - Special items for infants, elderly or disabled individuals
- Listen to the latest forecasts, especially when planning outdoor activities.
- Publicize multi-media access to tornado watches and warnings.
- Inspect designated tornado shelters for compliance with building codes to ensure their ability to withstand high winds.

- Install warning systems that are not completely dependent upon electricity.
- Pursue programs to provide or subsidize the provision of weather radios to low income populations.
- Evaluate the need for tornado safe rooms, particularly for mobile home parks.
- Analyze the shelter requirements for temporary residents/visitors to the elder care facilities.
- Evaluate the need for tornado safe rooms, particularly for mobile home parks.
- Initiate mobile home anchoring program
- Build tornado safe room where deemed necessary.
- Ensure all critical facilities have a backup source of power – generators
- Train, equip and maintain Storm Spotter cadre
- Build community shelters in critical locations specifically in close proximity to the County EOC.

Flood Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Enforce City and County Floodplain Ordnances
- Participation in the NFIP
- Promote the purchase flood insurance.
- Construct a levee or flood wall
- Elevate the lowest floor level of existing structures above the floodplain
- Elevate flood prone roads
- When feasible, relocate structures out of the floodplain
- Acquire and demolish structures in the floodplain
- Provide openings in foundation walls to allow water to flow in and out
- Install backflow valves to drains, toilets, and other sewer connections
- Maintain ditches and storm water drainage systems
- Ensure all critical facilities have a backup source of power – generators
- Sedimentation control (dredging)
- Wetland restoration
- Stream re-alignment
- Increase culvert cross section
- Dredge existing channels to maintain current depths and flows
- Identification and removal of stream blockages of tree limbs and trunks forming effective check dams and barrages, and resulting in the pooling of water during flood events
- Continue to monitor and evaluate the vulnerability of repetitive loss properties to determine if Mitigation action is warranted. Take mitigation action elevation, acquisition or other as required.
- Continue the program/work to plan, engineer, design and execute restoration of the Paducah Floodwall.

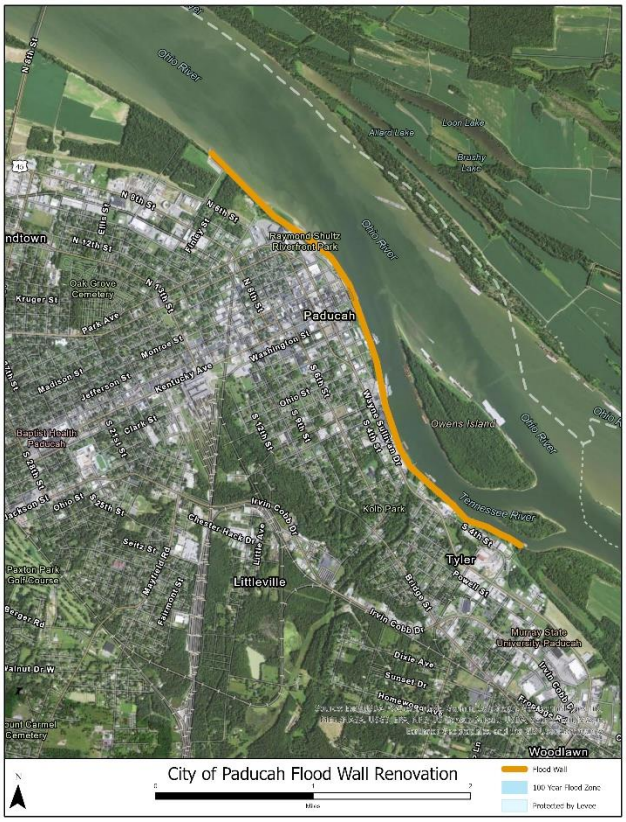


Figure 9.19 City of Paducah Floodwall Renovation Project:
Continue the protection from inundation of the City of Paducah from the Ohio River. The City of Paducah is responsible for three miles of concrete floodwall, 6.22 miles of earthen floodwall, the pipes, pumps and gates that are part of the flood protection system. The system was built in 1939 by the U.S. Army Corps of engineers and turned over to the "Local Authority" (City of Paducah) in 1949. A 1997 shoreline study by the U.S. Army Corps of Engineers, titled **Ohio River Paducah, Kentucky Analysis** "Flood Damage Reduction, Section 905(b) (WRDA-1996 Analysis)", identified 5 million dollars in repairs to the system, mainly to underground drainage pipes, varying in size from 18 to 72 inches in diameter with the longest being 158 feet.

Thunderstorm Wind /Hail Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Listen to the latest forecasts, especially when planning outdoor activities.
- Keep a NOAA weather radio with extra batteries nearby to listen for weather updates.
- Listen especially for severe thunderstorm watches and warnings.
- Practice lightning safety.
  - Outdoor activities should not take place when lightning is present.
  - Fully enclosed vehicles and large permanent buildings provide safe havens from lightning.
- Pursue programs to provide or subsidize the provision of weather radios to low-income populations.
- Promote trimming of tree limbs and debris, particularly in areas close to critical facilities and infrastructure such as power lines.
- Ensure all critical facilities have a backup source of power - generators.

Winter Storm Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Make sure critical facilities have a backup source of heat.
- Provide public education as to the safe use of back up heat sources.
- Promote trimming of tree limbs and debris, particularly in areas close to critical facilities and infrastructure such as power lines.
- Evaluate subdivision regulations for inclusion of underground utilities for new development.
- Promote public education to individuals and families, business, and schools for winter Storm Events and include the following:
  - Insulate the walls and attic of structures.
  - Caulk and weather-strip doors and windows.
  - Allow water to slowly drip from faucets to prevent pipes from freezing.
  - Check the antifreeze and battery in vehicles.
  - Stay off snow- or ice-covered roads if possible
  - Keep a supply of non-perishable food and water.
- Ensure all critical facilities have a backup source of power - generators.

Earthquake Mitigation Activities: Promote public education to individuals, businesses, and schools for hazard events that may include the following.

- Support, encourage, and lobby for the continuing study of the threat of ground shaking from the Wabash and New Madrid Seismic Zones.
- Evaluate public critical facilities and infrastructure to determine their resistance to ground movement.
- Replacement of brittle water and waste water infrastructure specifically cast iron pipe, asbestos cement pipe, and vitreous clay pipe.
- Ensure that all homes and other structures are secured to their foundations.
- Enforce existing seismic building standards (current building code)
- Promote public education to individuals and families, business, and schools for hazard events that may include the following:
- Identify “safe places” in structures that are vulnerable during an earthquake. A safe place might include space under a sturdy table or desk against an interior wall. Stay away from windows.
- Practice the “drop and cover” technique in each identified safe place. Drop, duck your head between your knees, and cover the back of your neck with your hands. Practice makes this process an automatic response in the event of an earthquake.
- Develop an action plan for an earthquake event – include home, work, school, and outdoor situations.
  - Secure heavy furniture to walls. Brace or anchor high or top-heavy objects.
  - Purchase earthquake insurance if available.
  - Install strong latches on all cabinet doors. This will prevent them from spilling their contents in the event of an earthquake.
  - Secure items on shelves or bookcases that might fall and cause injury during an earthquake. Move large or heavy items to lower or bottom shelves.
  - Store breakable or glass items in cabinets with latches.
  - Brace overhead light fixtures.

  - Secure water heater to wall studs.
  - Install flexible pipe fittings. These fittings are less likely to break.
- Participate in any/all earthquake planning and exercises at the State and National level.

Excessive Heat and Drought Mitigation Activities: Promote public education to individuals and families, business, and schools for hazard events that may include the following.

- Programs focused on at risk populations, Senior Citizens, very young children
- Air conditioner/fan loan or subsidized purchase program
- Identification of cooling shelters.
- Replacement of brittle water and waste water infrastructure specifically cast iron pipe

Wildfire Mitigation Activities: Promote public education to individuals and families, business, and schools for hazard events that may include the following.

- Each community to strive to be a "Firewise" Community.
- Promote public education to individuals and families, business, and schools for Wildfire Threat include the following:
  - Proper storage of flammables or Class Shingles or tin on roofs or Masonry construction
  - Remove plants with resins, waxes, or oils from landscaping.
  - Remove dead branches.
  - Reduce the amount of fuel around homes.
- Aggressively reduce available fuels in the vicinity of critical facilities
- Amnesty programs for hazardous materials/storage vessels
- Tire amnesty programs
- Removal of potential fuels from the vicinity of Critical Facilities.
- Pursue the acquisition of equipment and training to rapidly respond to brush fires to mitigate their becoming wildfires.

Dam Failure Mitigation Activities: Promote public education to individuals and families, business, and schools for hazard events that may include the following.

- Access and analyze USACE and TVA inundation maps or models for the projected downstream impact of the catastrophic failure of the Kentucky Dam and Barkley Dam.
- Assess the structures at risk to inundation.
- Continue to participate in the State Department of Water monitoring Program for the 3 DOW identified dams in McCracken County.

9:5.4 Implementation of Mitigation Measures

The purpose of this section is to provide a road map on how the mitigation actions identified in section 9:5.3 will be prioritized, implemented and administered in McCracken County.

All jurisdictions will adopt the JPHM Plan upon approval in 2023. Each county in the PADD has equal ability to enforce and implement mitigation strategies. The smaller cities in the Purchase Region, depend greatly upon the county government, and the PADD for support and combine resources to perform projects that improve the quality of life for residents, including mitigation projects and activities.

Given the size of most of the Purchase region's cities, the planning process from which the following mitigation actions derived and were prioritized occurred at the county level. However, the City of Paducah was an active participant in this planning process. Further, within each county-level planning meeting, individual city mitigation actions were discussed and prioritized. In practice, a city would derive one or two structural or property protection projects that it intended to pursue during the next five years and, first, discussed these projects' feasibility to implement in terms of local financing. Predictably, local financing was a significant constraint for both the county and its cities.

Preventative, natural resource protection, emergency service measures, and public information mitigation actions certainly were discussed at each planning meeting. However, the actions are not highly specific actions, by nature. Building code enforcement and enhancement, floodplain mapping and data, floodplain regulation, storm-water management, and planning activities, as examples, do not typically appear distinctive amidst a county and its cities. It is generally universally important, uncontroversial, and prescient to enforce codes, map and regulate floodplains, manage storm-water activity, and plan and zone. Similar that emergency service activities and public information activities are uncontroversial and generally sought (and not mutually exclusively) by both counties and its cities. So while such activities were discussed individually for counties and for cities, their inclusion within the following mitigation action list will appear similar within each jurisdiction's list. In other words: McCracken County and its single incorporated city, Paducah agreed that preventative activities, emergency service measures, and public information activities primarily should be implemented using local and federal-cum-state financing (e.g., EMPG) and are a high priority for pursuance during the next five years.

The jurisdictions that have participated in the mitigation planning process are listed in this plan. In addition to local participation, the PADD staff has provided professional assistance in GIS and plan development to help enhance the ability of the local jurisdictions to implement mitigation activities.

Funding: Outside of local financing and state financing options, the jurisdictions of the PADD will attempt to utilize the following funding sources in implementing goals, objectives and actions when possible: the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), the Pre-Disaster Mitigation Program (PDM), Hazard Mitigation Technical Assistance Programs (HMTAP), the National Earthquake Technical Assistance Program, the Wind

and Water Technical Assistance Program, and federal-state matching programs. It should be noted that the above list represents known funding sources at the time of this writing. It is not exhaustive.

Project Prioritization: McCracken County will maintain the list of set goals, objectives, and actions that have been identified in this plan. These items were prioritized based on a set of criteria located in the FEMA Multi-Hazard Mitigation Planning Guidance that includes social, technical, administrative, political, legal, economic, and environmental factors (STAPLE+E) within the county jurisdictions.

As mentioned above, this mitigation strategy will divide mitigation actions into Community-Rating System (CRS) categories *preventative activities*, *property protection activities*, *natural resource protection activities*, *emergency services measures*, *structural projects*, and *public information activities*.

Mitigation actions falling under *preventative activities*, *emergency services measures*, and *public information activities* generally (i.e., unless otherwise specified) are process-driven by nature and driven by uncontroversial and laudable goals. It is thus muddying and complicated to subject such measures to a formal, qualitative, and subjective prioritization mechanism like STAPLE+E. How does a community distinguish "technical assistance" or "hazard response operations" or "enforcement of building codes" as of equally or of higher priority than the construction of a community safe room? Consequently, such process-oriented actions are treated as default "High" in priority and are considered pursued by McCracken County and its only incorporated City, Paducah. McCracken County will "enforce building codes" within its jurisdiction while Paducah will undertake enforcement within the city.

The categories *structural projects*, *property protection activities*, and *natural resource protection activities* primarily will include actions that involve construction activity toward new and existing building structures. It is these intended projects and project categories that were prioritized using STAPLE+E.

Each structural/construction action for each community was given a High, Medium, or Low priority using the STAPLE+E framework. Because STAPLE+E relies upon qualitative and subjective assessment, Table 9.43 defines how each component of the STAPLE+E framework was interpreted. Generally, the mitigation actions with the highest priority were the most cost-effective and most compatible with the jurisdiction's social and cultural values. The below list of structural/construction actions includes a column specifying which components of the STAPLE+E framework as defined below were relevant in the designation of the projects' priority status. "E1" in the project lists refers to the "Economic" consideration. "E2" refers to the "Environmental" consideration.

The PADD staff reviewed each jurisdiction's priorities annually to ensure that they were properly prioritized. The designated council representative from each jurisdiction will be responsible for maintaining this list.

The STAPLE+E criteria guidelines for action prioritization that were given to the council members in order to analyze their actions were as follows:

Table 9.48 STAPLE+E Criteria Explanation

S - Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered. and opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority. to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation. actions. It is important to evaluate whether an action is cost-effective, as determined by a cost-benefit review, and possible to fund.
E - Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, that comply with Federal, State, and local environmental regulations, and that are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

Table 9.49-9.50 represent non-process actions requiring construction or acquisition related to the goals and objectives set forth in this plan, prioritized by each jurisdiction. The table identifies the hazard the action addresses, the action, the action priority, the entity responsible for the action, the potential sources of funding for the action, and to which Community Rating System (CRS) action category each project belongs.

Table 9.51 represents process actions that, thusly, are of High priority to McCracken County *and* to its incorporated jurisdiction equally: For example, it is expected that "adopting and enforcing building codes" applies with equally "High" priority to McCracken County and the incorporated City of Paducah.

Construction/Non-Process Projects to Be Pursued by Each Jurisdiction:

Table 9.49 McCracken County, Unincorporated

Hazard	Action	Priority	STAPLE+E	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeframe
Tornadoes	Purchase and Install Emergency Warning Sirens for census-designated places Reidland, Hendron, Farley, Massac & Reidland as well as unincorporated areas.	High	S, T, A, P, E1	Fiscal Court	Local, FEMA HMA	Emergency Services Measures	Immediate
Tornadoes	Construct large Community Safe Room for main concentration of population with smaller facilities for census-designated places	High	S, T, A, P, L, E1	Fiscal Court	FEMA HMA, Local	Structural; Emergency Services Measures	Immediate
All Identified Hazards	Purchase Generators for Critical Facilities such as the County EOC	High	S, T, A, P, E1	Fiscal Court	Local, FEMA HMA	Emergency Services Measures	Immediate
Flooding	Develop a Debris Removal Plan for Streams and Ditches	High	S, P, L, E1, E2	Fiscal Court; Public Works	Local, Federal Grants	Public Information ; Natural Resource Protection	On Going
Tornadoes; Severe Storms; Ice Storms	Trim Trees and Debris from Overhead Powerlines	Medium	S, P, L, E1	Utilities Providers	Private, Local	Preventative Activities	On Going
Wildfires	Purchase Equipment to suppress brush fires	Medium	S, P, E1	Fire Departments; Fiscal Court	Non-Profit, Private, Local, Federal Grants	Natural Resource Protection	Long Term
Flood	Educate the public on flood prone areas by providing maps & information	Medium	S,T, A, P, L, E1, E2	Fiscal Court	Local, state & federal programs	Property Protection	On Going
Flood	Develop a storm water management plan	Medium	S ,T, A, P, L, E1, E2	Fiscal Court	Local	Property Protection	Immediate

All Identified Hazards	Energy/Grid Resilience	High	Fiscal Court, EMA, Owners of Facilities	FEMA, HMA, Local, State, and Federal Grants	Emergency Services Measures	On Going

Table 9.50 Paducah, City of

Hazard	Action	Priority	STAPLE+E	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeframe
Flooding	Implement projects identified in the storm water management plan: The Branch, California Court, 26th&Kruger, 25th@Park, 23rd@Clay, Harrison & Madison @24th, Hospital, KY Ave 16thto 22nd, Cross* 25th, Pecan Drive	High	S, T, A, P, L, E1, E2	City	Local, State, Federal Grant Programs	Structural	Immediate
Flooding	Rehab & upgrade floodwall system	High	S, T, A, P, E1	City	Local, State, Federal Grant Programs	Structural	Immediate
Tornadoes	Construct Community Safe Room	High	S, T, A, P, L, E1	City	FEMA HMA, Local	Structural; Emergency Services Measures	Immediate
All Identified Hazards	Purchase Generators for Critical Facilities	High	S, T, A, P, E1	City	Local, FEMA HMA	Emergency Services Measures	On Going
Tornadoes; Severe Storms; Ice Storms	Trim Trees and Debris from Overhead Powerlines	Medium	S, P, L, E1	Utilities Providers	Private, Local	Preventative Activities	On Going
All Identified Hazards	Upgrade Emergency Services Communication Equipment (for Critical Facilities)	Medium	S, T, P, E1	County Emergency Management Agency	FEMA/DHS, Other Federal Grants, Local	Emergency Services Measures	On Going

All Identified Hazards	Energy/Grid Resilience	High	S, T, L, P, E1	Fiscal Court, EMA, Owners of Facilities	FEMA, HMA, Local, State, and Federal Grants	Emergency Services Measures	On Going

Table 9.51 Process Mitigation Actions That Apply to McCracken County and the City of Paducah Equally (i.e., "High") Priority

Hazard	Action	Priority	Responsible Entities	Potential Funding Sources	CRS Action Category	Completion Timeframe
Flooding	Enforce NFIP Flood Ordinances	High	County and City Executives; Floodplain Managers	Fiscal Court; City Councils	Preventative Activities	On Going
All Identified Hazards	Upgrade Emergency Services Communication Equipment (for Critical Facilities)	High	County Emergency Management	FEMA/DHS, Other Federal Grants, Local	Emergency Services Measure	On Going
Flooding	Monitor, Evaluate, Collect Damages Data to determine additional and on existing Repetitive-Loss Properties	High	County EMAs; City-Appointed Designees; Floodplain Managers	Fiscal Court; City Councils	Preventative Activities. Property Protection	On Going
All Identified Hazards	Promote the Usage of NOAA Weather Radios	High	County and City EMA and EM agents	Fiscal Court; City Councils	Preventative Activities. Public Information	On Going
Flooding	Provide Updated Floodplain Mapping and other information regarding flood-prone areas to Public	High	County and City EMA and EM agents; Floodplain Managers	Fiscal Court; KYEM; KDOW	Public Information. Preventative Activities	On Going
Earthquakes; Flooding	Public Outreach regarding Importance of and Availability of Earthquake and Flood Insurance	High	County; City; County EMA and EM agents; Floodplain Managers; Insurance	Fiscal Court; City Councils; KYEM; KDOW; UK-KGS	Public Information; Preventative Activities	On Going
All Identified Hazards	Adopt and Enforce Building Codes	High	County; City; Building Inspection agents	Fiscal Court; City Councils; KYEM; FEMA (through HMGP Initiative)	Preventative Activities	On Going

All Identified Hazards	Public Outreach for the Development of Evacuation Plans and Procedures relevant to All Identified Hazards	High	County; City	Fiscal Court; City Councils; KYEM	Public Information; Emergency Services Measures. Preventative Activities	On Going
All Identified Hazards	Develop additional Zoning and Land-Use Ordinance to regulate development	High	County; City; Developers	Fiscal Court; City Councils	Preventative Activities. Natural Resource Protection	Long Term
Dam Failure	Continue current cooperation with USACE regarding future impacts from Kentucky & Barkley Dams; participate in downstream hazard exercises, planning	High	County (with City Councils' support)	Fiscal Court; City Councils; USACE; KYEM; KDOW; Coast Guard	Preventative Activities. Emergency Services Measures. Natural Resource Protection ; Public Information	On Going
All Identified Hazards	Develop and Implement a Protection Program for Critical Information Systems	High	County; City	Fiscal Court; City Councils	Emergency Services Measures. Preventative Activities	Immediate
All Identified Hazards	Energy/Grid Resilience	High	Fiscal Court, EMA, Owners of Facilities	FEMA, HMA, Local, State, and Federal Grants	Emergency Services Measures	On Going