CHAPTER SIX: HAZARD IDENTIFICATION

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Introduction and Purpose

The underlying purpose of the Marion County Local Mitigation Strategy is to identify how the key facilities, systems and areas of the community are vulnerable to the natural, technological and societal (man-made) hazards to which they are exposed. First, it is necessary to identify the hazards that are of concern and then to specifically define how the elements of the community are vulnerable to those hazards. This is the "hazard identification and vulnerability assessment process." After specific vulnerabilities are defined, specific mitigation initiatives to counteract those vulnerabilities can be proposed for implementation through the Strategy.

The hazard identification process defines the types of hazards that could impact this County and its communities, as well as the locations where those impacts could occur. With this information, the vulnerability assessment process identifies if and how the facilities, systems or areas within those designated locations may be damaged or made inoperable by an event.

This section of the Strategy reports on hazard identification and vulnerability assessment process. Both natural hazards and technological hazards and threats to the economic vitality of the community are reviewed. It should be noted that new hazard information and methods to utilize it become available on a continuing basis. Therefore, as the LMS planning process continues, additional or modified information will become available to the Working Group.

The primary document is a summary of recommended mitigation actions as highlighted by the experiences of Marion County with the major disasters of the recent past. Interagency Hazard Mitigation Review Team reports were assessed during the planning effort and recommendations made therein regarding mitigation actions that are needed were considered by the Working Group in the development of the Strategy.

Overview of the Hazard Identification Process

Marion County is exposed to many different types of natural, atmospheric, technological and societal hazards that vary significantly in location, scope and seriousness of their effects on the community. The Hazard Identification/Vulnerability analysis process used by the Working Group began by identifying of the weather related, natural, technological and societal hazards that could potentially impact the geographic area under investigation. Table VI-1 indicates those hazards considered common or having the potential to affect the County.

Table VI-1 Hazards Affecting Marion County

Weather	Natural	Ecological	Technological/Societal	Health
Hurricane and Tropical Storm	Wildfire	Pest Infestation	Power Failure	Pandemic/Epidemic
Severe Winter Storm	Flood	Animal Disease	HazMat Incidents	Aging Population
Tornado	Drought		Urban Fire	
Extreme Heat	Sinkholes		Radiological	

Riverine Erosion	Societal/Civic Mass Casualty Traffic Related Civil Disturbance Terrorist Acts

Depending on the characteristics of the hazard and its impact, substantial components of the general population, business community, public services, community institutions and utilities are vulnerable to damage. In considering the vulnerability of Marion County to disasters, it is important to emphasize that some facilities and the populations they serve are often more sensitive to the impacts of disasters than others. For the purposes of the Vulnerability Analysis and Risk Assessment requirements of the LMS, only the weather related and natural hazards were analyzed. Ecological, technological, societal, and health related hazards remain applicable to Marion County; however, currently there are no set criteria for evaluating hazards not required by 44 CFR 201. At such time these review criteria are developed, they will be further analyzed in the LMS.

The vulnerability range of the community to disasters is very wide and depends on many factors. An ongoing role of the Working Group's Risk Assessment Subcommittee has been to undertake very specific analyses of the communities' vulnerabilities to support development of the Marion County LMS. Only by identifying specific vulnerabilities has the Working Group been able to define, the specific mitigation initiatives for incorporation into the Strategy.

A key element in the planning process adopted by the Working Group is to use a methodical, comprehensive approach to define specific vulnerabilities of the community to disaster impacts. The steps in the Hazard Identification and Vulnerability Assessment Process are as follows:

1) Use the hazard identification process to define the hazards that can strike the County and where they could impact.
2) Use a geographic information system (GIS) database to document the location of the identified hazards.
3) Use this information to select key facilities, systems and neighborhoods at risk because they are in or near those locations.
4) Analyze their specific vulnerability of the selected facilities, systems and neighborhoods to the effects of the disaster events.

Hazards Overview

In 1988, the Robert T. Stafford Disaster Relief and Emergency Assistance Act was enacted to support state and local governments when disasters overwhelm local resources. This law, as amended, establishes a process for requesting and obtaining a Presidential Disaster Declaration, defines the type and scope of assistance available from the federal government, and sets the conditions for obtaining that assistance. The Federal Emergency Management Agency (FEMA), now part of the Emergency Preparedness and Response Directorate of the Department of Homeland Security, is tasked with coordinating the response. Since 1960, Marion County has received numerous presidential disaster declarations for such hazards as hurricanes, tornados, fires and severe freezes. Refer to Table VI-2 below.

Table VI-2 Presidential Disaster Declarations, 1960-2020

Event	Declaration	Declaration
Hurricane Donna	9/12/1960	106
Hurricane Dora	9/10/1964	176
Hurricane Gladys	11/7/1968	252
Severe Winter Weather	1/31/1977	526
Severe Freeze	1/15/1990	851
Tornadoes, Flooding, High Winds	3/13/1993	982
Severe Storms, High Winds, tornadoes	1/6/1998	1195
Extreme Fire Hazard	6/18/1998	1223
Fires	4/27/1999	3139
Hurricane Frances	9/4/2004	1545
Hurricane Ivan	9/16/2004	1551
Hurricane Jeanne	9/26/2004	1561
Tropical Storm Fay	8/24/2008	1785
Hurricane Hermine	9/6/2016	4280
Hurricane Irma	9/5/2017	3385

Historic losses from weather events are summarized in Table VI-3 which indicates 181 events over the fifty four years from 1960-2014. Economic impacts on property loss and crop damage over this time period are detailed in Appendix “G”.

Table VI-3

Historic Weather Events, Marion County, 1960-2020

Name	Events	Economic Loss (millions)
Coastal	2	8.27
Flooding	12	16.34
Hail	14	8.67
Hurricane/tropical storm	9	1,298.90
Lighting	30	0.57
Severe Storm	39	19.66
Tornado	25	29.28
Wildfire	3	4.30
Wind	41	10.08
Winter Weather	6	12.82
Total	181	1,408.89

Hazards & Vulnerability Research Institute (2020).
The Spatial Hazard Events and Losses Database for the United States,
Version 13.1 [Online Database]. Columbia, SC: University of South Carolina.
Available from http://www.sheldus.org

Table VI-4 Hazard Matrix: Probability, Frequency, Impacts, and Spatial Extent

Hazard-Natural	Probability	Impact	Frequency	Distribution
Drought	L	Min	N/A	Countywide
Flood	H	Mod	1 event per year	Flood plains
Riverine Erosion	L	Min	N/A	Riverine basins
Tornado	M	Severe	1 event per 3 years	Countywide
Hurricane and Tropical Storm	L	Severe	1 event per 10 years	Countywide
Wildfire	M	Severe	Several events per year	Rural areas
Extreme Heat	L	Min	N/A	Countywide
Sinkholes	M	Mod	Several events per year	Countywide
Severe Winter Storm	L	Min	N/A	Countywide

Source: National Climatic Data Center

H = High – 1 event recorded per 1-4 years
M = Moderate – 1 event recorded per 5-9 years.
L = Low – 1 event recorded per 10+ years.
N/A = No recorded events or insufficient data.

Min = 1-25% of the total structure/infrastructure is damaged as a result of the hazard
Mod =25-50% of the total structure/infrastructure is damaged as a result of the hazard
Severe = 50-100% of the total structure/infrastructure is damaged as a result of the hazard

Table VI-5 Hazard Matrix: Detailed Hazard Impacts

Impacts on Structures and Infrastructure from Identified Hazards	All Structures	Mobile Homes	Poorly Constructed Homes	Non Elevated Homes	Telecommunications	Electrical utilities	Sewage Systems	Potable Water	Roadways	Waterways	Airports	Agriculture	Livestock
Drought	Min	Min	Min	Min	Min	Min	Min	Min	Min	Mod	Min	Mod	Mod
Flood	Mod	Min	Min	Mod	Min	Min	Mod	Mod	Mod	Mod	Min	Mod	Mod
Riverine Erosion	Min	Min	Min	Min	Min	Min	Min	Min	Min	Mod	Min	Min	Min
Tornado	S	S	S	S	S	S	Min	Min	Min	Min	S	Mod	Mod
Hurricane	S	S	S	S	S	S	Min	Min	Min	Min	S	Mod	Mod
Wildfire	S	S	S	S	S	S	Min	Min	Min	Min	M	Mod	Mod
Extreme Heat	Min	Min	Min	Min	Min	M	Min	Min	Min	Min	Min	Mod	Mod
Sinkholes	Mod	S	S	S	Min	Min	Mod	Mod	Mod	Min	Mod	Min	Min
Severe Winter Storm	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Mod	Min

Min = 1-25% of the total structure/infrastructure is damaged as a result of the hazard
Mod =25-50% of the total structure/infrastructure is damaged as a result of the hazard
Severe = 50-100% of the total structure/infrastructure is damaged as a result of the hazard

Table VI-6. Hazard Matrix: Hazard Extent		
Hazard	**Effect**	**Observation**
Drought	Severity of the drought index?	The worst possible drought event Marion County could experience would be a Category D0 drought, as measured by the Keetch-Byram Drought Index, Some lingering water deficits and slow recovery of pastures or crops while coming out of the drought.resulting in short-term dryness, slowed planting and growth of crops or pastures.
Flooding	How deep would the flooding be and what is the potential for property damage and loss of life?	During the 100 year flood, water can exceed normal levels by 1 to 5 feet. There are 19,049 parcels in Marion County located within the 100 year Flood Plain. The total assessed value of these parcels is approximately $4,581,189,526. The worst possible single flooding event could cause $600K of property damage and cause 1 injury.
Riverine Erosion	What is the potential for property damage and loss of life?	Approximately 364 improved parcels are located within 25 feet of rivers in Marion County. The total assessed value of these parcels is approximately $88,442,783. In the event of a 500 year flood or another similarly exceedingly rare hydrological event, riverine erosion may occur and affect 1-2 meters of riverbank. The majority of impacts from such an event would primarily occur on the more developed portions of the Rainbow River. No injuries or loss of life are expected as a result of river erosion.
Hurricane and Tropical Storm	What category on the Saffir Simpson Scale could impact the jurisdictions?	Potential Category Three Hurricane causing some structural damage to small residences and utility buildings with a minor amount of curtain wall failures. Mobile homes are destroyed.
Tornado	What category on the Fujita Scale could impact the jurisdictions?	Potential F-3 Tornado causing intense damage and destruction within the confined path of the storm.
Sinkholes	What is the maximum potential depth and diameter of a sinkhole?	Sinkholes can be as large as 100' in length by 100' in width and approximately 60' in depth.
Wildfire	What is the potential property damage and How many acres could be expected to burn?	Wildfires can occur as often as 2,218 times each year and can burn approximately 1,359.7 acres. A single wildfire event could damage up to $100K of property.
Extreme Heat	What is the maximum temperature to expect?	The maximum temperature that can be expected is 109 degrees with the possible loss of 1 life.
Severe Winter Storm	What is the minimum temperature to expect?	In 2010 temperatures were at 32 degrees for ten days. A period of two weeks with temperatures lows at 32 degrees can be expected. The loss of 1 life is expected.

Hurricane and Tropical Storms

A. Description of Hurricanes and Wind Storms

A hurricane is a tropical cyclone, occurring in the Atlantic Ocean or the Northeast Pacific Ocean, east of the International Dateline. Hurricanes are characterized by a large low-pressure center and numerous thunderstorms that produce strong winds and heavy rain. They feed on heat released when moist air rises, resulting in condensation of water vapor contained in the moist air.

Because of its subtropical location and long coastline, Florida is particularly susceptible to hurricanes. The greatest threats posed by a hurricane are storm surge, wind damage and inland flooding. With the exception of a few homes on the western shore of Lake George, Marion County communities need only be concerned about the latter two.

Wind damage from the storm itself is related to wind speed and the accompanying "pressure" that is exerted on structures when the wind speed doubles, four times more force is exerted on structures. Wind damage is also caused by hurricane spawned tornadoes. Tornadoes often form on the leading edge of a hurricane and can be more destructive than the hurricane itself. Tornadoes may even form in the relatively weak hurricanes, often causing much or more damage than the parent storm. It is extremely important for residents in flood prone areas of the County to keep track of a storm as it passes over all local and regional drainage basins. Rainfall varies with each hurricane, however, on the average, the normal hurricane has between ten and twelve inches of rain.

Hurricane extent is measured using the Saffir-Simpson Hurricane Scale. The scale was developed to make comparisons easier and to make the predicted hazards of approaching hurricanes clearer to emergency managers, National Oceanic and Atmospheric Administration's hurricane forecasters use a disaster-potential scale which assigns storms to five categories. This can be used to give an estimate of the potential property damage and flooding expected along the coast with a hurricane.

Table VI-7. Saffir-Simpson Hurricane Scale

Category	Winds	Effects
One	74-95 mph	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal road flooding and minor pier damage
Two	96-110 mph	Some roofing material, door, and window damage to buildings. Considerable damage to vegetation, mobile homes, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of center. Small craft in unprotected anchorages break moorings.
Three	111-130 mph	Some structural damage to small residences and utility buildings with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain continuously lower than 5 feet ASL may be flooded inland 8 miles or more.
Four	131-155 mph	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach. Major damage to lower floors of structures near the shore. Terrain continuously lower than 10 feet ASL may be flooded requiring massive evacuation of residential areas inland as far as 6 miles.

Five	greater than 155 mph	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Major damage to lower floors of all structures located less than 15 feet ASL and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5 to 10 miles of the shoreline may be required.

B. Location and Extent

All of Marion County would be vulnerable to hurricane damage from high winds, rain induced flooding and hurricane spawned tornadoes. The greatest threat from wind and tornadoes will be to those living in structurally unsound housing and mobile homes. Even though most regulations require that mobile homes be anchored to withstand high winds, with "over the top" and frame tie downs, their anchoring systems are usually designed to withstand wind velocities of only 70 to 100 miles per hour. The mobile homes themselves are usually designed to withstand winds up to only sixty miles per hour, thus, even with an advanced tie down system; the structure itself could be destroyed. Using a hazard modeling program, the peak wind gusts speed has been projected for various hurricane events for each census tract in Marion County. Refer to Appendix A, “Wind Speed by Census Tract”.

Hurricane induced flooding would also present problems for low-lying areas of Marion County filling up too fast, especially along the Ocklawaha River in east Marion County and the Withlacoochee River in southwest Marion County. Also, water retention areas overflowing create flooding problems. Many of the lakes would be impacted as well, although drainage wells or improved drainage systems have mitigated problems in these areas somewhat. Both Marion County and the City of Ocala maintain federally provided flood maps which show the 100 year flood prone areas of Marion County. The Marion County area will meet the one hundred-year flood level if 10.0 inches of rainfall occur within a twenty-four hour period.

Table VI-11B - Thunderstorm Wind Events 2000-2020

LOCATION	DATE	TIME	EVENT TYPE	MAGNITUDE (KNOTS)	FUJITA SCALE (TORNADO)	PROPERTY DAMAGE
ORANGE SPGS	7/7/2000	1824	Storm/Wind	No Report	N/A	$50,000
OCALA	7/11/2000	1820	Storm/Wind	No Report	N/A	$3,000
SPARR	8/9/2000	1510	Storm/Wind	No Report	N/A	$15,000
DUNNELLON	8/10/2000	1735	Storm/Wind	No Report	N/A	$2,500
REDDICK	9/5/2000	1330	Storm/Wind	No Report	N/A	$2,500
OCALA	9/6/2000	1615	Storm/Wind	No Report	N/A	$2,000
OCALA	3/4/2001	831	Storm/Wind	No Report	N/A	$80,000
FELLOWSHIP	3/29/2001	1000	Storm/Wind	No Report	N/A	$2,500
OCALA	3/29/2001	1030	Storm/Wind	No Report	N/A	$5,000

LYNNE	6/14/2001	1345	Storm/Wind	No Report	N/A	$3,500
OCALA	6/14/2001	1745	Storm/Wind	No Report	N/A	$3,500
SILVER SPGS	6/15/2001	1610	Storm/Wind	No Report	N/A	$3,000
OCALA	6/18/2001	1800	Storm/Wind	No Report	N/A	$30,000
BELLEVIEW	6/20/2001	1640	Storm/Wind	No Report	N/A	$3,000
OCALA	6/21/2001	1400	Storm/Wind	No Report	N/A	$20,000
OCALA	7/9/2001	1615	Storm/Wind	No Report	N/A	$2,500
MOSS BLUFF	9/1/2001	1845	Storm/Wind	No Report	N/A	$500
DUNNELLON	3/12/2002	2100	Storm/Wind	No Report	N/A	$500
OCALA	6/13/2002	1641	Storm/Wind	No Report	N/A	$1,000
OCALA	6/13/2002	1659	Storm/Wind	No Report	N/A	$2,000
FT MC COY	6/13/2002	1810	Storm/Wind	No Report	N/A	$1,000
DUNNELLON	6/22/2002	1400	Storm/Wind	No Report	N/A	$2,000
OCALA	7/24/2002	1425	Storm/Wind	No Report	N/A	$0
BELLEVIEW	7/24/2002	1600	Storm/Wind	No Report	N/A	$0
OCALA	7/24/2002	1622	Storm/Wind	No Report	N/A	$5,000
OCALA ARPT	8/5/2002	1555	Storm/Wind	58	N/A	$5,000
ORANGE LAKE	12/24/2002	1700	Storm/Wind	No Report	N/A	$5,000
OCALA	3/27/2003	1450	Storm/Wind	60	N/A	$0
LAKE WEIR	3/27/2003	1505	Storm/Wind	60	N/A	$0
COUNTYWIDE	4/25/2003	1430	Storm/Wind	60	N/A	$0
BELLEVIEW	5/18/2003	2056	Storm/Wind	55	N/A	$0
OCALA	5/19/2003	1515	Storm/Wind	55	N/A	$0
OCALA	6/16/2003	1412	Storm/Wind	55	N/A	$0
REDDICK	7/11/2003	1500	Storm/Wind	55	N/A	$0
MC INTOSH	7/11/2003	1505	Storm/Wind	55	N/A	$0
OCALA	7/12/2003	1415	Storm/Wind	55	N/A	$0
SPARR	8/4/2003	1350	Storm/Wind	50	N/A	$50,000
FT MC COY	11/5/2003	1630	Storm/Wind	45	N/A	$1,000
BELLEVIEW	11/5/2003	1700	Storm/Wind	45	N/A	$30,000
OCALA	6/2/2004	1030	Storm/Wind	50	N/A	$0
OCALA	6/4/2004	1245	Storm/Wind	50	N/A	$0
BELLEVIEW	6/6/2004	1525	Storm/Wind	50	N/A	$0
OCALA	6/20/2004	1530	Storm/Wind	50	N/A	$0
OCALA	6/20/2004	1535	Storm/Wind	50	N/A	$0
OCALA	6/26/2004	1550	Storm/Wind	55	N/A	$0
COUNTYWIDE	6/26/2004	1615	Storm/Wind	55	N/A	$0
MOSS BLUFF	6/26/2004	1845	Storm/Wind	55	N/A	$0
DUNNELLON	6/29/2004	1515	Storm/Wind	50	N/A	$0
DUNNELLON	6/29/2004	1515	Storm/Wind	50	N/A	$0

OCALA	7/4/2004	1450	Storm/Wind	50	N/A	$0
CITRA	7/7/2004	1315	Storm/Wind	50	N/A	$0
LOWELL	7/7/2004	1315	Storm/Wind	50	N/A	$0
OCALA	7/7/2004	1345	Storm/Wind	50	N/A	$0
LAKE WEIR	7/7/2004	1405	Storm/Wind	50	N/A	$0
OCALA	7/11/2004	1349	Storm/Wind	50	N/A	$0
OCALA	7/11/2004	1449	Storm/Wind	50	N/A	$0
FLEMINGTON	8/10/2004	1820	Storm/Wind	50	N/A	$0
OCALA	8/20/2004	1457	Storm/Wind	50	N/A	$0
WEIRSDALE	8/27/2004	1430	Storm/Wind	45	N/A	$2,000
OKLAWAHA	4/7/2005	1510	Storm/Wind	50	N/A	$0
SILVER SPGS	5/24/2005	1615	Storm/Wind	50	N/A	$0
LYNNE	5/24/2005	1615	Storm/Wind	50	N/A	$0
REDDICK	6/11/2005	1253	Storm/Wind	45	N/A	$1,000
DUNNELLON	7/9/2005	1730	Storm/Wind	50	N/A	$0
BELLEVIEW	7/13/2005	1530	Storm/Wind	50	N/A	$0
OCALA	4/8/2006	2330	Storm/Wind	45	N/A	$50,000
FT MC COY	5/28/2006	1450	Storm/Wind	50	N/A	$0
OCALA ARPT	5/28/2006	1540	Storm/Wind	65	N/A	$0
OCALA	5/28/2006	1550	Storm/Wind	50	N/A	$0
OCALA	5/28/2006	1635	Storm/Wind	50	N/A	$0
LYNNE	6/29/2006	1710	Storm/Wind	45	N/A	$2,000
FLEMINGTON	7/17/2006	1550	Storm/Wind	50	N/A	$0
FLEMINGTON	7/17/2006	1557	Storm/Wind	50	N/A	$0
OCALA	7/28/2006	1527	Storm/Wind	50	N/A	$0
MC INTOSH	7/30/2006	1415	Storm/Wind	50	N/A	$0
ROMEO	9/7/2006	1200	Storm/Wind	50	N/A	$0
OCALA ARPT	2/2/2007	30	Storm/Wind	52	N/A	$0
ANTHONY	2/2/2007	30	Storm/Wind	60	N/A	$0
SUNSET HARBOR	2/2/2007	330	Storm/Wind	50	N/A	$0
EARLY BIRD	4/15/2007	700	Storm/Wind	52	N/A	$0
BELLEVIEW	4/15/2007	740	Storm/Wind	52	N/A	$15,000
KENDRICK	6/12/2007	1215	Storm/Wind	50	N/A	$0
SALT SPGS	6/13/2007	1305	Storm/Wind	50	N/A	$0
FLEMINGTON	6/13/2007	1530	Storm/Wind	50	N/A	$0
MONTAGUE	6/25/2007	1540	Storm/Wind	50	N/A	$0
DANKS CORNER	7/14/2007	1100	Storm/Wind	50	N/A	$0
SALT SPGS	7/16/2007	1900	Storm/Wind	50	N/A	$0
MONTAGUE	7/17/2007	1630	Storm/Wind	50	N/A	$0
SUMMERFIELD	7/21/2007	1540	Storm/Wind	50	N/A	$0

EARLY BIRD	8/12/2007	1915	Storm/Wind	50	N/A	$0
YORK	8/14/2007	1925	Storm/Wind	50	N/A	$0
MONTAGUE	9/20/2007	1515	Storm/Wind	50	N/A	$0
EUREKA	9/20/2007	1750	Storm/Wind	50	N/A	$0
MONTAGUE	9/20/2007	2000	Storm/Wind	50	N/A	$0
SUMMERFIELD	9/20/2007	2111	Storm/Wind	50	N/A	$0
SOUTH OCALA	9/20/2007	2230	Storm/Wind	50	N/A	$0
LYNNE	9/21/2007	0	Storm/Wind	50	N/A	$0
ELECTRA	9/21/2007	8	Storm/Wind	50	N/A	$0
MONTAGUE	12/16/2007	445	Storm/Wind	50	N/A	$0
LUDDERSVILLE	2/26/2008	1625	Storm/Wind	60	N/A	$0
OCALA	2/26/2008	1655	Storm/Wind	52	N/A	$0
BELLEVIEW	2/26/2008	1715	Storm/Wind	52	N/A	$0
MONROES CORNER	4/5/2008	1300	Storm/Wind	50	N/A	$0
BELLEVIEW	4/5/2008	1300	Storm/Wind	50	N/A	$0
SANTOS	4/5/2008	1530	Storm/Wind	50	N/A	$0
LYNNE	6/10/2008	1335	Storm/Wind	50	N/A	$0
MARION OAKS	6/12/2008	1620	Storm/Wind	50	N/A	$0
SALT SPGS	6/25/2008	315	Storm/Wind	50	N/A	$0
CANDLER	6/28/2008	1415	Storm/Wind	50	N/A	$0
STARKES FERRY	7/6/2008	1750	Storm/Wind	52	N/A	$0
SALT SPGS	8/28/2008	1900	Storm/Wind	50	N/A	$0
CITRA	12/11/2008	925	Storm/Wind	50	N/A	$0
KENDRICK	3/29/2009	220	Storm/Wind	50	N/A	$0
MARTIN	4/14/2009	832	Storm/Wind	50	N/A	$0
CITRA	6/13/2009	1530	Storm/Wind	50	N/A	$0
CITRA	6/18/2009	1230	Storm/Wind	50	N/A	$0
WEST END	6/18/2009	1242	Storm/Wind	50	N/A	$0
OCALA	6/18/2009	1315	Storm/Wind	50	N/A	$0
STANTON	11/22/2009	1430	Storm/Wind	50	N/A	$0
MONTAGUE	1/21/2010	1925	Storm/Wind	50	N/A	$0
MARION OAKS	1/25/2010	440	Storm/Wind	50	N/A	$0
BLITCHTON	2/22/2010	1600	Storm/Wind	50	N/A	$0
MARION OAKS	3/11/2010	1230	Storm/Wind	50	N/A	$0
FLEMINGTON	4/25/2010	1255	Storm/Wind	50	N/A	$0
MARTEL	4/25/2010	1330	Storm/Wind	50	N/A	$0
ORANGE SPGS	5/24/2010	1520	Storm/Wind	52	N/A	$0
EUREKA	5/24/2010	1523	Storm/Wind	50	N/A	$0
BOARDMAN	5/30/2010	1625	Storm/Wind	50	N/A	$3,100
SPARR	6/15/2010	1540	Storm/Wind	50	N/A	$0

ORANGE SPGS	6/16/2010	1430	Storm/Wind	50	N/A	$0
SILVER SPGS	6/16/2010	1520	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	7/15/2010	1400	Storm/Wind	50	N/A	$0
MARION OAKS	1/25/2011	1645	Storm/Wind	50	N/A	$0
SUMMERFIELD	1/25/2011	1650	Storm/Wind	50	N/A	$0
BELLEVIEW	1/25/2011	1700	Storm/Wind	50	N/A	$10,000
MARION OAKS	2/7/2011	1330	Storm/Wind	50	N/A	$0
ORANGE BLOSSOM HILLS	3/30/2011	1505	Storm/Wind	50	N/A	$0
MILLWOOD	5/14/2011	1215	Storm/Wind	50	N/A	$0
BLITCHTON	5/23/2011	1710	Storm/Wind	50	N/A	$0
ORANGE SPGS	6/6/2011	1450	Storm/Wind	50	N/A	$0
FAIRFIELD	6/6/2011	1522	Storm/Wind	50	N/A	$0
BELLEVIEW	6/6/2011	1552	Storm/Wind	50	N/A	$0
BELLEVIEW	6/6/2011	1552	Storm/Wind	50	N/A	$0
BELLEVIEW	6/6/2011	1552	Storm/Wind	50	N/A	$0
DANKS CORNER	6/6/2011	1601	Storm/Wind	50	N/A	$0
DALLAS	6/6/2011	1603	Storm/Wind	50	N/A	$0
BELLEVIEW	6/15/2011	1820	Storm/Wind	50	N/A	$0
KENDRICK	6/15/2011	1850	Storm/Wind	50	N/A	$0
LAKE WEIR	6/15/2011	1900	Storm/Wind	50	N/A	$0
FT MC COY	6/15/2011	1920	Storm/Wind	50	N/A	$0
MONTAGUE	6/15/2011	1935	Storm/Wind	50	N/A	$0
BOARDMAN	6/15/2011	2035	Storm/Wind	50	N/A	$0
ORANGE SPGS	6/22/2011	242	Storm/Wind	50	N/A	$0
IRVINE	6/22/2011	1620	Storm/Wind	50	N/A	$0
ANTHONY	6/24/2011	1515	Storm/Wind	50	N/A	$0
ANTHONY	8/12/2011	1605	Storm/Wind	50	N/A	$0
CITRA	8/12/2011	1720	Storm/Wind	50	N/A	$0
LUDDERSVILLE	8/12/2011	1835	Storm/Wind	50	N/A	$0
ROMEO	8/12/2011	1835	Storm/Wind	50	N/A	$0
OCALA WEST	8/13/2011	1500	Storm/Wind	50	N/A	$0
OCALA WEST	8/13/2011	1512	Storm/Wind	50	N/A	$0
WEIRSDALE	8/13/2011	1525	Storm/Wind	50	N/A	$0
ORANGE SPGS	8/13/2011	1540	Storm/Wind	50	N/A	$0
OCALA	10/10/2011	320	Storm/Wind	45	N/A	$10,000
FLEMINGTON	10/10/2011	330	Storm/Wind	45	N/A	$20,000
ORANGE SPGS	5/8/2012	1805	Storm/Wind	50	N/A	$0
SUMMERFIELD	5/28/2012	1635	Storm/Wind	50	N/A	$0
BRUCEVILLE	5/30/2012	1525	Storm/Wind	50	N/A	$0
BRUCEVILLE	5/30/2012	1529	Storm/Wind	50	N/A	$0

BRUCEVILLE	5/30/2012	1529	Storm/Wind	50	N/A	$0
WEST END	6/10/2012	1555	Storm/Wind	50	N/A	$0
BELLEVIEW	6/24/2012	1920	Storm/Wind	50	N/A	$0
EMATHLA	6/24/2012	2200	Storm/Wind	45	N/A	$6,000
ANTHONY	7/2/2012	1745	Storm/Wind	50	N/A	$0
OCALA	7/3/2012	1530	Storm/Wind	50	N/A	$0
DALLAS	8/16/2012	1250	Storm/Wind	50	N/A	$0
SUMMERFIELD	8/23/2012	1145	Storm/Wind	50	N/A	$0
OCALA WEST	4/29/2013	1730	Storm/Wind	52	N/A	$0
KENDRICK	4/29/2013	1753	Storm/Wind	50	N/A	$0
OCALA WEST	5/20/2013	1500	Storm/Wind	50	N/A	$0
OCALA WEST	5/20/2013	1505	Storm/Wind	50	N/A	$0
CITRA	5/20/2013	1550	Storm/Wind	50	N/A	$0
WEST END	6/26/2013	1710	Storm/Wind	50	N/A	$0
MONROES CORNER	7/4/2013	1455	Storm/Wind	45	N/A	$3,000
OCALA	7/4/2013	1505	Storm/Wind	45	N/A	$2,000
KERR CITY	8/17/2013	1640	Storm/Wind	50	N/A	$0
SOUTH OCALA	8/17/2013	1915	Storm/Wind	50	N/A	$0
CHATMAR	9/15/2013	1445	Storm/Wind	50	N/A	$0
ROMEO	9/15/2013	1530	Storm/Wind	50	N/A	$0
SHADY	9/24/2013	1615	Storm/Wind	50	N/A	$0
MONROES CORNER	10/7/2013	1629	Storm/Wind	45	N/A	$5,000
ANTHONY	12/14/2013	1725	Storm/Wind	87	N/A	$3,000
CANDLER	4/30/2014	1405	Storm/Wind	50	N/A	$0
LINADALE	4/30/2014	1445	Storm/Wind	50	N/A	$0
WEST END	6/7/2014	1805	Storm/Wind	45	N/A	$120,000
SALT SPGS	6/8/2014	1550	Storm/Wind	50	N/A	$0
ELECTRA	6/8/2014	1610	Storm/Wind	50	N/A	$0
SUMMERFIELD	6/9/2014	1555	Storm/Wind	50	N/A	$0
MOSS BLUFF	6/10/2014	1630	Storm/Wind	50	N/A	$0
FT MC COY	6/20/2014	1900	Storm/Wind	50	N/A	$0
SILVER SPGS	6/20/2014	1910	Storm/Wind	45	N/A	$2,000
OCALA WEST	6/20/2014	2000	Storm/Wind	50	N/A	$0
ANTHONY	7/15/2014	1444	Storm/Wind	50	N/A	$0
STARKES FERRY	7/15/2014	1538	Storm/Wind	50	N/A	$0
STANTON	7/15/2014	1538	Storm/Wind	50	N/A	$0
SUMMERFIELD	7/15/2014	1544	Storm/Wind	50	N/A	$0
MARION OAKS	8/23/2014	1805	Storm/Wind	50	N/A	$0
FT MC COY	9/18/2014	1906	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	6/1/2015	1410	Storm/Wind	45	N/A	$6,000

LYNNE	6/12/2015	1600	Storm/Wind	50	N/A	$500
CHATMAR	6/16/2015	1550	Storm/Wind	50	N/A	$0
OCALA ARPT	6/18/2015	1445	Storm/Wind	50	N/A	$0
SOUTH OCALA	6/18/2015	1456	Storm/Wind	50	N/A	$0
LUDDERSVILLE	6/18/2015	1528	Storm/Wind	50	N/A	$0
MARION OAKS	6/18/2015	1600	Storm/Wind	50	N/A	$0
DANKS CORNER	6/18/2015	1609	Storm/Wind	50	N/A	$0
DALLAS	6/18/2015	1638	Storm/Wind	45	N/A	$500
BELLEVIEW	6/21/2015	1705	Storm/Wind	56	N/A	$0
BELLEVIEW	6/21/2015	1705	Storm/Wind	50	N/A	$0
BELLEVIEW	6/21/2015	1715	Storm/Wind	50	N/A	$0
KENDRICK	6/21/2015	1755	Storm/Wind	45	N/A	$20,000
OCALA ARPT	6/23/2015	1445	Storm/Wind	50	N/A	$0
BELLEVIEW	6/23/2015	1500	Storm/Wind	56	N/A	$0
CHATMAR	6/23/2015	1500	Storm/Wind	50	N/A	$0
CHATMAR	6/23/2015	1530	Storm/Wind	50	N/A	$0
SILVER SPGS	7/4/2015	1524	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	7/4/2015	1535	Storm/Wind	50	N/A	$0
DUNNELLON	7/13/2015	1312	Storm/Wind	50	N/A	$0
DUNNELLON	7/13/2015	1320	Storm/Wind	50	N/A	$0
FT MC COY	8/13/2015	1325	Storm/Wind	50	N/A	$0
LYNNE	8/20/2015	1612	Storm/Wind	45	N/A	$500
FELLOWSHIP	2/24/2016	850	Storm/Wind	50	N/A	$0
EMATHLA	5/17/2016	1445	Storm/Wind	45	N/A	$500
MONTAGUE	5/17/2016	1445	Storm/Wind	50	N/A	$0
CITRA	5/20/2016	1100	Storm/Wind	50	N/A	$0
OCALA	5/20/2016	1100	Storm/Wind	50	N/A	$0
SUMMERFIELD	5/20/2016	1100	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	5/20/2016	1103	Storm/Wind	50	N/A	$0
OCALA	7/14/2016	1645	Storm/Wind	45	N/A	$2,000
SANTOS	9/12/2016	1342	Storm/Wind	45	N/A	$1,000
ANTHONY	9/12/2016	1354	Storm/Wind	45	N/A	$1,000
SILVER SPGS AIRPARK	1/7/2017	230	Storm/Wind	50	N/A	$0
YORK	1/22/2017	1500	Storm/Wind	45	N/A	$3,000
OCALA	1/22/2017	1520	Storm/Wind	45	N/A	$50
OCALA WEST	1/22/2017	1530	Storm/Wind	45	N/A	$50
COTTON PLANT	2/15/2017	1955	Storm/Wind	50	N/A	$0
FLEMINGTON	4/4/2017	800	Storm/Wind	50	N/A	$0
OCALA WEST	4/4/2017	1105	Storm/Wind	50	N/A	$0
WEIRSDALE	4/6/2017	545	Storm/Wind	40	N/A	$200

LOWELL	6/14/2017	1624	Storm/Wind	50	N/A	$0
OKLAWAHA	6/15/2017	1620	Storm/Wind	50	N/A	$0
BELLEVIEW	6/15/2017	1620	Storm/Wind	50	N/A	$0
CHATMAR	7/6/2017	1445	Storm/Wind	50	N/A	$0
MARION OAKS	7/14/2017	1600	Storm/Wind	50	N/A	$0
COTTON PLANT	7/14/2017	1635	Storm/Wind	50	N/A	$0
CITRA	7/20/2017	1805	Storm/Wind	50	N/A	$0
ANTHONY	7/20/2017	1812	Storm/Wind	50	N/A	$0
ANTHONY	7/20/2017	1812	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	7/20/2017	1817	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1817	Storm/Wind	50	N/A	$0
MILLWOOD	7/20/2017	1820	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1823	Storm/Wind	45	N/A	$1,000
OCALA WEST	7/20/2017	1823	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1829	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1829	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	7/20/2017	1830	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1830	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1830	Storm/Wind	50	N/A	$0
OCALA WEST	7/20/2017	1830	Storm/Wind	50	N/A	$0
WEST END	7/20/2017	1831	Storm/Wind	50	N/A	$0
OCALA	9/1/2017	1400	Storm/Wind	50	N/A	$0
MONTAGUE	9/1/2017	1405	Storm/Wind	50	N/A	$0
OCALA	4/15/2018	1315	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	4/15/2018	1317	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	4/15/2018	1320	Storm/Wind	50	N/A	$0
WEST END	5/15/2018	1432	Storm/Wind	39	N/A	$200
FLEMINGTON	6/3/2018	1715	Storm/Wind	50	N/A	$0
OCALA ARPT	6/17/2018	1716	Storm/Wind	50	N/A	$0
COTTON PLANT	7/21/2018	1445	Storm/Wind	45	N/A	$2,000
SILVER SPGS AIRPARK	7/22/2018	1500	Storm/Wind	50	N/A	$0
REDDICK	8/25/2018	1605	Storm/Wind	45	N/A	$500
EARLY BIRD	8/25/2018	1620	Storm/Wind	50	N/A	$0
EARLY BIRD	8/25/2018	1620	Storm/Wind	45	N/A	$500
SANTOS	8/25/2018	1825	Storm/Wind	45	N/A	$500
SILVER SPGS	8/25/2018	1855	Storm/Wind	45	N/A	$500
OCALA ARPT	4/6/2019	1535	Storm/Wind	50	N/A	$0
CHATMAR	4/19/2019	1105	Storm/Wind	50	N/A	$0
SHADY	4/19/2019	1145	Storm/Wind	50	N/A	$0
SOUTH OCALA	4/19/2019	1150	Storm/Wind	50	N/A	$0

OCALA	4/19/2019	1150	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	4/19/2019	1150	Storm/Wind	50	N/A	$0
SILVER SPGS	4/19/2019	1156	Storm/Wind	50	N/A	$0
OCALA	4/19/2019	1203	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	4/19/2019	1203	Storm/Wind	50	N/A	$0
ANTHONY	4/19/2019	1210	Storm/Wind	50	N/A	$0
SUMMERFIELD	4/19/2019	1215	Storm/Wind	50	N/A	$0
LINADALE	6/9/2019	1430	Storm/Wind	50	N/A	$0
BELLEVIEW	6/16/2019	1445	Storm/Wind	45	N/A	$10
OCALA	6/19/2019	1346	Storm/Wind	45	N/A	$1,000
DUNNELLON	7/5/2019	1405	Storm/Wind	40	N/A	$500
BELLEVIEW	7/21/2019	1558	Storm/Wind	50	N/A	$0
DUNNELLON MUNI ARPT	7/21/2019	1621	Storm/Wind	50	N/A	$0
ANTHONY	2/6/2020	2216	Storm/Wind	50	N/A	$0
DANKS CORNER	4/20/2020	836	Storm/Wind	55	N/A	$0
PEDRO	4/20/2020	837	Storm/Wind	55	N/A	$0
CANDLER	4/20/2020	856	Storm/Wind	50	N/A	$0
OCALA WEST	4/30/2020	58	Storm/Wind	50	N/A	$0
DALLAS	6/6/2020	1515	Storm/Wind	50	N/A	$0
ELECTRA	6/18/2020	1848	Storm/Wind	50	N/A	$0
SILVER SPGS AIRPARK	6/19/2020	1600	Storm/Wind	56	N/A	$0
OCALA WEST	6/19/2020	1625	Storm/Wind	50	N/A	$0
OCALA WEST	6/19/2020	1631	Storm/Wind	50	N/A	$0
ANTHONY	6/19/2020	1633	Storm/Wind	50	N/A	$0
MONTAGUE	9/12/2020	1255	Storm/Wind	40	N/A	$5,000
OCALA ARPT	9/12/2020	1305	Storm/Wind	40	N/A	$500

Table VI-11C Hail Events 2000-2020

LOCATION	DATE	TIME	MAGNITUDE (KNOTS)	PROPERTY DAMAGE
OCALA	6/13/2000	1850	0.75	$0
OCALA	6/17/2000	1728	0.88	$0
CITRA	6/24/2000	1627	0.75	$0
SILVER SPGS	3/13/2001	930	0.75	$0
OCALA	5/25/2001	1831	0.75	$0
SALT SPGS	6/4/2001	1540	0.75	$0
FT MC COY	6/14/2001	1415	0.88	$0
FT MC COY	6/17/2001	1545	0.75	$0

OCALA	6/18/2001	1714	1	$0
OCALA	6/21/2001	1750	0.75	$0
MARION OAKS	6/27/2002	1545	0.88	$0
OCALA	7/24/2002	1540	1	$0
OCALA	3/27/2003	1317	0.88	$0
OCALA	3/27/2003	1334	0.75	$0
DUNNELLON	5/18/2003	1407	1.5	$0
LAKE WEIR	7/25/2003	1520	1	$0
FLEMINGTON	4/8/2004	1010	0.75	$0
OCALA	5/2/2004	1648	1	$0
OCALA	6/4/2004	1245	0.75	$0
OCALA	6/25/2004	1555	1.75	$0
OCALA	6/27/2004	1710	1	$0
OCALA	7/4/2004	1442	0.75	$0
SILVER SPGS	7/4/2004	1445	0.88	$0
OCALA	7/4/2004	1455	0.88	$0
OCALA	4/7/2005	1450	0.75	$0
LYNNE	5/24/2005	1615	0.88	$0
LYNNE	2/3/2006	1705	1	$0
LYNNE	2/3/2006	1711	1.75	$1,000
OCALA ARPT	5/28/2006	1539	1.75	$0
OCALA	5/28/2006	1550	0.75	$0
OCALA ARPT	7/28/2006	1549	0.88	$0
OCALA	7/28/2006	1630	0.88	$0
OCALA	8/4/2006	1604	0.88	$0
CHATMAR	5/6/2007	1555	0.75	$0
OCALA ARPT	5/13/2007	1406	0.88	$0
BLITCHTON	5/13/2007	1409	1	$0
KENDRICK	5/13/2007	1420	1.75	$0
KENDRICK	5/13/2007	1440	4.5	$0
CITRA	5/13/2007	1510	0.75	$0
OCALA	6/7/2007	1700	0.75	$0
SUMMERFIELD	6/10/2007	1615	0.75	$0
EUREKA	6/10/2007	1730	1	$0
SOUTHSIDE	6/13/2007	1515	1	$0
MOSS BLUFF	7/21/2007	1600	1	$0
MOSS BLUFF	7/21/2007	2100	1	$0
SALT SPGS	8/25/2007	1530	0.75	$0
BELLEVIEW	9/20/2007	2127	0.75	$0
BELLEVIEW	3/7/2008	1412	0.88	$0

DUNNELLON MUNI ARPT	6/1/2008	1340	0.75	$0
OCALA	6/10/2008	1240	0.88	$0
SPARR	6/25/2008	1420	0.75	$0
STARKES FERRY	7/6/2008	1747	0.75	$1,000
ORANGE SPGS	6/16/2009	1718	1	$0
OCALA	7/20/2009	1810	0.75	$0
BELLEVIEW	8/25/2009	1512	1	$0
OCALA WEST	3/11/2010	1017	0.75	$0
WEST END	3/11/2010	1020	0.75	$0
BELLEVIEW	4/25/2010	2120	1.75	$0
MARION OAKS	6/14/2010	1523	0.75	$0
OCALA	4/5/2011	702	1	$0
FLEMINGTON	4/20/2011	1550	0.75	$0
ANTHONY	4/20/2011	1608	1.75	$0
OCALA WEST	4/20/2011	1615	1.5	$0
LUDDERSVILLE	6/6/2011	1450	1	$0
CHATMAR	6/15/2011	1445	1	$0
BELLEVIEW	6/15/2011	1840	0.75	$0
ELECTRA	5/22/2012	1700	0.75	$0
WEST END	6/10/2012	1555	1	$0
FELLOWSHIP	7/3/2012	1537	0.88	$0
SHADY	7/16/2012	1710	1	$0
SUMMERFIELD	4/14/2013	1702	0.88	$0
MOSS BLUFF	4/14/2013	1730	1	$0
FT MC COY	5/20/2013	1430	0.75	$0
SHADY	9/24/2013	1615	1	$0
ANTHONY	12/14/2013	1725	0.75	$0
YORK	5/14/2014	1405	1	$0
LUDDERSVILLE	5/11/2015	1430	1	$0
DUNNELLON	6/23/2015	1508	0.75	$0
SILVER SPGS	4/4/2017	1115	0.88	$0
FLEMINGTON	6/3/2018	1717	1	$0
FLEMINGTON	6/3/2018	1720	1	$0
YORK	4/6/2019	1530	0.88	$0
OCALA ARPT	4/6/2019	1537	1	$0
OCALA ARPT	4/6/2019	1540	0.88	$0
YORK	5/22/2020	1640	0.88	$0
OCALA	6/19/2020	1628	1	$0

C. Description of Vulnerabilities

Roads leading into the metropolitan area have been submerged at various points (such as SR 40 and CR 35 in east Marion County and SR 40 in the Ocala National Forest). This hinders evacuation and/or emergency response capabilities, especially evacuation from Volusia County and the coast. Hurricane force winds could occur throughout the County making mobile homes a general county-wide vulnerability.

The HAZUS-MH model calculates loss estimates for hurricanes that can be used to demonstrate the cost effectiveness of mitigation measures. In Marion County, most of the building exposure (89.2%) is in the residential category. Refer to Table VI-8 below. A projection of direct economic loss by storm event for both property damage and building interruption is shown in Table VI-9. This data indicates that for a 100 year storm, total building related economic losses could exceed $587 million. Projected estimates of building damage, debris created, and shelter requirements are also provided in the HAZUS model and shown in Table VI-10 below.

Table VI-8
Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	24,387,244	79.2%
Commercial	4,229,912	13.7%
Industrial	1,020,480	3.3%
Agricultural	277,513	0.9%
Religious	506,984	1.7%
Government	107,379	0.4%
Education	254,420	0.8%
Total	30,783,932	100.0%

Source: Hazus-MH Hurricane Event Report, probabilistic hurricane event model report, March 23, 2021.

The 100 year return period hurricane approximates a Category 2 storm on the Saffir-Simpson Hurricane Scale. Marion County has not experienced a storm greater than a Category 2 hurricane since historical storm data collection began in 1900.

Table VI-9
Building Related Economic Losses
(thousands of dollars)

	Event Type				
	10 Year	20 year	50 Year	100 Year	500 Year
Property Damage	11,066	68,308	236,676	525,820	2,652,518

Building Interruption Loss	87	3,038	20,145	62,037	528,308
Total	11,153	71,347	256,822	626,083	3,180,825

Source: Hazus-MH Hurricane Event Report, probabilistic hurricane event model report, March 23, 2021.

Table VI-10
Potential Hurricane Impacts by Event Type

	Event Type				
	10 Year	20 year	50 Year	100 Year	500 Year
Building Damage					
Buildings At Least Moderately Damaged	2	31	708	39,586	25,267
Buildings Completely Destroyed	-	-	21	160	2,600
Essential Facilities At Least Moderately Damaged	1	3	4	4	80
Debris					
Tons of Debris Generated	102,287	268,262	705,650	1,187,050	2,295,009
Shelter Requirements					
Household displaced	-	1	120	483	4,358

Source: Hazus-MH Hurricane Event Report, probabilistic hurricane event model report, March 23, 2021.

D. Vulnerable Critical Facilities

A rough estimate of critical facility vulnerability can be found in the Hazus-MH Hurricane Event report. Critical or essential facilities include fire stations, hospitals, police stations, and schools. For a 100-year hurricane event, of the 129 facilities classified as essential facilities by the model, an estimated 4 facilities will have at least moderate damage. It is projected that 100 facilities will have an expected loss of use greater than one day. No facilities are projected to have complete damage, i.e. damage greater than 50% of total value.

E. Probability

Return periods have been calculated using several methodologies which can be used in risk analysis. However, the overriding assumption for hazard mitigation is that hurricanes do strike Florida each year and will affect Marion County at some point in the future. Return periods are shown below.

Table VI-11 - Hurricane Return Periods for the Withlacoochee Region

Area	TS	CAT 1	CAT 2	CAT 3	CAT 4	CAT 5
Withlacoochee Region	6.29	13.73	37.87	75.75	NDE	NDE
100 Mile Radius Affecting Region	1.42	3.43	6.04	8.39	37.87	NDE
Citrus	29.59	37.87	151	151	NDE	NDE
Hernando	15.11	50.5	NDE	151	NDE	NDE
Marion	10.79	37.87	151	NDE	NDE	NDE
Marion	12.59	25.19	75.75	NDE	NDE	NDE
Sumter	13.74	151	75.75	151	NDE	NDE

NDE: No Direct Effect

Note: This data represents the predicted interval between storms, not the amount of years since the last storm of any specific category. “NDE” No Direct Effect, indicates a hurricane of this magnitude has not crossed the county or region.

F. History

Florida has experienced the greatest number of hurricane landfalls of any state in the nation because of its geographic location. Florida's flat topography also makes it susceptible to the full force of hurricane winds and powerful storm surge. Between 1900 and 2008, Florida was impacted by 52 hurricanes, 14 of which were major hurricanes (Category 3 or higher). Generally, the lower intensity hurricanes have made landfall in the northwest portion of the state.

Shown in Map VI-1 are the tracks of hurricanes in Marion County from 1851 to 2020. This graphic illustrates that hurricane wind vulnerability is countywide. However, none of these hurricane tracks showed winds over 100 knots. Therefore, structural damage from hurricanes in Marion County is expected to be limited to mobile homes and other vulnerable structures.

This countywide history of hurricanes and tropical storms provides information on damages done by Florida's greatest weather threat.

September 9-12, 1964 Hurricane Dora: Hurricane Dora crossed Florida from east to west before turning to southern Georgia. On September 13-16, Dora produced over 20 inches of rainfall and caused flooding throughout one-third of the state of Florida, extensively affecting the St. Mary's, Santa Fe and Steinhatchee River basins. An estimated $150 million in losses were reported, affecting residential, commercial and agricultural operations.

September 10-11, 1990 Hurricane Donna: Hurricane Donna crossed the central Florida Keys before curving northward along Florida's West Coast, passing over Naples and Fort Myers before continuing across the central peninsula. The storm produced 10 to 12 inches of rain and caused wind and coastal flooding damages estimated at $150 million.

October 7-8, 1996 Tropical Storm Josephine: Tropical Storm Josephine impacted Florida's West Coast with 70 mph winds before exiting through the northeast portion of the state. Sixteen counties experienced extensive damage, with losses estimated near $45 million.

<u>August 13, 2004 Hurricane Charley:</u> Hurricane Charley made landfall at Cayo Costa, a barrier island just west of Cape Coral, as a Category 4 storm at approximately 3:45 PM EDT on Friday, 13 August 2004. Winds were estimated at 145 mph, with a minimum central pressure of 941 millibars. A 7-foot storm surge was recorded in Fort Myers at 3:45 PM EDT, around the time of landfall. In the Naples area, the maximum storm tide (the combination of normal tide level plus storm surge) was about 10 to 11 feet above mean sea level. The worst storm tide was north of Naples from Vanderbilt Beach to the Lee County line. In this area, the maximum storm tide was about 10 to 13 feet above mean sea level. Charley took approximately nine hours to traverse the Florida peninsula. It was the strongest hurricane to make landfall in the state since Hurricane Andrew in 1992. Just under 36 hours prior to Charley's landfall, Tropical Storm Bonnie struck the Florida Panhandle near Apalachicola. Not since 1906 have two storms struck the state of Florida so close together.

<u>September 5, 2004 Hurricane Frances:</u> The large eye of Hurricane Frances made landfall near Sewall's Point, Florida (in the vicinity of Stuart, Jensen Beach, and Port Salerno), as a Category 2 storm at approximately 1 AM EDT on Sunday, 5 September 2004. Winds were estimated at 105 mph, with a minimum central pressure of 960 millibars. Frances then emerged into the Gulf of Mexico near Hudson shortly before midnight. Unlike Hurricane Charley, which will be remembered for wind damage, Frances will be remembered most for flooding, including freshwater (overland and river) and tidal (storm surge). Initial storm surge values include an estimate of 6 feet near Cocoa Beach to the north to near 8 feet around Vero Beach to the south.

<u>September 16, 2004 Hurricane Ivan:</u> Ivan moved across the east-central Gulf of Mexico, making landfall as a major hurricane with sustained winds of near 120 m.p.h. on the 16th just west of Gulf Shores, Alabama. Ivan weakened as it moved inland, producing over 100 tornadoes and heavy rains across much of the southeastern United States, before merging with a frontal system over the Delmarva Peninsula on the 18th. While this would normally be the end of the story, the extratropical remnant low of Ivan split off from the frontal system and drifted southward in the western Atlantic for several days, crossed southern Florida, and re-entered the Gulf of Mexico on the 21st. The low re-acquired tropical characteristics, becoming a tropical storm for the second time on the 22nd in the central Gulf. Ivan weakened before it made its final landfall in southwestern Louisiana as a tropical depression on the 24th.

<u>September 25, 2004 Hurricane Jeanne:</u> The eye of Hurricane Jeanne made landfall near the southern end of Hutchinson Island, just east of Stuart, Florida, as a Category 3 storm at approximately 11:50 PM EDT on Saturday, 25 September 2004. Winds were estimated at 120 mph, with a minimum central pressure of 947 millibars. Many of the intense rain bands and strong winds were felt within the two hours prior to landfall. Tropical Storm Jeanne slowly progressed across Citrus, Levy, Gilchrist, and Lafayette Counties on Sunday, hugging the coast of the Florida Big Bend, and positioning itself just east of the capitol in western Madison County by 5 AM EDT Monday morning. Radar rainfall estimates from 25 September to 27 September of 5 to 8 inches covered a large swath of east central Florida. The highest values occurred across southern sections of Brevard and Osceola Counties, where 11 to 13 inches of rainfall was estimated.

<u>August 24, 2008 Tropical Storm Fay:</u> Fay was a long-lived tropical storm that made eight landfalls – including a record four landfalls in Florida – and produced torrential rainfall that caused extensive floods across the Dominican Republic, Haiti, Cuba, and Florida. Heavy rainfall was the most notable hazard caused by Tropical Storm Fay. There were numerous

rainfall reports of more than 20 in reported across east-central Florida and amounts in excess of 10 in were common elsewhere across the central and northern Florida, southwestern Georgia, and southeastern Alabama.

September 6, 2016 Hurricane Hermine: Hurricane Hermine was the first hurricane to make landfall in Florida since Hurricane Wilma in 2005, and the first to develop in the Gulf of Mexico since Hurricane Ingrid in 2013. The ninth tropical depression, eighth named storm, and fourth hurricane of the 2016 Atlantic hurricane season, Hermine developed in the Florida Straits on August 28 from a long-tracked tropical wave. The precursor system dropped heavy rainfall in portions of the Caribbean, especially the Dominican Republic and Cuba. After being designated on August 29, Hermine shifted northeastwards due to a trough over Georgia and steadily intensified into an 80 mph Category 1 hurricane just before making landfall in the Florida Panhandle during September 2. After moving inland, Hermine quickly weakened and transitioned into an extratropical cyclone on September 3 near the Outer Banks of North Carolina. The remnant system meandered offshore the Northeastern United States before dissipating over southeastern Massachusetts on September 8.

September 5, 2016 Hurricane Irma: Hurricane Irma was an extremely powerful Cape Verde hurricane that caused widespread destruction across its path in September 2017. Irma was the first Category 5 hurricane to strike the Leeward Islands on record, followed by Maria two weeks later. At the time, it was considered as the most powerful hurricane on record in the open Atlantic region, outside of the Caribbean Sea and Gulf of Mexico until it was surpassed by Hurricane Dorian two years later. It was also the third strongest Atlantic hurricane at landfall ever recorded, just behind the 1935 Labor Day Hurricane and Hurricane Dorian.

Irma developed from a tropical wave near the Cape Verde Islands on August 30. Favorable conditions allowed Irma to rapidly intensify into a Category 3 hurricane on the Saffir–Simpson wind scale by late on August 31. The storm's intensity fluctuated between Categories 2 and 3 for the next several days, due to a series of eyewall replacement cycles. On September 4, Irma resumed intensifying, becoming a Category 5 hurricane by early on the next day. Early on September 6, Irma peaked with 1-minute sustained winds of 180 mph and a minimum pressure of 914 hPa. Irma was the second-most intense tropical cyclone worldwide in 2017 in terms of barometric pressure, and the strongest worldwide in 2017 in terms of wind speed. Another eyewall replacement cycle caused Irma to weaken back to a Category 4 hurricane, but the storm re-attained Category 5 status before making landfall in Cuba. Although Irma briefly weakened to a Category 2 storm while making landfall on Cuba, the system re-intensified to Category 4 status as it crossed the warm waters of the Straits of Florida, before making landfall on Cudjoe Key on September 10. Irma then weakened to Category 3 status, prior to another landfall in Florida on Marco Island later that day. The system degraded into a remnant low over Alabama and ultimately dissipated on September 13 over Missouri.

August 30, 2019 Hurricane Dorian: Hurricane Dorian was an extremely powerful and devastating Category 5 Atlantic hurricane, which became the most intense tropical cyclone on record to strike the Bahamas, and is also regarded as the worst natural disaster in the country's recorded history.[1] It was also one of the most powerful hurricanes recorded in the Atlantic Ocean in terms of 1-minute sustained winds, with those winds peaking at 185 mph (295 km/h). In addition, Dorian surpassed Hurricane Irma of 2017 to become the most powerful Atlantic hurricane on record outside of the Caribbean Sea. Dorian was the fourth named storm, second hurricane, the first major hurricane, and the first Category 5 hurricane of the 2019 Atlantic hurricane season. Dorian struck the Abaco Islands on September 1 with maximum sustained winds of 185 mph (295 km/h), tying with the 1935 Labor Day hurricane for the highest wind speeds of an Atlantic hurricane ever recorded at landfall. Dorian went on to strike Grand Bahama at similar intensity, stalling just north of the territory with unrelenting winds for at least 24 hours. The resultant damage to these islands was catastrophic; most structures were flattened or swept to sea, and at least 70,000 people were left homeless. After it ravaged through the Bahamas, Dorian proceeded along the coasts of the Southeastern United States and Atlantic Canada, leaving behind considerable damage and economic losses in those regions.

Dorian developed from a tropical wave on August 24 over the Central Atlantic. The storm moved through the Lesser Antilles and became a hurricane north of the Greater Antilles on August 28. Dorian proceeded to undergo rapid intensification over the following days, before reaching its peak as a Category 5 hurricane with one-minute sustained winds of 185 mph (295 km/h) and a minimum central pressure of 910 millibars (26.87 inHg) by September 1. It made landfall in the Bahamas in Elbow Cay, just east of Abaco Island, and again on Grand Bahama several hours later, where it remained nearly stationary for the next day or so. After weakening considerably, Dorian began moving northwestward on September 3, parallel to the east coast of Florida. Dwindling in strength, the hurricane turned to the northeast the next day and made landfall on Cape Hatteras at Category 2 intensity on September 6. Dorian transitioned into an extratropical cyclone on September 7, before striking first Nova Scotia and then Newfoundland with hurricane-force winds on the next day. The storm finally dissipated near Greenland on September 10.

September 11, 2020 Hurricane Eta: Hurricane Eta was the record-tying twenty-eighth named storm, twelfth hurricane and fifth major hurricane of the extremely active 2020 Atlantic hurricane season, Eta originated from a vigorous tropical wave in the eastern Caribbean Sea on October 31. The system rapidly organized as it progressed west, with the cyclone ultimately becoming a Category 4 hurricane on November 3. With a peak intensity of 150 mph (240 km/h) and 923 mbar (hPa; 27.26 inHg), it was the third most intense November Atlantic hurricane on record, behind the 1932 Cuba hurricane and Hurricane Iota which formed just two weeks later. Some weakening took place as the system made landfall near Puerto Cabezas, Nicaragua, late that same day. Eta rapidly weakened to a tropical depression as it meandered across Central America for two days, before moving north over water. The storm later reorganized over the Caribbean as it accelerated toward Cuba on November 7, making a second landfall on the next day. Over the next five days, the system moved erratically, making a third landfall in the Florida Keys, on November 9, before slowing down and making a counterclockwise loop in the southern Gulf of Mexico, just off the coast of Cuba, with the storm's intensity fluctuating along the way. After briefly regaining hurricane strength on November 11, the system weakened back to a tropical storm once more, before making a fourth landfall on Florida on the next day, and proceeding to accelerate northeastward. Eta subsequently became extratropical on November 13, before dissipating off the coast of the Eastern United States on the next day.

Once the system began to reorganize in the Caribbean, tropical storm watches were issued on November 5, in the Cayman Islands. More watches were issued in parts of Cuba, the northwestern Bahamas, and South Florida. Eta brought heavy rainfall and gusty winds to the Cayman Islands and Cuba, the latter of which was already dealing with overflowing rivers that prompted evacuations. Heavy rainfall and tropical-storm force winds were recorded across all of the Florida Keys, South Florida and the southern half of Central Florida, bringing widespread flooding. Eta's second approach and landfall brought storm surge and gusty winds to the west coast of Central Florida and supplemental rainfall to northern Florida. One person was killed in Florida after being electrocuted in floodwaters from Eta.

Floods

A. Description of Hazard

FEMA defines a flood as a general and temporary condition of partial or complete inundation of normally dry land areas from:

1) The overflow of inland or tidal waters;
2) The unusual and rapid accumulation or runoff of surface waters from any source;
3) Mudslides (i.e., mudflows) which are proximately caused by flooding and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

A flood inundates a floodplain. Most floods fall into three major categories: riverine flooding, coastal flooding, and shallow flooding. Alluvial fan flooding is another type of flooding more common in the mountainous western states.

Florida historically and annually is affected by a large number of tropical weather systems. While storm surge has the greatest potential for loss of life, recent research indicates that inland flooding was responsible for the largest number of fatalities over the last 30 years. Studies show that 59 percent of the tropical cyclone deaths in the United States resulted from severe inland flooding.

Many parts of Florida are poorly drained and, in fact, drainage improvements are often discouraged under the current regulatory structures. Florida's Water Management Districts have adopted policies to encourage percolation of rainfall into the ground wherever possible. Placing fill into low lying areas is also discouraged through regulatory means. These policies make flooding conditions and situations difficult to mitigate through drainage improvements or engineering solutions. Avoidance of low lying areas is the most effective mitigation against flood damage.

B. Location and Extent

As a weather event, the location and/or extent of cumulative rainfall amounts can occur anywhere within the Central Florida area. Historical floods from other Florida locations are described below since Marion County is no less vulnerable than those other areas. Every jurisdiction in Marion County experiences a comparable amount of rainfall per year. The table below displays data collected from weather services around the County and includes annual average rainfall for each jurisdiction. Rainfall amounts that exceed these annual averages in excess of 2-3 inches are associated with higher risk of flooding especially in vulnerable areas.

Table VI-12 Average Annual Rainfall	
Jurisdiction	Rainfall (inches)
Ocala	51.9
Marion County	51.3
Dunnellon	53.4
McIntosh	50.7
Belleview	52.3
Reddick	50.8

Dam failure can also cause flood damage. The only dam with a potential threat to Marion County is the Moss Bluff Dam on the upper Ocklawaha River. However, failure at the Moss Bluff Dam would be expected to cause minimal property damage due the large amount of publicly owned preservation land throughout the large marsh complexes of the upper Ocklawaha River.

C. Description of Vulnerabilities

For Florida, as a whole, flooding is a continuous problem. While flooding results from either storm surge associated with hurricanes, riverbank overflow or ponding, it is the latter two that represent a hazard to Marion County. Any structure type that is located within a flood zone and is not elevated or is not protected by levees, beams, or floodwalls is vulnerable to flood damage.

Heavy rains and the subsequent inability of a river to accommodate the added runoff almost always cause flooding resulting from riverbank overflow. There are several areas within Marion County that would be similarly affected, including the Ocklawaha and Withlacoochee Rivers. This problem is compounded when heavy rains fell simultaneously in counties surrounding Marion County, thus adding to the volume of runoff received by local rivers. Ponding occurs in low areas that are either poorly drained or supersaturated soils (high water table). This type of chronic flooding is prevalent in all areas of the County where the drainage basins are located.

A watershed management program (WMP) has been implemented county-wide and provides a holistic view of both water quality and quantity problems. There are 22 watersheds on the Southwest Florida Water Management District (SWFWMD) side of the county and 10 planning units on the (St. Johns Water Management District (SJRWMD) side of the county. Refer to Map VI-8.

The WMP provides mapping of the stormwater management system which identifies where stormwater runoff flows, what type of land uses the runoff flows over, and where the runoff discharges whether to surface water or groundwater. Key documents generated from the WMP are the Floodplain Level of Service (LOS) Report, the Surface Water Resource Assessment (SWRA) Report and the Capital Projects Report. The Floodplain LOS Report identifies flood prone areas throughout the county and assigns a LOS based on the storm event at which a road floods. The SWRA Report provides water quality and quantity trends within the watershed and identifies areas of concern based on discharge locations, pollutant load, etc. The Capital Projects Report identifies corrective actions to mitigate locations of concern found in the SWRA.

In 2017, FEMA updated the Flood Insurance Rate Maps (FIRM) to reflect new data. As a result, there are additional properties now included in flood zones in the County. Map VI-2 shows the location of the FIRM Flood Zones for Marion County. Flood prone areas in the County are shown on Map VI-3

D. Vulnerable Critical Facilities

Vulnerable Critical Facilities located within the FEMA 100-year floodplain are listed above in the discussion of hurricane vulnerabilities.

E. Probability

Like other weather events included in this section, the rainfall amounts that cause flood conditions are considered a part of the Central Florida climate. Often heavy rainfall is isolated in a small area of a few square miles with severe results that require shelter activation. The probability of severe rainfall events to be a hazard situation is high, as these conditions are met at least once per year, especially in vulnerable areas.

F. History

A history of known flood events is presented below.

Table VI-13 Historical Flood Events in Marion County 1994-Current

Location or County	Date	Type	Deaths	Injuries	Property Damage
Ocklawaha	6/16/1994	Flash Flood	0	1	$5,000
Peninsular	9/15/1994	Flooding	0	0	$500,000
McIntosh	6/26/1995	Urban Flood	0	0	$2,000
Marion	10/11/1995	Flood	0	0	$55,000

Marion	10/14/1995	Flood	0	0	$10,000
Ocala	6/26/1997	Flood	0	0	$2,000
Ocala	1/8/1998	Flood	0	0	$20,000
Countywide	2/17/1998	Flood	0	0	$0
Countywide	3/1/1998	Flood	0	0	$25,500,000
Countywide	3/18/1998	Flood	0	0	$30,000
Ocala	3/19/1998	Flood	0	0	$8,000
Ocala	8/18/1998	Flood	0	0	$3,000
Ocala	6/11/1999	Flood	0	0	$3,000
Belleview	9/27/1999	Flood	0	0	$600,000
Countywide	9/27/1999	Flood	0	0	$15,000
West Portion	9/6/2000	Flood	0	0	$5,000
Ocala	6/26/2001	Flood	0	0	$0
Ocala	6/22/2002	Flash Flood	0	0	$0
Dunnellon	10/12/2002	Urban Stream Fld	0	0	$0
Ocala	6/13/2004	Flash Flood	0	0	$0
Silver Springs	6/13/2004	Flash Flood	0	0	$0
Ocala	6/19/2006	Flood	0	0	$0
Ocala	3/11/2010	Flood	0	0	$1,000
Chatmire	5/28/2012	Flood	0	0	$10,000
Belleview	6/24/2012	Flood	0	0	$300,000
Montague	8/23/2013	Flood	0	0	$100
Burbank	7/20/2017	Flood	0	0	$0
Martel	7/21/2018	Flood	0	0	$500
Cotton Plant	8/25/2018	Flood	0	0	$0
Dunnellon	12/14/2018	Flood	0	0	$0
Kendrick	12/14/2018	Flood	0	0	$0
Ocala	12/14/2018	Flood	0	0	$0
Ocala West	7/5/2019	Flood	0	0	$0
Totals			**0**	**1**	**$27,069,600**

Wildfire

A. Description of Hazard

A wildfire is an uncontrolled fire that spreads through vegetative fuels. Vegetative fuels include those that are characteristic of wildlands, such as trees, grasses, understory growth, and ground litter; and those that are purchased at nurseries for home or community landscaping purposes, including trees, mulch, grasses, and ornamental plants. In addition to the presence of fuel, the occurrence and severity of wildfires are governed by weather, such as high temperatures, low humidity, high winds, and drought conditions; and topography. Different combinations of these factors contribute to the potential severity of wildfires.

In the wildland/urban interface, buildings and other human development intermingle with vegetative fuels, exposing the development to potential fire damage when wildfires occur. Other factors that affect the vulnerability of development to wildfire are location, weather conditions during the wildfire, and the fire-suppression capabilities of local response agencies.

Wildfires can be a natural or a man-made hazard. Wildfires have burned across the woodlands of Florida for centuries and are part of the natural management of much of Florida's ecosystems. Wildfires caused by lightning are common in Central Florida, especially in association with weather patterns that create intense thunderstorms.

Forest fires from lightning account for a large percentage of Florida's wildfires during the summer months. However, people are still the leading cause of wildfires year-round in Florida. Human activities causing wildfires include: escaped non-authorized pile burns, escaped non-authorized and authorized yard trash burns and ignition by misuse of agricultural equipment. Potentially, any human activity that employs combustion can start a wildfire.

B. Location and Extent

Approximately one-third of Marion County is U. S. Forest land which is located generally east of the Ocklawaha River. Additionally, large portions of the County are dedicated to agriculture uses especially in the northwest portion of the County which is located within a Farmland Preservation Area. These agricultural areas are intermingled with populated areas as well as high-value property. The Florida Highlands, Lake Tropicana, Marion Oaks, Orange Springs and Silver Springs Shores are all populated areas that are either rural or have rural components and are at high risk for potential damage due to their proximity to naturally forested lands. Areas with few trees such as urban areas, which include, the City of Ocala, Belleview and portions of unincorporated County near the urban core which are densely developed have a low vulnerability to wildfire. The following table is derived from the Florida Forest Service.

Table VI-14 2010-2020 Wildfire Origins, Frequencies & Acres Impacted

CAUSE	FREQUENCY	%	ACRES	%
Campfire	7	1.21	8.90	0.15
Children	14	2.40	52.50	0.87
Debris Burn	0	0.00	0.00	0.00
Debris Burn--Authorized--Broadcast Acreage	7	1.21	140.80	2.35
Debris Burn--Authorized--Piles	31	5.35	183.90	3.06
Debris Burn--Authorized--Yard Trash	14	2.42	77.70	1.29
Debris Burn—Non-Authorized--Broadcast Acreage	7	1.21	60.00	1.00
Debris Burn—Non-Authorized--Piles	86	14.85	628.40	10.47
Debris Burn—Non-Authorized--Yard Trash	42	7.25	357.00	5.95

Equipment Use	0	0.00	0.00	0.00
Equipment--Agriculture	23	3.97	272.40	4.54
Equipment--Logging	6	1.04	56.90	0.95
Equipment--Recreation	4	0.69	168.30	2.80
Equipment--Transportation	13	2.25	55.30	0.92
Incendiary	92	15.89	805.10	13.41
Lightning	104	17.96	1,550.90	25.84
Miscellaneous--Breakout	4	0.69	119.30	1.99
Miscellaneous--Electric Fence	0	0.00	0.00	0.00
Miscellaneous--Fireworks	2	0.35	5.50	0.09
Miscellaneous--Power lines	25	4.32	62.50	1.04
Miscellaneous--Structure	2	0.35	0.80	0.01
Miscellaneous--Other	24	4.15	119.80	2.00
Railroad	0	0.00	0.00	0.00
Smoking	2	0.35	3.00	0.05
Unknown	70	12.09	1,274.00	21.22
TOTAL	**579**	**100.00**	**6,003.00**	**100.00**

Source: Marion County Fire Rescue; Florida Forest Service

C. Description of Vulnerabilities

Dry weather and drought conditions are major contributing factors in the size and severity of a wildfire. Fuel load is a factor in fire intensity and speaks to the need for well managed forest lands. As stated previously, Marion County has a large rural population. Those people and facilities located in rural, wooded areas are particularly vulnerable to wildfire. Subdivisions should be designed using Firewise principles and homeowners need to create at least 30 feet of cleared area around the house for defensible space. This house-by-house mitigation strategy will be the most effective means to reduce the level of wildfire vulnerability in Marion County due to the large size of the County and the rural distribution of the unincorporated population.

D. Vulnerable Critical Facilities

While the Ocala National Forest comprises less of the Marion County forest areas, it is considered the area of greatest vulnerability in Marion County. The boundaries of the western edge of the Forest are not defined by a clear line of ownership but are scattered among out-parcels of residential use. There are several clusters of significant populations located within the Forest boundaries. These populations and the critical facilities located in or near the Ocala National Forest are vulnerable to wildfires. Appropriate mitigation can come in the form of enhanced warning systems and the establishment of defensible spaces around all structures.

E. Probability

Florida's typical fire season is from January through May. The potential for wildfires increases dramatically during relatively dry months. These dry months, combined with low humidity and high winds, result in the highest number of reported wildfires. The largest number of lightning-caused fires occurs in July, coinciding with the peak of the thunderstorm season. Central Florida is known for the greatest concentration of cloud-to-ground lightning strikes in the world.

The wildfire potential map labeled Map VI-4 was created by using the Florida Wildland Fire Risk Assessment web application. Each of the 90 meter analysis areas was assigned a risk level between 1-9 based on the ability of a fire to start and spread in a given terrain type as well as fire spreading potential during a dry climatic year.

F. History

The following table identifies the origins, frequencies and acres impacted by wildfires in Marion County from 1998 to 2020.

Table VI-16
Historical Wildfire Events, Marion County 1998-2020

Location	Date	Type	Deaths	Injuries	Property Damage
OCALA	7/10/1998	Wildfire	0	0	$0
COUNTYWIDE	3/9/1999	Wildfire	0	0	$0
ANTHONY	3/15/1999	Wildfire	0	0	$0
COUNTYWIDE	3/15/1999	Wildfire	0	0	$0
COUNTYWIDE	3/24/1999	Wildfire	0	1	$0
COUNTYWIDE	4/1/1999	Wildfire	0	0	$0
COUNTYWIDE	4/5/1999	Wildfire	0	0	$0
COUNTYWIDE	4/19/1999	Wildfire	0	0	$0
COUNTYWIDE	4/21/1999	Wildfire	0	0	$0
COUNTYWIDE	4/25/1999	Wildfire	0	0	$0
COUNTYWIDE	4/28/1999	Wildfire	0	0	$0
COUNTYWIDE	5/9/1999	Wildfire	0	0	$0
COUNTYWIDE	5/18/1999	Wildfire	0	0	$0
COUNTYWIDE	5/23/1999	Wildfire	0	0	$0
COUNTYWIDE	5/28/1999	Wildfire	0	0	$0
COUNTYWIDE	5/28/2000	Wildfire	0	0	$100,000
CITRA	4/22/2001	Wildfire	0	0	$0
COUNTYWIDE	5/6/2008	Wildfire	0	0	$0

COUNTYWIDE	3/10/2009	Wildfire	0	0	$0
COUNTYWIDE	10/16/2010	Wildfire	0	0	$0
COUNTYWIDE	2/25/2011	Wildfire	0	0	$0
COUNTYWIDE	4/4/2011	Wildfire	0	0	$0
COUNTYWIDE	4/16/2011	Wildfire	0	0	$0
COUNTYWIDE	5/1/2011	Wildfire	0	0	$0
COUNTYWIDE	5/5/2012	Wildfire	0	0	$0
COUNTYWIDE	5/26/2012	Wildfire	0	0	$0
COUNTYWIDE	3/2/2013	Wildfire	0	0	$0
COUNTYWIDE	3/31/2017	Wildfire	0	0	$0
COUNTYWIDE	4/1/2017	Wildfire	0	0	$0
COUNTYWIDE	5/22/2019	Wildfire	0	0	$0
COUNTYWIDE	5/3/2020	Wildfire	0	0	$0
	Total		0	1	$100,000

NOAA, National Climate Data Center

Sinkholes

A. Description of Hazard

A sinkhole is a natural depression or hole in the surface topography caused by the removal of soil or bedrock, often both, by water. Sinkholes may vary in size from less than a meter to several hundred meters both in diameter and depth, and vary in form from soil-lined bowls to bedrock-edged chasms. They may be formed gradually or suddenly, and are found worldwide.

Sinkholes are a common feature of Florida's landscape. They are only one of many kinds of karst landforms, which include caves, disappearing streams, springs, and underground drainage systems, all of which occur in Florida. Karst is a generic term which refers to the characteristic terrain produced by erosional processes associated with the chemical weathering and dissolution of limestone or dolomite, the two most common carbonate rocks in Florida. Limestone in Florida is porous, allowing the acidic water to percolate through their strata, dissolving some limestone and carrying it away in solution. Over eons of time, this persistent erosional process has created extensive underground voids and drainage systems in much of the carbonate rocks throughout the state. Collapse of overlying sediments into the underground cavities produces sinkholes.

“Catastrophic ground cover collapse” is defined as “geological activity that results in all of the following: 1). The abrupt collapse of the ground cover; 2). A depression in the ground cover clearly visible to the naked eye; 3). Structural damage to the building including the foundation; and 4). The insured structure being condemned and ordered to be vacated by the government agency authorized by law to issue such an order for that structure.”

Sinkholes are one of Florida’s predominant landform features. Development may be sudden and result in property damage or loss of life. Florida has more sinkholes than any other state in the nation. However, most sinkholes that are of a size or location to be considered a hazard, progress to their maximum size over 2 to 3 days giving ample time for evacuation of structures and appropriate levels of emergency response. Florida's average sinkhole size is 3 to 4 feet across, 4 to 5 feet deep.

B. Location and Extent

All jurisdictions in Marion County are susceptible to sinkhole events.

The eastern half of Marion County is sparsely populated and mainly consists of the Ocala National Forest. Geologically, the "Hawthorn Layer," which is an impermeable layer of clay over the aquifer, underlies this area and significantly reduces the likelihood of sinkholes. The Hawthorn layer also reduces the vulnerability of the aquifer as our drinking water supply.

The western half of Marion County is a high recharge area of permeable sands and an "unconfined aquifer" with an increased vulnerability to HAZMAT spills. The material covering the aquifer is 30 to 200 feet thick, consisting mainly of in-cohesive and permeable sand. Sinkholes develop gradually and are small, shallow and few. Sinkhole sizes in Marion County range from over 200' to less than 10' wide however, the overwhelming majority of sinkholes fall into the under 10' wide range. The majority of sinkholes in the County are located in the most populous areas increasing the risk from a large sinkhole forming in an urbanized area.

C. Description of Vulnerabilities

Marion County sinkhole potential is mainly focused in the urbanized area around Ocala. Areas in the Ocala National Forest show no vulnerability. Any type of structure is vulnerable to sinkholes. Vulnerability depends more on location and proximity of the structure to existing sinkhole formations than to the type of structure or building materials.

D. Vulnerable Critical Facilities

Vulnerable critical facilities are those facilities that are near or adjacent to existing sinkhole activity. There are no known vulnerable critical facilities at this time.

E. Probability

Marion County averages approximately 12 sinkhole events annually. Probability for sinkhole formation in Marion County is generally low throughout the County with the exception of a central area within the City of Ocala boundaries where chances for sinkhole formation are higher due to a greater concentration of karst geology and more permeable soil conditions than in other areas. Shown in Map VI-5 is an analysis of sinkhole vulnerability provided by MEMPHIS (Mapping for Emergency Management Parallel Hazard Information System). The methodology for determining risk potential relied mainly on proximity to existing sinkholes and other geologic features.

F. History

The Florida Geological Survey has recorded 412 sinkholes or subsidence incidents in Marion County. Refer to Appendix B.

Riverine Erosion

A. Description of Hazard

Riverine erosion is damage from water moving at a velocity to cut into the land and transport soil into the mainstream of the river or collapse the banks.

B. Location and Extent

The following rivers may be susceptible to riverine erosion.

- Unincorporated Marion County – Withlacoochee River, Rainbow River, Silver River, Ocklawaha River.
- City of Dunnellon – Rainbow River.

Riverine erosion requires swift moving water to create damage at a level to be considered a disaster. The small elevation drop of the Ocklawaha and the Withlacoochee River valleys do not allow for water to reach a velocity to create severe erosion. Riverine erosion is typically measured by the cubic meters of sediment erosion per year. Various models exist to predict the extent of riverine erosion including the factor of safety approach, bank erosion hazard index (BEHI) and near-bank stress (NBS).

C. Description of Vulnerabilities

Without the velocity to cause damage quickly, the potential erosion damage is by slow erosion over time. Vulnerable facilities are limited to structures that are in, or close to, the water at normal levels and flow rates, including bridges, dams, docks, and boat ramps. Certain residential structures that are built on pilings are also subject to erosion potential. Appropriate mitigation for erosion is periodic inspections of water related structures.

D. Vulnerable Critical Facilities

There are no critical facilities in the County that demonstrate an increased vulnerability to riverine erosion. Dunnellon City Hall is located on the Withlacoochee River but is well above flood stage.

E. Probability

Marion County has not experienced a riverine erosion event in recorded history. Probability is Low for erosion incidents on the Ocklawaha, Silver, and Rainbow Rivers in Marion County as they are all slow moving rivers.

F. History

There is no known history of riverine erosion hazard events in Marion County.

Drought / Extreme Heat

A. Description of Hazard

Drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield. Drought risk is based on a combination of the frequency, severity, and spatial extent of drought (the physical nature of drought) and the degree to which a population or activity is vulnerable to the effects of drought. The degree of a region's vulnerability depends on the environmental and social characteristics of the region and is measured by their ability to anticipate, cope with, resist, and recover from drought. Society's vulnerability to drought is determined by a wide range of factors, both physical and social, such as demographic trends and geographic characteristics. People and activities will be affected in different ways by different hazards. Understanding and reducing these vulnerabilities is essential in preparing for and dealing with drought.

Extreme Heat

A heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity. A heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season. The term is applied both to routine weather variations and to extraordinary spells of heat which may occur only rarely. Worldwide, severe heat waves have caused catastrophic crop failures, thousands of deaths from hyperthermia, and widespread power outages due to increased use of air conditioning. A heat wave is considered extreme weather, and a danger because heat and sunlight may overheat the human body.

Heat kills by pushing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."

Drought and heat waves are weather events and, like other weather related hazards, are unpredictable. However, it is expected that droughts and heat waves are a normal part of the long-term weather pattern that is typical of Central Florida's climate. These climatic conditions can be deadly to people and animals that are unable to escape the heat or hydrate their bodies properly. When temperatures reach 100+ degrees, special needs populations and households without air conditioning are vulnerable.

B. Location and Extent

All jurisdictions in Marion County are vulnerable to extreme heat and drought events.

C. History

While Summer days in Marion County can reach temperatures in excess of one-hundred degrees Fahrenheit, sustained periods of four or more consecutive days is not. There are records of individual days and/or two-day events surpassing one-hundred degrees during the 2015 to 2020 time period, but there were no recorded events of at least four or more days of sustained temperatures surpassing that threshold.

Table VI-17 Drought Severity Classification							
		Ranges					
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30

D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Short-term drought indicator blends focus on 1-3 month precipitation. Long-term blends focus on 6-60 months. Additional indices used, mainly during the growing season, include the USDA/NASS Topsoil Moisture, Keetch-Byram Drought Index (KBDI), and NOAA/NESDIS satellite Vegetation Health Indices. Indices used primarily during the snow season and in the West include snow water content, river basin precipitation, and the Surface Water Supply Index (SWSI). Other indicators include groundwater levels, reservoir storage, and pasture/range conditions.

Heat Index/Heat Disorders: Possible Heat Disorders for People in Higher Risk Groups.

- Heat Index of 130° OR Higher: heatstroke/sunstroke highly higher likely with continued exposure,
- Heat index of 105°- 130°: sunstroke, heat cramps or heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity.
- Heat index of 90°- 105°: sunstroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity.
- Heat index of 80° - 90°: fatigue possible with prolonged exposure and/or physical activity

Based on the latest research findings, the NWS has devised the "Heat Index" (HI), (sometimes referred to as the "apparent temperature"). The HI, given in degrees F, is an accurate measure of how hot it really feels when relative humidity (RH) is added to the actual air temperature.

C. Description of Vulnerabilities

Crop loss is the greatest economic concern especially from those crops that are major exports. The vulnerability is greater in the various types of crops that are more susceptible to drought than others. Newly planted crops are extremely vulnerable to drought. Livestock must also be monitored and managed properly in cases of severe drought. Farmers in general are particularly affected by drought conditions as the water table falls and deeper wells need to be drilled for irrigation purposes.

D. Vulnerable Critical Facilities

Of course, water supply is a great concern during a drought and utility managers must be prepared to protect it by instituting water restrictions when needed. During extended periods of extreme heat power supplies also may be depleted due to the widespread use of air conditioning systems. Appropriate mitigation for the potential loss of power is to maintain backup generators for critical facilities.

E. Probability

Map VI-6 and the above referenced table shows the drought potential across the state. According to the data, Marion County is just outside the D0-D4 drought range indicating that while the County may not be prone to droughts, there is an increased probability for drought especially in the event of decreased rainfall.

The probability for extreme heat is low for Marion County. Four fatalities have been attributed to extreme heat in Florida in the past decade. Despite the probability for a fatal extreme heat event being relatively low, Marion County does experience 90+ degree temperatures during the summer months thereby increasing the potential risk of less severe adverse but still serious effects from heat.

F. History

There have been no recorded drought events in Marion County in the past 10 years.

Tornado

A. Description of Tornado Hazards

According to the Glossary of Meteorology (AMS 2000), a tornado is "a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud." A tornado is characterized by the isolated nature of extremely high winds of up to 500 mph. When compared with other states, Florida ranks 4th in the number of tornado events; 19th in tornado deaths; 11th in tornado injuries; and 18th in damages. These rankings are based upon data collected for all states and territories for tornado events between 1950-1995 (SPC, 2002). The northern portion of the state's Gulf Coast including Tampa and Tallahassee along with the Panhandle region have generally experienced more tornadoes than other areas of the state, primarily due to a higher frequency of thunderstorms making their way northeast through the Gulf of Mexico.

B. Location and Extent

Table VI-18 Enhanced F Scale Damage Indicators		
Number (Details Linked)	Damage Indicator	Abbreviation
1	Small Barns, Farm Outbuildings	Sbo
2	One- Or Two-Family Residences	Fr12
3	Single-Wide Mobile Home (Mhsw)	Mhsw
4	Double-Wide Mobile Home	Mhdw
5	Apt, Condo, Townhouse (3 Stories Or Less)	Act
6	Motel	M
7	Masonry Apt. Or Motel	Mam
8	Small Retail Bldg. (Fast Food)	Srb
9	Small Professional (Doctor Office, Branch Bank)	Spb
10	Strip Mall	Sm
11	Large Shopping Mall	Lsm
12	Large, Isolated ("Big Box") Retail Bldg.	Lirb
13	Automobile Showroom	Asr
14	Automotive Service Building	Asb
15	School - 1-Story Elementary (Interior Or Exterior	Es
16	School - Jr. Or Sr. High School	Jhsh
17	Low-Rise (1-4 Story) Bldg.	Lrb
18	Mid-Rise (5-20 Story) Bldg.	Mrb
19	High-Rise (Over 20 Stories)	Hrb
20	Institutional Bldg. (Hospital, Govt. Or University)	Ib
21	Metal Building System	Mbs
22	Service Station Canopy	Ssc
23	Warehouse (Tilt-Up Walls Or Heavy Timber)	Whb
24	Transmission Line Tower	Tlt
25	Free-Standing Tower	Fst
26	Free Standing Pole (Light, Flag, Luminary)	Fsp
27	Tree - Hardwood	Th
28	Tree - Softwood	Ts

Tornado extent is measured using the Enhanced Fujita Scale developed in 2007 and based on the original Fujita Scale. The

Enhanced F-scale still is a set of wind estimates (not measurements) based on damage. The scale uses three-second gusts estimated at the point of damage based on a judgment of 8 levels of damage to the 28 indicators listed below.

Table VI-19 Enhanced Fujita Scale

Fujita Scale			Derived Ef Scale		Operational Ef Scale	
F Number	Fastest 1/4-Mile (Mph)	3 Second Gust (Mph)	Ef Number	3 Second Gust (Mph)	Ef Number	3 Second Gust (Mph)
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Due to the unpredictable pattern of tornadoes, and because the entire state, has a relatively high reoccurrence frequency, the entire County is vulnerable to tornado- induced damage. The MEMPHIS (Mapping for Emergency Management Parallel Information System) shows a level of increased tornado vulnerability for the southeast corner of the County, mostly in the Ocala National Forest.

C. Description of Vulnerabilities

The damage potential for a tornado increases as a function of population density. As the number of structures and people increase, the potential damage/injury rate increases. Mobile homes, poorly constructed or substandard housing apartment complexes are especially susceptible to damage from a tornado. Mobile homes and substandard housing are exceptionally susceptible because of their lack of resistance to high winds, and apartment complexes and low rent projects because of their size and densities. All of the incorporated municipalities, as well as the unincorporated urbanized area of Marion County is vulnerable.

D. Vulnerable Critical Facilities

Specific vulnerable facilities cannot be identified due to the unpredictable nature of tornadoes and also based on the awesome destructive power. Mobile homes are of the greatest concern but wood frame structures are also unable to withstand the intense winds of a tornado. Concrete block structures with wooden roof truss systems are also vulnerable. Appropriate mitigation for tornadoes is to construct a safe room specifically engineered for such use.

E. Probability

Marion County has experienced 55 tornadoes between 1959 and the year 2020. Florida has averaged approximately 75 tornadoes per year since 1950, with an average of 3 deaths and 60 injuries per year. The MEMPHIS system using the TAOS model calculates the annual probability of tornado activity in the southeastern portion of Marion County with a medium risk at one chance in 250. The remainder of the County has a lower vulnerability score of 1 in 500 chances per year. Annualized losses for wind damages are calculated for all wind events and a specific tornado damage estimate cannot be specified.

The annual probability of tornado activity in Marion County is depicted in Map VI-7.

F. History

Many tornadoes in Florida could have killed scores of people and caused millions of dollars in property damage, but most of these tornadoes did not hit heavily populated areas.

Table VI-20 Tornadic Events 2000-2020

LOCATIONS	DATE	TIME	FUJITA	DAMAGE
MARTEL	3/4/2001	720	F0	$80,000
OCALA	3/4/2001	750	F0	$150,000
OCALA	3/29/2001	1020	F2	$1,500,000
MOSS BLUFF	6/5/2001	1632	F0	$30,000
MARION OAKS	6/22/2002	1400	F0	$2,000
FELLOWSHIP	6/22/2003	1515	F0	$50,000
FELLOWSHIP	11/28/2003	1528	F0	$25,000
CITRA	9/5/2004	505	F0	$0
CANDLER	9/7/2004	900	F0	$0
DUNNELLON	9/15/2004	2045	F1	$0
OCALA ARPT	4/7/2005	1440	F1	$0
BELLEVIEW	6/18/2007	2007	EF0	$0
YORK	4/20/2015	1431	EF1	$0
MARION OAKS	7/23/2016	2000	EF0	$0
MARTEL	5/5/2019	1027	EF1	$0
DANKS CORNER	4/20/2020	835	EF1	$0

Severe Winter Storms

A. Description of Hazard

A winter storm is an event in which the dominant varieties of precipitation are forms that only occur at cold temperatures, such as snow or sleet, or a rainstorm where ground temperatures are cold enough to allow ice to form (i.e. freezing rain). A freeze is marked by low temperatures below the freezing point. Florida's agricultural production is seriously affected when temperatures remain below the freezing point. Marion County is located in USDA Plant Hardiness Zone 9 and typically experiences freezing weather between December 15 and March 15. Other than agricultural losses, hazards include icy roads and bridges, power outages, structural damage from fallen trees and limbs, and exposure of humans and animals to extreme cold.

B. Location and Extent

All jurisdictions in Marion County are susceptible to the severe winter storm hazard. As a weather event, the location and/or extent of winter storm conditions could develop anywhere within Central Florida. Historical events from other Florida locations are included below due to the fact that Marion County is no less vulnerable than those other areas that were severely affected by freezes or winter storms. The following table expresses wind chill, the combination of temperature and wind, to cool an object. The average winter temperature in Marion County in January is 58.6 degrees, however, the County experiences sub-freezing temperatures on average 3-4 times per year.

Table VI-21
Wind Chill Extent
Temperature (F)

Calm	**40**	**35**	**30**	**25**	**20**	**15**	**10**	**5**	**0**	**-5**	**-10**
5	36	31	25	19	13	7	1	-5	-11	-16	-22
10	34	27	21	15	9	3	-4	-10	-16	-22	-28
15	32	25	19	13	6	0	-7	-13	-19	-26	-32
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48

C. Description of Vulnerabilities

Protection of economically important crops and livestock hinges on the availability and accuracy of weather information. Low-income households are also vulnerable to winter storm conditions if heating systems don't exist or are not operable. Unfortunately, public works departments in Florida don't have the necessary resources to de-ice roads and bridges or remove snow from roadways so even small amounts of snow and ice become a concern.

D. Vulnerable Critical Facilities

Power supply facilities are the most vulnerable critical facilities because winter storms and those with an extended time frame cause peak use periods to be extended. The result is that power suppliers cannot meet demand and must generate a pattern of "rolling brown-outs" that create temporary power outages in a geographic pattern.

E. Probability

A moderate storm may be expected in Florida every one to two years. Severe storms, where the greatest numbers of winter crops are lost, may be expected on average once every 15 to 20 years. Florida has a history of winter storms with severe freezes. Since December 1889, there have been at least 20 recorded severe freezes.

F. History

Each winter, Florida faces the threat of at least a moderate freeze. This presents a problem for Florida as a whole because of the large amount of agricultural activity conducted throughout the state. For Marion County this activity is centered on the vegetable and citrus industries. Personal injury or death due to freezes is not considered a hazard except indirectly through fire caused by incorrect or careless use of space heaters, etc.

Florida does not have a long history of winter storms, but is quite susceptible to freezes. The most notable winter storm hit the entire state on March 13, 1993 and has become known as the "Storm of the Century" or the "No-Name Storm." The storm came across the Gulf of Mexico as a normal late winter cold front, but gathered strength just before landfall. Hitting in the early morning hours with gale force winds, rain, hail, snow, flooding, power outages and widespread freezing conditions, the storm marched across the state and had strong effects as far south as Cuba. These hazards are dealt with individually each winter, but their combined effects proved too much for recovery resources across the state. Each individual emergency situation was made worse by the lack of warning from the weather forecasters. The storm was a fluke and responders were not prepared. The best mitigation for winter storms and freezing conditions is accurate weather forecasting.

Historical Severe Winter Storms

- <u>December 24-25, 1989:</u> A presidential disaster declaration was issued and crop losses exceeded $18 million. Hardest hit counties were Lake, Alachua, Marion and Polk. The freeze affected over two million acres of agricultural and citrus crops.

- <u>December 30, 2000:</u> Widespread freezing temperatures were observed across most of West central and Southwest Florida during the late evening of December 30 through the mid-morning hours of December 31, 2000, causing $4.5 million in crop damage. Low temperatures in Marion and Levy Counties dropped from the upper teens to lower 20s with durations below freezing for up to thirteen hours. In Citrus, Sumter, Hernando and Pasco counties, low temperatures dropped into the middle 20s and remained below freezing for nine to twelve hours. In Polk, Hillsborough, Manatee, Sarasota, Hardee, De Soto and Highlands counties, low temperatures dropped into the middle 20s to upper 20s and remained below freezing for durations of six to nine hours. In Manatee and Hillsborough counties, freezing temperatures may have caused an estimated two-million dollars in damages to the tropical fish industry. In eastern Charlotte, eastern Lee and extreme northern Pinellas counties, temperatures dropped into the lower 30s and remained below freezing for periods of two to five hours. The freeze caused an estimated 25 to 50 percent damage to tomato, pepper and squash crops in Lee and Charlotte counties. Temperatures fell into the mid-20s over Glades, Hendry, eastern Collier, and western portions of Palm Beach and Broward counties and fell to 32 degrees in the farming areas of south Miami-Dade County. Approximately 2 million in damage to vegetable crops occurred in Hendry and Glades counties.

- <u>January 1, 2001:</u> The second and coldest night of a two-night freeze in south Florida saw minimum air temperatures ranging from 25 to 30 degrees over interior sections of the peninsula. In the metropolitan areas of Miami-Dade, Broward and Palm Beach counties temperatures were in the middle 30s over the western suburbs. An estimated $6 million in crop damage included losses to corn and newly planted sugar cane in Palm Beach County, and to certain vegetables in Hendry and eastern Collier counties. An additional $5.1 million in crop damage was caused by widespread freezing temperatures across most of In West central and Southwest Florida. Low temperatures in Levy County ranged from the low to middle 20s with total durations below freezing for up to thirteen hours. In Citrus, Sumter, Hernando and Pasco counties, low temperatures ranged from the middle to upper 20s and remained below freezing for durations of nine to thirteen hours. In Polk, Hillsborough, Highlands, Hardee and De Soto counties, low temperatures ranged from the middle to upper 20s and remained below freezing for durations of six to nine hours. Isolated pockets of low temperatures in the upper teens were observed in extreme rural southern Highlands County. In Hillsborough County, the freeze caused nearly four million dollars in damage to the tropical fish crop. In Sarasota, Manatee, Charlotte and Lee counties, low temperatures dropped into the upper 20s and lower 30s and remained below freezing for durations of five to seven hours. In Lee County, the freeze caused nearly three million dollars in damage to the squash and cucumber crop. In Charlotte County, the freeze caused at least 100 thousand dollars damage to the pepper crop.

- January 24, 2003: A plume of Arctic air produces widespread record low temperatures and light snow flurries along the eastern coastline. The snow is described as ocean-effect snow, identical to lake effect snow in that it occurs due to very cold air passing over relatively warm water temperatures. Snow flurries are reported in the air as far south as Fort Pierce. No major crop damages are reported.
- 2015-2020: Instances of minor individual freezes did occur between 2015 and 2020. However, no severe and/or sustained winter freezes were recorded, in Marion County, during this time period.

Man-Made Disasters

Societal and technological disasters originating from human activities include: hazardous materials incidents, radiological disasters, terrorist acts, civil disturbance, urban fires and explosions and power failures. These incidents generally increase in probability as the development density increases. Furthermore, the amount of damage potential also increases in direct proportion to the development density pattern within the impacted area.

Mitigation against man-made disasters includes an overall hardening of all critical facilities including security procedures. It is this focus on preparedness that local communities should implement to better prepare, respond and recover from man-made disasters. The best mitigation efforts are those that will increase the capacity of responding agencies to perform their roles more rapidly and with better efficiency. These mitigation efforts include but are not limited to: communications upgrades, computer upgrades, equipment technology upgrades, training, exercises, intergovernmental/interagency coordination and other measures to build up the capacity of each local responding agency. It is the policy of the LMS Working Group to support capacity building efforts based on their overall benefits of creating a more disaster resistant/resilient community.

Manmade Disasters

Armed Violence (Acts of Domestic or Foreign Terrorism, Civil Disturbance or Military Conflict)

Although the federal government recognizes that the United States has entered the post-Cold War era, federal planning guidelines on military threats are in transition. For hazard analysis purposes, it is prudent to scale back on the magnitude of nuclear events for other more likely scenarios. For instance, emergency management attention to other threats of armed violence, such as terrorism, is growing. Although potential targets are unpredictable, high-density population centers and military installations are the most likely. Terrorism increases the likelihood of mass casualty and mass evacuation from a target area. For threats of armed violence of any kind, it is very likely that joint jurisdictional management of the operation will take effect, coordinated at the county level between the Sheriff and FDLE. For any of these scenarios, some degree of state and federal involvement may occur. The lead federal agency may be FEMA or the Department of Justice.

Hazardous Materials (non-radioactive)

Hazardous sites can include, but are not limited to, propane storage facilities, natural gas pipeline terminals, fuel storage facilities and tank farms. All of these items can become extremely dangerous in a hurricane. Often propane tanks or fuel oil tanks are not secured in a hurricane proof fashion because they are not permanent structures. In the case that the structure is a facility versus a tank, there is a higher level of risk as well as protection. Identifying the location of these sites will assist the safe reentry into the area after a storm has passed. In addition it can help before a storm by indicating where a mitigation strategy should be implemented.

A hazardous material is any substance that, if released into the environment, would have a harmful and sometimes fatal effect on persons and animals coming into contact with it. Hazardous materials include highly flammable fuels, herbicides and pesticides, petroleum and related products, natural gas and chemicals. Radioactive substances, although they are frequently included within the category of hazardous materials, were not considered a hazard within this analysis, although there are relatively large numbers of facilities within Marion County, which use small amounts of these substances. In any case, there are over 3,000 hazardous chemicals licensed for transport by the US Department of Transportation, many of which would have a disastrous effect if released in an accident.

Marion County and its communities are vulnerable to the effects of hazardous materials accidents resulting from both transportation and industry. Light industry present in Ocala/Marion County, store and utilize materials such as natural gas, anhydrous ammonia, petroleum distillates, chlorine and pesticides on a daily basis and hazardous materials are transported to and through the County by rail, highway and air.

Storage Tanks - Information on the location of the facilities that have storage tanks either above ground or below is required by several government agencies. From this standpoint, finding the most up to date and accurate source of this data is important. These storage tanks are important to emergency management in regards to the substances contained. If any of these tanks with hazardous wastes are damaged in a hurricane, the effects to the population can last longer than general cleanup of debris. These contaminants must be contained as soon as possible for emergency managers to re-enter an area. If the contaminants are allowed to leak for long periods of time the groundwater can be affected which can further damage the water supply, environment and wildlife.

Hazardous Waste Generating Facilities - The Florida Department of Environmental Protection maintains a database of waste generating facilities. These facilities are classified as small quantity and large quantity generators. The number of generating facilities varies from county to county based on the land uses allowed by the counties. Counties with higher levels of industrial, agricultural and commercial land uses will normally have a greater number of hazardous generating facilities. The FDEP has identified 590 hazardous waste generating facilities in Marion County. Refer to Appendix C.

As stated previously, the best mitigation for man-made disasters is preparation and an overall expansion of the capacity of all responding agencies to deal appropriately with the unlimited variety of emergency situations.

Epidemic/Pandemic Response

The Marion County Department of Health Public Health Preparedness Team is responsible for planning and coordinating the response to epidemic/pandemic conditions affecting the public within Marion County. The agency reviews the recommended guidelines from the Center for Disease Control (CDC), the World Health Organization (WHO) and the Florida Department of Emergency Management (FDEM). The active response is then coordinated with the State of Florida, the CDC, the Marion County Health Department, the Marion County Emergency Operations Center and other local medical providers.

There is no one single course of action or recommendation when considering education, response and prevention methods to address an active pandemic or epidimic. Those recommendations and actions will be entirely dictated by the unique characteristics of the pathogen itself. However, once the threat of an epidemic/pandemic is identified it is vital to take the appropriate action to contain, manage and reduce the spread of the virus. The key message at this stage is to reduce the transmission rate - the number of individuals infected by each single infected individual. If on average across a population the transmission rate is greater than one the number of cases will continue to increase. Measures that reduce the transmission rate to less than one will result in a decline in the total number of infections.

Once a significant level of infection is present within a population then reducing this rate of spread becomes vital. Actions targeted at reducing the transmission rate are termed Mitigation and can involve:

- Social distancing (cancel events, closing institutions, work from home etc.);
- Education of the public - to promote actions such as hand washing and avoiding groups etc;
- Sufficient supplies of and ace to Personal Protection Equipment (PPE);
- Economic measures - to provide relief to individuals and businesses and to increase compliance with social distancing related policies.

All these measures aim to limit the population exposed to infection and to reduce the transmission rate between them. This results in a flattening of the curve of cases over time and so reducing the peak in the number of cases needing medical care. This maintains the ability of the healthcare system to provide quality care to those affected and reduce the mortality rate as far as possible. The greater the stress on the healthcare system the higher the likely mortality rate, as resources are unable to meet the demand and healthcare workers themselves exceed their capacity to provide care. Flattening the curve also extends the time scale of the epidemic so that any potential vaccine can at some future point be used to rapidly increase immunity within the population.

March 25, 2020 Covid-19: The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China. The World Health Organization declared the outbreak a Public Health Emergency of International Concern in January 2020 and a pandemic in March 2020. As of 29 January 2021, more than 101 million cases have been confirmed, with more than 2.19 million deaths attributed to COVID-19. State of Florida confirmed cases numbered 1,687,594 with 26,035 deaths and Marion County numbered 24,012 confirmed cases with 574 deaths.