

RISK and VULNERABILITY (4.1.1)	 People	Property	Environment	Program Operations
<b>HAZARD/HIRA</b>	4.1.3 This document is updated annually by the VCEM Senior Planner (if conditions warrant) as part of the required annual LMS update submitted to FDEM - last revision 1/2/18			
<b>Natural</b>				
<b>Hurricanes/Tropical Storms</b>	<p>The entire County is at risk to hurricanes and tropical storms. According to the Volusia County Property Appraiser, over 45% of the County's population resides along the east coast (234,000 people). The coastal region also leads the County in tourism. The large coastal population is highly vulnerable to the affects of a hurricane. Volusia County's worst hurricane season was 2004. Hurricanes Charley, Frances and Jeanne impacted Volusia County, back-to-back. Although Charley was the only storm to impact the County with hurricane-force winds, never the less these storms had a major impact on homes and infrastructure, and caused adverse human consequences. Hurricane Matthew (2016) and Hurricane Irma (2017) both caused extended power outages, impacting most of Volusia County. (LMS Section V)</p>	<p>Volusia County's worst hurricanes on record were Hurricanes Charley, Frances and Jeanne in 2004. These back-to-back storms battered Volusia County with tropical storm force winds for weeks. Storms of this magnitude have the potential to destroy homes and infrastructure, injure and kill people in its path, and cause massive environmental consequences. Cumulatively the County experienced over \$560,000,000 in damages. Approximately 40% of homes were damaged. Based on the hazard analysis, Volusia County's annualized losses to residential buildings from hurricanes is over \$280 million. For non-residential buildings, annualized losses total almost \$70 million. (LMS Section V and VI)</p>	<p>Hurricanes do not only bring high winds to Volusia County, they also have the potential to produce inland flooding, tornadoes, storm surge, and significant beach erosion. These four hazards can severely impact the environment by downing trees, eroding sensitive coastal dunes and ecosystems, loss of sea turtle nests, and causing the runoff of debris and potentially hazardous materials into our waterways. Because erosion events were part of other hazard events, the monetary damage for the erosion alone is unknown. Volusia County has not had to resort to beach restoration following any hurricane/tropical storm event.</p>	<p>Program operations may be impacted by a hurricane. Historically, tropical depressions and tropical storms have not impacted the County's ability to perform it's day-to-day program and CEOC operations. Preparedness, response, and recovery efforts have been implemented with no additional strain to the County. In the case of a direct land-falling hurricane in Volusia County, program operations may become strained, especially if it is a major hurricane (Cat 3 or greater). In these situations we will rely on assistance from other counties through the Emergency Management Assistance Compact (EMAC) (mutual aid) and through the State and FEMA. Hurricanes Charley, Frances, Jeanne in 2004 and Hurricane Matthew (2016) and Hurricane Irma (2017) did not negatively impact VCEM operations for an extended period.</p>
<b>Floods</b>	<p>All of Volusia County is at risk to flooding. According to FEMA, flooding is the most costly natural hazard in the U.S. and can cause long-term adverse psychological impacts. According to FloodSmart.gov, all 50 states are at risk to flooding and flash floods. Flash floods are particularly dangerous because they can quickly sweep cars off roadways, causing injuries and casualties to people in its path. (Volusia County does not experience true "flash flooding"). In addition to life safety, property can be damaged by just an inch of water (FloodSmart.gov). Homeowners insurance and renter's insurance does not cover flooding. A separate policy under the NFIP must be purchased. Citizens without flood insurance may not receive any assistance to repair their homes and property following an event. Countywide, there are 47,452 structures in the 100-year floodplain. For a map the 100-year floodplain, see Figure 5.10 in the LMS.</p>	<p>Property in low-lying areas or Special Flood Hazard Areas (100 and 500 year floodplain) are susceptible to damage from flooding (FloodSmart.gov). Floods can destroy homes and businesses, erode property along creeks and rivers, and washout roads and bridges. In some cases, flooding is a secondary hazard from a hurricane event. Volusia County has experienced eleven major flood events since 1994 resulting in over \$35,000,000 in insured flood losses. (Section V). Hurricane Irma flooded hundreds of home countywide; this was the worst flood event in Volusia County's history.</p>	<p>Flooding has the potential to put our environment at risk in different ways. Flooding erodes our river beds which causes sediments to enter the waterways, potentially clogging our storm water systems. Floods can also bring hazardous materials/pollution into our waterways via runoff. The County's sensitive riparian ecosystems are often negatively impacted in this process. When Lake Okeechobee nears flood level, water is emptied directly into the intracoastal waterway. This water, rich in nutrients, results in algae blooms and oxygen depletion in our rivers, resulting in fish die-offs. Due to a lack of data on historical environmental impacts from flooding in Volusia County, we were unable to directly calculate the full cost.</p>	<p>In rare occasions, program operations may be impacted by a flood. The EOC is not in a Special Flood Hazard Area (SFHA), although much of the surrounding land, roadways, and access points do. Historically, the EOC has remained operational during flood events with no impact to program operations. County programs may become strained responding to local or statewide flooding events. In these situations we may rely on assistance from other counties and the state through the Emergency Management Assistance Compact (EMAC) and mutual aid agreements.</p>
<b>Thunderstorms</b>	<p>Severe thunderstorms are a common occurrence in Volusia County throughout the year. These are dangerous events capable of producing high winds, hail, tornadoes, and lightning. All citizens in Volusia County are at risk to the negative effects of thunderstorms. Downed trees, damage to homes, loss of electricity, and rarely, casualties (primarily due to motor vehicle accidents and lightning strikes) are common byproducts of severe thunderstorms. Thunderstorms also have the ability to down small aircraft. (LMS Section V and VI)</p>	<p>According to NOAA's Climatic Data Center, from 1993 - 2018, Volusia County had 120 severe thunderstorm/wind events, causing approximately \$142 million in property damage with zero fatalities. All property in Volusia County is at risk to the negative effects of thunderstorms. Downed trees, damage to homes, businesses, and infrastructure, and loss of electricity are common byproducts of severe thunderstorms. (LMS Section V and VI)</p>	<p>Severe thunderstorms in Volusia County have historically had a minimal impact on the environment. In some cases, these storms can down trees and vegetation and cause localized flooding.</p>	<p>There is no risk to program operations from thunderstorms. VCEM's ability to respond to and manage the event should not be impacted. The EOC is equipped with two generators and redundant communication systems. If there were a catastrophic series of thunderstorms with widespread tornado outbreaks, VCEM may rely on outside support to maintain operations as stated in the above hazard examples.</p>
<b>Tornadoes</b>	<p>Tornadoes pose a great risk to people and structures countywide. While Volusia County is not located in "tornado alley", the entire population is at risk to the impacts of a tornado. According to NOAA's Climatic Data Center, from 1953 to 2018, Volusia County had 98 recorded tornado events, responsible for 2 deaths and 107 injuries. This figure is probably low, as some EF0 tornadoes are not detected by the National Weather Service. Additionally there were several smaller tornadoes in 2017 that impacted a mobile home park and apartment complex. Not only can tornadoes threaten life safety, they can demolish homes and businesses, destroy infrastructure, and impact entire communities. Refer to web site references at the bottom of this page.</p>	<p>Tornadoes pose a great risk to property. From 1953 to 2018, Volusia County had 98 tornado events, responsible for over \$142,000,000 in property damage, two fatalities and 128 injuries were reported. (NOAA Climatic Data Center) Tornadoes can reach wind speeds over 200mph, (although the most powerful tornado to impact Volusia County was an EF3) lifting homes and businesses off of their foundations, crippling infrastructure and creating automobile sized missiles. Entire communities may be destroyed.</p>	<p>Because of the vast range of wind speeds associated with tornadoes, the environment is at risk to a variety of impacts. Even an EF0 (65-85mph) can uproot trees and vegetation. In stronger tornadoes, debris will tossed miles away from the source, potentially entering our waterways. Hazardous materials may escape if vehicles are damaged or storage tanks are compromised.</p>	<p>Unless there is a direct impact from a tornado, there is no risk to program operations at the County level. Preparedness, response, and recovery efforts should not be impeded. The EOC would remain operational, supporting the local officials. In the case of a direct hit to the EOC, program operations would be minimally affected, as the building is hardened to withstand an EF-4 tornado.</p>
<b>Wildfire</b>	<p>Wildfires are one of the most common hazard events in Volusia County. People and their property are at risk to the impacts of a wildfire. Wildfires burns down trees, vegetation, homes and businesses. Smoke from wildfires can be detrimental to the health of citizens living in close proximity to the fires. Smoke and ash from wildfires can obscure vision and cause extended road closures.</p>	<p>Wildfires can destroy public and private property, ravish parklands, and disrupt the service of critical utilities. The most recorded wildfires in a 2-month period in Volusia County was 233 fires between June and July 1998; 163,000 acres burned. The fires threatened 29,000 homes, \$60,000,000 in timber was lost, and \$2,100,000 in property damage resulted. Both forested and urban areas are at risk to wildfires. (LMS Section V and VI)</p>	<p>Though many wildfires occur naturally, the environment may be negatively impacted. Not only trees are impacted by these fires, so are the native species of plants and animals. Smoke and ash from the fires can pollute waterways and the air. These disasters can cause tremendous deforestation and increase the release of carbon dioxide into the air, creating a negative ratio of carbon dioxide and oxygen expenditure. Wildfires can also: Damage the habitat of the environment—which depends on the soil type and the fire's intensity; affect the species population and distribution after an incident; destroy homes and buildings; incur costly evacuations; create heavy smog that is harmful to living things; take animal and human lives. <a href="https://shop.ecoplum.com/blogs/sustainable-living/18611844-environmental-impact-of-forest-fires">https://shop.ecoplum.com/blogs/sustainable-living/18611844-environmental-impact-of-forest-fires</a></p>	<p>There is a minimal risk to program operations posed by wildfires. Historically, the EOC has been impacted by a wildfire on two occasions, however the smoke intrusion was never severe enough to require COOP activation. If there was a wildfire at or near the EOC that caused air pollution or blocked access roads to the facility, program operations may become strained. In this situation, VCEM may activate our COOP Plan. In extreme circumstances, the VCEM may seek outside help through mutual aid agreements and EMAC.</p>
<b>Drought/Extreme Heat</b>	<p>People are indirectly at risk to drought. Drought negatively affects agriculture and livestock, which impacts the food people eat. Farmers are the most directly impacted by the impacts of drought. Extreme heat is one of the leading causes of natural hazard deaths in the United States (International Journal of Health Geographic).</p>	<p>Property may be at high risk to drought under extreme circumstances. Extended periods of drought impacts agricultural products and farmlands. Crop losses may be significant. The fern industry may be adversely impacted. Volusia County experienced droughts in 1981, 1985, 1998, 1999, and 2000. (LMS Section V and VI)</p>	<p>The environment is also at risk to drought and extreme heat. Without water, vegetation and sensitive ecosystems may be negatively impacted. Stream flows may be reduced, impacting riparian and riverine ecosystems. (LMS Section V)</p>	<p>Program operations will not be impacted by drought conditions.</p>
<b>Hail</b>	<p>Everyone in Volusia County is at risk to hail. Hail can cause injuries and, in rare cases, death if people are outside during an extreme hail event. In Volusia County there have been no recorded fatalities or injuries reported from hail. (NOAA Climatic Data Center) Hail is more harmful to homes and businesses as it can damage roofs and windows on buildings and vehicles.</p>	<p>Although hail storms do not typically cause widespread damage to property, if the size of the hailstones are great enough, hail can puncture roofs, break car windshields, dent bodywork, and damage windows. Volusia County experienced 120 hail events from 1950 - 2018 (NOAA Climatic Data Center). The largest recorded hail occurred in July of 2007; the reported size of the hail was 2.00".</p>	<p>Although the entire County and environment is vulnerable to hail, there are no direct significant impacts to the environment. An example of an indirect impact may be vehicular accidents on roadways that leak gasoline and hazardous materials into roadways.</p>	<p>Program operations will not be impacted directly by hail. Because hail is formed during thunderstorms, see "Thunderstorms" for more information.</p>
<b>NOAA Climatic Data Center USA.com Volusia County Natural Disaster</b>	<a href="http://www.ncdc.noaa.gov/">http://www.ncdc.noaa.gov/</a> <a href="http://www.usa.com/volusia-county-fl-natural-disasters-extremes.htm">http://www.usa.com/volusia-county-fl-natural-disasters-extremes.htm</a> <a href="http://www.tornadohistoryproject.com/tornado/Florida/Volusia">http://www.tornadohistoryproject.com/tornado/Florida/Volusia</a>			

CONSEQUENCES (4.1.2)	 The Public	Responders	Continuity of Operations & delivery of services	Property, facilities & infrastructure
HAZARD/HIRA				
Natural				
Hurricanes/Tropical Storms	<p>The public may face extreme consequences from hurricanes and tropical storms. Hurricanes have the potential to injure and kill people, destroy residences and businesses, and interrupt water, power, and sewer services necessary to return to a normal way of life. Regardless if citizens have insurance or receive assistance, the recovery process from a major hurricane may be very costly and take weeks, months, and years to complete and will have serious psychological impacts. The 2004 hurricane season brought Hurricanes Charlie, Frances, and Jeanne that resulted in \$560,300,000 in damages. Hurricane Matthew (2016) \$493,500,000; Hurricane Irma (2017) \$371,091,000.</p>	<p>Responders may face extreme difficulties when responding to a hurricane or tropical storm event. Hurricanes down trees and power lines, destroy critical infrastructure such as local EOCs, fire stations, and hospitals, and damage bridges, roadways, and government buildings critical for response and recovery operations. Responders may have to rescue citizens isolated without resources. Responders should be aware of their risks at all times.</p>	<p>In an extreme event, such as a major hurricane, there may be an impact on delivery of routine program operations as the focus will be on response/recovery to the event. Following Hurricanes Matthew (2016) and Irma (2017) VCEM was able to resume delivery of services (training classes, public presentations, and so on) within two weeks of landfall.</p>	<p>There are numerous potential consequences that may result from a hurricane or tropical storm. Property along the coast and in storm surge areas may be severely impacted or destroyed. County facilities along the coast in storm surge zones have been identified. Critical infrastructure such as utilities, roadways, bridges, hospitals, EOCs, Police/Fire/EMS stations may be damaged or destroyed in an event. The City Island Library and County Administration Facility in downtown Daytona Beach experienced riverine flooding during Hurricane Irma. The Admin Facility will have to be demolished and rebuilt.</p>
Floods	<p>The public may face extreme consequences from flooding and/or flash floods (although Volusia County does experience true "flash flooding"). Floods have the potential to injure (wading in flood waters) and kill people, especially those who drive through flooded roadways. Floods can destroy residences and businesses, and interrupt water, power, and sewer services necessary to return to a normal way of life. Regardless if citizens have flood insurance or receive assistance, the recovery process from a flood may be very costly and take weeks, months, or years to complete. Hurricane Irma was the worst flood event in Volusia County history, flooding hundreds of homes countywide. Many had water in them for months.</p>	<p>Property in low-lying areas or Special Flood Hazard Areas (100 year floodplain) are susceptible to damage from flooding (FloodSmart.gov). Floods can destroy homes and businesses, erode property along creeks and rivers, and washout roads and bridges. In some cases, flooding is a secondary hazard from a hurricane event. Volusia County has experienced ten major flood events since 1994 resulting in over \$35,000,000 in insured flood losses. (LMS Section V)</p>	<p>The EOC is not located in a SFHA; however, many access roads may be impacted by flooding. In an extreme flood event, there may be an instance when access to the EOC is difficult, as the surrounding area is in the 100 year floodplain. If something like this should occur, EOC personnel may be transported by VCSO's helicopter assets or all terrain vehicles. Most likely they will stay onsite until the flood waters recede.</p>	<p>There are numerous potential consequences that may result from a flood. Property in the floodplain or other low-lying areas may be severely impacted or destroyed. County facilities in the floodplain have been identified. Critical infrastructure such as utilities, roadways, bridges, and Police/Fire/EMS stations may be damaged or destroyed in an event. During both Hurricanes Matthew and Irma portions of A1A in Volusia and Flagler County washed out from storm surge. Over 200 homes flooded during and after Hurricane Irma countywide.</p>
Thunderstorms	<p>The public may face some minor consequences from a thunderstorm. Thunderstorms have the potential to injure and/or kill people, damage residences and businesses, and interrupt power service. These impacts are very minimal compared to hurricanes and floods. It is important for beach goers to leave the beach when a thunderstorm approaches. Boaters and golfers should seek shelter. Recovery from a severe thunderstorm event may take several days.</p>	<p>Responders may face some difficulties when responding to a thunderstorm event. Trees may be down, blocking critical roadways and access points. Power lines may also be down in roadways or on private property creating a dangerous situation. Localized flooding may make some roads impassible.</p>	<p>VCEM does not anticipate any issues maintaining operations and the delivery of services following a thunderstorm. In a catastrophic event, VCEM has a COOP Plan in place that could be activated and implemented at any time.</p>	<p>Consequences to property, facilities, and infrastructure from thunderstorms are minimal. Downed trees and power lines are typical consequences from thunderstorms. Roofs and windows of homes and businesses may be damaged. Power service to residences and critical facilities may be impacted in the short-term.</p>
Tornados	<p>All of the public in Volusia County is at risk to tornados. Tornados are a very common occurrence in Volusia County. Fortunately most are of the F0/F1 variety, although in 2006 and 2007 an F3 tornado impacted large parts of the county (fortunately there were no fatalities). The public could face serious consequences from a touchdown, particularly mobile home residents. Tornados can be deadly. Common consequences are damage to homes and businesses, interruption of utility services, and devastation to the local economy.</p>	<p>Responders may face significant difficulties responding to a tornado touchdown. Search &amp; rescue operations may be required. Access to mobile home parks and gated communities may be difficult. Communication systems may be destroyed. In an extreme event, road signs and landmarks may be missing when trying to navigate to citizens in need. Power lines, debris, and trees may block roadways and access points. Responders should exercise extreme caution.</p>	<p>VCEM does not anticipate any issues maintaining operations and the delivery of services in the event of a tornado in the County. If there is a widespread tornado outbreak, or if the EOC is directly hit by a tornado, it may be necessary to move to the alternate EOC location to maintain operations during the event. The new EOC was built to withstand 180 MPH winds, so the probability of being adversely impacted by a tornado is low.</p>	<p>All property in Volusia County is at risk to tornados. The consequences to property, facilities, and infrastructure from a tornado may be catastrophic. Depending on the scale of the tornado, damage could be minimal or cataclysmic. Historically, Volusia County's greatest magnitude tornado was an EF3. An EF3 can cause extensive damage, level well constructed homes and buildings, uproot trees, and throw heavy vehicles. Public infrastructure and utilities may be demolished.</p>
Wildfire	<p>Wildfires are one of the most common hazard events in Volusia County. Between 2000 - 2008, the average number of wildfires per year was 129 (Table 5.18). People and their property are at risk to the impacts of a wildfire. Wildfires can burn down trees, vegetation, homes and businesses. Smoke from wildfires can be detrimental to the health of citizens living in close proximity to the fires. Smoke and ash from wildfires can obscure vision and cause extended road closures.</p>	<p>Responders will be directly impacted by a wildfire. Wildfires may change directions quickly as the wind and environmental elements change. Wildfires are often difficult to control and may take numerous resources to do so. Inhalation of smoke and fumes may pose a health risk to firefighters.</p>	<p>VCEM does not anticipate any issues maintaining operations and the delivery of services during a wildfire. During the wildfires of 1998, routine operations (training classes, public presentations) were suspended for a month. In an event that directly impacts the EOC, VCEM has a COOP Plan in place that could be activated and implemented at any time.</p>	<p>Property, facilities, and infrastructure in the wildfire zone may be significantly impacted. Homes and businesses may be destroyed in a fire, utility service could be interrupted, and access to roadways may be limited. We have been fortunate in Volusia County to have lost only a handful of residential structures during a wildfire.</p>
Drought/Extreme Heat	<p>Consequences of drought and extreme heat on the public are not always direct. Agriculture will be the most directly impacted by drought. The public's food supply may be impacted. If water restrictions are implemented by government, residential lawns and gardens will be impacted.</p>	<p>Responders will not be impacted by drought. In extreme heat, caution should be exercised for first responders. Responders must be sure to maintain adequate hydration.</p>	<p>Historically VCEM has not had any issues continuing operations and delivering services during droughts or extreme heat events.</p>	<p>Homes, businesses, critical facilities and infrastructure should not be significantly impacted by drought and extreme heat. In some drought situations, river flows may be reduced and impact hydrologic processes such as irrigation capacities, and tourism related businesses (lakes, golf courses, etc.). The St Johns River Water Management District may prohibit lawn irrigation, which may impact residences and golf courses. Wells may fall to dangerously low levels.</p>
Hail	<p>Consequences of hail on the public include possible injuries and, in extremely rare cases, death. Hail may indirectly cause public injury if it results in automobile accidents.</p>	<p>Consequences of hail on responders is minimal. Hail is typically a very brief event due to physics of the atmospheric conditions in Volusia County that are required to make hail. Responders should remain inside during hail storms.</p>	<p>VCEM will not have any issues continuing operations and delivering services during hail events. Hail events in Volusia County have historically been very brief.</p>	<p>Hail has the potential to damage property, facilities, and infrastructure. Large hail can puncture roof tops, windshields, vehicles, windows, and other outdoor structures.</p>