Georgia Hazard Identification and Risk Assessment

2022

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Approval and Implementation

Hazard Identification and Risk Assessment and appendices, including the Consequence Analysis, have been approved and implemented by:

James C. Stallings
James C. Stallings (Jun 7, 2022 14:18 EDT)

7 June 2022

James C. Stallings, Director
Georgia Emergency Management and
Homeland Security Agency

Date

Record of Change

Change #	Date	Part Affected	Date Posted	Who Posted
1		This version supersedes the 2018 Georgia Hazard Identification and Risk Assessment dated April 2018, which is rescinded.		Michael Engleking EM Planner

Record of Distribution

Plan #	Office/Department	Representative	Signature
1	GEMA/HS Emergency Management	Deputy Director	
2	GEMA/HS Homeland Security	Deputy Director	
3	GEMA/HS Recovery	Deputy Director	
4	GEMA/HS Finance & Administration	Deputy Director	
5	GEMA/HS Hazard Mitigation	Hazard Mitigation Manager	
6	GEMA/HS CIKR	CIKR Manager	
7	GEMA/HS External Affairs	PIO	
8	GEMA/HS Training & Exercises	Training Manager	
9	Ga Emergency Communications Agency	Executive Director	
10	Ga Department of Transportation	ESF 1 Lead	
11	Ga Department of Natural Resources – Environmental Protection Division	ESF 3 Lead	
12	Ga Forestry Commission	ESF 4 Lead	
13	Ga Department of Human Services	ESF 6 Liaison	
14	Ga Department of Public Health	ESF 8 Lead	
15	Ga Department of Natural Resources	ESF 10 Lead	
16	Ga Department of Agriculture	ESF 11 Lead	
17	Ga Environmental Finance Authority	ESF 12 Lead	
18	Ga Department of Public Safety	ESF 13 Lead	
19	Ga Department of Defense	ESF 16 Lead	
20	American Red Cross	ARC Liaison	

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a statewide overview of how various natural, human-caused, and technological hazards impact the State of Georgia. This Hazard Identification and Risk Assessment (HIRA) undertakes an all-hazards identification, classification, and vulnerability indexing process to ensure hazard analysis is comprehensive and all encompassing.

For the purposes of this HIRA, a natural hazard is defined as an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. In addition, a human-caused hazard includes any disastrous event caused directly and principally by one or more identifiable deliberate or negligent human actions, while a technological hazard is a hazard originating from technological or industrial conditions, including accidents, dangerous procedures, or failures.

These hazards can be intensified by societal behavior and practices, such as building in a floodplain, along a seacoast, or an earthquake fault. All these hazards may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage if the extent, magnitude, and impact is significant. While it is impossible to prevent and mitigate all hazards, the impacts of these hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

Georgia is not immune to any of these hazard types. Tropical cyclones and related coastal flooding, winter storms, and river flooding affect Georgia on a recurring basis. The coastal counties in the state are vulnerable to hurricane storm surge. Other damages associated with hurricanes and tropical storms include inland flooding, damaging winds and tornadoes. This type of flooding poses an additional health risk as it involves the overflow of storm sewer systems and is usually caused by inadequate drainage following heavy rain, or an extreme storm surge. In addition, Georgia is home to numerous pieces of critical infrastructure that are vulnerable to both human caused hazards, such as a cyber compromise or terrorism, and technological hazards, such as an infrastructure failure or transportation accidents.

Identifying the risk and vulnerability for a community is critical when determining how to allocate finite resources to carry out feasible and appropriate mitigation actions. The hazard analysis involves identifying all the hazards that potentially threaten Georgia, and then analyzing them individually to determine the degree of threat posed by each hazard. Addressing risk and vulnerability through hazard mitigation measures will reduce societal, economic, and environmental exposure to natural hazard impacts.

For multi-hazard identification, all hazards that may potentially impact the state should be identified, including natural, human-caused, and technological hazards, as well as cascading emergencies - situations when one hazard triggers others sequentially. For

example, severe flooding that damages buildings which store hazardous, water-reactive chemicals could result in critical contamination problems, dramatically escalating the type and magnitude of an event. Dam failures may result from an earthquake, creating a dangerous flash flooding scenario for communities located in dam inundation areas.

(1) *Federal Emergency Management Agency. "Threat and Hazard Identification and Risk Assessment Guide*

1.2 HIRA Updates

This HIRA updates the content from the previous edition, including the incorporation of content from Georgia's Hazard Mitigation Strategy (HMS) and Georgia's Threat and Hazard Identification and Risk Assessment (THIRA).

This HIRA includes:

- Update of all Risk and Vulnerability Assessments for all hazards.
- Update of the consequence analysis for all hazards;
- Update of all maps and data to encompass changes since the previous edition; and
- Amendment to critical facility data and structures information to include Georgia's Geographic Information System data sets.

The information in this document has been reviewed and revised by the state's Subject-Matter Experts (SME). The SMEs have validated the information contained within this section adequately represents the risk and vulnerability in Georgia.

2.0 HAZARD IDENTIFICATION

In order to fulfill the planning guidelines outlined in the Disaster Mitigation Act of 2000 and the Emergency Management Accreditation Program (EMAP), this HIRA addresses natural hazards, human caused hazards, and technological hazards.

The previously approved Georgia 2019 HMS focused on natural hazards and the Georgia 2018 THIRA focused on manmade hazards, while this HIRA update includes all hazards.

For the purposes of the HIRA, hazards have been grouped by hazard type (natural, human-caused, and technological) as well as by similarity of hazard events, occurrences, and typical impacts.

As part of the HIRA update," pandemic" terminology was added to the Infectious Disease hazard section. In addition, human-caused hazards and technological hazards were added to the overall vulnerability assessment to align with the THIRA and to meet the requirements for EMAP accreditation.

It should be noted that the below hazards are not a complete listing of all hazards that may occur in Georgia. This listing accurately represents the hazards that impact Georgia most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of

business, or other types of harm or loss. The following hazards are not addressed in the HIRA:

- Landslides
- Tsunamis

The hazards listed above were considered and discussed but it was decided that these hazards would not be included in the HIRA due to:

- The low frequency of occurrence;
- The minimal probability of occurrence; and/or
- The lack of resources to devote to further research the likelihood of potential occurrence or impact.

Table 1: Hazard Identification and Hazard Grouping

Natural Hazards			
Severe Weather • Thunderstorms • High/Strong Winds • Lightning • Hail • Tornadoes	**Flooding** • River Flooding • Flash Flooding • Urban Flooding • Coastal Flooding	**Tropical Cyclone** • Storm Surge • Tropical Cyclone Winds • Heavy Rainfall • Tornadoes	**Winter Weather** • Snow • Extreme Cold • Ice • Blizzard • Freezing Rain • Sleet
Drought/Wildfire • Extreme Heat • Wildfires • Smoke • Water Shortage	**Geologic Hazards** • Sinkholes • Earthquakes	**Infectious Diseases** • Infectious Diseases • Food Borne Diseases • Agricultural Disease Outbreaks • Novel Disease Outbreaks	
Human Caused Hazards			
Cybersecurity Incident • Hacking/Phishing • Infrastructure Disruptions • Ransomware/Malware • Network Intrusion/Disruption • Transportation	**Active Shooter** • Explosives/Improvised Explosive Devices • Vehicle Ramming • Sniper Attack • Hostage Taking	**Radiological Release** • Radiological Release Technical • Radiological Release Hostile	**Hazardous Material Release** • Transportation-Related Storage-Related, Spills, And Leaks
Technological Hazards			
Dam Failure • Downstream Flooding • Erosion • Property Damage • Environmental Damage • Transportation Disruption • Infrastructure Disruption		**Infrastructure Failure** • Communications • Transportation • Energy • Public Works	

Table 2: Hazard Identification Process

Hazard of Concern	How and Why hazard was Identified
Severe Weather • Thunderstorms • High/Strong Winds • Lightning • Hail • Tornadoes	• Review of historical disaster declarations and the National Weather Service (NWS) National Center for Environmental Information (NCEI) Storm Events Database • 20 out of 45 declared disaster events in Georgia were Severe Weather events
Flooding • River Flooding • Flash Flooding • Urban Flooding • Coastal Flooding	• Review of historical disaster declarations and NWS NCEI Storm Events Database • Flooding impacts Georgia nearly every year and results in the majority of the damages associated with hazard events • 11 out of 45 declared disaster events in Georgia were flood events
Tropical Cyclone • Storm Surge • Tropical Cyclone Winds • Heavy Rainfall • Tornadoes	• Review of historical disaster declarations and NWS NCEI Storm Events Database • NWS NCEI hurricane data • 9 out of 45 declared disaster events in Georgia were hurricane, tropical storm, or coastal events
Winter Weather • Snow • Extreme Cold • Ice • Blizzard • Freezing Rain • Sleet	• Review of historical disaster declarations and NWS NCEI • 4 out of 45 declared disaster events in Georgia were winter weather-related events
Drought/Wildfire • Extreme Heat • Wildfires • Smoke • Water Shortage	• Review of historical disaster declarations, NWS NCEI Storm Events Database, U.S. Drought Monitor and Drought Impact Reporter • The entire State of Georgia is subject to the effects of drought • 11 out of 45 declared disaster events in Georgia were extreme heat or wildfire events
Geologic Hazards • Sinkholes • Earthquakes	• Review of historical data, including United States Geological Survey • Earthquakes have impacted Georgia in the past. Between 2001 and 2020, there have been 197 earthquake events with epicenters in Georgia
Infectious Diseases: • Infectious Diseases • Food Borne Diseases • Agricultural Disease Outbreaks • Novel Disease Outbreaks	• Numerous bodies of water located in the state that assist with the breeding of mosquitos and other waterborne pathogens • 1 out of 45 declared disaster events in Georgia were an infectious disease event
Cybersecurity Incident • Hacking/Phishing • Infrastructure Disruptions • Ransomware/Malware • Network Intrusion/Disruption • Transportation	• Most of Georgia's critical infrastructure is linked to some technology-based platform, which is a key vector of attack in a cybersecurity incident
Active Shooter • Explosives/Improvised Explosive Devices • Vehicle Ramming • Sniper Attack • Hostage Taking	• Terrorist attacks can occur anywhere • Georgia is an attractive target due to it's to major urban areas, seaports, and tourism.

Radiological Release (Technical, Hostile) • Individuals (Physical and Psychological Health) • Property • Environment • Infrastructure • Agriculture • Zoological • Economy	• Georgia contains 6 counties within the 10-mile Emergency Planning Zone • 76 counties within the 50-mile Ingestion Pathway Zone of nuclear power plants located within Georgia and adjacent states.
Hazardous Material Release • Injury • Loss of life • Property damage • Environmental damage	• Over 445 reports of petroleum and sewage hazmat releases reported in 2019-2020 • 19,934 Tier 2 Facilities in Georgia
Dam Failure • Downstream Flooding • Erosion • Property Damage • Environmental Damage • Transportation Disruption • Infrastructure Disruption	• Georgia has 4537 Dams, according to the 2019 Dam Inventory • In Georgia all major rivers are dammed at least once • Numerous smaller dams, including agricultural exist
Infrastructure Failure • Communications • Transportation • Energy • Water/Wastewater	• Georgia is home to numerous pieces of critical infrastructure across all identified sectors

2.1 Disaster History

Georgia is vulnerable to impacts from tropical cyclones, winter storms, severe weather, flooding, wildfires, terrorist attacks, pandemics, and more. The following are examples of these types of disasters that have occurred in Georgia over the past 30 years.

Georgia is vulnerable to impacts from tropical cyclones, winter storms, severe weather, flooding, wildfires, terrorist attacks, pandemics, and more. The following are examples of these types of disasters that have occurred in Georgia over the past 30 years.

Tropical Cyclones

Tropical cyclone is an all-encompassing term describing hurricanes, tropical storms, and tropical depressions (typhoons are tropical cyclones that form in the western Pacific and Indian Ocean). Tropical cyclones that impact Georgia form in the Atlantic Basin (Atlantic Ocean, Caribbean Sea, and Gulf of Mexico). Due to Georgia's Atlantic coastline and proximity to the Gulf of Mexico, the state can receive impacts from tropical cyclones that make landfall along the Southeast Coast and along the northern Gulf Coast. There are four main hazards that tropical cyclones can produce in Georgia: *storm surge* (a rapid and sustained rise in sea level), *high to extreme winds*, *inland flooding*, and *tornadoes*.

Storm surge has the highest potential to cause devastation to Georgia's coastal regions (mainly in Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden counties). While coastal Georgia has not recorded devastating storm surge over the past century, the potential exists for a landfalling hurricane to produce some of the highest storm surge values possible in the United States. Due to a variety of factors, Georgia's coastline is especially vulnerable to extremely high storm surge values, making it one of the most vulnerable coastlines along with Louisiana. While storm surge values of a few to several feet have been experienced, storm surge values of 10 to 20 feet or more are possible in realistic worst-case scenarios. This type of surge would not just affect the immediate coastline of Georgia but could potentially inundate much if not all of the aforementioned 6 counties. Recent tropical cyclones that have produced storm surge in Georgia include Floyd in 1999, Matthew in 2016, and Irma in 2017. Storm surge values varied between 3 and 5 feet along the Georgia coast during those events.

High to extreme winds can have devastating effects on several sectors in Georgia. The most recent and significant example is Hurricane Michael in 2018, which rapidly intensified in the Gulf of Mexico and made landfall along the Florida Panhandle as a Category 5 hurricane. Although Michael officially weakened to just below major hurricane status before the center of the storm entered southwest Georgia, widespread sustained hurricane force winds caused massive power outages, agricultural loss, and damage to infrastructure. Another example of less extreme but more widespread wind damage occurred just the year prior in 2017 from Hurricane Irma, which also made landfall along the Florida Gulf Coast and was weakening as it moved into Georgia. However, due to an expanding wind field, wind gusts of 40-60 mph were experienced across much of Georgia, resulting in widespread power outages from downed trees and power lines. Hurricane Matthew in 2016 did not make landfall in Georgia but moved close enough to the Georgia coast that wind gusts of 94-96 mph were recorded on Tybee Island.

Inland flooding is also a major threat to Georgia from tropical cyclones due to the state's proximity to the Gulf of Mexico. Slower-moving storms can dump several inches to multiple feet of rainfall in the span of days. The most memorable example of this came from Tropical Storm Alberto in 1994, which stalled and dropped up to 25 inches of rain over parts of Georgia in less than 24 hours on July 4th. Thirty-four people were killed, more than 50,000 were displaced from their homes, and at least 400 coffins were forced from water-logged graves into flooded streets.

Finally, *tornados* are a common occurrence in tropical cyclones that affect the Southeast. While Louisiana and Mississippi suffered the greatest effects from Hurricane Katrina in 2005, Georgia received over 100,000 evacuees from the Gulf States. On August 29th, bands of heavy rain and damaging winds affected Western Georgia triggering a tornado outbreak. 18 tornadoes touched down in Georgia, killing two people and destroying numerous homes and businesses. Although tornadoes from tropical cyclones tend to be weaker than tornadoes from severe thunderstorms, they can be harder to detect and see, as they spin up quickly and are often rain-wrapped. While tornadoes may not pose as serious of a threat from tropical cyclones as storm surge, high winds, and flooding, they occur often enough to warrant consideration.

For a more in-depth history of impacts to Georgia from Hurricanes Floyd in 1999, Matthew in 2016, Irma in 2017, Michael in 2018, and Zeta in 2020, see 2.1.1 Georgia Hurricane History.

Winter Weather

Georgia regularly receives frozen precipitation during the winter, coming in the form of snow, sleet, freezing rain, or a combination of the three with or without liquid rainfall. Most often when wintry precipitation falls in Georgia, it causes minor to moderate ("nuisance") impacts that mostly range from roads closures to sporadic power outages. However, Georgia occasionally receives winter weather systems with the potential to cause major impacts. The most notable example of this over the past twenty years occurred in January 2014. In what could be considered a perfect confluence of events, a flash freeze crippled much of Georgia including downtown Atlanta on January 28, 2014. Drivers were stuck or stranded on roads for several hours, even for upwards of 24 hours, due to the impassability of roads and interstates. Students were stuck at their schools overnight, babies were born on roadways, and a massive volunteer effort was staged to keep people from freezing or starving outdoors. Impacts from this system lasted for weeks, and it continues to be the benchmark for worst case scenario planning and training at the time of publication. Following this storm, the State of Georgia made significant systematic improvements to winter weather response. These improvements drastically reduced the impacts of future storms, especially during December 2017 when snowfall totals far exceeded projected amounts.

Severe Weather

Like most of the southeastern and midwestern United States, Georgia experiences two severe weather seasons, primarily during Spring and secondarily during Autumn. When severe thunderstorms develop, any combination of damaging thunderstorm winds (greater than 50 knots/58 mph), large hail (greater than 1 inch in diameter) and/or tornadoes are possible. Severe thunderstorms occur frequently across Georgia, and dozens of tornadoes touch down in Georgia every year. Typically, most tornado touchdowns occur during outbreaks or particularly strong severe weather systems that move through during the Spring. However, tornadoes can sporadically develop and touch down at any point during the year across Georgia.

The costliest and one of the deadliest tornado outbreaks ever in the United States occurred on April 27th, 2011. Over a dozen tornadoes (including an EF-4 in Catoosa County) moved through Georgia, killing 14 people. The largest tornado outbreak ever recorded in Georgia occurred on January 21-22, 2017, where 41 tornadoes were recorded across the state. This set a new record for a two-day period in Georgia history (previously 25 recorded on September 15-16, 2004). In Georgia alone during these two days, 16 people were killed, 137 people were injured, and $313 million in damages occurred. One long-tracked tornado was on the ground for over 80 miles and reached EF-3 intensity. Another one of the strongest tornadoes to ever move through Georgia occurred in the early morning hours of March 26th, 2021, in and around the city of Newnan. At its peak, the tornado reached EF-4 strength, just one month shy of the 10-year anniversary of the most recent EF-4 in Georgia. This was also the first EF-4 or

greater tornado to impact the Metro Atlanta area since an EF-4 tornado touched down in Cobb and Cherokee counties on November 22, 1992. An EF-5 tornado has never been recorded in Georgia.

Tornadoes often cause the most devastation from severe weather, but thunderstorm wind gusts and large hail can also threaten life and property in Georgia. Thunderstorm winds can easily reach 60 to 80 mph in brief bursts, which can cause tornado-like damage on a large scale. Hail can also cause damage to roofs, cars, and other property.

Flooding

Flooding can occur in a few different forms: flash flooding, river flooding, and areal flooding. Flash flooding can be the most dangerous due to its rapid onset, but river flooding and areal flooding can be devastating and prolonged. The two most notable flooding events in Georgia over the past 30 years came from Tropical Storm Alberto in 1994 (discussed in the tropical cyclone inland flooding section above) and the epic floods of 2009 which impacted Metro Atlanta.

Between September 15-21, 2009, over a foot of rain fell over much of northern Georgia with up to 20 inches reported in spots. This caused a combination of flash flooding, river flooding, and areal flooding that killed 10 people and damaged 20,000 homes, businesses, and buildings culminating in over $300 million in damage. Hundreds of people were rescued by boat from their homes and neighborhoods. Some flood gages reached 500-year statistical levels, and many records were broken that had been previously set 90 years earlier in 1919.

Wildfires

Wildfires spread quickly and change direction rapidly, igniting brush, trees, and homes. On April 16, 2007, a downed power line ignited drought-parched forest floors in southern Georgia, which led to the largest and most devastating wildfires in state history. Nearly 564,000 acres were consumed in Georgia and Florida, and 18 homes were destroyed. More than 3,300 firefighters from 44 states, Canada and Puerto Rico came in to battle the blazes. In 2017, wildfires engulfed 19,411 acres across North Georgia, and the West Mims Fire on the Georgia/Florida line burned an estimated 130,942 acres.

Terrorism

Georgia is at risk for terrorist attacks. While Georgia has not experienced a large-scale attack, they can occur without warning. During the 1996 Olympics, a bombing occurred at Centennial Olympic Park, killing four and injuring 111. The next year, an Atlanta-area health clinic and a gay nightclub were bombed by the same man. In June 2009, a Georgia Tech student was convicted of conspiring to provide material support for terrorism and was sentenced to 13 years in federal prison.

Infectious Diseases (Epidemics, Pandemics, and outbreaks)

Pandemics can spread rapidly, leaving little time to prepare once an outbreak starts. In March 2020, the World Health Organization declared COVID-19 a pandemic. As of

September 2021, over 20,000 people died and more than 76,000 people were hospitalized in Georgia because of the virus.

2.1.1 Georgia Hurricane History (1990-2020)

Hurricane Floyd (1999)

In September 1999, Georgia, along with Florida, South Carolina and North Carolina, experienced large evacuation as Hurricane Floyd bore down on the southeastern coastline. An estimated three million people took to the highways to flee Floyd's forecasted path, jamming interstates in search of safety and shelter.

Hurricane Matthew (2016)

Hurricane Matthew began impacting coastal portions of Georgia on the morning of Friday, October 7, 2016, as a Category 3 major hurricane. After weakening to a Category 2, the center of the hurricane moved north and northeast, generally parallel to the southeast Atlantic coast. The center of the storm passed Brunswick, Georgia just 60 miles offshore before passing Savannah, Georgia only 35 miles offshore. The worst impacts began Friday evening and lasted through Saturday morning, and included record-breaking storm surge flooding, extreme rainfall, and sustained hurricane-force winds. This was the first time that hurricane-force impacts had occurred on the Georgia coast since Hurricane David in 1979.

Major to record-breaking flooding occurred along the Georgia coast. Sea Camp Dock at Cumberland Island briefly reached major flood stage on Friday afternoon. St. Simon's Island came within 3 inches of major flood stage early Saturday morning. The Savannah River at Fort Pulaski broke a 37-year record by nearly 4 inches early Saturday morning. All of this flooding was caused by excessive storm surge.

Hunter U.S. Army Airfield received 17.49 inches of rainfall between 11:00 AM Thursday and 10:00 AM Saturday. Savannah International Airport received 11.51 inches. The record for daily rainfall in the Savannah area was 9.02 inches, which occurred on September 16, 1924. Average annual rainfall in Savannah is 47.96 inches. Parts of Savannah received more than one-third of their yearly total over this period. Widespread amounts of 6-10 inches of rainfall were reported, with parts of Bryan, Chatham, Effingham, and Glynn counties receiving 10-16 inches.

Widespread hurricane-force wind gusts were observed, and in some counties lasted for almost 5 straight hours. The highest wind gusts were recorded on Tybee Island: a 94 MPH wind gust at 4:19 AM and a 96 MPH wind gust at 4:38 AM on Saturday morning. Tropical storm-force wind gusts of 39 MPH or greater occurred in Appling, Bacon, Bulloch, Candler, Charlton, Chatham, Evans, Glynn, Jeff Davis, Liberty, McIntosh, Screven, Ware, and Wayne counties. Hurricane-force winds of 74 MPH or greater occurred in multiple portions of Chatham and Bryan counties.

Hurricane Irma (2017)

Hurricane Irma made landfall as a major hurricane in southwest Florida on September 10, 2017. Irma moved northward through the day on September 10th, gradually losing

intensity but continuing to bring widespread wind damage and heavy rainfall along its track. By the morning of Monday, September 11th, then-Tropical Storm Irma moved into Georgia with a very large wind field containing at least tropical storm force wind gusts (39+mph). These high winds lasted several hours across most of the state, which resulted in many thousands of downed trees and caused 1.5 million customers in Georgia to lose power. Given the extensive damage, power was not restored to many areas for several days. With generally dry conditions prior to Irma's arrival, flooding issues in North and Central Georgia were relatively minor, though portions of southern and coastal Georgia experienced more significant flooding as well as coastal storm surge.

Widespread sustained winds of 30-45 mph with gusts in the 50-65 mph range downed numerous trees and power lines across the area. Many trees fell onto homes and businesses, causing additional damage. Unfortunately, at least two people were killed in North Georgia due to falling trees with several others sustaining injuries. The heaviest rainfall totals were confined to far southeast Georgia, where some areas received 9-13 inches of rainfall. In North and Central Georgia, most areas received 3-5 inches of rainfall. Even though much of the area was on the side of Irma typically favorable for tornadoes, no tornadoes were reported across Georgia during Irma's passage. The primary reason for this lack of tornadoes was the fact that an unseasonably cool and stable air mass was in place across the area. In fact, high temperatures were only in the 60s that day, which set record cool high temperatures for September 11th for many locations. These cool temperatures eliminated any instability that would have supported tornado-producing tropical convection associated with Irma.

Hurricane Michael (2018)

Hurricane Michael made landfall near Mexico Beach, Florida as a Category 5(?) hurricane around mid-morning October 10th, 2018. By 5pm, the storm had entered Southwest Georgia near Donalsonville as a Category 3 storm. It traveled a path from Donalsonville, through Albany and Dublin and exited the state just north of Augusta by 11am Thursday, October 11th.

Tragically, three people lost their lives as a result of the storm. In addition, the storm caused over $2.5 billion is losses to the agriculture industry, according to the University of Georgia Extension Service. Losses to the cotton and timber industries totaled nearly $700 million (cotton) and nearly $1 billion (timber), respectively.

Hurricane Zeta (2020)

Hurricane Zeta made landfall in southern Louisiana as a Category 3 storm and traveled northeast across Mississippi and Alabama, reaching Northwest Georgia near Cedartown and Rome as a tropical storm around 1am Thursday morning, October 29th and exiting the state near Franklin, N.C. by 10am.

The storm caused three fatalities and over one million people to lose power. Power outages ranged throughout metro Atlanta and North and Central Georgia, extending as far south as Sumter County in Southwest Georgia. Notably, Bulloch and McIntosh Counties, in Southeast Georgia, also experienced power outages during this time.

2.2 Federally Declared Disasters (2001-2020)

(DR-1554) September 18, 2004: Georgia Hurricane Ivan.
Individual Assistance - Dollars Approved: $4,243,819.01
Public Assistance - Dollars Approved: $11,948,606.45

(DR-1560) September 24, 2004: Georgia Tropical Storm Frances.
Public Assistance - Dollars Approved: $15,368,109.08

(DR-1686) March 03, 2007: Georgia Severe Storms and Tornadoes.
Individual Assistance - Dollars Approved: $1,354,036.12
Public Assistance - Dollars Approved: $50,329,193.22

(DR-1750) March 20, 2008: Georgia Severe Storms and Tornadoes.
Individual Assistance - Dollars Approved: $1,351,662.70
Public Assistance - Dollars Approved: $3,505,637.41

(DR-1761) May 23, 2008: Georgia Severe Storms and Flooding.
Individual Assistance - Dollars Approved: $2,458,564.00
Public Assistance - Dollars Approved: $10,732,656.80

(DR-1833) April 23, 2009: Georgia Severe Storms, Flooding, Tornadoes, and Straight-line Winds.
Individual Assistance - Dollars Approved: $4,420,415.46
Public Assistance - Dollars Approved: $21,064,693.30

(DR-1858) September 24, 2009: Georgia Severe Storms and Flooding.
Individual Assistance - Dollars Approved: $58,999,961.95
Public Assistance - Dollars Approved: $78,188,645.56

(DR-1973) April 29, 2011: Georgia Severe Storms, Tornadoes, Straight-line Winds, and Associated Flooding.
Individual Assistance - Dollars Approved: $5,549,148.17
Public Assistance - Dollars Approved: $20,337,390.55

(DR-4165) March 06, 2014: Georgia Severe Winter Storm.
Public Assistance - Dollars Approved: $46,734,451.61

(DR-4215) April 20, 2015: Georgia Severe Winter Storm.
Public Assistance - Dollars Approved: $10,843,502.79

(DR-4259) February 26, 2016: Georgia Severe Storms and Flooding.
Public Assistance - Dollars Approved to date: $19,634,249.33

(DR-4284) October 08, 2016: Georgia Hurricane Matthew.
Individual Assistance - Dollars Approved: $6,593,971.53
Public Assistance - Dollars Approved to date: $96,120,859.39

(DR-4294) January 25, 2017: Georgia Severe Storms, Tornadoes, and Straight-line Winds.
Individual Assistance - Dollars Approved: $620,724.39
Public Assistance - Dollars Approved to date: $14,777,933.28

(DR-4297) January 26, 2017: Georgia Severe Storms, Tornadoes, and Straight-line Winds.

Individual Assistance - Dollars Approved: $2,960,695.39
Public Assistance - Dollars Approved to date: $24,283,289.48

(DR-4338) September 15, 2017: Georgia Hurricane Irma.

Individual Assistance - Dollars Approved: $12,696,704.44
Public Assistance - Dollars Approved to date: $120,495,053.08

(DR-4400) October 14, 2018: Georgia Hurricane Michael

Individual Assistance – Dollars Approved: $12,581,999.88
Public Assistance – Dollars Approved to date: $342,155,677.08

(DR-4501) March 29, 2020: Georgia COVID-19 Pandemic

Individual Assistance – Dollars Approved: $41,094,747.08
Public Assistance – Dollars Approved to date: $201,936,722.61

(DR-4579) January 12, 2021: Georgia Tropical Storm Zeta

Public Assistance – Dollars Approved to date: $5,474,256.45

(DR-4600) May 5, 2021: Georgia Severe Storms, Tornadoes, and Straight-line

Public Assistance – Dollars Approved to date: $174,284.90

Source: https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties

3.0 RISK ASSESSMENT

This section details the risk assessment process and the methods used to rank hazard risks. Results from this process and accompanying methods will be presented in hazard-specific sections that follow.

Hazard Identification - In this step the hazards that could impact your community are separated from those that cannot. This requires a review of all hazards and their causes to determine whether they may be a threat to your community. This may require the consultation of the scientific community, historical records, and government agencies.

Risk Assessment - In this step the level of risk for each hazard is examined. This may involve speaking with hazard experts, researching past occurrences and possible scenarios. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance and critical infrastructure should be examined.

Risk Analysis - The information collected in the risk assessment step will be analyzed in this step. The desired outcome of the risk analysis is the ranking of the hazards. This highlights the hazards that should be considered a current priority for your emergency management program.

Monitor and Review - It is important to remember that a HIRA is an ongoing process and hazards, and their associated risks must be monitored and reviewed.

3.1 Ranking Methodology

In this section, the methodology of scoring vulnerability for a hazard will be explained as it relates to each hazard. The discussion of the methodology is critical to understanding how and why hazards are prioritized in Georgia.

A standardized methodology, which allows for greater flexibility and room for subject matter expertise was developed to compare different hazards' risk at the State level. This method prioritizes hazard risk based on a blend of quantitative factors extracted from multiple data sources.

These factors include Frequency (Table 3), Likelihood of Occurrence and Vulnerability to Hazard (Tables 4-11) which include:

- Social Impacts (fatalities, injuries, and evacuation) (Tables 4-6);
- Property Damage (hazard on buildings, structures and crops) (Table 7);
- Critical Infrastructure Service Disruptions/Impact (Table 8);
- Environmental Damage (Table 9);
- Business/Financial Impact (Table 10) and
- Psychosocial Impact (Table 11)

Likelihood of hazard occurrence (Table 3) was rated on a scale of one (1) through (6), in which the probability of future occurrence ranged from less than a one percent chance in the next 100 years (score of 1) to near 100 percent probability of happening within 12 – 60 months (score of 6).

Table 3 Likelihood of hazard occurrence

Frequency	Category	Percent Chance	Description
1	Rare	Less than a 1% chance of occurrence in any year.	Hazards with return periods >100 years.
2	Very Unlikely	Between a 1% - 2% chance of occurrence in any year.	Occurs every 50 – 100 years and includes hazards that have not occurred but are reported to be more likely to occur in the near future.
3	Unlikely	Between 3% – 10% chance of occurrence in any year.	Occurs every 20 – 50 years
4	Probable	Between 11% – 50% chance of occurrence in any year.	Occurs every 5 – 20 years
5	Likely	Between 51% – 99% chance of occurrence in any year.	Occurs >5 years.
6	Almost Certain	100% chance of occurrence in any year.	The hazard occurs annually.

Social Impacts are the direct negative effects of a hazard on the physical health of people. The social impacts sub variable is further divided into the fatality rate, injury rate and evacuation rate. Add all three together to get the social impact score.

- Fatalities Table (4) was rated on a scale of (0) through (4), in which the probability of a fatality is not likely (score of 0) to catastrophic more than 50 (Score of 4).
- Injuries Table (5) was rated on a scale of (0) through (3), in which the probability of an injury is not likely (score of 0) to severe more than 100 (Score of 3).
- Evacuation Table (6) was rated on a scale of (0) through (3), in which the probability of an evacuation is not likely (score of 0) to severe more than 500 (Score of 3).

Table 4 Fatalities

Vulnerability	Category	Description
0	None	Not likely to result in fatalities within the community.
1	Minor	Could result in fewer than five fatalities within the community.
2	Moderate	Could result in 5 to 10 Fatalities within the community.
3	Severe	Could result in 11 to 50 fatalities within the community.
4	Catastrophic	Could result in 50+ fatalities within the community.

Table 5 Injuries

Vulnerability	Category	Description
0	None	Not likely to result in injuries within the community.
1	Minor	Could injure fewer than 25 people within community.
2	Moderate	Could injure 26 to 100 people within the community.
3	Severe	Could injure 100+ people within the community.

Table 6 Evacuation

Vulnerability	Category	Description
0	None	Not likely to result in an evacuation shelter-in-place orders, or people stranded.
1	Minor	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.
2	Moderate	Could result in 100 - 500 people being evacuated, sheltered-in-place or stranded.
3	Severe	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.

Property Damage is the direct negative effects of a hazard on buildings, structures and other forms of property, such as crops.

Table (7) was rated on a scale of (0) through (3), in which the probability of property damage is not likely (score of 0) to widespread damage (Score of 3).

Table 7 Property Damage

Vulnerability	Category	Description
0	None	Not likely to result in property damage within the community.
1	Minor	Could cause minor and mostly cosmetic damage.
2	Moderate	Localized severe damage (a few buildings destroyed).
3	Severe	Widespread severe damage (many buildings destroyed).

Critical Infrastructure Service Impact are the negative effects of a hazard on the interdependent, interactive, interconnected networks of institutions, services, systems, and processes that meet vital human needs, sustain the economy, protect public safety and security, and maintain continuity of and confidence in government.

Table (8) was rated on a scale of (0) through (3), in which the probability of critical infrastructure service impact is not likely (score of 0) to severe (Score of 3).

Table 8 Critical Infrastructure Service Impact (CI)

Vulnerability	Category	Description
0	None	Not likely to disrupt critical infrastructure services.
1	Minor	Could disrupt 1 critical infrastructure service.
2	Moderate	Could disrupt 2 – 3 critical infrastructure services.
3	Severe	Could disrupt more than 3 critical infrastructure services.

Environmental Damage is the negative effects of a hazard on the environment, including the soil, water, air and/or plants and animals.

Table (9) was rated on a scale of (0) through (3), in which the probability of environmental damage is not likely (score of 0) to severe (Score of 3).

Table 9 Environmental Damage

Vulnerability	Category	Description
0	None	Not likely to result in environmental damage.
1	Minor	Could cause localized and reversible damage. Quick clean up possible.
2	Moderate	Could cause major but reversible damage. Full clean up difficult.
3	Severe	Could cause irreversible environmental damage. Full clean up not possible.

Business/Financial Impact that have a negative economic consequence of a hazard.

Table (10) was rated on a scale of (0) through (2), in which the probability of business/financial impact is not likely (score of 0) to severe (Score of 2).

Table 10 Business/Financial Impact

Vulnerability	Category	Description
0	None	Not likely to disrupt business/financial activities.
1	Moderate	Could result in losses for a few businesses.
2	Severe	Could result in losses for an industry.

Psychosocial Impact is the negative response of the community or a subset of the community to a hazard caused by their perception of risk. This includes human responses such as self-evacuation, mass panic and other potential undesirable responses.

Table (11) was rated on a scale of (0) through (2), in which the probability of Psychosocial Impact is not likely (score of 0) to severe (Score of 2).

Table 11 Psychosocial Impact

Vulnerability	Category	Description
0	None	Not likely to result in significant psychosocial impacts.
1	Moderate	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.
2	Severe	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding, self-evacuation and long-term psychological impacts.

3.2 Composite Hazard Index

The total vulnerability value can be obtained by adding the values obtained from each of the sub variables.

Table 12 Total Vulnerability

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/Financial Impact	Psycho-social Impact	Sub-variable Total
0	0	0	0	0	0	0

Once the vulnerability values have been added up, they are put into groups as shown in the table below. This gives equal weight to vulnerability and frequency.

Table 13 Vulnerability Groups

Sub Total Variable	Vulnerability	Description
1 - 4	1	**Minor**

5- 6	2	**Slight**
7- 8	3	**Moderate**
9 - 10	4	**Severe**
11 - 12	5	**Very Severe**
+13	6	**Catastrophic**

Risk Analysis

Once you have completed the Frequency and Vulnerability Work Sheets, you can now begin to prioritize your hazards by using the HIRA equation:

Risk = Frequency * Vulnerability

Table 14 Risk Analysis

Level Of Risk	
< 5	Very Low
6 -10	Low
11- 15	Moderate
16- 20	High
21- 25	Very High
> 25	Extreme

4.0 IMPACT ANALYSIS

Impact Analysis includes all populations and assets (environmental, economic, and critical facilities) that may be at risk from natural, human-caused, and technological hazards. Impact analysis measures the level of assets, populations, or resources within a given region, city, or town. The impacts are a function of the built environment, local economy, demographics, and environmental uses of a given region.

4.1 Facility Analysis

The damage and/or destruction of Georgia's seven (7) community lifeline sectors (Safety and Security; Food, Water, and Shelter; Health and Medical; Energy (Power and Fuel); Communications; Transportation; and Hazardous Materials) represents enormous economic, social, and general functional costs to a community, while also impeding emergency response and recovery activities.

Approximately 1 million people live within 75 miles of the Gulf of Mexico and in the 11 counties closest to the Atlantic Ocean in Georgia. These areas are the most vulnerable to hurricanes. A nonfunctional road can have major implications for a community: general loss of productivity; disruption of physical access preventing residents from getting to work or other daily activities; prevention of emergency vehicles from reaching

destinations; associated health and safety implications; and potential access difficulties causing the disruption of important lifeline supplies, such as food and other deliveries to the community.

Damaged or destroyed utility lines and facilities, including electricity, computer and satellite links, gas, sewer, and water services can cripple a region after a disaster. Power lines are often badly damaged or destroyed, resulting in the loss of power for days, weeks, or even months. This is particularly critical considering modern societies' dependence on electricity. In addition to basic modern household appliances being affected, public water supplies and water treatment and sewage facilities can also be impacted. Electric pumps cannot pump drinking water into an area without power, and even if they could, the water delivery system could be breached in several areas. Decreased levels in elevated water tanks also results in a lack of safe drinking water. Even disaster victims who do get water may have to boil it to eliminate waterborne pathogens introduced to the supply in breached areas or due to low service pressures.

Although not a complete representation of all the possible types of facilities, this dataset is a good representation of critical and state facilities in Georgia.

Table 15 Types of Facilities

State Owned Holdings:	21,386
State route miles	17,923
Interstate miles	1,247
Law Enforcement	841
Fire Stations	1748
Hospitals	222
Dispatch Centers	183
First Responder's Communication Towers	517
Fixed Gateways	178
TV Digital Station Transmitters	53
AM Transmission Towers	193
FM Transmission Towers	512
Cellular Towers	688
City Halls	125
Housing Units	4,283,477
Mobile Homes	384,876 (±4700)
Airports	454
Dams	4537
Fishing and Boating Access/Marinas	896

It should be noted that State Owned Holdings includes leased property, Law Enforcement includes Correctional Institutions, Fire Stations includes Emergency Medical Services, and Schools to capture all schools including higher education and as a result the school layer was more comprehensive compared to the Colleges and Universities data. The State Facilities dataset overlaps several of the critical facilities, as they are state-owned facilities.

Many privately-owned buildings and structures (such as hospitals, power plants, and certain industrial facilities) are critical to societal function, especially during emergencies

and disasters. Thus, critical facilities data collection extended to a broader array of critical facilities than would be available by only using state-owned facilities.

5.0 CONSEQUENCE ANALYSIS

The Consequence Analysis (CA) investigates the impact of each identified hazard on various elements of the community and state infrastructure of Georgia. The impact of each hazard is evaluated in terms of disruption of operations, recovery challenges, and overall wellbeing to all Georgia's residents and first responders. The CA supplements the hazard profile by analyzing specific impacts the most probable hazards would have on the State of Georgia. The CA analyzes the impact on the following:

1. Public
2. Responders
3. Continuity of operations (including delivery of services)
4. Property, facilities, and infrastructure
5. Environment
6. Economic condition of the state
7. Public confidence in governance

The following subsections present a description of each type of hazard Georgia may experience. The information presented in this section has been expanded upon to include human-caused and technological hazards. Facility data has been included in the vulnerability analysis as applicable.

Impacts from extreme weather events have become more frequent during the past half-century, and this trend is projected to continue. For instance, more frequent intense precipitation events may translate into more frequent flash flooding episodes. The National Climate Assessment and Development Committee documented that the average temperature across the United States increased 1.8°F since 1901, with the majority of the increase since 1980. Significant and hazardous weather events have and will continue to become more intense and frequent, and will result in health and livelihood related impacts, such as water supply, agriculture, transportation, and energy. In addition to more intense storm systems, the impacts of climate change include, but are not limited to, more frequent and intense heat waves, increases in ocean and freshwater temperatures, frost-free-days, heavy downpours, floods, sea level rise, droughts, and wildfires.

National Climate Assessment and Development Advisory Committee (NCADAC) May 2014 Climate Assessment Report. http://ncadac.globalchange.gov/

5.1 Severe Weather

5.1.1 Description: Severe Weather events can include thunderstorms, lightning, hail, tornadoes, and high winds individually and in combination covering large areas of the state. While most events related to severe weather are limited in terms of their impact, duration, and spatial extent, severe weather remains one of the most

common disaster types in the State of Georgia. Below are descriptions of each type of event which make up Severe Weather:

Thunderstorms: Thunderstorms are formed when moist air near the earth's surface is forced upward through some catalyst (convection or frontal system). As the moist air rises, the air condenses to form clouds. Because condensation is a warming process, the cloud continues to expand upward. When the initial updraft is halted by the upper troposphere, both an anvil shape and a downdraft form. This updraft and downdraft combination forms a "cell." Each thunderstorm cell may extend several miles across its base and to reach 40,000 feet in altitude. Thunderstorm cells can compound and move abreast to form a squall line of cells, extending farther than any individual cell's potential. Georgia experiences thunderstorms an average of 50 to 80 days per year.

High Winds: Sustained convective winds of 35 knots (40 mph) or greater lasting for one hour or longer, or winds (sustained or gusts) of 50 knots (58 mph) for any duration (or otherwise locally/regionally defined), on a widespread or localized basis.

The NCEI divides wind events into several types including High Wind, Strong Wind, Thunderstorm Wind, Tornado and Tropical Cyclone. For the purpose of this risk assessment, the Wind hazard will include data from High Wind, Strong Wind and Thunderstorm Wind.

Lightning: Lightning occurs when the difference between the positive and negative charges of the upper layers of the cloud and the earth's surface becomes great enough to overcome the resistance of the insulating air. The current flows along the forced conductive path to the surface (in cloud to ground lightning) and reaches up to 100 million volts of electrical potential. In Georgia, lightning strikes peak in July, with June and August experiencing the next highest numbers of strikes.

Hail: Hail is a type of precipitation that forms during the updraft- and downdraft-driven turbulence within the cloud. The hailstones are formed by layers of accumulated ice (with more layers creating larger hailstones) that can range from the size of a pea to the size of a grapefruit. Hailstones span a variety of shapes but usually are spherical.

Tornado: A tornado is a violently rotating column of air in contact with the surface of the ground. Exceptionally large tornadoes may not exhibit the classic "funnel" shape but can appear as a large, turbulent cloud near the ground or a large rain shaft. Most significant tornadoes stem from the right, rear quadrant of large thunderstorm systems where the circulation develops between 15,000 and 30,000 feet.

5.1.2 Previous Major Occurrences: In Georgia, an average of 295 severe weather events per year occurred from 2001-2020, causing 1422 injuries, 208 fatalities, and more than $264 million in damages. These events include 343 tornado events, giving a historic average of approximately 17 events per year. Tornado specific events resulted in 864 injuries, 71 fatalities, and more than $31 million in damages.

5.1.3 Impact on Public: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state's citizens. Below are

descriptions of the impacts that make up Severe Weather and descriptions of their impact on the public.

Thunderstorms: Thunderstorms cause an extensive amount of damage having high winds, rain, hail, flooding, and excessive lightning. They can cause heavy damage, destruction, and injury to the public. Thunderstorms can cause destruction of property, power failures, flooding, and even injury or death. Additionally, thunderstorms present some risk to those who are exposed to the elements during such events.

High Winds: High winds can damage private and public property, such as vehicles, food sources, trees, and power lines, as well as cause bodily injury from flying debris. Power outages can lead to disruption of employment, businesses, commerce, communication, and food resources. High winds may also cause buildings and structures to collapse, which may cause injury or death.

Lightning: According to the Vaisala U.S. National Lightning Detection Network, from 2009-2018 Georgia averaged approximately 642,203 clouds to ground lightning flashes per year. While lightning frequently occurs, only 7 lightning deaths were reported in 2011-2020, ranking Georgia 10th highest in the United States.

Hail: Hailstorms mostly endanger crops but have been known to damage automobiles, aircraft, and structures. Hail stones can vary in diameter, and in Georgia hail of up to 4.25 inches has been recorded. Individuals caught in a hailstorm could suffer injury or death depending on the size of the hail.

Tornado: Destructive because of strong winds and wind-borne debris, tornadoes can topple buildings, roll mobile homes, uproot vegetation, and launch objects hundreds of yards. Flying debris from tornados poses the greatest risk to people and may cause injury or death.

5.1.4 Impacts to Public Health: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its population. Below are descriptions of the impacts of these individual events and their impact on public health:

Thunderstorms: Potential health concerns include damage to homes, fire caused by lightning, and multiple fatalities. There can also be localized flooding and the need for swift water rescues. Significant portions of the population may be displaced by the destruction and those individuals may not have access to personal documents or medical records. Shelter and basic necessities will be of major concern to the public and their health. In addition, incorrect use of generators can lead to carbon monoxide poisonings.

High Winds: The damage of high winds may cause chemical and hazardous materials to spread to sources of food, water, and areas utilized by the public as well as animals.

Lightning: Potential public health concerns include lightning fatalities and long-term physical and mental effects for survivors. Homes and buildings can be set ablaze causing significant property damage.

Hail: Hailstorms mostly endanger crops but have been known to damage automobiles, aircraft, and structures.

Tornado: Tornadoes can have a significant impact on homes, businesses, and agricultural products. Losses may impact food stability in the state or region. There will also be an increased demand for medical treatment for traumatic injuries. Significant portions of the population may be displaced by the destruction.

5.1.5 Impact on Responders: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on responders:

Thunderstorms: Exposure to lightning, flooding, and high winds may cause injuries to first responders. Vehicles and resources may be damaged, leading to impaired response activities. First responders may be unable to access roadways due to flooding, trees down, or debris. Extreme caution may need to be exercised if thunderstorms produce heavy rainfall or hail. Visibility may also decrease significantly, greatly impacting transport activities.

High Winds: High winds may also destroy property and resources of first responders. High winds may create power outages that can hinder critical communications, access, or usability of resources. Injuries to first responders and equipment may be caused by flying debris, further challenging response operations. The ability of first responders to conduct their duties may be hindered by high winds, especially if trees, power lines, and/or debris have impacted roadways and transit.

Lightning: Lightning can cause power outages and damage communication equipment. It may also damage response vehicles or buildings. Lightning may start fires on buildings and homes which will require actions by all types of response teams.

Hail: Hail can cause damage to buildings and vehicles. Large hail can injure and possibly kill responders.

Tornado: First responders can be injured resulting in employee absenteeism that impacts the overall capacity to respond to an event. In addition, the deposit of debris on major roadways, the location of the event, damage to equipment or facilities may increase the amount of time required for first responders to complete rescue operations. Exposed wires or hazardous materials may cause injury to first responders in the process of conducting search and rescue operations.

5.1.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan (COOP). In the event of Severe Weather that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal

governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.1.7 Delivery of Services: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on the delivery of services:

Thunderstorms: Delivery of services may be impaired by flooding, downed power lines, and destruction of roadways and resources. The ability to deliver goods and services can be impacted locally, regionally, or statewide depending on the magnitude of the event.

High Winds: Any items in the path of high winds such as cars, trucks, planes, crops, and light buildings such as mobile homes may be destroyed or permanently damaged. The delivery of goods and services can be severely impacted if debris falls into roadways obstructing passage and access.

Lightning: In Georgia, lightning strikes peak in June, July and August due to the amount of convective activity peaking in the summer. Southeast Georgia receives the greatest density of lightning strikes with Charlton County and Brantley County each averaging greater that 80 events per km^2.

Hail: Hail can knock down trees and power lines which can block roadways and hinder response vehicles.

Tornado: Buildings and homes may be damaged by tornadic winds which can cause injuries and casualties. Roads may become blocked slowing response vehicles and the delivery of services may be impacted by dangerous conditions or lack of adequate access to transportation options. This may cause food, water, and resource systems to be delayed or halted, as well as personal transportation limitations for the public.

5.1.8 Property, Facilities, and Infrastructure: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on property, facilities, and infrastructure:

Thunderstorms: Public utility equipment such as power lines and transformers are most at risk from thunderstorms and their by-products. If power lines are downed it can create a cascading effect for isolated power outages or full-scale blackouts depending on the severity of the weather. Properties and critical facilities also may face foundational and physical damage due to flooding, lightning strikes, or excessive winds, delaying response and recovery operations. Power outages and physical damage to structures may cause energy supply and water supply systems to be disrupted or fail. Sewage systems may be compromised and taken off grid.

High Winds: High winds can cause minor to extreme damage to property. Excessive winds can uproot and topple trees, lift cars, break windows, and knock outpower lines, leading to power outages to critical facilities. Transportation pathways may become obstructed by hazardous and nonhazardous debris, slowing down response and recovery activities.

Lightning: Lightning can damage buildings and cause fires. Damage to buildings can have severe effects on the infrastructure of communities. Also, many types of buildings such as hospitals, fire and rescue buildings, and other government facilities can be damaged.

Hail: Large Hail can cause significant roof and building damage and vehicles can be damaged and windows broken.

Tornado: Damages from lower intensity tornadoes (EF-0 to EF-1) can range from chimney damage to uprooted shallow trees. A significant tornado (EF-2 to EF-3) would cause damage to roofs on frame houses, complete destruction of mobile homes and large trees and utility lines snapping. A devastating tornado (EF-4 to EF-5) would result in well-constructed houses being leveled, weak foundations blown away for some distance, and cars thrown. Mobile homes within the state are especially vulnerable. Communications or power infrastructure may be damaged or destroyed, resulting in service disruptions. Tornadoes may also disrupt transportation services.

5.1.9 Impact on Environment: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its population. Below are descriptions of the impacts of these individual types and their impact on the environment:

Thunderstorms: Waste and debris from damaged structures can contaminate sources of water, food, and safety. In addition, debris and by-products of thunderstorms can impact the environment by possibly spreading pollution; damaging sewer and wastewater treatment plants; and disturbing the wildlife and natural areas.

High Winds: High winds on the environment affects foliage, trees, animals, cars, and structures, leading to the chance of hazardous and dangerous chemicals and materials being introduced into local waterways, agriculture, public and private spaces, and can affect fragile ecosystems.

Lightning: Lightning strikes may ignite wooded areas or fields, leading to destruction of agricultural crops, critical ecosystems, and natural habitats.

Hail: Hailstorms mostly endanger crops but have been known to damage automobiles, aircraft, and structures.

Tornado: Tornadoes may cause significant damage to the environment by exposing hazardous materials, causing contamination of water or food sources, or uprooting vegetation. Animals may be injured by flying debris or being lifted by the tornado. Agricultural crops may be lost due to contamination or being uprooted.

5.1.10 Impact on State Economy: Severe Weather covers a wide section of natural disasters and has one of the most consequential effects on the state and its citizens. Below are descriptions of the impacts of these individual events and their impact on the state's economy.

Thunderstorms: Resources from all levels of the state will be utilized. Local and state governments will face adverse fiscal consequences. State employees and government agencies may not be able to go to work reducing the ability to respond quickly.

High Winds: State and local resources may be costly for recovery from high wind damage. While federal grant reimbursements help cover the costs of damage, there is still an adverse fiscal impact on local governments.

Lightning: Large events can place a heavy burden on the state's economy and budget. Federal resources may need to be sought. Homes and buildings can be set ablaze causing significant property damage.

Hail: Hailstorms mostly endanger crops but have been known to damage automobiles, aircraft, and structures. This can have a very large impact on car dealerships, and individual cars and trucks. Many of these vehicles will have to be repaired or replaced. Damage to crops will be one of the largest losses to the state.

Tornado: Tornadoes pose a fiscal impact on the local and state governments, even if some of those costs can be recouped through federal grant reimbursements. Local, county, and state resources may be drained by the response to a tornado.

5.1.11 Public Confidence in the State's Governance: Immediate, effective, and direct actions are necessary to build and foster public confidence in state governance. Efficiency in response and recovery operations is critical in keeping public confidence high. Ineffective response can decrease the public's confidence in the state's ability to respond and govern.

5.2 Flooding

5.2.1 Hazard Description: Flooding events can include river flooding, flash flooding, coastal flooding, and urban flooding, individually and in combination, covering large areas of the state. While most events related to inland flooding are limited in terms of their impact, duration, and spatial extent, inland flooding remains one of the more common hazards in the State of Georgia. Below are descriptions of each type of event:

River Flooding: River flooding is a temporary overflow of water on normally dry lands adjacent to the source of water (river, stream, or lake). The causes of river flooding include mass sources of precipitation such as tropical cyclones, frontal systems, and thunderstorms combined with other environmental variables such as changes to the physical environment, topography, ground saturation, soil types, basin size, drainage patterns, and vegetative cover. Adverse impacts can include structural damage, temporary backwater effects in sewers and drainage systems, death of livestock, agricultural crop loss, loss of egress and access to critical facilities

due to roads being washed-out or overtopped, and unsanitary conditions resulting from materials being deposited during recession.

Flash Flooding: Flash flooding rapidly peaks and recedes giving insufficient time for evacuations. The more dangerous flash floods are common to the mountainous, impermeable surfaces of northern Georgia.

Coastal Flooding: Coastal flooding is the inundation of land areas along the coast caused by higher that average high tides and worsened by heavy rains and onshore winds.

Urban Flooding: Urban flash flooding can present dangerous conditions, especially with roads that are washing out or overtopped. Also, debris can clog rivers and creeks, causing flooding in areas that typically do not flood. Insufficient or damaged culverts can become clogged and create areas of flooding locally.

5.2.2 Previous Major Occurrences: In total, 712 flooding events occurred between 2001-2020 in Georgia. This equates to a historic average of approximately 35.6 events per year. These storms in total have caused 15 injuries, 17 fatalities, and more than $97.6 million in damages.

The worst flooding event in Georgia since record keeping began stemmed from Tropical Storm Alberto, a decaying tropical cyclone that impacted Georgia in July 1994. The system produced torrential rainfall and resulted in some of the worst flooding ever observed across portions of Georgia, Alabama, and Florida. By far, the worst flooding occurred along Georgia's Flint and Ocmulgee Rivers and their tributaries. Across the entire three-state area affected by the flooding, 17 NWS river forecast locations set new record flood stages, some breaking the old record by 5–7 feet. The flooding from Tropical Storm Alberto took a significant toll on human life, killing 33 people. Of that total, 31 deaths occurred in Georgia and the other two in Alabama. In addition, approximately 50,000 people were forced from their homes by the flooding. More than 18,000 dwellings were damaged or destroyed, and nearly 12,000 people applied for emergency housing.

Flooding occurred in 2009 in northwest Georgia and the Atlanta area. This storm was considered an "Epic" storm that statistically only has a 1 in 500 chance of occurring each year. The Atlanta area received 9 to 12 inches of rain during this event and there was approximately $225 million in damages.

5.2.3 Impact on Public: Depending upon the location of rainfall, flooding can occur in all areas of the state. Rural areas typically suffer crop damage or damage to roads. Many of the fatalities, as is typical with flooding events, occur resulting from flash flooding, and most occur in vehicles.

5.2.4 Impacts to Public Health: Flooding can have a significant effect on communities, especially those near larger rivers or creeks. Flood waters become filled with all types of toxic waste if it remains for a long period of time. Citizens are in grave danger during flash flooding events. Many become trapped in their homes and cars. There are potential long-term health concerns related to mold growth in residential structures.

5.2.5 Impact on Responders: Fire, police, and emergency responders are often called on to evacuate people if flooding is imminent. First responders may face challenges with transportation and access to a location due to flooded or obstructed roadways. Flash floods and mudslides due to heavy rainfall can also injure first responders, as well as delay response operations. Coordinating response to flooding events can be a significant effort by first responders especially in the event of flash floods. Responders can also be impacted by exposures to flood waters.

5.2.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of flooding that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.2.7 Delivery of Services: Flooding can cause road and bridge closures, as well as disrupt transit service. If any of these shutdowns occur, the ability to deliver goods and services efficiently will be impacted. Exposure to water may also damage or destroy physical goods such as food, clothing, and hygiene products.

5.2.8 Property, Facilities, and Infrastructure: Flooding can cause significant property damage to homes and businesses. This in turn impacts the market value of flooded property. In addition, floods can impact schools, hospitals, and other municipal infrastructure which impacts the public's ability to use these services. Water sources can become contaminated with toxic and dangerous chemicals, or fecal matter. Water and sewer system disruptions may trigger solid-waste collection and disposal disruptions, causing dangerous public health risks.

5.2.9 Impact on Environment: Inland Flooding can impact the environment by spreading pollution, damaging water and wastewater treatment plants, and creating debris. In addition, the standing water following a flooding event can cause the spread of mosquitoes, disease, and other pollutants.

5.2.10 Impact on State Economy: Repeated flooding can have a devastating effect on property value which can have a detrimental effect on local tax bases. Flooding also places a significant drain on response resources, which can become costly during a large flooding event.

5.2.11 Public Confidence in the State's Governance: Ineffective flooding response can decrease the public's confidence in the state's ability to respond and govern. Multi-level government response requires direct actions that must be immediate and effective to maintain public confidence. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.3 Tropical Cyclone

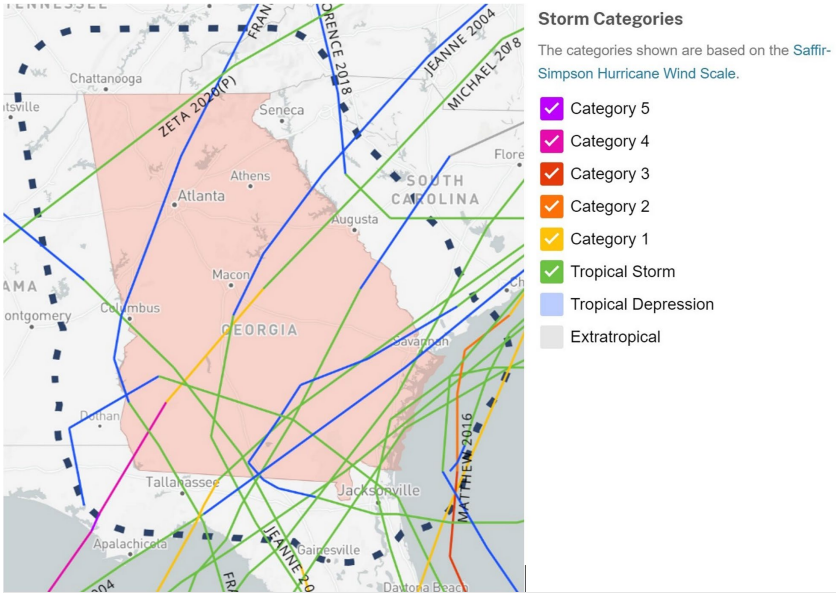

Figure 5-1 Tropical Storm / Hurricane Tracks

19 total storms have impacted Georgia at tropical storm or hurricane strength between 2001 and 2020.
12 occurred within state lines, 7 occurred within 50 miles of state lines.
Only 1 entered Georgia as a hurricane (Hurricane Michael – 2020). (NOAA Historical Hurricane Tracks)

5.3.1 Hazard Description: A hurricane is an intense tropical weather system with a well-defined circulation, producing maximum sustained winds of 74 mph or greater. Hurricane intensity is classified into five categories using the Saffir-Simpson Hurricane Scale. Winds in a hurricane range from 74 to 95 mph for a Category 1 hurricane to greater than 156 mph for a Category 5 hurricane. Hurricanes can cause catastrophic damage to coastlines and areas several hundred miles inland. Hurricanes can produce winds exceeding 155 miles per hour as well as tornadoes and microbursts. Additionally, hurricanes can create storm surges along the coast and cause extensive damage from heavy rainfall. Floods and flying debris from excessive winds are often the deadliest and most destructive results of hurricanes. Hurricane hazards can include storm surge, high winds, heavy rainfall, and tornados individually and in combination covering large areas of the state. Below are descriptions of each of these hazard types:

Storm Surge: An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed sea surface and the level that would have occurred in the absence of the cyclone. Storm surge produced by a tropical cyclone is a function of the geography of the coastline, the intensity of the hurricane, the angle of approach, and the forward speed.

High Winds: Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many

shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

Heavy Rainfall: Heavy rainfall can be described as a large amount of rain in one area for an extended amount of time which can cause significant flooding, contributing to flash floods, mudflows, or overtopping levees and dams.

Tornado: A tornado is a violently rotating column of air (seen only when containing condensation, dust, or debris) in contact with the surface of the ground. Tornadoes spawned by tropical systems tend to be weaker compared to tornadoes spawned by severe thunderstorms, but when coupled with the other hazards posed by tropical cyclones, the damage can be similar if not more extensive. Tropically induced tornadoes can also be more difficult to spot due to their quick spin-up nature, being embedded in rain bands, and oftentimes being rain-wrapped. This also typically prevents tropical tornadoes from being long tracked. Tornadoes usually appear in the right-front quadrant of a tropical cyclone since that is where the combination of forward motion and counter-clockwise rotation is highest.

5.3.2 Previous Major Occurrences: Between 1800 and 1850, three major hurricanes made landfall on the Georgia Coast in 1804, 1813, and 1824 causing a combined total of more than 600 fatalities.

Between 1851 and 1899, 17 tropical cyclones, three that became major hurricanes (in 1854, 1893, and 1898), made landfall on the Georgia Coast, with the number of fatalities nearing 2,700. From 1900 to 1949, four tropical cyclones (1911, 1928, 1940, and 1947) made landfall on the Georgia Coast. Between 1950 and 1999, only one hurricane made landfall along the Georgia coast (David in 1979). Between 2000 and 2020, Georgia has been impacted by Hurricane Matthew in 2016, Hurricane Irma in 2017, Hurricane Michael in 2018, and Hurricane Zeta in 2020.

5.3.3 Impact on Public: A large portion of Georgia's population is located in the coastal region of the state. During the summer months, the population in this area increases significantly due to the tourist season. Damage to homes, businesses, infrastructure, government facilities, and roadways can cause serious disruption to response operations. High winds, flooding and flying debris can have long-term consequences to all affected areas.

5.3.4 Impacts to Public Health: Toxic waste and materials can be introduced into flooding waters, contaminating water supplies as well as standing water. Extreme flooding, storm surge, and high winds may cause death or injury for humans and animals. Toxic flood waters can lead to the spread of disease. Mosquitoes may spread infection to humans and other animals.

5.3.5 Impact on Responders: First responders face many hazards such as flooding, high winds, and storm surge, which may cause personal injury, disease, or death. Coordinating an evacuation in advance of a significant hurricane event requires enhanced response coordination and causes a substantial strain on resources. Critical facilities and roadways may flood, lose power, or become damaged or destroyed. Emergency vehicles may become inoperable or inaccessible, reducing

response and recovery operations. Major events may require the localized suspension of public safety services for the safety of the responders.

5.3.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Tropical Cyclone that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.3.7 Delivery of Services: The ability to deliver goods and services efficiently will be impacted depending on the magnitude of the storm. Flooding and high winds cause damage to roadways and bridges, disrupting the availability of response units. Many businesses in the hurricane evacuation zone will have to shut down, causing loss of business and financial hardships. First response vehicles may become damaged, destroyed, or inoperable under extreme conditions.

5.3.8 Property, Facilities, and Infrastructure: Depending upon the magnitude and impact of the storm, widespread destruction to property, facilities, and infrastructure may occur. Public and private structures that are damaged may face significant recovery efforts and costs. Hurricanes and tropical storms can impact roads, bridges, schools, and healthcare facilities by water damage from storm surge. Communication systems such as TV and radio towers and internet systems can be damaged or destroyed. Power outages and the disruption of transportation can delay emergency response teams.

5.3.9 Impact on Environment: Hurricanes and tropical storms can cause significant devastation to coastal communities. Beach erosion and stream blockage can negatively impact the environment near the coast. Strong winds and flooding can cause damage to animals and crops.

5.3.10 Impact on State Economy: Georgia has a significant tourist industry, and a major hurricane or tropical storm could cause damage to beaches, historical sites, and other areas that tourists frequent. The costs of response and recovery efforts are significant and can have cascading impacts on the state economy at large.

5.3.11 Public Confidence in the State's Governance: Ineffective response both before and after a hurricane or tropical storm can decrease the public's confidence in the state's ability to respond and govern. Governmental response across local, state, regional, and federal levels require direct actions that must be immediate and effective to maintain public confidence.

5.4 Winter Weather

5.4.1 Hazard Description: Winter Weather events can include extreme cold, blizzards, snow, ice, freezing rain and sleet individually and in combination covering

large areas of the state. While most events related to Winter Weather are limited in terms of their impact, duration, and spatial extent, Winter Weather typically affects the northern part of the state annually. Below are descriptions of each type of event:

Snow: Precipitation in the form of ice crystals, mainly of intricately branched, hexagonal form and often agglomerated into snowflakes, formed directly from the freezing of the water vapor in the air

Ice: Frozen water, the solid state of water

Freezing Rain: Rain that falls as a liquid but freezes into glaze upon contact with the ground

Sleet: Pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes

Blizzard: A blizzard means the following conditions are expected to prevail for a period of three hours or longer: 1) Sustained wind or frequent gusts to 35 miles per hour or greater; and 2) Considerable falling and/or blowing snow

Extreme Cold: Below normal temperatures that may lead to serious health problems.

5.4.2 Previous Major Occurrences: In total, 287 winter weather events occurred from 2001 to 2020 in Georgia. This equates to a historic average of approximately 14.4 events per year. These storms in total have caused 64 injuries, 13 fatalities, and more than $5 million in damages.

5.4.3 Impact on Public: Freezing temperatures and heavy snow accumulation may cause dangerous travel conditions leading to collisions and injury on roadways, individuals not being able to go to work, or accessing critical community facilities. Power lines can become overloaded with heavy snow which can break and lead to a loss of electricity and heat in homes and businesses. Children and the elderly are especially susceptible to severe cold in their homes with loss of heat. This can cause a dangerous situation for pets that remain outdoors.

5.4.4 Impacts to Public Health: Extremely cold weather with low temperatures can lead to hypothermia, frost bite and could possibly lead to death. Individuals without shelter or a heating system are susceptible to these conditions. In addition, incorrect use of generators during power outages can lead to carbon monoxide poisonings.

5.4.5 Impact on Responders: First responders must protect themselves from exposure to freezing conditions for prolonged periods of time. Deteriorating road conditions create a delivery of service challenge. First responders' duties will include managing evacuation of people from snow impacted areas, directing traffic, closing roads, operating shelters, and taking care of the injured and sick. Equipment may also be damaged or destroyed due to cold temperatures, heavy wind, ice, and heavy snowfall, which may lead to a decrease in response capabilities.

5.4.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Winter Weather that affects the state's operations, the Agency

will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.4.7 Delivery of Services: Emergency response by first responders is compromised depending on the severity of the winter weather event. Deteriorating road conditions may lead to roadway and bridge closures, as well as transit service disruptions. Slick roads and icy conditions lead to increased vehicle accidents. Businesses may have to shut down, which leads to the disruption of goods and services.

5.4.8 Property, Facilities, and Infrastructure: Snow and ice can impact access to homes and critical facilities such as hospitals, schools, and supermarkets. Power loss can lead to disruption of critical infrastructure and technology. State and local transportation systems, government services, and communications may be disrupted during winter weather conditions. Roads and bridges may be heavily impacted by winter weather which can cause detours and delays. Roads and bridges can be completely obstructed by downed trees, power lines, and snow accumulation.

5.4.9 Impact on Environment: Vegetation and trees can be damaged with heavy snow and ice accumulation. Flooding may occur after the rapid melting of snow. Animals are susceptible to exposure to extreme cold, which may lead to illness or death. Flooding can lead to the release of foreign materials and dangerous chemicals which may leak into natural environments and water reservoirs, thus causing further damage.

5.4.10 Impact on State Economy: Winter Weather costs local and state governments a great deal of money and assets, possibly requiring assistance from the federal government. The removal of excess snow and debris is expensive. Businesses may not be able to open, thus causing a loss in revenue. Agricultural damage may also result in decreased revenue.

5.4.11 Public Confidence in the State's Governance: The public's confidence in the state's government is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.5 Drought/Wildfire

5.5.1 Hazard Description: Drought is a normal, recurrent feature of climate consisting of a deficiency of precipitation over an extended period of time (usually a season or more). This deficiency results in a water shortage for some social or environmental sector. Drought should be judged relative to some long-term average condition of balance between precipitation and evapotranspiration in a particular area that is considered "normal." Because the impacts of drought conditions are largely

dependent on the human activity in the area, the spatial extent of droughts can span a few counties to the entire state. Temporal characteristics of droughts are drastically different from other hazards due to the possibility of extremely lengthy durations as well as a sluggish rate of onset.

Extreme Heat: Extreme heat can cause significant damage to the local environment by dehydrating vegetation and wildlife, which would create a cascading effect to the surrounding environment. Extreme temperatures may severely decrease the yield of Georgia's cash crops. Extreme heat can be associated with drought and prolonged heat waves. Vulnerable human populations, as well as livestock are adversely affected by extreme heat and may suffer medical problems or death.

Wildfires: A wildfire is an uncontained fire that spreads through the environment. Wildfires may consume large areas, including infrastructure, property, and resources. Not only do the flames harm the environment, but the massive volumes of smoke spread by wind also affect the health of nearby populations. Wildfires result from the interaction of three crucial elements: fuel, ignition (heat), and oxygen. Natural and manmade forces cause the three crucial elements to coincide in a manner that produces wildfire events.

Smoke: Smoke is suspended carbon particles in air resulting from the combustion of wood, peat, coal or other organic matter. Smoke can cause health issues for people, even far away from fires.

Water Shortage: The loss of water due to evaporation, drought and overuse by local populations is of major concern to local communities that rely on this water for survival.

5.5.2 Previous Major Occurrences: Because droughts are "creeping" disasters, only large-scale events are considered notable. One of the most severe drought events in Georgia occurred in 1977 and resulted in a federal disaster declaration. The drought spanned most of the Midwestern and Southeastern United States and doomed many harvests of hay, corn, soybean, cotton, and peanut. The declaration included 130 of Georgia's 159 counties, with costs to farmers topping $300 million (figure not inflation-adjusted).

On April 16, 2007, a downed power line ignited drought-parched forest floors in southern Georgia, which led to the largest and most devastating wildfires in state history. Nearly 564,000 acres were consumed in Georgia and Florida, and 18 homes were destroyed. More than 3,300 firefighters from 44 states, Canada and Puerto Rico came in to battle the blazes.

In 2017 wildfires engulfed 19,411 acres across North Georgia and the West Mims Fire near the Georgia/Florida border burned an estimated 130,942 acres.

5.5.3 Impact on Public: Extreme heat can have large impacts on the wellbeing of those more vulnerable to severe conditions, such as the elderly and young children. Loss of electricity may impact air conditioning and cooling mechanisms in homes, leading to increased indoor temperatures. In the case of wildfires, not only do the

flames harm the environment, but the massive volumes of smoke spread by certain atmospheric conditions also affect the health of nearby populations.

5.5.4 Impacts to Public Health: Physical effects of heat can cause major health problems, dehydration, and may lead to death. People begin to suffer heat-related illness when their bodies are unable to compensate and properly cool. Heat stroke may increase the body temperature to 106 degrees Fahrenheit or higher. Very high body temperatures may damage the brain or other vital organs.

5.5.5 Impact on Responders: First responders need to take necessary measures to avoid the effects of extreme heat and wildfire suppression such as drinking plenty of water and getting proper rest. Emergency responders are susceptible to heat stroke and severe dehydration resulting from fire or extreme heat. There is also the possibility of extreme heat damaging instruments or equipment necessary for response activities.

5.5.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Drought/Wildfire that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.5.7 Delivery of Services: Wildfires can cause death or injury to people and animals, damage or destroy structures, and disrupt community services including transportation, gas, power, communications, and other services.

5.5.8 Property, Facilities, and Infrastructure: Drought has a significant effect on the water supply which is a major component to the infrastructure of communities. Wildfire can affect property of the state and its citizens. Droughts have severely affected municipal and industrial water supplies, stream-water quality, recreation, hydro power generation, navigation, and agricultural production.

The wildfires that cause the greatest loss of life and property are those located in the Wildland-Urban Interface. Wildland-Urban Interface has been defined in many ways, but from a fire management perspective, it is commonly considered an area where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

5.5.9 Impact on Environment: Storage projects are often used to mitigate drought and improve ecosystem services. These projects involve diverting floodwaters from a stream, river, or other body of water into a conduit such as a canal, pipe, or wetland and storing them in an above-ground storage facility. Water is then slowly released, reducing flood risk as well as facilitating groundwater recharge/seepage.

5.5.10 Impact on State Economy: Drought has had major effects on the state's economy over many years. Reduction in crop and grass production affects our food

supply as well as the food supply for farm animals. Fighting and putting down wildfires cost the State a good deal of funds each year. Proximity to wooded areas, exposes many of the state's facilities to wildfire and the cost to replace them.

5.5.11 Public Confidence in the State's Governance: Effective and timely actions by the state and local communities will bolster the public's confidence in the state's governance.

5.6 Geologic Hazards

5.6.1 Hazard Description: Earthquakes are defined as the sudden motion or trembling of the Earth's surface caused by an abrupt release of slowly accumulated strain. This release typically manifests on the surface as ground shaking, surface faulting, tectonic uplifting and subsidence, or ground failures, and tsunamis.

Sinkholes are generally defined as a natural depression or hole in the surface topography formed by mechanisms such as the gradual removal of soluble bedrock by percolating water, the collapse of cave roofs (due to some seismic activity), or the lowering of the water table. These natural phenomena occur in areas where the subsurface rock consists of evaporates (salt, gypsum, and anhydrite) and carbonates (limestone and dolomite).

Landslides occur when masses of rock, earth or debris move down a slope. Debris and mud flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." They can flow rapidly, striking with little or no warning at avalanche speeds. They also can travel several miles from their source, growing in size as they pick up trees, boulders, cars and other materials.

5.6.2 Previous Major Occurrences:

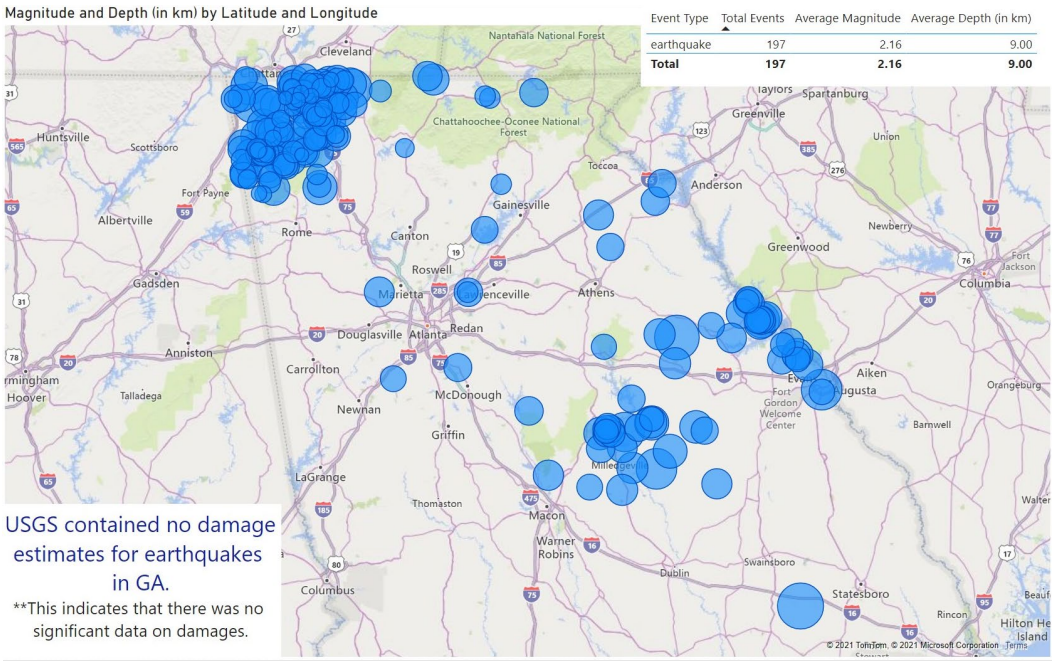

Table 16 Earthquakes

Year	Magnitude	Area Affected	Remarks
1811-1812	7.3-7.8	New Madrid	Rerouted MS River; Damage in Richmond; Felt in Boston
1886	6.9	Charleston, SC	V-VIII intensity
1914	5.0	North Georgia	Caused little damage
1964	4.5	Lake Sinclair	Tremors every 2-3 years
1972	4.5	Clarks Hill Reservoir	Quakes felt every 20 seconds
1976		Toombs County	V intensity
1985	3.0-3.5	Columbus	
1996	2.4	DeKalb County	Norris Lake area
2003	4.9	North Georgia/ Alabama border	Some power outages; Felled trees; Minor household damage
2010	2.8	Northwestern Georgia	Dalton area
2013	2.5-2.8	Georgia / South Carolina border	Thurmond Lake area
2015	2.6	Eatonton	Lake Oconee area
2017	2.7	Sparta, Georgia	Intensity IV; Minor household damage
2018	2.7	Northwestern Georgia	Intensity III; reported by over 100 people

Sinkholes: There have been no significant losses from sinkholes in the State of Georgia since at least 1960. However, one notable sinkhole event exists in recent history. During the 1994 flooding of Albany, Georgia from Tropical Storm Alberto, numerous sinkholes formed under the floodwaters. Notable sinkholes occurred in

Riverside and Oakview Cemeteries in downtown Albany, where a combination of flood waters and subsiding terrain released disturbed gravesites.

Landslides: An exact historical record is difficult to determine as many landslides and debris flow events are minor, do not cause significant damage or go unreported. Spatial Hazard Events and Losses Database for the United States (SHELDUS) data from 1952 to 2012 list one event occurring in Rabun County in 2004. Property losses from this event were estimated at $100,000. This event was triggered by excessive rainfalls from Hurricane Ivan as it passed through the State. In August 2013, heavy rains created a mudslide in Sandy Springs, GA that closed a local road. The road was closed for one year while a retaining wall was constructed at a cost of approximately $1 million. Residents reported eight other mudslides in the area.

5.6.3 Impact on Public: Geologic hazards may cause injury or death to the public by causing vehicle accidents, falling/flowing debris, or structure failure.

5.6.4 Impacts to Public Health: After a geologic hazard event, people may be seeking medical treatment for injuries or services that are interrupted from the event such as water, wastewater, or power. Fires or hazardous material releases could also be a result of a geologic hazard event.

5.6.5 Impact on Responders: The extent of the damage caused by a geologic hazard event could impact the responders' ability to access the damaged area and to transport people and resources to and from the area. Equipment, facilities, or other resources may be damaged from the event which could affect the responders' ability to respond by limiting speed and efficiency.

5.6.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of geologic hazard that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.6.7 Delivery of Services: Delivery of services may be affected by dangerous transportation conditions, including waterways, causing resources to be delayed or halted in their delivery to the public. Ground shaking or land subsidence could damage or destroy the goods or services that need to be delivered.

5.6.8 Property, Facilities, and Infrastructure: All critical facilities in the planning area are exposed to an earthquake hazard. All critical facilities in northwest Georgia and the coastal plain region are susceptible to sinkholes. All critical facilities in northeast Georgia may be affected by landslides. Transportation routes (roads, bridges, and waterways), pipelines, and buildings can collapse or be disrupted during a geologic hazard event.

5.6.9 Impact on Environment: Geologic hazard events have the potential to trigger secondary hazards such as fire, flash flooding, hazardous materials release, and dam failures. Toxins released during these events can have a detrimental effect on the environment by impacting bodies of water, groundwater, animals, livestock, and crops.

5.6.10 Impact on State Economy: Local, county, and state resources may be exhausted during the initial response. Reimbursement from the federal government should be possible if the local, county, or state government is overwhelmed but this will take time to process. If the event is severe, it may disrupt the private sector's ability to operate therefore impacting the overall State economy.

5.6.11 Public Confidence in the State's Governance: Governmental response must be immediate and effective to maintain public confidence. If the State is disorganized in its response operations or takes too long to begin recovery operations, the public may lose confidence in the government's ability to manage the event.

5.7 Infectious Diseases

5.7.1 Hazard Description: Georgia has a list of diseases that are required by law to be reported to the Department of Public Health thus enabling public health follow-up for patients, identification of close contacts and to identify outbreaks. All Georgia physicians, laboratories, and other health care providers are required by law (O.C.G.A. 31-12-2) to report patients with the conditions listed under Notifiable Disease Reporting Requirements. Both laboratory confirmed and clinical diagnoses are reportable within the specified time interval. This is particularly important to do in a timely manner for any disease or condition that may require immediate public health intervention. Disease reporting also provides a better understanding of disease trends and patterns in Georgia to support program and policy decision-making and resource allocation.

5.7.2 Previous Major Occurrences: Every year the Georgia Department of Public Health investigates hundreds of notifiable disease cases and outbreaks. Some examples of larger occurrences from the last five years include Zika, Legionella, Measles and Mumps Most notably in 2020, Georgia experienced the COVID-19 pandemic, which is ongoing through the time of the publication of this HIRA. As of September 2021, there were over 20,000 deaths and over 76,000 hospitalizations due to COVID-19.

5.7.3 Impact on Public: Depending on the scale of outbreak and type of disease, residents of the State of Georgia may be at risk of illness or death if they are exposed to the disease. Population density may play a role in the spread of disease.

5.7.4 Impacts to Public Health: An epidemic/pandemic will have significant impacts on public health. Specific impacts to residents will be dependent upon the type of disease or infection that is spread.

5.7.5 Impact on Responders: Any responder could be affected by the illness which he/she is investigating due to the infectious nature of the pathogen.

5.7.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Infectious Diseases that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there has been one (1) major incident ,COVID-19, which has led to the shutdown of many state, county, or municipal governmental operations. While expectation remains minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to limit access to access to government services and reduce availability of responders and assets. If activation of alternate facilities occurs, in-person operations may be difficult. Additionally, computer/network and other communication access may be impacted due to increased demand from working in remote locations.

5.7.7 Delivery of Services: Epidemics may, under extreme circumstances or large outbreaks, cause disruption of services in the event of employee absenteeism. Pandemic events may require the temporary closure of private and public businesses and government services, causing further disruption of services.

5.7.8 Property, Facilities, and Infrastructure: It is highly unlikely that an epidemic would have direct effects on critical infrastructure or other facilities or structures. However, under very extreme cases of absenteeism, it is possible that regular maintenance or repairs would not be performed, resulting in disrepair.

5.7.9 Impact on Environment: In some cases, disease outbreak is caused by infections spread from animals to humans. Under these circumstances, infections may be spread as the result of normal care (proximity) to sick animals or consumption of byproducts of infected animals. Infected animals may die resulting from the disease; timely removal of infected animal carcasses may help to reduce the spread of the disease among animals. It is unlikely that an epidemic would have any additional direct impacts on the environment.

5.7 10 Impact on State Economy: Depending on the scale of outbreak and type of disease, a localized infectious disease outbreak could impact the State of Georgia significantly. In the event residents and workers became infected from an epidemic, employee absenteeism would increase and the length of time necessary to recoup and regain lost time and money could be six months or longer.

5.7.11 Public Confidence in the State's Governance: Governmental response, on all levels – state and local – requires direct actions that must be immediate and effective to maintain public confidence. If government functionality is reduced by absenteeism, the public's confidence in governance may be reduced. The ability of the Department of Public Health to perform critical functions will directly impact the community's perception of government during an epidemic. Maintenance of these operations will be critical to response and recovery operation.

5.8 Cyber Incidents or Attacks on Government or Critical Infrastructure Sectors

5.8.1 Hazard Description: In broad terms, Cybersecurity refers to the methods, techniques, and practices of protecting cyberspace (internet-connected networks, devices, software applications, and the sensitive data that travels through them all) from unauthorized access that would compromise the confidentiality, integrity and/or availability of the data. Cyberspace and its underlying infrastructure are vulnerable to a wide range of risks stemming from both physical and cyber threats and hazards. Sophisticated cyber criminals, threat actors and nation-states exploit vulnerabilities to steal information and money and are developing capabilities to disrupt, destroy, or threaten the delivery of essential services.

Cyberspace is particularly difficult to secure due to several factors:

- the ability of malicious actors to operate from anywhere in the world,
- the linkages between cyberspace and physical systems,
- and the difficulty of reducing vulnerabilities and consequences in complex cyber networks.

Of growing concern is the cyber threat to critical infrastructure, which is increasingly subject to sophisticated cyber intrusions that pose new risks. As information technology becomes increasingly integrated with physical infrastructure operations, there is increased risk for wide scale or high-consequence events that could cause harm or disrupt services upon which our economy and the daily lives of millions of Georgians depend.

Cyber security is constantly evolving, and consists of a growing set of processes, risk management approaches, technologies, and best practices. Below are the basics on a few of the most common types of cyber security areas that need to be addressed and focused on:

- **Network Security**: Helps to protect internal traffic by controlling incoming and outgoing connections to prevent threats from accessing or spreading across the network. Important layers of network security can include antivirus programs, antispyware, Intrusion Detection/Prevention Systems (IDS/IPS) and a “next-gen” network firewall that can control traffic based on security policy and permissions.
- **Application Security:** Software as a Service (SaaS) and cloud-based applications are more accessible than ever and spread across various networks, and therefore can be especially vulnerable to attacks. Security controls such as requiring strong user passwords, multi-factor authentication methods, next-gen antivirus programs, application layer firewalls, and encryption services are most effective when implemented before the application is deployed.
- **Information Security**: Often confused with cybersecurity, “InfoSec” is a crucial part of overall cyber security that refers to the processes and tools designed to

protect sensitive information from modification, disruption, and destruction. The three primary tenets of InfoSec include confidentiality, integrity, and availability.

- **Cloud Security**: Cloud models allow for more convenience and an "always on" connectivity that requires more advanced considerations to keep them safe. Cloud security measures focus on building and hosting secure applications, enabling data recovery in case of loss, storage and network protections against malicious attacks, identity and access management (IAM), and reducing human error that can result in data leaks.
- **Data Loss Prevention (DLP)**: Data loss prevention focuses on three common pain points experienced by organizations of all sizes: personal information protection, intellectual property (IP) protection, and data visibility. DLP software tools monitor and control endpoints, filter data streams on networks, and protect data while at rest, in motion, and in use. Once a breach is detected, DLP software alerts IT professionals and provides encryption to prevent end users from maliciously or accidentally putting sensitive data at risk.
- **End User Education**: Research indicates that 90% of cyber claims stem from some type of human error or behavior. It's such a major point of weakness that even hiring a qualified technology partner to manage security won't protect an organization from the lack of end user education. One key and cost-effective first step to securing sensitive data is to implement cyber security training for internal teams to understand their role in device security, network responsibilities, and how to identify signs of malicious activity.

Considering the risk and potential consequences of malicious cyber events, strengthening the security and resilience of cyberspace has become an important national homeland security mission.

5.8.2 Previous Major Occurrences: In the last three or so years, the State of Georgia has seen an ever-increasing number of cybersecurity attacks either directly on State / Local government and education or to a private sector entity that has had significant impacts on governments or the citizens of Georgia through indirect consequences.

A very clear example of how a private company attack can have significant impacts to the populace was the ransomware attack against Colonial Pipeline. Headquartered in Alpharetta, GA and owning the largest fuel pipeline infrastructure in the United States, their pipeline transports roughly 2.5 million barrels of fuel daily from the Gulf Coast to the Eastern Seaboard. A leaked password was used by a Russian-linked cybercrime organization known as Darkside to gain access to the networks of the company on April 29th, 2021. On May 7th just before 5 AM, Darkside threat actors began their attack on corporate networks which resulted in the company completely shutting down the entire pipeline by 6:10 AM. Production remained completely shut down for five days which resulted in public panic buying and almost immediate shortages and complete outages of fuel. It took numerous weeks after the resumption of services for the supply chain to fully stabilize and recover.

From January 2019 to October 2021, the Office of the State's Chief Information Security Officer (CISO) has tracked over 30 significant cybersecurity attacks against Georgia's State and Local agencies.

These incidents included:

- Ransomware 15
- O365 Compromise 5
- Website Defacement 3
- Network Compromise 2
- Supply Chain 2
- Third Party Vendor 1
- End Point Compromise 1
- Typo squatting 1

A number of these ransomware events included impacts to Public Safety and Emergency Management agencies, some of which seriously impacted their ability to function. Some incidents also included local Public Safety Answering Points/e911 Centers.

5.8.4 Impact on Public: As was evidenced in section 5.8.2, Cybersecurity attacks against government and private sector infrastructure can affect the public directly in numerous ways. Impacts can range from minor inconvenience to major catastrophe depending upon the mission of the government agency or private infrastructure provider affected.

A sampling of the potential impacts to the general public are listed below:

- Dispersion of misleading and false information through website defacement/alteration
- Lack of availability of records and information from governmental entities
- Disclosure of personal information (PII) to nefarious or criminal enterprise
- Disruption of an entity's ability to service the public properly
- Disruption of the ability to travel via public transit, railway or airlines
- Lack of availability of commodity items such as fuel and food
- Creation of states of civil unrest though misinformation campaigns and compromise of social media accounts

5.8.5 Impacts to Public Health: There are several ways that a cyber-attack or incident could impact the public health. Attacks on the healthcare sector or on infrastructure such as water treatment are examples of how a cyber-attack can directly impact public health.

Healthcare: As the healthcare sector continues to offer life-critical services while working to improve treatment and patient care with new technologies, criminals and cyber threat actors look to exploit the vulnerabilities that are coupled with these changes. As a result, the healthcare industry is plagued by a myriad of cybersecurity-

related issues. These issues range from malware that compromises the integrity of systems and privacy of patients, to distributed denial of service (DDoS) attacks that disrupt facilities' ability to provide patient care. While other critical infrastructure sectors experience these types of attacks, the nature of the healthcare industry's mission poses unique challenges. For healthcare, cyber-attacks can have ramifications beyond financial loss and breach of privacy. Ransomware, for example, is a particularly egregious form of malware for hospitals as the loss of patient data can put lives at risk.

Water Treatment: As of October 2021, there are 2,243 Drinking Water/Public Water System permits issued by the GA DNR's Environmental Protection Division's Watershed Protection Branch. The permitted entities provide drinking water to Georgians in all 159 counties. In the event of a successful cyber-attack, the water could become unknowingly contaminated, or the supply/availability can be compromised.

Nationwide attacks against the water sector are on the increase both for criminal enterprise as well as terroristic attack:

- On Friday, February 5, 2021, a hacker initiated an attack on an Oldsmar, Florida water treatment facility which briefly adjusted the levels of sodium hydroxide from 100 parts per million to 11,100 parts per million. This attack occurred about 15 miles from the location of, and two days before the Super Bowl. If successful, the attack would have increased the amount of sodium hydroxide to an incredibly dangerous level in the water supply. The attack was discovered as it was occurring and stopped.
- In January 2021, a hacker tried to poison a water treatment plant that served parts of the San Francisco Bay Area.
- In May 2021, hackers breached the network of the Belle Vernon Municipal Authority in Pennsylvania.

CISA/DHS reported that in March, July, and August of 2021, threat actors launched ransomware that impacted the networks *and* industrial control systems of water systems in Nevada, Maine and California respectively.

5.8.6 Impact on Responders: The principle impacts on law enforcement, fire department, EMS and other first responder elements are primarily ones of limitation of function. A cyber-attack or incident that impacts the computer aided dispatch system will require that other legacy, manual processes be implemented to continue the operational capabilities of the responder. Other attacks against infrastructure could impact the public's ability to reach first responders (such as a Distributed Denial of Service - DDoS attack against the telephony services of an e911 center) or the first responder's ability to reach the public (such as an attack that disables all networked traffic signals in a major metropolitan area such as Atlanta).

5.8.7 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of a cyber-attack on critical infrastructure that affects the state's

operations, the Agency will enact the COOP appropriately to the situation at hand. Additionally a cybersecurity attack or incident could impact GEMA/HS' ability to implement their COOP based on the severity of the hazard to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.8.8 Delivery of Services: Cybersecurity attacks would most certainly create a disruption of services to a lesser or greater extent depending upon the breadth and scope of a given attack. Governments' ability to deliver services effectively has become more and more dependent upon cyber technology thus creating more attack surfaces for threat actors to target and as these attack surfaces increase, so will the attacks and attempted attacks. Largely to the adoption of a just-in-time delivery model, commercial and industrial sectors will be impacted in the event of a major disruption (as evidenced by the 2021 Colonial Pipeline ransomware attack) of supply chain capabilities and will create an availability vacuum and/or significant cost increase of everyday goods and services.

5.8.9 Property, Facilities, and Infrastructure: From an all-hazards perspective, the relevant threat created by a cybersecurity attack or compromise is an attack against industrial controls systems (ICS) or Supervisory Control and Data Acquisition (SCADA) systems. Such compromises could create a real danger to property and infrastructure through the danger of overheating, over pressurization, and display of erroneous data to allow systems to fail. At best the compromise of these system could allow threat actors to:

- Manipulate the HVAC systems to make working in a building uncomfortable at best or dangerously impossible at worst.
- The energy consumption of a building can be destabilized by unauthorized powering up or down of lights.
- Security cameras or motion detectors can be turned on or off, or footage deleted to mask criminal activity.
- Access control systems can be manipulated so that privileges can be revoked or granted to the whole building (via card readers or otherwise) or doors opened to off-limits areas.
- Fire-monitoring and suppression systems can be triggered, including alarms and sprinklers.
- Lift access controls can be suppressed or overridden.

5.8.10 Impact on Environment: Threat actor manipulation of ICS/SCADA systems could create a situation that could cause industrial waste leakage or release into the environment. Such an incident could have short-term and long-term effects depending upon the nature of the spill or release. Such a disaster could occur at locations like hazardous waste disposal and transport hubs, nuclear facilities, petroleum storage and processing facilities, and chemical production facilities to name a few.

5.8.11 Impact on State Economy: As a result of the proliferation of computer networks in ALL industries and in government, the potential of economic impact could be, for example, very minimal (thousands of dollars) for a small state agency with five computers to tens of millions of dollars (as was evidenced by the costs associated with the recovery of the City of Atlanta ransomware attack in 2018, estimated at $17M). One internet report (https://www.comparitech.com/blog/information-security/government-ransomware-attacks/#Key_findings) puts Georgia at an estimated $5.76B for the estimated dollar amounts lost in US government ransomware attacks from 2018 to 2020.

5.8.12 Public Confidence in the State's Governance: Public opinion can be a fickle thing; few may sympathize with the plight of an affected government agency or entity while most will take exception to the breach of their personal data or the lack of availability of governmental services. The public trusts (or believes) that the government has their personal data properly secured. Whether or not there is evidence in a cyber-attack that data was exfiltrated, each publicized attack of ransomware or breach in cybersecurity chips away at the confidence in the competency of governance. Surveys conducted by various polling organizations in 2021 give evidence that …"Recent high-profile breaches, including Solar Winds, Colonial Pipeline, and JBS Foods, have exposed how vulnerable organizations are to cybercrime and in particular ransomware attacks. Of note with recent attacks is how data breaches can quickly affect aspects of everyday life, such as the ability to fill a car with gasoline or buy meat at the grocery store. To rebuild consumer trust, survey respondents say organizations must invest in advanced technology systems that help proactively reduce their risk of third party-perpetrated cyberattacks."

5.9 Active Shooter

5.9.1 Hazard Description: Active killer or active shooter names the perpetrator of a type of mass murder marked by rapidity, scale, randomness, and often suicide.

The United States Department of Homeland Security defines the active shooter as "an individual actively engaged in killing or attempting to kill people in a confined and populated area; in most cases, active shooters use firearms and there is no pattern or method to their selection of victims." Most incidents occur at locations in which the killers find little impediment in pressing their attack. Locations are generally described as soft targets, that is, they carry limited security measures to protect members of the public. In most instances, shooters commit suicide, are shot by police, or surrender when confrontation with responding law enforcement becomes unavoidable. According to various sources 46 percent of active shooter incidents are ended by the application of force by police or security, 40 percent end in the shooter's suicide, 14 percent of the time the shooter surrenders and, in less than 1 percent of cases, the violence ends with the attacker fleeing.

Georgia has several large venue event centers and hosts SEAR 1 and SEAR 2 events annually. Crowds for events regularly exceed 250,000 people.

5.9.2 Previous Major Occurrences: There have been 75 mass shootings in the United States since Sandy Hook Elementary, where a gunman in 2012 killed 20 first-graders, six faculty members and himself. In those 75 shootings, at least 235 people died, As of December 2017, Georgia led the nation in school shootings, but not all of these events involved injuries.

Active shooter incidents in Georgia for 2016:

- Four people injured in Roswell on March 6, 2016 – An early morning argument at a Roswell hookah bar ended with a Gwinnett County man shooting into a car full of people and wounding four.
- Five people injured in northwest Atlanta on March 15, 2016 – Police suspect the five people injured in a shooting near a well-known nightclub in northwest Atlanta were innocent bystanders.
- Six people killed in Columbia County on April 22, 2016 – A 50-year-old man suspected of fatally shooting five people in two separate incidents in Appling was found dead in his home. The cause of death was an apparent gunshot wound.
- Five people killed in Moultrie on May 15, 2016 – Five people found dead in a South Georgia house fire were shot, and the blaze was set intentionally as a cover-up.
- One killed, three injured in Jackson on May 21, 2016.
- Four killed in Henry County on October 27, 2016 – Four people were fatally shot in the head in a McDonough home.

5.9.3 Impact on Public: Active shooters pose a direct threat to people and would cause considerable injury and death. An active shooter attack could kill and injure hundreds, which would overwhelm Level I Trauma Centers and local hospitals. Businesses, schools, and locations near the attack would be disrupted.

5.9.4 Impacts to Public Health: An active shooter attack will have varying effects on the population including injury, death, and significant psychological impacts. These impacts may be immediate or long-term depending on where the active shooter attack occurs.

5.9.5 Impact on Responders: An active shooter attack can create a dangerous environment and significant challenge for first responders. First responders may have to manage the evacuation of people from the area impacted, as well as direct traffic, close roads, operate shelters, and take care of the injured. First responders may also become the direct target of the active shooter themselves either immediately or as a secondary attack during response activities. Based on the type of attack Personal Protective Equipment may be required to protect the first responder. Equipment may also be damaged or destroyed due to the impact of the attack, which may lead to a decrease in response capabilities.

5.9.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of active shooter attack that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal

governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.9.7 Delivery of Services: The ability to deliver services can be impacted locally, regionally, or statewide depending on the characteristics of an active shooter attack. To reduce the public's potential exposure to the effects of an attack, roadway and bridge closures may be required, as well as transit service disruptions. Businesses and places of commerce may completely shut down due to an active shooter attack, which leads to the disruption of goods and services.

5.9.8 Property, Facilities, and Infrastructure: Transportation, governmental operations, and infrastructure facilities may be disrupted during a large-scale active shooter attack, both directly and indirectly. Roads and bridges may be heavily impacted by an active shooter attack, especially if explosive devices are utilized in the active shooter attack. An active shooter attack and the response and recovery from those attacks can impact access to homes and critical entities such as hospitals, schools, and supermarkets, as well as other critical facilities. Safe access to homes, vehicles, structures, and resources may adversely affect response activities. If power loss occurs as part of or following an active shooter attack, it may lead to disruption of critical infrastructure and technology.

5.9.9 Impact on Environment: An active shooter attack involving bombings and arson pose considerable negative impacts to the environment in the form of smoke and destruction of vegetation.

5.9.10 Impact on State Economy: An active shooter attack poses a fiscal impact on the local and state governments. Local, county, and state resources may be required during an active shooter therefore reducing their availability for future events. Private businesses may not be able to maintain operations during or after an incident if they are impacted, which would impact the economy.

5.9.11 Public Confidence in the State's Governance: If government employees or facilities are targeted directly by an active shooter, it will have a significant impact on the state's ability to govern. The public's confidence in the state's governance is affected by immediate local and state response through direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.10 Radiological Release (Technical, Hostile)

5.10.1 Hazard Description: The State of Georgia has six counties within the 10-mile Emergency Planning Zone (EPZ) and 76 counties within the 50-mile Ingestion Pathway Zone (IPZ) of nuclear power plants located within Georgia and adjacent states. Although the risk frequency is low, potential consequences are high.

Within the 10-mile EPZ the primary hazard is direct radiological contamination due to the release of radiological material from the nuclear power plant and the resulting fallout from the plume as it is driven by local weather conditions. It is expected that a high percentage of the radiological material will be deposited on the ground prior to reaching the 10-mile EPZ limit.

Potential impacts within the 50-mile IPZ are primarily focused on the impact to soil and water as it relates to crops, livestock, and poultry. The primary focus is to identify potential contamination and prevent the introduction of contaminated foodstuffs into the food chain.

Georgia's agricultural industry plays a major role in the State's economy, contributing billions of dollars annually. Georgia, ranked first in the nation's production of broilers (young chickens weighing less than two and a half pounds), blueberries, peanuts, and pecans.

An actual radiation impact, or perceived impact, to Georgia crops, livestock, poultry, and food industry could be overwhelming.

5.10.2 Previous Major Occurrences: The Three Mile Island Unit 2 reactor, near Middletown, PA., partially melted down on March 28, 1979. This was the most serious accident in U.S. commercial nuclear power plant operating history. Although its small radioactive releases had no detectable health effects on plant workers or the public, its aftermath brought about sweeping changes involving emergency response planning, reactor operator training, human factors engineering, radiation protection, and many other areas of nuclear power plant operations. It also caused the Nuclear Regulatory Commission (NRC) to tighten and heighten its regulatory oversight. All of these changes significantly enhanced U.S. reactor safety.

In addition to the enhanced NRC oversight, the Federal Government created a new program called Radiological Emergency Preparedness (REP). As outlined in federal guidance documents, the mission of the REP Program is to adequately protect the public health and safety by providing reasonable assurance that appropriate protective measures can be implemented offsite in the event of a radiological emergency.

The Fukushima Daiichi nuclear disaster was an energy accident at the Fukushima Daiichi Nuclear Power Plant in Ōkuma, Fukushima Japan, initiated primarily by the tsunami following the Tōhoku earthquake on 11 March 2011. Immediately after the earthquake, the active reactors automatically shut down their sustained fission reactions. However, the tsunami disabled the emergency generators that would have provided power to control and operate the pumps necessary to cool the reactors. The insufficient cooling led to three nuclear meltdowns, hydrogen-air explosions, and the release of radioactive material in Units 1, 2, and 3 from 12 March to 15 March. Loss of cooling also caused the pool for storing spent fuel from Reactor 4 to overheat on 15 March due to the decay heat from the fuel rods.

5.10.3 Impact on Public: The State of Georgia has a footprint in three 10-mile Emergency Planning Zones surrounding the following nuclear power plants; Plant

Hatch, located in Appling County; Plant Vogtle, located in Burke County; and Plant Farley, located on the west bank of the Chattahoochee River in Houston County, Alabama. The total at risk populations within the 10-mile Emergency Planning Zones are approximately; Plant Hatch, 8,900, Plant Vogtle, 3000, and Plant Farley, 1400. Both Appling and Toombs Counties each have one school within the 10-mile EPZ.

In addition, there are 70 more counties in Georgia within the 50-mile Ingestion Pathway Zones of nuclear power plants in South Carolina and Tennessee.

5.10.4 Impacts to Public Health: Based on all available information, the State of Georgia Radiological Emergency Coordinator will provide state and local decision makers with Protective Action Recommendations regarding minimizing the potential impact to the public. The recommendations may be to evacuate individuals within the potentially affected areas, advise individuals within the impacted areas to shelter in place, or in the event of a hostile action at the nuclear plant for those individuals to go inside and stay inside.

The State of Georgia highly recommends evacuation from areas of potential plume impact. Plans and procedures are in place to activate evacuee reception centers outside of the 10-mile EPZ where individuals can be screened for radiological contamination and decontaminated, as necessary. Congregate shelters will be located nearby to provide temporary accommodations for those individuals who may be unable to return to their residence due to radiological contamination.

The impact to public health, to include psychological public health, will vary depending on the size, strength, movement, and impact of the radiological release. Radiological health effects, both acute (short term) and chronic (long term), will be based on an individual's proximity to the radiological material, time of exposure, and strength of the specific isotope. Protective Action Guidelines are available to identify levels of contamination and an appropriate response.

5.10.5 Impact on Responders: As with any emergency event, emergency responders will be called upon to carry out operations in support of the overall response. The type of response assignment will be based upon the responder's primary area of expertise, i.e., law enforcement, fire suppression, emergency medical services, etc. A response to a radiological emergency may place emergency response personnel in a unique situation where they must adhere to and be mindful of radiological exposure and contamination as they conduct response activities. State and local first responders within Georgia have been provided training in radiological emergency response and radiation exposure and contamination protocols.

5.10.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of radiological emergency at a nuclear power facility that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of

alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.10.7 Delivery of Services:

Based on the locations of the nuclear power plants affecting the State of Georgia, the impact on the delivery of goods and services may possibly include national, state, regional, and local areas. Regional and local delivery of goods and services may be impacted by the closure of roads and bridges resulting from locations contaminated with radiological material. The statewide, and possibly national delivery of services may be impacted by railroads in South Georgia which serve a major terminal in Waycross. Additionally, several poultry and food processing centers in Georgia may be closed or products embargoed to protect the food chain from being potentially contaminated.

5.10.8 Property, Facilities, and Infrastructure: The impact to property, facilities, and infrastructure may be directly attributed to contamination of radiological material or the loss may be attributed to the lack of access to these areas for the near or long term. Based upon field monitoring information and protective action guidelines, some areas may be successfully decontaminated and available for return to limited or full service. Others with more extensive contamination, or the inability to be successfully decontaminated to an acceptable level, may need to be destroyed or placed on restricted access rendering them unusable for an identified or indefinite period.

5.10.9 Impact on Environment: Radiation is naturally occurring. Radiation comes to us from both natural and manmade sources. Limiting radiation exposure and contamination to acceptable protective action guideline levels allows the environment to provide critical resources such as safe water, air, and soil to support and sustain an ecological balance. This balance is crucial to sustaining agricultural and zoological interests. A radiological impact to the environment can be both near and long-term depending on identified contamination levels. Radiological contamination provides for adverse effects on individuals, agriculture interests, poultry, and livestock.

5.10.10 Impact on State Economy: Agriculture in the State of Georgia is a multi-billion-dollar industry with over 9 million acres devoted to farming. Much of this area in located within a 50-mile ingestion pathway of nuclear power plants in Georgia and adjacent states. Not only will a nuclear power plant emergency cost the State and local governments during the initial response, but it will also impact local and regional businesses if they are unable to maintain operations or sell their products for a unspecified period of time.

5.10.11 Public Confidence in the State's Governance: During the Three Mile Island emergency event in March 1979, the public lost confidence in state and local government's ability to control and effectively respond to the event due to their lack of preparedness and ineffective information sharing and dissemination with the public. Following the events at Three Mile Island, the REP Program was created to ensure that plans and procedures are in place to effectively respond and to communicate information and protective actions to residents and business near the facility. A nuclear power plant emergency will be live, breaking news across all forms of media

around the world. Confidence in state and local government will be based upon their ability to respond to a nuclear power plant emergency effectively and efficiently.

5.11 Hazardous Material Release (Transpiration / Storage Spills & Leaks)

5.11.1 Hazard Description: A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Hazardous materials are routinely stored and transported throughout Georgia. Georgia's industrial capacity and network of highways, pipelines, waterways, and railways result in vulnerabilities to hazardous material releases. Storage sites as well as hazardous materials in transit could be impacted by accidental, criminal, or terrorist events. Many sites that utilize or store hazardous materials are in coastal counties where they are could be exposed to tropical cyclone winds and rains.

A release of a hazardous material could result in injury, long term health problems, loss of life and damage to property and the environment. The consequences of a hazardous material release will vary greatly depending on the location, time, quantity, and material released.

5.11.2 Previous Major Occurrences: Based on available data, there were over 900 reports of oil and hazmat releases reported to the Georgia Environmental Protection Division in 2017. Some of the major occurrences:

- Benzyl Chloride releases in Fulton and Clayton Counties;
- Sulfuric acid spill in Fulton County;
- Multiple tanker roll overs throughout GA releasing thousands of gallons of gasoline and diesel fuel;
- Multiple train derailments resulting in the release of thousands of gallons of oil and diesel fuel;
- 1,200 gallons of gasoline spilled into Lake Thurmond Reservoir;
- Mercury spill in Whitfield County; and
- Multiple sunken vessels along Georgia's coast.

5.11.3 Impact on Public: Cities within Georgia with dense populations, particularly along major travel routes, are the most vulnerable (with an emphasis on any particularly vulnerable groups, such as infants and young children in day-care centers, children in schools, the elderly in residential facilities, hospital patients, etc.).

5.11.4 Impacts to Public Health: Varying chemicals will have different effects on the population as well as environmental effects which will dilute or increase the chemical releases potency. Protective measures will need to be taken particularly for those of the most vulnerable communities.

5.11.5 Impact on Responders: Varying chemical incidents can create a dangerous environment and significant challenge for first responders. First responders may have to manage the evacuation of people from the area impacted by a chemical incident, as well as direct traffic, close roads, operate shelters, and take care of the injured

and sick. First responders must control their own exposure to the chemical incident and ensure the correct PPE is utilized. Equipment may also be damaged or destroyed due to the impact of the chemical incident, which may lead to a decrease in response capabilities.

5.11.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Hazardous Material Spill/Release that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.11.7 Delivery of Services: The ability to deliver services can be impacted locally, regionally, or statewide depending on the characteristics of the chemical incident. To reduce the public's potential exposure to dangerous chemicals, roadway and bridge closures may be required, as well as transit service disruptions. Businesses and places of commerce may completely shut down due to chemical incidents, which leads to the disruption of goods and services.

5.11.8 Property, Facilities, and Infrastructure: Transportation, governmental operations, and infrastructure facilities may be disrupted during a significant chemical incident. Roads and bridges can be completely obstructed by chemical releases and required cleanup. Chemical incidents can impact access to homes and critical entities such as hospitals, schools, and supermarkets, as well as other critical facilities. Safe access to homes, vehicles, structures, and resources may adversely affect response activities. Power loss can lead to disruption of critical infrastructure and technology.

5.11.9 Impact on Environment: Agriculture crops and livestock are extremely susceptible to the adverse effects of chemicals and the potential of a spill or contamination of a large area of land. Chemical incidents may impact the environment directly by causing pollution, damaging sewer and wastewater treatment plants; or disturbing or killing wildlife and adversely affecting nature preserves.

5.11.10 Impact on State Economy: Severe chemical incidents pose a fiscal impact on the local and state governments. Local, county, and state resources may be required during a large chemical incident therefore reducing their availability for future events. Additionally, private businesses may not be able to maintain operations during or after an incident if they are impacted, which would impact the economy.

5.11.11 Public Confidence in the State's Governance: The public's confidence in the state's governance is affected by immediate local and state response through

direct and effective actions. Efficiency in response and recovery operations is critical in keeping public confidence high.

5.12 Dam Failure

5.12.1 Hazard Description: A dam is a constructed barrier across flowing water that obstructs, directs, or slows the velocity of the water, creating a reservoir, lake, or impoundment. The structure's purpose is to retain water for a variety of purposes such as generating power, providing water for irrigation or water supply, or controlling flooding.

The threat of dam failures is triggered by carelessness of design, construction, and maintenance. The integrity of older dams, often affected by weathering, mechanical changes, and the influence of chemical agents, is deteriorating. Not only is dam failure risk increasing (with aging infrastructure) but the population vulnerable to this hazard is also increasing due to downstream development.

Dam failures are generally grouped into three classifications: hydraulic, seepage, and structural. The three types of failure sometimes compound upon one another to create complex and interrelated hazard events.

Hydraulic failures are a result of the uncontrolled flow of water over and around the dam structure as well as the erosive action on the dam and its foundation. The uncontrolled flow causing the failure is often classified as wave action, toe erosion, or gullying. Earthen dams are particularly susceptible to hydraulic failure because earthen materials erode at relatively slow velocities. This type of failure constitutes approximately 40% of all dam failures.

While all dams exhibit some seepage, the velocity and amount of water are controlled to prevent failure. Seepage occurs through the structure and its foundation and erodes the structure from within. Seepage accounts for approximately 4% of all dam failures.

Structural failure involves the rupture of the dam or the foundation by water movement, earthquake, or sabotage. Large earthen dams and dams constructed with weak materials (such as silt) are especially susceptible to structural failure. This type of failure accounts for approximately 30% of all dam failures

5.12.2 Previous Major Occurrences: Kelly Barnes Dam, Toccoa, Georgia. The original structure consisted of a rock crib dam built in 1899 to create a small reservoir for a hydroelectric plant. The Toccoa Falls Bible Institute built an earthen dam over the original rock crib dam in 1937 to develop a more stable electric power source. The dam structure was raised several times, reaching 42 feet above the rock foundation by 1957, when power production was halted, and the reservoir was solely utilized for recreation. At around 1:30 am on Sunday, November 6, 1977, the Kelly Barnes Dam failed. This collapse resulted in a flash flood that swept downstream causing 39 fatalities and caused $2.3 million in property damage. The sole cause of the failure is undetermined, but the probable causes include a local slide on the steep downstream slope probably associated with piping (form of seepage) and a localized

breach in the crest followed by progressive erosion, saturation of the downstream embankment, and the subsequent total collapse of the structure.

Other dam failures have occurred in Georgia with some related to the spring of 1990 flooding and the July 1994 flooding associated with Tropical Storm Alberto. However, these dam failures were not documented as having a significant contribution to already flooded conditions.

5.12.3 Impact on Public: Dam failures impact those living near the incident area by resulting in flooding, power outages, property damage, and injury or death. Evacuations of the incident zone may require the victims to be sheltered. Roadways may be inaccessible to the public, inhibiting their ability to receive help.

5.12.4 Impacts to Public Health: Fast-moving water and debris-filled water are very dangerous to the public and can result in injury or death. Standing water poses health risks to the public because it can contain or foster diseases.

5.12.5 Impact on Responders: A dam failure may cause inaccessibility of transportation routes or damage to resources. Flooding from a dam failure puts responders in dangerous situations including performing swift high-water rescues, facilitating evacuations, and controlling traffic.

5.12.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of dam failure that affects the state's operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard's potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.12.7 Delivery of Services: Delivery of services may be disrupted due to transportation issues or access to goods. Public transportation may also be affected preventing victims from getting goods and services they need. Loss of power and communication could directly or indirectly affect all levels of response to the incident area.

5.12.8 Property, Facilities, and Infrastructure: Flooding from dam failures will damage or destroy all property, facilities, or infrastructure in its path. Roads, bridges, and other critical facilities may be directly or indirectly impacted from the rush of water and debris. Water and wastewater plants may become overwhelmed causing sanitation issues. Homes and businesses may be damaged or destroyed if near the incident.

5.12.9 Impact on Environment: Environmental impacts of a dam failure include flooding, moving debris, disturbance of pollutants, and overloading of water and wastewater treatment plants. Ecosystems could be heavily affected causing death or migration of wildlife.

5.12.10 Impact on State Economy: The fiscal impacts on the state economy will be due to a disruption in transportation routes inhibiting citizens' ability to travel to and from work and businesses. The utilization of resources at all levels of government will also add stress to the state's economy.

5.12.11 Public Confidence in the State's Governance: Governmental response must be immediate and effective to maintain public confidence. If the state is disorganized in its response operations or takes too long to begin recovery operations, the public may lose confidence in the government's ability to manage the event.

5.13 Infrastructure Failure

5.13.1 Hazard Description: Infrastructure in the United States is becoming more prone to failure as the average age of structures increases. Infrastructure is owned and managed by both the public and private sector and includes a number of structures that improve living conditions and commerce, including schools, hospitals, roads, bridges, dams, sewers, and energy systems. Between 2000 and 2009, the average age of government and privately-owned structures (excluding housing) increased by about one year. For government structures, the trend was even more pronounced over the long term—United States structures' average age rose from 18 years in 1970 to 25 in 2009, indicating that structures are being replaced at a slower rate. Bridges are generally designed to last 50 years, and the average bridge in the United States is 43 years old. Georgia has almost 800 structurally deficient bridges and over 2,000 functionally obsolete bridges.

Metro Atlanta's current system of multiple transit providers is inefficient, as well as time-consuming and confusing to the users. Metropolitan Atlanta Rapid Transit Authority is the largest transit agency in the country that does not receive state funding support for operations. Collaboration between governments is needed to establish a truly regional, accessible transit system in Georgia. Although traffic fatalities have been significantly reduced in the last five years, Georgia's traffic fatality rate is still well above the national average. Metro Atlanta is congested during peak commute hours.

Georgia has 191 wastewater plants with capacities over 1 million gallons per day. Tightening water quality standards such as instream nutrient level limits will likely require utilities to implement additional treatment processes and technologies. Reducing and eliminating sewer overflows must receive the focused attention of utilities. Also, improving maintenance programs with techniques such as expanded asset management is critical. These challenges underscore the need for workforce development to recruit qualified staff and keep up with advancing technologies.

5.13.2 Previous Major Occurrences: March 30, 2017 – A bridge collapsed on Interstate 85 in Atlanta, Georgia, after a massive fire. After the collapse of the 100-foot-long section, I-85 was closed to traffic over approximately two miles (between its split with I-75 and the interchange with State Route 400). Three sections of

northbound I-85 and three sections of southbound I-85 were replaced by May 13, 2017.

April 21, 2017 – An internet outage today disrupted Georgia Milestones testing across the state. As a result, some districts including Gwinnett and Clayton had to delay testing. A Department of Education spokesman reported “PeachNet (state internet provider) went down for a little while this morning. We had 124 districts testing. According to IT for GaDOE, 22 districts remained out as of late this morning. Some delayed testing today.”

December 17, 2017 – A major power outage halted air traffic at Hartsfield-Jackson Atlanta International Airport for 11 hours, grounding all the hub's outgoing flights and halting incoming traffic for tens of thousands of travelers hoping to land at the world's busiest airport. The outage, reported after a fire ravaged an underground power substation, forced travelers out of the darkened terminal and into an icy rain for hours, witnesses reported. It stranded others on Atlanta's tarmac as they waited to get off of incoming flights.

5.13.3 Impact on Public: Critical infrastructure failures impact those living within the hazard area and surrounding areas and can lead to heavy flooding, power loss, property damage, injury, and even death. Extensive flooding and damage may lead to the evacuation and displacement of those individuals in the impact zone. Roadways may be obstructed or inaccessible to the public, challenging transport and resource acquirement activities.

5.13.4 Impacts to Public Health: A failure of critical infrastructure, regardless of which piece of the infrastructure failed, would have a direct impact on public health. Power outages, transit failures, access to clean water would all be critical infrastructure failures which would create severe and immediate public health impacts.

5.13.5 Impact on Responders: Infrastructure failure would have a direct and immediate impact on first responder’s ability to respond effectively. Critical infrastructure failure may cause inaccessibility of roadways for first responders as well as damage of materials and resources. Communications system failure would impact the responders’ ability to communicate their status or communicate through their command system to identify areas that require response.

5.13.6 Continuity of Operations: GEMA/HS maintains a Continuity of Operations Plan. In the event of Infrastructure failure that affects the state’s operations, the Agency will enact the COOP appropriately to the situation. To date, there have been few or no major incidents that have shut down state, county, or municipal governmental operations. While expectation is minimal, this threat may impact GEMA/HS ability to implement their COOP based on the hazard’s potential to cause power outages and transportation difficulties. If activation of alternate facilities occurs, travel may be difficult. Additionally, computer/network and other communication access may be impacted due to power outages.

5.13.7 Delivery of Services: Delivery of services will be disrupted due to critical infrastructure failure. Transit systems may face closures due to public safety concerns due to inability to operate transportation vehicles such as trains and buses. The ability to deliver food, drinking-water, and services will be impacted locally, regionally, and statewide due to problems with accessibility and transport abilities. Communications, transportation, and governmental services operations would be impacted due to power failure and accessibility challenges.

5.13.8 Property, Facilities, and Infrastructure: Roads and bridges may be impacted and water and sewer systems may be damaged, leading to the issue of sanitation and waste collection. Property of homes and businesses may be completely destroyed if situated close to the failure point.

5.13.9 Impact on Environment: The impacts on the environment of critical infrastructure would vary based on the event and impact. Failure of wastewater plants would result in spreading pollution and hazardous materials throughout the environment including large bodies of water. Ecosystems and natural habitats may be destroyed, causing migration.

5.13.10 Impact on State Economy: Critical infrastructure failure would have a direct and considerable fiscal impact on the State government, even after some of the costs have been paid through federal disaster declarations if the failure was caused by another hazard. Additionally, infrastructure failure in every sector has the potential to impact the ability of businesses to operate. If the private sector is not able to maintain operability, there would be continued revenue loss until operability is restored.

5.13.11 Public Confidence in the State's Governance: Critical infrastructure failure would have a direct and immediate impact on the state's ability to provide governance, maintain order, and ensure the continuity of public services. If there were delays in restoring infrastructure, and any services contingent on this infrastructure, the public would become increasingly distrustful of the government's ability to restore services and ensure public safety and wellbeing. Direct, immediate, and effective actions must be taken to maintain public confidence. Response activities must include all levels of government.

6.0 OVERALL HAZARDS RESULTS AND SUMMARY

The preceding hazard sections discussed the probability, impacts, vulnerabilities, and risk for each of the natural, human-caused, and technological hazards determined to have a significant impact on the population, facilities, and infrastructure in the State of Georgia. This final sub-section to the HIRA provides an overall assessment and summary of the individual hazard analyses.

6.1 Composite Hazard Priorities

Hazard: Severe Weather

Risk Assessment: Frequency: 7 X Consequence: 5 = 35 Extreme

Associated Hazards:

- Thunderstorms;
- High Winds;
- Lightning;
- Hail;
- Tornado *(Most Significant Hazard in Georgia*)

Table 12 for Severe Weather

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
6	**2**	**2**	**2**	**1**	**1**	**14**

Hazard: Infrastructure Failure

Risk Assessment: Frequency: 6 X Consequence: 6 = 36 Extreme

Associated Hazards:

- Communications
- Transportation
- Energy
- Public Works

Table 12 for Infrastructure Failure

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**2**	**3**	**1**	**2**	**2**	**20**

Hazard: Cyber Attack

Risk Assessment: Frequency: 6 X Consequence: 6 = 36 Extreme

Associated Hazards:

- Hacking/Phishing
- Infrastructure Disruptions
- Ransomware/Malware Attacks
- Network Intrusion/Disruptions
- Transpiration Intrusion/Disruptions

Table 12 for Cyber Attack

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**0**	**3**	**0**	**2**	**2**	**17**

Hazard: Hazardous Material Spill/Release

Risk Assessment: Frequency: 6 X Consequence: 6 = 36 Extreme

Associated Hazards:

- Injury
- loss of life
- property and environmental damage

Table 12 for Hazardous Material Spill/Release

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
5	**2**	**2**	**3**	**1**	**1**	**14**

Hazard: Inland Flooding

Risk Assessment: Frequency: 6 X Consequence: 5 = 30 Extreme

Associated Hazards:

- River Flooding;
- Flash Flooding;
- Urban Flooding.

Table 12 for Inland Flooding

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**2**	**3**	**2**	**1**	**1**	**11**

Hazard: Tropical Cyclone

Risk Assessment: Frequency: 5 X Consequence: 6 = 30 Extreme

Associated Hazards:

- Storm Surge;
- High Winds;
- Heavy Rainfall;
- Tornado.

Table 12 for Tropical Cyclone

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
10	**3**	**3**	**3**	**2**	**2**	**23**

Hazard: Active Shooters

Risk Assessment: Frequency: 5 X Consequence: 6 = 30 Extreme

Associated Hazards:

- Explosives/Improvised Explosive Devices
- Vehicle Ramming
- Sniper Attack
- Hostage Taking

Table 12 for Active Shooter

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
8	**2**	**1**	**1**	**1**	**2**	**15**

Hazard: Winter Weather

Risk Assessment: Frequency: 4 X Consequence: 4 = 16 High

Associated Hazards:

- Snow;
- Ice;
- Freezing Rain;
- Sleet;
- Blizzard;
- Extreme Cold.

Table 12 for Winter Weather

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
4	**1**	**2**	**1**	**1**	**0**	**9**

Hazard: Infectious Diseases

Risk Assessment: Frequency: 6 X Consequence: 1 = 6 Low

Associated Hazards:

- Food borne diseases;
- Agricultural disease outbreaks;
- Novel disease outbreaks.

Table 12 for Infectious Diseases

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
3	**0**	**0**	**0**	**1**	**1**	**5**

Hazard: Dam Failure

Risk Assessment: Frequency: 2 X Consequence: 3 = 6 Low

Associated Hazards:

- Downstream Flooding;
- Erosion;
- Property Damage;
- Environmental Damage;
- Transportation Disruption;
- Infrastructure Disruption.

Table 12 for Dam Failure

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**1**	**1**	**2**	**1**	**1**	**8**

Hazard: Geologic Hazards

Risk Assessment: Frequency: 2 X Consequence: 2 = 4 Very Low

Associated Hazards:

- Earthquake;
- Sinkhole;
- Landslide.

Table 12 for Geologic Hazards

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
0	**1**	**1**	**2**	**1**	**0**	**5**

Hazard: Drought/Wildfire

Risk Assessment: Frequency: 1 X Consequence: 2 = 3 Very Low

Associated Hazards:

- Extreme Heat;
- Wildfires;
- Smoke;
- Water Shortage.

Table 12 for Drought/Wildfire

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
0	**1**	**1**	**2**	**1**	**1**	**6**

Hazard: Radiological Release

Risk Assessment: Frequency: 1 X Consequence: 3 = 3 Very Low

Associated Hazards:

- Radiological contamination impact areas:
- Individuals (Physical and Psychological Health)
- Property (Private / Commercial / Governmental)
- Environment (Air / Land / Water)
- Infrastructure (Private / Commercial / Governmental)

- Agriculture
- Zoological
    - Economy (Restricted Use Space / Consumer Confidence)

Table 12 for Radiological Release

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho-social Impact	Sub-variable Total
2	**1**	**1**	**3**	**1**	**1**	**9**

7.0 PLAN MAINTENANCE

GEMA/HS is the responsible agency for publishing the Hazard Identification and Risk Assessment. The Deputy Director of Emergency Management will oversee the update and maintain this plan as required. Appropriate officials in state agencies should recommend changes at any time and provide information periodically as to changes of personnel and available resources. All changes will be referred to the GEMA/HS Planning Section Manager.

This plan will be updated in accordance with the Plans Standardization and Maintenance Policy and the Plans Schedule.

8.0 ANNEXES

Annex A Acronyms

CA – Consequence Analysis

CI – Critical Infrastructure Service Impact

COOP – Continuity of Operations Plan

DDOS – Distributed Denial of Service

EMAP – Emergency Management Accreditation Program

EPZ – Emergency Planning Zone

Fin-Tech – Finance & Technology Industries

GDOA – Georgia Department of Agriculture

GEMA/HS – Georgia Emergency Management and Homeland Security Agency

HIRA – Hazard Identification and Risk Assessment

HMS – Hazard Mitigation Strategy

IPZ – Ingestion Pathway Zone

NCADAC – National Climate Assessment and Development Advisory Committee

NCEI – National Center for Environmental Information

NRC – Nuclear Regulatory Commission

NWS – National Weather Service

REP – Radiological Emergency Preparedness

SCADA – Supervisory Control and Data Acquisition

SEAR – Special Event Assessment Rating

SME – Subject-Matter Experts

SNAP – Supplemental Nutrition Assistance Program

TANF – Temporary Assistance for Needy Families

THIRA – Threat and Hazard Identification and Risk Assessment

WIC – Woman Infant and Children

Hazard Profile / Vulnerability Analysis Instructions

1. **Hazard Identification** - In this step identify the hazards that have the largest and probable impact. This requires a review of all hazards and their causes to determine whether they may be a threat. This may require the consultation of the scientific community, historical records government agencies and other stakeholders. List the identified hazards in table 1 below by natural, human-caused, or technological hazards. Use table two to explain how and why the hazard was identified.
2. **Hazard Profile:** - In this step the level of risk for each hazard is examined using a risk assessment. This may involve speaking with hazard experts, researching past occurrences and possible scenarios. The likelihood of the hazard occurring and the potential impacts of the hazard on people, property, the environment, business and finance and critical infrastructure should be examined. The desired outcome of the risk assessment is the ranking of the hazards.
3. **Vulnerability Analysis** - The information collected in the hazard profile step will be analyzed in this step. This highlights the hazards that should be considered a current priority for your emergency management program.
4. **Monitor and Review** - It is important to remember that a HIRA is an ongoing process and hazards, and their associated risks must be monitored and reviewed.

Table 1 Hazard Identification and Hazard Grouping

Natural Hazards	Human Caused Hazards	Technological Hazards

Table 2 Hazard Identification Process

Hazard of Concern	How and Why hazard was Identified

Hazard Profile Steps:

1. **Hazard:** *List a hazard from table 1 above.*
2. **Associated Hazards:** *List any associated hazards for the main hazard.*
3. **Risk Assessment:** *Frequency (Table 3) * Consequence (Table 13) = level of risk in table 14*

   a. **Obtain Frequency:** *Use Table 3 below to record the frequency of the hazards and add to Hazard Profile and Consequence Analysis Worksheet in Annex C.*

Table 3 Likelihood of hazard occurrence

Frequency	Category	Percent Chance	Description
1	Rare	Less than a 1% chance of occurrence in any year.	Hazards with return periods >100 years.
2	Very Unlikely	Between a 1- 2% chance of occurrence in any year.	Occurs every 50 – 99 years and includes hazards that have not occurred but are reported to be more likely to occur in the near future.
3	Unlikely	Between a 3 – 10% chance of occurrence in any year.	Occurs every 20 – 49 years
4	Probable	Between an 11 – 50% chance of occurrence in any year.	Occurs every 5 – 19 years
5	Likely	Between a 51 – 99% chance of occurrence in any year.	Occurs >4 years.
6	Almost Certain	100% chance of occurrence in any year.	The hazard occurs annually.

b. **Vulnerability :** Vulnerability is divided into six categories based on recommended practices. Use Table 4 – 11 below to record the frequency of the hazards that could affect your community. **Note:** The social impacts sub variable is further divided into the fatality rate, injury rate and evacuation rate.

Social Impacts - The direct negative effects of a hazard on the physical health of people. Social Impacts include fatalities, injuries, and evacuation.

Table 4 Fatalities

Vulnerability	Category	Description
0	None	Not likely to result in fatalities within the community.
1	Minor	Could result in fewer than five fatalities within the community.
2	Moderate	Could result in 5 – 10 Fatalities within the community.
3	Severe	Could result in 10-50 fatalities within the community.
4	Catastrophic	Could result in 50+ fatalities within the community.

Table 5 Injuries

Vulnerability	Category	Description
0	None	Not likely to result in injuries within the community.
1	Minor	Could injure fewer than 25 people within community.
2	Moderate	Could injure 25 – 100 people within the community.
3	Severe	Could injure +100 people within the community.

Table 6 Evacuation

Vulnerability	Category	Description
0	None	Not likely to result in an evacuation shelter-in-place orders, or people stranded.
1	Minor	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.
2	Moderate	Could result in 100 - 500 people being evacuated, sheltered-in-place or stranded.
3	Severe	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.

Property Damage - The direct negative effects of a hazard on buildings, structures, and other forms of property, such as crops.

Table 7 Property Damage

Vulnerability	Category	Description
0	None	Not likely to result in property damage within the community.
1	Minor	Could cause minor and mostly cosmetic damage.
2	Moderate	Localized severe damage (a few buildings destroyed).
3	Severe	Widespread severe damage (many buildings destroyed).

Critical Infrastructure Service Disruptions/Impact - The negative effects of a hazard on the interdependent, interactive, interconnected networks of institutions, services, systems, and processes that meet vital human needs, sustain the economy, protect public safety and security, and maintain continuity of and confidence in government.

Table 8 Critical Infrastructure Service Impact (CI)

Vulnerability	Category	Description
0	None	Not likely to disrupt critical infrastructure services.
1	Minor	Could disrupt 1 critical infrastructure service.
2	Moderate	Could disrupt 2 – 3 critical infrastructure services.
3	Severe	Could disrupt more than 3 critical infrastructure services.

Environmental Damage - The negative effects of a hazard on the environment, including the soil, water, air and/or plants and animals.

Table 9 Environmental Damage

Vulnerability	Category	Description
0	None	Not likely to result in environmental damage.
1	Minor	Could cause localized and reversible damage. Quick clean up possible.
2	Moderate	Could cause major but reversible damage. Full clean up difficult.
3	Severe	Could cause severe and irreversible environmental damage. Full clean up not possible.

Business/Financial Impact - The negative economic effects of a hazard.

Table 10 Business/Financial Impact

Vulnerability	Category	Description
0	None	Not likely to disrupt business/financial activities.
1	Moderate	Could result in losses for a few businesses.
2	Severe	Could result in losses for an industry.

Psychosocial Impacts - The negative response of community or a subset of the community to a hazard caused by their perception of risk. This includes human responses such as self-evacuation, mass panic and other potential undesirable responses.

Table 11 Psychosocial Impact

Vulnerability	Category	Description
0	None	Not likely to result in significant psychosocial impacts.
1	Moderate	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.
2	Severe	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and long-term psychological impacts.

The total vulnerability value can be obtained by adding the values obtained from each of the sub variables.

Table 12 Total Vulnerability

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho -social Impact	Sub-variable Total

Once the vulnerability values have been added up, they are put into groups as shown in the table below.

Table 13

Sub Total Variable	Vulnerability	Description
1 - 4	1	Minor
5- 6	2	Slight
7- 8	3	Moderate
9 - 10	4	Severe
11 - 12	5	Very Severe
+13	6	Catastrophic

This gives equal weight to Vulnerability and Frequency.

Risk Amassment

Once you have completed the Frequency, Vulnerability Work Sheets, you can now begin to prioritize your hazards by using the HIRA equation:

Risk = Frequency * Vulnerability

Table 14

Level of Risk		Level of Risk	
< 5	Very Low	16- 20	High
6 -10	Low	21- 25	Very High
11- 15	Moderate	> 25	Extreme

Consequence Analysis steps:

1. **Hazard:** Retype hazard and add level of Risk.
4. **Hazard Description:** Type one to two paragraphs about the selected hazards including all associated hazards.
5. **Previous Major Occurrences:** Discuss only the last two or three times the selected hazard had a major impact on the State.
    a. Or if there are no major impacts of the selected hazard, list the last two or three times the hazard has occurred,
    b. Or if the selected hazard has not occurred, list worst case scenarios.
6. **Impact on Public:**

7. **Impacts to Public Health:**
8. **Impact on Responders:**
9. **Continuity of Operations:**
10. **Delivery of Services:**
11. **Property, Facilities, and Infrastructure:**
12. **Impact on Environment:**
13. **Impact on State Economy:**

Annex C Hazard Profile / Vulnerability Analysis Worksheet

Hazard Profile / Vulnerability Analysis Worksheet

Hazard Profile

1. **Hazard:** *List the hazard from table 1 from the Hazard Profile / Vulnerability Analysis Instructions*
2. **Associated Hazards:** *List any associated hazards for the main hazard.*
3. **Risk Assessment:** *Frequency (Table 2) * Vulnerability (Table 12) = level of risk table 13*
    a. **Frequency:** *Add a (1-6) from table 2 from the Hazard Profile / Consequence Analysis Instructions*
    b. **Vulnerability :** *Use the sub-variable total from table 11 to find consequence in table 12.*

Table 11: *Use tables 3-10 to fill in table 11.* **Note:** *Social impacts is tables 3-5 added together.*

Social Impacts	Property Damage	Critical Infrastructure Impact	Environmental Damage	Business/ Financial Impact	Psycho -social Impact	Sub-variable Total
Add Tables 3-5	*Table 6*	*Table 7*	*Table 8*	*Table 9*	*Table 10*	Total of tables 3-10

Consequence Analysis

1. **Hazard:**
2. **Hazard Description:**
3. **Previous Major Occurrences:**
4. **Impact on Public:**
5. **Impacts to Public Health:**
6. **Impact on Responders:**
7. **Continuity of Operations:**

8. **Delivery of Services:**
9. **Property, Facilities, and Infrastructure:**
10. **Impact on Environment:**
11. **Impact on State Economy:**
12. **Public Confidence in the State's Governance:**

Annex C-Data Sources for Updates

1. Statistical Data Updates for Hazard Evaluation

Weather Statistics (Bulk data download)

https://www.ncdc.noaa.gov/stormevents/ftp.jsp

Additional information from GEMA/HS Hazard Mitigation.

**Note – Currency will have to be edited/formatted to provide useful data due to multiple entry methods for different years.

Earthquake Statistics

Earthquake Catalog https://earthquake.usgs.gov/earthquakes/search/

**Note – Draw Rectangle on map and export. Use GIS to sort all earthquakes inside GA borders.

Active Shooter Statistics

Provided by GEMA/HS Homeland Security.

Critical Infrastructure Failure Statistics

Provided by GEMA/HS CIKR Section.

Infectious Disease Statistics

Provided by GDPH Epidemiology Section.

Cyber Statistics

Provided by Georgia Technology Authority.

**Note – ESF 17 may be able to assist in the future.

Hazardous Material Release Statistics

DNR-EPD Complaint Tracking System: https://epd.georgia.gov/rules-laws-enforcement/complaint-tracking-system

**Request Login through EPD Hazardous Materials

Dam Statistics

Dam Breach data source: Provided by Safe Dam Program Manager.

Hurricane Tracks

https://coast.noaa.gov/hurricanes/#map

Lightning Data

https://interactive-lightning-map.vaisala.com/

2. Disaster Declarations

https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Additional information from GEMA/HS Recovery Division.

3. Data for Table 15

State owned holdings data source:

State of Georgia Building Land and Lease Inventory of Property Public Access GIS https://www.realpropertiesgeorgia.org/PublicHome/Index?ReturnUrl=%2f

State route mileage report data source:

http://www.dot.ga.gov/DriveSmart/Data/Documents/400%20Series/437/437_Report_2020.pdf

Interstate miles report found at:

http://www.dot.ga.gov/DriveSmart/Data/Documents/400%20Series/438/438_Report_2020.pdf

Local Law Enforcement data source:

HIFLD Open Data : Local Law Enforcement Locations : Local Law Enforcement Locations (arcgis.com)

Fire stations data source:

https://hifld-geoplatform.opendata.arcgis.com/datasets/fire-stations/explore?filters=eyJTVEFURSI6WyJHQSJdfQ%3D%3D&location=32.646826%2C-83.218428%2C7.70

Hospital data source:

HIFLD Open Data : Hospitals : Hospitals (arcgis.com)

911 Center Data Source:

https://gema.georgia.gov/local-911-center-directory

First Responder's Comm towers and fixed gateways data source:

Requested from GECA

TV Digital Station Transmitters data source:

HIFLD Open Data : TV Digital Station Transmitters : TV Digital Station Transmitters (arcgis.com)

AM towers data source:

HIFLD Open Data : AM Transmission Towers : AM Transmission Towers (arcgis.com)

FM towers data source:

HIFLD Open Data : FM Transmission Towers : FM Transmission Towers (arcgis.com)

Cell Towers data source:

HIFLD Open Data : Cellular Towers : Cellular Towers (arcgis.com)

City Halls data source:

HSIP Gold 2015 data

Housing Units and Mobile Homes data source:

American Community Survey Vintage 2015 - 2019, data was obtained from Census on December 11, 2020. https://gema-soc.maps.arcgis.com/home/item.html?id=a6549bd25a0e42bbab8758efd49a54b4

Airport data source:

USA Airports - Overview (arcgis.com)

Dam Inventory data source:

https://epd.georgia.gov/document/document/inventory-dams-november-2019/download

Fishing and Boating Access/Marina data source:

WRD_Water_Access_Points - Overview (arcgis.com)