Accommodation Statement

In accordance with the requirements of title II of the Americans with Disabilities Act of 1990 ("ADA"), Hillsborough County will not discriminate against qualified individuals with disabilities on the basis of disability in its services, programs, or activities. Persons with disabilities who need an accommodation for this document should email the Hillsborough County ADA Officer or call (813) 276- 8401; TTY: 7-1-1.

Table of Contents

FIGURES

TABLES

EXECUTIVE SUMMARY

Introduction

Under Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) enacted under the Disaster Mitigation Act of 2000 (DMA2K), Hillsborough County is required to have a Federal Emergency Management Agency (FEMA)-approved hazard mitigation plan to be eligible for federal hazard mitigation funding. The purpose of the County's Hazard Mitigation Plan, more commonly called the Local Mitigation Strategy (LMS) in Florida communities, is to reduce death, injuries, and property losses caused by natural hazards in Hillsborough County. The 2025 LMS update identifies hazards based on the history of disasters within the county and lists goals, directives, strategies, and actions for reducing future losses. Implementation of planned, pre-identified, and cost-effective mitigation measures not only helps reduce losses to lives, property, and the environment but also streamlines the disaster recovery process.

This is a 5-year update of the countywide LMS that was last approved in July of 2020. While the document may refer to specific historical events for context, the plan update focuses on changes to the communities and their vulnerabilities over the last five years and provides an update to capabilities, programs, and actions that the participants intend to utilize to reduce exposure or consequences from the identified hazards. The communities participating in this plan include:

- Hillsborough County, Unincorporated
- City of Plant City
- City of Tampa
- City of Temple Terrace

Document Significance and Application

The County's 2025 LMS serves as the fundamental framework for hazard mitigation within the county. The purpose of the 2025 LMS update is to:

- Reduce risk of hazards to people, property, and critical infrastructure.
- Increase public awareness and education about the plan and planning process.
- Maintain grant eligibility for participating jurisdictions.
- Update the plan in accordance with Community Rating System (CRS) requirements.
- Maintain compliance with state and federal legislative requirements for local hazard mitigation plans.
- Complete an update of information in the plan to demonstrate progress and reflect current conditions.

In meeting these requirements, the 2025 LMS update also seeks to:

- Establish comprehensive hazard identification and risk assessment methodologies that incorporate both traditional vulnerability analyses and emerging considerations regarding climate change impacts and social equity

- Demonstrate compliance with federal and state requirements while presenting locally-tailored solutions derived from extensive community input, including survey responses from 3,129 residents and technical expertise from 63 participating organizations.
- Delineates specific funding mechanisms and implementation pathways for hazard mitigation projects, enabling jurisdictions to effectively allocate resources and pursue grant opportunities.
- Documents the integration of hazard mitigation considerations into other planning mechanisms, ensuring alignment with comprehensive plans, building codes, and land development regulations.

In this way, the 2025 LMS will serve as a vital technical resource for government officials, planners, emergency managers, and other stakeholders involved in hazard mitigation and community resilience efforts throughout Hillsborough County.

Planning Process

The 2025 LMS update represents the most comprehensive and inclusive planning process to date, featuring extensive public engagement through surveys, public meetings, and multi-channel outreach efforts. The update process formally began in January 2024 with a kickoff meeting. The LMS Working Group (WG) consists of stakeholders from various backgrounds including local government, regional entities, state agencies, federal entities, non-profits, business entities, academic institutions, and neighboring jurisdictions. Sixty-three people attended WG meetings in 2024, including members and invited stakeholder guests.

There are 10 primary steps that comprise the LMS planning process. The process defines not only who should be involved, but how the process is going to work, and provides an understanding of how the process facilitates the production of the final product.

- The Planning Organization – The development of a mitigation strategy requires the involvement of representatives from the public, private, and governmental sectors.
- Involving the Public – An important component of the mitigation planning process involves public participation.
- Coordination – Coordinate activities within the county and to bring back perspectives of their constituency.
- Assessing the Hazard – Conduct and maintain a hazard identification and vulnerability assessment.
- Assessing the Problem – Quantify the impact of the hazards identified in the previous step on the community.
- Goals and Directives – Revisit goals and directives and make adjustments as appropriate.
- Possible Activities: Mitigation Opportunities and Initiatives – Identification of potential mitigation opportunities and initiatives.
- An Action Plan – Directives were identified for each goal to specifically identify action items and are reflected in six categories of mitigation activities.
- Adoption of the Strategy – Officially adopt the LMS.

- Implementation, Evaluation, and Revision – The LMS is intended to be a dynamic document that will be updated regularly.

Key planning activities were executed throughout the update process:

- A Community Vulnerability Study (CVA) was contracted by Hillsborough County and performed by the University of South Florida (USF), focusing on future flood conditions and public health implications.
- Community Rating System (CRS) updates were completed to evaluate floodplain management activities across jurisdictions.
- A comprehensive public survey gathered 3,129 responses providing valuable community input on hazard priorities and concerns.
- Two public outreach meetings, as well as a three-week-long public review period, were held to update the public on the development of the LMS and solicit feedback.
- The Justice40 criteria were integrated throughout the planning process to ensure equitable outcomes in hazard mitigation efforts.

Capability Assessment

Hillsborough County and its municipalities have developed a comprehensive set of policies, programs, and capabilities designed to help mitigate the impacts of hazard events.

The capability assessment evaluates four primary areas of organizational capacity:

- Planning and Regulatory Capabilities – Assess the tools available to direct development and growth.
- Administrative and Technical Capabilities – Examine staffing resources and technical expertise.
- Fiscal Capabilities – Analyze the financial tools and resources available for mitigation activities.
- Political Capabilities – Evaluate the level of public and leadership support for mitigation efforts.

Each community has its own unique core set of capabilities depending on factors such as geographic area size, population, and available funding. These include building codes, land use plans, regulations, and specific hazard mitigation programs.

Risk Assessment

The risk assessment aligns with the State of Florida Enhanced Hazard Mitigation Plan (SHMP) and provides the factual basis for developing the County's LMS. New to the 2025 update is an increased focus on climate change impacts on hazard characteristics and an emphasis on social vulnerability.

This risk assessment is used not only for the LMS, but also supports the County's Comprehensive Emergency Management Plan (CEMP). Each natural hazard profile includes a discussion of the geographic areas affected, the historical occurrences in the county, an impact analysis, the probability, and the vulnerability and loss estimation by county critical facilities, and a discussion of overall vulnerability. Alternatively, the human-caused and technological hazards include similar topics of discussion, but not all aspects are able to be quantified. This is because of the limited data available and the imprecise nature of the human-caused and technological hazards.

The assessment identifies 24 hazards across two categories:

Natural Hazards

- Flood
- Tropical Cyclone
- Severe Storm
- Tornado
- Wildfire
- Erosion
- Extreme Heat
- Drought
- Suspect Soil
- Winter Storm and Freeze
- Seismic Event
- Tsunami

Technological and Human-Caused Hazards

- Transportation Incident
- Infrastructure Disruption
- HazMat Incident
- Space Weather Incident
- Terrorism
- Cyberterrorism
- Agricultural Disruption
- Disease Outbreak and Biologic Incident
- Food and Waterborne Disease Outbreak
- Mass Migration
- Civil Disturbance
- Dam/Levee Failure

Mitigation Strategy

The LMS details goals and directives for achieving loss reduction in Hillsborough County. The four goals are:

- Improved Human Environment (People and Businesses) - With directives focusing on social vulnerability, public education, collaboration with community networks, warning and evacuation procedures, improving the resilience of businesses, and public health.
- Improved Built Environment (Housing, Commercial Facilities, and Infrastructure) - Focusing on resilient structures and sustainable infrastructure, watershed management, and flood reduction techniques.
- Improved Natural Environment (Land, Vegetation, Animals) – This goal emphasizes protection of natural habitats, management of the natural floodplain, and natural infrastructure solutions.
- Resiliently Designed Environments (Strengthened Human, Built, and Natural Environments) - Includes directives that promote countywide consistency for higher standards, consideration of higher risk thresholds for hazard assessments, and education of residents and businesses on impacts from climate variability.

Potential Funding Sources

The County utilizes diverse funding streams to achieve its mitigation goals, including:

- Federal grant programs such as the Hazard Mitigation Grant Program (HMGP)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- State grant programs
- Local funding mechanisms

The plan details specific requirements, eligibility criteria, and application processes for each funding source.

Plan Maintenance

The LMS WG will meet at least four times annually to monitor, evaluate, and update the Strategy's effectiveness. Annual updates are submitted to the Florida Division of Emergency Management (FDEM) by the last working weekday of each January. Updates address:

- Changes to hazard assessment
- Changes to project priority list
- Changes to critical facilities list
- Changes to repetitive loss list
- Revision to maps

Note to reviewers – this paragraph will be updated once review is final. After the 2025 LMS update underwent final revisions, and the plan was completed to the satisfaction of the State Hazard Mitigation Office (SHMO) which reviews the Plan for compliance on behalf of the Federal Emergency Management Agency (FEMA), the plan was officially adopted by Hillsborough County via a memorandum signed by the Chief Executive Officer (CEO) as the County's Authorized Representative. The 2020 LMS update was submitted on xx/xx/xxxx and approved on xx/xx/xxx. The plan will be in effect from xx/xx/xxx until xx/xx/xxxx. Each jurisdiction also approved the Plan within their community as identified in Appendix F.

The next five-year update will be due in 2030, though the plan may be updated more frequently if significant changes occur in the interim.

Appendices

The following appendices provide detailed supporting documentation for the LMS:

- Appendix A: Planning Process Documentation - Documents the extensive community engagement process, including meeting minutes, public notices, survey results from 3,129 respondents, and documentation of stakeholder participation.
- Appendix B: Risk Assessment Tables - Contains detailed data tables supporting the hazard analysis, including historical events, loss estimates, and vulnerability assessments for each jurisdiction.
- Appendix C: Additional Natural Hazard Planning Documents - Includes supplementary materials related to natural hazards, such as flood maps, wildfire risk assessments, and related planning documents.
- Appendix D: Mitigation Projects - Lists both active and completed mitigation projects for each jurisdiction, including project descriptions, costs, funding sources, and implementation status.
- Appendix E: FL Review Tool - Contains the Florida Division of Emergency Management's Local Mitigation Plan Review Tool, which demonstrates the plan's compliance with federal and state requirements.
- Appendix F: Plan Adoption - Contains the formal adoption resolutions from each participating jurisdiction and documentation of the official approval process.
- Appendix G: Plan Maintenance - Details the procedures for monitoring, evaluating, and updating the plan, including schedules for regular reviews and methods for incorporating new information.
- Appendix H: Governance and Bylaws - Outlines the organizational structure, roles, and responsibilities of the LMS Working Group and procedures for plan implementation.
- Appendix I: Mitigation Initiatives - Provides comprehensive information about current and proposed mitigation strategies, including current capabilities and opportunities for improvement across all jurisdictions.

SECTION 1 - INTRODUCTION

Purpose

The Local Mitigation Strategy (LMS) offers innovative approaches for combining resources and coordinating government leadership with the private sector. Mitigation strategies, the cornerstone to risk reduction, offer an opportunity for each sector of our community to plan and prepare for a safer future. Mitigation is an ongoing effort to lessen the disaster's impacts on people and property.

History, as recent as the writing of this document, tells the many stories of disasters that caused tragic losses of life and property. As tragic as these losses are, the probability of even greater catastrophic loss in the future is real. As the population continues to grow and the necessary infrastructure is built, the impact of a disaster multiplies. The LMS provides a conceptual framework to reduce these losses by breaking the 'disaster event – rebuild – disaster event – rebuild' cycle.

During the late nineties, Hillsborough County and its municipalities developed a multijurisdictional LMS and, in 2004, updated it as required by the Disaster Mitigation Act of 2000. Currently, the Code of Federal Regulations, 44 CFR §201.6 - Local Mitigation Plans (eCFR.gov, 2014) requires that the LMS be reviewed and revised every five years. Revisions must reflect any changes in priorities and the progress in local mitigation efforts and development and be submitted to the Florida Department of Emergency Management (FDEM) for approval for the continuation of state and federal mitigation grant funding.

Hillsborough County's diligence in continually improving and updating its LMS provides the community with the information and tools available to increase its resiliency to the disruptions caused by disasters. Another benefit is the potential reduction in the associated cost of disasters. The cost of recovery and rebuilding is much greater than the cost of planning and preparing before disaster strikes.

The goal of the Hillsborough County LMS is to establish and maintain an ongoing process that continually assesses potential disasters, develops corresponding mitigation techniques, and incorporates preparedness and response into the consciousness of the entire community. To date, Hillsborough County's LMS process has assessed vulnerabilities of the community to a variety of hazards, identified a comprehensive list of plans, programs, and projects to decrease the magnitude of those vulnerabilities, and prioritized the implementation of respective initiatives. This 'all-hazards' LMS will continue to be referenced through the Comprehensive Emergency Management Plan (CEMP), the local Comprehensive Plans, the Hillsborough County Land Development Code, the Floodplain Management Plan, the Hillsborough County Construction Code (Ord.13-31) and the unified Post-Disaster Redevelopment Plan (PDRP), the Adaptation Plan, and any similar plans belonging to individual jurisdictions.

What is Hazard Mitigation?

Mitigation is "sustained action that reduces or eliminates long-term risk to people and property from natural hazards and their effects" (FEMA, National Mitigation Strategy, 1996). According to the website of the Federal Emergency Management Agency (FEMA), “Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters. Mitigation is acting now—by analyzing, reducing, or insuring against risk—to reduce impacts of future disasters. Mitigation requires an understanding of local risks and current capabilities and a commitment to investing in long-term community well-being.”[1] According to the Code of Federal Regulations, “hazard mitigation means any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.”[2]

These definitions distinguish actions that have a long-term impact from those that are more closely associated with preparedness and immediate response to and short-term recovery from a specific event, although this ongoing process does encompass processes that address the time before and during a disaster.

Mitigation intends to focus on actions that produce repetitive benefits over time, rather than emergency planning or emergency services. The primary purpose of hazard mitigation is to safeguard communities so that when they experience a disaster, they suffer the least damaging effects possible with the ideal outcome of eliminating negative effects from the impact of a disaster.

The benefits of effective mitigation include, but are not limited to, economic, public health, and building resiliency.

Economic

- Effective mitigation techniques significantly reduce current dollars spent on mitigation as well as the demand for large amounts of future dollars when disasters strike.
- Current mitigation expenditures seek to reduce the economic disaster that often accompanies the hazard event through destruction of property, disrupted supply chains, and loss or interruption of jobs and businesses

Public Health

- Mitigation reduces the principal causes of injuries and deaths and decreases the demands on disaster response and recovery resources.
- By reducing the principal causes of injuries and deaths, mitigation enables a quicker lifesaving response and long-term economic recovery because the community infrastructure remains intact.
- Mitigation reduces the societal impacts of disaster because it results in less disruption of the social environment.

Built Environment

- Through the application of mitigation technologies and practices, society can lessen or eliminate the negative consequences of disasters. For example, mitigation measures can strengthen homes so that belongings are better protected from floods, hurricanes, and other hazards.

[1] https://www.fema.gov/hazard-mitigation-planning-frequently-asked-questions
[2] (44 CFR 201.2)

- Mitigation strategies can also be used to reinforce businesses and industries to lessen or avoid damages to their facilities, possibly allowing them to remain operational. Mitigation technologies can strengthen hospitals, fire stations, and other critical service facilities so that they can remain operational or reopen more quickly after an event
- Mitigation measures can help reduce disaster losses and suffering so that there is less demand for money and resources in the aftermath.

In practice, mitigation can take many forms. Actions include the following:

- Promote sound land-use planning based on known hazards
- Work closely with the insurance industry to accomplish ---
- Retrofit structures to withstand disasters where an increased risk is present
- Promote ‘beyond code’ building standards to reduce structural vulnerability
- Develop, adopt, and enforce effective building and development standards in high-risk areas
- Engineer existing and future infrastructure to withstand greater risks Develop and implement a hazard mitigation plan that illustrates strategies to reduce vulnerability to hazards

Enabling our community to help each other reduce the number of victims, property loss, and environmental damage is the foundation of our community-based LMS

Regulations

The Disaster Mitigation Act of 2000 (DMA2K) became law on October 30, 2000. The act amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Public Law 93-288, as amended).

Federal statutes and regulations applicable to Local Mitigation Planning include the following:

- Disaster Mitigation Act of 2000 (42 U.S. Code 5121)
- Stafford Act
    - Title III – Major Disaster and Emergency Assistance Administration
        - Section 322 – Mitigation Planning (42 U.S. Code 5165)
            - (a) Requirement of Mitigation Plan
            - (b) Local and Tribal Plans
            - (e) Increased Federal Share for Hazard Mitigation Measures
    - Title IV – Major Disaster Assistance Programs
    - Section 404 – Hazard Mitigation (42 U.S. Code 5170(c))
        - (c) Program Administration by States
- 44 Code of Federal Regulations 201 – Mitigation Planning
    - §201.6 Local Mitigation Plans
- 44 Code of Federal Regulations 13 – Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments
    - Subpart B – Pre-Award Requirements
        - §13.10 Forms for Applying for Grants

Florida statutes and regulations applicable to state and county mitigation planning include the following:

- Florida Statute 252
    - Florida Administrative Code 27P-22
- Florida Statute 252.3655

Other applicable standards include the Emergency Management Accreditation Program (EMAP) Standards. Hillsborough County is EMAP Accredited and the Hillsborough County LMS is compliant with the EMAP Standards. The applicable Standards include:

- 4.1: Hazard Identification, Risk Assessment and Consequence Analysis
- 4.2: Hazard Mitigation

Assurances

Hillsborough County will comply and assures it will continue to comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding in compliance with 44 CFR 13.11(c) as a subgrantee through the State of Florida. This includes managing and administering the Federal Emergency Management Agency (FEMA) funding locally in accordance with applicable Federal statutes and regulations.

The County also assures it will amend the LMS in accordance with 44 CFR. This includes amending the plan whenever necessary to reflect changes in state or federal laws and statutes.

County Profile

Natural Features and Topography

Hillsborough County is located in west-central Florida bordered by Pasco County to the north, Manatee County to the south, Polk County to the east, and on the west by Pinellas County and Tampa Bay. The 39.2 miles of coastline in Tampa Bay is home to Florida’s largest estuary, a place where freshwater and saltwater meet and mix to form a unique habitat. Of Hillsborough County's 1,266.4 square miles, 1,051 square miles are land and 215.4 square miles are water (39.7 inland, 155.9 coastal, and 19.8 territorial). The Bay grows to 398 square miles at high tide.

Identifying both the physical and the cultural features of a region is vital to understanding and prepare for the impact of the various types of hazards. This section builds a profile of Hillsborough County to identify, understand, and make information available to its citizens to prepare to mitigate, respond, and recover from various types of hazards. A map of the County is provided in Figure 2.1.

Hillsborough County’s topography ranges from sea level to approximately 160 feet in the Keystone area of northwestern Hillsborough County. The county is a karst region, meaning its terrain contains that contains sinkholes, caves, springs, and other solutional features.

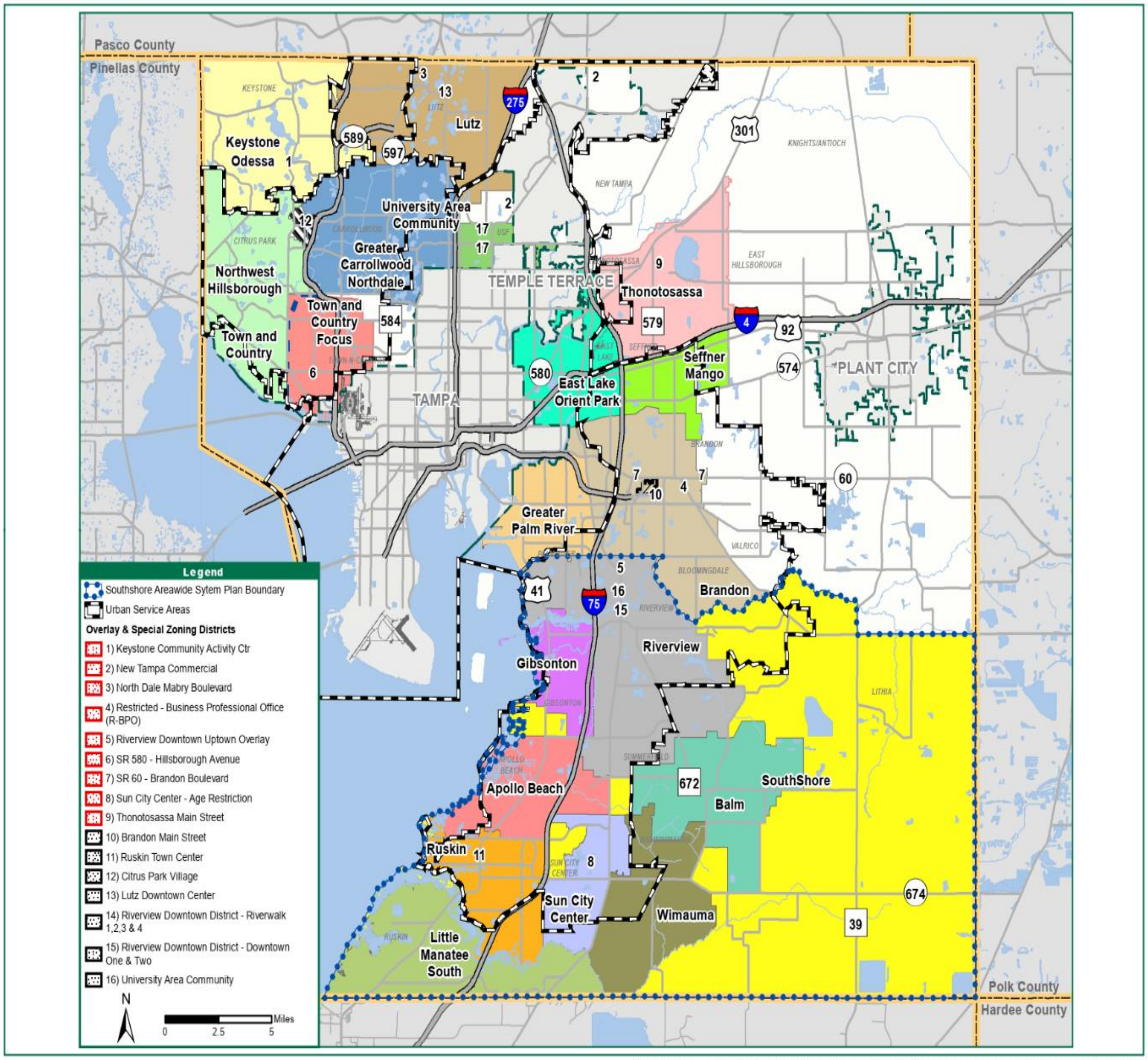


Figure 2.1. Map of Hillsborough County

Hillsborough County is the economic hub of the Tampa Bay metropolitan region. Its diverse industries include the chief financial district in downtown Tampa, the Tampa International Airport (TPA), the Port of Tampa - the largest seaport in the state based on tonnage, beaches and theme parks that provide tourists year-round destinations, both private and public colleges and universities, respected medical and medical research facilities, and a thriving agricultural sector. The agricultural industry is strong and produces strawberries, tomatoes, grapefruit, oranges, squash, tangerines, watermelons, cattle, dairy products, broilers, and eggs, in addition to an aquaculture industry that produces such products as aquarium fish and aquatic plants.

As the County continues to grow and thrive, it remains vulnerable to a wide range of natural, technological, and man-made hazards. Natural hazards include hurricanes, floods, tornadoes, storm surges, lightning, high winds, sinkholes, wildfires, and drought. Technological hazards include electrical failures, sewer failures, radiologic exposures, cyber incidents, and chemical exposures. Human-made hazards include terrorism, mass casualties, bomb threats, hostage situations, and workplace violence. Hillsborough County and its population of more than one million residents need to prepare for all of them.

Hillsborough County is comprised of four jurisdictions, three of which are incorporated. Of the three cities, Tampa is the largest in both size and population followed by the City of Plant City and then the City of Temple Terrace.

The physical features of the county were described in the Conservation and Aquifer Recharge Element of the county's Comprehensive Plan as follows: "...by virtue of its subtropical climate and variable hydrology and geology, [Hillsborough County] supports a rich and diverse complement of natural resources." There are three major rivers in the county: Hillsborough River, Alafia River, and Little Manatee River. The features of these rivers were described in the Conservation and Aquifer Recharge Element as follows: "The Hillsborough River begins in the Green Swamp and then flows southwestward draining 690 square miles before emptying into McKay and Hillsborough Bay. The Alafia begins in Polk County and flows westward. It drains a 420 square mile basin and enters Hillsborough Bay. The Little Manatee River begins in southeast Hillsborough County and northeast Manatee County and flows west to Tampa Bay, draining 225 square miles." Figure 2.2 shows Hillsborough County's wetlands and waterways. Table 2.1 lists the waterways featured on the map.

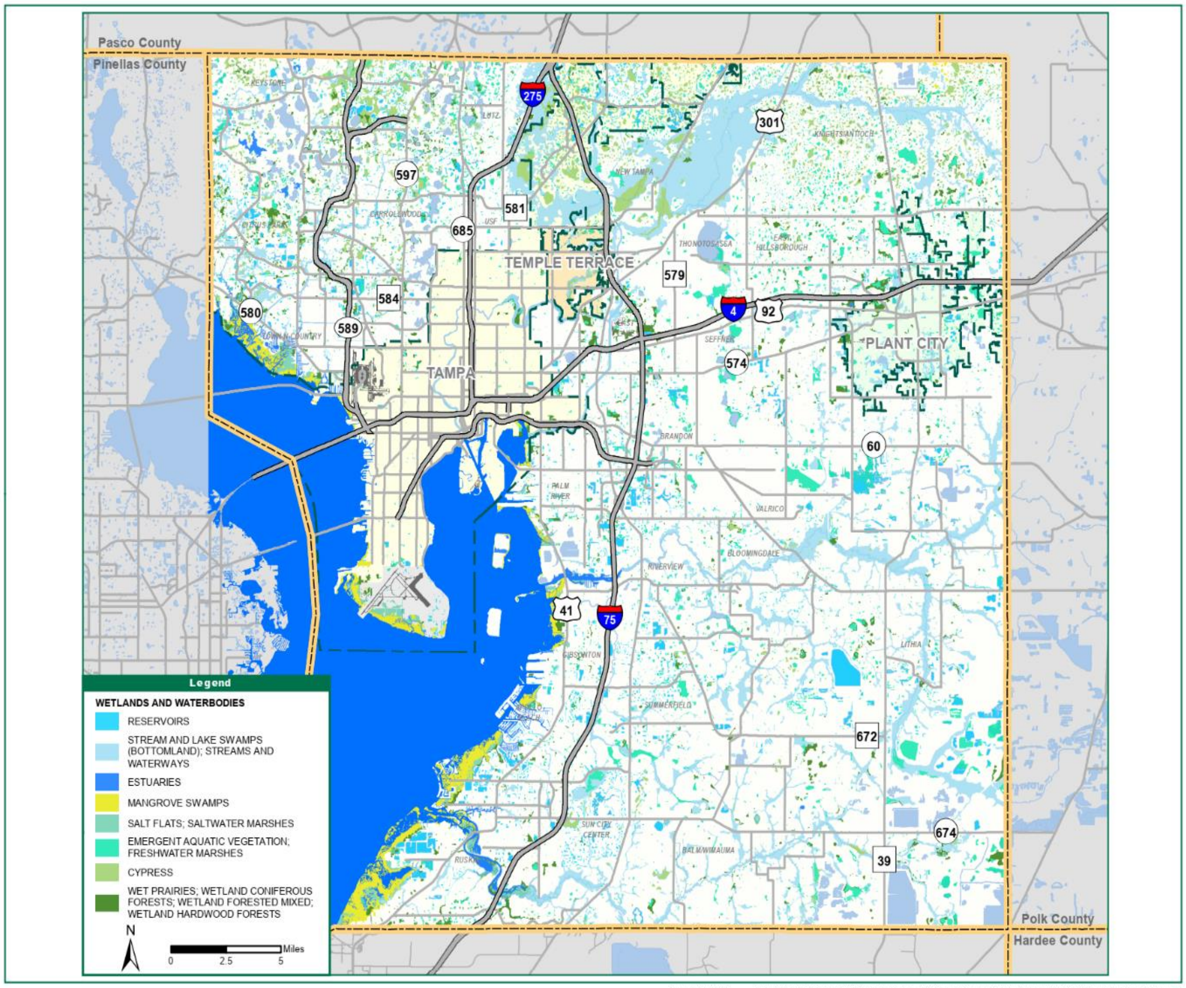


Figure 2.2. Hillsborough County Wetlands and Waterways

The following waterways are featured in Figure 2.2:

- Alafia River
- Alderman Creek
- Archie Creek
- Baker Creek
- Bell Creek
- Big Ditch
- Blackwater Creek
- Boggy Creek
- Brusshy Creek
- Bullfrog Creek
- Campbell Branch
- Chito Branch
- Cockroach Creek
- Curiosity Creek
- Cypress Creek
- Dug Creek
- English Creek
- Fish Creek
- Fishhawk Creek
- Flint Creek
- Halls Branch
- Hillsborough River
- Hollomans Branch
- Howard Prairie Brook
- Howell Branch
- Hurrah Creek
- Indian Creek
- Itchepackesassa
- Keystone Lake
- Lake Thonotosassa
- Little Bullfrog Creek
- Little Fishhawk Creek
- Little Manatee River
- Mizelle Creek
- New River
- North Prong Alafia River
- Owens Branch
- Pemberton Creek
- Rocky Creek
- Sherrys Brook
- South Prong Alafia River
- Spartman Branch
- Sweetwater Creek
- Thirtymile Creek
- Turkey Creek
- West Branch
- Wolf Branch

Demographics

The 2022 Census determined that Hillsborough County's population was 1,468,560. Table 2.1 shows the Census population breakdown between the jurisdictions and by population per square mile. In 2022, the University of Florida's Bureau of Economic and Business Research (BEBR) estimated the county's population would increase to 1,927,300 by 2045.

Table 2.1. Area, Population, and Density by Jurisdiction

Jurisdiction	Area (per sq. mi.)	2022 Population	Persons (per sq. mi.)
City of Plant City	28	39,655	1,416
City of Tampa	177	388,768	2,196
City of Temple Terrace	7	26,818	3,831
Unincorporated County	1,004	1,013,319	1,009
Hillsborough County Total	1,216	1,468,560	1,208

Table *2.2* shows the racial composition of the County and its jurisdictions based on 2018-2022 U.S. Census American Communities Survey.

Table 2.3 breaks down Hispanic and Latino populations by region from the same source, and

Table *2.4* includes age distribution by jurisdiction.

Table 2.2. Racial Composition by Jurisdiction (Estimates)[3]

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total Population	1,468,560	39,655	388,768	26,818	1,013,319
White	864,562	25,993	213,542	15,759	609,268
Black or African American	241,312	5,393	84,660	4,957	146,302
American Indian & Alaska Native	4,946	573	976	60	3,337
Asian	62,784	681	18,062	1,852	42,189
Native Hawaiian	1,262	0	551	7	704
Some Other Race	90,067	2,722	17,619	1,225	68,501
Two or More Races	203,627	4,293	53,358	2,958	143,018

[3] Source: U.S. Census Bureau, Table DP05,2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

Table 2.3.Hispanic or Latino by Specific Region[4]

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total Population	1,468,560	39,655	388,768	26,818	1,013,319
Hispanic or Latin	439,450	13,256	103,646	5,314	317,234
Mexican	74,939	6,961	11,863	1,011	55,104
Puerto Rican	120,907	2,991	25,745	2,362	89,809
Cuban	106,854	895	30,159	459	75,341
Other Hispanic	136,750	2,409	35,879	1,482	96,980

Table 2.4. Age Distribution by Jurisdiction5

	HC Total		Plant City		Tampa		Temple Terrace		Uninc. County	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Total	724,235	744,325	19,680	19,975	193,981	194,787	14,033	12,785	496,541	516,778
<5	43,550	41,517	1,056	1,230	11,208	11,661	545	480	30,741	28,146
5-9	44,032	43,995	1,171	1,282	11,416	11,509	859	522	30,586	30,682
10-14	49,022	43,843	1,627	1,111	12,201	9,580	966	663	34,228	32,489
15-19	48,689	46,979	1,496	1,448	13,743	14,794	1,026	1,152	32,424	29,585
20-24	48,438	48,560	1,248	1,203	13,626	14,521	1,453	1,403	32,111	31,433
25-29	54,025	54,176	1,206	1,243	18,290	17,338	1,517	1,137	33,012	34,458

[4] Source: U.S. Census Bureau, Table DP05, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

[5] Source: U.S. Census Bureau, Table S0101, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

	HC Total		Plant City		Tampa		Temple Terrace		Uninc. County	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
30-34	55,715	55,608	1,611	1,489	15,934	15,687	1,260	918	36,910	37,514
35-39	52,505	54,099	1,471	1,147	14,394	14,797	1,050	815	35,590	37,340
40-44	50,022	48,576	1,910	1,827	12,380	12,062	822	686	34,910	34,001
45-49	48,576	48,728	1,214	1,228	13,147	12,511	694	700	33,521	34,289
50-54	47,805	47,857	1,153	1,188	11,995	11,140	535	695	34,122	34,834
55-59	44,998	48,380	1,378	1,614	11,490	11,639	758	586	31,372	34,541
60-64	41,884	42,366	942	1,034	11,550	9,735	624	871	28,768	30,726
65-69	31,817	36,873	838	968	7,408	8,539	620	587	22,951	26,779
70-74	27,507	31,795	554	849	6,201	6,742	653	651	20,099	23,553
75-79	17,053	21,724	441	448	4,198	5,377	444	489	11,970	15,410
80-84	9,911	13,486	219	234	2,688	3,561	111	247	6,893	9,444
85+	8,686	15,763	145	432	2,112	3,594	96	183	6,333	11,554

According to the 5-year American Community Survey (ACS), data collected in 505,845 households countywide between 2018 and 2022 identified select information regarding income and benefits in 2022 inflation-adjusted dollars (American Community Survey [ACS], Table DP03, 2022). In Hillsborough County:

- Median household income is $70,612
- Median family income is $86,250
- Median non-family income is $46,081
- Average per capita income (dollar) is $39,509

Table 2.5 breaks down the number of households in the different jurisdictions by income range.

***Table 2.5. Households by Income by Jurisdiction (Estimates)*[6]**

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total Households	559,970	14,500	157,066	10,894	377,510
Less than $10,000	30,499	733	11,227	349	18,190
$10,000 to $14,999	19,450	453	6,851	379	11,767

[6] Source: U.S. Census Bureau, Table DP03, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
$15,000 to $24,999	38,212	1,265	12,664	491	23,792
$25,000 to $34,999	45,008	1,306	12,658	1,332	29,712
$35,000 to $49,999	66,196	2,165	18,324	1,844	43,863
$50,000 to $74,999	94,443	2,677	24,247	1,915	65,604
$75,000 to $99,999	72,301	1,889	17,620	1,516	51,276
$100,000 to $149,999	91,221	2,314	21,868	1,617	65,422
$150,000 to $199,999	45,438	1,177	11,327	655	32,279
$200,000 or more	57,202	521	20,280	796	35,605

As of the collection of this data, in Hillsborough County there were 208,195 individuals living in poverty, as defined by the U.S. Census Bureau, 2018-2022 American Community Survey (ACS). Table 2.6 shows poverty status by type and jurisdiction.

Table 2.6. Poverty Status by Type by Jurisdiction[7]

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
All Ages	1,430,459	39,025	384,514	26,311	980,609
<18	318,233	9,628	83,284	5,122	220,199
18-64	908,131	24,627	251,528	17,188	614,788
65+	286,620	4,770	49,702	4,001	228,147

Housing Mix

According to the 2018-2022 ACS 5-year Estimates, Hillsborough County has 559,970 occupied housing units. Of the 559,970 occupied units, 338,533 were owner-occupied, and 221,437 were

[7] Source: U.S. Census Bureau, Table S1701 and S1702, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

renter-occupied. Additionally, there were 46,364 vacant units. The average household size was 2.68 for owner-occupied and 2.41 for renter-occupied.

Table 2.7 shows the breakdown of household type and average size by jurisdiction.

Table 2.7 shows the breakdown of household occupation type and average size by jurisdiction.

Table 2.7. Household Occupation by Jurisdiction[8]

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total housing units	606,334	15,318	172,995	11,444	406,577
Total occupied units	559,970	14,500	157,066	10,894	377,510
Owner-occupied	338,533	9,075	79,321	5,418	244,719
Renter-occupied	221,437	5,425	77,745	5,476	132,791
Average household size of owner-occupied unit	2.68	2.74	2.55	2.54	2.68
Average household size of renter-occupied unit	2.41	2.66	2.20	2.25	2.41

[8] Source: U.S. Census Bureau, Table DP04 and B25008, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

The 2018-2022 ACS 5-year Estimates show that of the 606,334 housing units countywide that 344,825, or 56.9 percent, were single-family detached and 39,670, or 6.7 percent, were mobile homes. The majority of housing was single-family detached in the incorporated jurisdictions as well.

Table 2.8 shows the breakdown of household type and average size by jurisdiction.

Table 2.8. Housing Type by Jurisdiction9

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total housing units	606,334	15,318	172,995	11,444	406,577
1-unit, detached	344,825	10,121	88,909	4,878	240,917
1-unit, attached	44,961	722	11,470	1,026	31,743
2 units	10,616	378	4,931	120	5,187
3 or 4 units	24,713	575	8,266	1,195	14,677
5 to 9 units	33,102	664	10,006	1,256	21,176
10 to 19 units	39,525	885	11,525	1,131	25,984
20 or more units	67,612	1,041	35,473	1,814	29,284
Mobile home	39,670	917	2,240	24	36,489
Boat, RV, van, etc.	1,310	15	175	0	1,120

The continued population growth in Hillsborough County is reflected in the distribution of housing units by the year they were built. Of the 606,334 total housing units, 299,405 were built since 1990, 289,437 were built from 1940 to 1989, and 17,492 were built before 1939. Table 2.9 shows the year structures were built by jurisdiction and Table 2.10 indicates property values by jurisdiction.

Table 2.9. Year Structure Built by Jurisdiction (Estimate)[10]

[9] Source: U.S. Census Bureau, Table DP04, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

[10] Source: U.S. Census Bureau, Table DP04, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total housing units	606,334	15,318	172,995	11,444	406,577
Built 2014 or later	6,075	91	1,394	0	4,590
Built 2010 to 2013	82,602	1,700	21,672	567	58,663
Built 2000 to 2009	116,452	2,439	28,889	1,160	83,964
Built 1990 to 1999	94,276	2,747	20,710	1,597	69,222
Built 1980 to 1989	113,604	3,187	20,467	3,792	86,158
Built 1970 to 1979	82,224	1,885	18,608	2,174	59,557
Built 1960 to 1969	44,434	807	15,596	829	27,202
Built 1950 to 1959	36,844	1,212	21,839	1,094	12,699
Built 1940 to 1949	12,331	702	9,239	131	2,259
Built 1939 or earlier	17,492	548	14,581	100	2,263

According to the 2018-2022 ACS 5-year Estimates, the median value for the 338,533 owner-occupied housing units countywide was $294,900. It is important to note that housing values have increased significantly since 2022 and that is not captured in this data.

Table 2.10. Property Values by Jurisdiction Owner-Occupied Housing Units[11]

	Hillsborough County Total	City of Plant City	City of Tampa	City of Temple Terrace	Uninc. County
Total owner-occupied units	360,020	9,075	81,100	79,321	278,920
Less than $50,000	15,931	653	2,617	2,065	13,314
$50,000 to $99,999	10,359	648	1,411	2,627	8,948

[11] Source: U.S. Census Bureau, Table DP04, 2018-2022 American Community Survey 5-year Estimates
Note: Data are based on a sample subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. In addition to sampling variability, the ACS estimates are subject to non-sampling error.

$100,000 to $149,999	7,327	853	1,113	5,094	6,214
$150,000 to $199,999	13,822	1,513	3,160	7,632	10,662
$200,000 to $299,999	51,118	3,045	11,686	18,309	39,432
$300,000 to $499,999	146,840	2,052	25,955	21,389	120,885
$500,000 to $999,999	94,497	234	25,623	15,215	68,874
$1,000,000 or more	20,126	77	9,535	6,990	10,591

Business and Industry

Hillsborough County's geographic location and size play a crucial role in the Tampa Bay region's overall economic health and vitality. According to the 2018-2022 ACS 5-year Estimates, the county reported a labor force of 772,606. Table 2.11 below shows the number of employers and employees by industry for the first quarter of 2023 according to the Florida Labor Market Statistics, Quarterly Census of Employment and Wages Program.

Table 2.11. Number of Establishments and Employees by Industry[12]

Industry	Employment	Annual Change	Establishments	Annual Change	Average Wage	Annual Change	Location Quotient
Agriculture, Forestry, Fishing, Hunting	4,395	-17.6%	287	2.5%	$36,348	4.0%	0.57
Mining, Quarrying, Oil and Gas Extraction	88	-3.3%	21	-12.5%	$100,256	37.5%	0.03
Utilities	3,410	11.0%	77	10.0%	$93,340	-11.7%	0.93
Construction	49,758	3.3%	5,142	2.5%	$69,888	5.8%	1.18
Manufacturing	30,655	1.8%	1,392	3.3%	$72,176	4.7%	0.44
Wholesale Trade	34,789	1.8%	2,452	-2.6%	$92,508	7.2%	1.13
Retail Trade	75,667	1.3%	5,151	-1.2%	$42,536	1.1%	1.04
Transportation & Warehousing	31,171	4.9%	1,425	1.0%	$56,056	9.7%	0.89
Information	14,951	-1.3%	1,247	13.5%	$101,868	-5.5%	0.7
Finance and Insurance	68,206	6.4%	3,055	4.1%	$94,744	1.3%	1.79
Real Estate	17,308	4.4%	3,182	4.1%	$68,224	-0.3%	1.44

[12] Source: Hillsborough County 2023 Economic Development Indicator Report

Industry	Employment	Annual Change	Establishments	Annual Change	Average Wage	Annual Change	Location Quotient
Rental and Leasing							
Professional and Technical Services	79,021	4.7%	9,595	5.9%	$101,452	5.5%	1.3
Management of Companies and Enterprises	11,084	-1.9%	471	3.1%	$116,220	0.1%	0.75
Administrative and Waste Services	59,991	0.9%	4,838	5.9%	$51,480	2.3%	1.2
Educational Services	16,849	16.6%	801	4.2%	$45,864	2.0%	0.82
Health Care and Social Assistance	99,771	8.2%	6,020	2.7%	$68,952	7.0%	1.06
Arts, Entertainment, and Recreation	14,080	8.1%	698	2.8%	$65,936	10.5%	1.62
Accommodation and Food Services	67,382	5.5%	3,299	-0.6%	$29,848	4.9%	1.01
Other Services, except Public Administration	20,131	6.8%	3,590	2.5%	$45,864	5.6%	0.81
Public Administration	26,859	1.7%	164	0.0%	$75,972	6.8%	0.63
Unclassified	1,291	68.7%	1,519	22.5%	$49,608	-5.3%	0.47
ALL INDUSTRIES	**699,998**	**4.4%**	**54,262**	**3.5%**	**$67,860**	**4.0%**	**1.05**

The primary locations for industrial activity in Hillsborough County are in close proximity to the Port of Tampa and TPA. Historically, office space has primarily concentrated in the Port, Westshore, and University areas and the Central Business Districts of Tampa. Newer employment areas have grown to include, but are not limited to, the University Area and the Brandon and Sable Park areas. Other commercial development is along the I-75 and US 301 corridors. Except for the Mosaic facility on US 41 at the Alafia River, industries associated with phosphate mining are in the eastern portions of the county.

While the Port of Tampa continues to have a concentration of heavy and light industry, the character of the surrounding area near downtown Tampa has been undergoing a transformation. This area is no longer the site of warehousing, wholesale, and transportation activities. Rather, it is redeveloping with retail, office, residential, and tourist activities. Increased interest has been expressed in developing the area with more mixed use of residential and commercial uses. Table 2.12 lists the major employers in Hillsborough County.

Table 2.12. 2024 Major Employers in Hillsborough County[13]

Rank	Employer Name	Industry	Employees
1	State of Florida	Government	34,700
2	MacDill Air Force Base	Security and Defense	31,000
3	BayCare Health System	Healthcare	29,500
4	Hillsborough County Public Schools	Education	23,750
5	HCA West Florida Division	Healthcare	17,000
6	University of South Florida	Education	15,000
7	Hillsborough County	Government	11,100
8	H. Lee Moffitt Cancer Center	Healthcare	8,135
9	JPMorgan Chase & Co.	Financial Services	5,700
10	Progressive Insurance	Financial Services	5,350
11	Raymond James Financial	Financial Services	5,200
12	Bloomin' Brands	Food + Beverage	5,000
13	City of Tampa	Government	4,889
14	Seminole Hard Rock Hotel and Casino	Hotel and Casino	4,500
15	United Services Automobile Association	Financial Services	3,900
16	John Hopkins All Children's Hospital	Healthcare	3,467
17	Tampa Electric Company	Utilities	2,500
18	Suncoast Credit Union	Credit Union	2,470
19	Jabil	Manufacturing	2,000
20	Rooms To Go Furniture	Retail	2,000

Future Land Use

Typical of a metropolitan area, the variety of land uses found in Hillsborough County range from highly urban areas such as Tampa, to the busy suburban areas such as Brandon and Citrus Park, to the picturesque rural areas of Wimauma and Keystone. Historically, Hillsborough County's principal activity centers have been located in the business districts of downtown Tampa and the Westshore area, Old Carrollwood, The University of South Florida (USF) area, MacDill Air Force Base, The Port of Tampa, TPA, downtown Plant City, and adjacent unincorporated areas. Over time, new development has occurred largely within the identified urban service areas of Unincorporated Hillsborough County and the "New Tampa" area of north-central Hillsborough County. With development moving away from the county's urban core, former suburban and rural areas are becoming urban in character. According to the Planning Commission, unincorporated areas of Hillsborough County experiencing increasing population growth include Balm/Wimauma, Brandon, Carrollwood, Greater Sun City Center, Riverview, Westchase, and Town N' Country.

Outside the County's urbanized central area, the City of Plant City has been experiencing rapid growth from the expanding warehouse/wholesale industry in the City of Lakeland. The City of Temple Terrace has also experienced growth associated with both the expansion of the USF and development occurring along the I-75 corridor. In addition to the growth and development in Unincorporated Hillsborough County, redevelopment activity is evident in the three municipalities:

[13] Source: Tampa Bay Today, 2024

Tampa's residential development and redevelopment in the Interbay and Tampa Heights areas, and the City of Temple Terrace's and the City of Plant City's downtown redevelopment plans.

As Hillsborough County's population grows and expands, the need for expanding and improving mitigation techniques grows with it. Growth and new construction away from coastal flooding and velocity wave action produces more resilient construction because of location and updated building codes. Redevelopment in the 100-year flood risk areas in downtown Tampa and the Interbay area must meet the strict National Flood Insurance Program (NFIP) floodplain management standards. Hillsborough County's wetlands are protected through comprehensive plans, land develop code, and permitting processes, detailed in ***Section 4 – Capability Assessment.*** Additionally, the Hillsborough County Environmental Protection Commission, established by the Florida State Legislature, provides local standards for protection, maintenance and utilization of wetlands within the County. All these actions are resulting in more disaster-resistant communities. Further information on Future Land Use and how it will be impacted by hazards can be found in ***Section 4 - Future Land Use***.

The Planning Commission website is Tampa and Hillsborough County's information center for long-range planning and projects. Meeting information, maps, and information on how to get involved can also be found on the site at:https://planhillsborough.org/

SECTION 2 - PLANNING PROCESS

Introduction

History of Hillsborough County's LMS

The LMS offers innovative approaches for combining resources and coordinating government leadership with the private sector. Mitigation strategies, the cornerstone to risk reduction, offer an opportunity for each sector of our community to plan and prepare for a safer future. Mitigation is an ongoing effort to lessen the impacts that disasters have on people and property.

Hillsborough County's history includes many disasters that caused tragic losses of life and property. As tragic as these losses are, the County can anticipate even greater catastrophic loss in the future. As the population continues to grow and the necessary infrastructure is erected, the impact of a disaster multiplies. The LMS provides a conceptual framework to reduce these losses by breaking the cycle of 'disaster event – rebuild – disaster event – rebuild.'

During the late nineties, Hillsborough County and its municipalities – the cities of Tampa, Plant City, and Temple Terrace – developed a multijurisdictional LMS and, in 2004, updated it as required by the Disaster Mitigation Act of 2000. Currently, the Code of Federal Regulations, 44 CFR §201.6 - Local Mitigation Plans, requires that the LMS be reviewed and revised every five years.[14] This revision must reflect any changes in priorities and the progress in local mitigation efforts and development, and must be submitted to FDEM for approval for continuation of state and federal grant funding.

Hillsborough County's diligence in continually improving and updating its LMS provides the community with the information and tools available to increase its resiliency to the disruptions caused by disasters. Another benefit is the potential reduction in the associated cost of disasters. The cost of recovery and rebuilding due to the devastation caused by a disaster is much greater than the cost of planning and preparing before disaster strikes.[15]

LMS Goals and Coordination

The goal of the Hillsborough County LMS is to:

- Establish and maintain an ongoing process that continually assesses risk and vulnerability from potential disasters;
- Develop corresponding mitigation techniques; and
- Incorporates preparedness and response into the consciousness of the entire community.

To date, Hillsborough County's LMS process has produced the assessed vulnerabilities of the community to a variety of hazards, identified a comprehensive list of plans, programs, and projects to decrease the magnitude of those vulnerabilities, and prioritized the implementation of respective initiatives. This 'all-hazards' LMS will continue to be referenced through the CEMP, the local Comprehensive Plan, the Hillsborough County Land Development Code, the Floodplain

[14] (eCFR.gov, 2014

[15] (Berginnis, 2014).

Management Plan, the Hillsborough County Construction Code (Ord.13-31) and the unified Post-Disaster Redevelopment Plan (PDRP). See more information about these documents in *Section 3 - Capability Assessment* and *Section 5 – Mitigation Strategy*.

At the core of the unified multi-jurisdictional mitigation planning process is the coordination and partnership among governmental units, commercial enterprises (industry partners), and citizen groups. This partnership consists of respective groups and the cities of Plant City, Temple Terrace, and Tampa, as well as unincorporated Hillsborough County.

The success of the planning processes for all-hazards and floodplain management planning for each respective community within the county and with the NFIP Community Rating System (CRS) does rely on the close involvement of public and private sector organizations and state and federal agencies.

During the LMS development process, USF simultaneously conducted a Community Vulnerability Assessment (CVA) for the County and provided key insight throughout the process. Additionally, neighboring jurisdictions were invited to attend planning meetings and sent drafts for review. Although not a comprehensive list, additional participants included:

- Environmental organizations such as the Florida Department of Environmental Protection (FDEP), Sierra Club, and Tampa Bay Estuary Program, Tampa Bay Conservancy
- Dam owners included Shadow Run Dam Corporation,
- Community organizations such as My Warrior's Place, a retreat center for veterans, military service members, law enforcement officers, and more,
- Private industries included representatives from Clearview Land Design, Applied Sciences, Stantec, and Kimley Horn,
- Healthcare organizations included Tampa General Hospital, Advent Health, and the Tampa Bay Health & Medical Preparedness Coalition,
- Relief organizations were represented by the American Red Cross

Since its adoption in 2004 and the first approved update in 2009, the updating of the LMS is an ongoing process and is revised on an annual basis pursuant to Florida Administrative Code (FAC) 27P-22.004 (4)(e). A requirement for incremental annual updates includes maintaining records of the meetings of the LMS Working Group (LMS WG). These records include details of many of the aspects that are incorporated in the required five-year update and include:

- Reports from private/quasi-public groups and non-profit/volunteer groups;
- Updates on continuity planning and critical facilities and infrastructure;
- Proposed and completed projects; and
- Discussions of available funding and grant application cycles.

A LMS WG held several meetings to review the recommendations and work plan to formulate a strategy on how to best proceed with the update.

The LMS Coordinator created a task list from these discussions, and organizations and personnel were identified to complete the initial revisions.

Initial revisions were performed or coordinated by the committee. The revised sections were sent to the LMS WG for comment, suggested revisions, deletions, or additions. Each jurisdiction was represented and participated in the planning process. All suggestions, revisions, and corrections were considered in the final document.

2025 Update

The update process formally began in 2024 with a kickoff meeting in January. The County's Hazard Mitigation Section opted to utilize the services of Dewberry to supplement the activities of the LMS WG and revise the full plan. Many of the entities involved had related efforts occurring simultaneously, and so one of the key activities was the integration of these studies into the plan. Two of the most relevant projects include:

- Hillsborough County's CVA – Hillsborough County contracted the USF to perform the assessment. The effort focuses on future flood conditions and evaluates public health implications for flood-related hazards.
- Community Rating System (CRS) Updates – The CRS program, which evaluates jurisdictions' floodplain management activities, is a very involved program that requires specific analysis, code assessments, and public information activities (among other actions) to be performed annually. Where applicable, the CRS work of the cities and their subcontractors have been incorporated under the direction of the LMS WG.

Throughout the update process, these projects were discussed at WG meetings so that their results could be shared with stakeholders and evaluated for inclusion in the new document. The sections below illustrate the full planning process in accordance with the 10-step process as required by Activity 510 (Floodplain Management Planning or FMP) of the 2017 Manual for the Community Rating System and 2021 addendum. The County and its jurisdictions utilize the LMS document to meet the FMP requirements under the CRS program. See ***Appendix B.2 - Critical Facilities*** for more information.

STEP 1: THE PLANNING ORGANIZATION

LMS Working Group (LMS WG)

The LMS WG is a diverse coalition of representatives from public, private, and governmental sectors, essential for developing a comprehensive mitigation strategy. Sixty-three members and stakeholders from various backgrounds attended meetings in 2024, The list of participants in the list fluctuates frequently as entities come in and out of the planning process and staff change jobs or roles within the community. The bulleted list below identifies the count of stakeholders by each type of entity, and lists some of the key agencies in that category. While not all members participate at local meetings or events, they are invited and are provided correspondence via email. The full list of LMS WG attendees can be found in Table 3.1: Local Mitigation Strategy (LMS) Working Group Members , and have the following affiliations:

- Local Government: 48 members. These are employees of the 3 participating jurisdictions and Unincorporated Hillsborough County.
- Regional Entities: 7 members. These are employees of associated regional agencies.

- State Entity: 3 members. These members are part of agencies such as Florida Dept. of Transportation and the Florida Division of Emergency Management,
- Federal Entity: 1 member, representing the U.S. Airforce.
- Non-Profit Entity: 4 members, including representatives of John Hopkins Medicine, Well Built Cities, the Moffitt Cancer Center and the Human Development Center.
- Business Entity: 7 members with most being local engineering companies.
- Academic Institution: 4 members of USF, including representatives of the Florida Center for Community Design and Research.
- Neighboring Jurisdictions: 6 members, including representatives from the counties of Pinellas, Manatee, and Pasco Counties.
- Tribal Entity: 0 member, representing the Seminole Tribe of Florida. The Seminole Tribe has their own mitigation plan and did not participate in the planning process, although invited.
- Private Members of the Public: 6 members. Public including Hillsborough County Neighborhood Association, Citizen Advisory Committee members, and County and municipal leadership programs. The residents participate in LMS WG meetings by phone and in person depending upon their availability.
- CRS coordinator: 1 member

Table 3.1: Local Mitigation Strategy (LMS) Working Group Members

Person	Affiliation	Division/Office /Specialty	Position
Ali Howerton	Hillsborough County	Environmental Services	Sustainability Program Manager
Allan Biddlecomb	Pasco County	Public Infrastructure & Utility Services	Program Administrator
Allanna Parris / Allanna Stephens	Florida Department of Environmental Protection (FDEP)		Senior Public Relations Specialist
Amanda Converse	Hillsborough County		
Angie Leslie	TECO Energy		TECO/Emergency Management Mgr.
Angie Speir	Florida Division of Emergency Management (FDEM)		
Ashley Cantrell-Tharp	Wright Flood		Wright Flood/Training Manager*
Barbara Spaulding	Hillsborough Resident/Attendee		Resident
Ben Allushuski	City of Tampa	Stormwater Engineering	Stormwater Engineering/CRS Coordinator
Bill Twaite	Hillsborough	Engineering and	

Person	Affiliation	Division/Office /Specialty	Position
	County	Operations	
Brian Cook	Applied Sciences Consulting	Consulting	Director of Urban Design and Resilience
Brian McCarthy	City of Temple Terrace	Engineering	City Engineer
Brittany Lemke	Hillsborough County		
Carmine Pisano	Hillsborough County		
Chris Rideout	Hillsborough County	FIre Rescue	Project Manager
Christina Hummel	Hillsborough County	Engineering and Operations	CRS Coordinator
Clarissa Grant	University of South Florida (USF)	Emergency Management	
Cody Stewart	Applied Sciences Consulting		
Colleen Marshall	Hillsborough County	Development Services	Executive Planner
Commander Moore	Hillsborough County	Fire Rescue - Emergency Management	OEM Section Chief
Daniel Gessman	University of South Florida (USF)	Facilities Management	GIS Program Manager
Danny Gallagher	Hillsborough County	Solid Waste Management Dept. (Recycle Coordinator)	Project Manager
David Brown	Applied Sciences Consulting		
Derek Doughty	"Johnson, Mirmiran & Thompson, Inc "		Consultant - Senior Associate - Water Resources
Diana Ramirez	Hillsborough Resident/Attendee		Resident
Dianne Good	Hillsborough County	Fire Rescue - Emergency Management	Emergency Management Coordinator
Earl Brown	Hillsborough County	Pet Resources - Veterinary/Behavioral Services	
Eric Lavina	Hillsborough County		Senior Coordinator

Person	Affiliation	Division/Office /Specialty	Position
Eric Lindstrom	Hillsborough County	Economic Development	Manager Competitive Sites
Eugene Henry	Hillsborough Resident/Attendee		Hazard Mitigation Manager/Resident
Frank Coughenour	City of Plant City	Engineering	Senior Engineer
Garry Lisiewski	Urban Area Security Initiative/ Tampa Police Dept.		Vice President
Hisham Ewais	Hillsborough County		Project Manager
Jesse Boyer	Hillsborough County		
Joe Mastandrea	Hillsborough County	Office of Emergency Management	Planning Coordinator II at Hillsborough County Fire Rescue
John Allan Stock	City of Plant City		Environmental Compliance Superintendent
John Antapasis	City of Tampa	Fire Rescue	
Jonah Katz	Hillsborough County	Community and Infrastructure Planning	Planner
Jose De Jesus	Port Tampa Bay	Engineering	
Kayla Caselli	City of Tampa		
Ken Farrell	City of Tampa		Senior Fiscal Analyst
Kevin Moran	Hillsborough County	Environmental Services	
Kristin Combs	Jacobs		
Lauren Storch	Hillsborough County	Water Resources - Grants Program	Manager Cost Control
Lizzie Ehrreich/Baker	HC Transportation Planning Organization (TPO)	Planning Commission	
Maggie Winter	University of South Florida (USF)	Hillsborough County Vulnerability Assessment - GIS	USF VA Leader
Marie Bourgeois	University of South Florida (USF)		
Matt Goolsby	Clearview Land		
Matthew Pleasant	Applied Sciences Consulting, School Board		Planning Manager
Megan Maraia Blancher	Tampa Bay Regional Planning Council (TBRPC)		

Person	Affiliation	Division/Office /Specialty	Position
Meghan Maraia Blancher	Tampa Bay Regional Planning Council (TBRPC)		Coastal Ecologist
Melvin Dickson	Hillsborough County	Environmental Lands	Manager
Monica Martin	Hillsborough County	Environmental Services	Principal Planner / Hazard Mitigation & LMS Coordinator
Nicole Smith	Human Development Center		Director
Paul Hillary	City of Tampa		Senior Grants, Revenue & Finance Analyst
Rebecca Hessinger	Hillsborough County	Community and Infrastructure Planning	
Robert Parris	City of Tampa		Lead Emergency Planner
Ross Dickerson	Hillsborough County	Conservation and Environmental Lands Management Dept.	Environmental Lands Manager
Trinity Miller	Hillsborough County	Affordable Housing	
Troy Salisbury	Hillsborough County	Environmental Services	Hazard Mitigation, Resiliency, and Sustainability Manager
Whit Remer	City of Tampa	Office of Chief of Staff	Sustainability and Resilience Officer
Zahra Andalib	National Flood Experts	Division/Office/Specialty	Consultant - Director of Engineering

More information on these LMS WG Members and which meetings they attended can be found in ***Appendix A – Planning Process Documentation***.

Through the involvement of the members of the LMS WG, the LMS was developed in coordination with neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have development review authority, businesses, academia, and other private and non-private interests. Pasco County, Pinellas County, and the Tampa Bay Regional Planning Council (TBRPC) were invited stakeholders. Representatives were brought together to enhance the Hillsborough County LMS WG. These additional stakeholders, as well as the public, continue to be welcomed to attend any meeting, encouraging both a dynamic membership and participation of the WG. Meetings are noticed on County and municipal websites and online event calendars.

Organization and Meetings

The LMS WG elects a Chair and Co-Chair at its regular annual meeting in November or January of each year. The WG voted to meet at least every quarter in an online space with additional meetings to be scheduled as the workload dictates. In order to complete the 5-year update of the LMS in 2025, the LMS WG met from January 2024 to January 2025. The quarterly meeting schedule will resume in April 2025 augmented with conference calls to address comments and recommendations from the State Division of Emergency Management and FEMA. The meeting calendar is provided in ***Appendix A – Planning Process Documentation*** and reflects the WG work through the development and the revision of the LMS.

The preparation for the 2025 LMS update began in early 2024 at an LMS meeting, and, shortly after, the contractor, Dewberry, was procured to update the plan. Throughout 2024, the LMS WG met numerous times and went through the entire process of assessing the hazards, analyzing the risks, and updating the capability assessment and appropriate mitigation actions. The plan was reviewed and updated to reflect progress in county mitigation efforts and changes in priorities. The schedule of the LMS meetings is included in Table 3.2: List of LMS WG Meetings, along with the agencies and departments that participated on the LMS WG.

Table 3.2: List of LMS WG Meetings

Date	LMS Working Group Meetings
January 11, 2024	• Begin the Update Process.
March 28, 2024	• Project List Additions and Scheduling of Future LMS WG Quarterly Meetings
May 16, 2024	• Risk Assessment Process and Public Outreach Process. Updates to the Project List.
August 8, 2024	• Goals and Objectives and Strategy Review, Project List Review and Prioritization.
November 14, 2024	• Finalize and Approve Mitigation Strategies. Present proposed Operations Plan and Plan Maintenance Procedures.
January 9, 2025	• Review the Project Timeline and the Public and Stakeholder Review Process.

The representatives commit their time and available resources to develop a mitigation strategy that would protect life, property, and the environment and contribute to the County's economic well-being. The implication of the Hazard Mitigation Planning and Hazard Mitigation Grant Program (HMGP) Interim Final Rule is that each of the jurisdictions and representatives on the WG must show participation in the planning process to qualify for HMGP, Building Resilience Infrastructure and Communities Grant Program (BRIC), and Flood Mitigation Assistance Program (FMA) funding. The definition of participation, as determined by the WG, is attendance at a minimum of 50% of the scheduled meetings during the year.

Outside of meetings, copies of documents were sent periodically to the WG members. This allowed the WG members to review, update, and help create new sections of the Plan. It also enabled them to weigh in on the development of the strategy and provide recommendations and comments on the risk assessment, goals and directives, mitigation initiatives, and public awareness programs.

Beyond the LMS Working Group (WG), Hillsborough County assembled a core group to guide and support the development and implementation of the Local Mitigation Strategy (LMS). The group, led by key Hillsborough County staff, is pivotal in ensuring the strategy's success. It included representatives from various departments and agencies, external consultants, and subject matter experts who provided a broad range of perspectives and expertise.

The core group met regularly to plan and organize Working Group meetings, review key documents, and oversee public engagement efforts, such as community events and surveys. Additionally, the committee collaborated closely with the University of South Florida's (USF) Community Vulnerability Assessment (CVA) team to align the LMS and CVA development processes. This collaboration ensured that both plans complemented each other, cohesively highlighting vulnerabilities and resilience strategies.

By coordinating efforts across various stakeholders and incorporating diverse input, the Steering Committee helped shape a comprehensive and inclusive approach to mitigation planning that meets community needs and compliance requirements, including the Community Rating System (CRS).

The steering committee also worked closely with USF's CVA team, to coordinate meetings and engagements that highlighted the work of the CVA and the LMS together and integrate the development of these two plans.

Public Engagement Plan Development

Working closely with the LMS WG team, Hillsborough County developed the most comprehensive public and stakeholder engagement strategies of any of its previous updates for the 2025 update, focusing on enhancing community awareness and collecting diverse input on risk assessment and mitigation strategies. The plans identify key stakeholders, including government departments, businesses, property owners, non-profits, educational institutions, and community groups representing diverse demographics. Communication strategies emphasize multi-channel outreach, accessibility, action prioritization, and visualization of complex information. The County is implementing an equity framework based on its Nondiscrimination & Equity Plan to ensure inclusive participation.

The engagement process includes a variety of activities designed to reach a broad audience, detailed below, which include a project webpage, online surveys, public meetings (both in-person and virtual), press releases, and social media outreach. Special attention is given to engaging dam owners, integrating their feedback into the LMS. The timeline spans from March 2024, with the launch of the CVA/LMS webpage and public survey, through December 2025, when the LMS is adopted.

During the overall LMS Planning Process and numerous meetings of the LMS WG, the relationships between community networks, the private sector, and regional government entities were fostered to include other studies and inform the process and strategy development. The County LMS Planning Process elements and integration are clearly outlined in

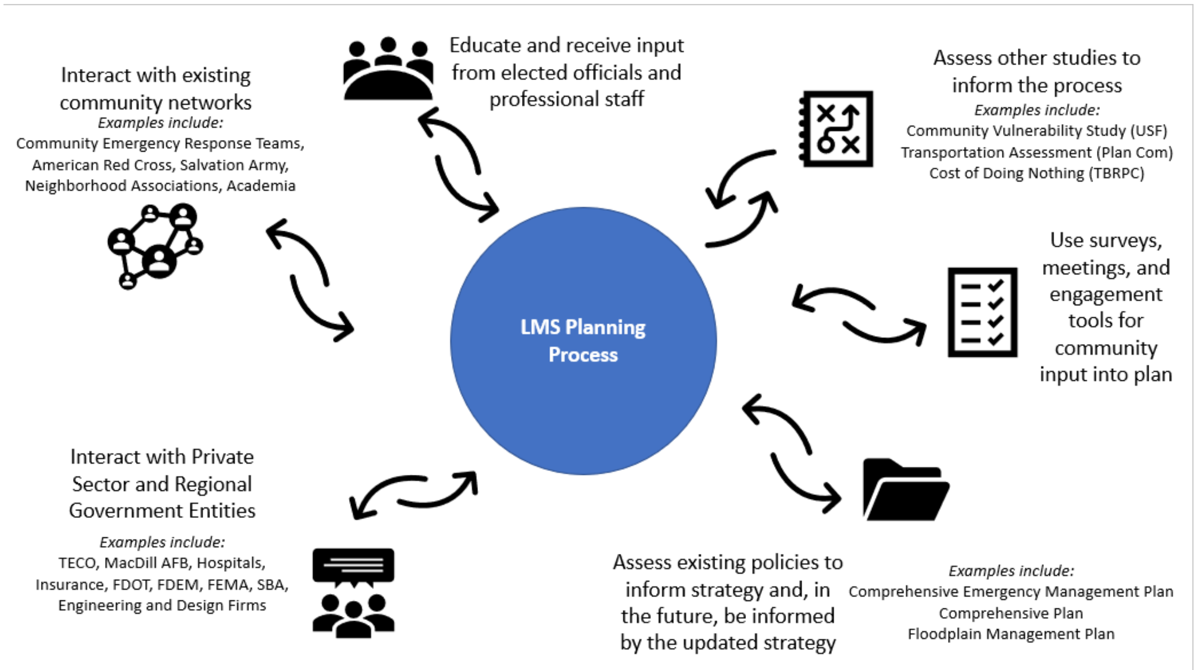


Figure 3.1: Hillsborough County LMS Planning Process

Image Caption: *This diagram shows the LMS Planning process as a central hub, with information flowing out of and into this central body of knowledge to various stakeholder engagement actions including (clockwise): (1) Interact with existing community networks, (2) educate and receive input from elected officials and professional staff, (3) assess other studies to inform the process, (4) use the surveys, meetings, and engagement tools for community input into plan, (5) assess existing policies to inform strategy, and in the future be informed by the updated strategy, and (6) interact with private sector and regional government entities.*

STEP 2: INVOLVING THE PUBLIC

Public awareness is a key component of any community's overall mitigation strategy aimed at making a home, neighborhood, school, business, or entire city safer from the potential effects of hazards. As citizens become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the hazards present in their community and take the steps necessary to reduce their impact.

Public participation was a critical component of Hillsborough County's mitigation planning process. Individual citizen and community-based input has provided the entire planning team with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions by developing community "buy-in" from those directly affected by the decisions of public officials. This crucial feedback and input has been embedded in each step of the LMS 2025 update process.

Public involvement in the development of the Hillsborough County LMS update was sought using three methods: Public Survey, Public Outreach Events, and Online Document Review and Input.

Public Survey

Hillsborough County deployed a comprehensive survey to gather public input on hazard mitigation priorities and concerns. The survey was available from the beginning of April to the end of August, and received a total of **3,129** survey responses, providing valuable insights for the LMS WG to consider in the plan update.

The survey garnered responses from residents across all jurisdictions in Hillsborough County, ensuring a comprehensive representation of the area's population and their experiences with natural hazards. Selected survey results are presented below:

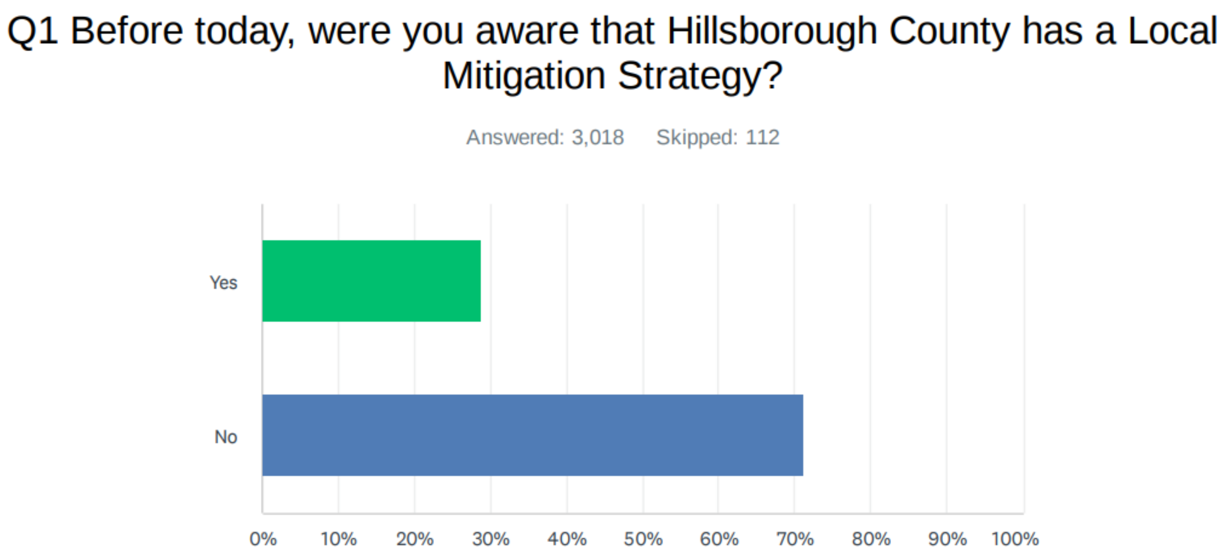


Figure 3.2: Public Survey Question 1: Before today, were you aware that Hillsborough County has a Local Mitigation Strategy (LMS)?

Image Caption: *This image shows a screenshot of a bar chart from public survey results. The bar chart shows that for question 1: "Before today, were you aware that Hillsborough County has a Local Mitigation Strategy (LMS)?", out of 3,018 answers, just below 30% of respondents had known about the LMS before the day they took the survey.*

Natural Hazards

- When asked about natural threats to their neighborhoods, respondents consistently ranked Hurricane/Tropical Cyclone as the highest concern, followed by Severe Storm, Extreme Heat, Flooding, and Drought. This ranking reflects the region's vulnerability to tropical weather systems and climate-related hazards.
- Flooding emerged as a major concern, with many residents, especially those in South Tampa and other low-lying areas, reporting frequent experiences with flooded streets that made travel difficult and hazardous. Respondents noted that overbuilding and poor urban planning had exacerbated flooding problems, with new developments often failing to account for proper water runoff management.
- The impact of extreme heat in recent years was highlighted, with residents reporting increased electricity costs and health concerns. Many also mentioned dealing with drought

conditions affecting their lawns and gardens, sometimes leading to significant financial costs for landscaping repairs.

- Respondents shared numerous memorable experiences of being negatively impacted by natural hazards in Hillsborough County. The majority of these accounts centered around the destructive effects of hurricanes and flooding, with Hurricanes Ian and Irma being frequently mentioned. These experiences included property damage, extended power outages, and challenges related to evacuation and recovery.
- Looking towards future risks, respondents expressed greatest concern about the increasing frequency and intensity of storm events, including severe storms, hurricanes, tropical cyclones, and tornadoes. This was closely followed by worries about habitat disruption, particularly tree loss and changes to local ecosystems, as well as apprehension about more extreme or frequent heatwaves.

Technological and Human Caused Hazards

- Respondents identified Cyberterrorism as the top concern, followed by Infrastructure Disruption, Terrorism, Civil Disturbance, and Disease Outbreak and Biological incidents. This ranking highlights growing awareness of technological vulnerabilities alongside more traditional safety concerns.
- Respondents frequently mentioned issues related to power and internet outages, often linked to weather conditions or infrastructure failures. The COVID-19 pandemic was also cited as a significant technological hazard, with respondents noting its negative impacts on the economy, education, and public health.
- Cybersecurity and scams were highlighted as growing concerns, with some respondents mentioning specific incidents of cyberterrorism affecting local services or their personal data. This underscores the need for increased focus on digital security measures at both individual and community levels.

Emergency Response

- The survey revealed that over 70% of respondents are enrolled in HCFL Alert, the County's emergency alert and notification system. This high participation rate suggests strong community engagement with local emergency preparedness efforts. The majority of these respondents indicated that they prefer to receive alerts and hazard information through text messages, email, and television, underscoring the importance of maintaining multiple communication channels for emergency information.
- Evacuation challenges during hurricanes and severe storms were described as stressful and often chaotic. Residents emphasized the need for better evacuation routes, more efficient traffic management to prevent bottlenecks during emergencies, and increased availability of shelters, especially those accommodating pets.

Reducing Risks

- When asked about the most important community activities to reduce risk from natural hazards, respondents prioritized three main areas: Emergency Services & Preparedness (such as providing generators and safe rooms), Property Protection measures (including floodproofing, hurricane windows, and relocation assistance), and Large Community Structural Projects (like improved stormwater infrastructure and flood control systems).

- Infrastructure concerns were prominent in the responses, with numerous calls for improvements such as burying power lines to reduce outages and better maintaining storm drains and ditches to handle heavy rainfall. Some respondents expressed frustration with local government responses, feeling that more proactive measures were needed to prepare for and mitigate the effects of natural hazards. In Figure 3.3, respondents to the survey indicated a low confidence in the County's resilience.

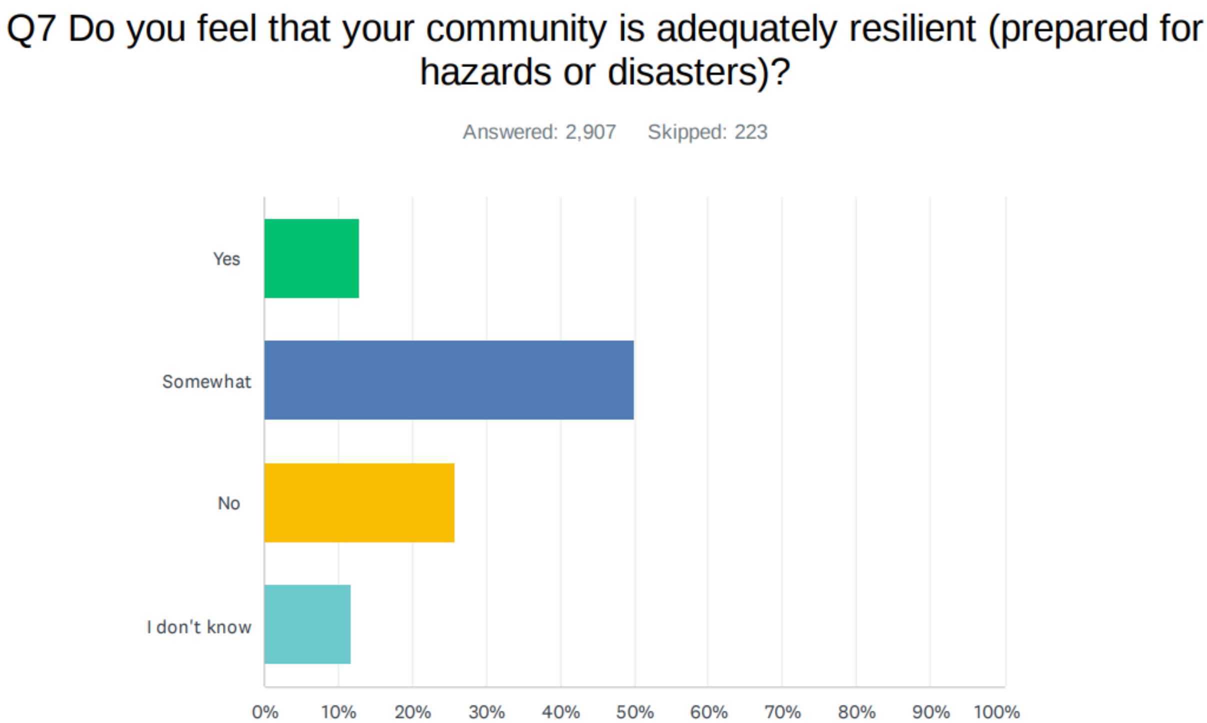


Figure 3.3: Public Survey Question 7: Do you feel that your community is adequately resilient (prepared for hazards or disasters)?

Image Caption: *This image shows a screenshot of a bar chart from public survey results. The bar chart shows that for question 7: "Do you feel that your community is adequately resilient (prepared for hazards or disasters)?", out of 2,907 answers, just over 10% of respondents felt that Hillsborough County was adequately resilient, 50% of respondents felt that the county was somewhat resilient, while the remaining respondents felt the county was not resilient or were unsure.*

- Respondents strongly advocated for stricter zoning regulations and building codes, particularly to limit construction in flood-prone areas and to ensure new structures can withstand high winds and flooding. There were also calls for financial assistance programs to help homeowners retrofit their properties for better hazard resilience.
- Environmental protection measures were suggested by many respondents, including the preservation of green spaces, tree canopies, and natural habitats. There was particular

emphasis on the need to protect and restore wetlands, mangroves, and other natural buffers that can help absorb floodwater and reduce erosion.

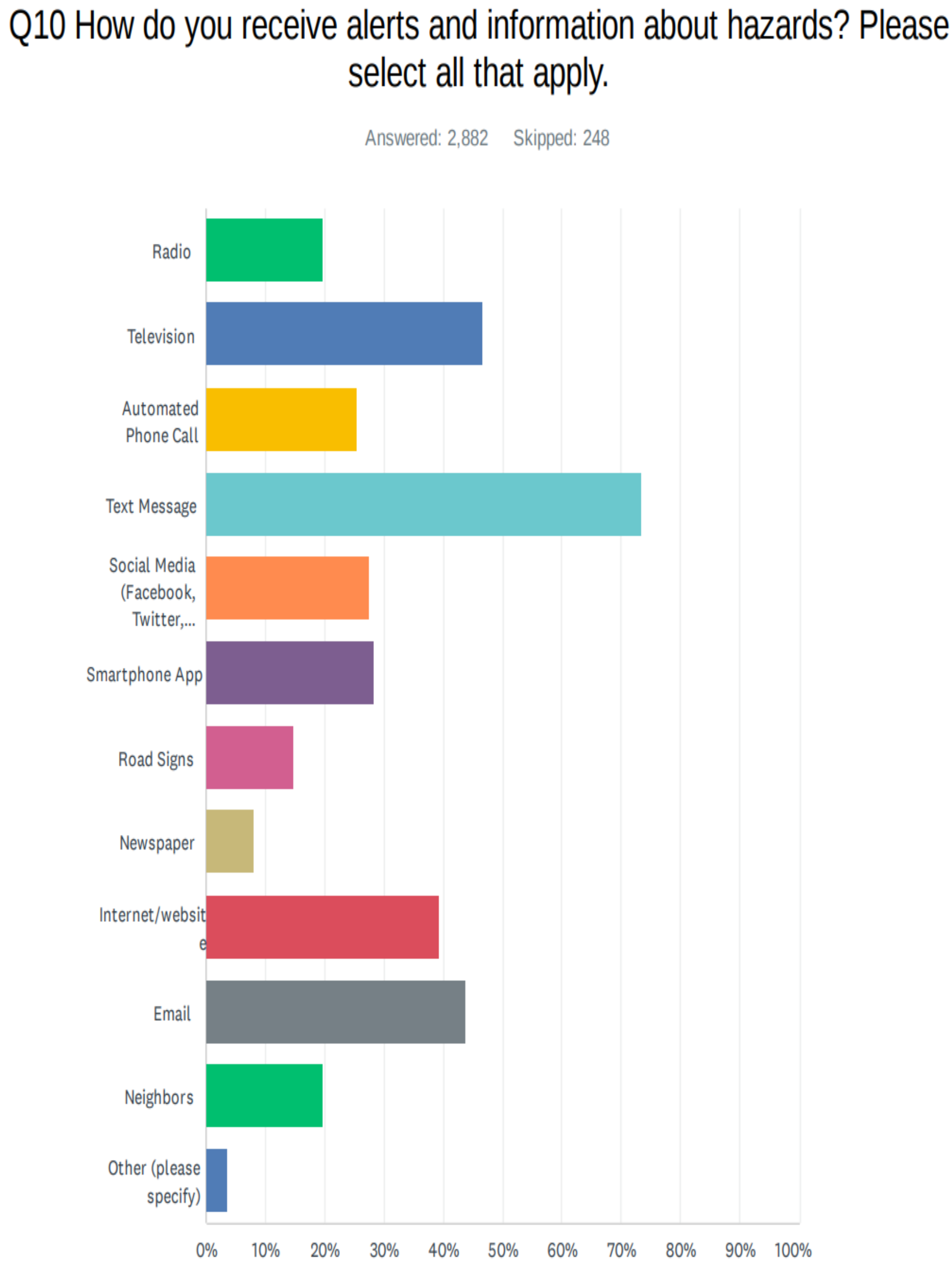


Figure 3.4: Public Survey Question 10: How do you receive alerts and information about hazards?

Image Caption: *This image shows a screenshot of a bar chart from public survey results. The bar chart shows that for question 10: "How do you receive alerts and information about hazards?", out of 2,882 answers, just over 70% of respondents indicated that they receive alerts via text, while almost 50% indicated that they received alerts through television and email.*

The aggregated survey report is attached in ***Appendix A – Planning Process Documents***.

Public Outreach Events

Public Outreach Events - Whether in-person, virtual, or hybrid--serve multiple essential purposes:

- Inform the community about potential hazards and mitigation efforts,
- gather diverse perspectives and local knowledge,
- Provide opportunities for the public to directly access LMS developers, and
- foster a sense of ownership and participation in the planning process.

By engaging directly with residents, businesses, and other stakeholders, the County can ensure that the Strategy reflects the true needs and priorities of the community.

Throughout the LMS update process, Hillsborough County has organized various outreach events to raise public awareness and encourage community participation:

- Tabling Events: The JC Newman Cigar Factory Tabling Event (Figure 3.5) allowed team members to set up an informational booth, provide materials about the LMS update process, and collect feedback from attendees. Such events help reach community members who might not typically attend formal meetings.

Figure 3.5: Tabling at the El Reloj Cigar Factory Event and demonstration of mapping activity.

Image Caption: (Left) Two Hillsborough County members stand at a table with various brochures and activities ready to engage the public about important issues. (Right) One activity was a mapping exercise that invited passersby to highlight key hazard areas that they are aware of in their communities.

- News Interviews: Video interviews with local media outlets like Channel 10, Tampa Bay Times, Channel 8, and Fox 13 helped spread awareness about the LMS update process to a broad audience and provided an opportunity to explain the importance of the strategy and how residents can get involved. Figure 3.6: Interview with Fox 13 News shows a photo from an interview with a local TV Station.

Figure 3.6: Interview with Fox 13 News

Image Caption: A member of the Local Mitigation Strategy (LMS) Planning Team smiles with local television station host during an informational segment about the LMS Update and upcoming Public Outreach Meeting.

- News Articles: Written longform newspaper articles (June 28, 2024 and July 4, 2024) offered in-depth explanations of the LMS process, its significance for community safety, and ways for the public to contribute their input.
- Educational Tours: While hazard mitigation was not the full focus of the event, the Yacht Educational Harbor Tour (July 12, 2024) combined education with engagement, allowing participants to see firsthand some of the areas potentially affected by hazards and discuss mitigation strategies.

By utilizing a mix of in-person events, media appearances, and written communications, Hillsborough County created multiple touchpoints for public engagement, ensuring that all segments of the community had the opportunity to learn about and participate in the LMS update process.

In addition to general engagement, the public was provided two opportunities to directly contribute to the development of the LMS, (in addition to optional participation in WG meetings): (1) A meeting held during the drafting stage of the Plan; and (2) Upon completion of a final draft Plan, but prior to official Plan approval and adoption. Since Hillsborough County is a large county of over 1,000 square miles in area, it was identified that there should be a hybrid component to the public meetings with an option to attend in-person, as well as online. The second public meeting was held fully online to add accessibility to a broader audience.

- June 11, 2024 – Riverview Public Library, 9951 Balm Riverview Road, Riverview, FL 33569
- February 20, 2025 - Online Virtual Platform

Meetings were advertised on the County's website, the local newspaper, the local news on television and radio, the County's electronic calendar, additional websites, and through social media avenues. During and after the public meetings, members provided valuable input to the plan which was ultimately incorporated.

Additional information on each of these engagements can be found in ***Appendix A***. In addition, during the planning process, a public participation survey (see Appendix A) was made available at the meetings and distributed through Hillsborough County social media sites and email. Table 3.3: List of Engagements, provides a summary of opportunities for public and stakeholder involvement.

Table 3.3: List of Engagements

Meeting Name	Date	Venue	Meeting Type	Number of Attendees
LMS WG Meeting - 2024 - Meeting 1 - Introduction	1/11/2024	LMS Working Group	Virtual	32
LMS WG Meeting - 2024 - Meeting 2 - Update Kick-Off	1/17/2024	Core Planning Team	Virtual	5
Floodplain Management Plan Team Meeting 1	2/15/2024	Floodplain Management Plan Team	Virtual	21
LMS WG Meeting - 2024 - Meeting 3 - (HMGP Idalia LMS WG Meeting)	3/28/2024	Stakeholder/ Public	Hybrid	24
Channel 10 WTSP Interview via Zoom	4/10/2024	Stakeholder/ Public	In-Person	County-wide
Tampa Bay Times Interview	4/11/2024	Stakeholder/ Public	In-Person	County-wide
Channel 8 Interview (on-site)	4/12/2024	Stakeholder/ Public	In-Person	County-wide
Hillsborough County Vulnerability Assessment Outreach Meeting	4/16/2024	Stakeholder/ Public	Hybrid	County-wide
Tampa LMS Update	4/29/2024	Stakeholder/ Public	Virtual	14
HC CVA Steering Committee Meeting	5/15/2024	Stakeholder/ Public	Virtual	35
USF Oracle On-campus Interview	5/15/2024	Stakeholder/ Public	In-Person	County-wide
LMS WG Meeting - 2024 - Meeting 4 - HIRA	5/16/2024	LMS Working Group	Virtual	39

Meeting Name	Date	Venue	Meeting Type	Number of Attendees
JC Newman Cigar Factory Tabling Event	5/18/2024	Stakeholder/ Public	In-Person	County-wide
Bay 9 News Tampa	6/1/2024	Stakeholder/ Public	In-Person	County-wide
Hurricane Expo	6/1/2024	Stakeholder/ Public	In-Person	County-wide
Fox 13 In-Studio Interview - 4pm	6/9/2024	Stakeholder/ Public	In-Person	County-wide
Public Outreach Meeting #1	6/11/2024	Stakeholder/ Public	Hybrid	24
Fox 13 - Vulnerability/LMS Flooding/Survey Interview	6/12/2024	Stakeholder/ Public	In-Person	County-wide
Fox 13 - Played a few times (10,11,6pm)	6/21/2024	Stakeholder/ Public	In-Person	County-wide
Article in Newspaper	6/28/2024	Stakeholder/ Public	Other	County-wide
Article In Newspaper	7/4/2024	Stakeholder/ Public	Other	County-wide
Interview on Vulnerability Assessment - Tampa bay times	7/11/2024	Stakeholder/ Public	In-Person	County-wide
Yacht Educational Harbor Tour	7/12/2024	Stakeholder/ Public	In-Person	County-wide
Floodplain Management Plan Team Meeting 2	7/25/2024	Floodplain Management Plan Team	Virtual	15
LMS Mitigation Workshop Hillsborough	7/31/2024	Stakeholder/ Public	Virtual	13
LMS WG Meeting - 2024 - Meeting 5 - Mitigation Strategy	8/8/2024	LMS Working Group	Virtual	41
Land Use Planning and Future Development Discussion	8/26/2024	Stakeholder/ Public	Virtual	7
Floodplain Management Plan Team Meeting 3	10/31/2024	Floodplain Management Plan Team	Virtual	17
LMS WG Meeting - 2024 - Meeting 6 - Draft Plan Review	11/14/2024	LMS Working Group	Virtual	38

Website and Online Engagement

The Hillsborough LMS website is available as part of the County's website at the following location:

https://www.hillsboroughcounty.org/en/residents/public-safety/emergency-management/local-mitigation-strategy

Draft Plan deliverables were made available on the County's LMS website along with contact information for providing input. In the past, the website has served as a valuable tool in updating and, in some cases, creating new sections of the Plan. Through a separate SharePoint site, members have updated their projects and accomplishments, departmental responsibilities, and local goals, policies, land development regulations, and mitigation programs. Links to the draft plan were provided at the public meeting on February 20, 2025.

During the plan maintenance process, the County will continue to use and refine the public engagement tools and methods described above to improve public awareness about mitigation, reach out to a wider audience, and increase participation in the County's mitigation efforts.

STEP 3: COORDINATION

The LMS WG representatives have a responsibility to not only participate in the committee and its subcommittees, but to also reach out in their community to share significant information and messages, to coordinate activities within the county and to bring back perspectives of their constituency. The intent is for the representatives to contact agencies, organizations, and their residents to collect information related to hazards and mitigation activities, provide information regarding the LMS and its update as well as offer these agencies and organizations an opportunity to be involved in the planning effort. The documents shared for the 2025 LMS update and the discussions at the WG meetings helped to share information regarding existing plans, studies, and data belonging to different jurisdictions that are relevant to LMS. These discussions helped refine the Goals and Directives within the LMS plan as a part of the five-year update. These discussions also emphasized the need to adopt language in related plans that encourage consistency in vulnerability metrics and mitigation measures throughout the county. Local plans, such as comprehensive plans, capital improvement plans, economic development plans, etc., were also reviewed to inform the mitigation update process and may be updated in the future following the update of the risk assessment and strategy development. These plans are listed in ***Section 3 – Capability Assessmen****t* and detailed in ***Section 5 - Mitigation Strategy***.

STEP 4: ASSESSING THE HAZARD

One of the most important tasks required of the County is to conduct and maintain a hazard identification and risk assessment. The information provided by the assessment is the foundation upon which decisions about future mitigation initiatives are based. An analysis of both natural and technological hazards is on-going as new information and technology evolves and events occur. The hazard identification and risk assessment data is gathered from FEMA, National Oceanographic and Atmospheric Administration (NOAA) and the National Weather Service, the Tampa Bay Regional Planning Council (TBRPC); the National Hurricane Center SLOSH (Sea Lake Overland Surge in Hurricanes) model; the Laser Infrared Detection and Ranging system (LIDAR); The United States Department of Agriculture (USDA); The Council on Environmental Quality (CEQ); the municipalities and their departments; and Hillsborough County departments of Emergency Management, Planning, Building, Information Systems, Public Works, Utilities, and Developmental Review

Services. The Hazard Identification and Risk Assessment relied heavily on GIS planning tools to identify vulnerable areas, populations, and recognize geographic vulnerabilities of critical facilities and key infrastructure.

STEP 5: ASSESSING THE PROBLEM

This previous step assessed the hazards facing the community. This step quantifies the impact of those hazards on the community. Population and demographic data from the 2022 ACS data, critical infrastructure and facilities inventories, flood insurance data, building type/valuation from the property appraiser data, historical damage, and an estimation of potential future events were collected.

This section also described the areas within the floodplain that provide natural functions including wetlands, riparian areas, sensitive areas, and habitat. This was tied to the community goals and policies reflected in the local government comprehensive plans which provide a description of the development, redevelopment, and population trends.

Additionally, the update process integrated vulnerability assessments from concurrent projects, including the Hillsborough County's CVA being performed by USF, which assesses future flood, sea level rise, and infrastructure vulnerabilities as it relates to environmental impacts, and public health. During the May 2024 meeting of the LMS WG on the Risk Assessment and Public Outreach Process, USF presented its overall effort on the Hillsborough County's CVA and mitigation approaches for floods along with the County's presentation of the LMS risk assessment results.

STEP 6: GOALS AND DIRECTIVES

In 2024, the WG decided to take a fresh look at their goals and directives. The names of each of the goals remained the same as the 2020 update but with some key language updates to the context of each goal. The WG was asked to think about future development, climate adaptation, social vulnerability, community resilience and preparedness, dam safety, and enhancing and protecting ecosystems as part of their goal development. Updates to the goals included strengthening the language used to describe each of the goals and including who/what each goal impacts in the goal name (People & Business for example). Using the LMS planning process to examine opportunities to make Hillsborough County more disaster-resistant, the LMS WG identified 15 objectives that align with the revised goals. ***Section 5 – Mitigation Strategy*** covers these specific directives by defining the intent/actions for that directive as well as a proposed metric for how it will be measured. This approach was developed for the 2020 LMS and continued in for the 2025 LMS update. As a result, directives have been more fully integrated into activities of the LMS WG and adjusted as necessary to best support the communities.

STEP 7: POSSIBLE ACTIVITIES: MITIGATION OPPORTUNITIES AND PROJECTS

The process of developing the LMS culminated in the identification of potential mitigation opportunities and projects. As the original strategy was developed in 1998, there have been multiple updates to the proposed project list to address the County's natural hazard vulnerabilities. Some of these projects have persisted on the list for multiple cycles and thus the LMS WG endeavored to clean the list to what projects are most likely to be implemented if the funding and technical feasibility can be achieved.

Each WG member is required to review, evaluate, and approve feasible mitigation projects. This allows for the exchange of good ideas, accomplishments, and past experiences, both successful and unsuccessful. The process also identifies any inconsistencies between communities. The most successful policies limit public expenditures in areas subject to repetitive damage from disasters; protect critical facilities and infrastructure; preserve, restore and enhance natural resources that can mitigate hazards; encourage economic diversification as protection from the loss of any one asset; encourage structural retrofitting, property acquisition and relocation; and identify procedures to expedite post-disaster recovery and permitting. Because of the education gained from this process, the WG is better prepared to determine the future mitigation projects that should be or need to be pursued. Some of the needed mitigation projects require unified intergovernmental coordination and participation. Other projects can be accomplished on an individual community basis.

STEP 8: AN ACTION PLAN

Directives were identified for each Goal to specifically identify action items and were reflected in six categories of mitigation activities: Prevention, Property Protection, Public Education and Awareness, Natural Resource Protection, Structural Projects, and Emergency Services. These directives are detailed in ***Section 5 – Mitigation Strategy*** and aligned with individual projects in ***Appendix D - Mitigation Projects***. In the original version of the table, each directive was cross-referenced to the six categories above.

Hillsborough County and each of its three participating municipalities submitted a list of their prioritized mitigation projects. The projects were then placed on a consolidated county-wide list, which was divided into six categories relevant to specific goals and directives. These mitigation actions were then evaluated using the STAPLEE method. This technique identified the following local conditions: Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLEE). Actions were also evaluated using other criteria:

- Compatibility with the LMS
- Compatibility with Local Government Comprehensive Plans

A spreadsheet was exchanged with WG participants at meetings and via email for review. All applicants were asked to update the status of existing projects to either active (will have estimated implementation date and status) or archived (complete, deleted, or unknown). Deferred or deleted projects were updated with an explanation as to what had changed. Stakeholders were asked to provide any new mitigation projects that had been initiated or were planned to initiate since the publishment of the previous LMS in 2020 and before the 2025 update adoption.

The County held a series of collaborative workshops where stakeholders from the county and its jurisdictions could evaluate active projects according to specific criteria:

- Alignment with federal, state, and local priorities
- Alignment with LMS Goals and Objectives

- Alignment with the STAPLEE Criteria - weighs social, technical, administrative, political, legal, economic, and environmental considerations for mitigation projects

New projects were self-scored by the applicant, then reviewed by the LMS WG, and then presented to the LMS WG to provide any clarification on details before being approved by the WG and added to the LMS Project List. More details of this process can be found in ***Section 5 – Mitigation Strategy***.

Within ***Appendix D – Mitigation Projects***, there are two tables per each jurisdiction: (1) Active projects (new or deferred projects) and (2) Archived projects (those that are completed, deleted, or unknown).

STEP 9: ADOPTION OF THE STRATEGY

After the 2025 LMS update underwent final revisions, and the plan was completed to the Florida Division of Emergency Management's satisfaction (and thus the Federal Emergency Management Agency per agreement with FDEM), the plan was officially adopted by Hillsborough County via a memorandum signed by the Chief Executive Officer as the County's Authorized Representative, on XX/XX/2025. Each municipality adopted the updated plan, and the exact dates are provided in Appendix F – Plan Adoption. The 2025 Plan will be effective from Month, Day, Year until Month, Day, Year.

The following documentation can be found in ***Appendix F: Plan Adoption*.**

- Adoption
- Approval

For information how this plan will be implemented, evaluated and revised, please refer to ***Section 7 - Plan Maintenance***.

SECTION 3 - CAPABILITY ASSESSMENT

Table 4.1: Local Hazard Mitigation Plan Requirements

Section	Description
S1 (C1-a)	The plan must describe how resources of each participant, the existing authorities, policies, programs, and funding are available to support the mitigation strategy. This must include a discussion of the existing building codes and land use and development ordinances or regulations. Capabilities may be described in a table or narrative.
S2 (C1-b)	The plan must describe the ability of each participant to expand on and improve the capabilities described in the plan (see S1).

Overview

Hillsborough County recognized the need to conduct a Capability Assessment across county and jurisdictional lines. By conducting this assessment, the County can identify:

- The organizational capacity of agencies and departments that will be tasked with implementing the LMS.
- Existing gaps, shortfalls, or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability of existing mitigation goals, objectives, and actions.
- The existence and feasibility of opportunities to enhance specific mitigation policies, programs, or projects moving forward in the LMS process.

Coupled with the Risk Assessment, the Capability Assessment helps identify and target meaningful mitigation actions for incorporation into the Mitigation Strategy portion of the LMS. It not only helps establish the goals and directives for the county to pursue under this Plan but also ensures that those goals and directives are realistically achievable under given local conditions.

Capability Assessment Development and Distribution

The Hillsborough County Capability Assessment evaluates two primary components: 1) An inventory of a local jurisdiction's relevant authorities, plans, policies, ordinances, or programs already in place and 2) An analysis of its capacity to carry them out. To conduct the Capability Assessment for the 2025 LMS update, the County distributed a survey questionnaire to partners at county and jurisdictional levels. The survey questionnaire requested information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to and/or hinder the jurisdictions' ability to implement hazard mitigation actions.

The Capability Assessment was structured to assess the following key areas:

(1) **Planning and Regulatory Capability:** Focuses on the implementation of plans, ordinances, and programs that guide and manage growth, development, and redevelopment responsibly

while maintaining the community's welfare. This includes emergency response and mitigation planning, comprehensive land use and transportation planning, and the enforcement of zoning or subdivision ordinances and building codes.

(2) **Administrative and Technical Capability:** Evaluates the ability to allocate staff time and resources for mitigation projects, policies, and programs. It also assesses the level of technical expertise, such as proficiency in using Geographic Information Systems (GIS) for hazard vulnerability assessments.

(3) **Fiscal Capability:** Examines the financial resources available to implement mitigation actions, including external grant funding and locally-based revenue. It considers the costs associated with mitigation policy and project implementation, ranging from administrative costs to direct project expenses.

(4) **Political Capability:** Assesses the political will of local jurisdictions to enact meaningful mitigation policies and projects. It includes evaluating the local political climate and the willingness to enforce stricter development standards or guide development away from hazard-prone areas.

Each survey questionnaire was prepopulated with the results from the 2020 Capability Assessment. Respondents were asked to update the responses based on recent capabilities. The survey also included fields for updated or new documents relevant to specific capabilities. ***Completed surveys can be found in Appendix C.***

The team reviewed responses, analyzed in the following sections, and presented the summary level results during the LMS WG meeting in August 2024, providing a comprehensive understanding of current capabilities and areas for improvement.

Planning and Regulatory Capability Assessment

Planning and regulatory capability is based on implementing plans, ordinances, and programs that demonstrate a local jurisdiction's commitment to guiding and managing growth, development, and redevelopment responsibly while maintaining the general welfare of the community. It includes emergency response and mitigation planning, comprehensive land use planning, and transportation planning; the enforcement of zoning or subdivision ordinances and building codes that regulate how land is developed and structures are built; and protecting environmental, historical, and cultural resources in the community. Although conflicts can arise, these planning initiatives generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision-making process.

Hillsborough County's Capability Assessment is designed to provide a general overview of the key planning and regulatory tools and programs that are in place or under development for Hillsborough County, along with their potential effect on loss reduction. This information will help identify opportunities to address existing gaps, weaknesses, or conflicts with other initiatives in addition to integrating the implementation of this Plan with existing planning mechanisms where appropriate.

In Hillsborough County and its jurisdictions, there is a symbiotic and coordinated relationship between many of their plans as they have developed and been published at different points in time.

These plans inform and are informed by the LMS document and the planning process in which the government stakeholders participate. The data that informs these local plans (and the LMS) often lives in geospatial tools outside the plan documents and is refreshed more frequently than the policy documents.

The most direct links between the actual LMS document and local codes occur through the CEMP and each jurisdiction's Comprehensive Land Use Plan. The CEMP utilizes the risk assessment portion of the LMS to inform its recommendations and align its support. The County adheres to the recommendations within the CEMP, and all jurisdictions coordinate emergency management activities with the County. The comprehensive plans have individual elements, some informed by the LMS (or more broadly stated in some local plans as "hazard mitigation activities"). For example, many communities have a Conservation and Coastal Management Element in which ecologic and coastal hazard mitigation concerns within the jurisdiction are addressed.

Table 4.2: Relevant Plans, Ordinances, and Programs below summarizes the relevant local plans, ordinances, and programs already in place or under development for Hillsborough County. An "X" indicates that the given item is currently in place and being implemented. A "^" means that the item has been updated since the 2020 LMS. An "*" indicates that the given item is being developed for future implementation. Cells left empty indicate that these tools are not available or existing at this time.

Table 4.2: Relevant Plans, Ordinances, and Programs

Planning/Regulatory Tool	Unincorporated County	City of Tampa	City of Plant City	City of Temple Terrace
Hazard Mitigation Plan	X	X	X*	X
Threat and Hazard Identification and Risk Assessment (THIRA)	X	X^		X^
Comprehensive Land Use Plan	X	X*	X	X
Floodplain Management Plan/Flood Mitigation Plan	X	X	X*	X
Open Space Management Plan (Parks & Rec/Greenway Plan)	X	X^		X
Stormwater Management Plan/Ordinance	X	X		X
Natural Resource Protection Plan	X	X^		X
Flood Response Plan	X	X^		X
Emergency Operations Plan	X	X^	X	X^
Emergency Management Accreditation Program (EMAP Accreditation)	X			
Continuity of Operations Plan	X	X^		X^
Evacuation Plan	X	X^		X^
Disaster Recovery Plan	X	X		X^
Capital Improvements Plan	X	X^	X	X
Economic Development Plan	X	X^		X

Planning/Regulatory Tool	Unincorporated County	City of Tampa	City of Plant City	City of Temple Terrace
Historic Preservation Plan		X	X	X^
Flood Damage Prevention Ordinance	X	X	X	X
Zoning Ordinance	X	X	X	X
Subdivision Ordinance	X	X	X	X
Post-Disaster Redevelopment/ Reconstruction Plan/Ordinance	X	X		X
Building Code	X	X	X	X
Fire Code	X	X	X	X
National Flood Insurance Program (NFIP)	X	X	X	X
NFIP Community Rating System (CRS Program)	X	X	X	X

The planning and regulatory tools that Hillsborough County and its jurisdictions deploy to mitigate hazards are detailed below in the following sections. The descriptions below focus on illustrating relevant local plans, ordinances, and programs that have been updated or published since the 2020 plan. All other planning/regulatory tools that have not changed can be found described in Appendix I – Mitigation Initiatives.

Emergency Management

Hazard mitigation is one of the four primary phases of emergency management. Though they seem conceptually distinct, the three other phases—preparedness, response, and recovery—are interconnected with hazard mitigation. Opportunities to reduce potential losses through mitigation practices are often implemented before disaster strikes, such as the elevation of flood-prone structures or through the continuous enforcement of policies that prevent and regulate development vulnerable to hazards due to its location, design, or other characteristics. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as installing storm shutters before a hurricane and certainly during the long-term recovery and redevelopment process following a hazard event.

Planning for each phase is a critical part of a comprehensive emergency management program and key to successfully implementing hazard mitigation actions. As a result, the Capability Assessment Survey asked several questions across various emergency management plans to assess the participating jurisdictions' willingness to plan and their level of technical planning proficiency.

The various types of emergency management plans surveyed are described as follows, with relevant plans updated since the 2020 LMS detailed below.

Local Mitigation Strategy (LMS)

Hillsborough County's LMS represents the community's blueprint for reducing the impact of natural and human-caused hazards on people and the built environment. It includes consideration of and adaptation to a changing climate. FEMA requires the County to undergo a thorough review every five years to ensure it is reflective of the region's current needs. The last Hillsborough County LMS was adopted in 2020 and includes the essential elements of a hazard mitigation plan—a risk assessment, capability assessment, and mitigation strategy.

Relevant Document: Hillsborough County Multi-Jurisdictional Local Mitigation Strategy - 2020 Plan Update

Threat and Hazard Identification and Risk Assessment (THIRA)

Hillsborough County's THIRA is a comprehensive risk assessment process that helps a community understand its risks and estimate capability requirements. Outputs of the THIRA process can inform a variety of disaster preparedness and emergency management efforts, including emergency operations planning, mutual aid agreements, and hazard mitigation planning.

Emergency Management Plans

Disaster Recovery Plan

A disaster recovery plan guides the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans to capitalize on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.

Emergency Operations Plan

An emergency operations plan outlines the responsibilities and how resources are deployed during and following an emergency or disaster. The State of Florida requires that every county develop and maintain a compliant CEMP. This plan addresses the threats to which a county or a region is exposed and how the local governing agency plans to respond to them. Response often includes warning which can result in losses avoided when people can remove themselves and personal property from harm's way.

Continuity of Operations Plan

A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event. Ensuring government functioning can reduce threats such as heat-related illness and provide ongoing communications that assist with removing people and property from harm's way.

Flood Response Plan

A flood response plan establishes procedures for responding to a flood emergency including coordinating and facilitating resources to minimize flood impacts.

In Hillsborough County, two core documents address the three types of plans mentioned above:

- Comprehensive Emergency Management Plan (CEMP) (2021) - In Hillsborough County, the CEMP aims to preserve the health, safety, and general welfare of Hillsborough residents by minimizing the potential impacts of disaster on life and property throughout the county. With this goal in mind, the CEMP provides a coordinated and comprehensive structure for emergency operations, disaster recovery, and continuity of operations through the provision of uniform policies and procedures to ensure effective coordination of county-wide action to prevent, prepare for, respond to, recover from, and mitigate natural or man-made disasters. The CEMP is reviewed and updated on a more frequent basis than the 2025 update of the LMS Plan. As such, the 2025 LMS update references the 2021 Update of the CEMP. However, the CEMP is currently in the process of another update and intends to align with the published 2025 update of the LMS Plan.

- City of Tampa Comprehensive Emergency Operations Plan (CEOP) (2024) - The Tampa CEOP outlines the responsibilities and means by which resources are deployed during and following an emergency or disaster. Since the 2020 LMS was published, the Tampa Office of Emergency Management has entirely updated the Tampa CEOP
- Post-Disaster Redevelopment Plan (PDRP) Hillsborough County developed the PDRP to identify policies, operational strategies, and roles and responsibilities for implementation that would guide decisions affecting long-term recovery and redevelopment throughout unincorporated Hillsborough County, and the cities of Tampa, Temple Terrace, and Plant City. All three cities collaborated to emphasize opportunities for hazard mitigation and community improvements consistent with the goals within the County's other local comprehensive plans and with the full participation of its citizens. Informed decision-making during redevelopment will result in safer rebuilding. The PRDP is currently being updated and will be published concurrently with the 2025 update of the LMS Plan.

General Planning

Hazard mitigation activities must involve agencies and individuals beyond the emergency management profession. Stakeholders may include local planners, public works officials, and economic development specialists. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals, even though they are not designed as such. Therefore, the Capability Assessment Survey also asked questions regarding general planning capabilities and the degree to which hazard mitigation is integrated into other ongoing planning efforts in Hillsborough County.

The following describes the various types of general planning tools surveyed.

Comprehensive Land Use Plan

Hillsborough County and its jurisdictions have created a complementary and referential set of Comprehensive Land Use Plans, known as Imagine 2040. The plans establish the overall vision for what each community aspires to be and serve as a guide for future governmental decision-making. The comprehensive plans contain sections on demographic conditions, land use, transportation elements, and community facilities.

Most recently adopted in 2016, Hillsborough County conducted an extensive public outreach campaign over the course of a year canvassing the cities of Tampa, Temple Terrace, and Plant City in order to create this plan. In 2023-2024, the plans were updated, with changes relevant to the 2025 LMS detailed below.

Relevant Documents:

- Unincorporated Hillsborough County Comprehensive Plan (2024) – Updated sections include Recreation and Open Space, Intergovernmental Coordination, and Solid Waste, with some sections (Future Land Use and Public Schools) still in progress.
- Adopted Plant City 2040 Comprehensive Plan (2023) – No mitigation relevant updates.
- Adopted Imagine 2040: Temple Terrace 2040 Comprehensive Plan (2023) – No mitigation relevant updates.
- Imagine 2040: Tampa Comprehensive Plan (2024) – The 2024 update includes new policies on Future Land Use, Housing, and Coastal considerations, with specific provisions for hazard mitigation and emergency management. The updated document is currently in the process of public review and comments.

Capital Improvements Plan (CIP)

Hillsborough County's CIP guides the scheduling of spending on public improvements throughout the region. CIPs guide future development away from identified hazard areas and limit public spending in hazardous areas—the most effective long-term mitigation actions available to local governments. Plans that have been updated following the 2020 LMS include the following:

Relevant Documents:

- Hillsborough County Capital Improvement Program (2024) – As of 2024, Hillsborough County intends to spend \$1.7 Billion on Capital Improvement Programs, with the budget going towards the following areas: public and employee health and safety, maintenance of critical assets, maintaining reserves, investing in County employees, and funding for critical deficiencies for Fire Rescue, Parks, Water/Sewer, Transportation and Stormwater. This plan details how funds across departments and funding sources will be disbursed, as well as key projects and their community value, and performance measures as well as a summary budget, a comparison of funded positions, and notes explaining changes from year to year.
- Plant City Capital Improvements: Multi Year Plan (2023) – This plan anticipates spending just over \$11 M on stormwater infrastructure maintenance between 2023 and 2025, and \$2.6 M being deployed for water- and resiliency-related capital improvements.
- Tampa Bay Water Capital Improvement Program Fiscal Years 2024-2033 (2023) – This plan contains information on capital projects including their Renewal and Replacement Program, a prioritized long-term plan for the renewal, repair, or replacement of assets that will result in sustainable infrastructure, as well as Phase 1 Mitigation Projects detailing long-term mitigation at wetland and lake sites that were impacted by historical groundwater pumping.

Historic Preservation Plan (HPP)

An HPP is intended to preserve historic structures or districts within a community. An often-overlooked aspect of the HPP is the assessment of buildings and sites located in areas subject to natural hazards and the identification of ways to reduce future damages, which may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot easily be relocated out of harm's way.

Relevant Document: [Tampa Historic Design Guidelines](#) (2023) – For Hyde Park, Seminole Heights, Tampa Heights, and Ybor City, these guidelines include design elements for stormwater management, relocation, and retrofitting.

Zoning Ordinance

Zoning is the primary means by which land use is controlled by local governments. As part of a community's police power, zoning protects the public health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, a zoning ordinance can be a powerful tool when applied in identified hazard areas. In Hillsborough County, a land development code fills the role of this tool, and indicates zoning districts, special districts, natural resources, and design standards and improvement requirements that can guide development to mitigate the impacts of hazards, especially flood and wind events. The Land Development Code can be found on the Hillsborough County Website.[16]

Subdivision Ordinance

A subdivision ordinance is intended to regulate the development of residential, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. A subdivision design that accounts for natural hazards can dramatically reduce future development exposure.

Building Codes, Permitting, and Inspections

Building codes regulate construction standards. In Hillsborough County communities, permits and inspections are required for new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process needed both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk a community faces. The Florida Building Code (FBC) is a statewide building construction regulatory system emphasizing uniformity and accountability to ensure building strength during natural disasters. The building code is implemented and enforced locally by individual counties. This delegation allows for greater state coverage but also presents challenges as some smaller counties need more staff and resources than other counties might have. All construction in the state must adhere to the FBC. This allows local jurisdictions to ensure structures are more resistant to certain natural disasters, especially wind and flood events.

Relevant document: Tampa Land Development Code Amendments (2024) – No mitigation relevant changes.

---

16 https://library.municode.com/fl/hillsborough_county/codes/land_development_code?nodeId=HILLSBOROUGH_COLADECO

Floodplain Management

Flooding represents the most significant natural hazard facing the nation. Fortunately, the tools available to reduce the impacts associated with flooding are among the most developed compared to other hazard-specific mitigation techniques.

National Flood Insurance Program (NFIP)

In addition to approaches that cut across hazards, such as education, outreach, and the training of local officials, the NFIP contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments; however, FEMA strongly encourages it as a first step in implementing and sustaining an effective hazard mitigation program. As a result, participation in the NFIP is used as part of this assessment as a critical indicator for measuring local capability.

For a county or municipality to participate in the NFIP, they must adopt a local flood damage control regulations that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings, and through substantial improvements to existing buildings, be protected from damage by a 100-year flood event and that new development in the floodplain will not exacerbate existing flood problems or increase damage to other properties.

An essential service the NFIP provides is mapping identified flood hazard areas. Once completed, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information for educating residents, government officials, and the private sector about the likelihood of flooding in their community.

The Risk Assessment Section on Flood contains NFIP policy and claim information for each participating jurisdiction in Hillsborough County. The jurisdictions involved in developing this plan are also members of the NFIP and are committed to maintaining and enforcing their floodplain management ordinances and regulating all development and improvements in Special Flood Hazards Areas (SFHAs).

All jurisdictions in Hillsborough County participate in the NFIP and will continue to comply with required program provisions. They will work to comply in the future by utilizing many strategies adequately. To ensure continued compliance with the NFIP, each community will:

- Continue to enforce their adopted floodplain management ordinance requirements, which include regulating all new development and substantial improvements in SFHAs and Coastal High Hazard Areas (CHHAs)
- Continue to maintain all records about floodplain development, which shall be available for public inspection
- Continue to notify the public when there are proposed changes to the floodplain ordinance or FIRMs
- Maintain the maps and changes identified through Letters of Map Amendments, Revisions, or Changes
- Continue to promote flood insurance for all property

- Continue the Community Rating System (CRS) outreach programs

Community Rating System (CRS)

An additional indicator of strong floodplain management capability is the active participation of local jurisdictions in the CRS. The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP by adding extra local measures to protect from flooding. All 19 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class rating. Class ratings, which range from 10 to 1, are tied to flood insurance premium reductions, as shown in Table 4.3: CRS Premium Discounts by Class. As class ratings improve (the lower the number, the better), the percent reduction in flood insurance premiums for NFIP policyholders in that community increases.

Table 4.3: CRS Premium Discounts by Class

CRS Class	Premium Reduction: SFHA
1	45%
2	40%
3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

Community participation in the CRS is voluntary. Any community that fully complies with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been simplified over several years based on community comments. It intends to make the CRS more user-friendly and make extensive technical assistance available for communities who request it. Unincorporated Hillsborough County and the cities of Tampa, Plant City, and Temple Terrace all participate in the CRS. Their CRS Class and resulting premium reductions are shown in Table 4.4: Hillsborough County CRS Communities and Classes.

Table 4.4: Hillsborough County CRS Communities and Classes

Location	CRS Class	Premium Reduction
City of Tampa	5	25%
City of Temple Terrace	8	10%

Location	CRS Class	Premium Reduction
City of Plant City	6	20%
Unincorporated	5	25%

Since the 2020 LMS, the City of Temple Terrace's CRS Class has been changed from a 6 to an 8, resulting in a 10% premium increase.

The City of Plant City will be classified as a Class 6 starting April 1, 2025 and receive a 20% discount.

The NFIP and the CRS program encourage county-level mitigation programs to address repetitive loss (RL) and severe repetitive loss (SRL) properties.

The following describes the other types of floodplain management tools surveyed.

Flood Damage Control Regulation

A flood damage prevention ordinance establishes minimum building standards in the floodplain to minimize public and private losses due to flood conditions. As noted above, all participating jurisdictions have an ordinance.

Floodplain Management Plan (FMP)

An FMP (or a flood mitigation plan) provides a framework for action regarding corrective and preventative measures to reduce flood-related impacts. Hillsborough County's LMS serves as the County's FMP.

The City of Tampa uses a plan named Land Regulatory Response to Sea Level Rise (2020). This document compiles policy for sea level rise and helps the City of Tampa analyze regulatory options and best practices for individual locational situations where protection is needed over and above NFIP standards.

Open Space Management Plan (OSMP)

An OSMP is designed to preserve, protect, and restore largely undeveloped lands in their natural state and to expand or connect areas in the public domain such as parks, greenways, and other outdoor recreation areas. In many instances, open space management practices are consistent with the goals of reducing hazard losses, such as the preservation of wetlands or other flood-prone areas in their natural state in perpetuity.

Relevant Documents:

- Parks and Recreation Master Plan Final Draft (2023) – This plan considers the City of Tampa's previous planning efforts and goals and needs to provide recommendations and prioritized strategies over the next 15 years. This updated plan takes an integrated and community engagement approach to developing a cohesive strategy across policy and capital improvements.

- Tampa Coastal Action Plan (2018): This document reviews the City and County's comprehensive plans to develop recommendations for policy and capital improvements for coastal areas. Hillsborough River Master Plan (2024) – Compiling the relevant sections of the Hillsborough Comprehensive Plan, this document incorporates policies about water quality and quantity, safety and use of the river, and protection of wildlife and natural spaces.
- Environmental Lands Acquisition and Protection Program (ELAPP) (2008) - In Hillsborough County, the ELAPP is a voluntary program established for the purpose of providing the process and funding for identifying, acquiring, preserving, and protecting endangered, environmentally sensitive and significant lands. Through the ELAPP, Hillsborough County manages more than 63,400 acres of environmentally sensitive wildlife habitat and corridors.

Stormwater Management Plan (SMP)

An SMP is designed to address flooding associated with stormwater runoff. It is typically focused on design and construction measures intended to reduce the impact of more frequently occurring urban drainage flooding, which is increasing in intensity due to climate change.

Other Resilience or Environmental Planning

Since the publishing of the 2020 LMS Plan, many plans and documents specifically about climate resiliency and equity have been released:

- Climate Action and Equity Plan (2023) – This document sets goals and principles to enable the City of Tampa to center equity as it reduces greenhouse gas emissions and adapts infrastructure.
- Tampa Bay Regional Resiliency Action Plan (2022) – Offering local and regional goals for action across seven counties, this document addresses future climate impacts on risks and future conditions, community vulnerability, housing, ecosystems, and infrastructure.
- Tampa Bay Estuary Program: 2020 Habitat Master Plan Update (2020) – This document builds upon and extends the work of two previous habitat master plans, establishing 2030 protection and restoration targets and longer-term 2050 goals for Tampa Bay’s critical coastal habitats.
- Tampa Heat Resilience Playbook (2023) – The Playbook provides the City, its partners, and residents with a series of actionable recommendations for supporting Tampa as it adapts to and mitigates the impacts of extreme heat, including recommendations for structural and environmental mitigation methods.
- Hillsborough County Heat Island Analysis (Palm River - Progress Village Community) – (2024) – The Palm River-Progress Village Community is located in unincorporated Hillsborough County, adjacent to the City of Tampa. It is considered socially vulnerable to the impacts of the heat island effect. This document identifies heat vulnerabilities and proposes heat adaptation, intervention, and mitigation actions. Examples include cooling centers, shade structures, and living shorelines.

- Hillsborough County Vulnerability Assessment (CVA) and Adaptation Plan (AP) (2025) - A CVA helps the community measure the potential impacts of flooding and sea level rise. It identifies structures, infrastructure, people, and natural resources that may be affected. The CVA will inform a comprehensive Adaptation Plan, which guides identifying areas at risk and adapting strategies that could be implemented. Previously completed in 2020, the 2025 update will include analyses with more modern data and show risk over longer time horizons. Preliminary CVA findings inform and enhance the flood profile within the Risk Assessment chapter of this plan. The two initiatives will inform LMS as they are completed.

For information on measures that are currently being deployed, as well as ongoing efforts to improve Hillsborough County's ability to mitigate hazards, see ***Appendix I: Mitigation Initiatives, Section A: Current Mitigation Strategies.***

Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is directly tied to its ability to direct staff time and resources for that purpose. Hillsborough County's administrative capability can be evaluated by determining how mitigation-related activities are assigned to local departments and whether adequate personnel resources exist to complete these activities. The degree of intergovernmental coordination among departments will also affect administrative capability for implementing and succeeding proposed mitigation activities.

Technical capability can generally be evaluated by assessing local government employees' knowledge and technical expertise, such as personnel skilled in using GIS to analyze and determine community hazard vulnerability.

The Capability Assessment Survey was used to capture information on administrative and technical capability by identifying available staff and personnel resources. Table 4.5 below summarizes the Capability Assessment Survey results for Hillsborough County regarding relevant staff and personnel resources. An "X" indicates the presence of a staff member(s) in that jurisdiction with the specified knowledge or skill. Cells left empty indicate that these tools are not available or existing at this time.

Table 4.5: Relevant Staff/Personnel Resources

Staff/Personnel Resources	Unincorporated County	City of Tampa	City of Plant City	City of Temple Terrace
Planners with knowledge of land development/land management practices	X	X	X	X
Engineers or professionals trained in construction practices related to buildings and/or infrastructure	X	X	X	X

Staff/Personnel Resources	Unincorporated County	City of Tampa	City of Plant City	City of Temple Terrace
Planners or engineers with an understanding of natural and/or human-caused hazards	X	X	X	X
Emergency Manager	X	X	X	X
Floodplain Manager	X	X	X	X
Land Surveyors	X	X		
Scientists familiar with the hazards of the community	X			
Staff with education or expertise to assess the community's vulnerability to hazards	X	X	X	X
Personnel skilled in GIS and/or Hazus	X	X	X	X
Resource development staff or grant writers	X	X		

Fiscal Capability

The ability of a local government to take action is often closely associated with the amount of money available to implement policies and projects. This may be outside grant funding awards or locally-based revenue and financing. The costs associated with mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs related to creating and monitoring a program. In other instances, direct expenses are linked to an actual project, such as acquiring flood-prone homes, which can require a substantial commitment from local, state, and federal funding sources.

The Capability Assessment Survey captured information regarding Hillsborough County's fiscal capability by identifying locally available financial resources.

Table 4.6 below summarizes the Capability Assessment Survey results for Hillsborough County related to relevant fiscal tools and resources. An "X" indicates that the given fiscal resource has previously been used or is available to implement hazard mitigation actions. An "^" indicates that the item has been updated since the 2020 LMS. Cells left empty indicate that these tools are not available or existing at this time.

Table 4.6: Relevant Fiscal Resources

Fiscal Tool/Resource	Unincorporated County	City of Tampa	City of Plant City	City of Temple Terrace
Capital Improvement Programming	X	X	X	X
Community Development Block Grants (CDBG)	X	X	X	X
Special Purpose Taxes (or taxing districts)	X	X^	X^	
Gas/Electric Utility Fees			X	
Water/Sewer Fees		X^	X^	X
Stormwater Utility Fees	X		X	
Development Impact Fees	X		X	
General Obligation, Revenue, and/or Special Tax Bonds				
Partnering Arrangements or Intergovernmental	X	X	X	X

Political Capability

One of the most challenging capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to reduce the impact of future hazard events. Hazard mitigation may not be a local priority or may conflict with or be seen as an impediment to other community goals, such as growth and economic development. Therefore, the local political climate must be considered in designing mitigation strategies, as it could be the most difficult hurdle to overcome in accomplishing their adoption and implementation.

The County used the Capability Assessment Survey to capture information on the political capability of Hillsborough County and its municipalities. Table 4.7: Local Political Support below provides a summary of the results regarding political capability. An "X" indicates the expected degree of political support for local elected officials in adopting/funding information. The City of Plant City and the City of Temple Terrace were selected unknown for political support since they could vary widely depending on a particular project. Cells left empty indicate that these tools are not available or existing at this time.

Table 4.7: Local Political Support

Level of Support	Unincorporated County	City of Plant City	City of Tampa	City of Temple Terrace
Limited	X			
Moderate			X	
High				
Unknown		X		X

Federal, State, and Other Funding Sources and Technical Assistance

Most county and local governments rely on technical assistance and funding support from their other levels of government, non-profits, and other stakeholders. This technical and funding assistance critically impacts the County's and local governments' capabilities to implement a well-integrated and holistic approach to mitigation, resilience, and climate adaptation. ***Section 6 – Potential Funding Sources*** outlines federal, state, and other capabilities and resources for fiscal and technical support.

Conclusion

The County's Capability Assessment identified gaps, weaknesses, and potential opportunities that could either hinder or help the deployment of the 2025 LMS update. The overall capability to implement hazard mitigation actions varies among the participating jurisdictions. Larger jurisdictions typically have higher planning and regulatory capability, more staff and technical resources, and greater fiscal capability than smaller jurisdictions. These gaps or opportunities identified for each jurisdiction in the Capability Assessment—in tandem with the Risk Assessment—have been used by partners as the basis for the mitigation measures that are identified in this LMS; therefore, each jurisdiction addresses their ability to expand on and improve their existing capabilities through the identification of their mitigation measures.

SECTION 4 - RISK ASSESSMENT

Table 5.1: Local Hazard Mitigation Plan Requirements

Section	Description
R1 (B1-a)	The plan must include a description of all natural hazards that can affect the jurisdiction(s) in the planning area and their assets, such as dams, located outside of the planning area.
R2 (B1-a)	The plan must provide rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area.
R3 (B1-b)	The plan must include information on location for each identified hazard.
R4 (B1-c)	The plan must provide the extent of the hazards that can affect the planning area.
R5 (B1-d)	The plan must include information on previous occurrences for each hazard that affects the planning area. At a minimum, this includes any state and federal major disaster declarations for the planning area since the last update.
R6 (B1-e)	The plan must include the probability of future events for the identified hazards that can affect the planning area.
R7 (B1-f)	For multi-jurisdictional plans, when hazard risks differ across the planning area and between participating jurisdictions, the plan must specify the unique and varied risk information for each applicable jurisdiction and their assets outside the planning area.
R8 (B2-b)	The plan must describe the potential impacts on each participating jurisdiction and its identified assets.
R9 (B2-a)	The plan must describe the overall vulnerability of each participant to the identified hazards.
R10 (B2-a)	For plan updates, the risk assessment must meet Element E1-a (Changes in Development).
R11 (B2-c)	The plan must address repetitively flooded NFIP-insured structures by including the estimated numbers and types (residential, commercial, institutional, etc.) of repetitive/severe repetitive loss properties.

Introduction

To minimize the losses suffered from disasters, it is important to understand the types of hazards and severity of these events that can potentially affect Hillsborough County and its incorporated jurisdictions. Losses to the built, natural, and human environment cannot be eliminated. Equipped with the knowledge of potential impacts and vulnerabilities, Hillsborough County can take steps today to reduce the negative impact of a disaster within unincorporated county and its jurisdictions, including the cities of Tampa, Temple Terrace, and Plant City.

The Hazard Identification and Risk Assessment (HIRA) is a tool used to identify and assess hazards, understand their potential severity, and identify opportunities to lessen the intensity or mitigate the damage caused by the forces of and aftermath of a disaster. Consistent with Federal and State Plans and the CEMP, the Hillsborough County LMS reflects an “All-Hazards” approach to mitigation and, consequently, focuses on identifying technological, societal, and natural hazards that may affect the county.

Each natural hazard profile includes an overall summary of the risk analysis, an overview of the hazard, a discussion of the geographic areas affected, the historical occurrences affecting the county, the probability, and an impact analysis that includes an overview of impacts to the built environment, ecological impacts, and population and social vulnerabilities.

New to this 2025 update, there is an increased focus on the impacts of climate change on the characteristics of each hazard and an emphasis on social vulnerability.

Public health and technological hazard profiles include similar discussion topics, but not all aspects can be quantified due to limitations in available data and the imprecise nature of these events.

The LMS WG, Dewberry (as the County's consultant) and USF compiled information for each profile. Section 1, Planning Process, includes a full list of participating stakeholders.

The hazard profiles were shared at the LMS WG and Public Outreach meetings to gather feedback and input. Feedback from these meetings was utilized to finalize the profiles in the HIRA.

The Hillsborough County's LMS hazards analysis then builds on the findings of the HIRA to develop a strategic approach to mitigating risk county-wide. The County uses these mitigation strategies to develop and maintain the LMS program, designed to determine and prioritize these mitigation initiatives and strategies.

Current Status and Future Maintenance

As of 2025, this risk assessment is the most current and detailed hazard analysis for Hillsborough County. The information has been analyzed using the most current data sets available at the time of revision and update.

Significant research was required to update the 12 natural and 12 technological hazard profiles. References and sources are included as footnotes in the hazard profiles. Primary sources of data included:

- FEMA Disaster Declarations
- NOAA's National Center for Environmental Information (NCEI) Storm Events Database
- Hazus-MH
- FEMA
- Council on Environmental Quality (CEQ)
- U.S. Census Bureau

Identified Hazards

The plan addresses those natural hazards as required by FEMA and the State of Florida. Based on meteorological, geological, and topological research, four hazards (earthquakes, volcanic eruptions, tsunamis, and landslides) do not pose any significant threat to Hillsborough County.

Volcanic eruptions and landslides present no threat to Hillsborough County, while earthquakes and tsunamis are of minimal concern. Therefore, volcanic eruptions and landslides were not profiled in the 2025 plan update. Earthquake and tsunami sections are included.

The following natural hazards are profiled in this risk assessment.

- Flood
- Tropical Cyclone
- Severe Storm
- Tornado
- Wildfire
- Erosion
- Extreme Heat
- Drought
- Suspect Soil
- Winter Storm and Freeze
- Seismic Event
- Tsunami

Because this risk assessment serves as the sole risk assessment for Hillsborough County, other hazards have been included to meet requirements. EMAP and other planning mechanisms require the CEMP and LMS to identify the same hazards. To avoid duplication of effort, the Hillsborough County LMS risk assessment serves as the CEMP risk assessment and the risk assessment for any other emergency management plans. The technological hazards included in this risk assessment are listed below.

- Transportation Incident
- Infrastructure Disruption
- HazMat Incident
- Space Weather Incident
- Terrorism
- Cyberterrorism
- Agricultural Disruption
- Disease Outbreak and Biologic Incident
- Food and Waterborne Disease Outbreak
- Mass Migration
- Civil Disturbance
- Dam/Levee Failure

Since data for human-caused and technological hazards is less readily available and there are fewer or no historical occurrences, these hazards were not assessed to the same level of scrutiny required by the Disaster Mitigation Act of 2000 for natural hazard risk assessments. These 24 hazards were identified based on examination of past disasters, probability of occurrence, possible impacts, and vulnerability to the extent data allowed.

Hazard Profiles

The hazard profiles all follow the same outline, and the sections and a short description of the intent of the section are listed in Table 5.2.

Table 5.2: Hazard Profile Description

Hazard Profile Section	Description
Hazard Description and Background	This section includes: A basic overview of the hazard, such as causes, definitions, various types of the hazard, the measurements of the hazard, advisories for the hazard,

Hazard Profile Section	Description
	and any other pertinent information. Statements about the overall frequency and magnitude determinations regarding the hazard. Impacts of climate change, where the potential impacts of climate change on that hazard and the county and jurisdictions are described. If statement that no known potential impacts of climate change exist for a given hazard; a statement is placed in the place of a discussion.
Geographic Areas Affected by Hazard	This section discusses the areas of the county that are likely to be impacted by the hazard. There may also be references to where the hazard has occurred.
Historical Occurrences of Hazard	This section lists significant occurrences of the hazard overall from a variety of identified sources. There is also a list of every Presidential Disaster Declaration in the county for the hazard, if there have been any.
Probability of Future Occurrence of Hazard	This section includes a description of the likelihood of the hazard occurring in the future. There is probabilistic data from Hazus-MH and the National Risk Index (NRI). Annual probability is also determined by dividing the number of past occurrences by the period of records to determine the probability of an event in any given year based on history. There is also a statement about the determined overall probability of the hazard. In each probability subsection, an analysis of the likely impacts of climate change, based on a literature review and existing research, is included.
Hazard Impact Analysis	This section lists possible impacts due to the hazard occurring in the county. They are categorized into impacts affecting: • Public • First Responders • Continuity of Operations (including continued delivery of services) • Property, Facilities, Infrastructure • Environment • Economic Condition of the Jurisdiction • Public Confidence in Each Jurisdiction’s Governance. The impacts were categorized to align more easily with EMAP Standard requirements. Several of the water-related and public-health-related hazards also describe additional impacts on the built environment, ecological impacts, and population and social impacts.
Vulnerability Analysis and Loss Estimation by Jurisdiction	<u>Natural Hazards</u>: This section overall vulnerability and an estimation of losses based on available tools and data. This information is gathered from various sources. Vulnerability of critical facilities and assets was also included for hazards that lend themselves to spatial analysis. <u>Technological Hazards</u>: This section discusses overall vulnerability. Where possible, loss estimation information is provided. Examples of the cost of incidents in the past are also provided to provide a baseline of possible

Hazard Profile Section	Description
	losses if information is available.
Hazard Summary Matrix	A statement about the ranking system listed below, and a statement about the overall vulnerability of the respective hazard in each profile. These statements are followed by the Hazard Summary Matrix. Overview: A few sentences from the hazard description. Probability: Rankings of the likelihood of the hazard occurring. Impact Analysis: Rankings of the hazard's general impact on people, property, and critical facilities. Spatial Extent: Ranking of the area of the county that will be affected by the hazard. Warning Time: Amount of time generally available before an impending hazard event. Public Sentiment: Public concern for the hazard utilizing public survey responses. Duration: Length of time a typical hazard event will last. PRI Score: Numerical value that indicates the degree of risk for the hazard. Overall Vulnerability: Overall risk ranking based on PRI scores.

The 2025 LMS update has also added the following:

- Emphasis on climate change impacts
- Impacts of the hazard on future development (See section 4.1 Future Land Use)
- Use of the Justice40 Climate and Economic Justice Screening Tool and other sources to assess social vulnerability
- Increased emphasis on community lifelines

Continuing to address the needs and challenges of vulnerable populations in Hillsborough County is essential. Mitigation activities designed to increase the likelihood of improving public health objectives, preventing disaster-related economic costs, building resilience, and reducing unnecessary loss of life are informed by this risk assessment. Vulnerability is not just the potential for damage and disruption. Socially vulnerable populations may lack resources to prepare, evacuate, adapt to, and recover from disasters, increasing their vulnerability. Vulnerable populations include but are not limited to, populations living in low-income areas, senior citizens, special needs populations, non-English speaking households, and residents living in manufactured homes. A map of the census tracts in Hillsborough County that are considered disadvantaged communities is shown in **Error! Reference source not found.**.

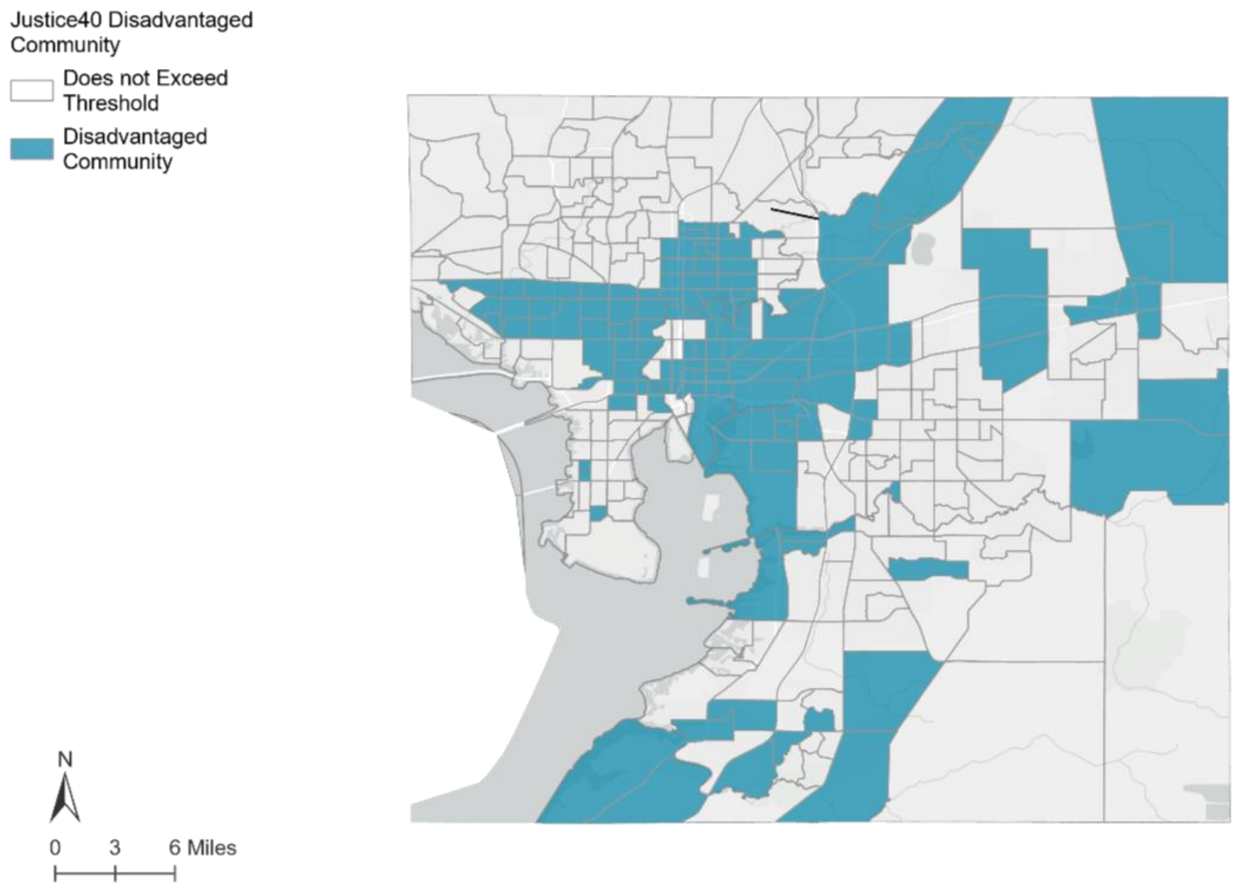


Figure 5.1. Justice40 Disadvantaged Communities in Hillsborough County

Data Sources

Significant research was required to update the 12 natural hazards and 12 technological hazard profiles. References and sources are included as footnotes in the hazard profiles, but the main data sources included the sources below.

Hazus-MH

Hazus-MH is a nationally applicable standardized methodology with models for estimating potential losses from floods, hurricane wind and earthquakes. HAZUS-MH uses Geographic Information Systems (GIS) technology to estimate physical, economic, and social impacts of disasters. This helps users to visualize the spatial relationship between populations and other more permanently fixed geographic assets or resources for the specific hazard being modeled. HAZUS-MH is used for preparedness, response, recovery, and mitigation and is useful in the risk assessment step in the mitigation planning process.

New for this update, Hazus-MH was utilized for the earthquake risk assessment. For the flood and tropical cyclone hazard profiles the 2020 Hazus model runs were inflated to 2023 dollars and losses adjusted to account for population changes, increased rebuilding costs, and other factors outlined in that section. The County elected to take this approach to stretch limited resources and believe that the adjusted 2020 results still provide a good analysis of the relative risk of locations for comparison within the county. Hazus-MH results were also supplemented with the FEMA's National Risk Index (NRI) vulnerabilities and loss estimations updated census data and Hazus-based analysis.

FEMA

Publicly available information from the FEMA website provides data about all disaster declarations for Florida, including emergency declarations, major disaster declarations, and fire management assistance declarations.

The Risk Mapping, Assessment, and Planning (RiskMAP) program aims to identify flood risk and promote informed planning and development practices to help reduce risk. The GIS portion of the RiskMAP program was used to inform the *Flood Hazard Profile* and analyses.

The NRI is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. It was designed and built by FEMA in close collaboration with various stakeholders and partners in academia, and federal government; local, state, and federal government; and private industry. For the 2025 LMS update, census tract level risk from the NRI was used to determine vulnerability and potential losses for several natural hazards at the census tract level.

NOAA/NWS/NHC

NOAA is a scientific agency within the U.S. Department of Commerce. It focuses on understanding and predicting changes in the Earth's environment, including weather, climate, oceans, and fisheries. NOAA conducts research, provides data and forecasts, and works to protect marine ecosystems and promote sustainable use of marine resources. The National Weather Service (NWS) is part of NOAA, and both agencies provide information on climate and weather patterns, hazard history, and more via their websites that are included in the natural hazard profiles.

The National Hurricane Center (NHC) is an organization nested within NOAA/NWS and conducts research on as well as issues watches, warnings, forecasts, and analyses for tropical weather. Much of the *Tropical Cyclone Hazard Profile* stems from information on this website. The NHC is located in Florida International University (FIU) in Miami, Florida.

National Centers for Environmental Information (NCEI)

The NCEI Storm Events Database records:

- The occurrence of storms and other significant weather phenomena with sufficient intensity to cause loss of life, injuries, significant property damage, and disruption to commerce
- Rare or unusual weather phenomena that generate media attention, and

- Other significant meteorological events, such as record maximum or minimum temperatures.

The database was used to search for data from January 1950 through December 2023. Event types recorded include coastal flood, cold/wind chill, drought, excessive heat, extreme cold/wind chill, flash flood, flood, frost/freeze, hail, heat, heavy rain, high wind, lightning, sleet, storm surge/tide, strong wind, thunderstorm wind, tornado, tropical depression, tropical storm, wildfire, winter storm, and winter weather.

National Climate Assessment (NCA)

The NCA, published by the U.S. Global Change Research Program (USGCRP), explores the effects of climate change across water, ecosystems, human health, energy, transportation, agriculture, and forests throughout the regions of the country. Potential impacts of climate change on the natural hazards were gathered partly from this assessment and included in the natural hazard profiles.

United States Drought Monitor

Hosted by the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln, NOAA, and the U.S. Department of Agriculture (USDA), the U.S. Drought Monitor (USDM) produces a map each week that depicts which parts of the country are currently experiencing drought, designated through five different classifications: Abnormally Dry, Moderate Drought, Severe Drought, Extreme Drought, and Exceptional Drought.

Southern Wildfire Risk Assessment

The Southern Wildfire Risk Assessment (SWRA) works with various other agencies to provide wildfire risk information for southern U.S. states, including identifying areas prone to wildfires. The SWRA Portal (SWRAP) additionally creates awareness and supports mitigation planning. Information from this assessment was used to develop GIS information for the *Wildfire Hazard Profile*.

United States Geological Survey (USGS)

The USGS provides the United States with reliable scientific information to describe and understand the Earth and to minimize the loss of life and property from natural disasters. Several hazard profiles include Information from USGS, including the *Suspect Soil Hazard Profile*.

CEQ

In 2021, the CEQ developed the Climate and Economic Justice Screening Tool, which identifies communities experiencing burdens across eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. Communities that experience a high level of burden across these categories are considered to be disadvantaged and especially vulnerable to the hazards included in this section because they are overburdened and underserved.

Federal agencies use the tool to help identify disadvantaged communities that will benefit from programs included in the Justice40 Initiative, which seeks to deliver 40% of the overall benefits of investments in climate, clean energy, and related areas to disadvantaged communities.

Florida State Agencies

Information from State of Florida agencies, such as Division of Emergency Management (FDEM), Florida Department of Transportation (FDOT), FDEP, and Department of Agriculture and Consumer Services (FDACS) was used to develop the hazard profiles and the GIS data shown. The 2023 Florida Enhanced State Hazard Mitigation Plan was a significant source of data to inform the hazard profiles.

Priority Risk Index

The results of the hazard profiling process were used to generate county-wide hazard classifications according to a "Priority Risk Index" (PRI). The PRI is intended to be utilized as an objective planning tool for classifying and prioritizing hazard risks in Hillsborough County based on standardized criteria.

PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an upon agreed-upon weighting factor as summarized in Table 2 below. The assigned risk value for each category is multiplied by the weighting factor to calculate the PRI value for a given hazard. The sum of all six categories equals the final PRI value as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .25) + (IMPACT x .25) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (PUBLIC SENTIMENT x .10) + (DURATION x .10)]

This 2025 update is the first for Hillsborough County to include public sentiment in the PRI equation based on survey results from 3,129 Hillsborough residents and stakeholders. Based on the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When applying the scheme for Hillsborough County, the highest PRI value is 3.6 (severe storm). Prior to being finalized, the members of the Hillsborough County LMS WG reviewed and accepted the PRI values for each identified hazard. Table 5.3: Priority Risk Index for Hillsborough County shows the results of this process.

Table 5.3: Priority Risk Index for Hillsborough County

PRI Category	Degree of Risk - Level	Degree of Risk - Criteria	Index Value	Assigned Weighting Factor
Probability	Unlikely	Less than 1% annual probability	1	25%
Probability	Possible	Between 1 and 10% annual probability	2	25%
Probability	Likely	Between 10 and 100% annual probability	3	25%
Probability	Highly Likely	100% annual probability	4	25%

PRI Category	Degree of Risk - Level	Degree of Risk - Criteria	Index Value	Assigned Weighting Factor
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption to the quality of life. Temporary shutdown of critical facilities.	1	25%
Impact	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	25%
Impact	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	25%
Impact	Catastrophic	High number of deaths/injuries possible. More than 50% of the property affected is damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	25%
Spatial Extent	Negligible	Less than 1% of the area affected	1	20%
Spatial Extent	Small	Between 1 and 10% of the area affected	2	20%
Spatial Extent	Moderate	Between 10 and 50% of the area affected	3	20%
Spatial Extent	Large	Between 50 and 100% of the area affected	4	20%
Warning Time	> 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	10%
Warning Time	6 to 12 hours	Self-explanatory	3	10%
	< 6 hours	Self-explanatory	4	10%
Public Sentiment	Not Concerned	Based on Public Survey Results	1	10%
	Somewhat Concerned	Based on Public Survey Results	2	10%
Public Sentiment	Moderately Concerned	Based on Public Survey Results	3	10%

PRI Category	Degree of Risk - Level	Degree of Risk - Criteria	Index Value	Assigned Weighting Factor
	Very Concerned	Based on Public Survey Results	4	10%
Duration	< 6 hours	Self-explanatory	1	10%
	< 24 hours	Self-explanatory	2	10%
Duration	< 1 week	Self-explanatory	3	10%
	> 1 week	Self-explanatory	4	10%

Table 5.4 summarizes the degree of risk assigned to each category for all identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the LMS WG. The results were then used in calculating PRI values and making final determinations for the risk assessment.

Table 5.4: Summary of PRI Results for Hillsborough County by Category/Degree of Risk

Type of Hazard	Hazard	Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Natural Hazard	Flood							
Natural Hazard	Severe Storm	Highly Likely	Critical	Large	6 to 12 hrs	Very Concerned	< 1 week	3.60
Natural Hazard	Tropical Cyclone	Likely	Critical	Large	> 24 hrs	Very Concerned	< 1 week	3.10
Natural Hazard	Wildfire	Likely	Limited	Moderate	< 6 hrs	Somewhat Concerned	< 1 week	2.80
Natural Hazard	Suspect Soil	Likely	Limited	Moderate	< 6 hrs	Moderately Concerned	< 24 hrs	2.80
Natural Hazard	Tornado	Likely	Critical	Small	< 6 hrs.	Somewhat Concerned	< 6 hrs	2.70
Natural Hazard	Erosion	Highly Likely	Limited	Moderate	> 24 hrs	Somewhat Concerned	< 1 week	2.70
Natural Hazard	Extreme Heat	Likely	Minor	Large	> 24 hrs	Very Concerned	> 1 week	2.70
Natural Hazard	Drought	Likely	Minor	Large	> 24 hrs	Very Concerned	> 1 week	2.60
Natural Hazard	Winter Storm and Freeze	Likely	Minor	Large	> 24 hrs	Not Concerned	< 1 week	2.30
Natural Hazard	Seismic Events	Possible	Limited	Moderate	< 6 hrs	Not Concerned	< 6 hrs	2.20
Natural Hazard	Tsunami	Unlikely	Limited	Small	< 6 hrs	Not Concerned	< 6 hrs	1.80
Technological and Human-Caused Hazards	Agricultural Disruption	Likely	Limited	Large	< 6 hrs.	Moderately Concerned	> 1 week	3.20

Type of Hazard	Hazard	Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Technological and Human-Caused Hazards	Terrorism	Possible	Critical	Moderate	< 6 hrs	Very Concerned	> 1 week	3.10
Technological and Human-Caused Hazards	Disease Outbreak and Biologic Incident	Likely	Critical	Large	> 24 hrs	Moderately Concerned	< 1 week	3.00
Technological and Human-Caused Hazards	Cyberterrorism	Likely	Limited	Moderate	< 6 hrs	Very Concerned	< 1 week	3.00
Technological and Human-Caused Hazards	HazMat Incident	Possible	Critical	Moderate	< 6 hrs	Somewhat Concerned	> 1 week	2.90
Technological and Human-Caused Hazards	Transportation Incident	Possible	Critical	Moderate	< 6 hrs	Somewhat Concerned	< 1 week	2.80
Technological and Human-Caused Hazards	Infrastructure Disruption	Possible	Limited	Moderate	< 6 hr	Very Concerned	< 1 week	2.7
Technological and Human-Caused Hazards	Space Weather	Likely	Critical	Moderate	< 6 hrs	Not Concerned	< 6 hrs	2.70
Technological and Human-Caused Hazards	Civil Disturbance	Possible	Critical	Moderate	< 6 hrs	Moderately Concerned	< 1 week	2.70
Technological and Human-Caused Hazards	Food and Waterborne Disease Outbreak	Likely	Limited	Small	> 24 hrs	Moderately Concerned	< 1 week	2.40
Technological and Human-Caused Hazards	Dam/Levee Failure	Unlikely	Critical	Moderate	< 6 hrs	Not Concerned	< 6 hrs	2.20

Type of Hazard	Hazard	Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Technological and Human-Caused Hazards	Mass Migration	Unlikely	Minor	Moderate	> 24 hrs	Somewhat Concerned	> 1 week	1.80

The Hillsborough County LMS WG reviewed the findings of the Hazard Profiles as well as the PRI Value for consensus. The PRI Value allows identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk), and the resulting score can then be used to inform and prioritize mitigation actions. All potential hazards for Hillsborough County are categorized as high, moderate, or low risk. The low-risk categorization does not mean a damaging event will not occur; it is simply that it is less probable and likely to cause less damage than higher-ranked hazards.

Risk is expressed in relative terms according to the estimated impact a hazard will have on human life and property throughout all of Hillsborough County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately and is described in the individual hazard profiles. It should be noted that although some hazards are classified below as posing a low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases. Their assigned classification will continue to be evaluated during future updates. The Hillsborough County LMS WG, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future updates.

Looking forward, the summary hazard classifications, when combined with the asset inventory and quantitative vulnerability assessment provided, allows for the prioritization of those high hazard risks for mitigation planning purposes and, more specifically, the identification of hazard mitigation opportunities for Hillsborough County to consider as part of their proposed mitigation strategy. The PRI for each hazard was calculated for the overall County. Based on quantitative analysis by jurisdiction and input from the LMS WG, some hazards were adjusted for the participating jurisdictions. For example, the erosion hazard is less in the City of Plant City and the City of Temple Terrace than for the City of Tampa and unincorporated areas of the county since coastal flooding, a driver of erosion, impacts them differently. Overall vulnerability rankings are provided in Table 5.5.

Table 5.5: Hazards Vulnerability by Jurisdiction

Type of Hazard	Hazard	Hillsborough County	City of Plant City	City of Tampa	City of Temple Terrace
Natural Hazard	Flood	High	High	High	High
Natural Hazard	Tropical Cyclone	High	High	High	High
Natural Hazard	Severe Storm	High	High	High	High
Natural Hazard	Tornado	Moderate	Moderate	Moderate	Moderate

Type of Hazard	Hazard	Hillsborough County	City of Plant City	City of Tampa	City of Temple Terrace
Natural Hazard	Wildfire	Moderate	Moderate	Moderate	Moderate
Natural Hazard	Erosion	Moderate	Low	High	Low
Natural Hazard	Extreme Heat	Moderate	Moderate	High	Moderate
Natural Hazard	Drought	Moderate	Moderate	Moderate	Moderate
Natural Hazard	Suspect Soil	Moderate	Moderate	Moderate	Moderate
Natural Hazard	Winter Storm and Freeze	Low	Low	Low	Low
Natural Hazard	Seismic Events	Low	Low	Low	Low
Natural Hazard	Tsunami	Low	Low	Low	Low
Technological and Human-Caused Hazards	Transportation Incident	Moderate	Moderate	Moderate	Moderate
Technological and Human-Caused Hazards	Infrastructure Disruption	Moderate	Moderate	Moderate	Moderate
Technological and Human-Caused Hazards	HazMat Incident	Moderate	Moderate	Moderate	Moderate
Technological and Human-Caused Hazards	Space Weather	Moderate	Moderate	Moderate	Moderate
Technological and Human-Caused Hazards	Terrorism	High	High	High	High
Technological and Human-	Cyberterrorism	High	High	High	High

Type of Hazard	Hazard	Hillsborough County	City of Plant City	City of Tampa	City of Temple Terrace
Caused Hazards					
Technological and Human-Caused Hazards	Agricultural Disruption	High	High	High	High
Technological and Human-Caused Hazards	Disease Outbreak and Biologic Incident	High	High	High	High
Technological and Human-Caused Hazards	Food and Waterborne Disease Outbreak	Low	Low	Low	Low
Technological and Human-Caused Hazards	Mass Migration	Low	Low	Low	Low
Technological and Human-Caused Hazards	Civil Disturbance	Moderate	Moderate	Moderate	Moderate
Technological and Human-Caused Hazards	Dam/Levee Failure	Low	Low	Low	Low

Hillsborough County Asset Inventory

An inventory of georeferenced assets within Hillsborough County and its jurisdictions was compiled to identify and characterize those properties potentially at risk to the identified hazards. By understanding the type and number of assets that exist and where they are in relation to known hazard areas, the relative risk and vulnerability of such assets can be assessed. Under this assessment, two categories of physical assets were created and then further assessed through GIS analysis:

Physical and Improved Assets

The two categories of physical assets consist of:

1. Improved Property: Includes all improved properties in Hillsborough County according to local parcel data provided by the county. The information has been expressed in terms of the number of parcels and total assessed value of improvements (buildings) that may be exposed to the identified hazards. In addition, building footprint data was available for all jurisdictions and was used to improve the overall assessment by accurately assessing how many buildings are in hazard areas (exposure).
2. Critical Facilities: Critical facilities vary by jurisdiction, and the critical facilities provided by the county are used in this section. It should be noted that this listing is not all-inclusive for assets located in the county, and it is anticipated that it may be expanded or adjusted during future updates as more geo-referenced data becomes available for use in GIS analysis. Critical facilities for each jurisdiction were determined based on jurisdictional boundaries and not necessarily by jurisdictional ownership. A complete list of Critical Facilities is included in Appendix B.

The following tables (Table 5.6 through Table 5.9) provide a summary listing of the geo-referenced assets that Hillsborough County has identified for inclusion in the vulnerability assessment.

Table 5.6: Improved Property in Hillsborough County

Location	Number of Parcels	Number of Buildings	Improved Value
City of Plant City	16,078	58,813	$3,522,460,141
City of Tampa	137,213	541,555	$44,821,840,846
City of Temple Terrace	8,956	37,593	$2,487,002,584
Unincorporated	360,046	1,496,995	$72,849,248,254
HILLSBOROUGH COUNTY TOTAL	522,293	2,134,956	$123,680,551,825

Table 5.7 below summarizes the emergency service, hazardous material, health, communication, and other critical facilities in Hillsborough County. These facilities were identified as primary critical facilities in that they are necessary to maintain government functions and protect citizens' life, health, safety, and welfare.

Table 5.7: Critical Facility Inventory in Hillsborough County

Location	Number of Critical Facilities
City of Plant City	122
City of Tampa	962
City of Temple Terrace	48
Unincorporated	2,549
HILLSBOROUGH COUNTY TOTAL	3,681

These critical facilities were analyzed in the context of FEMA community lifeline categories for consideration in developing mitigation strategies. The FEMA community lifeline categories are shown below in Table 5.8 along with the associated critical asset types that comprised each lifeline in this LMS effort:

Table 5.8: FEMA Community Lifelines and Associated Critical Asset Types

Community Lifeline	Asset Types
Safety and Security	• Colleges and Universities • Schools • Disaster Recovery Centers • Law Enforcement Facilities • Local Government Facilities • Emergency Operations Center • State Government Facilities • Fire Stations • Logistical Staging Areas • Hotels/Motels • Correctional Facilities
Health and Medical	• Emergency Medical Service Facilities • Hospitals • Healthcare Facilities
Communications	• Communication Facilities • Libraries
Energy	• Electric Facility Substations • Solar Facilities • Power Plants • Electric Facilities eGrid
Water Systems	• Stormwater Facilities • Seawater Desalination Plants • Port Tampa • Wastewater Facilities • Marinas
Hazardous Materials	• Chemical Waste Facilities
Transportation	• Evacuation Routes • Heliports • Airports

Community Lifeline	Asset Types
Food, Hydration, Shelter	• Drinking Water Facilities • Risk Shelters • Emergency Shelters

FEMA created these community lifeline categories to reframe incident information, understand and communicate incident impacts using plain language, and promote unity of effort across the whole community to prioritize efforts to stabilize the lifelines during incident response. For the 2025 LMS update, when describing the vulnerability of assets, the 2023 LMS Policy Guide emphasizes the importance of considering the vulnerability of community lifelines.

The count of community lifelines by category and by jurisdiction is shown below in Table 5.9. Several critical facilities were not included as community lifelines, such as solid hazardous waste facilities for example, while evacuation routes were added as community lifelines while not being included in the critical facility asset exposure analysis.

Table 5.9: Community Lifelines by Jurisdiction

Community Lifeline	City of Tampa	City of Temple Terrace	City of Plant City	Uninc. Areas	Total Assets
Safety and Security	428	24	28	483	963
Health and Medical	140	9	13	268	434
Transportation	682	27	188	1,605	2457
Food, Water, Shelter	62	9	24	784	879
Water Systems	61	2	10	244	317
Communications	129	6	19	371	525
Energy	54	5	7	131	197
Hazardous Materials	0	0	0	7	7
Totals	1,556	73	289	3,893	5779

The facilities were mapped and used as the basis for further analysis of hazards that lend themselves to spatial analysis (e.g. flood and wildfire). Figure 5.2 through Figure 5.6 provide examples of various facility and lifeline locations in the county.

Figure 5.2. Critical Facilities in Hillsborough County – Critical Facilities

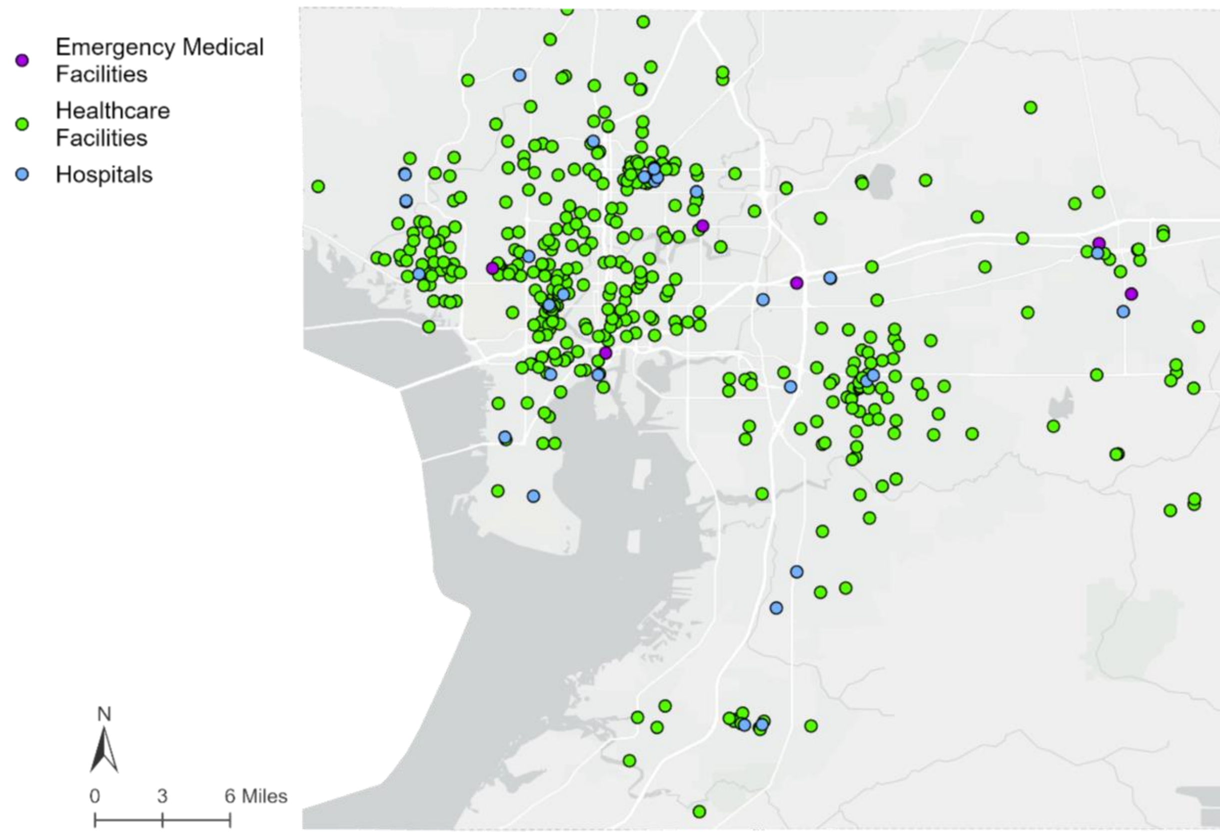


Figure 5.3. Medical Facilities in Hillsborough County

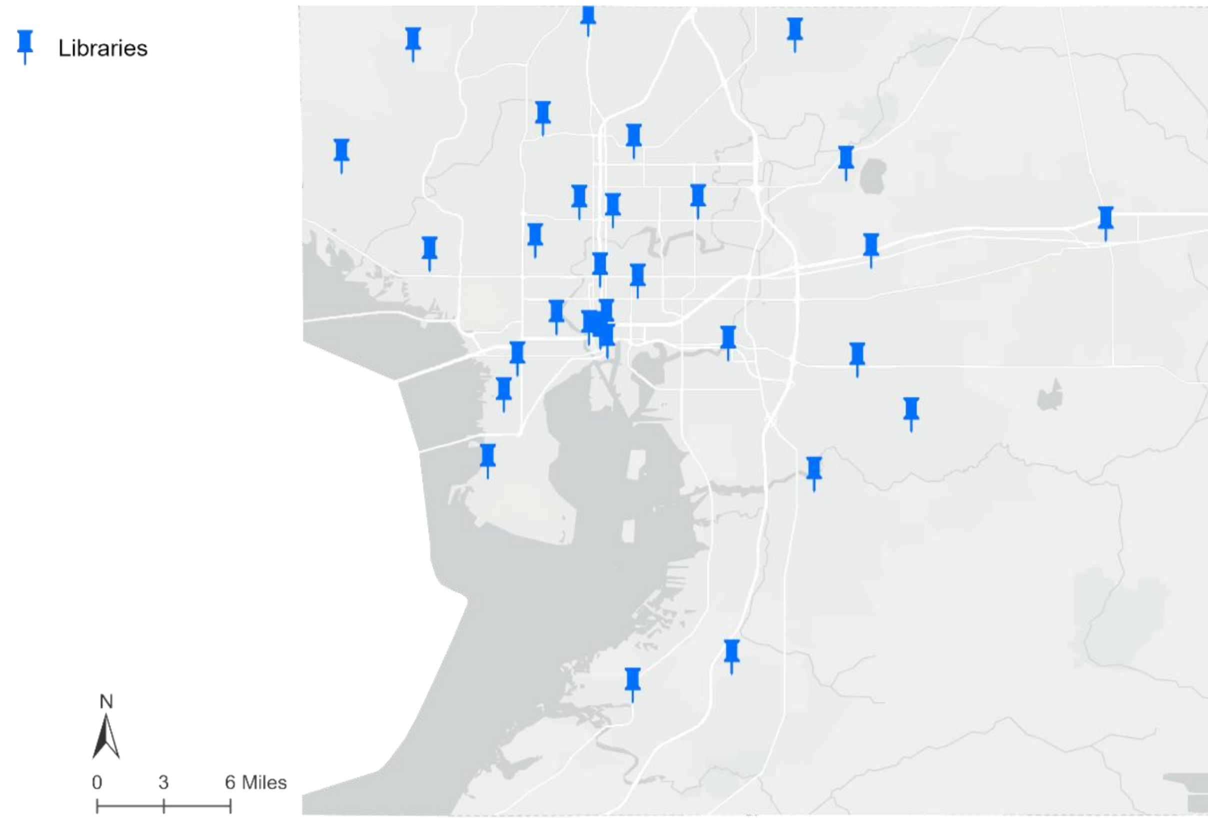


Figure 5.4. Libraries in Hillsborough County

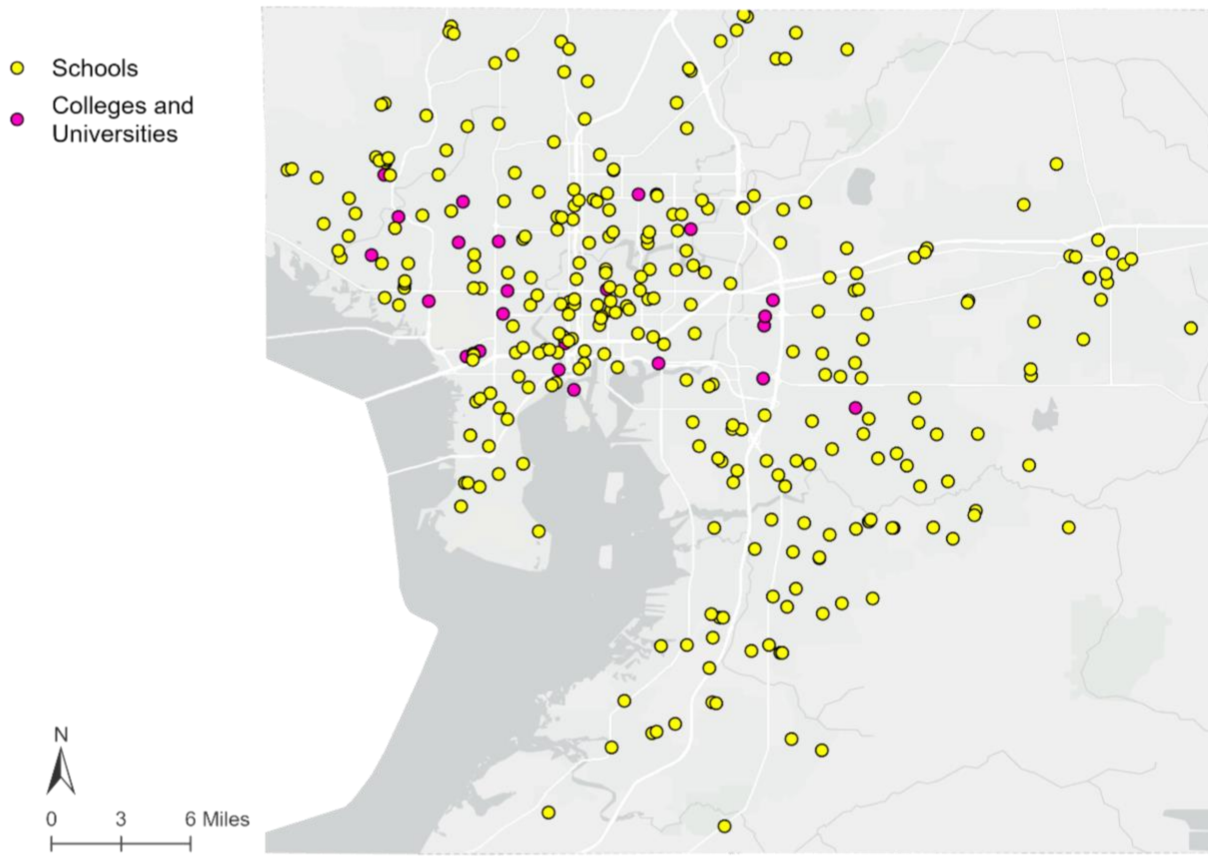


Figure 5.5. Schools in Hillsborough County

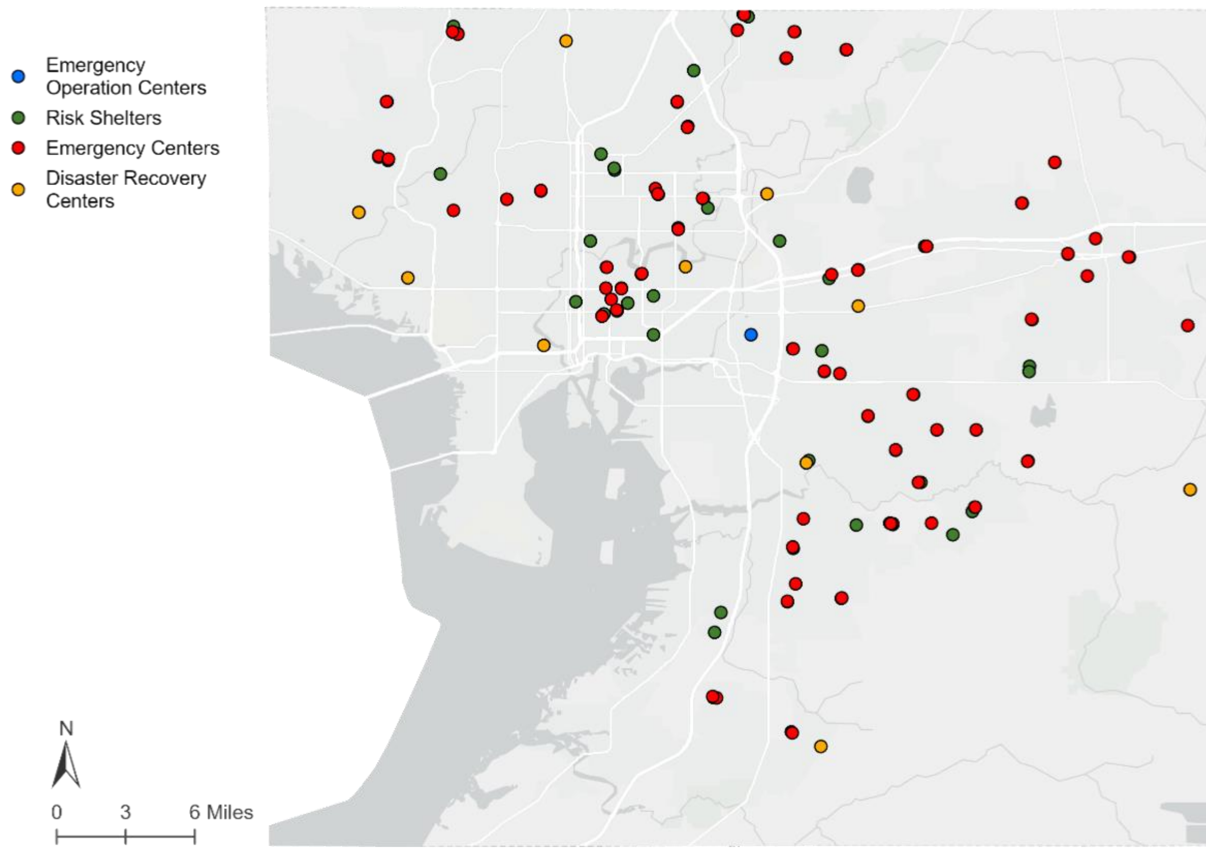


Figure 5.6. Emergency Shelters and Operation Centers in Hillsborough County

Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess segments of the resident population in Hillsborough County that are potentially at risk to these hazards. The map in Figure 5.6 above shows the designated disadvantaged communities in Hillsborough County using the Justice40 Climate and Economic Justice Screening Tool (CEJST).

Figure 5.7 illustrates population density by census block as it was reported by the U.S. Census in 2022.

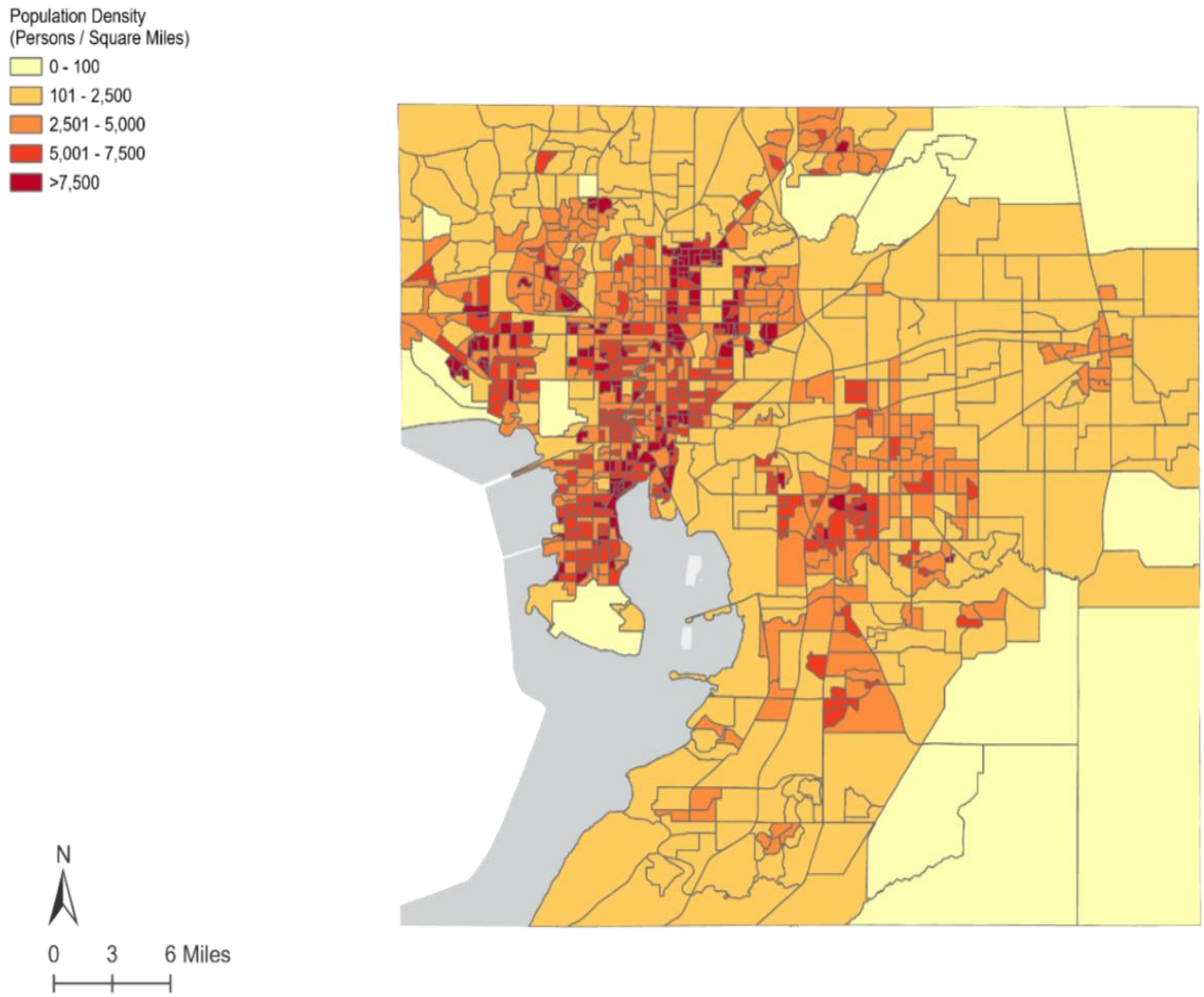


Figure 5.7. Population Density in Hillsborough County

Since the previous LMS was approved, Hillsborough County has experienced growth and development across the county. Table 5.10 below shows the number of building units in Hillsborough County in 2017, the most recent update from the 2020 LMS Update for the county, and in 2022, the most recent update for the 2025 LMS update for the County, according to the U.S. Census ACS, and the percent change.

Table 5.10. Building Counts for Hillsborough County and Percent Change from 2017-2022

Location	Total Housing Units (2017)	Total Housing Units (2022)	% Change in Housing Units
City of Plant City	14,673	15,318	4.4%
City of Tampa	165,678	172,995	4.4%
City of Temple Terrace	11,181	11,444	2.4%
Unincorporated	372,106	406,577	9.3%

Location	Total Housing Units (2017)	Total Housing Units (2022)	% Change in Housing Units
HILLSBOROUGH COUNTY TOTAL	563,638	606,334	7.6%

Table 5.11 below shows population estimates for the county from 2019 to 2022 based on the U.S. Census Bureau ACS 5-Year Estimates. Population growth began to rebound from the pandemic in 2020, but the impacts are still present in the population estimates below.

Table 5.11. Population Growth in Hillsborough County

Location	Population Estimates 2019	Population Estimates 2020	Population Estimates 2021	Population Estimates 2022	% change 2019-2022
City of Plant City	39,012	39,437	39,272	39,655	1.6%
City of Tampa	387,916	395,912	380,476	388,768	0.2%
City of Temple Terrace	26,539	26,901	26,585	26,818	1.1%
Unincorporated	968,811	989,108	998,026	1,013,319	4.6%
HILLSBOROUGH COUNTY TOTAL	1,422,278	1,451,358	1,444,359	1,468,560	3.3%

As the population and construction increases in Hillsborough County and its incorporated jurisdictions increase, vulnerability may also increase. Ensuring that land use and building codes are followed rigorously is critical to growing a more resilient County.

The remainder of this section provides profiles for the natural, human-caused, technological, and societal hazards.

Natural Hazards

4.1 Flood Hazard Profile

Flood Description

A flood or flooding refers to the overflowing of the normal confines of a body of water or the accumulation of water over areas that are not normally submerged. Floods include coastal floods, river (fluvial or riverine) floods, flash floods, urban floods, drainage (pluvial) floods, sewer floods, and glacial lake outburst floods. Floodplains are defined as any land area susceptible to being inundated by water from any flooding source. While many people underestimate the severity of floods, loss of life and property from flooding are real threats in Hillsborough County. Flood stages are the water elevations at which varying levels of damage to personal property occur. Locally heavy precipitation may flood areas other than delineated floodplains or along recognized drainage channels. If local conditions cannot accommodate intense precipitation through infiltration and surface runoff, water may accumulate and cause flooding.

Types of Flooding

In Hillsborough County, several variations of flooding occur as a result of the effects of severe thunderstorms, tropical storms and hurricanes, seasonal rain, climate change, and other weather-related conditions. This hazard profile will focus on two broad flooding categories: inland flooding and coastal flooding.

- Inland Flooding
  - Riverine Reach
  - Flash Floods
- Coastal Flooding
  - Tidal Flooding
  - Sea Level Rise

The greatest flood threat comes from storm surge, which can cause widespread damage throughout coastal areas, estuaries, and areas adjacent to rivers. Localized flooding from rainfall can adversely affect the county's coastal and inland areas, including low-lying locations along the Hillsborough, Alafia, and Little Manatee Rivers.

Inland or Riverine Flooding: Hillsborough County's low-lying topography and subtropical climate make it highly vulnerable to inland or riverine flooding. Riverine flooding occurs when the flow of runoff exceeds the carrying capacities of the natural drainage systems. Flood damage is proportional to the volume and the velocity of the water. High volumes of water can move heavy objects and undermine roads and bridges. Flooding can occur from precipitation upstream without any precipitation occurring near the flooded areas.

Flash floods can present more significant safety risks than other riverine floods because of the rapid onset, the high-water velocity, the debris load, and the potential for channel scour. In addition, more than one flood crest may result from a series of fast-moving storms. Sudden destruction of structures and the washout of access routes may result in a loss of life.

Although rural flooding is dangerous to fewer people and may be less costly than urban flooding, it can cause great damage to agricultural operations. The U.S. Geological Survey has established a system of monitoring stations to retrieve data about streamflow conditions. This system works in real time for flood warnings and short-term trends. The system is accessible at the following website: http://waterdata.usgs.gov/fl/nwis/rt.

- Riverine Reach: The influence of river flooding on river stage gradually decreases with proximity to the Gulf, and the influence of tides and storm surges on river stage gradually increases the flood levels in bodies of water. Tides affect river stages at low and medium flows in the upper tidal reach and at all flows in the lower tidal reach. In the lower part of the lower tidal reach, stages during storm surges are higher than river flood stages. Soils are present in all riverine wetland forests, but the most nutrient-rich swamps are dry during low-flow periods. Most surface soils in the deepest riverine swamps, upper and lower tidal swamps, and lower tidal mixed forests are continuously saturated mucks.
- Upper Tidal Reach: Upper tidal mixed forests are found on low levees or in transitional areas between swamps and higher forest types. Upper tidal swamps are present at elevations below the median monthly high stage and usually have surface soils that are permanently saturated mucks.
- Lower Tidal Reach: The lower tidal reach is a floodplain found on elevations that do not receive regular tidal inundation or frequent river flooding but have a high-water table and are briefly inundated by storm surges several times a decade. Lower tidal mixed forests include swamps with numerous small reaches and are found on deep muck soils below the elevation of the median daily or monthly high stages.
- Flash Flooding: As Hillsborough County's population has rapidly increased since 1960, so has the profile of the landscape. Rapid urbanization has manifested in increased impervious surface areas such as asphalt roads, concrete areas, sidewalks, and structures. This increase has led to a much higher level of flash flooding during heavy rainstorms and flooding events. In the past, the design of urban drainage systems has concentrated on disposing of stormwater as rapidly and efficiently as possible in a concentrated area. However, stormwater is often collected and transported elsewhere without a comprehensive strategy for dealing with it as a system. As a result, drainage in urbanized areas of Hillsborough County is often a piecemeal solution and needs improvements in the comprehensive design. Increases in high-intensity short-duration rainfall events are contributing to the flash flooding hazard.

Coastal Flooding: Coastal flooding usually results from a severe weather system, such as a severe thunderstorm, hurricane, or tropical storm with high winds. Water driven ashore by the wind, known as storm surge, is the main cause of coastal flooding.

- Tidal Flooding: A tide is the periodic rise and fall of a body of water resulting from gravitational interactions between the sun, moon, and earth.[17] Tides are very predictable; most coastal areas experience two high tides and two low tides daily. High tides occur about every 12 hours

[17] http://tidesandcurrents.noaa.gov/glossary.html

and 25 minutes, and it takes about half that time (6 hours and 12.5 minutes) for the tide to go from high to low or low to high.[18]

- King Tides: Higher than normal tides and usually occur in the autumn months from September to November. These tides tend to be 6 inches or more above the average high tide of that area. Similar to regular high and low tides, king tides are predictable and usually last for 5-7 days.[19] King tides can cause flooding of streets and even structures. It is also important to note that weather conditions and concurrent rainfall can exacerbate the effects of king tides.
- Storm Surge: The damaging effects to structures in beach areas are caused by a combination of higher levels of storm surge, winds, waves, rains, erosion, and battering by debris. Sea walls, jetties, and beach areas are affected by coastal flooding, and the loss over a period of time becomes costly. Loss of life and property damage are often more severe because a storm surge involves velocity wave action and accompanying winds.

The output of the National Oceanic and Atmospheric Administration (NOAA) storm surge prediction model (SLOSH) shows that storm surge height of 28 feet or more above sea level could impact certain Hillsborough coastal and riverine areas under a worst-case Category 5 hurricane. Local topography, bay, and river orientation, depth of the sea bottom, astronomical tides, and other physical features are considered in a predefined grid referred to as a "SLOSH basin."

The bay and river orientation in Hillsborough County, depth of the sea bottom, astronomical tides, as well as other physical features are considered to determine storm surge levels and the impact they may have on the built environment, ecology, and population of Hillsborough County. Storm surge is discussed in depth in the *Tropical Cyclone Hazard Profile*. Rising sea levels will continue to contribute to coastal flooding as addressed later in this section.

National Weather Service Advisories

The National Weather Service (NWS) is tasked with providing weather forecasts and warnings of hazardous weather to agencies and the public for the purposes of protection, safety, and general information. If severe weather is detected, alerts are issued, and the Emergency Alert System may activate and broadcast the alert, mainly for severe thunderstorms or tornadoes. These advisories and alerts are shown in

Table 5.12. below.

18 https://oceanservice.noaa.gov/education/tutorial_tides/tides05_lunarday.html#:~:text=High%20tides%20occur%2012%20hours,24%20hours%20and%2050%20minutes.

19 http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2016/06/KingTideToolkit.pdf

Table 5.12.National Weather Service Advisories and Thresholds for Flooding[20]

National Weather Service Advisories	
Flooding or Flash Flooding	
Flood Advisory	Normally issued as an Urban and Small Stream Flood Advisory, this is issued when the flooding is not expected to be severe enough to warrant a flood warning, but it may cause inconvenience and could threaten life or property if caution is not exercised. Examples include nuisance flooding of low-lying areas and areas of poor drainage, and minor flooding of roadways.
Flood or Flash Flood Watch	Issued when conditions are favorable for flooding to occur. It does not mean flooding will occur, but it is possible.
Flood Warning	Issued when flooding is imminent or already happening.
Areal Flood Warning	Issued for flooding that occurs more gradually, normally from prolonged and persistent moderate to heavy rainfall.
Flash Flood Warning	Issued when a flash flood is imminent or occurring, referring to a sudden violent flood that can take minutes to hours to develop. It is even possible to experience a flash flood in areas not receiving rain.
River Flood Warning	Issued when a river is forecast to go above its designated flood stage at the forecast point.
Coastal Flood Advisory/ Watch/Warning	Issued when flooding along the coast of the Atlantic Ocean, Pacific Ocean, or the Gulf of Mexico is possible. The flooding must be due to water being forced from the nearby body of water onto land, and not from rainfall.

Floodplains

FEMA defines a floodplain is any land area susceptible to being inundated by floodwaters from any source. The USGS further defines a floodplain as the relatively flat lowland that borders a river and is usually dry but is subject to flooding.[21]

To establish floodplains, FEMA adopted the base flood elevation, which is the level of a flood that has a 1% probability of occurring in any given year. This level of flood is referred to as a base flood, a 1% annual chance flood, a flood with 1% Annual Exceedance Probability (AEP), or the 100-year flood. The area that a base flood would inundate is called the 100-year floodplain. This is often misunderstood because many assume such a flood would only occur once every 100 years, when in actuality it means there is a 1% chance of the flood reaching that specified floodplain in any given year. The same theory is applied to understand the 500-year floodplain; it has a 0.2% chance of occurring each year or a 0.2% AEP.

FEMA has identified and mapped areas of flood risk on Flood Insurance Rate Maps, and the zones are called Special Flood Hazard Areas (SFHA). The 100-year floodplain is considered a high-risk area

[20] https://www.weather.gov/safety/flood-watch-warning
[21] https://pubs.usgs.gov/fs/FS-229-96/

and is denoted as Zone A. The 500-year floodplain is shown by the notation Zone C or shaded Zone X. The areas between the 100 and 500-year floodplains are shown using Zone B and Zone X. Additionally, high-risk coastal areas are denoted as Zone V. This information is shown in Table 5.13 below.

Table 5.13. FEMA Flood Zone Designations[22]

Zone	Description
Low to Moderate Risk Areas	
C and X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level. Zone C may have ponding and local drainage problems that don't warrant a detailed study or designation as a base floodplain. Zone X is the area determined to be outside the 500-year flood and protected by levee from 100-year flood.
B and X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. B Zones are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
High Risk Areas	
A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.
A.E.	The base floodplain where base flood elevations are provided. A.E. Zones are now used on new format FIRMs instead of A1-A30 Zones.
A1 - 30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a BFE (old format).
A.H.	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
A.O.	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
A.R.	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
High Risk Coastal Area	

[22] https://www.fema.gov/flood-zones

Zone	Description
V	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
VE, V1 - 30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
Undetermined Risk Areas	
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.

Mitigation measures are taken to reduce the flood risk in the floodplain; however, development is not prohibited. Floodplains are managed through building codes, local ordinances, and zoning regulations to mitigate the damage from floodwaters. The floodway is the channel of a watercourse and those portions of the adjoining floodplain that need to be kept open to provide for the passage of a base flood. The floodway fringe is the portion of the floodplain that, when fully developed, should not result in more than a one-foot rise in flood levels.

Floodplains cover a very large area in Hillsborough County. Pressure from developers to build and the potential tax revenues from developments make it difficult to keep floodplains undeveloped and make floodplain management challenging. This lack of control and inadequate information regarding the extent of floodplains and flood-prone areas typically leads to unsound development on floodplain land. Floodplains offer many benefits to communities by providing natural flood and erosion control, natural water filtration processes, habitats for plant and animal communities, recreational areas, and scientific field studies. Acting as natural flood storage areas, floodplains decrease the destructive force of floodwaters downstream by reducing the velocity of floodwaters. Though floodplain vegetation is partially responsible for slowing the rush of floodwaters, it also serves other valuable functions, such as reducing soil erosion, trapping floodwater sediment that increases soil fertility by providing nutrients to environments and reducing sediment load downstream.

The chemical filtration processes and biological activity that occur within a floodplain can also help reduce flood-generated pollution from agricultural and urban runoff and sewage overflow. Floodplains preserve and recharge groundwater supplies and provide opportunities for recreation, education, and scientific study. Urban expansion may encourage development in floodplains that would otherwise be reserved for these benefits.

In 2021, Hillsborough County's Flood Insurance Rate Maps, provided by the Federal Emergency Management Agency (FEMA), were updated to reflect potential inundation areas. In general, the map updates will result in one of the following for property owners in the affected area:

- The flood risk is reduced but not removed for properties removed from the high-risk areas.
- Properties newly identified as high-risk will experience potential changes in insurance requirements and costs and new building requirements.

- Properties in high-risk areas may see their risk increase more.

These are useful tools for assessing a flood risk for a property and are a factor in flood insurance and building requirements. Most homeowners' insurance policies do not cover flood damage. Flood maps are changed for coastal areas, generally west of Interstate 75 in southern Hillsborough County, south of Interstate 275 and Tampa International Airport in Tampa, south of Linebaugh Avenue in Tampa, and near the lower Hillsborough, Alafia, and Little Manatee rivers.[23]

National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary program where communities who agree to regulate development in FEMA identified flood hazard areas and to adopt Flood Insurance Rate Maps, and a Flood Insurance Study, are eligible for federally backed flood insurance.

Currently, all jurisdictions and the unincorporated areas of Hillsborough County participate in the NFIP. At the beginning of 2024, there were 63,771 NFIP policies in Hillsborough County, with flood insurance coverage totaling over $21.3 billion. This is a 1.2% decrease in total NFIP policies and a 19.8% increase in total coverage from 2019. The data used was gathered from the FEMA's FIMA NFIP redacted policies. Only policies which have termination dates past the year 2023 were used in this summarization.

According to the Policy and Claim Statistics for Flood Insurance page on the FEMA website (https://www.fema.gov/policy-claim-statistics-flood-insurance), there have been 8,237 claims countywide in Hillsborough County since Hillsborough County joined the NFIP on June 16th, 1980, with the total paid equaling approximately $102 million. This does not include claims associated with the 2024 storms, Hurricanes Helene and Milton and related post-event flooding. Table 5.14 summarizes the NFIP policies by jurisdiction in the county, while Table 5.15 summarizes the NFIP claims by jurisdiction.

Table 5.14. Hillsborough County NFIP Policies by Jurisdiction, as of 2024

Jurisdiction	Number of Policies	Total Coverage (in Thousands)	Total Policy Cost
City of Plant City	929	$287,608	$779,402
City of Tampa	23,986	$9,234,411	$47,609,451
City of Temple Terrace	429	$145,563	$406,935
Unincorporated	38,427	$11,654,099	$52,940,687
HILLSBOROUGH COUNTY TOTAL	**63,771**	**$21,321,681**	**$101,736,475**

Table 5.15. Hillsborough County NFIP Claims by Jurisdiction, 1980-2024

Jurisdiction	Total Number of Claims	Total Paid in Claims
City of Plant City	26	$105,993
City of Tampa	4,137	$58.861,362
City of Temple Terrace	46	$286,156

[23] https://hcfl.gov/residents/public-safety/flooding/find-my-flood-zone

Jurisdiction	Total Number of Claims	Total Paid in Claims
Unincorporated	4,028	$42,789,247
HILLSBOROUGH COUNTY TOTAL	**8,237**	**$102,042,758**

Repetitive and Severe Repetitive Loss Properties

A repetitive loss (RL) property is one for which two or more losses of at least $1,000 each have been paid by the National Flood Insurance Program (NFIP) over a rolling 10-year period. Hillsborough County is an NFIP "C" Community (ten or more repetitive losses). A severe repetitive loss property (SRL) is defined as a property that has had four or more claims of more than $5,000 or two or more claims that cumulatively exceed the building's value (exclusive of land).

Repetitive Loss (RL) properties are an important focus of strong mitigation programs. RL and SRL properties account for a disproportionately high percentage of all NFIP Losses. Mitigation at these structures typically provides a very high return on investment.

Table 5.16 summarizes the losses incurred by RL properties in Hillsborough County. In total, 443 RL properties in the county have experienced 1,343 losses, resulting in over $30.1 million in claims payments. All loss numbers and dollar values are based on best available data at the time or preparation of this document. These numbers will likely increase when data is updated post Helene and Milton.

Table 5.16. Hillsborough County Repetitive Loss Properties Summary

Jurisdiction	Number of R.L. Properties	Number of Losses	Building Payments	Contents Payments	Total Payments
City of Plant City	0	0	$0	$0	$0
City of Tampa	183	555	$10,729,441.21	$2,543,314.34	$13,272,755.55
City of Temple Terrace	3	7	$27,611.30	$6,909.01	$34,520.31
Unincorporated	257	781	$12,854,687.83	$3,942,707.34	$16,797,395.17
HILLSBOROUGH COUNTY TOTAL	**443**	**1,343**	**$23,611,740.3**	**$6,492,930.69**	**$30,104,671.03**

Table 5.17 shows the type of RL properties located in Hillsborough County. In total, the county has 420 residential RL properties, 23 commercial RL properties, and 0 other types of RL properties.

Table 5.17. Hillsborough County Repetitive Loss Properties by Type

Jurisdiction	Residential	Commercial	Other	Total
City of Plant City	0	0	0	0
City of Tampa	169	14	0	183
City of Temple Terrace	3	0	0	3
Unincorporated	248	9	0	257
HILLSBOROUGH COUNTY TOTAL	**420**	**23**	**0**	**443**

Additionally, SRL properties located in Hillsborough County are listed in Table 5.18 below. In total, the county has 94 SRL properties totally 422 instances of loss and over $11.5 million in total losses.

Table 5.18. Hillsborough County Severe Repetitive Loss Properties

Jurisdiction	Number of SRL Properties	Number of Losses	Building Payments	Contents Payments	Total Payments
City of Plant City	0	0	$0	$0	$0
City of Tampa	34	151	$4,107,755.08	$1,125,606.13	$5,233,361.21
City of Temple Terrace	0	0	$0	$0	$0
Unincorporated	60	271	$4,722,448.86	$1,626,300.95	$6,348,749.81
HILLSBOROUGH COUNTY TOTAL	**94**	**422**	**$8,830,203.94**	**$2,751,907.08**	**$11,582,111.02**

The SRL properties were broken down by type in Table 5.19 below. 97% of the total SRL properties in the county are residential properties with the remaining 3 properties classified as commercial.

Table 5.19. Hillsborough County Severe Repetitive Loss Properties by Type

Jurisdiction	Residential	Commercial	Other	Total
City of Plant City	0	0	0	0
City of Tampa	31	3	0	34
City of Temple Terrace	0	0	0	0
Unincorporated	60	0	0	60
HILLSBOROUGH COUNTY TOTAL	**91**	**3**	**0**	**94**

Figure 5.8 shows the location of repetitive loss (RL) properties in Hillsborough County by illustrating RL property density. This highlights areas susceptible to repetitive flooding and at risk of flood hazards.

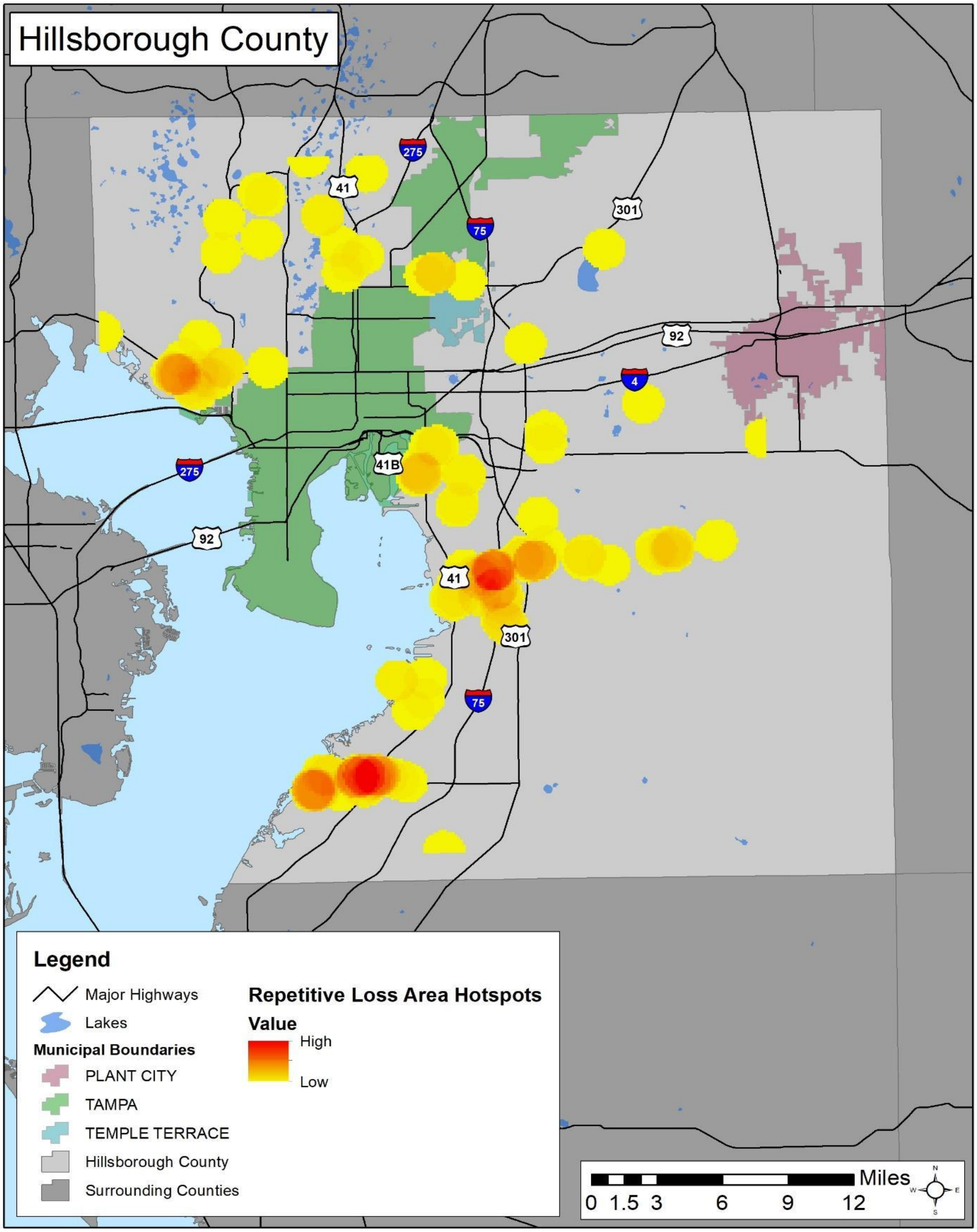


Figure 5.8. Repetitive Loss Area Hotspots in Hillsborough County

Substantial Improvements and Substantial Damage Determinations

A requirement of participation in the NFIP, is that Hillsborough County and its incorporated jurisdictions adopt and enforce substantial improvement and substantial damage provisions. Often referred to as the "50-percent rule," the provisions required that any improvement to a building in the FEMA-identified Special Flood Hazard Area (SFHA) where the cost of improvements equals or exceeds 50% of the building's market value (excluding land value) must be brought into compliance with NFIP standards. To maintain compliance, the County enforces regulations through its Floodplain Management Ordinance, as outlined in Chapter 8 of the Code of Ordinances. Flood damage control regulations can also be found in Part 3.06.00 of the Hillsborough County Land Development Code. Hillsborough County enforces local, FEMA, and State of Florida building code requirements.

Similarly, if a building is damaged in a hazard event, and the damage meets or exceeds 50% of the building's market value, it must meet the same standards. After a disaster, there is a spiked demand for substantial damage determinations by the County and City staff. Hillsborough County has developed a Substantial Improvement/Substantial Damage Procedures document with instructions and detailed worksheets to guide permit applicants through the process. It must be completed for all permits for repair, elevation, demolition, and other construction activities within the SFHA. The Building Official or designated staff review the package for concurrence during the permitting process. The Building Official or staff may coordinate with the floodplain manager if needed. The package provides detailed instructions on how to complete the determination, including where to find building values and detailed instructions on what expenses count toward project costs. The County strongly encourages property owners to solicit professional design or construction support services to assist in completing the package.

In a post-disaster environment, a screening is conducted during the initial damage assessment to flag buildings that appear to be substantially damaged. A list is developed to estimate the number of potentially substantially damaged buildings in the FEMA SFHA and the floodplain manager coordinates with Building Services staff to ensure compliance is met via the permitting process. Building Services currently completes substantial damage determinations in house. Consultant support may be considered in the future based on the magnitude of an event. The Cities of Tampa, Plant City and Temple Terrace follow similar substantial improvement/damage procedures.

Hillsborough County has a 12-month cumulative substantial improvement/damage rule, meaning any improvements or repairs that were made in the 12-month period preceding the permit application must be counted in the cost side of the equation.

Community Rating System

The NFIP's Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result of points accumulated for approved CRS activities, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

- Reduce and avoid flood damage to insurable property

- Strengthen and support the insurance aspects of the NFIP
- Foster comprehensive floodplain management

Hillsborough County, and the Cities of Tampa and Temple Terrace are part of the CRS. Participation is explained in detail in **Section 3 – Capability Assessment**.

Sea Level Rise

Hillsborough County is vulnerable to sea level rise, given its extensive shoreline and low elevation. If sea levels rise, several consequences could be observed, including the salinization of freshwater sources, land loss, and increases in storms and flooding. Rising sea level affects surface water and groundwater salinity through saltwater intrusion. Shallow coastal aquifers, such as those in Hillsborough County, are at risk of this saltwater intrusion process.

As sea levels rise, water inundates and erodes coastal wetland ecosystems such as mangroves and salt marshes. Higher water levels wash away wetlands and flood previously dry land. These coastal wetland ecosystems are crucial to absorbing the impact of tropical storms and provide a breeding ground for a significant proportion of sea life. Sea level rise would increase the vulnerability of coastal areas to flooding during storms. During a tropical storm or hurricane, storm surges build up on top of a higher base of water, resulting in more significant damages.

Additionally, shore erosion increases storm vulnerability by removing the dunes and beaches that otherwise provide a buffer between coastal property and storm waves and surge. Lastly, sea level rise would result in an increase in coastal flooding from rainstorms because low areas drain more slowly as sea levels rise.

The Hillsborough County Vulnerability Assessment (VA), currently under development, concludes that given projections for more frequent and intense extreme rainfall events coupled with forecasts for increasing urbanization (exacerbating runoff), events that exceed the current 100-year floodplain will occur, on average, with greater frequency (i.e., the average annual probability of exceedance will be greater than 1%). Due to these increasing flood risks, preparing and planning for future conditions is important when designing flood mitigation strategies. When completed later this year, the Hillsborough County VA, being developed by the University of South Florida (USF), will provide an in-depth discussion of the effects of climate change on flooding and sea level rise for the 2050 and 2080 planning horizons. This will include extensive mapping and analysis of impacts to affected areas and critical assets. This plan previews some of the preliminary findings.

Geographic Areas Affected by Flood

Like much of the Florida coast, Hillsborough County is particularly susceptible to flooding due to the large amounts of coastline, significant drainage systems, and relatively low elevations. Areas along waterways, including lakes, rivers, streams and wetlands, are particularly susceptible to flooding due to heavy storms and rain or storm surge.

A geographic assessment of the flooding hazard in Hillsborough County is depicted below using FEMA FIRM floodplain data. It outlines the areas in the 100-year and the 500-year floodplains, with 1% annual probability and 0.2% probability of floods, respectively.

Below, in Figure 5.9, 100-year floodplain (including VE zones subject to additional hazards due to storm-induced velocity wave action) and the 500-year floodplain are shown. The 500-year floodplain includes the areas shown in a lighter blue shade.

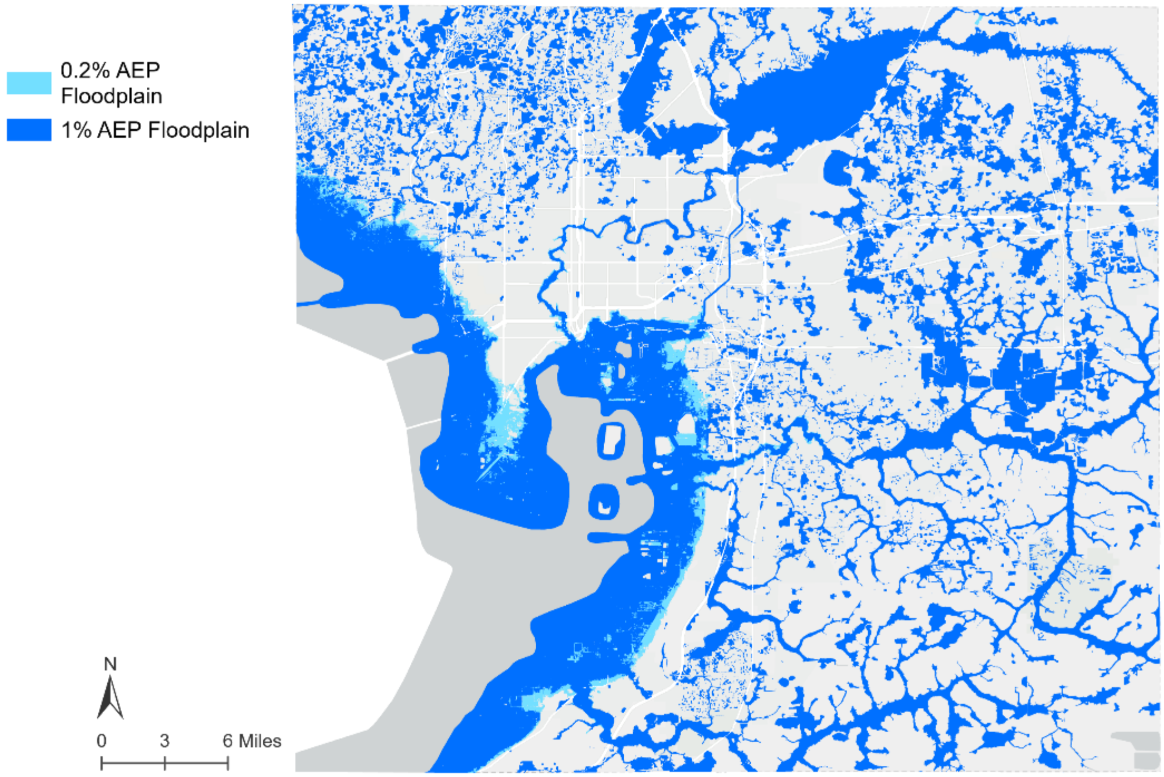


Figure 5.9. 1% AEP and 0.2% AEP Floodplains in Hillsborough County[24]

Businesses and structures in downtown Tampa are vulnerable to flooding due to their location on the bay. Many major businesses located in coastal areas are susceptible to flooding, including the Port Tampa Bay, Tampa International Airport (TIA), Tampa General Hospital, the Westshore business district, and retail stores and restaurants along these waterways and coastal areas of Hillsborough County. New areas of development include Water Street, Sparkman Warf, and the Downtown Tampa Riverwalk, along with other large areas of development in Westshore are at risk of the effects of coastal flooding.

Sea Level Rise (SLR)

Figure 5.10 through Figure 5.15 below show delineations of the geographic areas vulnerable to potential sea level rise for the 2050 and 2080 SLR planning horizons. Intermediate Low, Intermediate, and High sea level rise scenarios were used to show projected exposure for the 2050 and 2080 planning horizons. These maps show “sunny day” sea level rise scenarios and do not include storm surge.

[24] https://www.fema.gov/flood-maps/national-flood-hazard-layer

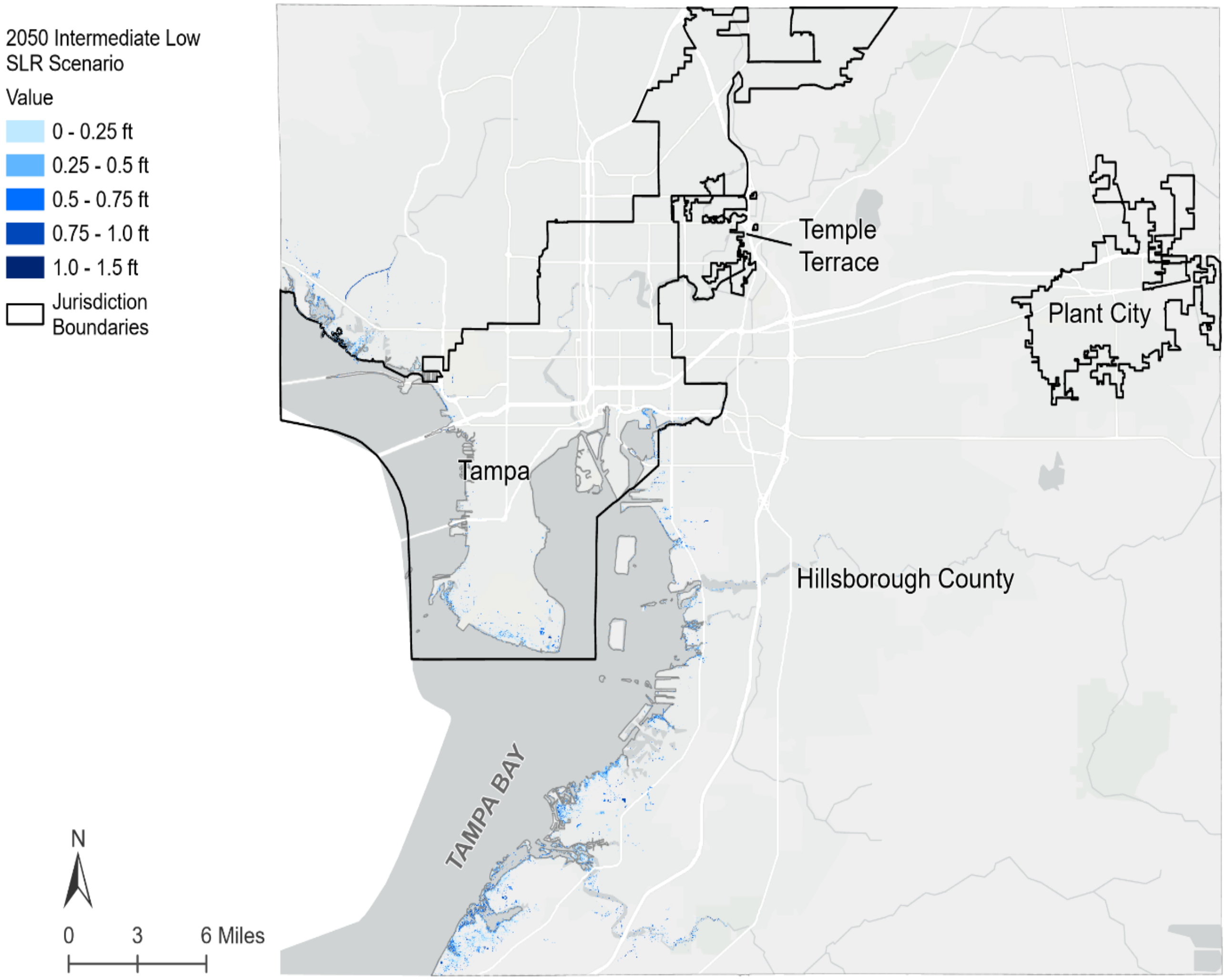


Figure 5.10. 2050 Intermediate Low SLR Scenario

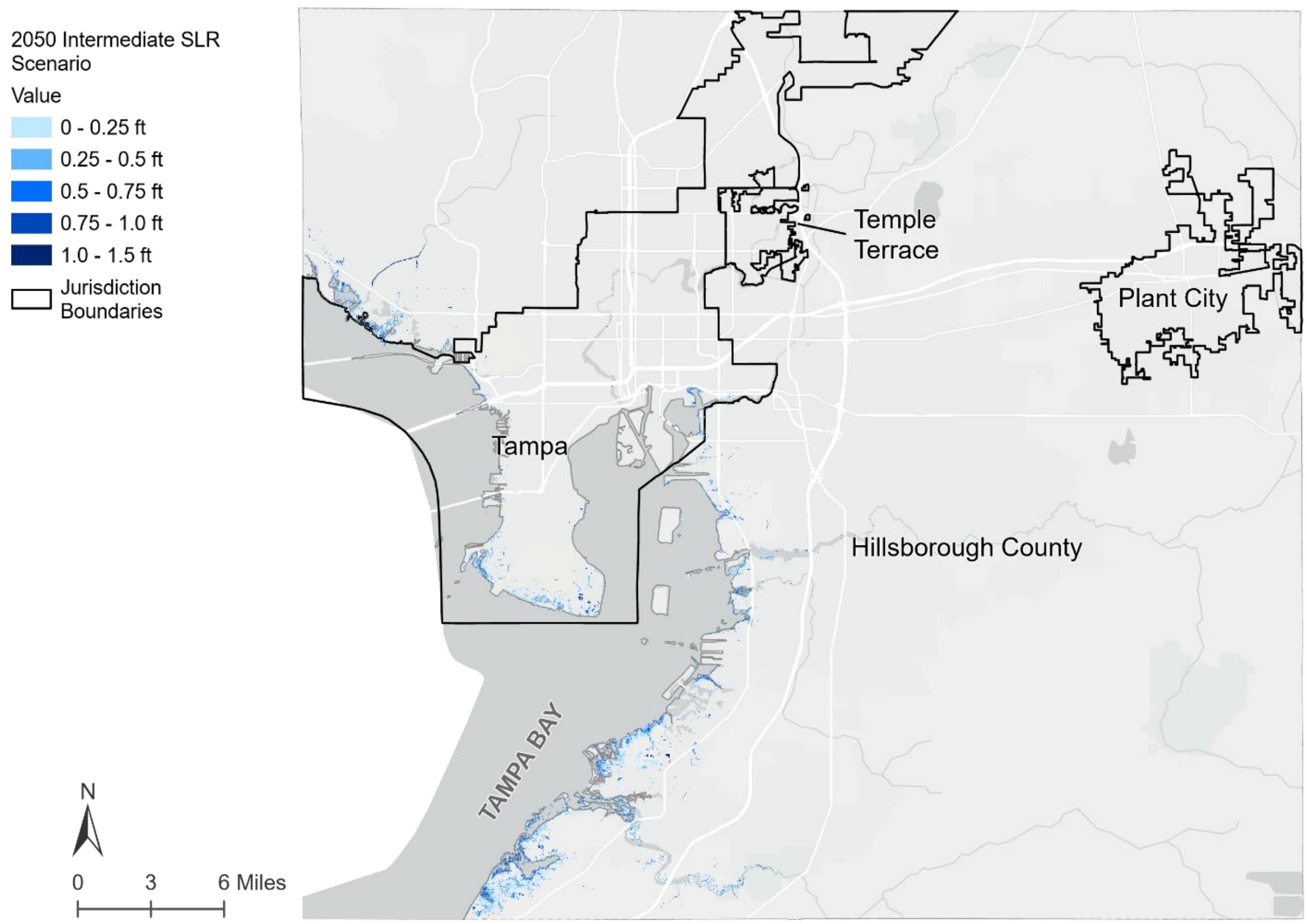


Figure 5.11. Intermediate 2050 SLR Scenario

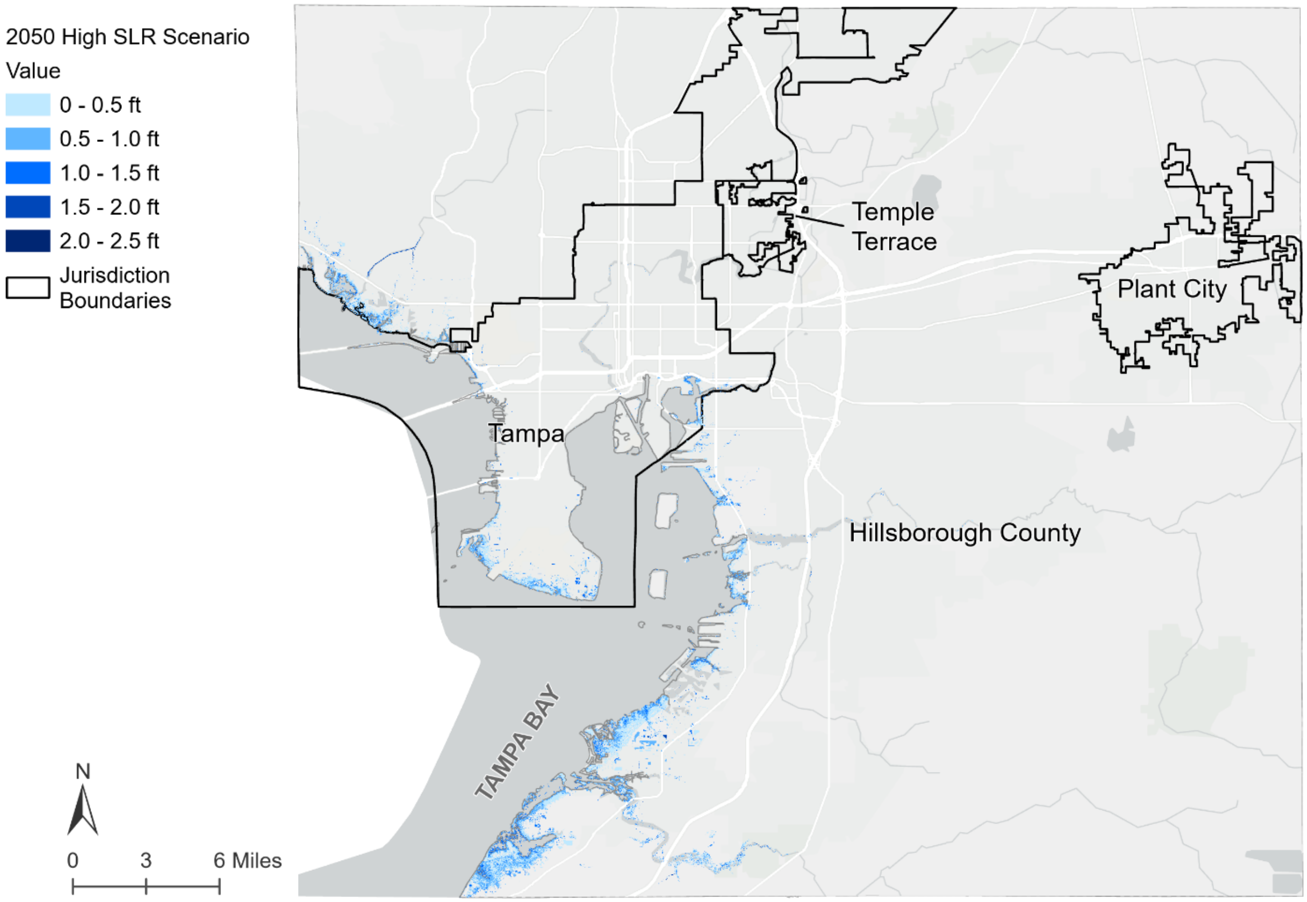


Figure 5.12. High 2050 SLR Scenario

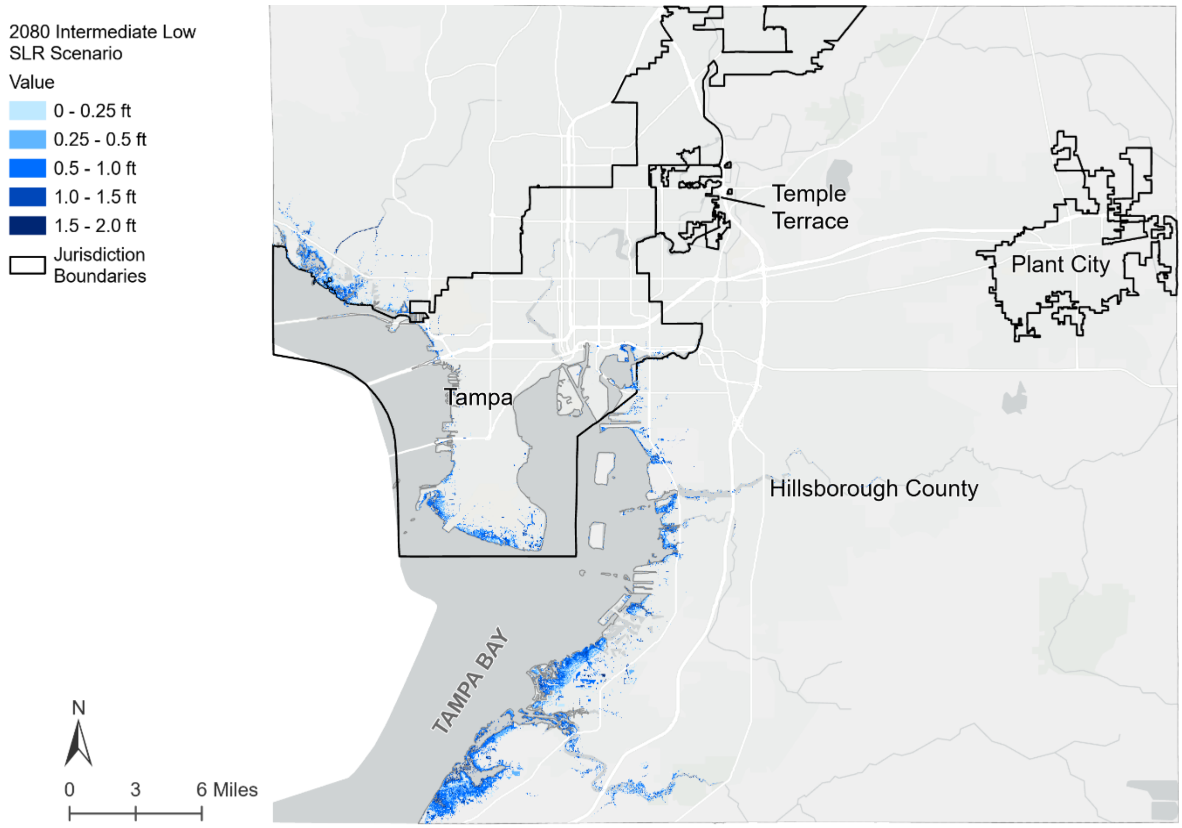


Figure 5.13. Intermediate Low 2080 SLR Scenario

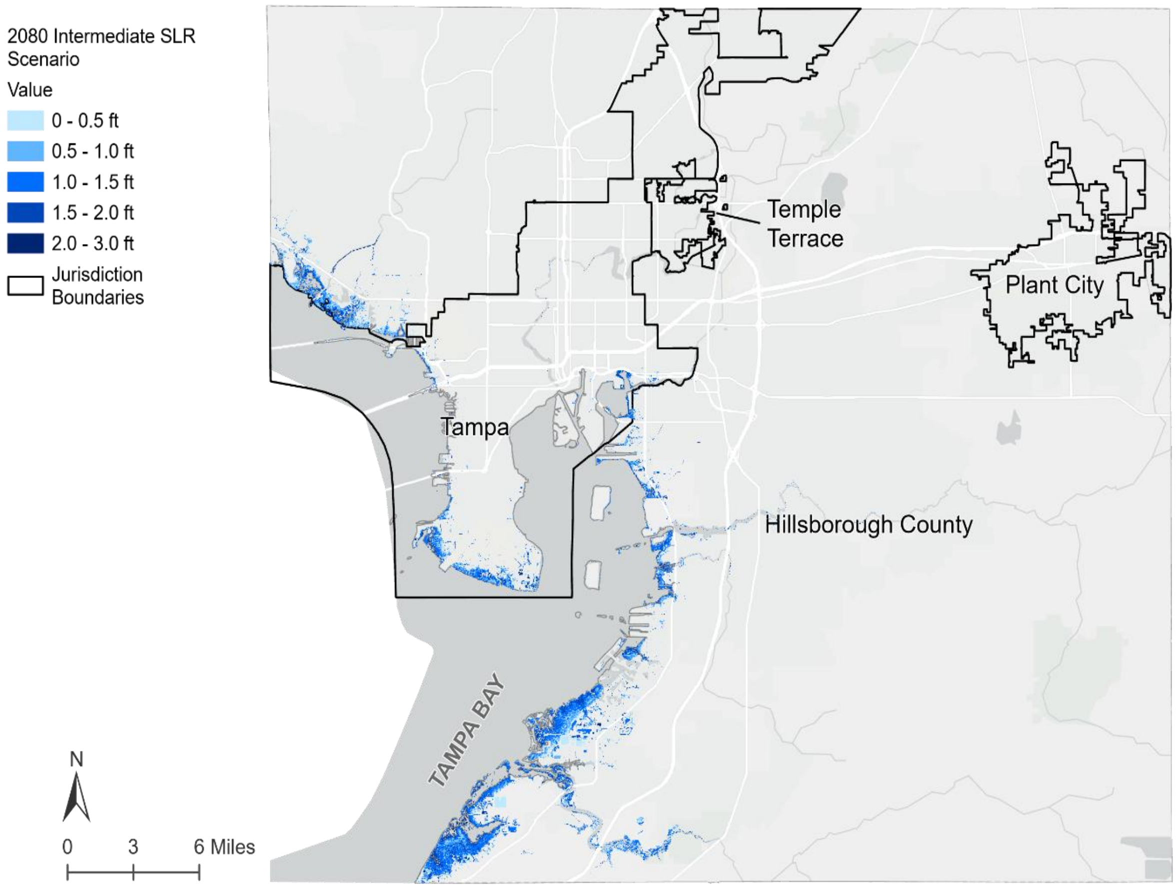


Figure 5.14. Intermediate 2080 SLR Scenario

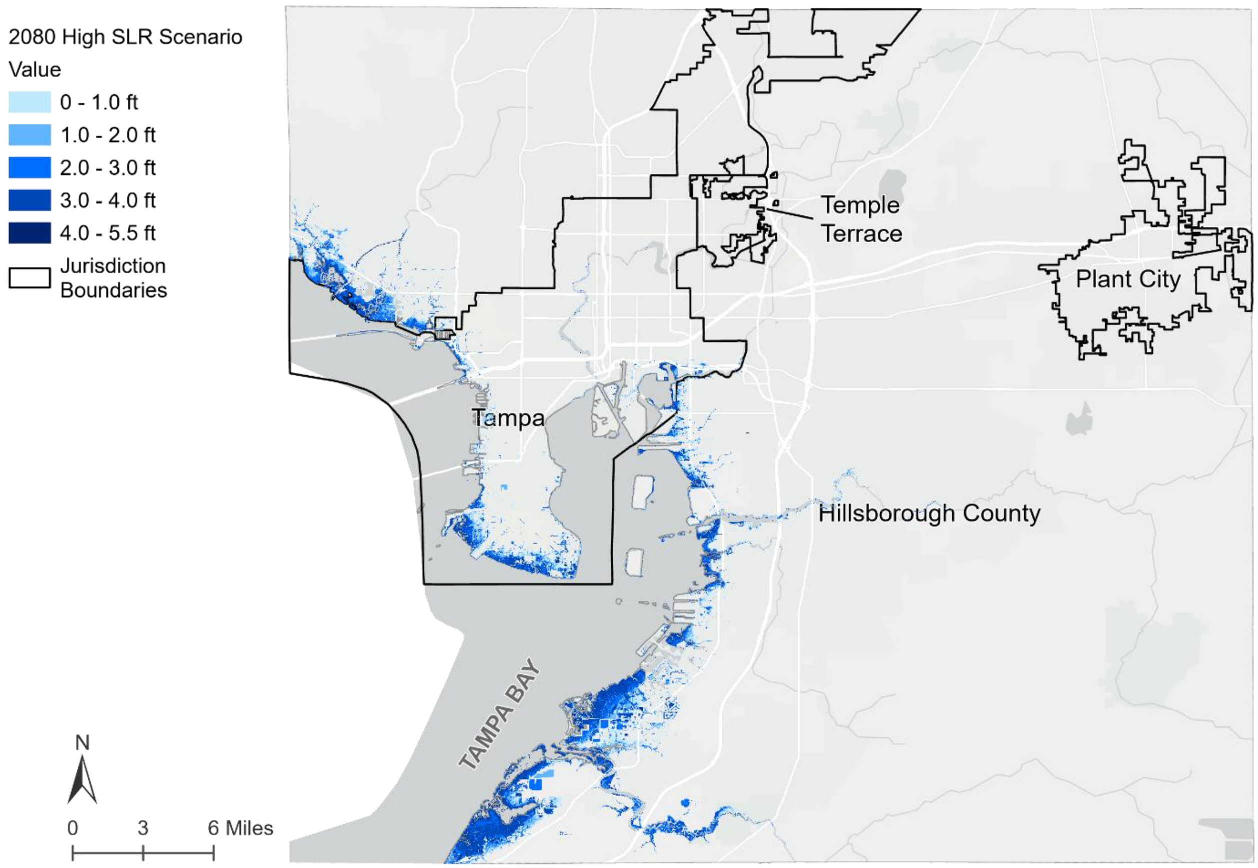


Figure 5.15. High 2080 SLR Scenario

Historical Occurrences of Flood

Inland and Coastal Flooding

Historically, floods have been a factor in over 80% of all Presidential-declared disasters in the nation.[25] The National Strategy for reducing flood damages has evolved from relying almost solely on structural flood control projects to a more comprehensive approach emphasizing non-structural measures such as local land-use planning and zoning, building codes, use of green infrastructure, and acquisition or relocation of flood-prone buildings.

Due to its unique geographical location and configuration, Florida is prone to flooding. Hillsborough County experienced excessive flooding in September 1988 when I-4 near Plant City was cut off for several days and numerous residences in the county were flooded. Rainfall caused by the El Nino weather system caused extensive flooding throughout the county over an extended period from late 1997 through the spring of 1998. In addition, substantial flooding was caused by Hurricane Frances and Jeanne in 2004. Most recently in the summer of 2024, Hurricanes Helene and Milton caused extensive flooding throughout Hillsborough County.

[25] http://nesec.org/flood/

Localized flooding from strong thunderstorms is quite common during the summer rainy seasons and occurs annually.

Hillsborough County has experienced a number of damaging flood events in recent history. Below in Table 5.20 the most significant flood events in recent history are highlighted.

Table 5.20. Significant Flood Occurrences in Hillsborough County [26]

Date	Information
September 6th, 2004	Widespread heavy rain associated with Hurricane Frances across west central Florida led to record flooding on many of the rivers. In Hillsborough County, the Hillsborough County River at Morris Bridge (flood Stage 32 feet) reached its all-time high of 34.38 feet on the 8th, the Alafia River at Lithia (flood stage 13 feet) reached the 5th highest stage at 22.33 feet on the 7th, and the Little Manatee River at Wimauma (flood stage 11 feet) reach 17.09 feet on the 7th.
September 26th, 2004	Widespread heavy rain combined with saturated ground and swollen rivers to cause river flooding across west central Florida and lead to record flooding on one of those rivers. In Hillsborough County, the Alafia River at Lithia (flood stage 13 feet) reached 19.19 feet on the 28th, and the Little Manatee River at Wimauma (flood stage 11 feet) reach 14.60 feet on the 28th.
October 1st, 2004	Widespread heavy rain from the hurricanes in September combined with saturated ground and swollen rivers continued to cause river flooding across west central Florida. In H.C., the Alafia River at Lithia reached 19.19 feet on September 28th and fell below flood stage on October 3rd. The Little Manatee River at Wimauma reach 14.60 feet on September 28th and fell below flood stage on October 1st.
February 3rd, 2006	The combination of tropical moisture flowing into a line of thunderstorms and an approaching upper-level disturbance allowed a train of intense thunderstorms to repeatedly cross over parts of the Tampa Bay area. Between 8 and more than 11 inches of rain fell in roughly a five-hour period in a five-mile-wide stripe extending from Madeira Beach northeast through Pinellas Park, then across Old Tampa Bay to west Tampa, including Tampa International Airport. The area of heaviest rain was so concentrated that downtown St. Petersburg, less than 10 miles away, recorded less than an inch of rain during the same period. The torrential rains caused flash flooding in the areas where more than 8 inches fell. The flash flooding prompted the mayor of St. Petersburg to term the event a "hundred-year flood". In Lealman, an entire mobile home community was evacuated, and at least 60 of the homes were flooded. A partial roof collapse was reported at a big box store in St. Petersburg. Water pouring into the store washed out several cash register stands and injured one employee as they were washed into the parking lot. Another roof collapsed at Treasure Island. Hundreds of vehicles were stranded by the flood waters. Hillsborough County Rain Reports: Tampa International Airport: 8.24 inches, Citrus

[26] https://www.weather.gov/tbw/tbwweatherevents_tabs#pre2010

Date	Information
	Park: 6.90 inches, Thonotosassa: 4.35 inches
September 1st, 2009	A trough of low pressure was dissipating across the area with high pressure ridging across southern Florida. This kept west to southwest winds in place across the local area and allowed for numerous thunderstorms with heavy rains and a tornado. The river stage on the Little Manatee River near Wimauma reached 14.15 feet during the evening of July 2nd. Flood stage is 11 feet. The flooding was a result of two days of heavy rain. The total rainfall at the National Weather Service in Ruskin from June 30th through July 1st was 4.53 inches. Fire Rescue reported Owens Road was washed away in the area of the river and numerous roads were inaccessible due to flooding. The damage amount listed is a rough estimate of the road damage.
August 6th, 2012	Deep layer moisture allowed sea breeze thunderstorms to develop over west central and southwest Florida, dumping heavy rain with minor flooding. One of these storms produced severe hail. Broadcast media reported roads closed due to flooding near Linebaugh Avenue and Nebraska Avenue. Additionally, one or two inches of water flooded some ground floor units at the Richmond Hill Apartment Complex at the same intersection. Road closures also occurred at 113th Avenue and 15th Street intersection due to a foot of standing water. Near Florida Avenue and Busch Boulevard at the Floriland Business Center, around 30 cars were stuck in standing water from the heavy rain.
May 2nd, 2014	A nearly stationary cold front helped generate a squall line that dumped heavy rain over much of West Central Florida. In part of Hillsborough County, training storms produced 6-10 inches of rain, leading to flash flooding. Long durations of heavy rain fell over northern Tampa and the surrounding areas, with radar storm total precipitation estimates of 6-10 inches being confirmed by mesonet rain gauges in the area. Water levels rose quickly in the areas of heaviest rain, shutting down roads, stranding cars, and entering houses. Hillsborough County's Office of Emergency Management reported water entering a house near 56th Street and Fowler Avenue, significant flooding on Fowler Avenue between North 50th and North 56th Streets blocking the entrance to USF, general flooding on North 22nd Street between Busch Boulevard and Fowler Avenue, and flooding at Bougainvillea Avenue and North 30th Street.
September 28th, 2014	A stalled frontal boundary produced localized areas of heavy rain which caused minor flooding in low-lying areas as well as along some area rivers. Flooding of several manufactured homes begins on 32nd and 33rd street in Ruskin when the gauge on the Little Manatee River at Wimauma reaches 14.5 feet. Moderate flooding continued until October 3rd and the maximum crest was 14.67 ft. About 10 other homes were cutoff as roads were inundated. This area floods one to five times a year and residents move vehicles and other valuables out of the area when flooding is expected.
October 1st, 2014	Heavy rains from a stalled frontal boundary in late September caused moderate flooding along the Little Manatee River near Wimauma from

Date	Information
	September 28th until October 3rd. Flooding of several manufactured homes begins on 32nd and 3rd street in Ruskin when the gauge on the Little Manatee River at Wimauma reaches 14.5 feet. The maximum crest was 14.67 ft. About 10 other homes were cutoff as roads were inundated. This area floods one to five times a year and residents move vehicles and other valuables out of the area when flooding is expected. Damage of $30,000 was reported in September as moderate flooding began on the 28th.
June 10th, 2015	Heavy rain across the area lead to several inches of water with multiple sites reported over 6 inches of rain from the storm. Hillsborough County Sheriff's Office reported flooding on Hanna Avenue at 56th Street, with several stalled vehicles on the roadway. Trained spotters reported cars floating down the road near the intersection of Ferdinand Avenue and Tacon Street in Palma Ceia, and on MacDill Air Force Base it was estimated that approximately 90 percent of the roads were flooded. The Florida Department of Emergency Management (FDEM) reported that heavy rain and flooding closed the bridge to Davis Island. As a result, Tampa General Hospital (TGH) was on bypass for over an hour due to the fact that emergency vehicles could not get to or from the hospital. Damage was roughly estimated to be $200,000, mostly from flooded cars.
August 1st, 2015	Multiple days of heavy rain caused widespread road closures across the Tampa area. Dozens of roads were flooded including the major thoroughfares of Armenia Avenue, Dale Mabry Highway, Gandy Boulevard, Westshore Boulevard, Veteran's Expressway, U.S. 41, and State Road 60. The flooding resulted in 117 road cave-ins across Tampa, 99 homes and 66 businesses were impacted by the flooding, and 9 City of Tampa vehicles were damaged. Additionally, a large tree was uprooted due to the saturated ground and fell on a car just west of Bayshore Boulevard on South Gandy Boulevard. Further north across parts of Temple Terrace, including the University of South Florida (USF), there was additional damage from flooding. USF sustained $137K in damages while 101 homes in the Temple Terrace were impacted, 88 homes and 7 mobile homes sustained major damage. 

Date	Information
	The scene following 08/01/15 flooding event at the Westshore Blvd. exit on I-275, Photo courtesy of WFLA Channel 8
August 27th, 2017	Heavy rain fell across southern Hillsborough County on the 27th and continued into the 28th. Six to nine inches of rain were reported over 48 hours, with the highest totals in and around Apollo Beach. Hillsborough County's Office of Emergency Management reported several homes and cars were inundated by flood water in Apollo Beach on the evening of the 27th. Four people needed to be rescued from flooded vehicles on Gulf and Sea Boulevard.
September 10-12, 2017	Heavy rains from Hurricane Irma caused the Little Manatee River at Wimauma to rise above flood stage on the 10th, with flooding continuing through the 16th. The water level crested at 17.69 feet on the 12th, 0.69 feet above the major flooding threshold. The flood waters entered several mobile homes on 32nd and 33rd streets in Ruskin. Flood damage to homes was estimated at $2 million. In coastal portions of Hillsborough County, the highest winds reported from Hurricane Irma was a gust to 79 knots at the WeatherFlow station XEGM at Egmont Key. Rainfall was generally around 5 inches or greater, with the highest rain total being 16.18 inches at the CWOP site D3252 in Tampa. The wind resulted in damage to numerous homes, as well as knocking over trees and power lines. Hillsborough County's Office of Emergency Management reported that 41 homes or businesses were destroyed, 130 sustained major damage, 166 had minor damage, and an additional 93 were affected by hurricane Irma throughout Hillsborough County. The track of Irma resulted in a much stronger negative surge north of the eye, causing extremely low water levels. A couple of manatees got beached in the mud, and there was a lot of media coverage showing people walking out into the dry part of the bay to rescue them. No significant damage was reported from either the negative surge or the weak positive surge. The total damage from Irma in Hillsborough County was estimated at $19.95 million, including $17.86 million in individual assistance claims and $2.09 million in public assistance claims, of which, $7 million was estimated to be caused by wind damage in coastal portions of Hillsborough County. Three indirect fatalities were reported in Hillsborough County from Hurricane Irma. A 55-year-old man in Town N' Country was trimming a damaged tree with a chainsaw when a branch fell on the chainsaw, causing it to kick upward and strike him in the neck. A 60-year-old man fell from a ladder in Tampa while cutting branches and died on the 14th. A 61-year-old man also died on the 14th while cleaning up yard debris when a branch knocked the ladder out from under him, causing him to fall to the ground. In inland portions of Hillsborough County, winds from Hurricane Irma were estimated to be around 60-70 knots based on surrounding observations. Rainfall was generally around 6 inches or greater, with the highest rain total 7.62 inches at the COOP site PLCF1 in Plant City. The wind resulted in damage to numerous homes, as well as knocking over trees and power lines. Hillsborough County's Office of

Date	Information
	Emergency Management reported that 41 homes or businesses were destroyed, 130 sustained major damage, 166 had minor damage, and an additional 93 were affected by Hurricane Irma throughout Hillsborough County. Heavy rains across the area also resulted in widespread river flooding, with rising water levels damaging houses on the Hillsborough River, the Alafia River, and the Little Manatee River in Hillsborough County. The total damage from Irma in Hillsborough County was estimated at $19.95 million, including $17.86 million in individual assistance claims and $2.09 million in public assistance claims, of which, $6.95 million was estimated to be caused by wind damage in inland portions of Hillsborough County. Additionally, crop damage to citrus plants in Hillsborough County was roughly estimated at $28.5 million.
May 17th, 2018	Heavy rain fell in northeastern Hillsborough County, with some sites reporting over 7 inches of rain. This led to street flooding along Highway 60 near Plant City, resulting in two vehicles ending up in the ditch and becoming partially submerged. Broadcast media relayed pictures of two vehicles in a flooded ditch along Highway 60 south of Plant City. The water was up to the hood of both cars. Nearby rain gauges reported as much as 7 inches of rain.  *Photo courtesy of the Tampa Police Department (TPD).*
October 13, 2020	Hurricane Eta produced street flooding and road closures across coastal Hillsborough County. During Hurricane Eta, more than 8 inches of rain with a maximum of 10.64 inches near Sun City Center occurred in Hillsborough County.
October 2, 2022	Hurricane Ian impacted Hillsborough County with water levels peaking around 18.4 feet in the Alafia River. Nearby homes were surrounded with water, stranding residents over the weekend.
August 31, 2023	Hurricane Idalia caused serious flooding in the Tampa Bay region. Storm surge swamped neighborhoods and busy roads, triggering shutdowns of some bridges between Tampa and the St. Petersburg area. Access to

Date	Information
	barrier islands was temporarily shut off and several dozen people had to be rescued from flooded homes. 
December 17, 2023	Up to 5 inches of flooding occurred in Hillsborough and Pinellas County on December 17, 2023, almost as much flood water in homes as seen during Hurricane Idalia. Many business owners were impacted by the floods as well, as the flood event was an unexpected occurrence.
September 26, 2024	Hurricane Helene, which made landfall in the Big Bend area of Florida as a powerful Category 4 storm, brought widespread storm surge and heavy rainfall, particularly affecting coastal and low-lying areas of the Tampa Bay Area. The storm caused extensive flooding and infrastructure damage, underscoring the need for updated floodplain management and mitigation strategies in vulnerable communities.
October 5, 2024	Hurricane Milton, which made landfall in Manatee County as a strong Category 3 storm, posed unique challenges due to its erratic path and wind-driven impacts. While it did not cause the catastrophic flooding seen with Helene, Milton resulted in extensive wind damage to residential and commercial properties, as well as prolonged power outages across the region. Both storms tested Hillsborough County's emergency response capacity and highlighted the growing importance of resiliency planning to address climate-related hazards. As these storms demonstrate, the frequency and intensity of tropical systems in our area are increasing, requiring continued investment in hazard mitigation, infrastructure improvements, and community outreach to reduce future risk.

Additionally, several FEMA major disaster declarations in Hillsborough County are specifically related to flooding events, shown in Table 5.21. Please note that some of these events are also listed under Severe Storms and Tornadoes. Also, some events are categorized by FEMA as tropical storms or hurricanes and not flooding, even though the event may have caused significant flooding.

Table 5.21. FEMA Major Disaster Declarations in Hillsborough County, Flood, 1953-2024[27]

Disaster Number	Date	Name/Description
DR-586	May 15th, 1979	Severe Storms, Tornadoes, Flooding
DR-607	September 29th, 1979	Severe Storms, Flooding
DR-966	October 3–4, 1992	Severe Storms, Tornadoes, Flooding
DR-982	March 12–16, 1993	Tornadoes, Flooding, High Winds and Tides, Freezing
DR-1195	December 25th, 1997–April 24th, 1998	Severe Storms, High Winds, Tornadoes, Flooding
DR-4709	April 12, 2023-April 14, 2023	Severe Storms, Tornadoes, Flooding
DR-4828	September 23 – October 7, 2024	Hurricane Helene
DR-4834	October 5 – November 2, 2024	Hurricane Milton

According to the NCEI Storm Events Database, there were 81 flood reports in Hillsborough County from 1996 to 2023.[28] These flood events, shown in Table 5.22, are only inclusive of those reported by NCEI from 1996 through November 2023. It is likely that additional events have affected Hillsborough County. As additional local data becomes available, this hazard profile will be amended.

Table 5.22. Summary of Flood Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Crop Damage (2023)*	Annualized Property Loss	Annualized Crop Loss
City of Plant City	4	1	1	$10,180,465	$951	$377,054	$35
City of Tampa	44	0	0	$16,698,690	$0	$618,470	$0
City of Temple Terrace	0	0	0	$0	$0	$0	$0
Unincorporated	33	0	0	$13,244,403	$757,865	$490,533	$28,069
HILLSBOROUGH COUNTY TOTAL	81	1	1	$40,123,558	$758,816	$1,486,058	$28,104
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023 dollar values were calculated based on buying power in December 2023.							

27 www.fema.gov/api/open/v1/DisasterDeclarationsSummaries.csv
28 https://www.ncdc.noaa.gov/stormevents/

Probability of Future Flood

Based on history and knowledge, it is likely that Hillsborough County will continue to experience flooding events, on some scale, annually.

Figure 5.9, in the Geographic Areas Affected by Flood section above, shows the areas with a 1% annual probability of a flood, or the 100-year flood, and the areas with a 0.2% chance and annually probability of a flood, or the 500-year flood. Flash flooding or drainage flooding can happen almost anywhere in the County and its cities.

Figure 5.16, below, depicts the flash flood risk in Florida. Though the potential of flash floods is difficult to predict.

In 2003, NOAA experts developed the Flash Flood Potential Index (FFPI), which used the following equation where M represents Slope, L refers to Land Cover or Use, S represents Soil Type or Texture, and V equals the Vegetation Cover or Forest Density:

FFPI = (M+L+S+V)/N

Since 2003, this equation has been refined into four scenarios to represent specific areas and conditions accurately. For the figure below, the equation used is referred to as Model 4:

FFPI = (2*M+S+2*LV)/5

More information about the FFPI can be found here: **Error! Hyperlink reference not valid.**https://www.cbrfc.noaa.gov/papers/ffp_wpap.pdf.

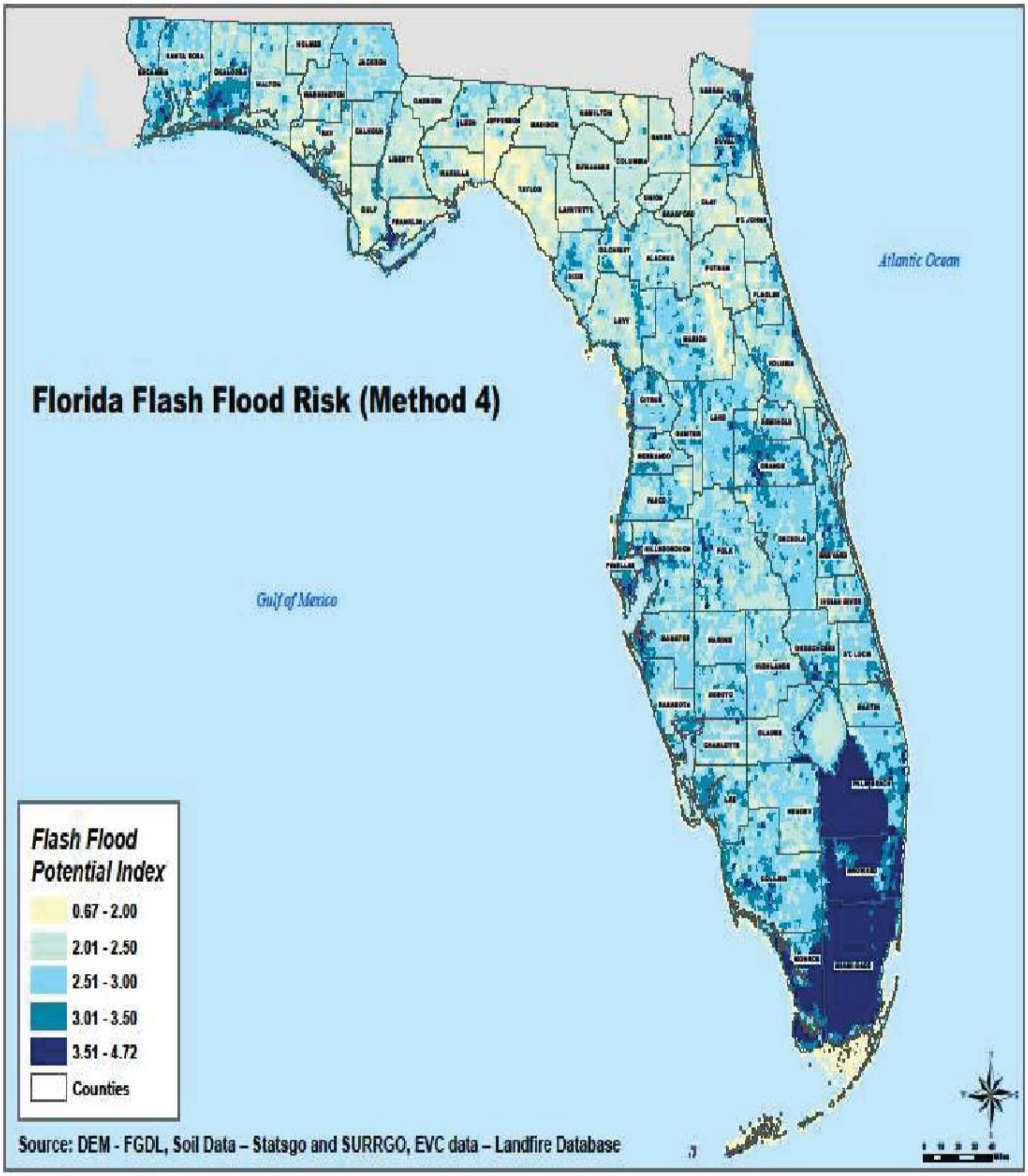


Figure 5.16. Florida Flash Flood Risk

This map shows that many areas in Hillsborough County have a flash flood potential that ranges between 2.01 and 4.72.

Flooding varies within the county. Based on the preceding table, the Tampa-Hillsborough area may have a major flood event once a year on average. It has been determined that structures within the

100-year flood elevation have a 26% chance of flooding in any given year.[29] The actual risk of flooding varies depending on the height of the "finished floor" elevation. Because of the varied construction dates and types within the county, some structures flood at a two-year interval (a severe flooding problem).

Through detailed hydrodynamic computer modeling, the Hillsborough County Stormwater Management Program has identified flood risk areas throughout the seventeen County watersheds for storm events associated with return periods from mean annual to 100 years. Return periods translate directly into the probability of occurrence. At each location, the watershed models can provide the expected flow and water surface elevation associated with each event. The determination of projected flood depth varies with the county's location and type of flooding. This is based on the three distinctive types of flooding that can occur, including coastal, riverine, and inland flooding.

Potential Effects of Climate Change on Flooding

Climate-driven long-term trends of rising sea levels, increasing storm intensity, and consequent severe compound flooding are degrading coastal ecosystems and threatening residents living in coastal and riverine areas.

Inland and Riverine Flooding

A warmer atmosphere holds more water vapor and, therefore, can result in heavier and longer-lasting rainfall events. A possible global pattern is for arid areas to become drier and humid areas to become wetter. Strong storms are expected to become stronger where precipitation is enhanced because rainfall events with a given recurrence frequency, e.g., the 25-year storm, will happen more often.

Coastal Flooding

A warmer atmosphere may influence three drivers of coastal flooding: rainfall intensity and frequency, storm surge intensity, and sea level. Rising sea levels would raise the base for coastal floods and storm surge, resulting in greater flood depths within existing flood hazard zones, landward expansion of coastal and tidal rivers, and stream floodplains and storm surge zones in areas with relatively flat topography. The relationship between a given increase in sea level and the resulting expansion of a coastal flood hazard or storm surge zone depends on the slope of local coastal topography as well as the type of geologic substrate (sand, clay, gravel, rock, etc.), and the presence and type of vegetation. The boundaries of coastal flood zones will expand more rapidly as the rate of sea level rise increases.

If the frequency of higher-intensity tropical cyclones increases, coastal communities (see the *Tropical Cyclone Hazard Profile*) will experience the storm surge flooding associated with those stronger storms more often (category 4 and 5 hurricanes). However, storm surge height is not solely determined by hurricane intensity. It also is a function of the storm's size and speed, the coast's geometry and bathymetry, and the process by which the storm develops prior to landfall.[27] The

[29] https://www.fema.gov/pdf/floodplain/nfip_sg_unit_3.pdf

effects of climate change on tropical storm size (radius of maximum wind and outer radius) have not yet been studied thoroughly.

Probability Based on Historical Occurrences

When considering reported flood events over the 27-year period of history from NCEI Storm Event Database, the probability of flooding from all sources is approximately 300% in any given year, or three occurrences per year at any given location in the County (Table 5.23).

Table 5.23. NCEI Flood Reports 1996–2023[30]

Type of Flood	NCEI Reports	Average per Year
Flash Flood	10	0.4
Flood	71	2.6
TOTAL	**81**	**3.0**

Flood Impact Analysis

All communities in Hillsborough County could receive the following impacts due to flooding. Variable climate impacts are likely to worsen exposure for coastal communities, but more frequent, higher-volume precipitation events could also impact inland communities.

- Public
    - Injury/death
        - Car accidents because of flood waters, high winds, panic, traffic jams because of evacuations, no power after storm
        - Not receiving emergency response during storm –emergency medical services
        - Drowning in flood waters
        - Vehicle accidents
        - Exposure to hazardous materials
        - Illness from contaminated water
    - Traffic
        - Panic to due to evacuation.
        - Accidents from driving through flooded roads –car washed away, water deeper than expected
    - Damage to property
        - Issues with damage to uninsured property
        - Mold damage causing the need for expensive mold remediation actions
        - Cost to replace damaged and destroyed items, such as furniture, flooring, etc.
        - Cost and labor to repair damaged homes and other structures to make the house inhabitable
        - If the property was uninsured, the cost falls upon the property owner

[30] https://www.ncdc.noaa.gov/stormevents/

        - Hotel room fees or having to live in a shelter until damage is repaired or the home is replaced
        - Damaged or washed-away vehicles
- Responders
    - Injury/death
    - Responding during flooding, traversing flooded roads
    - Drowning
    - Dangerous rescue missions from roofs, unstable buildings, stranded cars
    - Exposure to hazardous materials or wastewater
    - Power outage dangers, such as being electrocuted by live downed wires
- Continuity of Operations (including continued delivery of services)
    - Floodwaters may damage buildings, electrical systems, paperwork, etc., making continued operations difficult or impossible
    - Floodwaters may hinder access to buildings (roads or sidewalks), preventing employees and the public from entering a building
- Property, Facilities, Infrastructure
    - Property damage
        - Floodwaters can damage property or carry heavy debris that could cause damage
    - Infrastructure damage
        - If water overwhelms the drainage systems, it can backup and cause damage to
    - Drains or even result in wastewater release
    - Cost of repairing damage to property such as buildings
    - Cost of replacing items damaged, such as furniture on the first floor of a flooded home
    - Crop damage or loss
    - Damage to transportation infrastructure, like a road being washed out or a bridge collapsing, and/or closure of major transportation networks
    - Inability to control wastewater
    - Release of hazardous materials
- Environment
    - Release of hazardous materials or wastewater could damage the environment
    - Damage to habitat for plants and animals
    - Inundation of agricultural areas could destroy crops
    - Event-generated debris impacting waterway navigation and submerged wetland habitats
    - Eroded river banks
    - Loss or damage to habitat for animals because of flooding
    - Crop damage or loss
- Economic Condition
    - Damaged and destroyed businesses leading to long-term closures and possibly permanent closures
    - Delayed re-opening of businesses because of utility issues, road blockages, etc.

  - Crop damage or loss from flooding leads to a decline in agricultural revenues
- Public Confidence in Each Jurisdiction's Governance
  - If floodwaters do not recede quickly, it appears as though the water utilities and government are not able to manage water properly, which calls into question the capability of the government
  - If public or government offices must close because of restricted access due to floodwaters, people may think the government is not able to handle emergency events and lose confidence in their capabilities

Impact Summary

All of Hillsborough County is susceptible to flooding. However, key geographic areas are particularly susceptible to flooding, including low-lying areas, neighborhoods near water and downstream from dams, dry creek beds, drainage ditches, and urban areas lacking impervious surfaces. Coastal communities across Hillsborough County are increasingly at risk from compound flooding, water quality degradation, water-borne pathogens, coastal erosion, and ecosystem loss.

Impact to the Built Environment

The entire built environment may be vulnerable to flooding events, including coastal, flash flooding, and inland flooding due to increased rainfall-induced flooding and/or storm surge. Although improvements have and will be made, floods will continue to occur.

In general, the map updates will result in one of the following for property owners in the affected area:

- For properties removed from the high-risk areas, the flood risk is reduced but not removed.
- Properties newly identified to be at high-risk will experience potential changes in insurance requirements and costs and new building requirements.
- Properties in high-risk areas may see their risk increase more.

The amount of flooding should be reduced as drainage improvements are made and homes built prior to the County's implementation of the National Flood Insurance Program (NFIP) are upgraded or removed. For example, drainage infrastructure determines how long contaminated flood waters may linger in neighborhoods and urban areas. Filthy water can contain numerous diseases, snakes, and flesh-eating bacteria.

The entire built environment may be vulnerable to flooding, especially in low-lying, storm surge evacuation zones, areas close to canals and structures built prior to floodplain regulations, have below-grade crawl spaces, and are mobile homes improperly anchored to a foundation. Structures in areas where there has been repetitive losses and no mitigation efforts established may also be at a higher risk of flooding. Areas of concern for repetitive loss in 2050 include Westshore, Davis Island, along the Alafia River, and Bull Frog Creek, with minor issues along the Hillsborough River and TNC. The low-lying areas of Hillsborough County are considered especially vulnerable to flooding. Still, in recent years, heavy development has occurred in many of the County's flood-prone areas and the high population density make these areas even more vulnerable. Keep in mind, past flooding events do not necessarily indicate future flooding problems.

The various types of flooding can impact the built environment differently. For example, flash flooding is especially dangerous to life and property because it is often unexpected and can carry large amounts of debris. Flowing flood waters cause erosion, carry damaging debris, and can even carry away people, cars, and unanchored structures. Flooding that does not subside quickly can cause lasting damage to buildings and pose health concerns to the affected population. Stagnant water leads to mold in buildings and creates an ideal environment where mosquitoes can breed.

Residential Structures

In Hillsborough County, an estimated 97,537 residential structures and 176,088 housing units are located in the floodplain, with 27.58% of these buildings constructed before 1974. Buildings constructed prior to 1974 are Pre-FIRM buildings or buildings built before the effective date of the Flood Insurance Rate Map (FIRM) for a community. This means they were built before detailed flood data and flood elevations were provided to the community and usually before the community enacted comprehensive regulations on floodplain regulation.

Impact to Critical Infrastructure

With inland and coastal flooding, high flood levels along with potential wave action, may destroy sections of bridges and roadways. It is speculated that the Tampa Bay bridges that connect Hillsborough to Pinellas County would be in jeopardy under severe weather conditions.[31] Infrastructure such as bridges and roads that pass over culverts are also susceptible to flood-related damages. Flooded roads can lead to property damage, prevent residents from being able to evacuate, and hinder access to emergency services.

Fire stations, hospitals, schools, and emergency shelters are critical facilities that play a central role in disaster response and recovery. Understanding which facilities are susceptible to flooding and the degree of that exposure can help reduce or eliminate service interruptions and costly redevelopment. There are 28 hospitals in Hillsborough County with a total bed capacity of 4,593 beds and 79 fire stations (27 Tampa Fire Rescue, 47 Hillsborough County Fire Rescue, 3 Plant City Fire Rescue Department, and 2 Temple Terrace Fire Department) in Hillsborough County.[32] Furthermore, there are 289 public schools (32 high schools, 43 middle schools, 139 elementary schools, 11 K-8 schools), 56 charter schools, 63 private schools, and 24 colleges and universities, of which 58 are utilized as emergency shelters during tropical storms to ensure residents that are susceptible to coastal flooding have a safe area to stay on an "as-needed" basis. 20 of these shelters meet all Americans with Disabilities Act (ADA) requirements.

Water control structures help provide flood protection, manage lake water levels, and prevent salt water from flowing up freshwater streams and creeks. Thirty-three of these structures are located across Hillsborough County and are designed to help mitigate and manage flooding.[33]

[31] https://www.jstor.org/stable/4124819?seq=14#metadata_info_tab_contents
[32] https://www.fha.org/FHA/FHA/Data-and-Research/Data-Research.aspx
[33] www.tampabay.wateratlas.usf.edu/upload/documents/water-control-structures-hillsborough-2011.pdf

Wastewater facilities and storage of hazardous materials should be protected from flooding. The spread of waste can exacerbate flood damage and cause additional environmental damage and public health impacts.

Ecological Impacts of Flooding

Flooding causes severe coastal erosion and damage to natural and man-made waterways. Coastal areas and areas along canals and rivers are more vulnerable to storm surge and flash flooding. Saltwater inundation can occur inland through the canals and waterways along the coast, having a far-reaching ecological impact on the flora and fauna inland.[34] As Hillsborough County continues to grow, with a projected population of 2,017,294 by 2050, the factors of flood protection become more complicated.[35] These factors include an increase in the amount of impervious surfaces and loss of natural water storage areas that will then effect new development downstream.

Watershed urbanization involves a change in the natural habitat which is dredged, filled, and paved to support urban development. These changes can potentially exacerbate flooding-related issues due to increased water volume in the area (peak discharges) being two to five times higher than pre-development levels. A moderately developed watershed may produce 50% more runoff volume than a forested watershed during the same storm.[36] Increased urban development in Hillsborough County has led to the removal of natural upland and wetland habitats, increasing the construction of roads, parking lots, sidewalks, rooftops, and other impervious surfaces. Furthermore, canals being built or maintained through dredging penetrate the aquifer, allowing saltwater intrusion into this source of drinking water for Hillsborough County. Saltwater intrusion impacts soil quality and building construction as well.

Diminished Littoral Zones

Littoral zones are important to lake health and water quality, functioning as a barrier and purifier for water quality issues such as runoff pollution and algal blooms.[37] Flooding in freshwater sources such as lakes will make this littoral zone less prevalent and less diverse. With abnormally fluctuating water levels, littoral zones diminish and homogenize due to changes in the survival rates of terrestrial and aquatic organisms surrounding a lake. This effect will also be seen more severely in man-made hydrologic reservoirs as the water levels fluctuate more.[38] Scouring can also be more intense when this littoral zone is reduced, leading to complications with near-water construction.

Impervious Surfaces

---

[34] https://ccsenet.org/journal/index.php/jsd/article/view/3821

[35] https://planhillsborough.org/wp-content/uploads/2023/07/Final_Alt_JURIS_PROJ_All_Jurisdictions.pdf

[36] https://tbeptech.org/TBEP_TECH_PUBS/2009/TBEP_06_09_Habitat_Master_Plan_Update_Report_July_2010.pdf

[37] https://titusville.com/FAQ.aspx?QID=102#:~:text=Aquatic%20plants%20in%20the%20littoral,clarity%20and%20prevent%20algal%20blooms.

[38] Tamar Zohary & Ilia Ostrovsky (2011) Ecological impacts of excessive water level fluctuations in stratified freshwater lakes, Inland Waters, 1:1, 47-59, DOI: 10.5268/IW-1.1.406

There has been a significant increase in impervious surface area in Hillsborough County and its Cities as development has increased for the last several decades.

Impervious surfaces due to development are an environmental concern because, with their construction, a chain of events is initiated that modifies the air quality and water resources. The pavement materials seal the soil surface, eliminating rainwater infiltration and natural groundwater recharge. These surfaces shed rainwater rather than allowing it to soak into the ground, thus decreasing groundwater recharge.[39] Groundwater recharge is needed to replenish aquifer drinking water; while it percolates to the aquifer, an additional water filtration occurs that helps to increase water quality. When the water cannot percolate, such as in urban, paved areas, it instead flows rapidly into rivers and other bodies of water, where it will travel out to the ocean. This allows chemicals, agricultural waste, oil, and nutrients such as those from fertilizers to enter into environments where they can profoundly affect the health of the ecosystem and the residents of Hillsborough County. As a result, algal blooms can occur due to the increase in nutrients, oysters and other estuarine animals can perish due to the sudden drop in salinity, and varied flora and fauna can suffer in the watershed due to the pesticide and chemical runoff.

When impervious surfaces cover areas where water naturally seeps into underground water sources or aquifers, they reduce the amount of water available to recharge wells and springs. During storms, excess water that could not seep into the ground flows across impervious surfaces, where it can gather harmful pollutants (e.g., oil and fertilizer) and deposit them into surrounding waters and farther downstream. As impervious surfaces increase, so do stormwater runoff volumes, the velocity of stormwater flows, and pollutant levels in runoff.[40]

Wetlands

Wetlands help protect our natural ecosystems by providing a wide range of hydrological and ecological benefits, including flood protection and erosion control (i.e., green infrastructure), filtration of toxins and nutrients from runoff, recharge and discharge of groundwater resources, and vital habitat for a multitude of plant and wildlife species. Additionally, wetlands are important natural resources for recreation and education and provide economic commodities such as fish, rice, timber, and peat.[41]

Approximately 173,752 acres (28%) of Hillsborough County's land area are wetlands in the floodplain. Wetlands in coastal and riverine floodplains can protect people and their property, community infrastructure, and agricultural investments from floods. Wetlands act as natural sponges, holding floodwaters and lowering flood heights. Wetlands improve water quality runoff associated with concrete, asphalt, rooftops, and other impervious surfaces is a leading cause of water pollution. Wetlands near developed and agricultural areas trap pollutants and excess nutrients in surface runoff, keeping water bodies cleaner. This natural filtering helps prevent water

[39] https://pubs.usgs.gov/circ/1348/

[40] Schueler, T. R., 1994. The importance of imperviousness. Watershed Protection Techniques, 1(3): 100-111.

[41] EPA, 2010. Protection of Environment. 40 C.F.R. pt. 232.2

use restrictions, such as beach and shellfish closures and reduces the need for costly treatment systems.[42]

Social and Population Impacts from Flooding

Understanding a population's current demographic and socioeconomic characteristics provides context to understanding vulnerabilities within communities and neighborhoods across Hillsborough County. Examining potential future problems that may impact populations in these at-risk areas allows for the development and implementation of structural and non-structural mitigation measures to protect those more susceptible to flooding. This knowledge can increase the ability of local planners and the population to prepare before an event, remain safe during an event, and better plan for rehabilitation in the aftermath.

For those residents of Hillsborough County who live along the coast, the Hillsborough, Alafia, and Little Manatee River, within the 100-year Special Flood Hazard Area, or urban neighborhoods living with the flooding, it is a way of life. While the chances of flooding are not a common event, should it occur, the flooding conditions can range from nuisance to catastrophic. In review of the National Climatic Center database and the National Weather Service Hydrologic Prediction Service websites, widespread heavy rain associated with Hurricane Irma in 2017 across west central Florida led to record flooding on many rivers and widespread flooding throughout Hillsborough County.

Historically, flooding has caused a substantial amount of property damage. As more people move to Hillsborough County and more development takes place, the potential for flood-related damages increases each year. From approximately 1.23 million residents in 2010 to approximately 1.54 million in 2024, there has been an estimated 25.2% increase in population growth in Hillsborough County.[43] As for the population living in a floodplain, in 2000, there were 231,624 residents; in 2016, this number increased to 305,524.[44] Hillsborough County was estimated to have the third largest floodplain population change from 2000-2016, with a 32% increase (estimated 73,900 residents). According to the Bureau of Economic and Business Research (2018), an upward estimate of 1.04 million new residents are projected to migrate to the area by 2045, likely resulting in an even larger increase in residents living in the floodplain.[45]

The more homes and people located in a floodplain, the greater the potential for harm from flooding. Impacts are likely to be even greater when additional risk factors (age, income, capabilities) are involved since people at greatest flood risk may have difficulty evacuating or taking action to reduce potential damage.

People who live in areas prone to flooding and who may be uninsured or underinsured are at greatest risk. The cost of insurance may be prohibitive, and people living outside a flood zone may believe they are not at risk. People who rent properties may not be aware of their flood risk as the owner may not disclose it, or they may not know the area's history.

---

[42] https://coast.noaa.gov/snapshots/.
[43] https://www.census.gov/quickfacts/fact/table/hillsboroughcountyflorida/PST12022
[44] https://www.governing.com/gov-data/census/flood-plains-zone-local-population-growth-data.html#methodology.
[45] https://www.bebr.ufl.edu/sites/default/files/Research%20Reports/projections_2018.pdf

Socio-economic Status

According to the U.S. Bureau of Labor Statistics (BLS), the unemployment rate for Hillsborough County was 3.7% in August 2024.[46] Approximately 13.3% of individual residents in Hillsborough County live below the poverty line according to the 2023 American Community Survey.[47] Due to their unstable economic situations, these segments of the population are likely to seek assistance, may not have adequate health or renter/homeowner's insurance, or may end up homeless after a major flooding event.

Older Adults

According to the U.S. Census Bureau (2023), 15.3% of the Hillsborough County population is over the age of 65.[48] This portion of the population may be more vulnerable due to financial barriers, lack of social networks and transportation, or health reasons. Many retirees live on fixed incomes and may not have resources for home mitigation measures to maintain their homes to reduce the impacts of rain or flooding, the ability to afford homeowner's insurance, or evacuate due to a flooding event.

They may need additional assistance to help retrofit or mitigate the effects of tropical storms and hurricanes on their homes or need assistance for evacuating due to a variety of chronic health problems, including cognitive impairments and diminished mobility.

Between 2010 and 2045, Hillsborough County will experience considerable growth in its older population. In 2050, the population aged 65 and over is projected to be 351,661, over 100,000 greater than the estimated population of 235,585 residents in 2023.[49] The aging of the population will have wide-ranging implications for Hillsborough County, presenting challenges to policy makers and emergency planners.

Housing and Transportation

Vulnerability is not just a product of building codes; social vulnerability plays an important role in understanding risk. Identifying mobile home parks with exceptional social cohesion serves as a model for those where social capital appears to be lacking and improves the disaster preparedness of those areas.

There are 35,993 mobile homes in Hillsborough County as of 2023.[50] Residents in mobile home communities usually own their homes and pay monthly rent to park on the property within the mobile

---

46 https://ycharts.com/indicators/hillsborough_county_fl_unemployment_rate#:~:text=Hillsborough%20County%2C%20FL%20Unemployment%20Rate%20is%20at%203.70%25%2C%20compared,month%20and%203.30%25%20last%20year.

47 https://data.census.gov/all?q=poverty%20line&g=050XX00US12057

48 https://data.census.gov/table?q=age&g=050XX00US12057

49 https://www.bebr.ufl.edu/wp-content/uploads/2022/10/projections_2022_asrh.pdf

50 https://data.census.gov/table?q=S2504:%20Physical%20Housing%20Characteristics%20for%20Occupied%20Housing%20Units&g=050XX00US12057

home park. The arrangement is popular among retirees and low-income families seeking affordable housing.

By drawing from various levels of flood plain data for Hillsborough County and cross-referencing it with the location of our mobile home parks, identifying which manufactured home parks are at the greatest risk for future storm surge and flooding events has been conducted. Long-term risks exist for those who live closest to the coastline along Tampa Bay in South County, as well as Town' N Country, with regard to storm surge, flooding, and anticipated sea-level rise. Furthermore, there is a concern for residents of manufactured home parks that lay within the watersheds of some of our largest rivers (specifically the Alafia and Hillsborough rivers) that may lead to the risk of inland flooding during tropical storm and hurricane events. In the event of a flood, many of these home parks could see significant destruction of personal property and displacement of their residents.

High-density residential areas that are susceptible to potential storm surge include Town' N Country, South Tampa, Davis Island, Apollo Beach, and Ruskin. Tampa ranked in the top 10 among large metropolitan areas with severe shortages of rental homes affordable to low-income households.[51]

Health Vulnerabilities

Populations of concern in Hillsborough County include individuals with health concerns that need to be considered when looking at homes impacted by flooding. Many individuals may be electricity dependent (i.e., ventilators, oxygen concentrators, CPAP and other sleep apnea devices, dialysis machines, take medications needing refrigeration) and have functional needs that pose a challenge to their safety and well-being. Healthcare facilities could experience extended periods of disruption after a disaster, and mitigating against potential risks, developing comprehensive plans for their facility, and having adequate resources on hand are essential.

As mentioned above, populations over the age of 65 may be more susceptible to health concerns that may impact their ability to evacuate or mitigate against flood damages. Between 2023 and 2050, Hillsborough County will experience considerable growth in its older population.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Historical Losses

The NCEI Storm Events Database information, presented in the Historical Occurrences section above, also contained property and crop damage dollar amounts, shown in Table 5.24 below. This information, combined with values of structures in hazard areas and projected losses from HAZUS-MH, can provide a more complete analysis than using only one data source.

Table 5.24. Flood Events in Hillsborough County, by Type, (1996–2023)

Type of Event	Number of Events	Deaths	Injuries	Property Damage (2023 dollars*)	Crop Damage (2023 dollars*)
Flash Flood	10	1	2	$13,852,657	$951
Flood	59	0	0	$25,667,412	$757,865

51 https://www.tampabay.com/business/hillsboroughs-booming-growth-makes-tampa-bay-one-of-the-countrys-fastest-growing-regions-20190422/

Type of Event	Number of Events	Deaths	Injuries	Property Damage (2023 dollars*)	Crop Damage (2023 dollars*)
TOTAL	**69**	**1**	**2**	**$39,520,069**	**$758,816**

*NCEI was not updated with 2024 data at the time this document was prepared

The information can be analyzed to provide the average amount of property and crop damage that is likely each year. This information is shown in Table 5.25 below.

Table 5.25. NCEI Floods, 1996–2023

NCEI Storm Event (hazard)	Average Floods per Year	Annualized Property Loss (2023 dollars*)	Annualized Crop Loss (2023 dollars*)
All Types of Floods	3	$1,486,058	$28,104

**NCEI was not updated with 2024 data at the time this document was prepared*

According to the analysis, Hillsborough County is historically vulnerable to almost $1.5 million in property damages and over $28,000 in crop damages from roughly 3 flood events each year.

Exposure

To estimate exposure of improved property to flood, the approximate number of parcels and their associated improved value located in the floodplains was determined using GIS analysis (Table 5.26).

Table 5.26. Estimated Exposure of Improved Property to Flood

Location	Buildings and Parcels in Flood Risk Area								
	100-Year Floodplain			500-Year Floodplain			VE-Zone		
	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)
Plant City	3,654	7,386	$1,517,094	0	0	$0	0	0	$0
Tampa	31,089	107,230	$18,697,924	13,728	2,630	$9,304,582	893	932	$2,499,256
Temple Terrace	514	1,256	$434,775	0	0	$0	0	0	$0
Unincorporated	88,246	188,035	$27,263,652	16,940	90,183	$3,875,902	148	172	$265,644
HILLSBOROUGH COUNTY TOTAL	**123,503**	**303,907**	**$47,913,445**	**30,668**	**92,813**	**$13,180,484**	**1,383**	**1,104**	**$2,764,900**

The floodplains were intersected with census block data to estimate the county population's exposure to flood. As a result, these population estimates will be an overestimate of risk since the entire census block's population count will be included even if only a portion of the census block's area is located in a floodplain. However, these estimates still give an idea of the county population's flood risk (

Table 5.27).

Table 5.27. Estimated Exposure of Population to Flood

Location	Population in Flood Risk Area		
	100-Year Floodplain	500-Year Floodplain	VE-Zone
City of Plant City	13,455	0	N/A
City of Tampa	250,835	143,590	4,582
City of Temple Terrace	12,217	0	N/A
Unincorporated	610,561	33,283	4,570
HILLSBOROUGH COUNTY TOTAL	**887,068**	**176,873**	**9,152**

Sea Level Rise

To estimate exposure of improved property to sea level rise, the approximate number of parcels and their associated improved value located in the areas vulnerable to 2050 and 2080 Intermediate Low, Intermediate, and High sea level rise scenarios was determined using GIS analysis (Table 5.28 and

Table 5.29). These figures are for "sunny day" sea level rise and do not include storm surge.

Table 5.28. Estimated Exposure of Improved Property to Sea Level Rise Risk Areas in 2050

Sea Level Rise Scenario	Buildings and Parcels in Sea Level Rise Risk Areas								
	Hillsborough County Total			Tampa			Unincorporated		
	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)
Intermediate Low	8,480	61	$7,129,933	1,817	43	$4,822,363	6,663	18	$2,307,570
Intermediate	8,649	63	$7,210,207	1,853	44	$4,834,916	6,769	19	$2,375,290
High	9,429	84	$7,694,645	2,074	56	$5,177,770	7,355	28	$2,416,876

*City of Plant City and City of Temple Terrace have no buildings or parcels located in sea level rise risk areas, so they are not included in this table.

Table 5.29. Estimated Exposure of Improved Property to Sea Level Rise Risk Areas in 2080

Sea Level Rise Scenario	Buildings and Parcels in Sea Level Rise Risk Areas								
	Hillsborough County Total			Tampa			Unincorporated		
	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs.	Improved Value (in 1000s)
Intermediate Low	9,619	88	$7,744,721	2,123	59	$5,197,291	7,496	29	$2,547,430
Intermediate	10,702	140	$8,295,797	2,348	76	$5,356,575	8,354	64	$2,939,221
High	17,269	3,493	$11,560,982	4,992	1,682	$7,420,978	12,277	1,811	$4,140,003

City of Plant City and City of Temple Terrace have no buildings or parcels located in sea level rise risk areas, so they are not included in this table.

To estimate the county population's exposure to potential sea level rise in a near-term scenario, the areas vulnerable to 2050 Intermediate Low, Intermediate, and High sea level rise scenarios were intersected with census block data and As a result, these population estimates will overestimate risk since the entire census block's population count will be included even if only a portion of the census block's area is located in an inundation area. However, these estimates still give an idea of the county population's risk to sea level rise. Table 5.30 shows this estimated population exposure.

Table 5.30. Estimated Exposure of Population to Sea Level Rise Risk Areas in 2050

Sea Level	Population in Sea Level Rise Risk Areas		
	Intermediate Low	Intermediate	High

Rise Depth	County Total	Tampa	Uninc.	County Total	Tampa	Uninc.	County Total	Tampa	Uninc.
0 to 1 ft	2,351	125	2,226	11,426	3,778	7,648	58,639	27,788	30,851
1 to 2 ft	0	0	0	4,307	486	3,821	13,805	3,144	10,661
2 to 3 ft	0	0	0	0	0	0	4,526	751	3,775
3 to 4 ft	0	0	0	0	0	0	0	0	0
4 to 5 ft	0	0	0	0	0	0	0	0	0

**City of Plant City and City of Temple Terrace have no population located in sea level rise risk areas, so they are not included in this table.*

Hazus-MH

Hazus-MH was used to estimate the direct economic loss for the county from a 100-year flood, as shown below. This analysis includes losses to buildings, contents, inventory, relocation, capital, wages, and rental income. These loss values are shown in Table 5.31 using 2020 Hazus data inflated to 2024-dollar values with some additional corrections noted below.

Table 5.31. Direct Economic Loss from 100-year Flood

	100-year Flood Event
Building Loss*	$1,012,245,260
Contents Loss**	$1,007,878,290
Inventory Loss***	$26,190,710
Relocation Loss****	$556,454,530
Capital Related Loss*****	$495,869,430
Wage Loss******	$750,411,060
Rental Income Loss*******	$216,208,720
TOTAL LOSS	**$4,065,258,000**

*Inflated to 2024 dollars and increased by 20% to account for increased construction costs

**inflated to 2024 dollars and increased by 10% to account for increased costs

***inflated to 2024 dollars

**** inflated to 2024 dollars and increased by 20% to reflect increases in hotel and housing costs

*****inflated to 2024 dollars

******inflated to 2024 dollars and increased by 10% to reflect increase in wages

*******inflated to 2024 dollars (not increased. Rents have increased, as have ownership and maintenance costs)

Figure 5.17 below shows the areas in the county with direct economic loss due to a 100-year storm event.

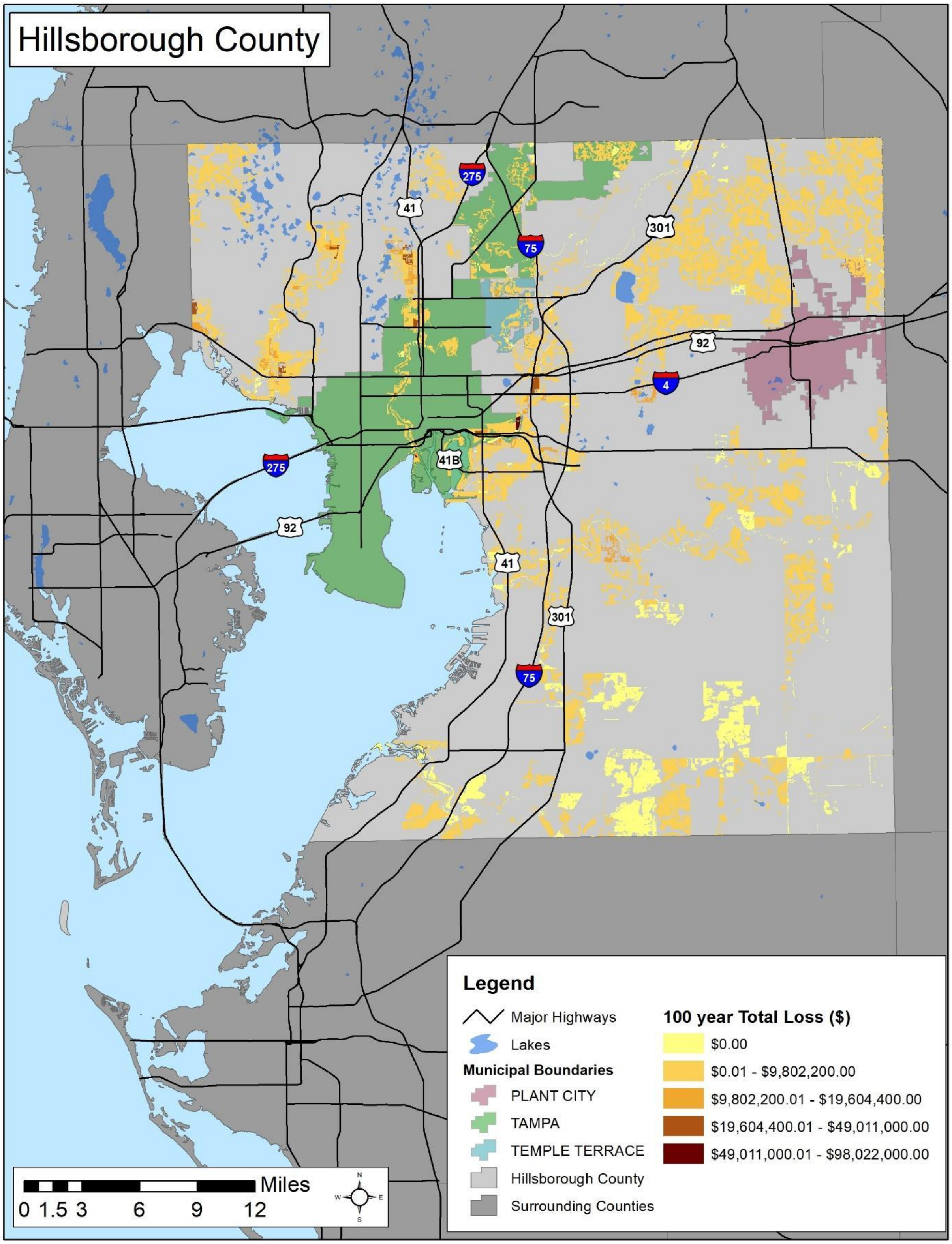


Figure 5.17. Direct Economic Loss 100-year Return Period

Coastal Flooding

Please refer to the *Tropical Cyclone Hazard Profile* for vulnerability and loss estimates by jurisdiction due to coastal flooding and storm surge.

National Risk Index (NRI)

The National Risk Index (NRI) was utilized to obtain additional information, paired with Hazus loss estimation data, on the risk and loss analysis for Hillsborough County on a census tract level. The riverine flood data used in the NRI uses FEMA's National Flood Hazard Layer (NFHL) to determine flood exposure. This data is used to calculate an exposure value for each census tract based on identified high-probability flood areas intersecting with census tract boundaries, and through that exposure data, an annualized frequency of flood events, calculated via the NCEI storm events database, and a historic loss ratio was calculated to help determine the expected annual loss for each census tract due to hurricane/tropical cyclone. A final NRI risk score was then calculated by multiplying the expected annual loss by the CDC's social vulnerability score and dividing that by the community resilience score that was calculated by the Hazards Vulnerability & Resilience Institute's (HVRI) Baseline Resilience Indicators for Communities (BRIC) index.[52]

Figure 5.18 shows vulnerability to riverine flooding by census tract across the county using the NRI risk rankings.

[52] https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

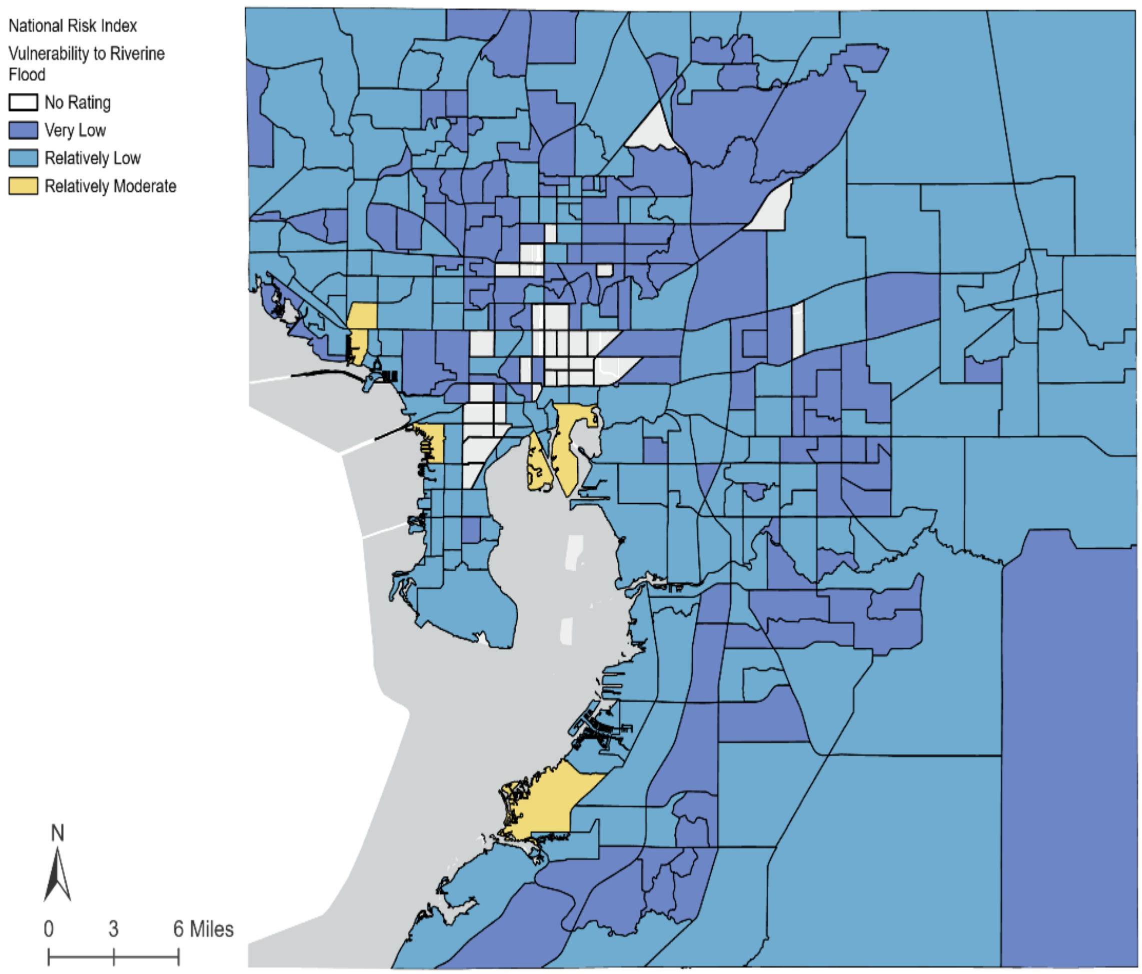


Figure 5.18. NRI Vulnerability to Riverine Flood in Hillsborough County by Census Tract

As seen in Figure 5.18, Hillsborough County has very low to relatively low vulnerability to riverine flood in the majority of census tracts in the county with a few relatively moderate census tracts and some with no ratings available. Table 5.32 below, breaks this down by jurisdiction.

Table 5.32. NRI Vulnerability to Riverine Flood by Jurisdiction

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk	# of Relatively Moderate Risk	# of Relatively High Risk	# of Very High Risk	# No Rating
Hillsborough County (Unincorporated)	204	2	3	0	0	2
Plant City	1	10	0	0	0	0
Tampa	29	42	3	0	0	29

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk	# of Relatively Moderate Risk	# of Relatively High Risk	# of Very High Risk	# No Rating
Temple Terrace	5	3	0	0	0	0
Hillsborough County (Total)	**239**	**57**	**6**	**0**	**0**	**31**

Figure 5.19Figure 5.47 shows expected annual losses in Hillsborough County from riverine flood damages by census tract, as reported by the NRI.

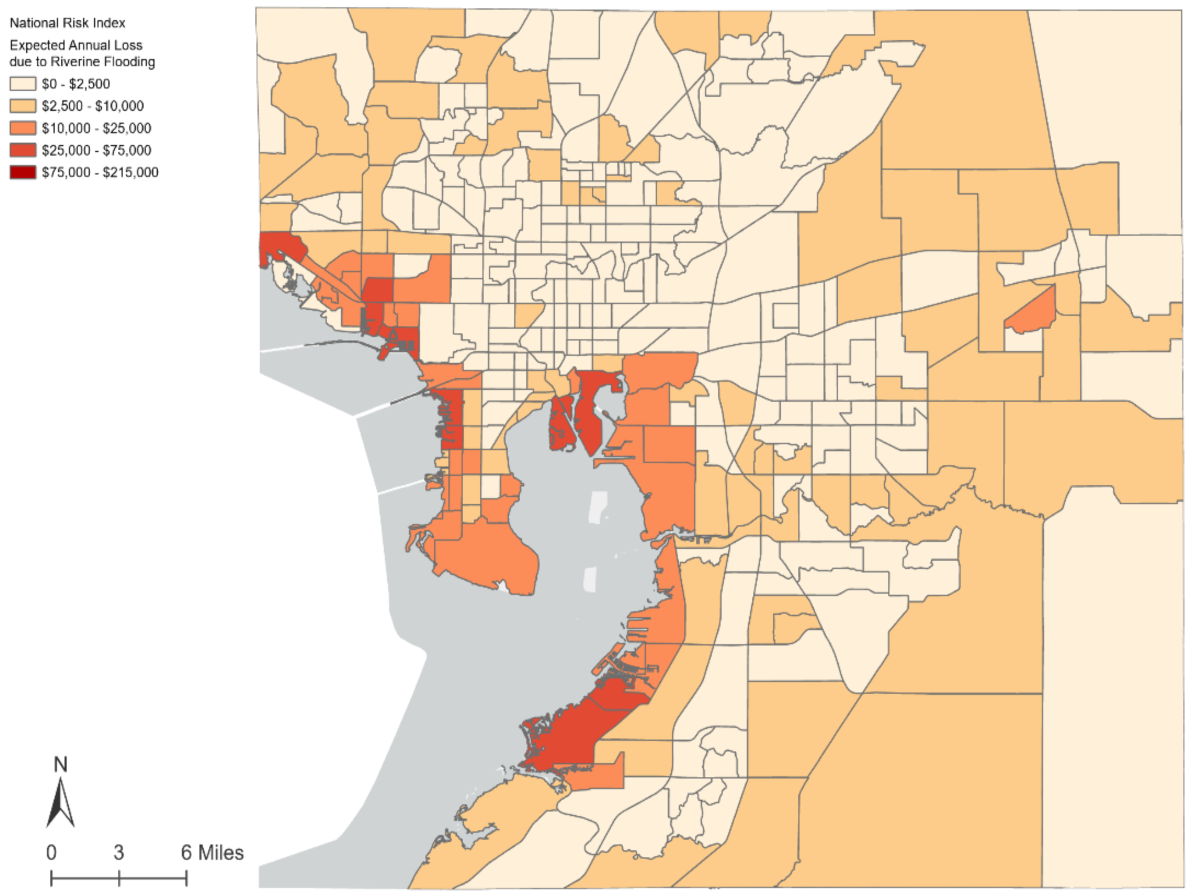


Figure 5.19. NRI Expected Annual Loss to Riverine Flooding in Hillsborough County

The majority of census tracts in Hillsborough County have less than $2,500 in expected annual loss due to riverine flood with very few having more than $25,000 in expected annual loss. The breakdown of the expected annual loss by jurisdiction is shown below in Table 5.33. The total expected annual loss for riverine flooding is significantly different from the Hazus expected loss values for a 100-year storm. This is thought to be due, in part, to the NRI coastal census tracts only reporting riverine flooding damage and not that caused by surge or coastal storms.

Table 5.33. Expected Annual Loss Due to Riverine Flooding Breakdown by Jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$1,633,973
City of Plant City	$36,261
City of Tampa	$563,078
City of Temple Terrace	$10,406
Hillsborough County (Total Loss)	**$2,243,718**

Justice40 Climate and Economic Justice Screening Tool (CEJST)

The Justice40 Climate and Economic Justice Screening Tool (CEJST) was used to determine disadvantaged communities that are more vulnerable to riverine flooding. No census tracts are considered to be at high risk to riverine flooding, as defined by the NRI. Figure 5.20 shows Justice40 disadvantaged communities census tracts for planning purposes.

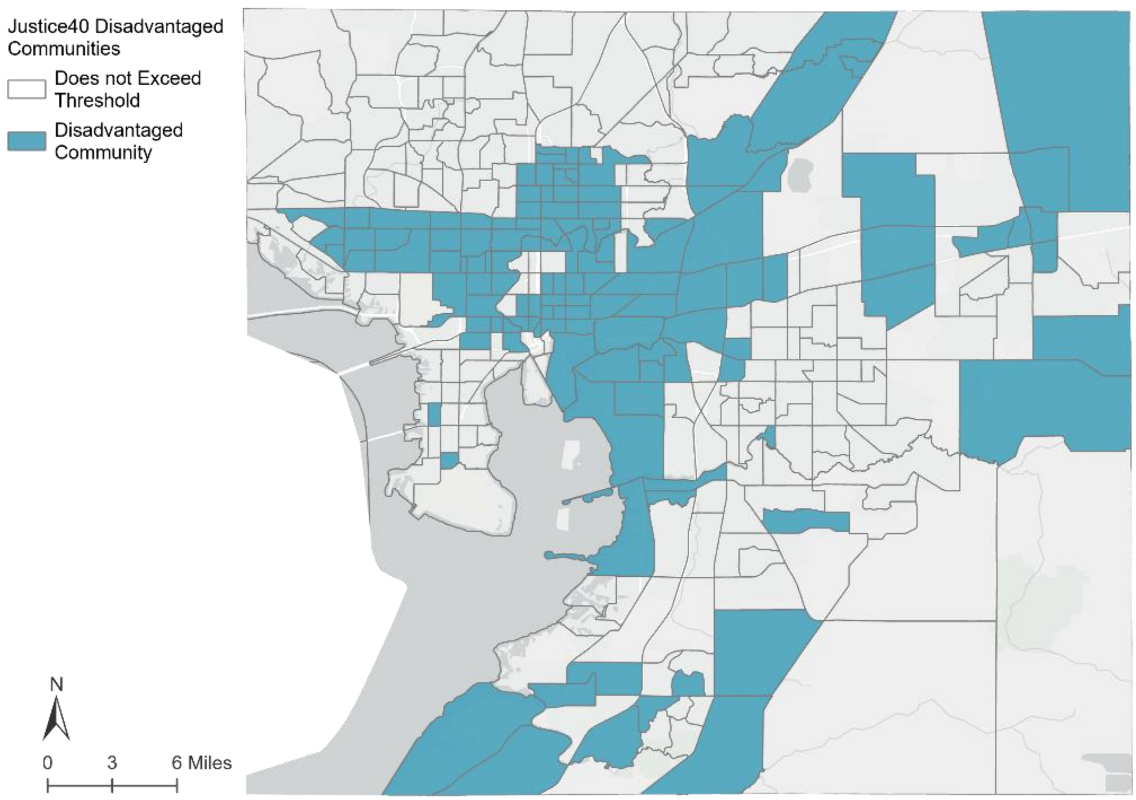


Figure 5.20. Justice40 Disadvantaged Communities in Hillsborough County

Vulnerability Analysis and Loss Estimation of Critical Facilities

To estimate flood exposure for the critical facility analysis, floodplains were intersected with critical facility locations. Flood Insurance Rate Map (DFIRM) data was used to delineate the effective and preliminary floodplains. Table 5.34 below summarizes the number of critical facilities in the county that are located within an identified floodplain.

Table 5.34. Exposure of Critical Facilities to Flood Risk Areas

Location	Number of Critical Facilities in Flood Risk Area		
	100-Year Floodplain	500-Year Floodplain	VE-Zone
City of Plant City	12	0	0
City of Tampa	210	67	11
City of Temple Terrace	3	0	0
Unincorporated	403	60	1
HILLSBOROUGH COUNTY TOTAL	**628**	**127**	**12**

Sea Level Rise

Additional analysis was conducted to estimate the exposure of critical facilities to sea level rise. Areas vulnerable to 2050 and 2080 Intermediate Low, Intermediate, and High sea level rise scenarios intersected with the critical facility locations. The findings indicated that 0 assets in Hillsborough County reside in the 2050 or 2080 sea level rise scenario extents. This is for sunny day sea level rise scenarios and does not include storm surge, which is analyzed in more detail in the tropical cyclone hazard section. The Hillsborough County Vulnerability Assessment, currently under development, will provide detailed loss estimation for critical facilities for multiple storm and sea level rise scenarios.

Community lifeline categories were also analyzed for exposure to 2050 and 2080 Intermediate Low, Intermediate, and High Sea level rise scenarios. For community lifelines, evacuation routes were added and were the only community lifelines exposed under these sea level rise scenarios.

In Tampa, 21 evacuation routes are exposed in 2050 in the Intermediate Low and Intermediate scenarios, while 23 are exposed in High scenario. In Unincorporated Hillsborough County, 19 evacuation routes are exposed to Intermediate Low and Intermediate sea level rise scenarios in 2050, while 20 are exposed in the High scenario. The Cities of Temple Terrace and Plant City have no community lifelines exposed to sea level rise.

In 2080, there are 23, 26, and 28 evacuation routes exposed to Intermediate Low, Intermediate, and High sea level rise scenarios in Tampa respectively. There are 20, 22, and 31 evacuation routes exposed to Intermediate Low, Intermediate, and High sea level rise scenarios in Unincorporated Hillsborough County respectively.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Please refer to the *4.3 Tropical Cyclone Hazard* Profile for vulnerability and loss estimations of critical facilities and community lifelines due to coastal flooding and storm surges.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.6 (

Table 5.35).

Table 5.35. Overall Vulnerability of Hillsborough County to Flood

Flood					Overall Vulnerability	
Overview						
A flood or flooding refers to the general or temporary conditions of partial or complete inundation of normally dry land areas from the overflow of inland or tidal water and surface water runoff from any source. While many people underestimate the severity of floods, loss of life and property from flooding are real threats in Florida. Florida experiences several different kinds of floods due to the effects of severe thunderstorms, hurricanes, seasonal rains, and other weather-related events.					HIGH	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score

Highly Likely	**Critical**	**Large**	**6 to 12 hours**	**Very Concerned**	**< 1 week**	**3.6**

4.2 Severe Storm Hazard Profile

Severe Storms Description

In this hazard profile, Severe Storms refer to thunderstorms with one or more effects: lightning, hailstorms, flooding, tornadoes, and straight-line winds. Tornadoes and flooding, associated with severe storm events, are profiled in a separate hazard profile.

Thunderstorms are prevalent in Hillsborough County, and Florida leads the nation in the number of thunderstorms annually. However, these storm systems are shorter in duration than those that develop over the western states. Thunderstorms in Florida routinely last approximately 30 minutes and rarely affect an area greater than 15 miles. Despite the shorter duration, multiple storms can develop together and act as an integrated system, increasing the impact and extent of the storms.

A thunderstorm forms when moist, unstable air is lifted vertically into the atmosphere. Lifting this air results in condensation and the release of latent heat. Vertical lifting can be caused by:

- Unequal warming of the surface of the Earth.
- Orographic lifting due to topographic obstruction of airflow or
- Dynamic lifting due to the presence of a frontal zone.

A typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Despite their relatively small size, all thunderstorms are dangerous. Of the estimated 100,000 thunderstorms that occur each year in the United States, about 10% are classified as severe.[53]

The three key elements of a thunderstorm are wind, water, and lightning. The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least one inch in diameter, has 58 mph or stronger winds, or contains a tornado.

Thunderstorms also vary in type, depending on size and organization. Below are the different types of thunderstorms:[54]

- Ordinary cell thunderstorms only have one cell. The ordinary cell consists of a one-time updraft and a one-time downdraft. These storms may also be called single-cell or pulse thunderstorms.
- Multi-cell cluster thunderstorms are organized in clusters of two to four short-lived cells. As the first cell matures, it is carried downstream by the upper-level winds, with a new cell forming upwind of the previous cell to take its place.
- Multi-cell line thunderstorms form in a line that extends, sometimes for hundreds of miles, and can persist for hours. These are called squall lines, which can be continuous or include contiguous precipitation.
    - Long-lived squall lines are called derechos and can cause severe damage with fast straight-line winds.

[53] https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/
[54] http://climatecenter.fsu.edu/topics/thunderstorms

- Supercell thunderstorms are dangerous storms with long-lived strong tornadoes and damaging wind, hail, and flash floods.

More detailed descriptions of each classification are included in Table 5.36.

Table 5.36. Thunderstorm Classification

Types Characteristics	Single-Cell Storm	Multi-Cell Cluster	Multi-Cell Line (Squall Line)	Super-Cell
Severe Weather Occurs as:	A brief isolated downburst, small hail, heavy rain, weak tornadoes	Downbursts, moderate size hail, flash floods, weak tornadoes	Downbursts, small-moderate sized hail, occasional flash floods, weak tornadoes	Strong downbursts, large hail, occasional flash floods, weak-violent tornadoes
Severe Event Predictability	Low	Moderate	Moderate	High (Once identified as Super-Cell)
Danger to Public	Low	Moderate	Moderate	Extreme
Danger to Aviation	Low	Moderate to High	Moderate to High	Extreme

Five major hazards produced by thunderstorms need to be considered: *lightning, heavy rainfall, straight-line winds, tornados, and hail*.

- ***Lightning***: Lightning is a rapid electrical discharge in the atmosphere between clouds, the air, or the ground. Thunder is the sound of this rapid discharge and can be heard up to 25 miles away. Lightning tends to strike tall objects such as trees but can also strike in an open field. Thunderstorms always include lightning because lightning is what causes the sound of thunder.[55]
- ***Heavy Rain:*** Heavy rains are defined as intense large amounts of rainfall in a short period. Because of this, flash floods often occur during slow-moving thunderstorms. Other factors, such as the area's topography, soil conditions, and ground cover, can also affect flash flooding from heavy rains. For example, if the ground is waterlogged, new rainfall cannot filter into the ground and has no place to go, causing a flood. As stated in the *Flood Hazard Profile*, flash flooding is a significant concern because of the rapid onset, the high-water velocity, the debris load, and the potential for channel scour. In addition, more than one flood crest may result from a series of fast-moving storms with heavy rainfall. Sudden destruction of structures and the washout of access routes may result in the loss of life. Furthermore, the rapid urbanization within Florida has manifested itself in the form of increased impervious surface areas, leading to less natural drainage and more flash flooding resulting from heavy rains.

[55] https://www.nssl.noaa.gov/education/svrwx101/lightning/

- ***Straight-line Winds:*** Severe Storms often include strong winds called “straight-line” winds and differ from those in tornadoes. These damaging winds exceed 50–60 mph and can reach up to 100 mph. Due to the higher number of occurrences, damage from these winds is more common than damage from tornadoes in the continental United States. Straight-line winds form as a result of outflow from a thunderstorm downdraft.[56]
    - *Downburst Winds*: Strong “downbursts” (winds) are concentrated, straight-line winds created by falling rain and sinking air that exceeds 125 mph.
    - *Microburst Winds*: A separate wind phenomenon is the “microburst,” which are narrowly- concentrated downdrafts that can exceed speeds of 150 mph.
- ***Tornados:*** A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. Tornado wind speed ranges typically from 65 mph to over 200 mph. The maximum winds in tornadoes are often confined to extremely small areas and vary tremendously over very short distances, even within the funnel itself. For more information regarding tornados, please see the *4.6 Tornado Hazard* Profile.
- ***Hail:*** Hail is frozen precipitation that can occur during a thunderstorm. Hail forms when raindrops freeze into balls of ice and usually range from 1/4 inch in diameter to 4 1/2 inches in diameter. Damage from hail increases with the size of the hail and can cause damage to vehicles, aircraft, and homes, as well as fatalities to people and livestock. However, Florida thunderstorms do not often include hail because the hailstones usually melt before they reach the ground because of the generally warm temperatures in the state. Categories of hailstorms, including size and damage, are listed in Table 5.37 below.[57]

Table 5.37. TORRO Hailstorm Intensity Scale [58]

	Intensity Category	Typical Hail Diameter (mm)*	Probably Kinetic Energy J-m^2	Typical Damage Impacts
H0	Hard Hail	5	0-20	No damage
H1	Potentially Damaging	5-15	>20	Slight damage to plants and crops
H2	Significant	10-20	>100	Significant damage to fruit, crops, and vegetation
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Widespread glass damage, vehicle body panel damage
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries

[56] https://www.nssl.noaa.gov/education/svrwx101/wind/
[57] http://www.nssl.noaa.gov/education/svrwx101/hail/
[58] https://www.torro.org.uk/research/hail/hscale

	Intensity Category	Typical Hail Diameter (mm)*	Probably Kinetic Energy J-m^2	Typical Damage Impacts
H6	Destructive	40-60		Bodies of grounded aircrafts dented; brick walls pitted
H7	Destructive	50-75		Severe roof damage, risk of serious injuries
H8	Destructive	60-90		Severest recorded in the British Isles; Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

*Approximate range since other factors (e.g., number and density of hailstones, hail fall speed, and surface wind speeds) affect severity

To give a better approximation of the size of each category of hailstorms, a size code relationship table is presented in Table 5.38. This table is provided by the Tornado and Storm Research Organization (TORRO) as an accompaniment to the general Hailstorm Intensity scale.

Table 5.38. Hail Size and Diameter in Relation to TORRO Hailstorm Intensity Scale

Size Code	Maximum Diameter (mm)	Description
H0	5-9	Pea
H1	10-15	Mothball
H2	16-20	Marble, grape
H3	21-30	Walnut
H4	31-40	Pigeon's egg > Squash ball
H5	41-50	Golf ball > Pullet's egg
H6	51-60	Hen's egg
H7	61-75	Tennis ball > Cricket ball
H8	76-90	Large Orange > Softball
H9	91-100	Grapefruit
H10	>100	Melon

National Weather Service Advisories

The National Weather Service (NWS) is tasked with providing weather forecasts and warnings of hazardous weather to agencies and the public protection, safety, and general information. If severe weather is detected, alerts are issued, and the Emergency Alert System may activate and broadcast the alert, mainly for severe thunderstorms or tornados (Table 4).

Table 5.39. National Weather Service Advisories and Thresholds [59]

National Weather Service Advisories	
Severe Thunderstorm	
Severe Thunderstorm Watch	Issued when conditions are favorable for severe thunderstorms to develop. A watch means being prepared for storms as large hail, damaging winds, and/or tornadoes are possible.
Severe Thunderstorm Warning	Issued when severe thunderstorms are occurring or are imminent. It is either detected by weather radar or reported by storm spotters. A warning means to take shelter.
Tornado	
Tornado Watch	Issued when conditions are favorable for severe thunderstorms and tornadoes to develop. A watch means being prepared for storms as large hail, damaging winds, and/or tornadoes are possible.
Tornado Warning	Issued when a tornado is sighted or imminent. It is either detected by weather radar or reported by storm spotters. A warning means to take shelter.
Flash Flooding	
Flash Flood Watch	Issued when conditions are favorable for flash flooding. A watch means to get prepared for possible flooding.
Flash Flood Warning	Issued when a flash flood is imminent or occurring, referring to a sudden violent flood that can take minutes to hours to develop. It is even possible to experience a flash flood in areas that are not receiving rain. It is either detected by weather radar, indicated by stream gauges, or reported by storm spotters. A warning signifies a command to leave low-lying or flood-prone areas.

Causes of Fatalities in Severe Storms

Severe Storms are life-threatening in all aspects. NOAA tracks weather-related fatalities, and lighting itself contributes to the most deaths from thunderstorms in Florida. Other causes include flooding, tornadoes, and winds.[60] Lightning may strike people directly or cause death and injury from fires it initiates. In an average year, more people die from lightning nationwide than from all hurricanes and tornadoes combined. However, that is mainly due to the frequency of lightning events nationwide compared to hurricanes and tornadoes.

Various factors contribute to lightning fatalities, including the willingness or unwillingness to cancel or postpone activities, the ability to know when a storm is approaching or developing, the ability to get to a safe place quickly, and the vulnerability of the actual activity.

Geographic Areas Affected by Severe Storms

Severe thunderstorms can occur anywhere in the county. As the number of structures and the population increases, the probability that a severe storm will cause property damage or human

[59] https://www.weather.gov/ctp/wwaCriteria
[60] http://www.nws.noaa.gov/om/hazstats.shtml#

casualties also increases. Florida experiences more thunderstorms yearly than any other state in the United States (80 to 105+ days per year).[61] The combination of heat, humidity, and sea breezes on the Gulf and Atlantic coasts makes the perfect breeding ground for thunderstorms over the Florida Peninsula. With the dense population and the number of people who spend a great deal of time outdoors year-round, more people are struck and killed by lightning in Florida than in any other state. On average, Florida has 3,500 cloud-to-ground lightning flashes per day, and 1.2 million flashes per year occur.[62]

Lightning

Figure 5.21 shows cloud-to-ground flash density in the United States for counties. Hillsborough had 4 to 5 lightning flashes per km^2 in 2023; from 2016-2022, Hillsborough County had 10-12 lightning flashes per km^2 per year.[63] All of Hillsborough County is equally susceptible to lightning strikes.

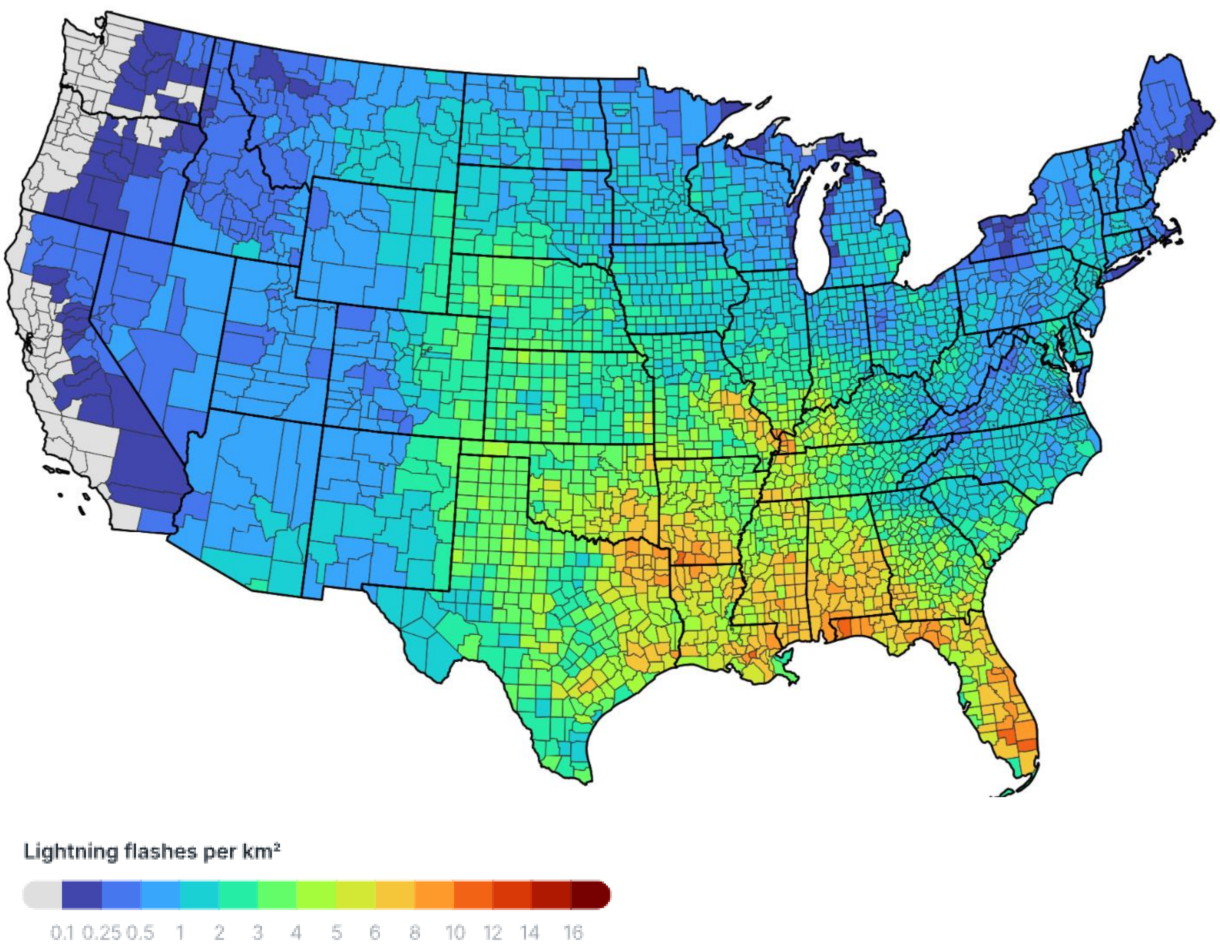


Figure 5.21. U.S. Average Cloud-to-Ground Flash Density per County, 2023 [64]

[61] https://www.noaa.gov/jetstream/thunderstorms

[62] www.accuweather.com/en/weather-news/why-florida-ranks-highest-for-lightning-fatalities-in-the-us/350561

[63] https://indd.adobe.com/view/ddf9619e-36e0-46b4-981d-3458b2532b98

[64] https://indd.adobe.com/view/ddf9619e-36e0-46b4-981d-3458b2532b98

Heavy Rain

Severe storms produce heavy rain, so their locations and spatial extents coincide. Hillsborough County is assumed to be uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to heavy rain, which may be produced by such storms.

Hail

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Hillsborough County is uniformly exposed to severe thunderstorms; therefore, all areas of the county are equally exposed to hail, which such storms may produce. Figure 5.22 shows the location of hail events that have impacted Hillsborough County based on NOAA historical data from 1955 to 2022. Hail events are evenly distributed across the county.

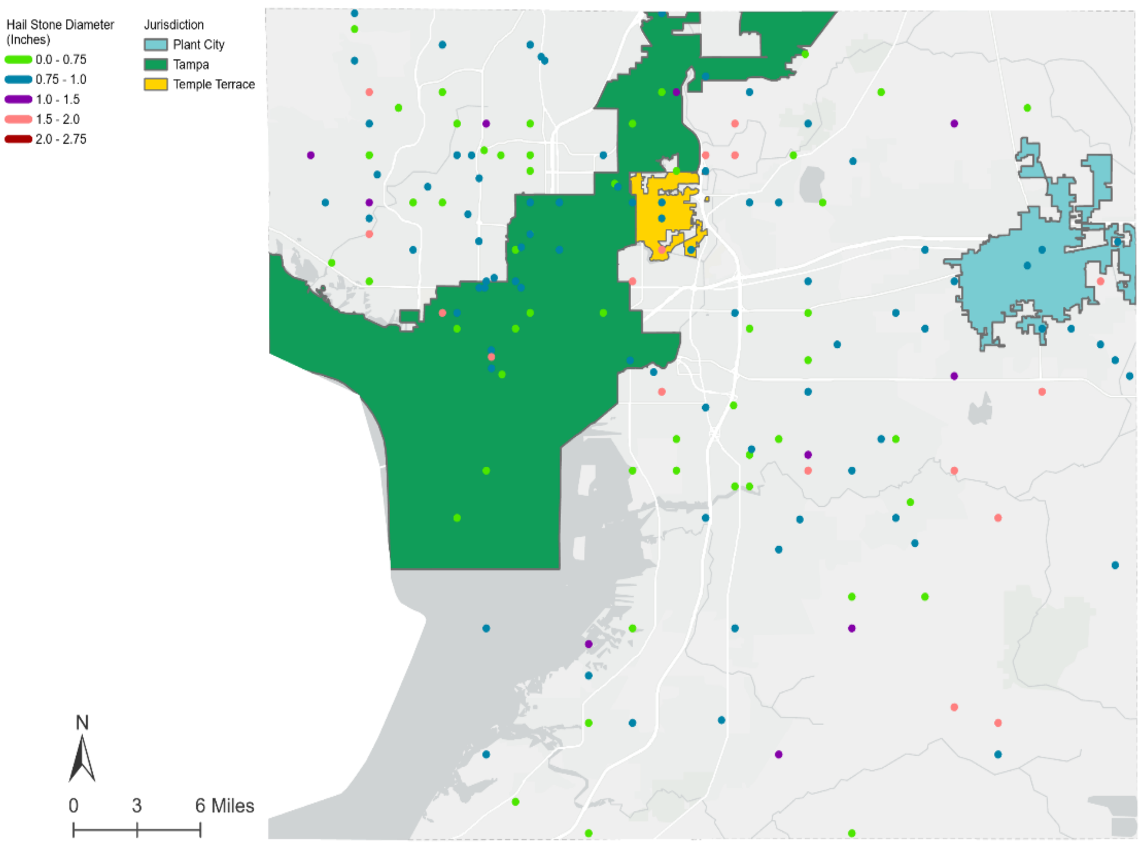


Figure 5.22. Hail events and diameter in Hillsborough County, 1955-2022[65]

Wind

A thunderstorm and its accompanying hazards, including wind, are atmospheric hazards and thus have no geographic boundaries. It is typically a widespread event that can occur in all regions of the

[65] https://www.arcgis.com/home/item.html?id=5972242f44714758b97c415a62a49ad5

United States. However, thunderstorms are most common in central and southern states, such as Florida, because atmospheric conditions in those regions are favorable for generating these powerful storms. All of Hillsborough County is assumed to be equally susceptible to wind hazards. Figure 5.23 shows the location of wind events impacting Hillsborough County based on NOAA historical data from 1955 to 2022.

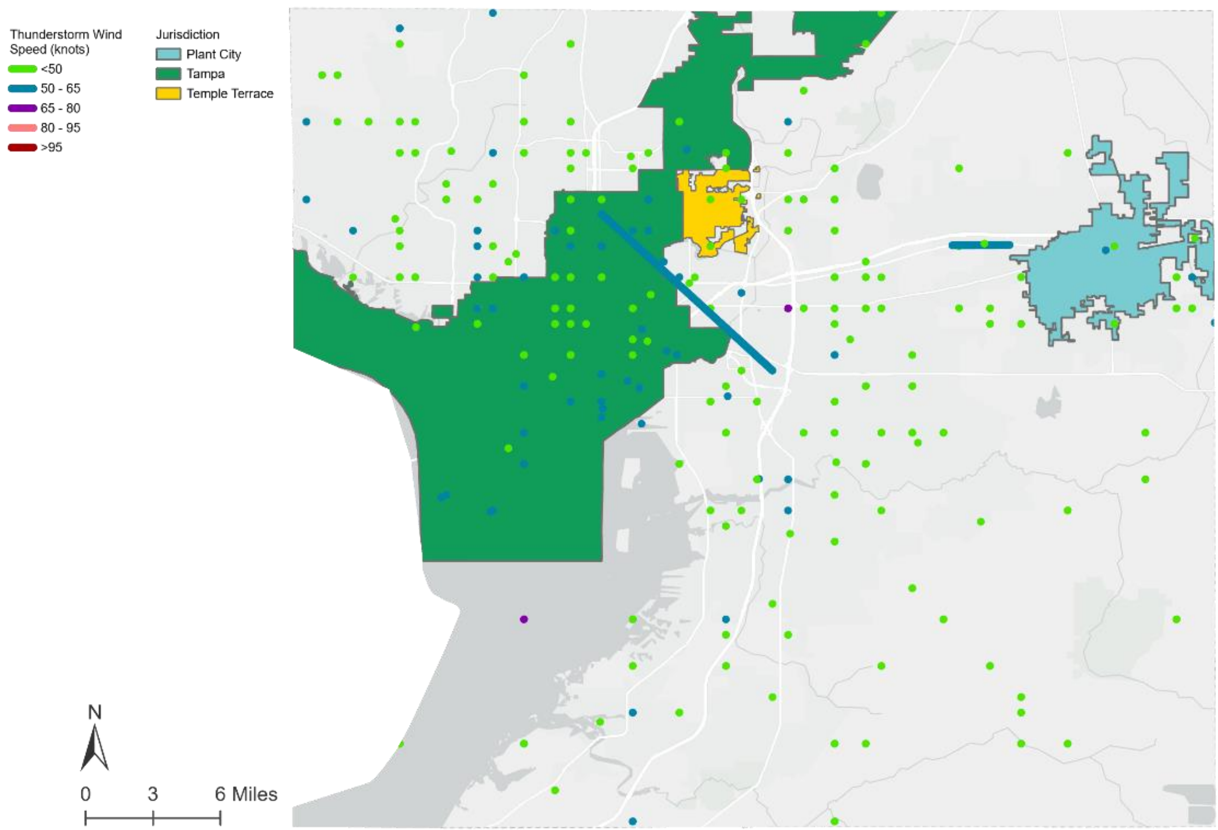


Figure 5.23. Hillsborough County Wind Events, 1955–2022 [66]

Historical Occurrences of Severe Storms

Table 5.40 lists major events from the NCEI database for Hillsborough County between 1988 and 2022. NCEI records have not been updated to reflect events since 2022.

[66] https://www.spc.noaa.gov/gis/svrgis/

Table 5.40. Significant Severe Storm Occurrences in Hillsborough County[67]

Date	Description
May 5, 1998	Thunderstorm Wind – Thunderstorm winds measured at 85 mph damaged nine parked aircraft and nine hanger doors at the Peter O. Knight Airport on Davis Island. The thunderstorm wind at a marina on Davis Island damaged at least 27 drydocked sailboats and five moored power boats.
June 21, 1998	Thunderstorm Wind – Thunderstorm winds snapped a large 500-pound, 15-inch oak branch, which fell atop and killed a 71-year-old female while she walked along a sidewalk near the 6300 block of State Road 39 in Plant City.
August 26, 2000	Thunderstorm Wind – The broadcast media reported that thunderstorm winds produced widespread damage from near Plant City west to Thonotosassa. Thunderstorm winds destroyed two hangers and damaged eight small planes five miles northwest of Plant City. Also, several large trees and power lines were downed by thunderstorm winds along U.S. Highway 301 near Hillsborough State Park. In Thonotosassa, thunderstorm winds overturned a trailer on Five Acre Road.
July 4, 2001	Lightning - Eight people were injured while taking cover in a tent when lightning struck a nearby tree and the tent's central metal support rod on Beer Can Island in Hillsborough Bay. An adult, holding the center metal support rod of the tent, was seriously injured from the lightning strike.
June 16, 2003	Heavy Rain – Several buildings sustained minor water damage, and five parked cars were half underwater in a parking lot on the University of South Florida campus.
October 2, 2007	Heavy Rain – Rainfall of 3.79 inches was measured at the USGS river gaging station. The radar estimated rainfall of 6 to 8 inches from Fort Lonesome to Duette in Manatee County. The excess water-filled ditches, but no homes received damage due to rising water. The Little Manatee River, 4.2 miles southwest of Wimauma, rose 5 feet between 8 PM EDT and 2 AM EDT with a maximum stage of 11.97 feet at 2 PM on October 3rd. The flood stage is 11 feet, and only minor flooding was reported.
February 5, 2010	Thunderstorm Wind – 13 people were injured when estimated 60 mph thunderstorm winds ripped the tethers of a 600-square-foot food tent at the Florida State Fair, causing the tent to collapse. In addition, the wind blew over some tables and blew the cover off of an ATM.
December 21, 2014	Lightning – The Florida State Watch Office relayed a report from Tampa Fire Rescue of a lightning strike across the street from Raymond James Stadium shortly after the conclusion of the Buccaneers football game. Lightning detection networks show that this was one of the first lightning strikes in the area. Seven people were transported to a nearby hospital, and another four took themselves to the hospital for treatment. One person was said to

[67] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Heavy+Rain&eventType=%28C%29+Lightning&eventType=%28Z%29+Strong+Wind&eventType=%28C%29+Thunderstorm+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Date	Description
	be in critical condition while being transported to a nearby hospital. Minor damage occurred to the car, and the victims were around as well.
July 5, 2017	Thunderstorm Wind – A large tree fell onto a van, temporarily trapping one person inside and injuring two people.
December 21, 2018	Thunderstorm Wind – The Sunshine Skyway Bridge was closed from around 9 AM to 5 PM on December 21st due to 78 mph wind gusts at the road surface, which is about 200 feet above the water.
July 19, 2019	Lightning – A fire at McLane Middle School is suspected to have been sparked by a lightning strike. The fire did significant damage before rescue crews were able to put it out.
April 2, 2022	Lightning - Two people hospitalized in stable condition after being struck by lightning outside of Raymond James stadium after attending an outdoor event.
August 24, 2022	Thunderstorm Wind - Multiple videos and pictures received via public of downed trees and sign damage near Ybor City amid localized burst of intense winds. Emergency Management later reported 12 residential structures sustained major damage and 1 commercial structure was destroyed. Microburst signature evident via radar. $1 million in property damage reported.

Additionally, there have been five FEMA major disaster declarations in Hillsborough County that are related to severe storms and one Emergency Declaration between 1979 and present shown in Table 5.41.

Table 5.41. FEMA Major Disaster Declarations and Emergency Declarations in Hillsborough County, Severe Storm, 1953–2023[68]

Disaster Number	Date	Name/Description
DR-586	May 15, 1979	Severe Storms, Tornadoes & Flooding
DR-607	September 29, 1979	Severe Storms & Flooding
DR-966	October 3–4, 1992	Severe Storms, Tornadoes & Flooding
DR-982	March 12–16, 1993	Tornadoes, Flooding, High Winds & Tides, Freezing
DR-1195	December 25, 1997–April 24, 1998	Severe Storms, High Winds, Tornadoes, and Flooding
EM-3561	July 4, 2021 – July 8, 2021	Tropical Storm Elsa

While severe storms may seem to be a lesser threat to life safety than a hurricane, severe storms can be fatal. From 1996 to 2023 in Hillsborough County, severe storms killed 10 people, 9 people died from lightning strikes and 1 person died from thunderstorm wind utilizing data from the NCEI

[68] https://www.fema.gov/disaster/declarations

database.[69] (It is important to note that the wind-related fatalities could have been from other storms or thunderstorms).

The NCEI database began recording these events in 1996, so some of the analysis in this plan is based on a 28-year period of history.

Lightning

Florida is ranked number 2 in the U.S. regarding the number of lightning strikes.[70] Lightning-related deaths are the highest in the nation in the state of Florida, with 51 deaths from 2013-2022, according to NOAA (Table 5.42).[71]

Table 5.42. Number of Lightning Fatalities by State, 2013-2022

State	Fatalities 2013-2022	Rank of Fatalities
Florida	51	1
Texas	19	2
Alabama	13	3
North Carolina	11	4
Arizona	10	5
Colorado	9	6
Georgia	9	6
Missouri	7	8
Pennsylvania	7	8
New York	7	8

According to the NCEI Storm Events Database, there were 108 reports of lightning in Hillsborough County from 1996 to 2023 (Table 5.43).[72] It is important to note that the database only includes reported events. Table 5.43 provides a summary of reported lightning occurrences, by jurisdiction, in this time span, along with reported deaths, injuries and property damages. Property damages have been inflated to 2023 dollars.

Table 5.43. Summary of Lightning Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
City of Plant City	4	0	7	$1,649,726	$61,101
City of Tampa	41	3	34	$2,587,129	$105,820
City of Temple Terrace	6	2	1	$158,651	$5,876

[69] https://www.ncdc.noaa.gov/stormevents/
[70] https://indd.adobe.com/view/ddf9619e-36e0-46b4-981d-3458b2532b98
[71] http://lightningsafetycouncil.org/Deaths%20by%20State%20Table.pdf
[72] https://www.ncdc.noaa.gov/stormevents/

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
Unincorporated	57	4	27	$4,549,772	$168,510
HILLSBOROUGH COUNTY TOTAL	**108**	**9**	**69**	**$8,945,278**	**$331,307**
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023-dollar values were calculated based on buying power in December 2023.					

A comprehensive list of lightning occurrences for this timeframe can be found in Appendix B

Heavy Rain

According to the NCEI Storm Events Database, there were 36 reports of heavy rain in Hillsborough County from 1996 to 2023.[73] These heavy rain events only include those reported by NCEI from 1996 through December 2023. There were no reported deaths or injuries, and only limited property damage is reported. See Table 5.44.

A comprehensive list of these events is included in Appendix B.

Table 5.44. Summary of Heavy Rain Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
City of Plant City	0	0	0	$0	$0
City of Tampa	9	0	0	$1,614	$60
City of Temple Terrace	1	0	0	$16,647	$617
Unincorporated	26	0	0	$0	$0
HILLSBOROUGH COUNTY TOTAL	**36**	**0**	**0**	**$15,345**	**$882**
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023-dollar values were calculated based on buying power in December 2023.					

[73] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Heavy+Rain&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Hail

According to the NCEI Storm Events Database, there were 189 reports of hail in Hillsborough County from 1996 to 2023.[74] These hail events only include those reported by NCEI from 1996 through December 2023. The actual number is likely higher. Table 5.45 provides a summary by jurisdiction as well as the number of injuries, deaths and property damage.

Table 5.45. Summary of Hail Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
City of Plant City	10	0	0	$0	$0
City of Tampa	47	0	0	$537,709	$19,915
City of Temple Terrace	17	0	0	$0	$0
Unincorporated	115	0	0	$1,636,845	$60,624
HILLSBOROUGH COUNTY TOTAL	**189**	**0**	**0**	**$2,174,554**	**$80,539**

*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023-dollar values were calculated based on buying power in December 2023.

A compressive list of occurrences can be found in Appendix B.

Studies conducted by NOAA and the NWS continually refine the ability to determine the extent and maximum size of hail that could impact specific areas, including Hillsborough County. Analysis of historical records available through the NCEI Storm Events database revealed that between 1958 and 2023, the largest hail recorded was approximately 3.0 inches in diameter.

Wind

According to the NCEI Storm Events Database, there were 296 reports of thunderstorm wind in Hillsborough County from 1996 to 2023.[75] These wind events only include those reported to NCEI from 1996 through December 2023. The actual number is likely higher. Table 5.46 shows the reported events by jurisdiction, along with deaths, injuries, and reported property damages. A complete listing of events by date is included in Appendix B.

[74] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Hail&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

[75] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+High+Wind&eventType=%28Z%29+Strong+Wind&eventType=%28C%29+Thunderstorm+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Table 5.46. Summary of Wind Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
City of Plant City	15	1	0	$1,072,923	$39,738
City of Tampa	114	0	26	$5,832,031	$216,001
City of Temple Terrace	16	0	0	$369,644	$13,691
Unincorporated	151	0	2	$3,359,391	$124,422
HILLSBOROUGH COUNTY TOTAL	**296**	**1**	**28**	**$10,633,989**	**$393,851**
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023-dollar values were calculated based on buying power in December 2023.					

Probability of Future Severe Storms

The probability of a thunderstorm occurring depends on atmospheric and climatic conditions. Based on historical analysis, severe storms will continue to affect Hillsborough County. Hillsborough County experiences 80 to 105 days of thunderstorms through the year and the state of Florida has about 1.4 million lightning strikes on an annual basis making Florida first in the United States for lightning strikes per square mile.[76] Due to these annual occurrences, lightning is one of the prevalent hazards in the county. Severe thunderstorms can occur at any time within the county, but mostly between the period from early summer through late fall. The greater the number of thunderstorms and/or their duration, the higher the number of lightning and hail occurrences. Figure 5.24 shows the annual mean thunderstorm days in the U.S., including Hillsborough County.

---

[76] www.floridadisaster.org/hazards/thunderstorms/

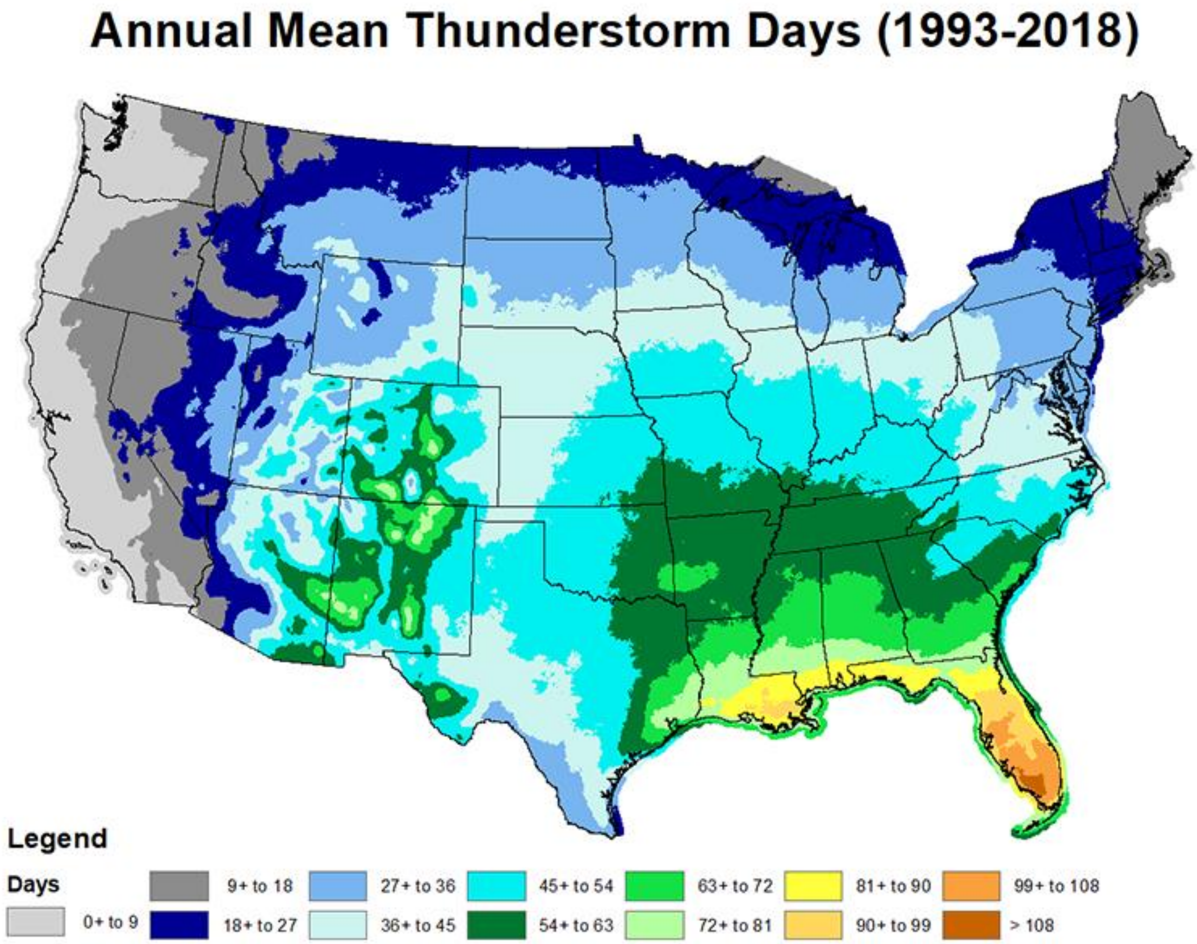


Figure 5.24. Annual Mean Thunderstorm Days (1993-2018), United States[77]

Potential Effects of Climate Change on Severe Storms

With higher temperatures and humidity, atmospheric instability will increase, likely increasing the probability and frequency of severe thunderstorms and tornadoes. According to NASA, climate change can directly impact the frequency and intensity of thunderstorms. Modeling data predicts that there will be more days per year in the Southeast portion of the United States with severe thunderstorms. As severe thunderstorms increase in frequency and intensity, outcomes such as hazardous conditions, with risk of injury or fatality, and property damage will increase as well.[78]

However, some believe vertical wind shear could also decrease, resulting in fewer or weaker severe thunderstorms and tornadoes.[79] That being said, decreases in vertical wind shear are most likely to occur when convective available potential energy (CAPE) is high in spring and summer months,

[77] https://www.noaa.gov/jetstream/thunderstorms

[78] https://climate.nasa.gov/news/897/severe-thunderstorms-and-climate-change/

[79] Seneviratne et al. (2012). Changes in climate extremes and their impacts on the natural physical environment. In Field et al. (Eds.), Managing the risks of extreme events and disasters to advance climate change adaptation, p.159. https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf.

which could result in more frequent severe storms. Furthermore, days with high CAPE are also likely to occur during times of the year with strong low-level wind shear, increasing the likelihood of the most severe storm events, including tornadoes.[80]

While signs point to increasing severity and frequency of severe storms, it is stated in the Fifth National Climate Assessment that changes in smaller-scale, short-lived severe weather such as thunderstorms are difficult to assess, and direct observations of these events and the conditions associated with them are still incomplete. It is *likely* that climate change is contributing to more frequent and intense severe storms, and it is *likely* that severe storm season will lengthen as the United States and the world continues to warm, particularly in the Southeast during cool-season months, but there is no complete conclusive data in this regard for severe storms. [81]

Overall, there has been an increase in the number of severe storm and tornado reports over the last 50 years. However, this increase may be attributed to the technological improvements that allow for better identification and reporting of such storms, so the data is not yet conclusive.

Probability Based on Historical Occurrences

An analysis of severe storm reports from 1996 to 2023 in Hillsborough County from the NCEI Storm Events Database indicates that there will be approximately four lightning events, two heavy rain events, five hail events, and seven wind events each year in Hillsborough County.

Table 5.47. NCEI Severe Storm Reports for Hillsborough County, 1996–2023[82]

Type of Severe Storm	NCEI Reports	Average per Year
Lightning	108	4.0
Heavy Rain	36	1.3
Hail	189	7.0
Wind	296	11.0
TOTAL	**629**	**23.3**

The numbers in Table 5.47 above are averages and will fluctuate annually. Most events will include multiple types of components. It is clear from the number of events in the 27-year period of record that the probability of events of this type is more than 100% annually.

Severe Storms Impact Analysis

All jurisdictions could receive the following impacts from severe storms. Variances in how much damage these storms generate within each community would be dependent upon severity of storms, maintenance of vegetation and infrastructure, and strength of residential and commercial structures.

- Public
    - Injury or death from being struck by lightning

[80] Diffenbaugh et al. (2013), http://www.pnas.org/content/110/41/16361.full.
[81] https://nca2023.globalchange.gov/downloads/NCA5_Ch2_Climate-Trends.pdf
[82]https://www.ncdc.noaa.gov/stormevents/

  - Injury or death from hail
  - Injury or death from flying debris
  - Injury or death from tornadoes and not having adequate shelter
  - Car accident
  - Indirect death
  - Survivors guilt if their house was not damaged from a severe storm or tornado and other neighbors died
- Responders
  - Responding during a severe storm can be very dangerous because of heavy rains, strong winds, hail, lightning, tornadoes
  - Downed powerlines posing a threat to first responders
  - Potential medical call without knowledge of threat
  - Maintaining personal safety when securing area
  - Live wires can catch palm trees, fields, or structures on fire in which first responders may have difficulty using water sources to respond to the event before the power is shut off
- Continuity of Operations (including continued delivery of services)
  - Thunderstorms often cause power outages from wind damage to power lines or lightning damage to power stations or other electrical infrastructure
  - Delays in air transportation
- Property, Facilities, Infrastructure
  - Damage to property, including homes and businesses, can occur from strong winds, flooding, or tornadoes. The damage can range from minor roof damage to total structure loss.
  - Damage to critical facilities, such as transformer stations, etc., from fallen trees and limbs, causing a power outage
  - Power outages leading to traffic signals being out
- Environment
  - Damage to environment, from strong winds, flooding, and tornadoes
  - There may be severe damage to vegetation in localized areas from a tornado
  - Severe soil erosion
- Economic Condition
  - Power outages cause lost revenue and lost wages for businesses and employees
  - Damage to agriculture especially due to hail or flooding
- Public Confidence in Each Jurisdiction’s Governance
  - Power outages for extended periods give the appearance that the jurisdiction does not know how to restore power
  - Large volumes of rain may overwhelm storm drains causing localized flooding in which residents may blame local government or expect immediate response to mitigate from future occurrences

Impact to the Built Environment

Spatial analysis using GIS was not conducted since severe storms are a hazard that do not have geographically definable boundaries. Severe storms are considered atmospheric and have the potential to affect all buildings and all populations in Hillsborough County.

Severe storms do not always impact structures, but impacts could include flooding from heavy rain, wind, tornadoes, hail, and lighting. Most structures do not sustain damage from wind in these events because of the Florida Building Code and the speed of most winds during severe storms. Most buildings are built to withstand hurricane force winds, and severe storms often do not have as high wind speeds. Homes and businesses that were built under older building codes and standards or structures that do not have impact resistant features or protection that can be installed may be more vulnerable to wind damage. Tornadoes, however, may cause damage to structures. If hail diameter is large enough, structures can be significantly damaged from hail Within Hillsborough County, the diameter of hail is very likely not to reach a significant enough size to cause damage to structures. The impact from hail is typically recognized as property damage, including that to vehicles suffering from hail impact as well as the roofs of structures, both commercial and residential. Lightning impacts on structures are minimal. However, homes and businesses throughout Hillsborough County are at risk of fire due to lightning strikes igniting debris and materials that have been struck directly.

Impact to Manufactured Homes and RV

Since wind and water both pose a threat to manufactured homes, severe thunderstorms pose a threat to the infrastructure and even those that are secured by the required steel bands are less resilient than homes that have an established foundation. Manufactured homes are required to be elevated and anchored to a vertical, engineer-certified system, allowing some mitigation for minor flood prevention.[83]

There are three distinct generations of mobile homes based on their years of manufacture, which have been identified as pre-1976, 1976 to 1994, and post-1994.[84] Units that were manufactured before 1976 do not have manufacturing design standards, whereas those between 1976-1994 were built under HUD's Manufactured Home Construction and Safety Standards (MHCSS; 24 CFR 3280) and its Model Manufactured Home Installation Standards (24 CFR 3285). All post-1994 generations of manufactured homes have incorporated stricter design and manufacturing standards, including wind load standards based on American Society of Civil Engineers (ASCE) specifications. Despite these changes to the current code, it is estimated that a large portion of mobile homes are not installed to the current code in Hillsborough County.

Ecological Impacts of Severe Storms

Hail damage to the agricultural industry of Hillsborough County is always a potential threat. While historically, in the last five years, there has been no documented event with hail large enough on the TORRO scale to cause large scale crop damage, the potential for future impact on the agricultural

---

[83] Florida Manufactured Homes Association (FMHA, 2018). Hurricanes & Manufactured Homes: Four Myths Busted. Retrieved at http://www.fmha.org/.

[84] Schreiber, S. (2005). Mobile Homes and Hurricanes: The Crisis in Florida. Association of Collegiate Schools of Architecture (ACSA). Retrieved from http://www.acsa-arch.org/.

industry does exist, and there are reports of large-scale economic impacts on the agricultural industry due to hailstorms in the past. Severe thunderstorm winds, rain, hail, and tornadoes cause damage to natural and agricultural assets. Crops are more susceptible to wind damage as strong winds can break plants and ruin crops.

Natural Systems to Reduce Stormwater Runoff

Impervious surfaces due to development are an environmental concern because, with their construction, a chain of events is initiated that modifies the air quality and water resources. The pavement materials seal the soil surface, eliminating rainwater infiltration and natural groundwater recharge. There was a 26.36% net increase in impervious surface area in Hillsborough County due to development between 1996 and 2010. During this time, 28.57 miles^2 of agricultural land was developed, and 35.41 miles^2 of scrub, woody wetlands, and emergency wetlands were developed as well.

These natural systems reduce the occurrence of flash flooding and damage that are caused by these summer thunderstorms that occur during the summer months in Hillsborough County. Important mitigation measures in the area will be to discourage development in flood-prone areas and encourage any future development to incorporate green infrastructure and design practices to protect the natural systems, such as wetlands, which help to buffer against floods.

Social and Population Impacts from Severe Storms

People could be impacted by severe storms in a number of ways. Lightning can result in death or severe injury if a person is struck. Heavy rain can result in rising floodwaters that can lead to drowning or other serious injury. Injuries from hail are rare but can be severe. Wind can cause trees to fall and potentially result in injuries or death. A tornado can directly damage and destroy buildings and vehicles with occupants inside, as well as create flying windborne debris that can cause serious injuries or loss of life.

From 2006 through 2021, 444 people were struck and killed by lightning in the United States.[85] With an average of 28 people per year, this would equate to 500 people struck and killed by lightning in the United States by 2023. Almost two thirds of the deaths occurred to people who had been enjoying outdoor leisure activities. Males accounted for 80% of all fatalities and more than 90% of the deaths in the fishing, sports, and work categories.[86]

The impact of lightning on Hillsborough County is significant. While not always directly measurable by personal injury or financial loss, the fact Hillsborough County lies in one of the most concentrated areas for lightning strikes in the world leads to effects outside of meteorological documentation. The practice of safety in lightning avoidance is a major mitigation measure for residents in the area, as this hazard can result in construction delays, canceled outdoor events, and possible revenue loss based on these interruptions and cancellations due to thunderstorm generated lightning. Estimations based on previous meteorological records reveal that lightning strikes can reach 1,000

[85] https://www.cdc.gov/disasters/lightning/victimdata/infographic.html
[86] https://www.weather.gov/media/safety/Analysis06-18.pdf

per hour in the peak of a severe summer thunderstorm. Although not all of these are cloud-to-ground lightning, the impact can still be severe.

Recreational Activities

Residents and visitors of Hillsborough County partaking in many outside activities, leading to increased vulnerability to lightning and hail that may occur during a thunderstorm. High risk areas include baseball, football, soccer fields, recreational areas, lakes, boats, docks, and beaches where populations are exposed to lightning strikes and/or are directly impacted by hail.

Attendees at Raymond James Stadium, George M. Steinbrenner Field, Plant Field, Al Lopez Field, Larry Sanders Progress Village Sports Complex, Lowry Park Zoo, Busch Gardens Amusement Park, MIDFLORIDA Credit Union Amphitheatre, Florida State Fair Grounds, the Tampa Riverwalk, Sparkman's Wharf, and Curtis Hixon Waterfront Park are at higher risk. They are advised to seek shelter when lightning strikes are within close proximity. Special events that occur annually in the community include numerous music festivals/concerts, races including marathons/half marathons, the Florida State Fair, Strawberry Festival in Plant City, the Gasparilla Day Parade and Gasparilla Children's Parade. Various common recreational activities in Hillsborough County, including fishing, kayaking, biking, skateboarding, swimming, riding motorcycles, and golfing, could pose a risk to those engaging in these activities when a severe thunderstorm and lightning occurs.

Various factors contribute to lightning fatalities, including the willingness to cancel or postpone activities, the ability to know when a storm is approaching or developing, the ability to get to a safe place quickly, and the vulnerability of the actual activity.

Health Vulnerabilities

Populations of concern in Hillsborough County include individuals with health concerns that need to be considered regarding power outages that could occur due to a severe thunderstorm. Many individuals may be electricity dependent (i.e., ventilators, oxygen concentrators, CPAP and other sleep apnea devices, dialysis machines, take medications needing refrigeration) and have functional needs that pose a challenge to their safety and well-being.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

Since severe storms are a hazard that does not have geographically definable boundaries, it was excluded from spatial analysis through GIS. However, because severe storms are considered atmospheric, they have the potential to affect all buildings and all populations in Hillsborough County.

Severe storms do not always impact structures, but impacts could include flooding from heavy rain, wind, hail, and lighting. Please refer to the *Flood Hazard Profile* for the 100-year and 500-year floodplain vulnerability and loss estimations. Most structures do not sustain damage because of the Florida Building Code and the speed of most winds during severe storms. This is because most buildings are built to withstand hurricane-force winds, and severe storms often do not have high wind speeds. Hail is unlikely to cause damage because of the fact that, oftentimes, hail does not impact the county. Lightning impacts on structures are minimal.

People could be impacted by severe storms in a number of ways. Lightning can result in death or severe injury if a person is struck; heavy rain can result in rising floodwaters that can lead to drowning or other serious injury; injuries from hail are rare, but they can be severe; and wind can cause trees to fall and potentially result in injuries or death.

National Risk Index

The National Risk Index (NRI) was utilized to obtain information for risk analysis on the severe storm hazard at the census tract level across Hillsborough County. As severe storms are not a category in the NRI, hail, strong wind, and lightning were analyzed to determine Hillsborough County's vulnerability to severe storms as they are each component of the hazard.

The NRI compiles data from the NWS's monthly Storm Data publication to use as records for hail and strong wind events in the county and uses the NCEI storm events database to use as records for lightning events in the county, to determine the probability of each occurring by census tract. NRI also takes into account which census tracts are exposed to the hazard. For hail, strong wind, and lightning, the NRI assumes all census tracts are exposed as each hazard can occur anywhere. The hazard event records are used to determine the annual frequency of the hazard occurring by census tract, which is then paired with a calculated historical loss ratio based on past hazard events. Annual frequency, exposure, and the historic loss ratio are used to calculate expected annual loss which is then multiplied by the CDC's social vulnerability index score and divided by a Community Resilience score which is taken from the Hazards Vulnerability & Resilience Institute's (HVRI) Baseline Resilience Indicators for Communities (BRIC) index to obtain the NRI's vulnerability ranking. [87]

Hail

Figure 5.25 shows vulnerability to hail by census tract across the county from FEMA's National Risk Index.

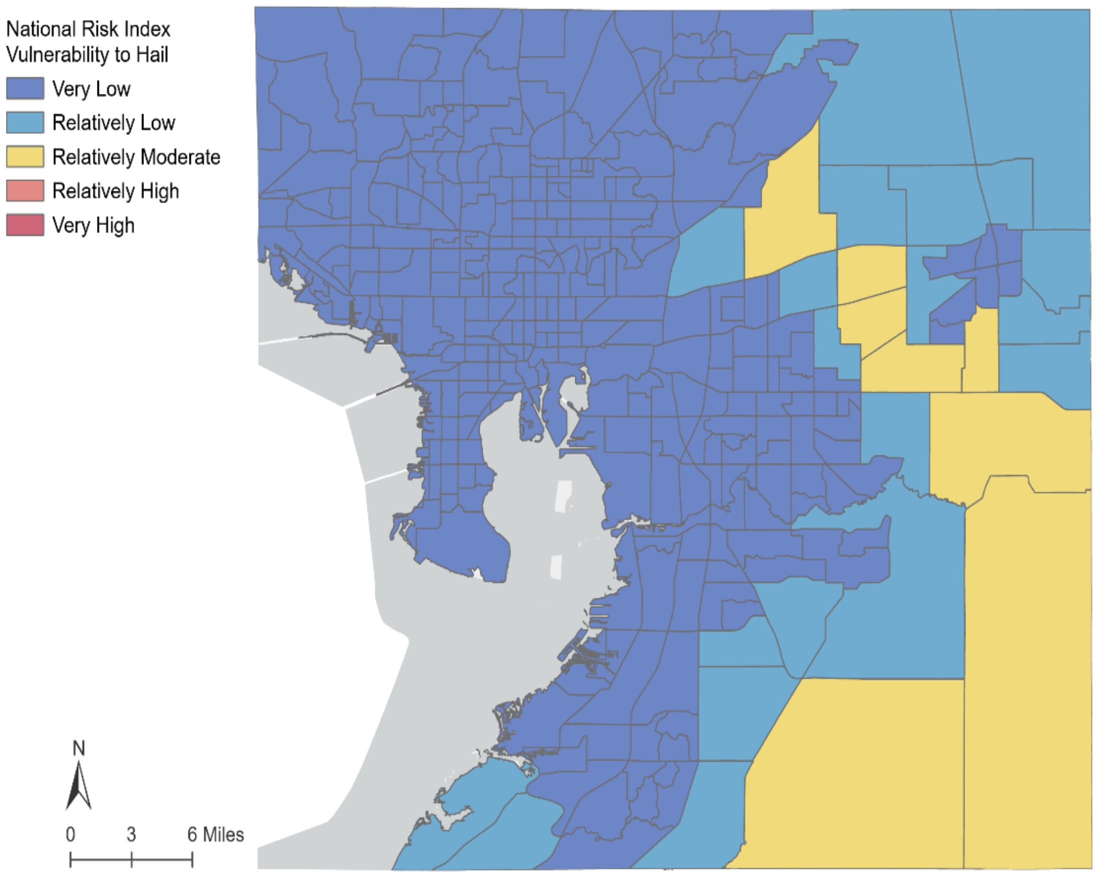


Figure 5.25. NRI Vulnerability to Hail [88]

[87] https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
[88] https://hazards.fema.gov/nri/map

As seen in Figure 5.25, Hillsborough County has a relatively low vulnerability to hail. Only areas in unincorporated Hillsborough County have a moderate risk of hail based on this NRI data with 8 total census tracts having moderate risk of hail likely due to this land being mostly agriculturally based.

Table 5.48 below, breaks this down by jurisdiction.

Table 5.48. NRI Vulnerability to Hail Breakdown by Jurisdiction

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk	# of Relatively Moderate Risk
Hillsborough County (Unincorporated)	187	16	8
City of Plant City	7	4	0
City of Tampa	103	0	0
City of Temple Terrace	8	0	0
Hillsborough County (Total)	**305**	**20**	**8**

Figure 5.26 shows annual losses in Hillsborough County from hail damages by census tract, as reported by the NRI.

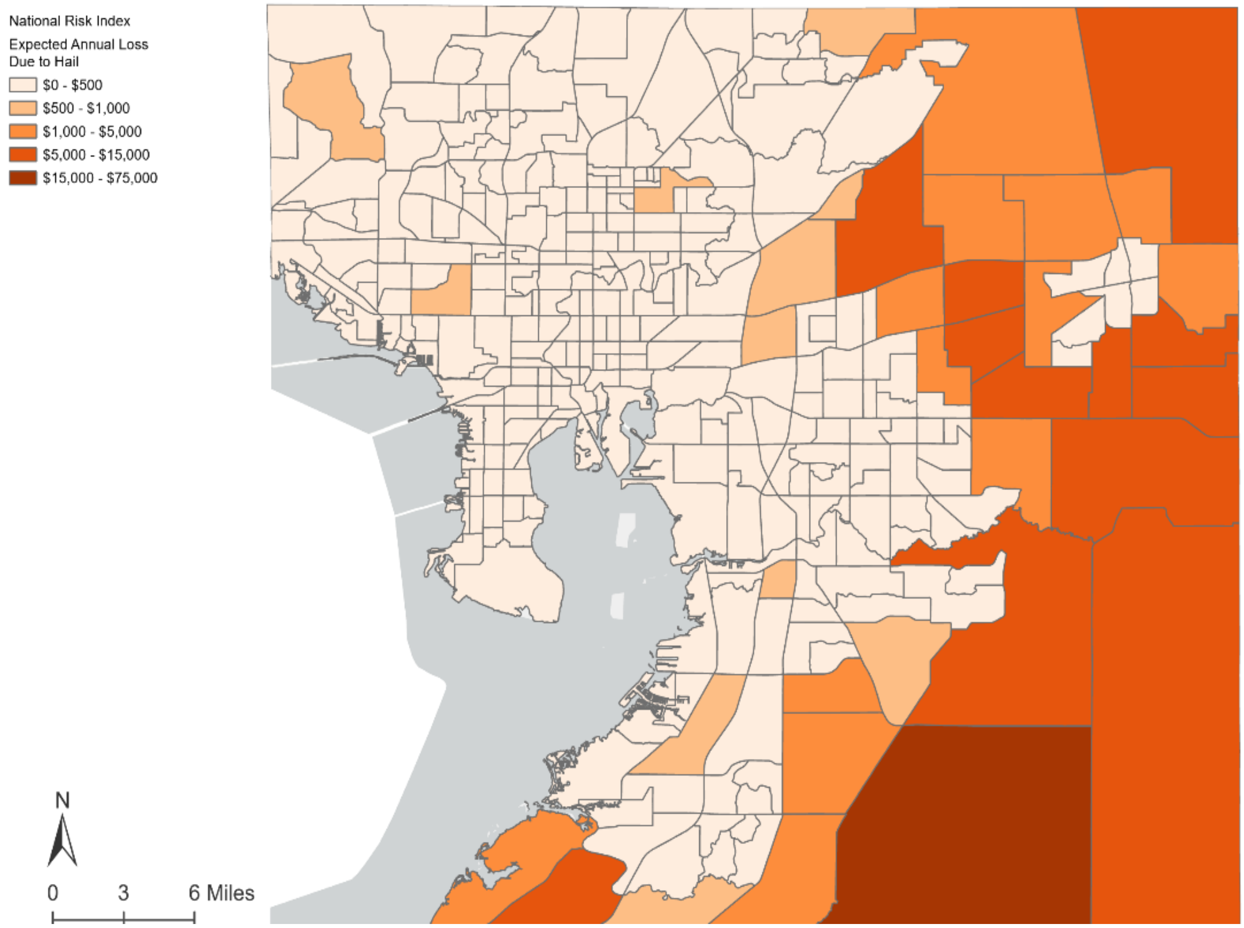


Figure 5.26. Expected Annual Loss due to Hail[89]

[89] https://hazards.fema.gov/nri/map

The majority of census tracts in Hillsborough County have below $500 in expected annual loss due to hail. Southern and eastern Hillsborough County account for most of the expected annual loss values. 90% of all expected annual loss due to hail can be found in unincorporated Hillsborough County. This is largely due to the larger number of agricultural acres found in these regions and the impact hail can have on crops. The breakdown of the census tract expected annual loss by jurisdiction can be found in Table 5.49 below.

Table 5.49. Expected Annual Loss due to Hail Breakdown by Jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$288,972
City of Plant City	$14,817
City of Tampa	$17,922
City of Temple Terrace	$1,440
Hillsborough County (Total Loss)	**$323,151**

Strong Wind

Similar to hail, risk is low in Hillsborough County for strong wind damage from these types of events, as shown in Figure 5.27 .

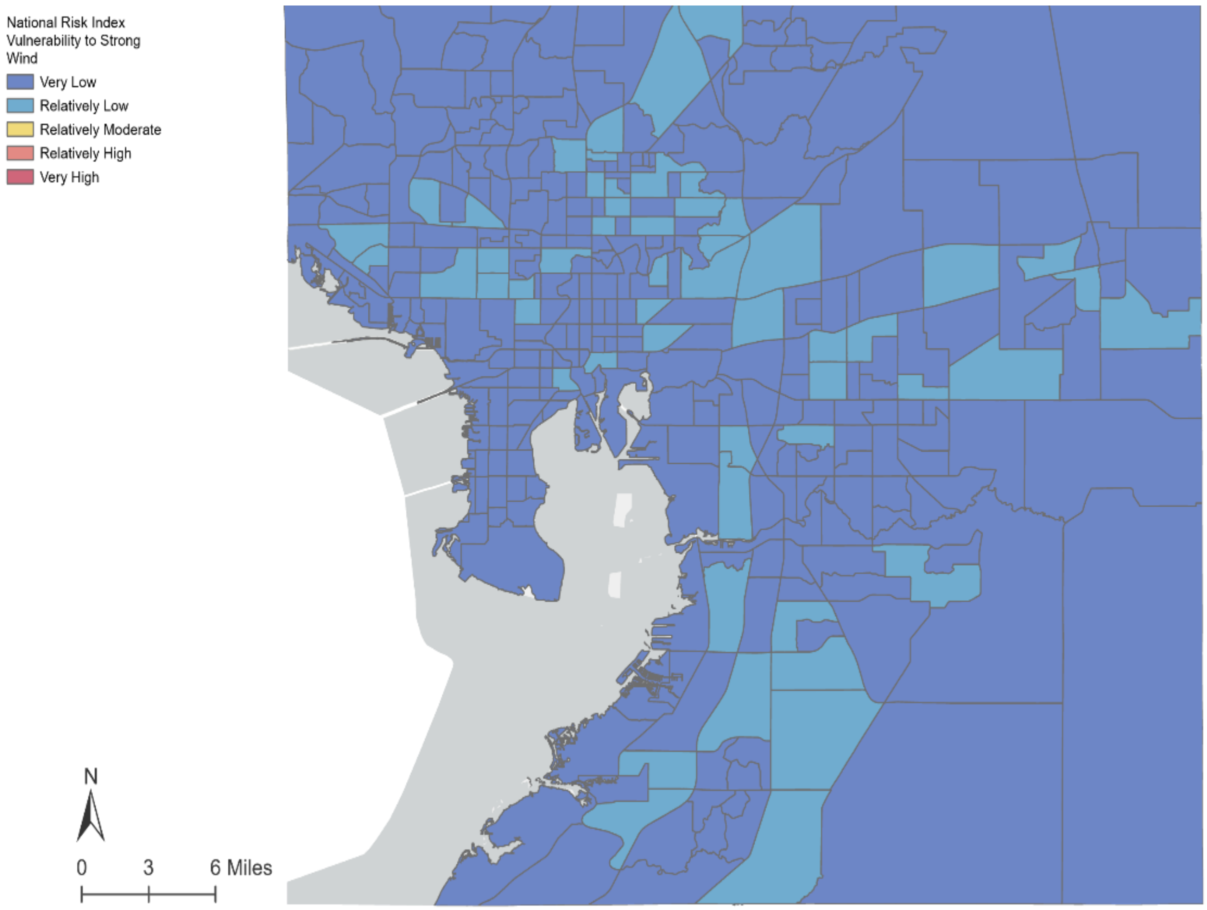


Figure 5.27. NRI Vulnerability to Strong Wind [90]

Eighty-four percent of the census tracts in the county have a very low risk of strong wind, with the remaining 16% having a relatively low risk of strong wind. This risk to strong wind is broken down by jurisdiction in Table 5.50 below.

Table 5.50. NRI Vulnerability to Strong Wind Breakdown by Jurisdiction

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk
Hillsborough County (Unincorporated)	176	35
City of Plant City	8	3

[90] https://hazards.fema.gov/nri/map

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk
City of Tampa	91	12
City of Temple Terrace	4	4
Hillsborough County (Total)	**279**	**54**

Figure 5.28 shows NRI's expected annual losses from strong wind associated with severe storms by census tract.

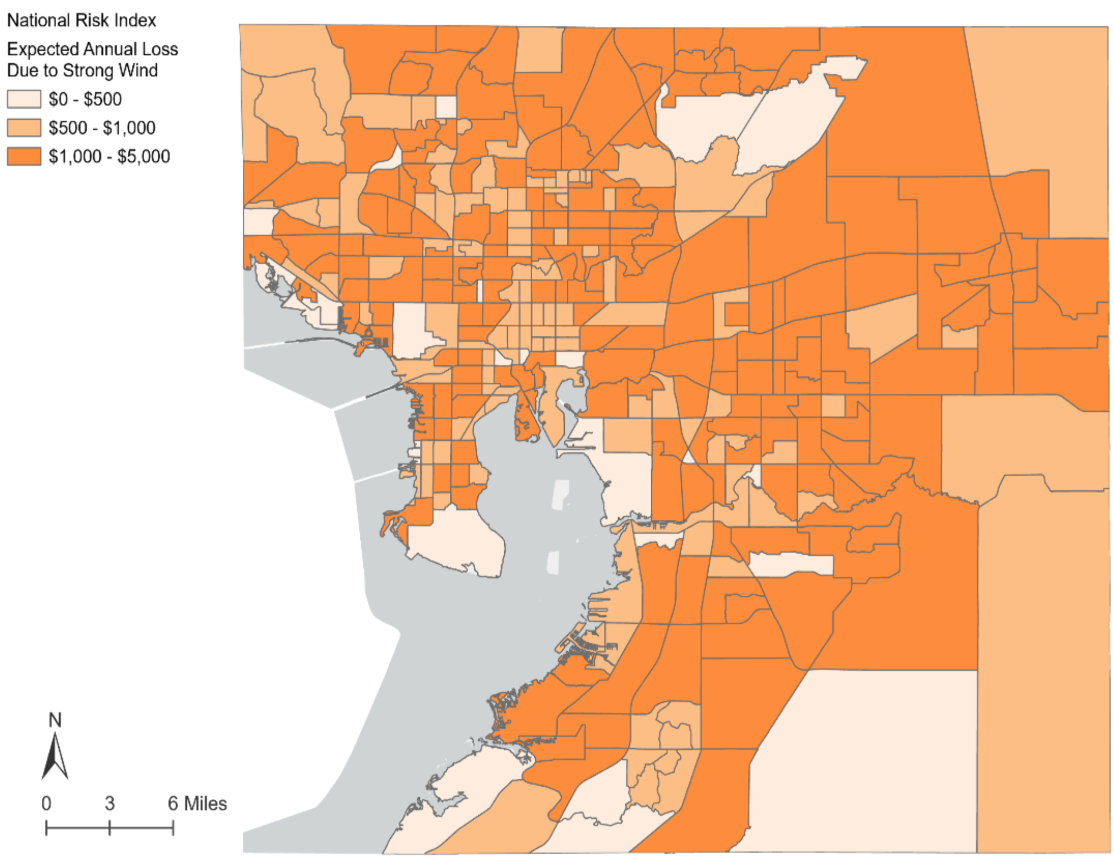


Figure 5.28. Expected Annual Loss Due to Strong Wind [91]

A $813,039 loss is expected annually in the county. While no census tract has an expected annual loss greater than $5,000, the loss rate is relatively uniform throughout the county and overall leads to a higher expected annual loss than hail. These loss values are broken down by jurisdiction in Table 5.51 below. 83% of the expected annual loss in the county is in unincorporated Hillsborough, 14% in the City of Tampa, 2% in the City of Plant City and 1% in the City of Temple Terrace.

[91] https://hazards.fema.gov/nri/map

Table 5.51. Expected Annual Loss Due to Strong Wind Breakdown by Jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$676,135
City of Plant City	$15,059
City of Tampa	$110,725
City of Temple Terrace	$11,120
Hillsborough County (Total Loss)	**$813,039**

Lightning

Figure 5.29 This shows vulnerability to lightning by census tract from the NRI. The NRI uses an NCEI dataset of all recorded cloud-ground lightning strikes to calculate their historic occurrences of lightning events by census tract. All census tracts are considered for lightning as well. This data then uses the same method as mentioned above in the Hail section to calculate expected annual loss and areas that are vulnerable to lightning strikes.

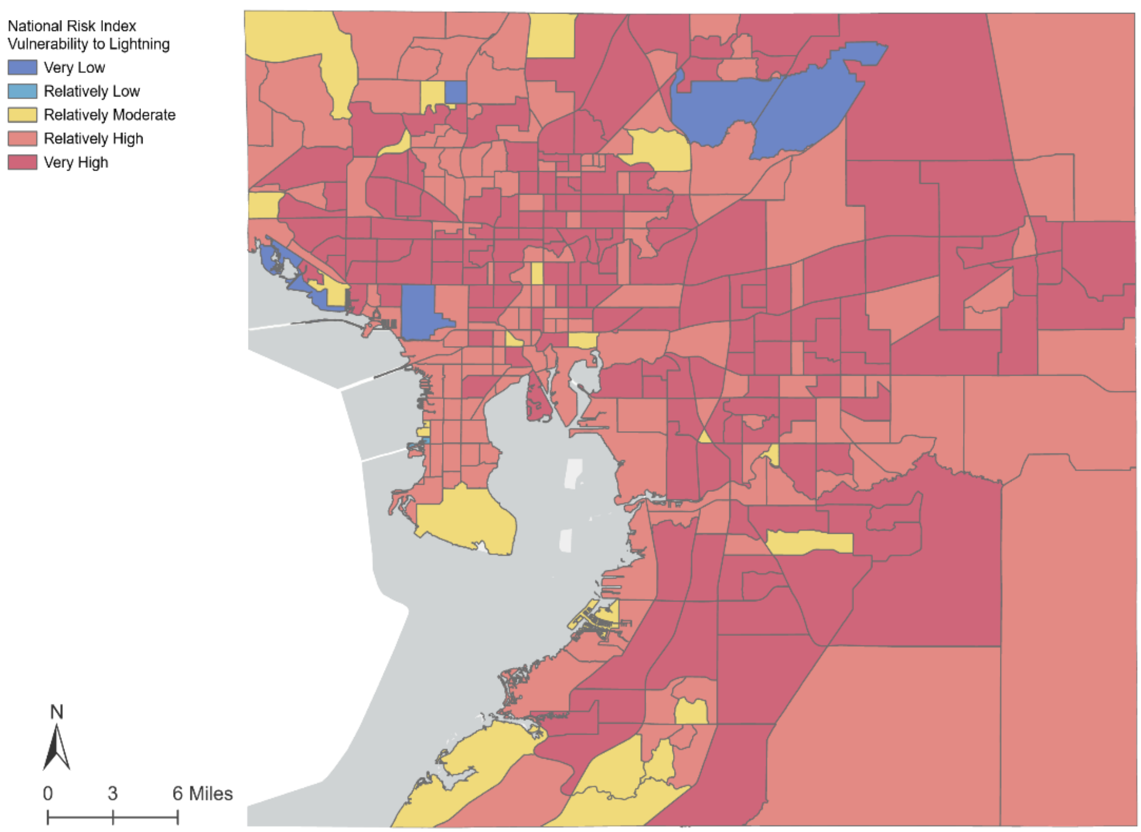


Figure 5.29. NRI Vulnerability to Lightning [92]

[92] https://hazards.fema.gov/nri/map

In contrast to hail and strong wind in the county, lightning holds a high level of risk throughout Hillsborough as shown in Figure 5.29. 155 of the census tracts in Hillsborough County have a very high risk of lightning, according to the NRI, and 150 of the census tracts in the county have a relatively high risk of lightning. These, along with the 21 moderate risk-to-lightning census tracts, account for 98% of the county having a moderate to high risk of lightning. A breakdown of vulnerability by census tracts in each jurisdiction can be seen in Table 5.52 below.

Table 5.52. NRI Vulnerability to Lightning Breakdown by Jurisdiction

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk	# of Relatively Moderate Risk	# of Relatively High Risk	# of Very High Risk
Hillsborough County (Unincorporated)	5	0	15	86	105
City of Plant City	0	0	0	4	7
City of Tampa	1	1	6	56	39
City of Temple Terrace	0	0	0	4	4
Hillsborough County (Total)	**6**	**1**	**21**	**150**	**155**

Figure 5.30 shows expected annual losses from lightning by census tract according to the FEMA's NRI.

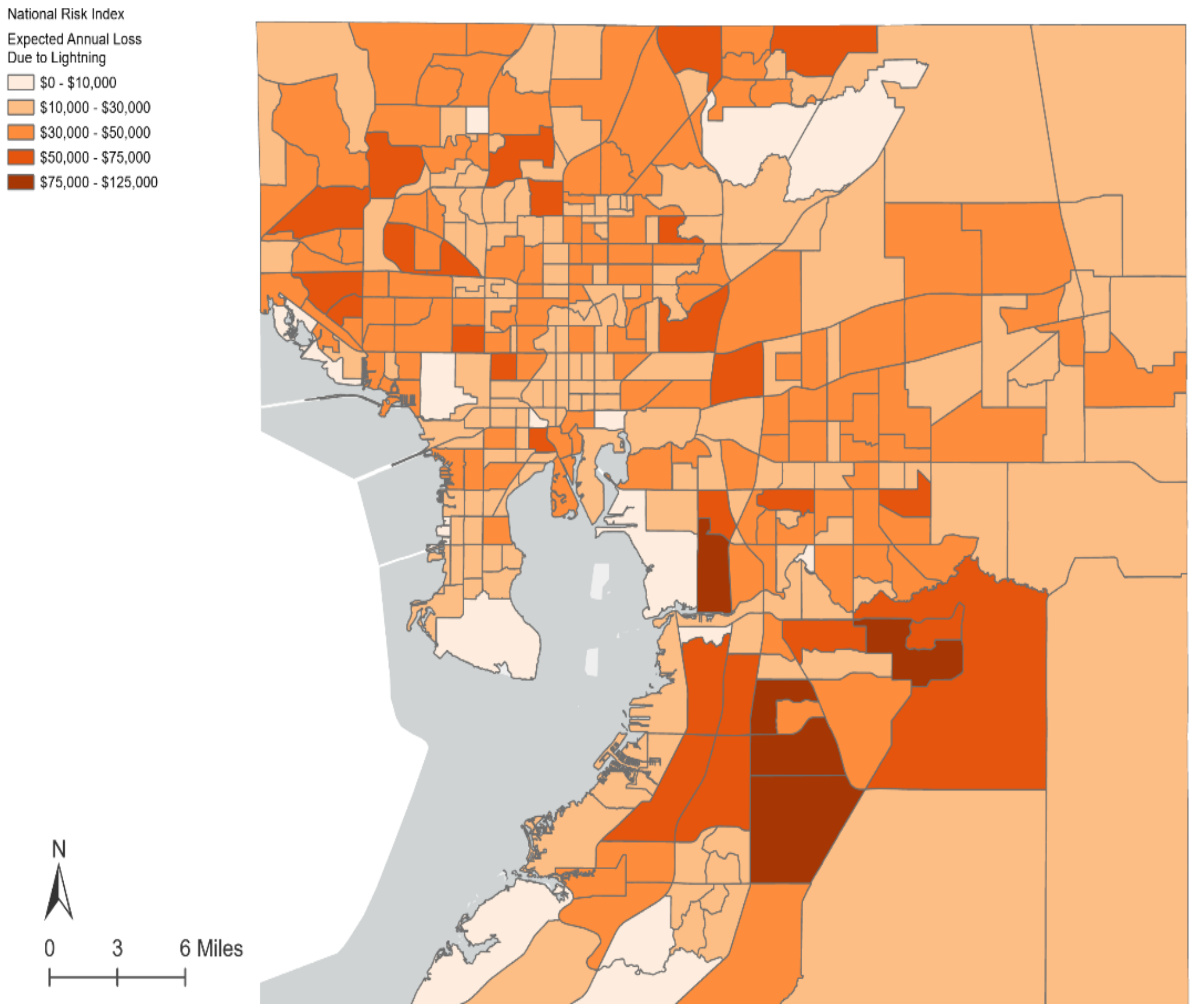


Figure 5.30. Expected Annual Loss due to Lightning [93]

Similarly to the high risk of lighting mentioned above, the expected annual loss due to lightning is high in the county and is shown below in Table 5.53.

Table 5.53. Average Expected Annual Loss due to Lightning Breakdown by Jurisdiction.

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$7,714,398
City of Plant City	$319,891
City of Tampa	$2,747,422
City of Temple Terrace	$267,600

[93] https://hazards.fema.gov/nri/map

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Total Loss)	**$11,049,311**

Population by jurisdiction within high or moderate risk of exposure to severe storm events (hail, strong wind, and/or lightning is presented in Table 5.54 below. This analysis was conducted using the NRI population data. The total population at risk is estimated at 1,427,090, which is 97.2% of the entire county's population. 100% of the population is at high or moderate risk of severe storms in Plant City and Temple Terrace. Tampa and Unincorporated Hillsborough County are not far behind, with 97.0% and 97.1% of the population exposed to high or moderate risk of severe storm respectively. 97.2% of the total population of Hillsborough County is exposed to severe storms.

Table 5.54. Total population and percentage at moderate risk of severe storm exposure, by jurisdiction

Jurisdiction	Total Population	Total Population at Risk	Total % at Risk
Hillsborough County (Unincorporated)	989,745	961,042	97.1%
City of Plant City	48,289	48,289	100%
City of Tampa	382,484	373,272	97.6%
City of Temple Terrace	37,764	37,764	100%
Hillsborough County (Total)	**1,458,282**	**1,420,367**	**97.4%**

Historical Losses

The NCEI Storm Events Database information, presented in the Historical Occurrences section above, also contained property and crop damage dollar amounts, shown in the table below. As noted in that section, these numbers represent reported losses only and likely understate actual losses.

Table 5.55 shows actual reported losses from 1996-2023, inflated to 2023 dollars.

Table 5.55. Severe Storm Events in Hillsborough County, by Type, (1996–2023)[94]

Type of Event	Number of Events	Deaths	Injuries	Property Damage (2023 dollars)	Crop Damage (2023 dollars)
Lightning	108	9	69	$8,945,278	$331,307
Heavy Rain	36	0	0	$15,345	$882
Hail	189	0	0	$2,174,554	$80,539
Wind	296	1	28	$10,633,989	$393,851
TOTAL	**629**	**10**	**97**	**$21,769,166**	**$806,579**

The information can be analyzed to provide the average amount of property and crop damage that is likely each year. This information is shown in Table 5.56 below.

Table 5.56. NCEI Severe Storms, 1996–2023

NCEI Storm Event (hazard)	Average Severe Storms per Year	Annualized Property Loss (2023 dollars)	Annualized Crop Loss (2023 dollars)
All Types of Severe Storm	23.3	$806,265	$29,873

According to the analysis, Hillsborough County is historically vulnerable to a little over $800,000 in property damages and approximately $30,000 in crop damages from roughly 23 severe storm events each year.

Justice40 Climate and Economic Justice Screening Tool (CEJST)

Utilizing the Climate and Economic Justice Screening Tool (CEJST) and the National Risk Inventory (NRI) datasets at the census tract level, disadvantaged communities were identified in Hillsborough County. In addition, a high or moderate risk of severe storm (hail, strong wind, and lightning) was identified from the NRI dataset and overlayed with the disadvantaged communities. As shown in

[94] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Hail&eventType=%28C%29+Heavy+Rain&eventType=%28Z%29+High+Wind&eventType=%28C%29+Lightning&eventType=%28Z%29+Strong+Wind&eventType=%28C%29+Thunderstorm+Wind&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Figure 5.31, a total of 131 communities (e.g. census tracts) across Hillsborough County are identified as disadvantaged, accounting for 53% of total communities at the census tract level.

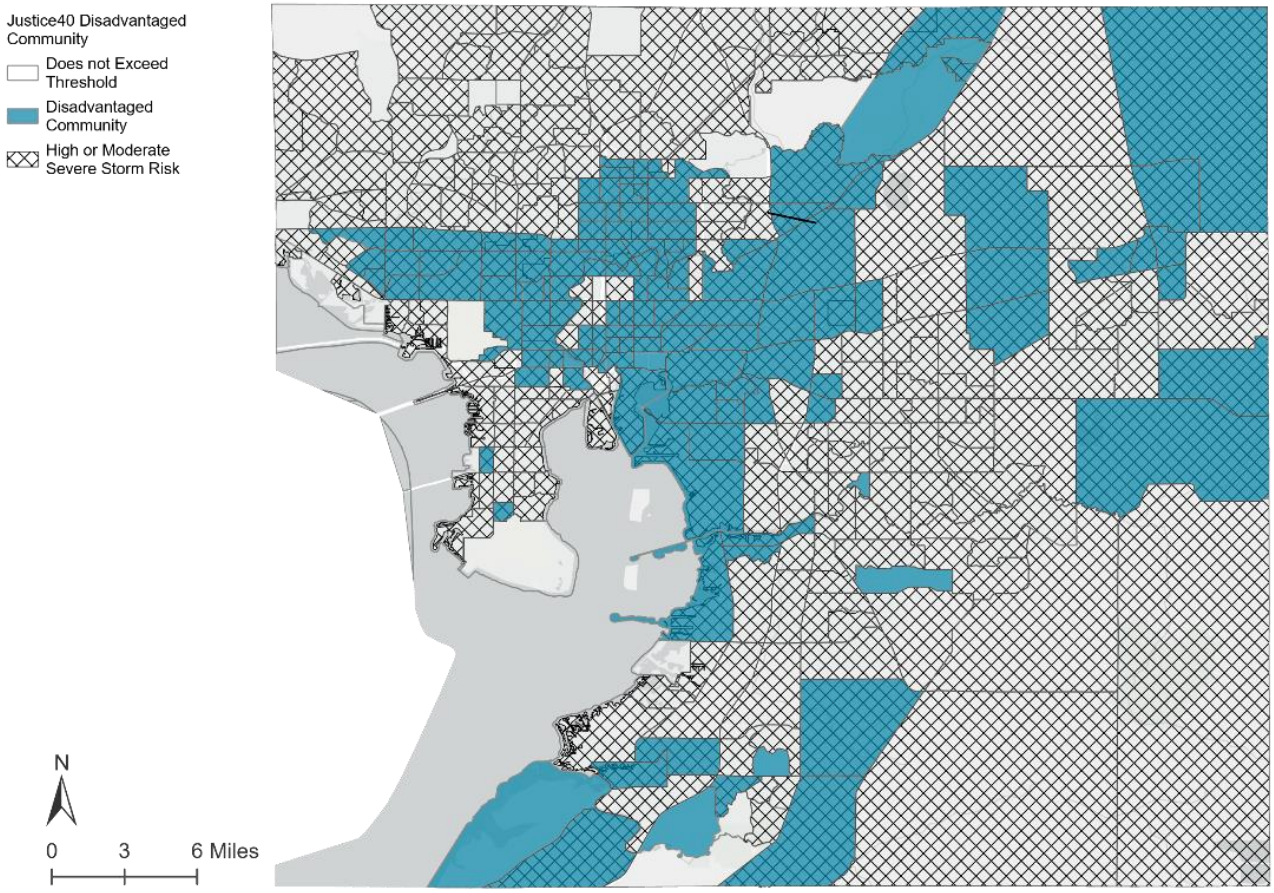


Figure 5.31. Justice40 Disadvantaged Communities Vulnerable to Severe Storm

A majority of the disadvantaged communities, 52.7%, are located in unincorporated Hillsborough County followed by the City of Tampa with 41.2% of the total disadvantaged communities.

Table 5.57 displays the total number of disadvantaged communities in each jurisdiction and the number of those communities at risk of moderate or high risk of severe storm exposure. Of the 131 disadvantaged communities in Hillsborough County altogether, all but 6 are at risk of moderate to high severe storm exposure, equating to approximately 95.4%. All of which are in Unincorporated Hillsborough County.

Table 5.57. Breakdown of disadvantaged communities and risk to severe storm, by jurisdiction

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities with Mod/High Severe Storm
Hillsborough County (Unincorporated)	69	63
City of Plant City	6	6
City of Tampa	54	54
City of Temple Terrace	2	2
Hillsborough County (Total)	**131**	**125**

Vulnerability Analysis and Loss Estimation of Critical Facilities

Severe storms can strike anywhere in Hillsborough County; therefore, all of the county critical facilities and community lifelines are equally vulnerable and at risk. However, severe storms do not always impact structures. Severe storms' impacts on structures, including critical facilities and community lifelines, are listed above under Exposure. Older buildings and small appurtenant structures are at higher risk of wind damage, hail damage to roofs and the potential for fire from lightning strikes. Lightning strikes can also bring down vulnerable communications along with impacts to building electrical systems.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.6 (

Table 5.58).

Table 5.58. Overall Vulnerability to Severe Storm for Hillsborough County

SEVERE STORM					Overall Vulnerability	
Overview						
The three key elements of a thunderstorm are wind, water, and lightning. The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least one inch in diameter, 58 mph or stronger winds, or a tornado. Lightning, flash floods, hail, straight line winds, and tornadoes are some of the hazards related to severe storms. Afternoon thunderstorms are typical summer-time occurrences that can become severe storms and can occur in any part of the county.					HIGH	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Highly Likely	Critical	Large	6 to 12 hrs	Very Concerned	< 1 week	3.6

4.3 Tropical Cyclone Hazard Profile

Tropical Cyclone Description

Tropical storms and hurricanes are characterized by strong winds and rain, tidal and inland flooding, and high waves, and have the potential to spawn severe thunderstorms, lightning, and tornados. These weather events, generally known as tropical cyclones, are an organized system of rotating clouds and thunderstorms that originate over tropical or subtropical waters and have a closed low-level circulation. These storms form when a developing center of low pressure moves over warm water, and the pressure drops in the storm's center. As the pressure drops, the system becomes more organized, and the winds begin to rotate around the low pressure, pulling in the warm and moist ocean air. This is what causes the wind and rain associated with a tropical cyclone. As the storm system rotates faster, an eye forms in the center. Higher-pressure air from above flows down into the eye.

Tropical cyclones act as a safety valve that limits the build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the poleward latitudes.

Tropical cyclones rotate counterclockwise in the Northern Hemisphere, moving normally from east to west with an average diameter of 200 to 400 miles. If all conditions are favorable (warm ocean water and favorable high-altitude winds), the system could strengthen to become categorized as a tropical storm or hurricane. The following are descriptions of the four general levels of development for tropical cyclones:

- **Tropical Depression—**The formative stages of a tropical cyclone in which the maximum sustained surface winds are 38 mph (33 knots) or less.
- **Tropical Storm—**A tropical cyclone with maximum sustained surface winds ranging from 39 to 73 mph (34 to 63 knots).
- **Hurricane—**A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher.
- **Major Hurricane—**A tropical cyclone with maximum sustained surface winds of at least 111 mph (96 knots) or higher, corresponding to a Category 3, 4, or 5 on the Saffir-Simpson Hurricane Wind Scale.

Hurricanes are further ranked by wind speed from Category 1 to 5, with 5 being catastrophic. The Saffir- Simpson Hurricane Wind Scale is shown in Table 5.59.

Special Consideration: *While this document will profile Tropical Cyclone as one hazard, the communities within Hillsborough County have operational and planning documents that discretize the hazard into Minor (Tropical Depression through Category 2 Storm) and Major (Category 3 and higher events). Table 4.4 at the beginning of the Risk Assessment Section identifies this relative to each jurisdiction.*

Table 5.59. Saffir-Simpson Hurricane Wind Scale[95]

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74–95 mph	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96–110 mph	**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.
3 (major)	111–129 mph	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130–156 mph	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or Higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Four major hazards produced by tropical storms and hurricanes need to be considered: *storm surge, high winds, large rainfall, and rip currents*.

- ***Storm Surge***: Storm surge is the rise in water level in coastal areas caused by a hurricane's wind and pressure forces. Generally speaking, the more intense the hurricane, the higher the surge will be. The output of the National Oceanic and Atmospheric Administration (NOAA) storm surge prediction model (SLOSH) shows that storm surge height of 28 feet or more above

[95] http://www.nhc.noaa.gov/aboutsshws.php

sea level could impact certain Hillsborough coastal and riverine areas under a worst-case Category 5 hurricane.

The National Hurricane Center forecasts storm surge using the SLOSH model, which stands for Sea, Lake, and Overland Surges from Hurricanes. The model is accurate to within 20 percent. The inputs include the central pressure of a tropical cyclone, storm size, the forward motion, its track, and maximum sustained winds. Local topography, bay and river orientation, depth of the sea bottom, astronomical tides, and other physical features are considered in a predefined grid referred to as a "SLOSH basin." To allow for tracking or forecasting uncertainties, usually several model runs with varying input parameters are generated to create a map of MOMs, or Maximum of Maximums.[96]

In 2010, the National Hurricane Center separated storm surge from the Saffir-Simpson Hurricane Wind Scale because it did not accurately describe storm surge. For example, a Category 1 hurricane could have a devastating storm surge, while a Category 5 hurricane could have minimal storm surge. The Gulf Coast of Florida has a long, gently sloping shelf and shallow water depths, leading to higher storm surge than the Atlantic Coast of Florida but there are smaller waves. The bay and river orientation in Hillsborough County, the depth of the sea bottom, astronomical tides, and other physical features are considered to determine storm surge levels and their impact on the built environment, ecology, and population of Hillsborough County. An example of storm surge can be seen in Figure 5.32.

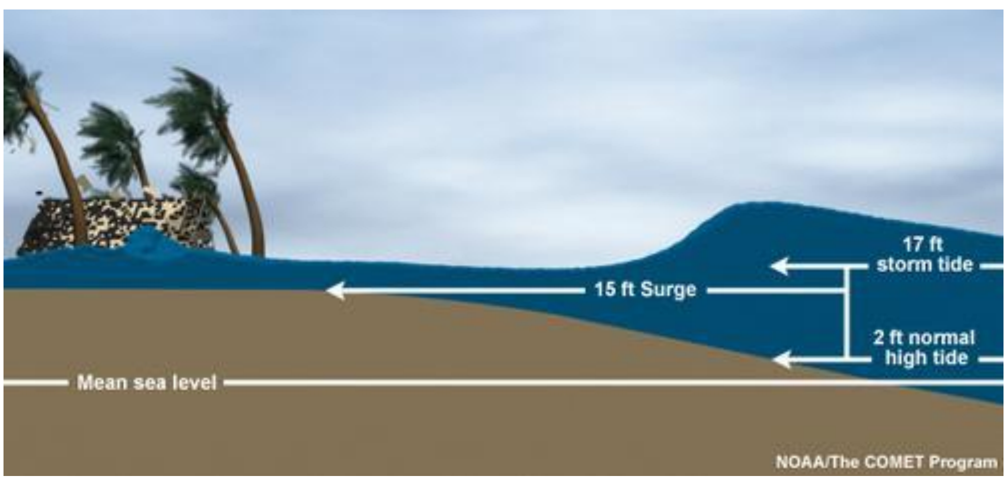


Figure 5.32. Storm Surge Explanation

- ***High Winds***: The high winds of a hurricane also present significant dangers and hazardous conditions to the populace and cause severe damage to the built environment and ecology, as well as a substantial amount of debris. This hazard especially applies to structures unable to withstand the stress and uplift forces from hurricane force winds ranging from 74 to more than 155 miles per hour. Structures most vulnerable to hurricane force winds tend to be manufactured homes and substandard housing not built to current building codes. Debris, including signage, pieces of structures not properly secured, flying glass from structures and

[96] http://www.nhc.noaa.gov/surge/slosh.php

high-rise buildings, and even shallow-rooted trees, are often carried by the high winds, which causes further damage and roadway obstructions. The majority of wind damage caused by hurricanes has resulted from downbursts, which are strong downdrafts causing damaging winds on or near the ground.

- ***Tornados***: Tornados are a threat during tropical cyclones and have been associated with most cyclones that have affected Florida. Tornados tend to develop on the northwest edge relative to the hurricanes' forward motion. These tornados are usually short-lived and relatively weak. For more information regarding tornados, please see the *Tornado Hazard Profile*.
- ***Large Rainfall***: Rainfall varies with hurricane size, forward speed, and other meteorological factors. Residents must be aware that rainfall can cause flash flooding and flooding on rivers and streams that can persist for several days after the storm. This flooding is the biggest threat from tropical cyclones for people living inland in low-lying areas and along rivers or canals that are a major drainage system. The Rainfall amounts are related to the speed and size of a tropical cyclone, not the intensity of the storm. Slower moving and larger tropical cyclones have a longer and larger capacity to produce more rainfall in an area, leading to increased flooding. For more information regarding flooding, please see the *Flood Hazard Profile*.
- ***Rip Currents***: The strong winds associated with tropical cyclones can cause rip currents, which significantly threaten mariners, coastal residents, and visitors. Rip currents are channeled currents of water flowing away from shore and can easily pull strong swimmers into the open water. These rip currents can occur before and after a tropical storm or hurricane, even when the county is still far from the storm system.

The National Weather Service produces Rip Current Outlooks to alert beachgoers to the risk of rip currents at a particular beach or waterway. There are three levels of outlooks:[97]

- Low Risk: The risk for rip currents is low; however, life-threatening rip currents often occur in the vicinity of jetties, reefs, and piers.
- Moderate Risk: Life-threatening rip currents are possible in the surf zone.
- High Risk: Life-threatening rip currents are likely in the surf zone.

National Hurricane Center Advisories

The NOAA National Hurricane Center (NHC) tracks and predicts tropical weather systems. Whenever tropical cyclones form, they issue advisories every six hours until the storm is over. Public advisories are issued more often when the storm is expected to form into a tropical storm or hurricane.

Table 5.60 describes the advisories and thresholds the NHC can issue during a Tropical Cyclone event.

[97] https://www.weather.gov/media/srh/tropical/TropicalCyclones11.pdf

Table 5.60. National Hurricane Center Advisories and Thresholds during a Tropical Cyclone.[98]

National Hurricane Center Advisories	
Tropical Storm	
Tropical Storm Watch	Issued when sustained winds of 39 to 73 mph are possible in the specified area within 48 hours in association with a tropical cyclone. These watches are issued 48 hours in advance of the anticipated onset of tropical storm force winds because preparedness activities become difficult and unsafe once winds reach tropical storm force.
Tropical Storm Warning	Issued when sustained winds of 39 to 73 mph are expected in the specified area within 36 hours in association with a tropical cyclone. These warnings are issued 36 hours in advance of the anticipated onset of tropical storm force winds because preparedness activities become difficult and unsafe once winds reach tropical storm force.
Potential Tropical Storm	Until 2017, the National Hurricane Center was only able to issue warnings when a storm had already formed. This is a problem because sometimes forecasting is certain enough to know that a disturbance will turn into a storm closer to landfall, but by the time a warning is sent out when a storm is close to land; it will be too late for protective actions. To remedy this issue, the NHC will now have the option to issue Potential Tropical Cyclone Warnings for areas of disturbance that are expected to develop into a tropical storm or hurricane and impact land within 48 hours.
Hurricane	
Hurricane Watch	Issued when 74 mph winds or higher are possible in the specified area within 48 hours in association with a tropical cyclone. Because preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours in advance of the anticipated onset of tropical storm force winds.
Hurricane Warning	Issued when 74 mph winds or higher are expected in the specified area within 36 hours in association with a tropical cyclone. Because preparedness activities become difficult once winds reach tropical storm force, the hurricane warning is issued 36 hours in advance of the anticipated onset of tropical storm force winds.
Storm Surge	
Storm Surge Watch	Issued when there is the possibility of life-threatening inundation from rising water moving inland from the shoreline in the specified area, generally within 48 hours, in association with an ongoing or potential tropical cyclone.
Storm Surge Warning	Issued when the danger of life-threatening inundation from rising water moving inland from the shoreline in the specified area, generally within 36 hours, in association with an ongoing or potential tropical cyclone.

[98] http://www.nhc.noaa.gov/aboutgloss.shtml

National Hurricane Center Advisories
Storm Surge Watches and Warnings may be issued earlier based on timing forecasts and may be issued for locations adjacent to expected life-threatening inundation areas.

Causes of Fatalities in Tropical Cyclone Storms

There are two categories of causes of fatalities in tropical storms or hurricanes: direct and indirect. A direct death means that the fatality is attributable to forces of the storm, such as water or wind. An indirect death means that the fatality resulted from actions before, during, and after the storm.

According to a study from the National Hurricane Center, from 1963 to 2012, there was an average of 40 to 50 direct deaths from tropical storms or hurricanes each year. According to the study, 90% of the deaths are due to water, either storm surge, freshwater flooding, or rainfall. Of course, a large storm-to-storm and year-to-year variability is associated with that average.[99] Some of the impacts of storm surge can be seen in Figure 5.33. Storm surge can begin before the storm hits, cutting off escape routes for residents. The waves created from the surge can erode beaches and damage buildings, among other impacts to the community.

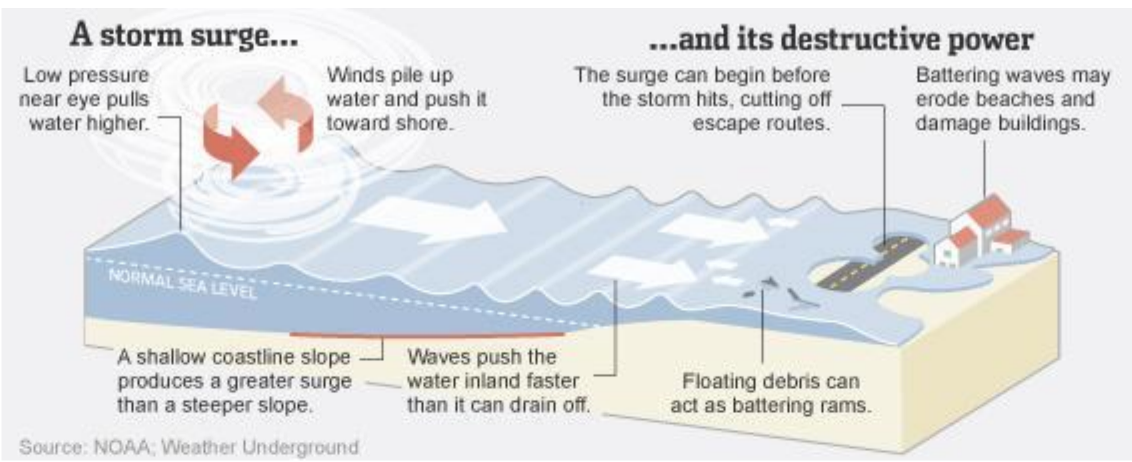


Figure 5.33. Explanation of Storm Surge in Areas with a Shallow Coastline Slope and the Potential Effects on Coastal Communities

The study also examined indirect deaths and found that there is an average of 30 to 40 indirect fatalities from tropical storms or hurricanes each year. Additionally, those over age 70 were found to be 8 times as likely to be victims than those under age 21. The study found four primary contributing factors to indirect deaths, some of which occur in combination. The leading cause of indirect deaths is cardiovascular complications; in fact, one-third of all indirect deaths are attributed to cardiovascular complications. The next factor is complications during evacuations, either during the evacuation or when the victim reaches the destination. Vehicle accidents are also a contributing factor to indirect deaths. Examples of vehicle accidents include hydroplaning, traffic lights out, and downed trees. Finally, indirect deaths are sometimes caused by power-related complications, such

[99] http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-12-00074.1

as the improper use of generators leading to carbon monoxide poisoning or structure fires, electrocutions, and loss of power to life-sustaining medical equipment.[100]

Geographic Areas Affected by Tropical Cyclone

The average diameter of tropical force winds extends 300-400 miles, while hurricane force winds average 100 miles.[101] This means all areas of Hillsborough County are subject to the effects of tropical cyclones. However, some areas are more vulnerable than others. Maps throughout this section illustrate the areas of Hillsborough County that are and can be impacted by tropical storms and hurricanes at different levels over time. Tropical cyclones are random in distribution, so no specific area in the county is more at risk than another. Figure 3, below, depicts all the tropical cyclones that affected Hillsborough County from 1852 to 2022 using data from NOAA's historical hurricane tracking data. It clearly shows that all areas of the county can be affected by tropical cyclones.[102] However, the coastal areas and along the rivers are more vulnerable to the effects that a tropical cyclone can produce due to urban development, location, population density, and the storm surge that can occur.

In 2024, Hillsborough County experienced significant impacts from multiple hurricanes, particularly Hurricanes Debby, Helene, and Milton, which caused widespread damage across the Tampa Bay area. These storms occurred within a short time frame, resulting in cumulative impacts that exacerbated flooding issues and led to extensive property damage.

The heavy rainfall associated with these hurricanes caused unprecedented flooding in several areas of Hillsborough County, including Apollo Beach, Ruskin, Gibsonton, and Town-n-Country. Notably, some of these areas experienced flooding for the first time, prompting a need to reanalyze flood-prone zones and develop new mitigation efforts. The flooding mainly affected older homes constructed at grade, which were more vulnerable to water intrusion.

In addition to flooding, the high winds and saturated ground conditions during these storms caused numerous old-growth trees to fall, resulting in property damage to homes and vehicles and creating hazardous road blockages. These impacts highlighted the need for enhanced tree maintenance programs and stormwater management improvements to reduce future risks. The back-to-back nature of these hurricanes underscored the importance of resilience planning and adaptive strategies to address evolving climate risks in Hillsborough County.

[100] http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-15-00042.1
[101] http://www.hurricanescience.org/science/science/hurricanestructure/
[102] https://coast.noaa.gov/hurricanes/

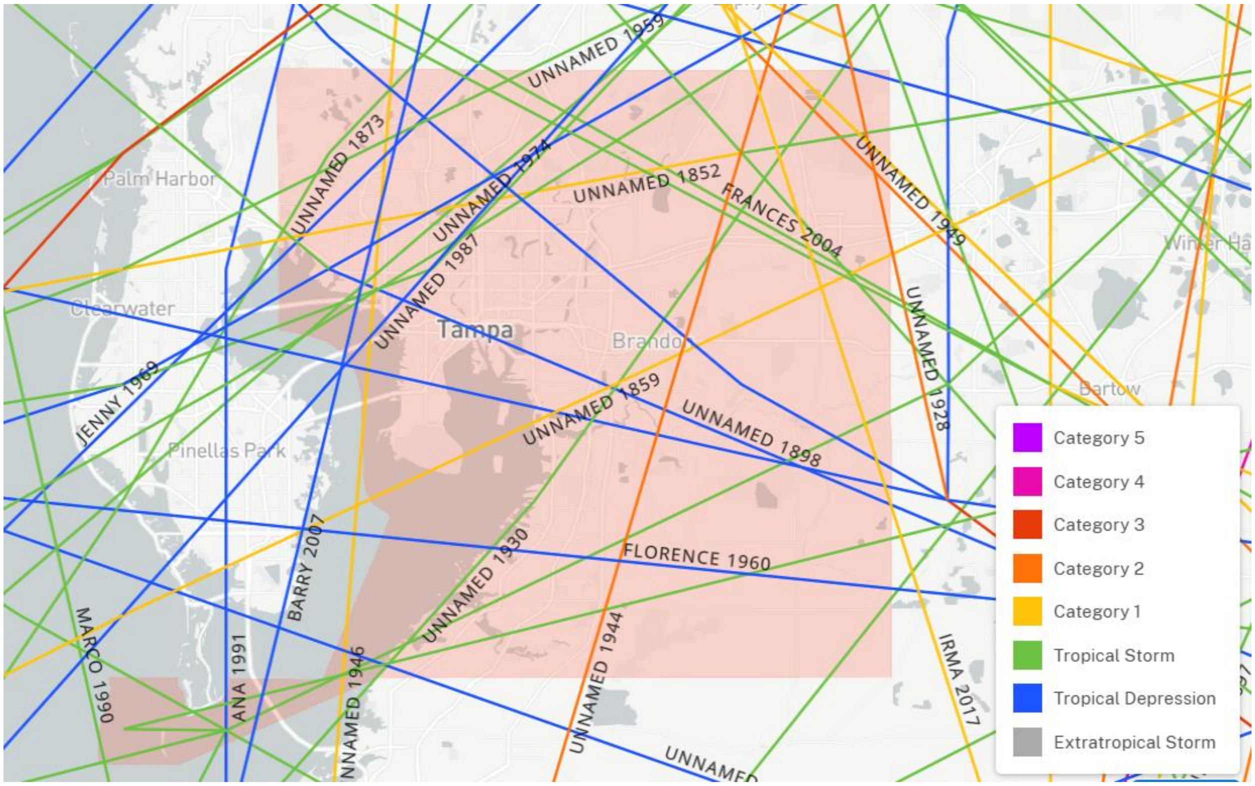


Figure 5.34. Historical Tropical Cyclone Tracks, Hillsborough County, 1852 to 2022[103]

Figure 5.35 through Figure 5.39 show storm surge delineation for Category 1 through Category 5 hurricanes using data from the National Hurricane Center's (NHC) storm surge risk maps.[104]

[103] https://oceanservice.noaa.gov/news/historical-hurricanes/
[104] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

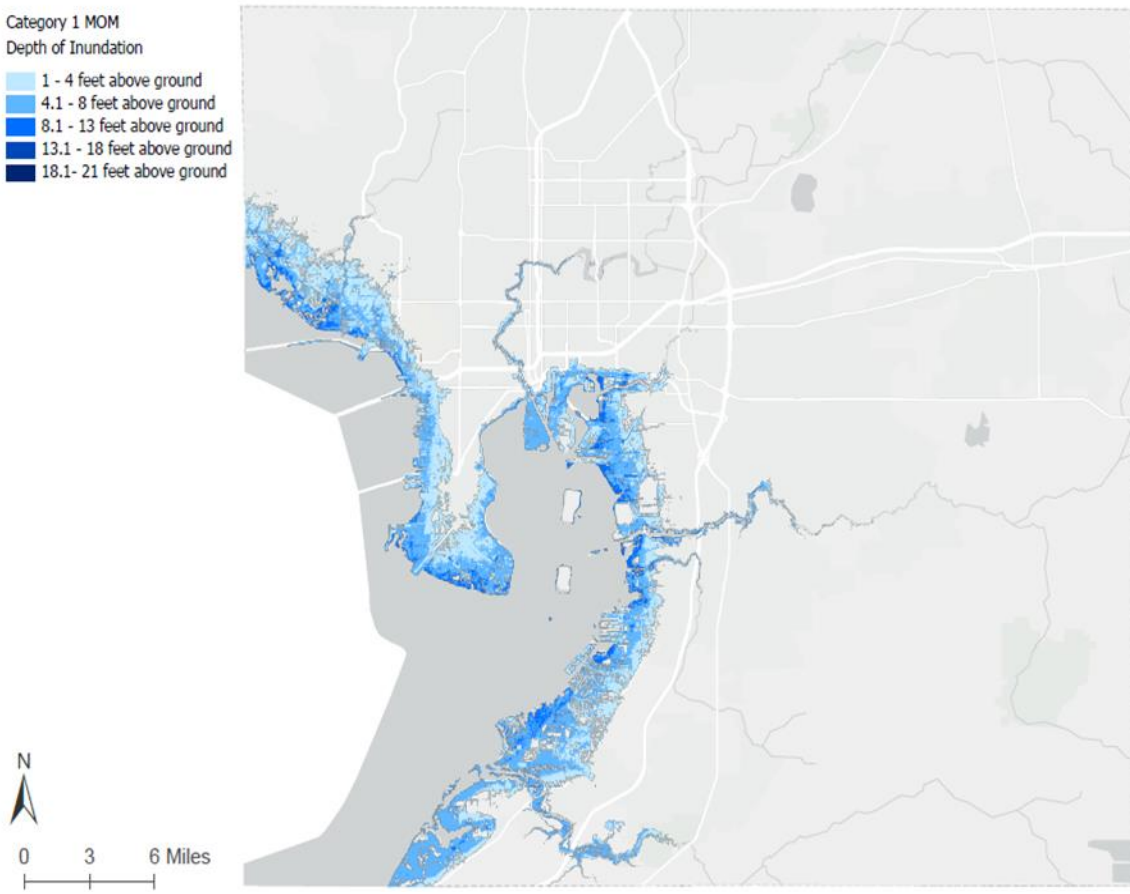


Figure 5.35. Storm Surge Zones – Category 1 Depth[105]

[105] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

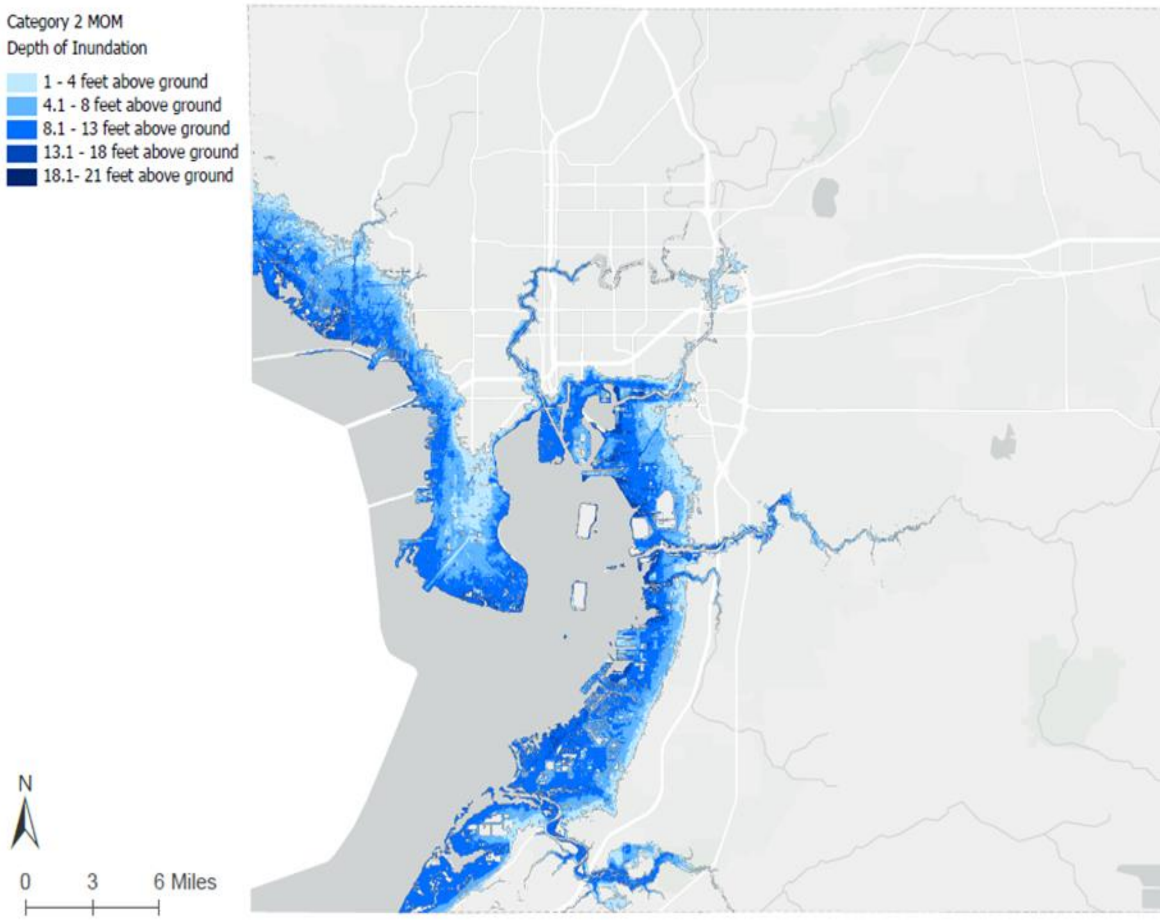


Figure 5.36. Storm Surge Zones – Category 2 Depth [106]

[106] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

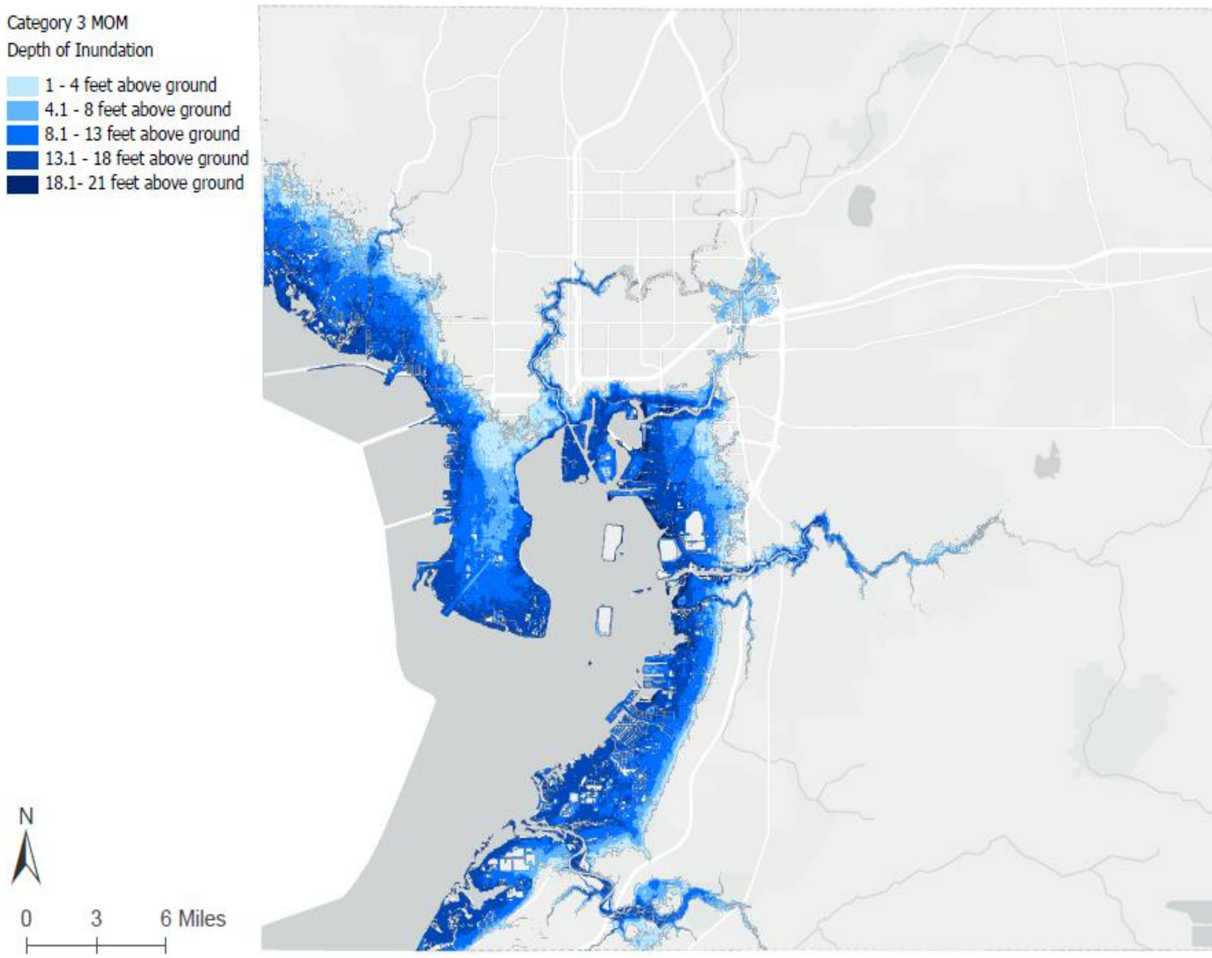


Figure 5.37. Storm Surge Zones – Category 3 Depth[107]

[107] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

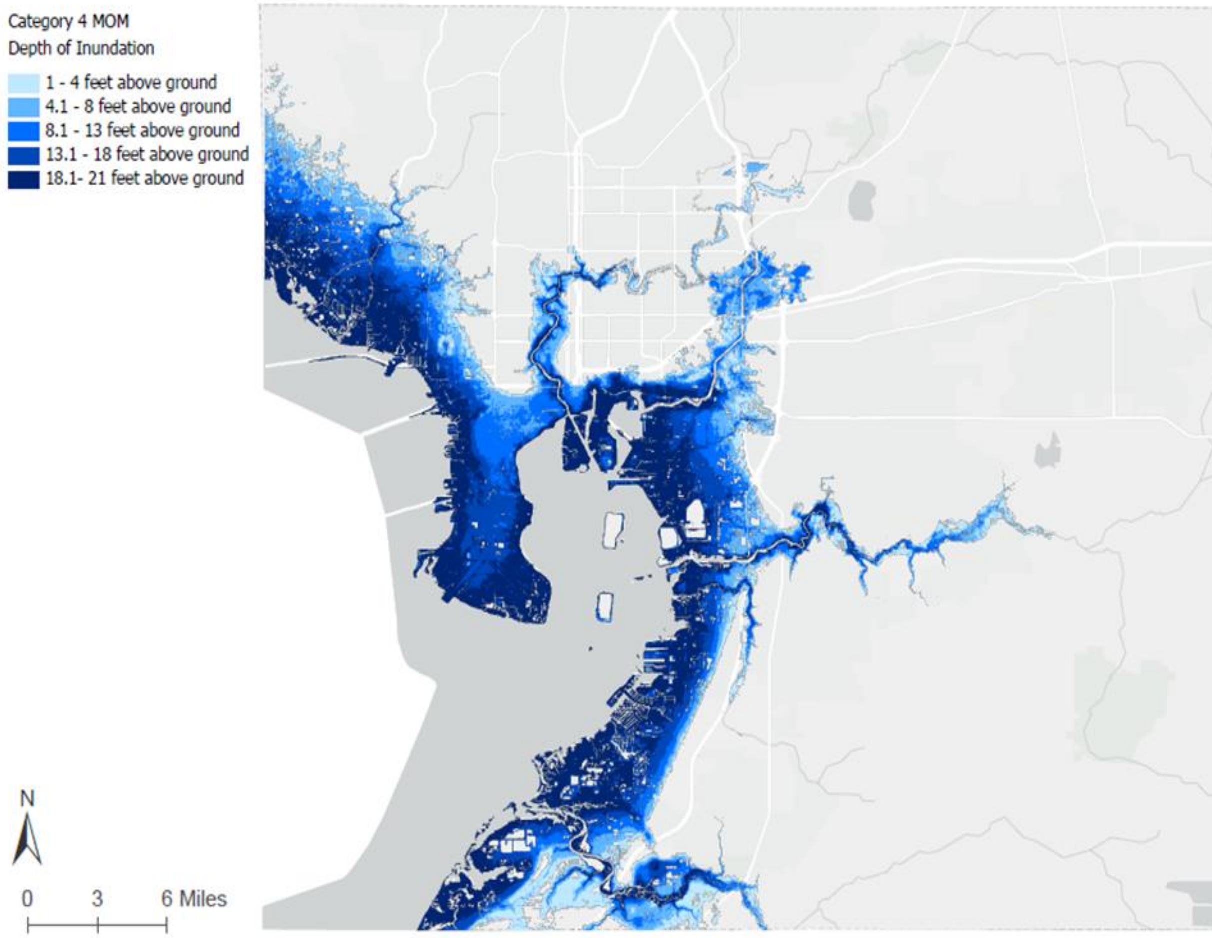


Figure 5.38. Storm Surge Zones – Category 4 Depth[108]

[108] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

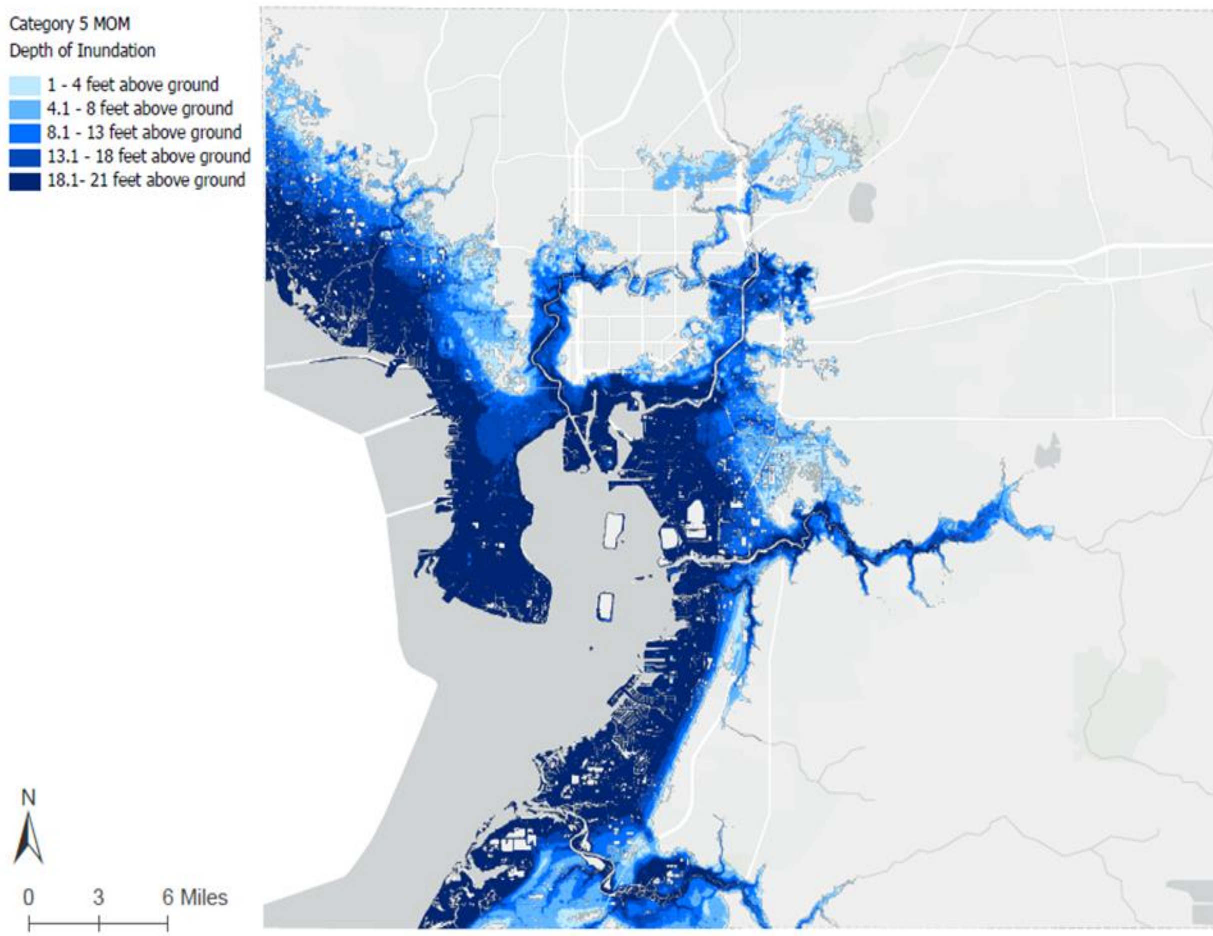


Figure 5.39. Storm Surge Zones – Category 5 Depth[109]

Hillsborough County's vulnerability to potential hurricanes and tropical storms is analyzed and monitored prior to each approaching storm. The population at risk and the potential for property or economic damages are based on the specific characteristics of the threatening hurricane. The principal tool for analyzing the expected hazards from potential hurricanes that may affect the Tampa Bay Region is the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) numerical storm surge model.

All coastal areas (158 mi. shoreline) of the 1,051 square mile Hillsborough County and the floodplains along the three county rivers (Hillsborough, Alafia, and Little Manatee) are considered hazard areas for hurricane storm surge. These areas include Ruskin, Apollo Beach, Gibsonton, Progress Village, South Tampa, the MacDill Air Force Base (AFB), Westshore, Town 'N Country, and the Downtown Tampa area, including Ybor City, Davis Island, Channelside, and Harbor Island are most at-risk to storm surge. Populations along the Alafia, Hillsborough, and Little Manatee River floodplains are at the highest risk of inland flooding, storm surge, rainfall impacts, and high wind

[109] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

during a hurricane. These communities are located in the Level A and B evacuation zones near coastal areas of Hillsborough County.

In the event of a Category 5 Hurricane, industries that will experience the highest number of employee losses include health and social care, retail trade, professional services, finance and insurance, administrative and waste services, and tourism (direct employment).[110] Hillsborough County is the nation's 8th largest school district, and it serves as the region's largest employer. Whereas the MacDill Air Force Base is the region's second-largest employer, a major tropical cyclone would devastate the local economy and workforce due to its location in South Tampa on the Tampa Bay. More than 15,000 military personnel have an annual economic impact of $4.9 billion to the region.[111] Table 5.61. Employment in Hillsborough County, 2023. shows the distribution of employment in Hillsborough County in 2023.

Table 5.61. Employment in Hillsborough County, 2023.[112]

Industry	Employment	Annual Change	Establishments	Annual Change	Average Wage	Annual Change	Location Quotient
Agriculture, Forestry, Fishing, Hunting	4,395	-17.6%	287	2.5%	$36,348	4.0%	0.57
Mining, Quarrying, Oil and Gas Extraction	88	-3.3%	21	-12.5%	$100,256	37.5%	0.03
Utilities	3,410	11.0%	77	10.0%	$93,340	-11.7%	0.93
Construction	49,758	3.3%	5,142	2.5%	$69,888	5.8%	1.18
Manufacturing	30,655	1.8%	1,392	3.3%	$72,176	4.7%	0.44
Wholesale Trade	34,789	1.8%	2,452	-2.6%	$92,508	7.2%	1.13
Retail Trade	75,667	1.3%	5,151	-1.2%	$42,536	1.1%	1.04
Transportation & Warehousing	31,171	4.9%	1,425	1.0%	$56,056	9.7%	0.89
Information	14,951	-1.3%	1,247	13.5%	$101,868	-5.5%	0.7
Finance and Insurance	68,206	6.4%	3,055	4.1%	$94,744	1.3%	1.79
Real Estate Rental and Leasing	17,308	4.4%	3,182	4.1%	$68,224	-0.3%	1.44
Professional and Technical	79,021	4.7%	9,595	5.9%	$101,452	5.5%	1.3

[110] U.S. Bureau of Labor Statistics (2018). https://www.bls.gov/.

[111] https://www.visittampabay.com/media/fast-facts/

[112] https://assets.contentstack.io/v3/assets/blteea73b27b731f985/blt7013101b876640ac/2023_Annual_Economic_Indicators_Report.pdf

Industry	Employment	Annual Change	Establishments	Annual Change	Average Wage	Annual Change	Location Quotient
Services							
Management of Companies and Enterprises	11,084	-1.9%	471	3.1%	$116,220	0.1%	0.75
Administrative and Waste Services	59,991	0.9%	4,838	5.9%	$51,480	2.3%	1.2
Educational Services	16,849	16.6%	801	4.2%	$45,864	2.0%	0.82
Health Care and Social Assistance	99,771	8.2%	6,020	2.7%	$68,952	7.0%	1.06
Arts, Entertainment, and Recreation	14,080	8.1%	698	2.8%	$65,936	10.5%	1.62
Accommodation and Food Services	67,382	5.5%	3,299	-0.6%	$29,848	4.9%	1.01
Other Services, except Public Administration	20,131	6.8%	3,590	2.5%	$45,864	5.6%	0.81
Public Administration	26,859	1.7%	164	0.0%	$75,972	6.8%	0.63
Unclassified	1,291	68.7%	1,519	22.5%	$49,608	-5.3%	0.47
ALL INDUSTRIES	**699,998**	**4.4%**	**54,262**	**3.5%**	**$67,860**	**4.0%**	**1.05**

Businesses and structures in the downtown Tampa area are vulnerable to hurricanes due to their location on the bay. Many major businesses located in coastal areas are susceptible to hurricanes, including Port Tampa Bay, Tampa International Airport (TIA), Tampa General Hospital, the Westshore business district, and retail stores and restaurants along these waterways and coastal areas of Hillsborough County. Newer areas of development include Water Street, Sparkman Warf, and the Downtown Tampa Riverwalk, along with other large areas of development in Westshore, are at risk of the effects of tropical storms and hurricanes.

In 2022, 27 million people visited Hillsborough County, with expenditures totaling $5.4 billion. Tourism supports more than 57,000 local jobs and $2 billion in wages.[113] Although it saw a dip during COVID-19, tourism has begun to bounce back in the region. Similarly, hotels have seen a dip in revenue and occupancy rates since 2020 but have begun to rebound. In March 2023, Hillsborough County hotels had a high 76.4% occupancy rate and an increase of revenue to $244,804,472.[114]

---

[113]https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/tampabay/Tampa_Bay_Fast_Facts_2019 _5e0877cc-4985-490e-a817-a93d28b1d66f.pdf
[114] https://www.bizjournals.com/tampabay/news/2019/04/26/tampa-and-hillsborough-hotel-revenue-and-occupancy.html

Historical Occurrences of Tropical Cyclone

Due to its unique geographical location and configuration, Florida is the most hurricane-prone state in the country. Hurricanes and tropical storms are the greatest natural disaster threat to Hillsborough County.

Table 5.62 lists the significant tropical storms and hurricanes that affected Hillsborough County from 1921 – present using information from the National Weather Service along with additional online research.[115]

Table 5.62. Significant Tropical Cyclone Occurrences in Hillsborough County

Date	Information
October 1921	The hurricane of record for the 20th century in Tampa Bay was in October 1921, when a Category 3 hurricane passed within 30 miles of Tampa. Storm surge and abnormally high tides caused damage to several areas of Hillsborough County. Strong winds damaged trees and structures, and the agricultural industry suffered a significant loss. Six deaths were attributed to this hurricane and approximately $1 million dollars in damage.
September – October 1948	Two other hurricanes of note hit Tampa Bay within two and a half weeks of each other in September- October 1948, causing 10 and 15 feet of storm surge.
Hurricane Easy, September 1950	Hurricane Easy hit northwest of Tampa with 125 mph winds and tides reaching 6.5 feet.
Hurricane Gladys, October 1968	Hurricane Gladys came ashore to the north of Hillsborough County with hurricane force winds briefly affecting the area at 80 mph, leading to storm surges of roughly 6 feet in the area and 3 deaths reported.
Hurricane Elena, September 1985	Elena threatened the area and caused the Tampa Bay region to conduct a major evacuation of over 500,000 people. The four bridges leading into Pinellas County were closed soon after Elena began threatening the county. Gandy Bridge was closed due to the eastbound span being struck by two barges during the storm. While the Sunshine Skyway and Courtney Campbell Parkway were closed due to debris and erosion on the highway, and the Howard Frankland Bridge was closed due to debris.
Tropical Storm Josephine, October 1996	The county sustained substantial flooding with storm tides (storm surge plus astronomical tide) to range from 4 to 6 feet in Hillsborough County.
Hurricane Georges, September-October 1998	Although Hurricane Georges caused a mandatory evacuation of coastal areas and manufactured homes, it caused minimal damage.
1995 – 2001	The following Tropical Storms and Hurricanes led to voluntary

[115] https://www.weather.gov/tbw/tbwweatherevents_tabs

Date	Information
Hurricane Seasons	evacuation advisories with minimal to no damage due to the storm not directly hitting Hillsborough County: • Tropical Storm Erin, August 1995 • Hurricane Floyd, September 1999 • Tropical Storm Harvey, September 1999 • Hurricane Irene, October 1999 • Hurricane Gordon, September 2000 • Hurricane Gabrielle, 2001
2004 Hurricane Season	There were several tropical cyclones that affected Florida during the 2004 hurricane season, unprecedented in modern times. Hurricanes Charley, Frances, Ivan, and Jeanne, as well as Tropical Storm Bonnie, all hit Florida within a 48-day span – the most tropical activity in one state in 120 years. All four of these hurricanes either threatened or came close to striking Hillsborough County. The impact on Hillsborough County is as follows: • Hurricane Charley made landfall as a Category 4 on the southwestern coast of Florida south of Tampa Bay. However, it was initially projected to directly impact Hillsborough County; • Hurricane Ivan was projected to directly hit Hillsborough County but passed to the west and made landfall as a Category 4 hurricane on the northern Gulf Coast; • Hurricane Frances made landfall on the east coast of Florida as a Category 2 hurricane and traversed through the county after crossing the state of Florida; • Hurricane Jeanne, which made landfall on central Florida's east coast as a Category 3 hurricane, traveled through Hillsborough County. Hurricanes Frances and Jeanne caused substantial damage in Hillsborough County with flooding, extensive debris, and significant power outages, though no winds were recorded in the hurricane force category.
Hurricane Wilma, October 2005	Hurricane Wilma produced tropical force winds for much of southwest and west central Florida. Damages due to peak winds reaching 51 mph in Hillsborough County led to damages related to downed tree limbs and localized flooding. There were 381 insurance claims that totaled $127,000.
Tropical Storm Alberto, June 2006	A peak wind gust of 56 mph (49 knots) was recorded at the MacDill AFB, with storm surge levels reaching 3.28 feet at McKay Bay and 2.75 feet at Old Port Tampa. The overspray

Date	Information
	from the surge combined with fresh water flooding closed parts of Bayshore Blvd.
Tropical Storm Debby, July 2012	Tropical Storm Debby caused significant damage and interruption from flood and wind. Storm surge from Debby flooded Bayshore Boulevard, a major artery between downtown Tampa and MacDill AFB. High winds associated with Debby caused the Sunshine Skyway Bridge (a major thoroughfare at the mouth of Tampa Bay) to be closed for several days, causing significant transportation interruption and detours. Although the Skyway Bridge is in Manatee County, south of Hillsborough County, detour traffic to the county was pushed to Hillsborough County surface roads and three cross bay bridges. Tropical Storm Debby created significant isolated inland flooding situations, whereby some structures within the University of South Florida area received flooding. Flooding within this area to storms less than the one-percent storm will be minimized in the future due to a stormwater project that was completed after 2012.
Hurricane Isaac, September 2012	Hurricane Isaac was anticipated to come into close proximity to Tampa Bay during the Republican National Convention (RNC), which was being held in the area at this time. Despite minor impacts on Hillsborough County, the start of the RNC was postponed to ensure the safety of delegates, guests, members of the media attending the RNC, and residents of the Tampa Bay area who would be engaged with the event.
Tropical Storm Andrea, June 2013	During Tropical Storm Andrea, approximately 3,000 "properties" were slightly affected by coastal storm surge. However, no structures were identified as having flood water within structures.
Tropical Storm Erika, September 2015	Tropical Storm (TS) Erika made landfall after a historic month of flooding (52" inches of rain in 2015 when normal was 21"). The storm crossed the northern end of Florida on September 2 after dropping rain in the southern half of the state. The Hillsborough County Emergency Operation Center (EOC) was activated, and a state of emergency was actually declared on September 28 because the state was already water-saturated.
Tropical Storm Colin, June 2016	Tropical Storm Colin developed over the Gulf of Mexico on June 5th. Maximum storm tide was around 3 to 7 feet MLLW in the afternoon of June 6th, with a calculated highest storm surge ranging from around 2.5 to 4.5 feet during the evening. Widespread areas of 6 to 10 inches of rain fell over the area; the Skyway Bridge section of Interstate 275 connecting Manatee and Pinellas Counties across the Tampa Bay was closed by the Florida Department of Transportation for about

Date	Information
	25 hours beginning late morning on June 6th. The Coast Guard closed the Port of Tampa due to high winds and was opened up again less than 24 hours later. Additionally, Hillsborough County Emergency Management reported numerous trees and 93,000 power outages in Tampa Bay at peak due to winds. Public Works removed approximately 30 trees from roadways. One of the trees landed on a home and removed the front of the home from the rest of the building, displacing a resident.
Hurricane Hermine, September 2016	Hurricane Hermine made landfall in the Florida Panhandle as a Category 1 Hurricane on September 2. In coastal Hillsborough County, the highest wind gust recorded was 58 MPH on the morning of September 2nd at Old Port Tampa. Storm total rainfall ranged from 6 to 10 inches, with the highest value recorded at 9.11 inches. Hillsborough County Emergency Management found 8 homes sustained minor damage, 7 homes had major damage, and 9 homes were destroyed. Damage was estimated at $800,000, mostly from wind damage. The Sunshine Skyway Bridge across the mouth of the Tampa Bay was closed for just over 24 hours beginning on the afternoon of the 1st due to the high wind speeds. Numerous power outages were also reported, with around 39,000 people without power in Pinellas and Hillsborough County on the evening of the 1st. The power outage affected the local wastewater treatment plant, and more than 900,000 gallons of partially treated wastewater were dumped into the Hillsborough Bay. Heavy rainfall caused extensive flooding. A federal disaster was declared on September 28, and Hillsborough County became eligible for individual assistance. The total damage estimate for the storm was approximately $857,000.00.
Hurricane Matthew, October 2016	On October 3, the Governor declared a state of emergency for all Florida counties and activated the National Guard. On October 6, the President declared a federal state of emergency for jurisdictions in the path of the storm. In the Tampa Bay area, schools across the region canceled classes in anticipation of widespread impact. While Matthew did not directly impact Florida, it did cause over 1 million in power outages and has been blamed for 12 deaths statewide.
Hurricane Irma, September 2017	On the morning of September 5th, less than 300 miles east of the Leeward Islands, Irma became a Category 5 hurricane with maximum sustained winds of 175 mph. Due to this potentially catastrophic hurricane heading toward Florida, the Hillsborough County Office of Emergency Management initiated preparations and activated the Emergency Operations Center (EOC).

Date	Information
	The track of Irma resulted in a much stronger negative surge north of the eye, causing extremely low water levels. A couple of manatees got beached in the mud, and there was a lot of media coverage showing people walking out into the dry part of the bay to rescue them. In coastal portions of Hillsborough County, the highest winds reported from Hurricane Irma were gusts upwards of 91 mph (79 knots) with rainfall around 5 inches or greater, with the highest rain total being 16.18 inches. The wind resulted in damage to numerous homes, as well as knocking over trees and power lines. Hillsborough County Emergency Management reported that 41 homes or businesses were destroyed, 130 sustained major damage, 166 had minor damage, and an additional 93 were affected by Hurricane Irma throughout Hillsborough County. The total damage from Irma in Hillsborough County was estimated at $19.95 million, including $17.86 million in individual assistance claims and $2.09 million in public assistance claims, of which $7 million was estimated to be caused by wind damage in coastal portions of Hillsborough County. Additionally, crop damage to citrus plants in Hillsborough County was roughly estimated at $28.5 million. In Hillsborough, up to 265,000 customers were left without electricity – about 36%. In Hillsborough County, wind gusts peaked at 91 mph, all rivers were at major flood stage, 60 shelters were opened for 30,000 people, and four points of distribution were opened to distribute food, water, and ice. Heavy rains across the area also resulted in widespread river flooding, with rising water levels damaging houses on the Hillsborough River, the Alafia River, and the Little Manatee River. Flood damage to homes was estimated at $2 million. Water levels were above the major flooding threshold along the Little Manatee River at Wimauma (0.69 feet), Alafia River at Lithia (3.79 feet), and Hillsborough River at Morris Bridge (0.66 feet). The flood waters entered several mobile homes on 32nd and 33rd streets in Ruskin along the Little Manatee River, in homes near Lithia Pinecrest Road near the Alafia River, and mobile homes in the Pine Ridge Estates neighborhood along the Hillsborough River. Three indirect fatalities were reported in Hillsborough County from Hurricane Irma that occurred while the individuals were clearing debris.
Hurricane Dorian, September 2019	Hurricane Dorian was expected to make landfall on the east coast of Florida and travel across the state through the Tampa

Date	Information
	Bay area. Hillsborough County activated its EOC and began planning for evacuations and shelter operations. Schools in the area closed, and sandbags were distributed. The system, however, slowed down over the Bahamas and began heading north along the east coast, resulting in no direct effects from Dorian on the area.
Hurricane Eta, November 2020	Hurricane Eta originated from a tropical depression that formed in the central Caribbean Sea on October 31st. The depression strengthened into Tropical Storm Eta later that day and continued rapid intensification to major hurricane status on November 2nd while moving westward across the western Caribbean Sea. The storm made a southwest jog into the southeastern Gulf of Mexico on the 9th before it briefly stalled and then turned northward on the 10th. Eta accelerated north-northeast across the eastern Gulf of Mexico toward the western Florida coast and briefly strengthened to a minimal hurricane during the early morning hours on the 11th while centered about 170 miles south-southwest of Tampa. Eta then weakened to a tropical storm as it approached the peninsula and made landfall on November 12th near Cedar Key. Eta will be mostly remembered in our area for the heavy rain and storm surge flooding that occurred near the coast.
Hurricane Elsa, July 2021	The 2021 Hurricane Season quickly jumped into high gear but ended on a quiet note. Well before the season quieted, though, Hurricane Elsa arrived in early July. Elsa was the earliest 5th named storm on record. Areas along the west coast of Florida experienced as much as 2 to 3 feet of storm surge, and 6-10 inches of rain fell across portions of southwest Florida. In southern Sarasota and Charlotte Counties, neighborhoods flooded after weeks of heavy rain was compounded by the additional rainfall associated with Elsa. With onshore winds as Elsa approached, storm surge occurred along coastal areas from around the Tampa Bay Area northward along the Nature Coast, with minor coastal flooding in vulnerable locations.
Hurricane Ian, September 2022	Hurricane Ian started out as a tropical wave off the coast of Africa in mid-September. Over several weeks, this disorganized wave would move westward, eventually arriving in the Caribbean Sea. On the morning of September 23rd, south of the islands of Puerto Rico and Hispaniola, Ian would become a tropical depression. Later that same day, tropical storm Ian would form. As Ian intensified in the Caribbean Sea, the storm made a northward turn and made landfall in western Cuba. After emerging off the northwest Cuban coast, Ian underwent a period of rapid intensification as it moved north and then northeast towards Florida, intensify into a Category

Date	Information
	4 Hurricane with sustained winds of 150 mph. Ian made landfall at 305 PM on September 28, 2022, as a Category 4 Major Hurricane near Cayo Costa in Southwest Florida. Storm surge of 10 to 15 feet battered the barrier islands south of the landfall with historic rainfall amounts up to nearly 27 inches causing major flooding over inland areas. Tampa and Hillsborough County saw serious flooding but dodged a direct hit from the hurricane.
Hurricane Idalia, August 2023	Hurricane Idalia began as a disorganized cluster of thunderstorms that moved across Central America from the Pacific Ocean and into the southern Caribbean Sea. On August 26, 2023, the system became Tropical Depression Ten and slowly continued to organize over the next few days while remaining almost stationary in the northwest Caribbean Sea. On August 27th, Tropical Depression Ten became Tropical Storm Idalia. By the early hours of August 28th, Idalia had become a hurricane and began to move towards the north. As Idalia moved north, the storm continued to intensify, eventually reaching category three strength as it made its final approach to the Florida peninsula on the morning of August 30, 2023. Similar to Hurricane Ian, Tampa and Hillsborough County saw serious flooding, but dodged a direct hit from the hurricane.

While the full impacts of these recent hurricanes have yet to be fully assessed, it is important to note that both Hurricane Helene (September 2024) and Hurricane Milton (October 2024) have had significant effects on Hillsborough County. Hurricane Helene, which made landfall in the Big Bend area of Florida as a powerful Category 4 storm, brought widespread storm surge and heavy rainfall, particularly affecting coastal and low-lying areas of the Tampa Bay Area. The storm caused extensive flooding and infrastructure damage, underscoring the need for updated floodplain management and mitigation strategies in vulnerable communities.

Hurricane Milton, which made landfall in Manatee County as a strong Category 3 storm, posed unique challenges due to its erratic path and wind-driven impacts. While it did not cause the catastrophic flooding seen with Helene, Milton resulted in extensive wind damage to residential and commercial properties, as well as prolonged power outages across the region. Both storms tested Hillsborough County's emergency response capacity and highlighted the growing importance of resiliency planning to address climate-related hazards. As these storms demonstrate, the frequency and intensity of tropical systems in our area are increasing, requiring continued investment in hazard mitigation, infrastructure improvements, and community outreach to reduce future risk.

Additionally, there have been 18 FEMA major disaster declarations in Hillsborough County that are related to tropical cyclone events listed in Table 5.63.

Table 5.63. FEMA Major Disaster Declarations in Hillsborough County, Tropical Cyclone, 1953–2024[116]

Disaster Number	Date	Name/Description
DR-252	November 7, 1968	HURRICANE GLADYS
DR-337	June 23, 1972	TROPICAL STORM AGNES
DR-743	August 29–September 2, 1985	HURRICANE ELENA
DR-1141	October 7–21, 1996	TROPICAL STORM JOSEPHINE
DR-1539	August 11–30, 2004	TROPICAL STORM BONNIE AND HURRICANE CHARLEY
DR-1545	September 3–October 8, 2004	HURRICANE FRANCES
DR-1561	September 24–November 17, 2004	HURRICANE JEANNE
DR-4068	June 23–26, 2012	TROPICAL STORM DEBBY
DR-4280	August 31–September 11, 2016	HURRICANE HERMINE
DR-4337	September 4–October 18, 2017	HURRICANE IRMA
DR-4399	October 7-October19, 2018	HURRICANE MICHAEL
DR-4468	August 28-September 9, 2019	HURRICANE DORIAN
DR-4564	September 14-September 28, 2020	HURRICANE SALLY
DR-4673	September 23-November 4, 2022	HURRICANE IAN
DR-4680	November 7-November 30, 2022	HURRICANE NICOLE
DR-4734	August 27-September 4, 2023	HURRICANE IDALIA
DR-4828	September 23-October 7, 2024	HURRICANE HELENE
DR-4844	October 5-November 2, 2024	HURRICANE MILTON

According to the NCEI Storm Events Database, there were 12 tropical cyclone reports in Hillsborough County from 2016 to 2023.[117] While Hurricane Helena and Milton were added above in Table 5.63, additional data associated with those events is still being collected and will be included in future updates. These tropical cyclone events only include those reported by NCEI from 1996 through December 2023, and events are only reported at the county level. Additional events have likely affected Hillsborough County. As additional local data becomes available, this hazard profile will be amended. Table 6 provides a summary of reported tropical cyclone occurrences from 1996-2023, along with reported deaths, injuries, property, and crop damages.

Table 5.64 provides additional details.

---

[116] www.fema.gov/api/open/v1/DisasterDeclarationsSummaries.csv

[117] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Hurricane+%28Typhoon%29&eventType=%28Z%29+Tropical+Depression&eventType=%28Z%29+Tropical+Storm&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Table 5.64. Summary of Tropical Cyclone Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Crop Damage (2023)*	Annualized Property Loss	Annualized Crop Loss
HILLSBOROUGH COUNTY TOTAL	12	3	0	$79,198,332	$35,310,382	$2,933,271	$1,307,792

*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023 dollar values were calculated based on buying power in December 2023.

Table 5.65. Historical Tropical Cyclone Occurrences in Hillsborough County

	Date	Type	Deaths	Injuries	Property Damage*	Crop Damage*
Hillsborough County						
INLAND HILLSBOROUGH (ZONE)	6/6/2016	Tropical Storm	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	6/6/2016	Tropical Storm	0	0	$63,635	$0
COASTAL HILLSBOROUGH (ZONE)	9/1/2016	Tropical Storm	0	0	$1,016,438	$0
INLAND HILLSBOROUGH (ZONE)	9/1/2016	Tropical Storm	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	10/7/2016	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	7/31/2017	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	9/10/2017	Hurricane	0	0	$8,637,441	$35,310,382
COASTAL HILLSBOROUGH (ZONE)	9/10/2017	Hurricane	0	0	$8,699,582	$0
INLAND HILLSBOROUGH (ZONE)	11/9/2020	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	11/11/2020	Tropical Storm	0	0	$0	$0

	Date	Type	Deaths	Injuries	Property Damage*	Crop Damage*
INLAND HILLSBOROUGH (ZONE)	11/11/2020	Tropical Storm	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	7/6/2021	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	7/7/2021	Tropical Storm	0	0	$11,236	$0
COASTAL HILLSBOROUGH (ZONE)	9/28/2022	Tropical Storm	3	0	$60,770,000	$0
INLAND HILLSBOROUGH (ZONE)	9/28/2022	Tropical Storm	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	11/10/2022	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	11/10/2022	Tropical Storm	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	8/30/2023	Tropical Storm	0	0	$0	$0
INLAND HILLSBOROUGH (ZONE)	8/30/2023	Tropical Storm	0	0	$0	$0
*Damage is reported in 2023 dollars. All damage may not have been reported.						

Storm Surge

According to the NCEI Storm Events Database, there were 4 reports of storm surge in Hillsborough County from 1998 to 2023.[118] These storm surge events only include those reported by NCEI from 1996 through December 2023, and events are only reported at the county level. Additional events have likely affected Hillsborough County. As additional local data becomes available, this hazard profile will be amended. Table 5.66 provides a summary of reported storm surge occurrences from 1998-2023, along with reported deaths, injuries, property, and crop damages. Table 5.67 provides additional details.

According to the NCEI Storm Events Database, there were four reports of storm surge in Hillsborough County from 1998 to 2023. These storm surge events, as recorded by NCEI from 1996 through December 2023, only capture events reported at the county level, meaning additional events have

---

[118] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Storm+Surge%2FTide&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

likely impacted the area but remain undocumented. Hurricanes Debby, Helene, and Milton contributed significantly to storm surge impacts within Hillsborough County.

Hurricane Debby impacted Hillsborough County in both 2012 and 2024. During its 2024 occurrence, Debby generated storm surge levels of up to 4 feet in low-lying coastal areas, primarily affecting Apollo Beach and Ruskin. The combination of storm surge and heavy rainfall led to extensive flooding, inundating regions that had never before experienced flooding.

Hurricane Helene brought a storm surge approximately 4-9 feet above predicted tide levels. Gibsonton and Town-n-Country were particularly hard hit, with floodwaters damaging older homes built at grade level and creating prolonged standing water in some neighborhoods.

Hurricane Milton, which occurred weeks after Helene, compounded the issue with another storm surge reaching 4 to 6 feet. The cumulative effect of these storms overwhelmed drainage systems, causing new areas of concern to emerge in Hillsborough County's flood maps. Properties previously considered safe from flooding were inundated, leading to a reanalysis of risk areas and identifying new mitigation strategies.

This hazard profile will be updated with additional local data to reflect a more comprehensive understanding of storm surge risks in Hillsborough County as data is collected. Table 5.66 and Table 5.67 provide summaries of reported storm surge occurrences from 1998 to 2023, including documented deaths, injuries, and property damages.

Table 5.66. Summary of Storm Surge Occurrences in Hillsborough County

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
HILLSBOROUGH COUNTY TOTAL	**4**	**0**	**0**	**$571,696**	**$21,174**
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023 dollar values were calculated based on buying power in December 2023.					

Table 5.67. Historical Storm Surge Occurrences in Hillsborough County

	Date	Type	Deaths	Injuries	Property Damage*	Crop Damage*
Hillsborough County						
APOLLO BEACH	1/2/1998	Storm Surge/Tide	0	0	$0	$0
APOLLO BEACH	1/2/1999	Storm Surge/Tide	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	11/11/2020	Storm Surge/Tide	0	0	$571,696	$0

	Date	Type	Deaths	Injuries	Property Damage*	Crop Damage*
COASTAL HILLSBOROUGH (ZONE)	11/11/2020	Storm Surge/Tide	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	11/11/2020	Storm Surge/Tide	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	11/11/2020	Storm Surge/Tide	0	0	$0	$0
COASTAL HILLSBOROUGH (ZONE)	7/7/2021	Storm Surge/Tide	0	0	$0	$0
*Damage is reported in 2023 dollars. All damage may not have been reported.						

Probability of Future Tropical Cyclone

Since tropical cyclones are random in distribution, it is not easy to forecast when Hillsborough County will experience its next tropical storm or hurricane. However, due to the high frequency of tropical cyclones that have affected the Gulf Coast of Florida in the past, it is reasonable to assume that Hillsborough County will experience tropical cyclones in the future. Less intense tropical cyclones (tropical depressions, tropical storms, Category 1, and Category 2) occur more frequently than major tropical cyclones (Category 3, Category 4, and Category 5).

The frequency of hurricanes in the Tampa Bay area is high.

Potential Effects of Climate Change on Tropical Cyclone

A warmer atmosphere could influence two of the factors that affect the generation and strength of tropical cyclones: (1) increased thermal energy resulting from higher sea surface temperatures (SST) and (2) increased vertical wind shear.[119] It is believed that these effects are likely to counteract each other to some degree. However, the exact role of increasing SST remains to be determined.

As measured by power dissipation indices, tropical cyclone intensity may increase directly as a function of SST, or intensity may be a function of the difference between SST in the cyclone development region and mean global tropical SST.[120] Vertical wind shear disturbs the structure of a tropical cyclone; therefore, increased shear can lead to system weakening.

Global tropical cyclone intensities will likely increase on average. As temperatures rise, it is predicted that a larger number of hurricanes will reach Category 4 and 5 strengths. However, it is

---

[119] Grinsted et al. (2013). Projected Atlantic hurricane surge threat from rising temperatures. Proceedings of the National Academy of Sciences, 110(14), 5369, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3619316/.

[120] Seneviratne et al. (2012). Changes in climate extremes and their impacts on the natural physical environment. In Field et al. (Eds.), Managing the risks of extreme events and disasters to advance climate change adaptation, p. 159. https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/.

believed that the frequency of all tropical cyclones will either decrease or see little change.[121] Tropical cyclone intensity is one of the principal determinants of storm surge height; thus, the net effects of climate change on tropical cyclone intensity will also affect the magnitude of coastal flooding associated with these storms.[122] The vulnerability of coastal regions to storm-surge flooding and higher coastal inundation levels is expected to increase with future sea-level rise and coastal development. This change would imply an even larger percentage increase in the potential destruction of a storm and impact on populations along rivers and coastal areas of Hillsborough County.

As stated in the Flood Hazard Profile, higher rainfall intensity is likely due to anthropogenic warming and accompanying increases in atmospheric moisture. This means that rainfall correlated with tropical storms and hurricanes will likely increase in the future. Modeling studies, on average, project an increase of 10-15% in rainfall rates due to global warming.[123] Additionally, tropical cyclone tracks and, consequently, the number of systems that make landfall in Florida could be influenced by atmospheric steering currents and climate phenomena such as the El Niño-Southern Oscillation, North Atlantic Oscillation, Atlantic Meridional Mode, and Madden-Julian Oscillation.[124]

Probability Based on Historical Occurrences

Tropical cyclone and separate storm surge reports in the NCEI Storm Events Database are limited to a period of history of only 27 years (1996 to 2023). There were 16 disaster declarations in Hillsborough County associated with tropical cyclones in the 55-year period from 1968 through 2023. Probability based on past disaster declarations equates to approximately a 30% chance in any given year. Based on the history of tropical cyclone events in Table 5.67, between 1921 and 2023 (102 years), there were 29 significant storms. Based on that history, there is a 28% probability of occurrence in any given year.

Based on historical information, this hazard was determined to have a probability level of likely (30%+ annual probability). This includes all tropical cyclone-related events. The probability of a Category 3-5 storm is less than 30% but is increasing as a result of climate change.

Tropical Cyclone Impact Analysis

Portions of the City of Tampa and Unincorporated Hillsborough County face potential storm surge conditions in addition to winds. The inland portions of those jurisdictions, as well as Plant City and

---

[121] NOAA Geophysical Fluid Dynamics Laboratory [GFDL]. (2019). Global warming and hurricanes: An overview of current research results. https://www.gfdl.noaa.gov/global-warming-and-hurricanes.

[122] Kossin et al. (2010). A globally consistent reanalysis of hurricane variability and trends. Geophysical Research Letters, 34, 4. doi: 10.1029/2006GL028836.

[123] NOAA GFDL. (2019). Global warming and hurricanes: An overview of current research results. https://www.gfdl.noaa.gov/global-warming-and-hurricanes.

[124] Grossmann, I. & Morgan, M. (2011). Tropical cyclones, climate change, and scientific uncertainty: What do we know, what does it mean, and what should be done? *Climate Change*, 108: 543-579. Doi 10.1007/s10584-011-0020-1.

Temple Terrace, could be devasted by wind impacts and rain-induced flooding. All jurisdictions could receive some or all of the following potential impacts due to tropical cyclones.

- Public
    - Injury/death
        - Car accidents because of flood waters, high winds, panic, traffic jams because of evacuations, no power after storm
        - Not receiving emergency response during a storm –emergency medical services
        - Delayed emergency response because of blocked roads, etc.
        - Drowning in flood waters
        - Hit or crushed by debris
        - Stranded on the roof because of flooding
        - Exposure to hazardous materials
        - Illness from contaminated water
        - Pet and other animal deaths from all of the above
    - Damage to Home or Property
        - Power loss or damage to power connections in the home
        - Mold damage causing the need for expensive mold remediation actions
        - Cost to replace damaged and destroyed items, such as furniture, flooring, etc.
        - Cost and labor to repair damaged homes and other structures to make the house inhabitable
        - If the property was uninsured, the cost falls upon the property owner
        - Hotel room fees or having to live in a shelter until damage is repaired or the home is replaced
        - Damaged or washed-away vehicles
        - Lost wages because there is no way to get to work if roads are blocked, or if a car was damaged in a storm, or if an employer experienced damage
        - Possibly forced to evacuate
            - Cost to travel
            - Cost to stay at hotel
            - Loss of wages if out of town
            - Loss of food if you cannot go back to get it
        - Power outage
            - Cost of generators and gas to run the generators
                - Risk of accidental fire or carbon monoxide poisoning is high
            - Loss of food in refrigerator and freezer
            - Difficulties traveling anywhere because of outages at traffic lights
            - Cost of purchasing disaster supplies such as flashlights
            - Hotel room fees or having to live in a shelter until power is restored
            - Lost wages because an employer is experiencing a power outage
        - Emotional or psychological toll of surviving

            - If a friend or family member dies in a storm, an individual may feel a great sense of guilt or stress
            - If major damage occurs for an individual, they will likely experience stress and anxiety dealing with evacuating, staying in shelters, working to get insurance payments, working to get government assistance, etc.
            - Being forced to leave or forfeit a pet in an unsafe area during or after a tropical cyclone

- <u>Responders</u>
    - Injury/death
        - Responding during tropical storms is unsafe
        - Responding immediately after tropical storms is unsafe because of debris, unstable transportation infrastructure, unstable structures
        - Rescuing people from unstable buildings or by boat
        - Exposure to hazardous materials
    - Stress caused by the severity of tasks such as rescuing people
    - Feelings of guilt for not being able to save people
    - Witnessing gruesome scenes of injured or dead
- <u>Continuity of Operations (including continued delivery of services)</u>
    - Loss of revenue if businesses cannot operate during or after the event
    - Loss of wages if your employer's organization is damaged or destroyed and you cannot work. Utility failures such as electric or gas may prevent businesses from opening even if there is no damage
    - Utility failures may impede or prevent government offices from continuing daily services
    - Severe damage and interruption to transportation systems and infrastructure like roads and bridges, communication systems, power, water, wastewater, etc.
- <u>Property, Facilities, Infrastructure</u>
    - Damaged or destroyed property, such as homes and other buildings
        - Roofing is particularly susceptible to damage from high winds
        - The first floor of many buildings, plus all the items on that floor, are susceptible to severe damage from flooding
    - Cost of repairing damage to property such as buildings
    - Cost of replacing items damaged, such as furniture on the first floor of a flooded home
    - Crop damage or loss
    - Damage to transportation infrastructure, like a road being washed out or a bridge collapsing, and/or closure of major transportation networks
    - Inability to get clean water
    - Inability to control wastewater
    - Release of hazardous materials
- <u>Environment</u>
    - Beach and dune erosion
    - Downed trees

- Eroded riverbanks
- Release of hazardous materials can contaminate or damage the environment
- Loss or damage to habitat for animals because of flooding or high winds
- Crop damage or loss
- Event-generated marine debris impacting waterway navigation and submerged wetland habitats

- Economic Condition
  - Damaged and destroyed businesses leading to long-term closures and possibly permanent closures
  - Delayed re-opening of businesses because of utility issues, road blockages, etc.
  - Crop damage or loss from flooding and high winds
  - Absenteeism from work
  - Loss of tourism because of coastal erosion or damaged hotels and attractions
- Public Confidence in Each Jurisdiction's Governance
  - Evacuations not ordered in time lead to a decrease in public confidence
  - Shelters not opened or having little information
  - Warnings not communicated effectively
  - Communicating too much
  - Over-exaggeration of possible storm impacts, especially if the storm does not have expected impacts

Impact Summary

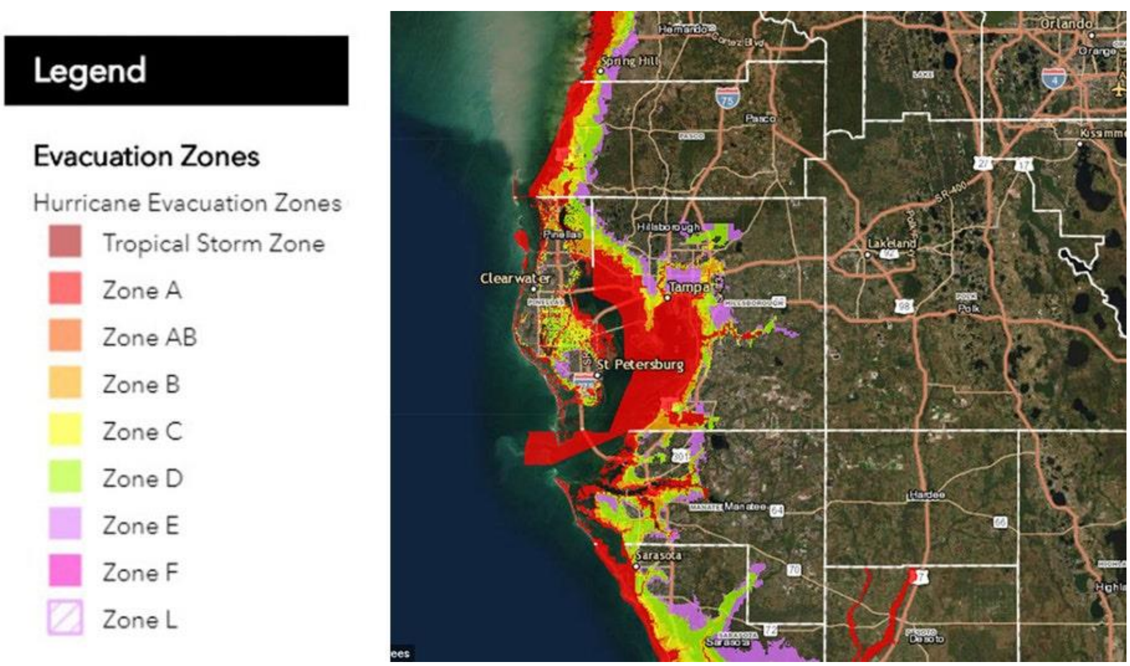


Figure 5.40. Hurricane Evacuation Zones, 2023

Using the 2023 Hurricane Evacuation Zones (Figure 5.40), some of the major commercial, industrial, and residential areas impacted would include:

a. **Category 1 Storm**: Rocky Point; the western, southern, and eastern edges of the Interbay Peninsula, including portions of MacDill Air Force Base, Davis Island, Harbor Island; Hookers Point, Port Sutton, Riverview, Gibsonton, Big Bend, Apollo Beach, Ruskin, and portions of the Hillsborough, Alafia, and Little Manatee Rivers floodplain.

b. **Category 3 Storm**: same as a Category 1 storm; plus, portions of Town N' Country, the Westshore business district including a portion of the western-most runway of Tampa International Airport; two-thirds of the Interbay Peninsula including all of MacDill Air Force Base, the eastern and western sides of the Hillsborough River to the Dam including Downtown Tampa and U.S. 41 south of Palm River.

c. **Category 5 Storm**: same as a Category 3 storm, plus expanded portions of Town N' Country; the three runways and portions of the terminal at Tampa International Airport, all of the Interbay Peninsula south of Henderson Avenue; the area between Hillsborough Avenue and the U.S. 301/I-75 interchange; area east of the By-pass Canal, south of 7th Avenue, and north of the Crosstown Expressway, areas between U.S. 41 and I-75, and expanded areas of the Hillsborough, Alafia, and Little Manatee River floodplains.

Impact on the Built Environment

The entire built environment may be vulnerable to hurricanes and tropical storms due to wind, rain, and/or storm surge damage. The Saffir-Simpson Hurricane Wind Scale does not address the potential for other hurricane-related impacts (i.e., storm surge, rainfall-induced floods, and tornados), simply wind-caused damage that is dependent on local building codes in effect and how well and how long they have been enforced. For example, building codes enacted during the 2000s in Florida are likely to reduce the damage to newer structures. Hurricane wind damage depends on factors such as duration of winds, change of wind direction, and age of structures.

Homes and businesses built under older building codes and standards, or structures without impact-resistant features or protection that can be installed, may be more vulnerable to wind damage. Most damage from strong winds is caused not by the wind but by the debris it carries. Therefore, one of the best ways to mitigate wind hazards is to minimize the amount of debris that can become airborne. Property maintenance regulations should be adopted and enforced because areas near trash piles, junkyards, and unkempt properties are vulnerable to damage from airborne debris. Improperly constructed or maintained buildings, high-rise buildings, and manufactured homes are more susceptible to wind events and contribute to airborne debris.

Impact on Manufactured Homes and RV

Water and wind pose a threat to manufactured homes, leading to a higher risk to infrastructure, and even those secured by the required steel bands are less resilient than homes with an established foundation. Manufactured homes are required to be elevated and anchored to a vertical, engineer-certified system, allowing some mitigation for minor flood prevention.[125]

Manufactured homes have a reputation for being poorly designed and are therefore unsafe in hurricane-force winds and storm surges. Only a fraction of mobile homes are strapped down with the kind of hardened braces meant to withstand hurricane-force winds and minor flooding. Upgrading and retrofitting an older mobile home is uneconomical. This has resulted in the development of new safety regulations with regard to construction practices. There are three generations of mobile homes based on their year of manufacture, identified as Pre-1976, 1976 to 1994, and Post-1994.[126] Units that were manufactured before 1976 do not have manufacturing design standards, whereas those between 1976-1994 were built under HUD's Manufactured Home Construction and Safety Standards (MHCSS; 24 CFR 3280) and its Model Manufactured Home Installation Standards (24 CFR 3285). After Hurricane Andrew, the standards changed, and all post-1994 generations of manufactured homes have incorporated stricter design and manufacturing standards, including wind load standards based on American Society of Civil Engineers (ASCE) specifications. Despite these changes to the current code, it is estimated that a large portion of mobile homes are not installed to the current code.

Impact on Critical Infrastructure

Power lines are at risk of toppling or having trees fall on them during windstorms, resulting in loss of power, risk of fire, and injury if someone comes in contact with a downed line. Uprooted trees can cause damage to underground and overhead utilities. Hurricanes and tropical storms may also cause flying debris that can lead to additional damages.

With surge heights anticipated to reach bridge causeway levels, pounding waves may destroy sections of bridges, as seen during hurricanes Ivan in 2004 and Katrina in 2005. From these examples, it is speculated that the Tampa Bay bridges would be in jeopardy under severe hurricane conditions.[127]

Essential Facility Inventory

There are 19 hospitals in Hillsborough County, with a total bed capacity of 4,593 beds (Table 5.68).[128] There are 252 public schools (31 high schools, 33 magnet schools, 43 middle schools, 137 elementary schools, 8 K-8 schools), 53 charter schools, 63 private schools, 12 universities, and 12 colleges).[129] There are 70 fire stations (23 Tampa Fire Rescue, 44 Hillsborough County Fire Rescue, 1 Plant City Fire Rescue Department, and 2 Temple Terrace Fire Department) and 3 emergency

[125] Florida Manufactured Homes Association (FMHA, 2018). Hurricanes & Manufactured Homes: Four Myths Busted. Retrieved at http://www.fmha.org/.
[126] Schreiber, S. (2005). Mobile Homes and Hurricanes: The Crisis in Florida. Association of Collegiate Schools of Architecture (ACSA). Retrieved from http://www.acsa-arch.org/.
[127] https://www.jstor.org/stable/4124819?seq=14#metadata_info_tab_contents
[128] Florida Hospital Association (FHS), 2019. http://www.fha.org/reports-and-resources/hospital-directory.aspx
[129] http://www.sdhc.k12.fl.us/schools/

operation facilities (Hillsborough County EOC, City of Tampa EOC, and the University of South Florida EOC).

Table 5.68. Hospitals and Bed Capacity in Hillsborough County

Hospital	Beds
AdventHealth Carrolwood	103
AdventHealth Tampa	536
Brandon Regional Hospital	422
H. Lee Moffitt Cancer Center & Research Institute	206
James A. Haley Veterans' Hospital	353
Kindred Hospital Bay Area – Tampa	73
Kindred Hospital Central Tampa	102
Memorial Hospital of Tampa	183
Shriners Hospital for Children – Tampa	60
South Bay Hospital	138
South Florida Baptist Hospital	147
St. Joseph's Children's Hospital	186
St. Joseph's Hospital Behavioral Health Center	60
St. Joseph's Hospital, Inc.	437
St. Joseph's Hospital – North	108
St. Joseph's Hospital – South	114
St. Joseph's Women's Hospital	157
Tampa Community Hospital	201
Tampa General Hospital	1007
19 Total Hospitals in Hillsborough County	**4,593 Total Beds**

Source: Florida Hospital Association (FHA), 2019. [130]

<u>Impact on Hotels and Motels in Hillsborough County</u>

Most hotels in Tampa Bay have seen an incline in occupancy rates and revenue over the past years as tourism increases. In March 2023, Hillsborough County hotels had a high 76.4% occupancy rate and an increase of revenue to $244,804,472 overall.[131] Many hotels in the county are in coastal areas, including Downtown Tampa and Westshore near Tampa International Airport, in predominantly evacuation Zones A and B. This causes associated concerns for the added population needing to evacuate, housing post-disaster, recovery personnel having housing, and for employees to be able to return to work. Furthermore, this could have a devastating effect on our tourism industry post-disaster.

In 2023, an estimated 27 million visitors were in Hillsborough County, with over 6 million hotel room nights booked. There are 57,000 jobs sustained by tourism and over $944 million in taxes supported by tourism, $206 million of which accrues to local government. The $206 million in local taxes

---

130 Florida Hospital Association (FHS), 2019. http://www.fha.org/reports-and-resources/hospital-directory.aspx

131 https://www.bizjournals.com/tampabay/news/2019/04/26/tampa-and-hillsborough-hotel-revenue-and-occupancy.html

generated would be enough to fully fund the Hillsborough County Police Department ($160m).[132] Protecting and engaging the hotel industry in mitigation planning would be important to protect visitors and the local economy.

Ecological Impacts of Tropical Cyclone

Tropical cyclones cause severe coastal erosion and flooding or wind damage to natural and agricultural assets. Crops are more susceptible to wind damage as strong winds can break plants and ruin crops.

Coastal areas and areas along canals and rivers are more vulnerable to storm surge. Saltwater inundation can occur inland through the canals and waterways along the coast, impacting the flora and fauna inland.[133] Furthermore, canals being built or maintained through dredging penetrate the aquifer, allowing saltwater intrusion into this source of drinking water for Hillsborough County. Saltwater intrusion impacts soil quality and building construction as well.

Natural Systems to Reduce Stormwater Runoff

Impervious surfaces due to development are an environmental concern because, with their construction, a chain of events is initiated that modifies the air quality and water resources. The pavement materials seal the soil surface, eliminating rainwater infiltration and natural groundwater recharge. A 26.36% net increase in impervious surface area in Hillsborough County was due to development between 1996 and 2010. During this time, 28.57 $miles^2$ of agricultural land was developed, and 35.41 $miles^2$ of scrub, woody wetlands, and emergency wetlands were also developed.

Social and Population Impacts from Tropical Cyclone

Understanding a population's current demographic and socioeconomic characteristics provides context to understanding vulnerabilities within communities and neighborhoods across Hillsborough County. Examining potential future problems that may impact populations in these at-risk areas allows for the development and implementation of structural and non-structural mitigation measures aimed at protecting those more susceptible to the effects of tropical storms and hurricanes. This knowledge can increase the ability of local planners and the population to prepare before an event, remain safe during an event, and better plan for rehabilitation in the aftermath.

Population and social vulnerability need to be taken into consideration to ensure planners mitigation measures are taking into consideration social inequalities that may lead to some groups being more susceptible to the impacts of hazards, as well as hinder their ability to mitigate risk in a way that will make them more resilient to the effects of a natural or technological disaster. According to academic researchers Cutter & Emrich (2006), "this susceptibility is not only a function of the demographic

---

[132] Tourism Economics. The Economic Impact of Tourism on Hillsborough County, 2018. https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/tampabay/Tourism_Economics_2018 _Economic_Impact_c6fa7ef7-42fd-4b93-9c88-2bf382d02e9e.pdf

[133] Williams, V. (2010) Identifying the economic effects of saltwater intrusion after Hurricane Katrina. Journal of Sustainable Development, https://doi.org/10.5539/jsd.v3n1p29

characteristics of the population (age, gender, wealth, etc.), but also more complex constructs such as health care provision, social capital, and access to lifelines (e.g., emergency response personnel, goods, services).[134] In this section, population and social vulnerability are examined in regard to tropical storms and hurricanes. The Justice40 Climate and Economic Justice Screening Tool (CEJST) was used to determine disadvantaged communities. This analysis can be found below in Section 6.1.

Poverty and Homelessness

According to the U.S. Bureau of Labor Statistics (BLS), the unemployment rate for Hillsborough County was 3.0% in December 2023.[135] Approximately 12.9% of individual residents in Hillsborough County live below the poverty line.[136] Due to their unstable economic situations, these segments of the population are likely to seek assistance, may not have adequate health or homeowner's insurance, or may end up homeless after a major hurricane event.

New Residents

Historically, hurricanes and tropical storms have caused the greatest amount of property damage. As more people move to Hillsborough County and more development takes place, the potential for hurricane-related deaths and damages increases yearly. From approximately 1.23 million residents in 2010 to approximately 1.5 million in 202, there has been an estimated 24.9% increase in population growth in Hillsborough County.[137] According to the Bureau of Economic and Business Research (2018), an upward estimate of 1.04 million new residents is projected to migrate to the area by 2045.[138]

Older Adults

According to the U.S. Census Bureau (2023), 15.1% of the Hillsborough County population is over the age of 65. This portion of the population may be more vulnerable due to financial barriers, lack of social networks and transportation, or health reasons. Many retirees live on fixed incomes and may not have resources for home mitigation measures to ensure they have the supplies necessary to be prepared.

They may need additional assistance to help retrofit or mitigate the effects of tropical storms and hurricanes on their homes or need assistance for evacuating due to a variety of chronic health problems, including cognitive impairments and diminished mobility.

Between 2010 and 2045, Hillsborough County will experience considerable growth in its older population. In 2045, the population aged 65 and over is projected to be 342,382, over double the

---

[134] Cutter, S. & Emrich, C. (2006). Moral Hazard, Social Catastrophe: The Changing Face of Vulnerability Along the Hurricane Coasts. Annals of The American Academy of Political and Social Science, 604. 102-112. doi:10.1177/0002716205285515.

[135] https://www.bls.gov/eag/eag.fl_tampa_msa.htm

[136] https://www.census.gov/quickfacts/fact/table/hillsboroughcountyflorida,US/INC910222

[137]https://www.census.gov/quickfacts/fact/table/hillsboroughcountyflorida,US/INC910222

[138] https://www.bebr.ufl.edu/sites/default/files/Research%20Reports/projections_2018.pdf

estimated population of 231,870 residents in 2010.[139] The aging of the population will have wide-ranging implications for Hillsborough County, presenting challenges to policymakers and emergency planners.

Housing and Transportation

Housing and transportation are a major concern due to the damaging effects of a tropical cyclone on the built environment. Mobile/manufactured home residents and persons with inadequate resources to protect their homes or access evacuation resources are at greatest risk to tropical storms and hurricanes. Prolonged power outages and gas shortages cause additional challenges to businesses and service providers. They can disproportionately impact persons relying on regular home services such as medical services or food delivery. Furthermore, debris can block evacuation and emergency services access routes. The extent of debris, infrastructure outages, and restoration times can complicate and increase response and recovery timelines.

Vulnerability is not just a product of building codes; social vulnerability plays an important role in understanding risk. Identifying mobile home parks with exceptional social cohesion serves as a model for those where social capital appears to be lacking and improves the disaster preparedness of those areas.

479 mobile home parks and over 33,270 manufactured homes are registered in Hillsborough County.[140] Residents in mobile home communities usually own their homes and pay monthly rent to park on the property within the mobile home park. The arrangement is popular among retirees as well as low-income families looking for an affordable housing option.

By drawing from various levels of flood plain data for Hillsborough County and cross-referencing it with the location of our mobile home parks, identifying which manufactured home parks are at the greatest risk for future storm surge and flooding events has been conducted. Long-term risks exist for those who live closest to the coastline along Tampa Bay in South County, as well as Town ‘N Country, regarding storm surge, flooding, and anticipated sea-level rise. Furthermore, there is a concern for residents of manufactured home parks that lay within the watersheds of some of our largest rivers (specifically the Alafia and Hillsborough rivers) that may lead to the risk of inland flooding during tropical storms and hurricane events. In the event of a flood, many of these home parks could see significant destruction of personal property and displacement of their residents.

High-density residential areas susceptible to potential storm surge include Town ‘N Country, South Tampa, Davis Island, Apollo Beach, and Ruskin. Tampa ranked in the top 10 among large metropolitan areas with severe shortages of rental homes affordable to low-income households.[141]

Health Vulnerabilities

[139] https://www.bebr.ufl.edu/sites/default/files/Research%20Reports/projections_2019_asrh.pdf

[140] US Census Bureau. (2017). Physical housing characteristics for occupied housing units, 2013-2017 ACS 5-year estimates. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF.

[141] https://reports.nlihc.org/oor/florida

Populations of concern in Hillsborough County include individuals who have health concerns that need to be considered whether they decide to evacuate or stay in their home during a tropical cyclone. Many individuals may be electricity dependent (i.e., ventilators, oxygen concentrators, CPAP and other sleep apnea devices, dialysis machines, take medications needing refrigeration) and have functional needs that pose a challenge to their safety and well-being. Healthcare facilities could experience extended periods of disruption after a disaster, and mitigating against potential risks, developing comprehensive plans for their facility, and having adequate resources on hand are essential.

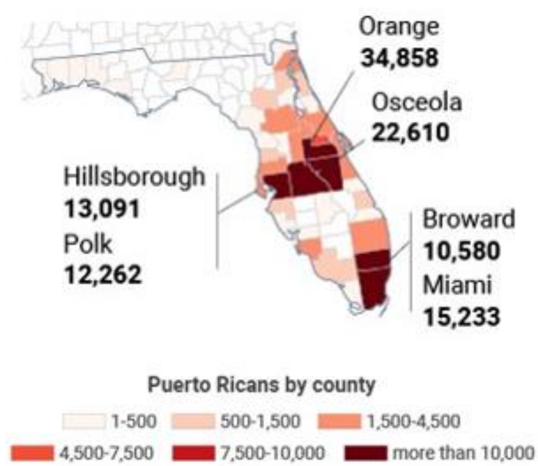
As mentioned, populations over the age of 65 may be more susceptible to health concerns that may impact their ability to evacuate or mitigate against tropical storms and hurricanes. Between 2010 and 2045, Hillsborough County will experience considerable growth in its older population. In 2045, the population aged 65 and over is projected to be 342,382, over double the estimated population of 145,237 residents in 2010.[142] The aging of the population will require the county to identify additional facilities to serve as Special Needs Shelters and retrofit their facilities to meet the requirements necessary to serve as an SNS. In 2019, 1,858 special needs shelter pre-registrants were from Hillsborough County.

Population Migration

Migration of persons affected by catastrophic hurricanes from other areas of Florida and the Caribbean may affect Hillsborough County. For example, nearly 400,000 Puerto Ricans left the island following Hurricane Maria between October 2017 and February 2018, with Florida receiving about 150,000 between these months. Hillsborough County had an influx of new residents from Puerto Rico migrating due to the conditions on the island following the impact of this hurricane. There was an estimated migration of 13,091 Puerto Ricans to Hillsborough County between October 2017 and February 2018 following Hurricane Maria. These totals can be seen in Table 5.69.

Table 5.69. Estimated Population of Puerto Ricans in Florida by County.[143]

Counties in Florida Receiving Puerto Rican Population	Total
Orange	34,858
Osceola	22,610
Miami-Dade	15,233
Hillsborough	13,091
Polk	12,262
Broward	10,580
Seminole	7,430



In 2018, Hurricane Michael led to an exodus of residents from the Florida Panhandle to other communities with adequate rental housing and job opportunities. Following Hurricane Dorian

[142] https://www.bebr.ufl.edu/sites/default/files/Research%20Reports/projections_2019_asrh.pdf

[143] https://www.citylab.com/environment/2018/05/watch-puerto-ricos-hurricane-migration-via-mobile-phone-data/559889/

(2019), residents from the Bahamas began to seek refuge on other adjacent islands or communities in Florida. The usefulness of monitoring geo-referenced data from Hillsborough County School enrollment numbers can help support disaster relief efforts, especially when it comes to developing accurate emergency planning and determining when and where the affected population is relocating following a major disaster in other areas of the state and if the Caribbean islands are affected by a major hurricane.

Tropical cyclones can severely impact the local economy due to loss of employment and the closure of local businesses that were majorly impacted by the storm if business continuity and mitigation measures are not implemented. It can take an estimated four to eight years for the economy to recover without outside stimulus to support reconstruction and recovery.[144]

Impact on Visitors and Tourism in Hillsborough County

Many hotels in Hillsborough County are located along coastal areas and rivers that would be in evacuation Zone A or B. In the event of a major hurricane, visitors and evacuees staying in hotels or motels may need to seek refuge elsewhere if the location is vulnerable to storm surge. Visitors and tourists may not be familiar with the area or what to do to prepare for a hurricane, making them more vulnerable.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Due to Hillsborough County's geographic location, the entire county is vulnerable to damage from tropical cyclones. As the county's population increases, so does the number of those who have not experienced the impact of a tropical cyclone or major hurricane.

The county's vulnerability to hurricanes varies with the progression of the hurricane season. Early and late in the season (June and October), the region of maximum hurricane activity is in the Gulf of Mexico and the western Caribbean. Most systems that move into Florida approach the state from the south or southwest, entering the Keys or along the west coast. In the mid-season (August and most of September), tropical cyclones develop off the coast of Africa. These systems, known as Cape Verde Storms, approach the state from the east or southeast.

Historic Losses

The NCEI Storm Events Database information, presented in the Historical Occurrences section above, also contained property and crop damage dollar amounts, shown in

Table 5.70 below. This information, combined with values of structures in hazard areas and projected losses from HAZUS-MH, can provide a more complete analysis than using only one data source.

---

[144] https://www.hillsboroughcounty.org/library/hillsborough/media-center/documents/emergency-management/21--pdrp-economic-analysis-of-a-hurricane.pdf.

Table 5.70. Tropical Cyclone Events in Hillsborough County, by Type, (1996–2023)[145]

Type of Event	Number of Events	Deaths	Injuries	Reported Property Damage (2023 dollars)	Reported Crop Damage (2023 dollars)
Tropical Storm	11	3	0	$61,861,309	$0
Hurricane	1	0	0	$17,337,023	$35,310,382
Storm Surge	4	0	0	$571,696	$0
TOTAL	**16**	**0**	**0**	**$79,770,028**	**$35,310,382**

The information can be analyzed to provide the average amount of property and crop damage that is likely each year. This information is shown in Table 5.71. Data was used for the average tropical cyclones per year and annualized property and crop loss from 2016-2023 as tropical cyclone events reported have increased in frequency since 2016. All property and crop loss data were from 2016 and onward.

Table 5.71. NCEI Tropical Cyclones, 2016–2023[146]

NCEI Storm Event (hazard)	Average Tropical Cyclones per Year	Annualized Property Loss (2023 dollars)	Annualized Crop Loss (2023 dollars)
All Types of Tropical Cyclones	2.0	$11,395,718	$5,044,340

According to the analysis, Hillsborough County is historically vulnerable to around $11.4 million in property damages and over $5.0 million in crop damages annually from approximately 2.0 tropical cyclone events in any given year. Dollar damages are based on reported historical damages only and likely significantly understate actual annualized damage.

Exposure

[145]https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Hurricane+%28Typhoon%29&eventType=%28Z%29+Storm+Surge%2FTide&eventType=%28Z%29+Tropical+Depression&eventType=%28Z%29+Tropical+Storm&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

[146]https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Hurricane+%28Typhoon%29&eventType=%28Z%29+Storm+Surge%2FTide&eventType=%28Z%29+Tropical+Depression&eventType=%28Z%29+Tropical+Storm&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Storm Surge

To estimate exposure of improved property to storm surge, the approximate number of parcels and their associated improved values located in hurricane risk areas was determined using GIS analysis. The risk areas utilized are the hurricane storm surge areas associated with various category hurricanes. Table 5.72 and Table 5.73 provide summaries of exposure from storm surge by category of hurricane.

Table 5.72. Estimated Exposure of Improved Property to Hurricane Risk Areas – Hurricane Storm Surge (Category 1, 2, and 3)

	Buildings and Parcels in Hurricane Risk Areas								
	Category 1			Category 2			Category 3		
	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)	No. of Parcels	No. of Bldgs	Improved Value (in 1000s)
City of Plant City	0	0	$0	0	0	$0	0	0	$0
City of Tampa	26,045	97,955	$12,843,150	41,112	155,377	$18,178,342	55,782	1,211,760	$24,266,410
City of Temple Terrace	0	0	$0	0	0	$0	184	52	$5,712
Unincorporated	36,245	122,523	$11,343,373	89,599	192,031	$15,048,597	69,158	260,684	$11,932,866
HILLSBOROUGH COUNTY TOTAL	**62,290**	**220,478**	**$24,186,523**	**93,711**	**347,408**	**$33,226,939**	**125,299**	**472,495**	**$43,546,508**

Table 5.73. Estimated Exposure of Improved Property to Hurricane Risk Areas – Hurricane Storm Surge Total (Category 4 and 5)

	Buildings and Parcels in Hurricane Risk Areas					
	Category 4			Category 5		
	No. of Parcels	No. of Buildings	Improved Value (in 1000s)	No. of Parcels	No. of Buildings	Improved Value (in 1000s)
City of Plant City	0	0	$0	0	0	$0
City of Tampa	69,492	211,760	$27,931,749	82,708	317,100	$31,048,397
City of Temple Terrace	507	539	$620,598	1,125	4,776	$759,717
Unincorporated	94,677	421,103	$26,026,753	122,513	783,840	$623,579,034
HILLSBOROUGH COUNTY TOTAL	**164,676**	**633,402**	**$54,579,099**	**206,346**	**805,716**	**$735,138,644**

To estimate the county population's exposure to storm surge, areas of risk were intersected with census block data. As a result, these population estimates will overestimate risk since the entire census block's population count will be included even if only a portion of the census block's area is located in a hurricane storm surge area. However, these estimates still give an idea of the county population's risk to storm surge.

Table 5.74 and Table 5.75 show population exposure to storm surge areas.

Table 5.74. Estimated Exposure of Population to Hurricane Risk Areas – Hurricane Storm Surge (Category 1, 2, and 3)

Storm Surge Depth	Population in Hurricane Risk Areas											
	Category 1				Category 2				Category 3			
	County Total	Tampa	Temple Terrace	Uninc.	County Total	Tampa	Temple Terrace	Uninc.	County Total	Tampa	Temple Terrace	Uninc
0 to 1 ft	1,046,443	280,731	54,187	711,525	961,421	258,841	37,697	664,883	877,695	228,540	31,458	617,697
1 to 2 ft	404,979	179,383	1,346	224,250	430,738	168,048	18,513	244,177	453,619	165,432	23,588	264,599
2 to 3 ft	395,931	176,092	1,346	218,493	429,333	166,728	18,513	244,092	439,543	165,432	18,024	256,087
3 to 4 ft	396,973	147,282	2023	247,668	421,965	150,163	18,513	253,289	436,080	150,863	18,024	267,193
4 to 5 ft	385,991	147,811	2,023	236,157	471,968	179,346	16,935	275,687	480,422	177,395	16,767	286,260
5 to 8 ft	378,433	157,061	1,346	220,026	451,985	173,588	18,513	259,884	462,283	173,174	23,588	265,521
8 to 11 ft	344,145	130,843	2,023	211,279	351,559	120,146	16,935	214,478	324,718	117,779	16,767	190,172
11 to 14 ft	242,912	98,295	2,023	0	438,102	198,339	18,513	221,250	517,447	198,339	21,651	297,457
> 14 ft	0	0	0	0	359,405	116,795	18,513	224,097	483,766	172,302	21,651	289,813
*Plant City has no population located in storm surge risk areas, so it is not included in this table.												

Table 5.75. Estimated Exposure of Population to Hurricane Risk Areas – Hurricane Storm Surge (Category 4 and 5)

Storm Surge Depth	Population in Hurricane Risk Areas							
	Category 4				Category 5			
	County Total	Tampa	Temple Terrace	Uninc.	County Total	Tampa	Temple Terrace	Uninc.
0 to 1 ft	763,858	199,631	25,822	538,405	583,069	131,510	17,801	433,758
1 to 2 ft	476,820	156,243	30,388	290,189	620,101	204,425	28,010	387,666
2 to 3 ft	457,125	156,243	18,563	282,319	463,289	204,692	20,706	237,891
3 to 4 ft	456,195	160,511	18,563	277,121	462,935	200,345	20,706	241,884
4 to 5 ft	480,422	165,078	28,592	286,752	496,689	166,411	29,032	301,246
5 to 8 ft	395,234	125,175	16,767	253,292	416,361	131,621	37,494	247,246
8 to 11 ft	540,383	185,792	28,592	325,999	631,150	191,665	31,965	407,520
11 to 14 ft	566,429	202,041	28,592	335,796	408,729	128,910	28,592	251,227
> 14 ft	605,955	214,483	28592	362,880	748,175	261,515	28,592	458,068
*Plant City has no population located in storm surge risk areas, so it is not included in this table.								

Hazus-MH

Wind

FEMA's Hazus-MH modeling software was used to estimate the number of damaged buildings from a 100-year and 500-year hurricane event for the county during the 2020 plan update, as shown in **Error! Reference source not found.** Figure 5.41 through Figure 5.44**Error! Reference source not found.**, below. This analysis includes the number of buildings that sustain at least moderate loss and at least severe loss from hurricane winds. While additional buildings have been constructed since Hazus-MH was last run, the overall ranges by census tract have not changed significantly. For this 2025 plan update, it was determined that the cost of updating Hazus data using the 6.0 module was not a wise use of limited resources. Hazus-MH outputs from 2020 were inflated, as described below, to account for inflation, changes in population, and construction costs. This updated data is supplemented with FEMA's NRI vulnerability and loss classifications, which were updated in the last year.

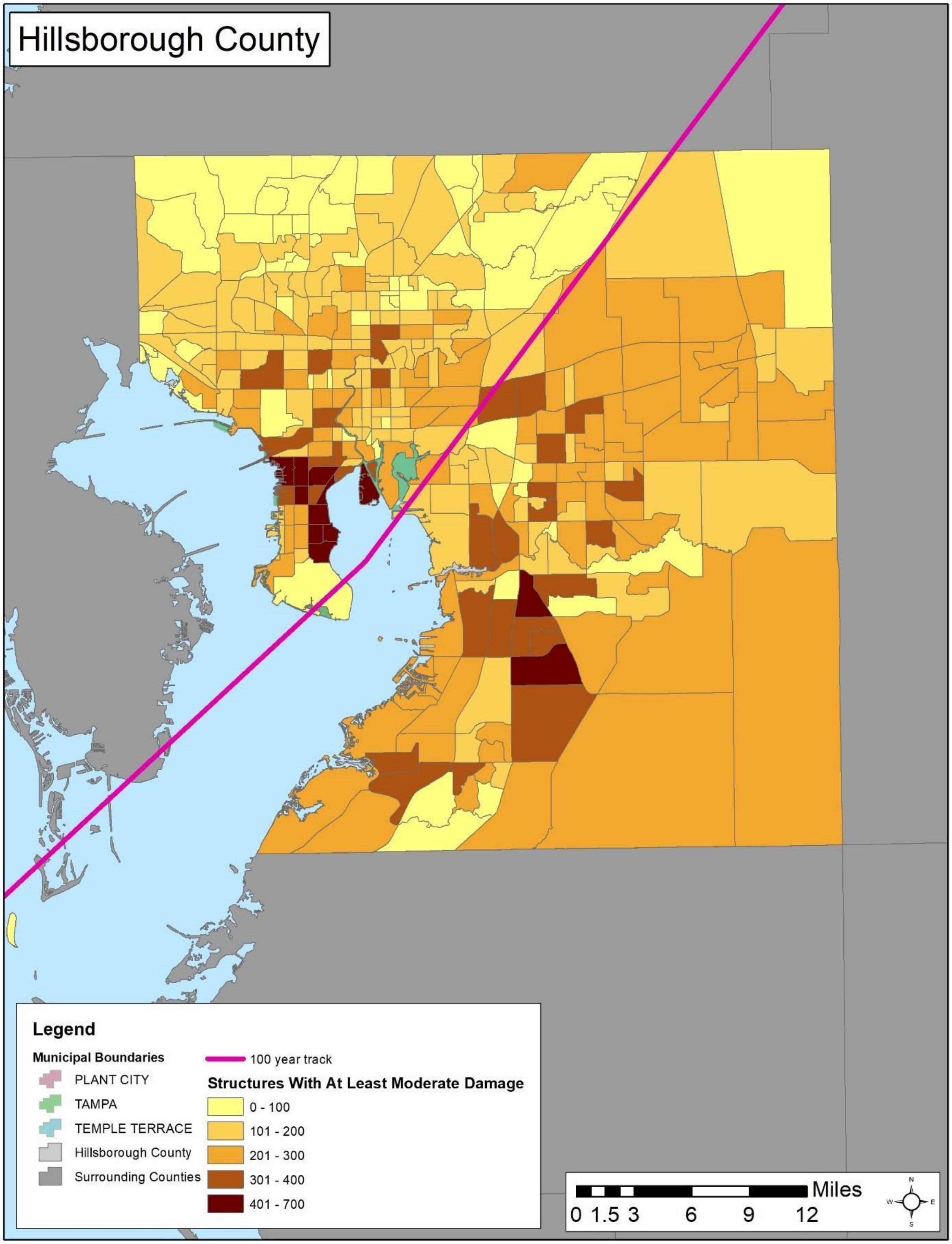


Figure 5.41. At Least Moderate Loss, 100-year Return Period

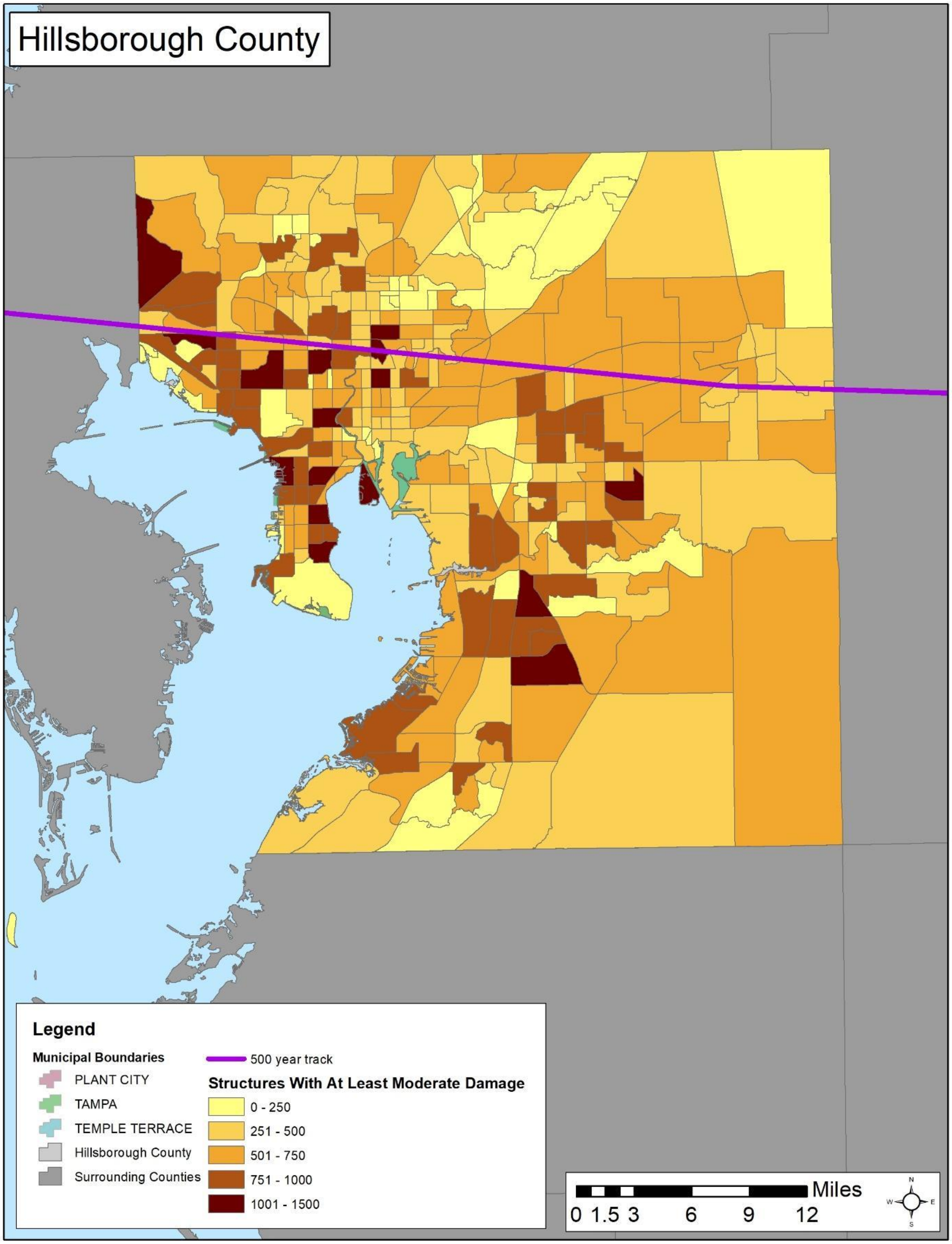


Figure 5.42. At Least Moderate Loss, 500-year Return Period

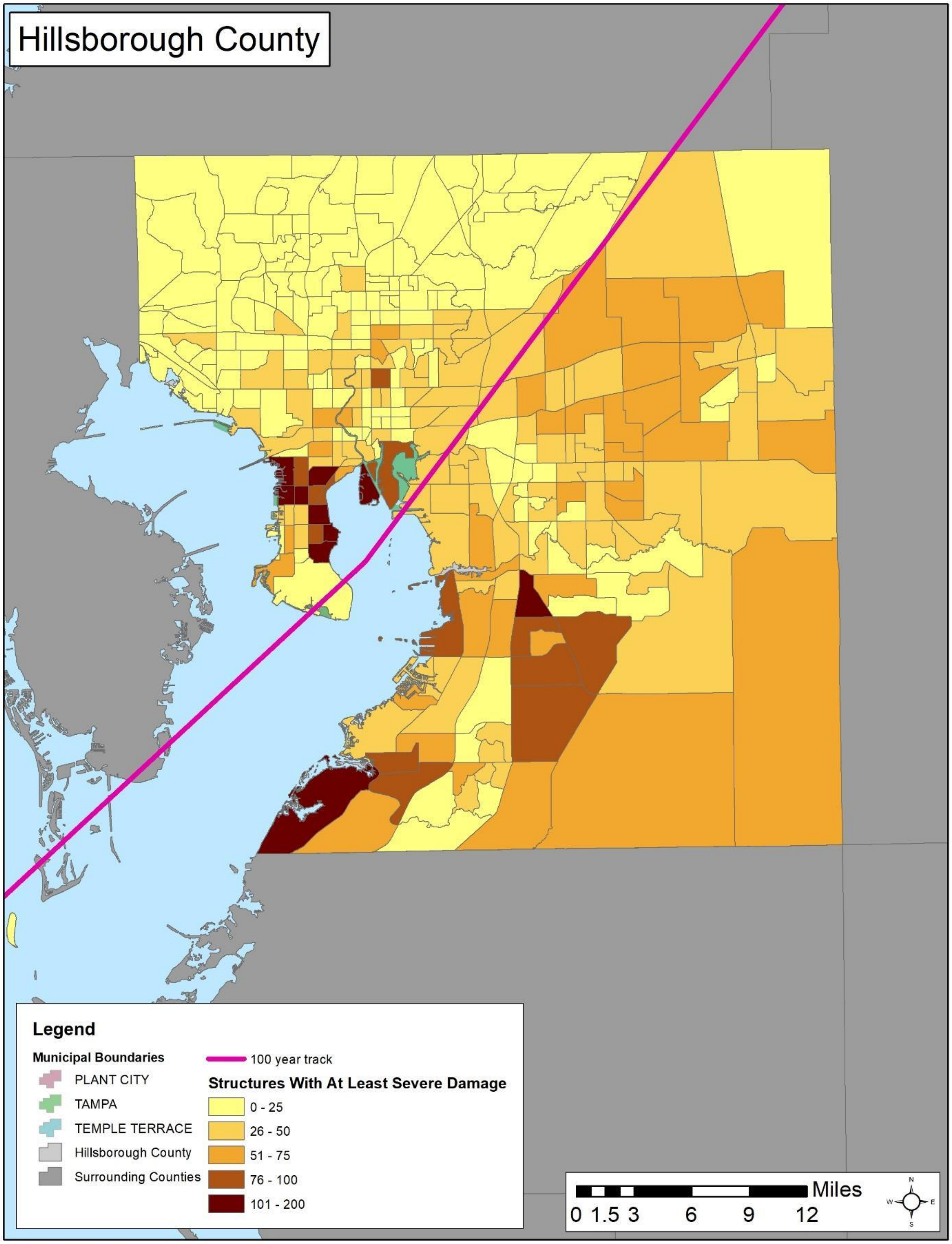


Figure 5.43. At Least Severe Loss, 100-year Return Period

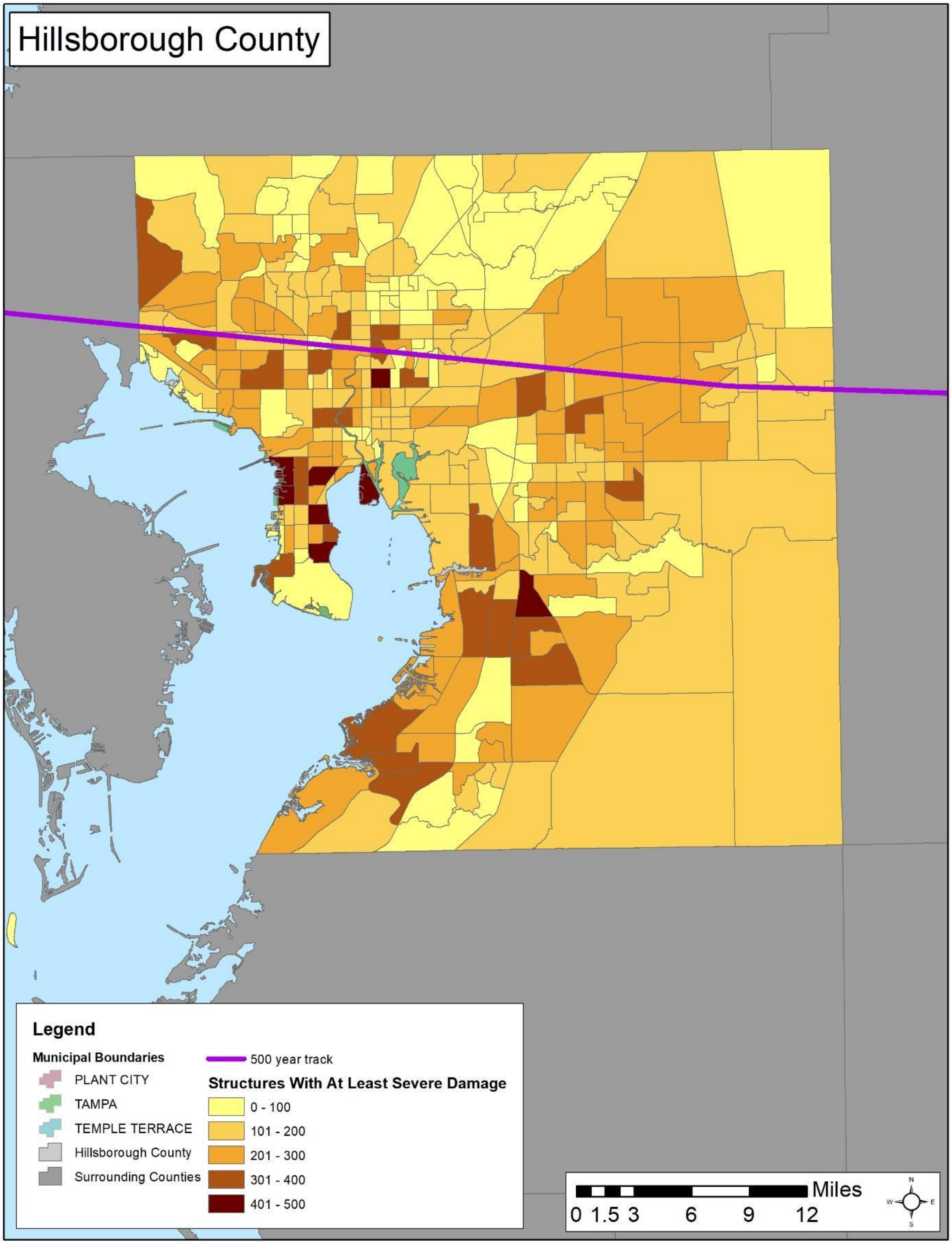


Figure 5.44. At Least Severe Loss, 500-year Return Period

Hazus-MH was also used to estimate the county's annualized loss from a hurricane event, as shown below. This analysis includes annual losses to buildings, contents, inventory, relocation, capital, wages, and rental income from hurricane winds. These loss values are shown in Table 5.76 using 2020 Hazus data inflated to 2023 dollar values with some additional corrections noted below.

Table 5.76. Estimated Annualized Direct Economic Losses from Hurricane Event Wind

	Hurricane Event
Building Loss*	$311,511,060
Contents Loss**	$92,194,179
Inventory Loss***	$1,180,480
Relocation Loss****	$38,137,596
Capital Related Loss*****	$5,152,700
Wage Loss******	$6,645,793
Rental Income Loss******	$14,088,410
TOTAL LOSS	**$468,910,218**

*Inflated to 2023 dollars and increased by 20% to account for increased construction costs

**inflated to 2023 dollars and increased by 10% to account for increased costs

***inflated to 2023 dollars

**** inflated to 2023 dollars and increased by 20% to reflect increases in hotel and housing costs

*****inflated to 2023 dollars

******inflated to 2023 dollars and increased by 10% to reflect increase in wages

*******inflated to 2023 dollars (not increased. Rents have increased, as have ownership and maintenance costs)

Figure 5.45 shows ranges of annualized costs at the census tract level.

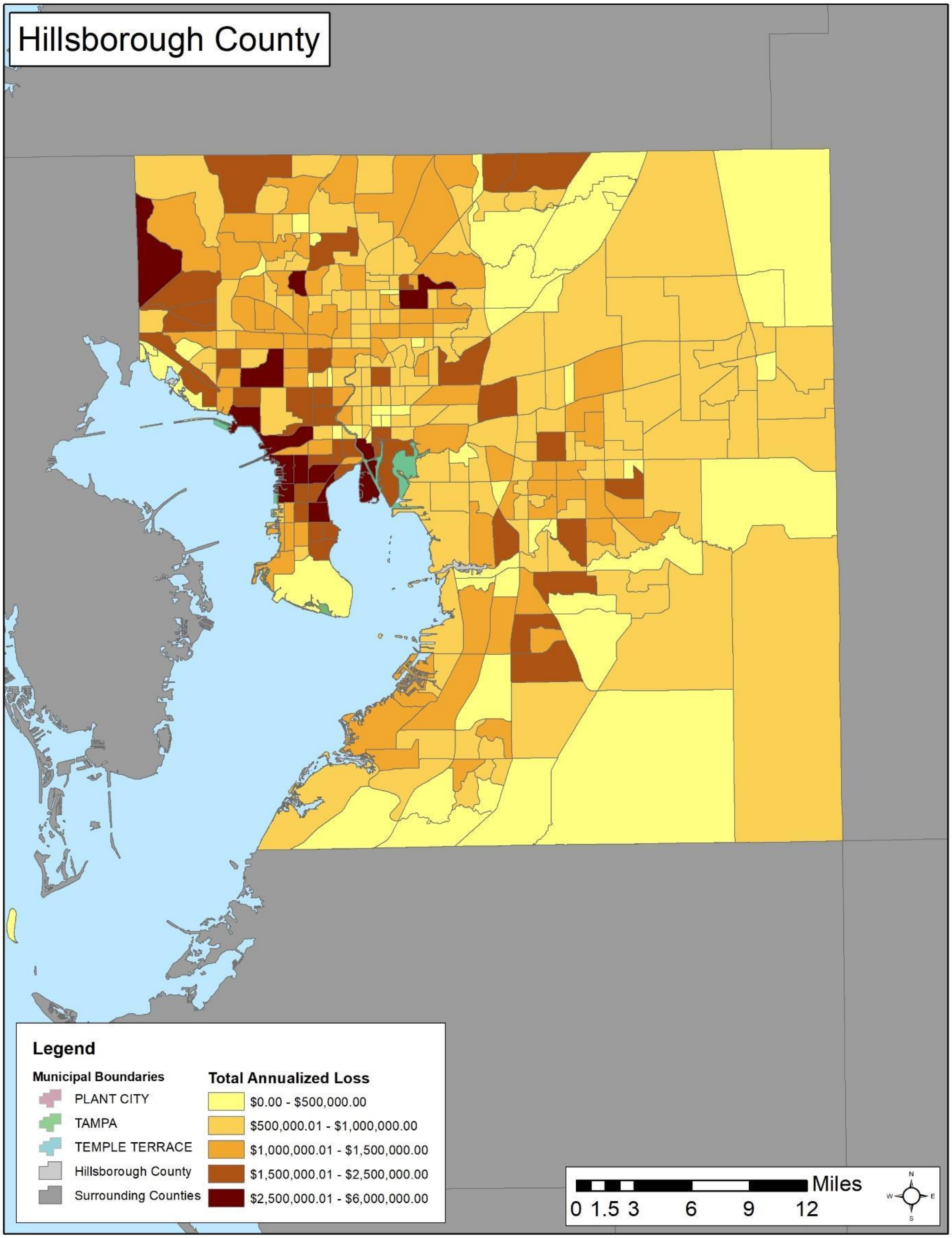


Figure 5.45. Total Annualized Loss

6.1 National Risk Index (NRI)

The National Risk Index (NRI) was utilized to obtain additional information, paired with Hazus loss estimation data, on the risk and loss analysis for Hillsborough County on a census tract level. The hurricane data used in the NRI uses the NHC's HURDAT2 Best Track Data Archive, which is the most comprehensive source of information on both Atlantic and Pacific tropical and subtropical cyclones. It contains a series of storm observation records at six-hour intervals with location, maximum wind speed, central pressure, and (beginning in 2004) cyclone size. [147] This data is used to calculate an exposure value for each census tract based on identified high probability hurricane areas intersecting with census tract boundaries, and through that exposure data, an annualized frequency of hurricane events and a historic loss ratio was calculated to help determine the expected annual loss for each census tract due to hurricane/tropical cyclone. A final NRI risk score was then calculated by multiplying the expected annual loss by the CDC's social vulnerability score and dividing that by the community resilience score that was calculated by the Hazards Vulnerability & Resilience Institute's (HVRI) Baseline Resilience Indicators for Communities (BRIC) index.

Figure 5.46 shows vulnerability to hurricane by census tract across the county using the NRI risk rankings.

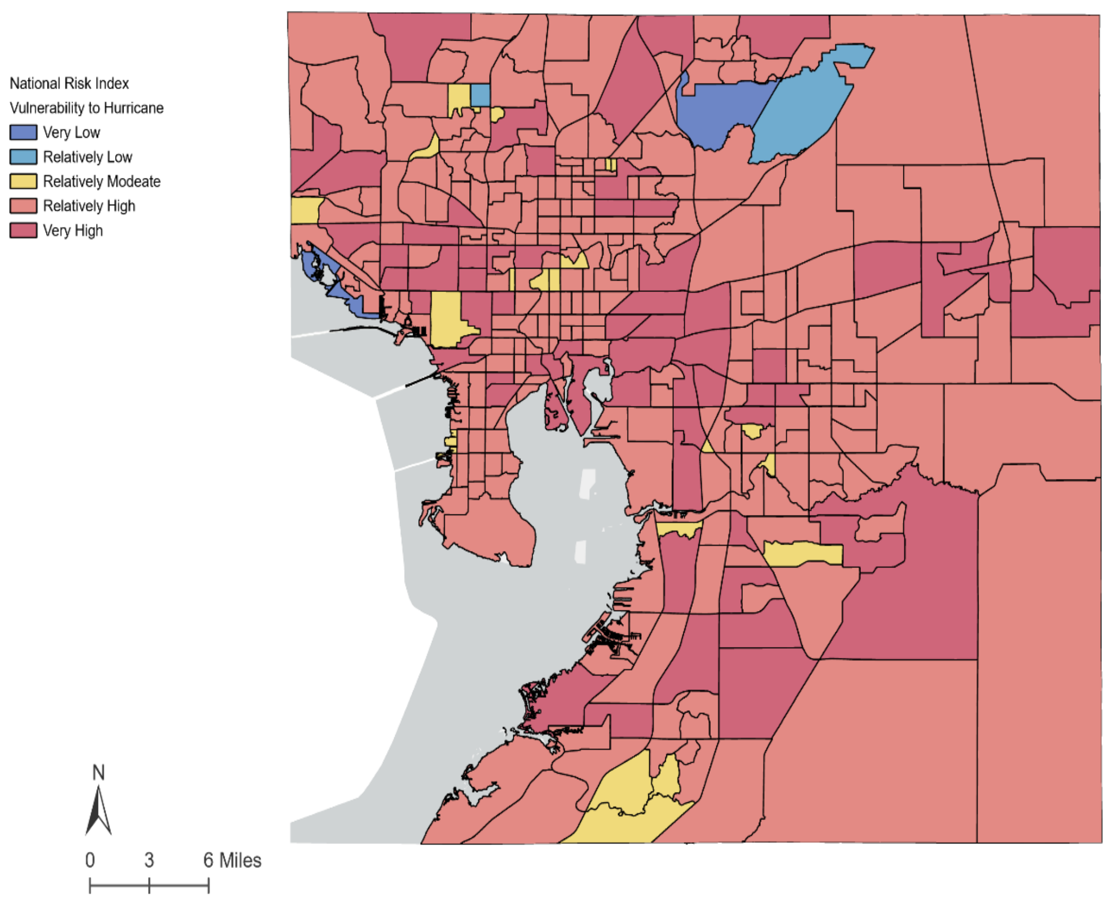


Figure 5.46. NRI Vulnerability to Hurricane for Hillsborough County by Census Tract

As seen in Figure 5.46, Hillsborough County has a relatively high to very high vulnerability to hurricane. Only five total census tracts have relatively low or very low risk of hurricane in the county.

Table 5.77 below, breaks this down by jurisdiction.

Table 5.77. NRI Vulnerability to Hurricane Breakdown by Jurisdiction

Jurisdiction	# of Very Low Risk	# of Relatively Low Risk	# of Relatively Moderate Risk	# of Relatively High Risk	# of Very High Risk
Hillsborough County (Unincorporated)	3	2	13	147	46
City of Plant City	0	0	0	7	4
City of Tampa	0	0	8	82	13
City of Temple Terrace	0	0	0	7	1
Hillsborough County (Total)	**3**	**2**	**21**	**243**	**64**

Figure 5.47 shows expected annual losses in Hillsborough County from hurricane damages by census tract, as reported by the NRI.

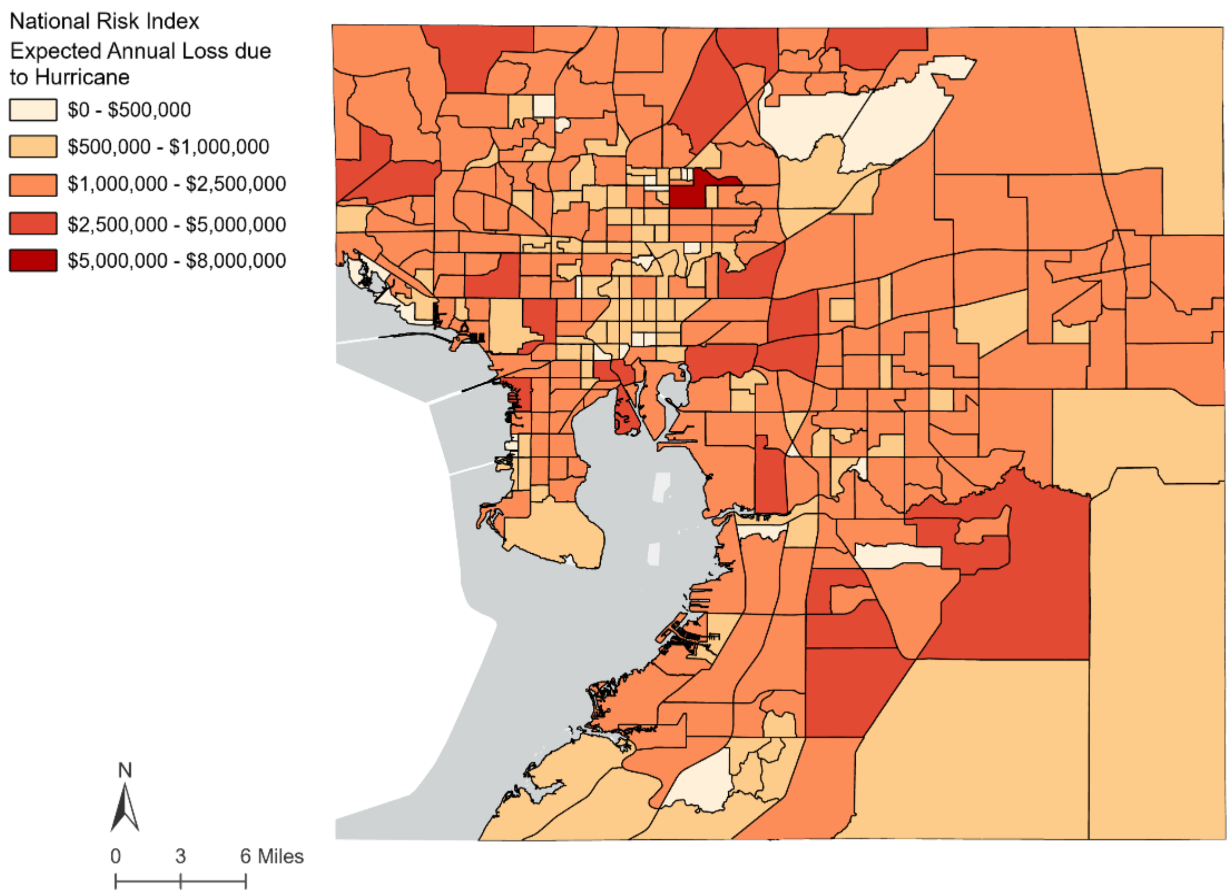


Figure 5.47. Expected Annual Loss due to Hurricane

The majority of census tracts in Hillsborough County have $1 million to $2.5 million in expected annual loss due to hurricane, with some going as high as $5-$8 million in expected annual losses. The breakdown of the expected annual loss by jurisdiction is shown below in Table 5.78. The total expected loss is relatively similar to the Hazus loss values showing a range of around $469 million in expected annual loss using the inflated Hazus data to around $494 million in expected annual loss using NRI data.

Table 5.78. Expected Annual Loss Due to Hurricane Breakdown by Jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$335,133,447
City of Plant City	$17,156,851
City of Tampa	$132,169,035
City of Temple Terrace	$9,723,446
Hillsborough County (Total Loss)	**$494,182,779**

Justice40 Climate and Economic Justice Screening Tool (CEJST)

The Justice40 Climate and Economic Justice Screening Tool (CEJST) was used to determine disadvantaged communities that are more vulnerable to tropical cyclones.

The impact area of a Category 3 hurricane was overlaid on top of the communities in Figure 5.48. A Category 3 hurricane was used to determine vulnerability as it is considered a major storm but is also more likely to occur than a Category 4 or 5 hurricane, even though they would have larger impact areas. This analysis is for storm surge only. All disadvantaged census tracts are vulnerable to tropical cyclone winds to some degree.

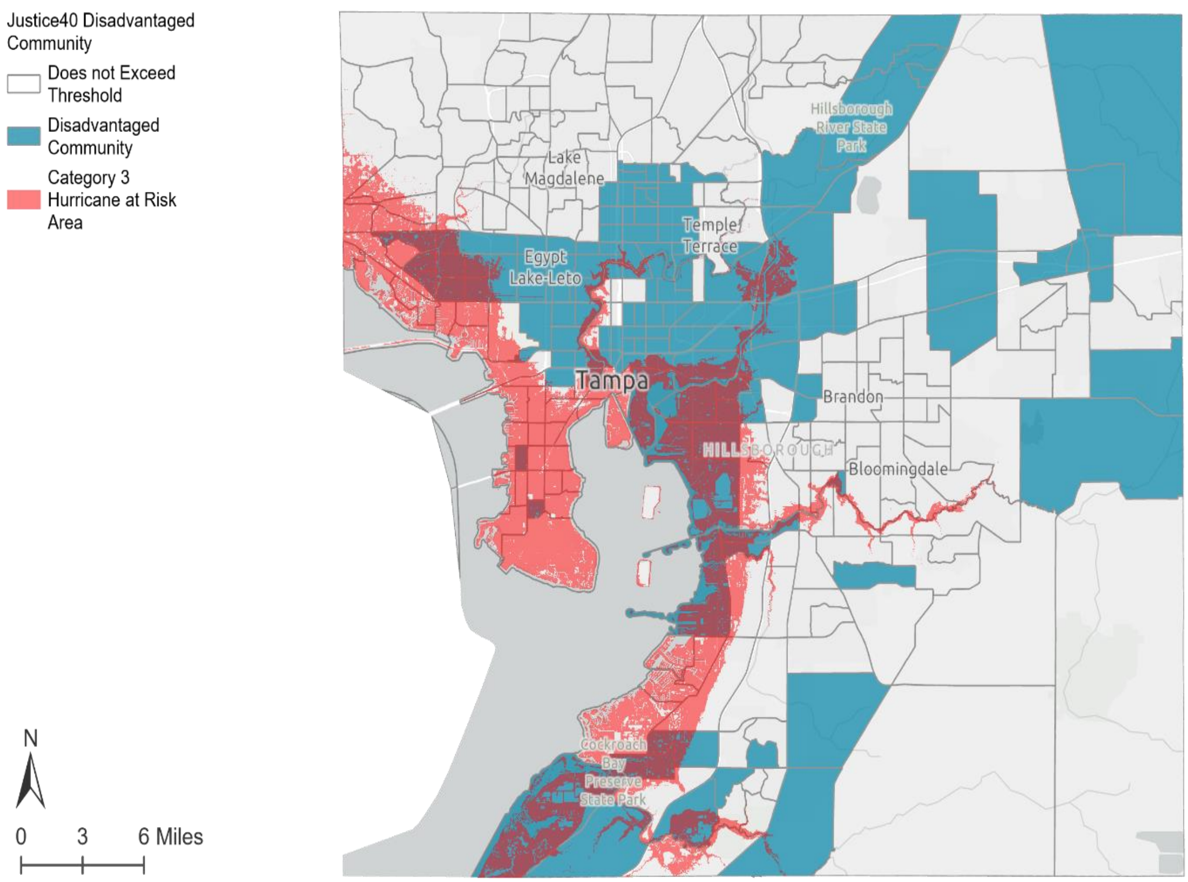


Figure 5.48. Justice40 Disadvantaged Communities with Category 3 Hurricane at Risk Area overlay[148] [149]

The counts of disadvantaged communities exposed to a Category 3 hurricane storm surge are shown below in Table 5.79. Overall, 45% of the disadvantaged communities in Hillsborough County are

[148] https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5
[149] https://experience.arcgis.com/experience/203f772571cb48b1b8b50fdcc3272e2c

exposed to a Category 3 Hurricane. 32 of these 56 communities are found in unincorporated Hillsborough County, which equates to 57% of the exposed disadvantaged communities and around 50% of the total disadvantaged communities in unincorporated Hillsborough County. 43% of the total disadvantaged communities in Tampa are exposed to a Category 3 Hurricane as well, and the single disadvantaged community in Temple Terrace is also exposed. These communities would face greater damages if a tropical cyclone were to impact their areas as the populations within these communities past socioeconomic and climate impact thresholds, indicating them as disadvantaged and more vulnerable.

Table 5.79. Count of Disadvantaged Communities Exposed to Tornado Risk by Jurisdiction

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities Exposed to Category 3 Hurricane Surge Impact Area
Hillsborough County (Unincorporated)	63	32
City of Plant City	6	0
City of Tampa	54	23
City of Temple Terrace	1	1
Hillsborough County (Total)	**124**	**56**

Vulnerability Analysis and Loss Estimation of Critical Facilities

Since all counties within Florida are vulnerable to the effects of tropical cyclones, all of the Hillsborough County critical facilities are vulnerable to potentially damaging storm surge and hurricane force winds.

To estimate exposure to storm surge for the critical facility analysis, hurricane storm surge areas were intersected with critical facility locations. Table 5.80 summarizes the critical facilities in the county that are located within a hurricane risk area.

Table 5.80. Exposure of Critical Facilities to Hurricane Risk Areas – Hurricane Storm Surge

Location	Number of Critical Facilities in Hurricane Risk Area				
	Category 1 Storm Surge	Category 2 Storm Surge	Category 3 Storm Surge	Category 4 Storm Surge	Category 5 Storm Surge
City of Plant City	0	0	0	0	0
City of Tampa	46	64	80	108	135
City of Temple Terrace	0	0	0	0	3
Unincorporated	43	63	85	124	161
HILLSBOROUGH COUNTY TOTAL	**89**	**127**	**165**	**232**	**299**

All of the critical facilities and their associated risk can be found in Appendix B.

While all county facilities are vulnerable to tropical cyclones, it is clear that there are coastal areas with significant numbers of critical facilities within storm surge zones.

The critical facilities were broken out further into FEMA Community Lifeline categories. These lifelines are categorized as: Safety and Security; Health and Medical; Transportation; Food, Water, Shelter; Water Systems; Communications; Energy; and Hazardous Materials. Several critical facilities were not included as community lifelines, such as solid hazardous waste facilities for example, while evacuation routes were added as community lifelines while not being included in the critical facility asset exposure analysis.

To estimate exposure to storm surge for the community lifeline analysis, hurricane storm surge areas were intersected with community lifeline locations. Table 5.81 summarizes the community lifelines in the county that are located within a hurricane risk area and

Table 5.82-Table 5.84 summarizes this exposure by jurisdiction for Tampa, Temple Terrace, and Unincorporated Hillsborough County. Plant City had zero lifelines exposed to hurricane storm surge areas.

Table 5.81. Exposure of FEMA Community Lifelines to Hurricane Risk Areas – Hurricane Storm Surge

Community Lifeline	Number of Community Lifelines in Hurricane Risk Area (% of Total)					
	Category 1 Storm Surge	Category 2 Storm Surge	Category 3 Storm Surge	Category 4 Storm Surge	Category 5 Storm Surge	Total Community Lifelines
Safety and Security	109 (11%)	195 (20%)	263 (27%)	372 (39%)	468 (49%)	963
Health and Medical	37 (9%)	57 (13%)	73 (17%)	110 (25%)	171 (39%)	434
Transportation	297 (12%)	452 (18%)	598 (24%)	769 (31%)	971 (40%)	2457
Food, Water, Shelter	12 (1%)	21 (2%)	28 (3%)	58 (7%)	89 (10%)	879
Water Systems	91 (29%)	107 (34%)	113 (36%)	140 (44%)	156 (49%)	317
Communications	59 (11%)	91 (17%)	116 (22%)	161 (31%)	207 (39%)	525
Energy	30 (15%)	47 (24%)	58 (29%)	76 (39%)	88 (45%)	197
Hazardous Materials	0 (0%)	2 (29%)	3 (43%)	3 (43%)	3 (43%)	7
Totals	**635 (11%)**	**972 (17%)**	**1252 (22%)**	**1689 (29%)**	**2153 (37%)**	**5779**

The majority of community lifelines exposed are in the Transportation community lifeline category, although that is mainly due to the high prevalence of evacuation routes with exposure. By Category 5 hurricane storm surge close to 50% of all Safety and Security Assets as well as Water Systems assets are exposed. Safety and Security assets include fire stations, law enforcement facilities, schools, and hotels among other asset types, and Water System assets include stormwater facilities, wastewater facilities, and marinas among other asset types.

Table 5.82. City of Tampa Exposure of FEMA Community Lifelines to Hurricane Risk Areas – Hurricane Storm Surge

Community Lifeline	Number of Community Lifelines in Hurricane Risk Area (% of Total)					
	Category 1 Storm Surge	Category 2 Storm Surge	Category 3 Storm Surge	Category 4 Storm Surge	Category 5 Storm Surge	Total Community Lifelines
Safety and Security	81 (19%)	136 (32%)	186 (43%)	233 (54%)	266 (62%)	428
Health and Medical	13 (9%)	20 (14%)	27 (19%)	46 (33%)	80 (57%)	140
Transportation	129 (19%)	218 (32%)	329 (48%)	393 (58%)	464 (68%)	682
Food, Water, Shelter	0 (0%)	1 (2%)	1 (2%)	3 (5%)	7 (11%)	62
Water Systems	40 (66%)	44 (72%)	44 (72%)	48 (79%)	53 (87%)	61
Communications	26 (20%)	40 (31%)	52 (40%)	64 (50%)	80 (62%)	129
Energy	13 (24%)	21 (39%)	28 (52%)	34 (63%)	39 (72%)	54
Hazardous Materials	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0
Totals	**302 (19%)**	**480 (31%)**	**667 (43%)**	**821 (53%)**	**989 (64%)**	**1,556**

In the City of Tampa, over 50% of Safety and Security, Health and Medical, Transportation, Water Systems, Communications, and Energy assets are exposed to Category 5 hurricane storm surge areas.

Table 5.83. Temple Terrace Exposure of FEMA Community Lifelines to Hurricane Risk Areas – Hurricane Storm Surge

Community Lifeline	Number of Community Lifelines in Hurricane Risk Area (% of Total)					
	Category 1 Storm Surge	Category 2 Storm Surge	Category 3 Storm Surge	Category 4 Storm Surge	Category 5 Storm Surge	Total Community Lifelines
Safety and Security	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (4%)	24
Health and Medical	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (11%)	9
Transportation	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	27
Food, Water,	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9

Shelter						
Water Systems	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)	2
Communications	0 (0%)	0 (0%)	0 (0%)	1 (17%)	1 (17%)	6
Energy	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (20%)	5
Hazardous Materials	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0
Totals	**0 (0%)**	**0 (0%)**	**0 (0%)**	**2 (3%)**	**5 (7%)**	**73**

In the City of Temple Terrace there is far less exposure to hurricane storm surge areas due to a further distance from the coast than the City of Tampa. A maximum of 1 asset per community lifeline category was exposed in a Category 5 storm.

Table 5.84. Unincorporated Hillsborough County Exposure of FEMA Community Lifelines to Hurricane Risk Areas – Hurricane Storm Surge

Community Lifeline	Number of Community Lifelines in Hurricane Risk Area (% of Total)					
	Category 1 Storm Surge	Category 2 Storm Surge	Category 3 Storm Surge	Category 4 Storm Surge	Category 5 Storm Surge	Total Community Lifelines
Safety and Security	28 (6%)	59 (12%)	77 (16%)	139 (29%)	201 (42%)	483
Health and Medical	23 (9%)	35 (13%)	44 (16%)	62 (23%)	88 (33%)	268
Transportation	172 (11%)	238 (15%)	274 (17%)	382 (24%)	515 (32%)	1,605
Food, Water, Shelter	12 (2%)	20 (3%)	27 (3%)	55 (7%)	82 (10%)	784
Water Systems	51 (21%)	63 (26%)	69 (28%)	91 (37%)	102 (42%)	244
Communications	33 (9%)	51 (14%)	64 (17%)	96 (26%)	126 (34%)	371
Energy	17 (13%)	26 (20%)	30 (23%)	42 (32%)	48 (37%)	131
Hazardous Materials	0 (0%)	2 (29%)	3 (43%)	3 (43%)	3 (43%)	7
Totals	**336 (9%)**	**494 (13%)**	**588 (15%)**	**870 (22%)**	**1165 (30%)**	**3,893**

In Unincorporated Hillsborough County, Hazardous Materials, Safety and Security, and Water Systems have the highest percentage of exposure to Category 5 storm surge. Only Food, Water, Shelter assets do not see greater than 10% of the community lifeline category assets exposed to hurricane storm surge starting with a Category 2 storm.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.1 (

Table 5.85).

Table 5.85. Overall Vulnerability to Tropical Cyclone for Hillsborough County

<table>
<tr><th colspan="5">TROPICAL CYCLONE</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation. A tropical storm is one such system that has a maximum sustained surface wind speed of 34-73mph, while a hurricane has sustained winds of 74 mph or greater. Florida is at risk of experiencing these tropical systems due to its subtropical climate and exposed position within large bodies of water. Residents in all sections of the county are potentially vulnerable to the effects of a tropical cyclone. Still, due to high levels of development and concentrated numbers of civilians, the coastlines are vulnerable to greater impacts.</td><td colspan="2">HIGH</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Critical</td><td>Large</td><td>> 24 hrs</td><td>Very Concerned</td><td>< 1 week</td><td>3.1</td></tr>
</table>

4.4 Wildfire Hazard Profile

Wildfire Description

Wildfire, or wildland fire, is a non-structure fire that occurs across vegetation or other natural fuels in areas of minimal or no development. The three types of wildland fire include naturally occurring wildfire, interface or intermix fire, and prescribed fire. A brief description is provided below:

- Wildfire: Unplanned wildland fire, fueled mainly by natural vegetation. Includes authorized human-caused fires, escaped fire projects and use events, and all other wildland fires.
- Interface or Intermix Fire: Wildfires spread from rural areas into developed or urban areas. Significant risks may exist due to threatening buildings, infrastructure, emergency services, and lives.
- Prescribed Fire: Any fire ignited by management actions to meet specific objectives. Maximum resource planning for minimal to no property damage, loss of human life, or smoke impacts.

Wildfires occur in Hillsborough County throughout the year and are part of the natural cycle of Florida's fire-adapted ecosystems. Wildfires can be ignited by natural causes or by human activities. When not detected quickly and contained, they can spread, causing property damage and even threatening human life. To contain it, due to the composition of wildfires, focus is put on identifying fire fuels and reducing heat, oxygen, or both to the fire. All plant material, including grass, shrubs, trees, leaves, and pine needles, are examples of materials that act as fuels. There are four types of fuels for wildland fires: [150]

- Ground Fuels – organic soils, forest floor material, stumps, dead roots, and buried fuels
- Surface Fuels – litter layer, downed woody materials, dead and live plants to two meters in height
- Ladder Fuels – vine and draped foliage fuels
- Canopy Fuels – tree crowns

Wildfire events can cause major environmental, social, and economic damages due to loss of life, property, wildlife habitats, and agriculture. Fortunately, many of these fires are quickly suppressed before they can damage or destroy property, homes, and lives. In Fiscal Year 2021-22, the Florida Forest Service suppressed 2,202 wildfires. Of the 2,202 suppressed wildfires that were reported, approximately 82% of them had human causes as opposed to natural causes, such as lightning.

Secondary impacts include other hazards, such as flooding by removing vegetation and altering watersheds. Moreover, wildfires have long-term ecological consequences, disrupt ecosystems, and affect biodiversity.

The 2001-2020 average of acres burned in the United States was approximately seven million acres, causing millions of dollars in damage. Since 1983, the National Interagency Fire Center has reported

[150] https://link.springer.com/referencework/10.1007/978-3-319-51727-8

approximately 70,000 wildfires per year. For Florida during the 1984-2021 period, the average extent of burned land was 1.7 acres per square mile.[151]

Human causes include, but are not limited to, arson, burning debris, or accidents. The remaining 28% of wildfires in Florida are caused by lightning strikes).[152]

Population movement trends in the United States, such as throughout Hillsborough County, have resulted in rapid development in the outlying fringes of metropolitan areas, such as the Greater Tampa Bay Area, as well as in rural areas with attractive recreational and aesthetic amenities, including access to water resources, parks, and forested areas. This demographic change is increasing the size of the wildland urban interface (WUI), defined as the area where structures and other human development meet or intermingle with undeveloped wildland. The WUI creates an environment for fire to move readily between vegetation fuels, such as brush or forests, and structural fuels, such as houses and buildings. Homes and other flammable structures can become fuel for WUI fires. There are three categories of WUI fires:

- Mixed Interface fires contain structures that are scattered throughout rural areas. Usually, there are isolated homes surrounded by larger or smaller areas of land.
- Occluded Interface fires are characterized by isolated (either large or small) areas within an urban area. An example may be a city park surrounded by urban homes trying to preserve some contact with a natural setting.
- Class Interface fires where homes, especially those crowded onto smaller lots in new subdivisions, press along the wildland vegetation along a broad front. Vast adjacent wildland areas can propagate a massive flame front during a wildfire, and numerous homes are put at risk by a single fire.

The WUI is largely the result of development in areas once considered wildlands where people desire to live in a more natural setting. Natural landscaping, which allows natural vegetation to grow and accumulate near homes, is a hazardous trend and does not mitigate the risk of fire reaching into a homeowner's land. Many subdivision layouts are designed with numerous dead-end streets and cul-de-sacs, creating access issues for firefighting services and equipment. In addition, many of these areas do not have wet hydrants or other sources of water for firefighting.

Fire Suppression

As mentioned above, the Florida Forest Service suppressed 2,202 wildfires during the 2021-2022 Fiscal Year. Florida Forest Service is not the only organization that suppresses fires throughout Hillsborough County and Florida. Fire suppression activities and response are utilized at all levels of fire management, including federal, state, and local levels, to manage wildfires. These efforts include prescribed burns, which help reduce fuel loads and maintain a healthy ecosystem, as well

---

[151] https://www.epa.gov/climate-indicators/climate-change-indicators-wildfires

[152] https://oppaga.fl.gov/ProgramSummary/ProgramDetail?programNumber=4126#:~:text=In%20Fiscal%20Year%202021-22%2C%20the%20Florida%20Forest%20Service,as%20opposed%20to%20natural%20causes%2C%20such%20as%20lightning.

as wildfire preparedness campaigns to educate communities on prevention and safety measures. Wildfire prevention and public awareness campaigns, including but not limited to Smokey the Bear and the National Fire Protection Association's (NFPA) Firewise Program, have helped to greatly reduce the number of human-caused wildfires in Florida. Programs like these encourage fire safety and prevention activities at an individual and community level. Fire safety activities include fuel reduction, safe camping and outdoor recreation practices, and emergency planning. Although wildfires can cause severe damage, controlled fires can provide environmental benefits. Sometimes, burns are "prescribed" by fire managers, meaning they are intentionally lit under carefully controlled conditions. The Florida Forest Service issues around 88,000 authorizations for an average of 2.1 million acres to be burned each year through prescribed burns[153] (). In Hillsborough County, more than 64,000 acres of environmentally sensitive lands undergo prescribed routine burning on county conservation lands. Various organizations are involved during prescribed burning on Hillsborough County-managed land, including Hillsborough County Conservation and Environmental Lands Management, Florida Forest Service, Florida Fish and Wildlife Conservation Commission, Florida State Parks, and additional professional contractors and volunteers.[154] Benefits of prescribed burns include insect pest control, removal of exotic species, the addition of nutrients to the soil for trees and other vegetation, and removal of undergrowth to allow sunlight to reach the forest floor. Additional fuel sources are removed so when an un-prescribed burn occurs, there is less material for the wildfire to grow.[155, 156] In Hillsborough County, and Florida as a whole, prescribed fires are intended to maintain the diverse land types that have been historically formed by lightning strike-driven fires. Alongside managing the landscape, prescribed fires support many wildlife species that depend on the vegetation that regenerates from fire-enriched soils. In addition to prescribed burning on Hillsborough County-managed land for environmentally sensitive areas, coordination between federal agencies, local fire departments, and volunteer organizations routinely occurs throughout the other parts of the county and jurisdictions to emphasize early detection and rapid response. Other measures used to help reduce the number and severity of wildfires include NWS advisories, open fire permit applications, and county burn bans. Hillsborough County and its jurisdictions are divided between two different National Weather Service stations. There are three advisories that the NWS can issue for wildfires:[157]

- Red Flag Warning: indicates ongoing or imminent critical fire weather in the next 24 hours. Fire Conditions are ongoing or expected to occur shortly.
- Fire Weather Watch: indicates weather conditions could result in critical fire weather conditions in the next 72 hours. Critical fire weather conditions are possible but not imminent or occurring.
- Extreme Fire Behavior: implies that a wildfire is either moving fast, has prolific crowning or spotting, has fire whirls, or has a strong convection column.

---

[153] Prescribed Fire / Wildland Fire / Forest & Wildfire / Home - Florida Department of Agriculture & Consumer Services (fdacs.gov)

[154] https://hcfl.gov/residents/parks-and-leisure/conservation-lands/prescribed-fire-and-burning

[155] http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/Wildland-Fire

[156] https://www.nps.gov/fire/wildland-fire/learning-center/fire-in-depth/fire-spread.cfm

[157] http://www.nws.noaa.gov/om/fire/ww.shtml

Wildfire weather watches and red flag warnings are used to convey the possibility of severe fire weather to wildland fire agencies and firefighting communities. Fire weather conditions include dry conditions or periods of drought and dry lightning. Severe weather can be predicted; therefore, wildland fire risk can be monitored during weather events that may include potential lightning strikes. NWS lightning warnings are available on average 24 to 48 hours prior to a significant electrical storm.

Intensity

The intensity of wildland fires depends on weather conditions, the existing environment, and human activity. The magnitude of wildfires is characterized by the speed of propagation, number of acres burned, and potential destructive impacts on populations and infrastructure. The severity and impact of a wildfire are dependent on the behavior of the fire in combination with fire detection, response, and suppression capabilities. Wildfire patterns can also cause events to act differently, with three existing patterns that can drive how wildfires are spread:

- Surface Fires: burn along the forest floor, consuming the litter layer and small branches on or near the ground.
- Ground Fires: smolder or creep slowly underground. These fires usually occur during periods of prolonged drought and may burn for weeks or months until sufficient rainfall extinguishes the fire or it runs out of fuel.
- Crown Fires: spread rapidly by the wind, moving through the tops of the trees.

The spread, or increased burned extent, of a wildfire is predicted with the Spread Index, which is a numeric rating that corresponds with how fast a fire travels in 'Chains per Hour. A chain is measured as 66 feet. For example, if a Spread Index is predicted to be 23, the fire is predicted to spread 1,518 feet (23 x 66') in an hour. [158]

The type and amount of fuel, as well as its burning qualities and level of moisture, affect wildfire potential and behavior. The continuity of fuels, expressed in both horizontal and vertical components, is also a factor because it expresses the pattern of vegetative growth and open areas. Topography is important because it affects the movement of air (and thus the fire) over the ground surface. The slope and shape of the terrain can change the rate of speed at which the fire travels. Temperature, humidity, and wind (both short- and long-term) affect the severity and duration of wildfires.

Fuel Moisture (FM) content is the quantity of water in a fuel particle expressed as a percent of the oven-dry weight of the fuel particle. FM is influenced by past and present weather events and is crucial for assessing fire potential. There are two types of FM: live and dead. Live FM changes slower and is affected by events such as drought, disease, early curing of annuals, timber harvesting, and changes in fuel models caused by wind and ice storms. Dead fuels undergo drying and wetting processes through evaporation,

[158] https://www.nwcg.gov/course/ffm/fire-behavior/83-rate-of-spread

and their moisture content is influenced by factors such as fuel size, weather, topography, decay classes, fuel composition, surface coatings, fuel compactness, and arrangement.

Fuels are classified into four categories based on moisture responses, measured by a time lag. The time lag represents the time it takes for fuel particles to reach two-thirds of the way to equilibrium within the local environment. The four categories include:

- 1-hour fuels: up to 0.25-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.
- 10-hour fuels: 0.25-inch to 1-inch diameter - computed from observation time, temperature, humidity, and cloudiness can be an observed value.
- 100-hour fuels: 1-inch to 3-inch diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity
- 1,000-hour fuels: 3-inch to 8-inch diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges.

Environmental short-term loss caused by wildland fire can include the destruction of wildlife habitat and watersheds. Long-term effects include reduced access to affected recreational areas, destruction of cultural and economic resources and community infrastructure, and vulnerability to flooding due to the destruction of watersheds.

Geographic Areas Affected by Wildfire

According to the Florida Forestry Association (FFA), approximately 50% of the state of Florida is forested, with most of the forested areas used for timber or agricultural production. Figure 1 shows the interface and intermix areas in Hillsborough County that are most susceptible to wildfire damages using data from the USDA. All jurisdictions--Hillsborough County, the City of Plant City, the City of Tampa, and the City of Temple Terrace--are susceptible to wildfires and their potential impacts.

WUI areas of the state have increased. WUI areas are vulnerable to wildfires and can cause significant property damage. The WUI areas were re-mapped in 2020 by the USDA, showing WU interface areas and the intermix areas from low to high density. The interface areas are where urban sprawl presses up against public and private natural areas. Intermix areas are areas undergoing a transition from agricultural and forest uses to urban land uses. These areas are both at risk of wildfire.

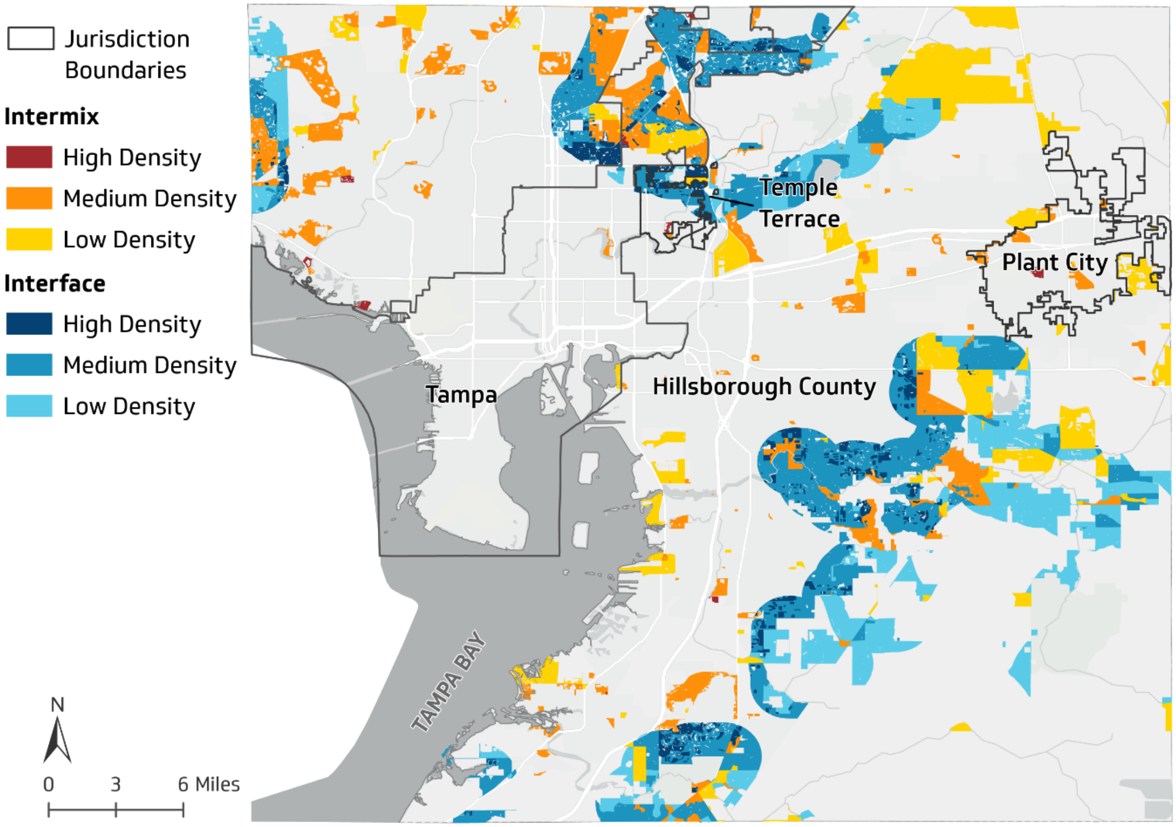


Figure 5.49. Intermix and Interface Low to High Density Areas in Hillsborough County[159]

Figure 5.49. allows visualization of the WU Interface and Intermix. The northern portion of the city of Tampa is shown to be at high risk due to a large portion covered by intermix and interface areas. High density interface areas where there is a high risk for wildfire are also present in northern Temple Terrace. Plant City has a mix of some areas of low-high density intermix at different parts of the city. Pockets of low-high density intermix and interface areas are found throughout the rest of unincorporated Hillsborough.

Historical Occurrences of Wildfire

The most naturally caused wildland fires typically occur in July due to lightning strikes or coincide with the height of the thunderstorm season. Human-caused fires, such as arson, debris or trash burning, or sparking equipment, can occur any time of year but usually occur during the same season as naturally caused wildfires.

Table 5.86 includes a brief narrative of significant wildfires in the county between 1999 and 2024.

---

[159] https://www.fs.usda.gov/rds/archive/catalog/RDS-2015-0012-4

Table 5.86. Significant Wildfire Occurrences in Hillsborough County

Date	Description
March 5, 1999[160]	Two firefighters were injured while suppressing an 80-acre wildfire in northwest Hillsborough County.
May 29, 2000	Sparks from a moving freight train ignited two separate wildfires that consumed nearly 600 acres of brush and scrub trees near County Road 37 and Keysville Road over rural eastern Hillsborough County.
May 2006[161]	Interstate 75 was closed for six hours between Gibsonton Drive and Big Bend Road as 130 emergency workers fought the blaze with plows, helicopters, brush trucks, and water tankers. Thousands of people were evacuated in developments east of the interstate when the fire jumped the road. A brush fire developed in Ruskin and eventually spread to 50 acres. The fire was reported by print media to have damaged a mobile home, several carnival food trucks, a warehouse, and a few old racing cars. Additionally, smoke from the fire shut down Interstate 75 between mile markers 229 and 240 for several hours.
March 25, 2024[162]	A massive brush fire broke out at Mosaic Company plant and rapidly expanded due to high winds. 39 firefighting units and 1 hazmat unit were present to control and extinguish the fire. No injuries or evacuations were reported.

The NCEI Storm Events contains records of reported wildfire events and associated damages. There are only two fire-related incidents included in the database, one in unincorporated Hillsborough County and one in Tampa. There are no damages listed in the database for the reporting period of 1996 to 2023. The two events coincide with the March 1999 fire and the May 2000 fire, as noted in

Table 5.86.

Since 1999, FEMA has issued several Fire Management (FM) disaster declarations. The 1999 wildfire season was so severe that in addition to the Fire Management assistance being authorized, an Emergency Declaration (EM) was made to assist with handling the fires. Table 5.87 lists all the FM and EM designations, plus the single major disaster declaration (DR) that Hillsborough County has received from FEMA.

Table 5.87. FEMA Major Disaster Declarations in Hillsborough County, Wildfire, 1953–2023[163]

[160] https://www.tampabay.com/archive/1999/03/05/dry-weather-brings-threat-of-fire-to-area/
[161] https://www.tampabay.com/archive/2006/05/09/runaway-fire-jumps-i-75/?outputType=amp
[162] https://www.msn.com/en-us/news/us/massive-brush-fire-contained-after-breaking-out-at-mosaic-company-plant-in-riverview/ar-BB1kws8B
[163]

Disaster Number	Date	Name/Description
DR-1223	May 25–July 22, 1998	Extreme Fire Hazard
FS-2259	April 13, 1999	FL - Fires 04/13/99
EM-3139	April 15–May 25, 1999	FL - Fires 04/15/99
FS-2300	May 22, 2000	Lakeland District Fire
FS-2353	February 17, 2001	FL - Lakeland Complex Fire

In addition to these FM designations, there has been one major disaster designation for a wildfire in Hillsborough County, named the Florida Extreme Fire Hazard, DR-1223, which occurred from May 25 until July 22, 1998.

Data from the State Fire Marshal Annual Reports was also reviewed to obtain additional information on historical wildfire events in the county. Table 5.88 summarizes the wildfires reported from 2006 to 2016. These are clearly smaller events than those captured by the sources above. There are no entries in the database between 2016 and 2024.

Table 5.88. Reported Wildfires in Hillsborough County, 2006–2016

Year	Number of Reported Wildfires	Acres Affected
2006	66	1,968.7
2007	42	1,085.6
2008	30	1,129.3
2009	58	3,752.8
2010	25	386.6
2011	44	1,368.4
2012	52	1,175.8
2013	29	290.6
2014	21	430.4
2015	17	71
2016	42	913
2017	**-**	**-**
2018	**-**	**-**
2019	**-**	**-**
2020	**-**	**-**
2021	**-**	**-**
2022	**-**	**-**
TOTAL	**426**	**12,572.2**

Probability of Future Occurrences of Wildfire

The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small but could increase in size due to local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. Highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the WUI will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. Residential buildings are generally at greater risk due to the use of more wood in construction. Areas with higher ignition density are more vulnerable and at risk of wildfire shown below in Figure 5.50.

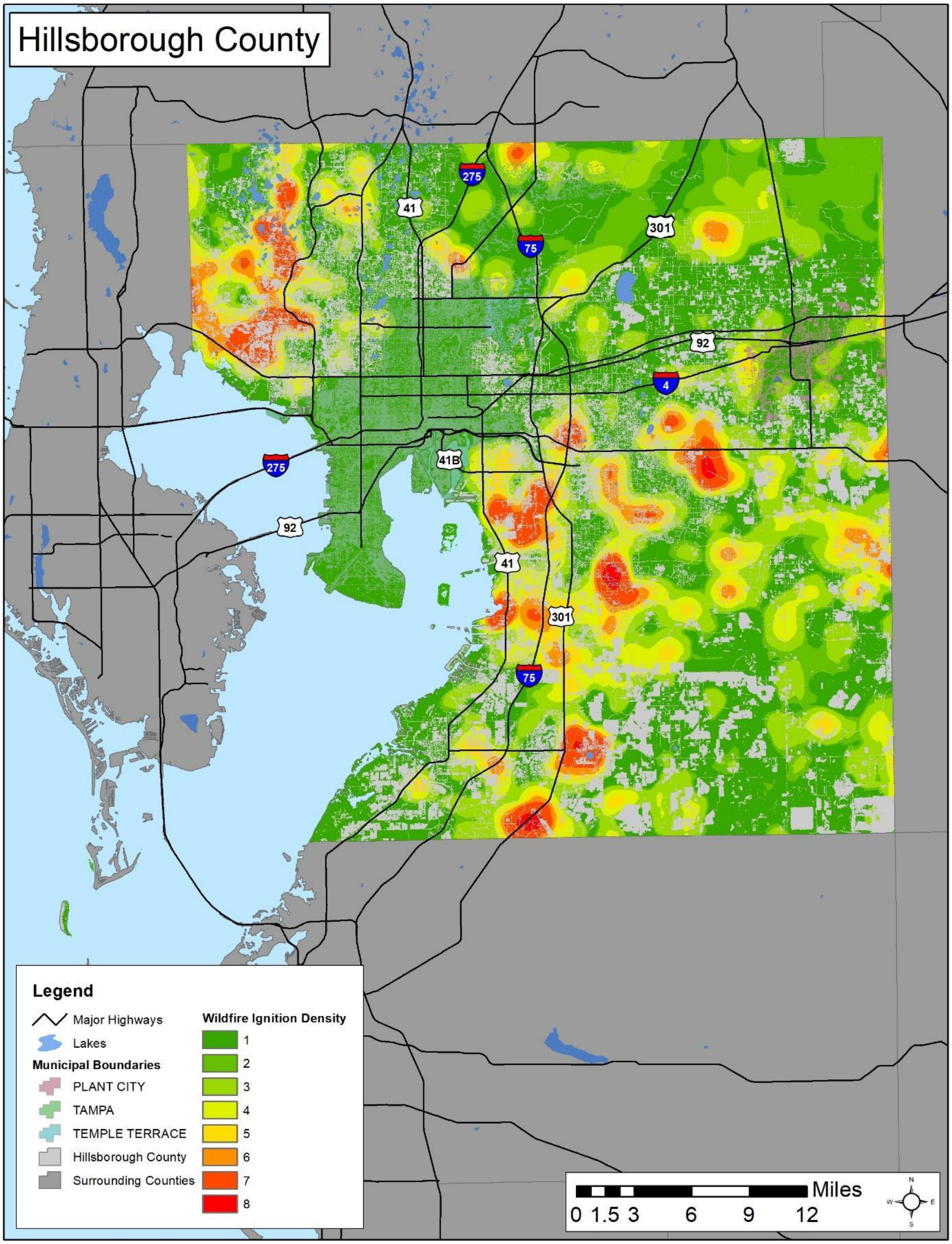


Figure 5.50. Wildfire Ignition Density

Florida has a year-round fire season with the most active time being April to July, with the largest number of lightning-caused fires occurring in July. The dry months, combined with low humidity and high wind, tend to have the highest number of fires reported. Approximately 80% of all wildfires in Florida occur within one mile of the WUI. Figure 5.51Figure 5.51 shows the burn probability throughout the county in and around the WUI.

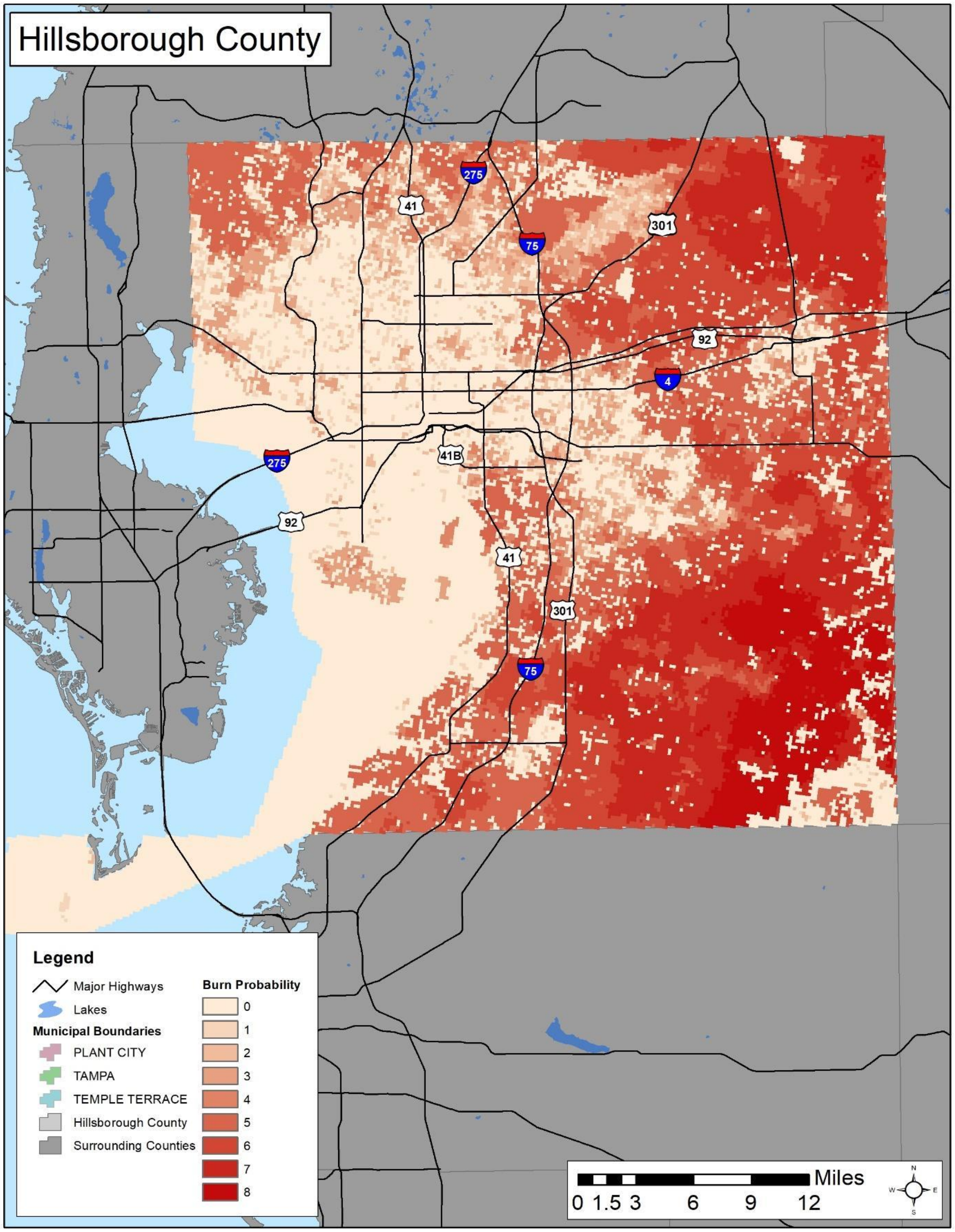


Figure 5.51. Burn Probability in Hillsborough County

Potential Effects of Climate Change on Wildfire

The increased frequency or intensity of extreme heat or drought events, due to the augmenting of existing fuel flammability, could affect wildfire behavior.[164] Changes in vegetation types could also alter fuel mixtures. Reducing moisture of living vegetation, soils and decomposing organic matter during drought or extreme heat events is associated with increased incidence of wildfires. Changes over time in vegetation types could change the mixture and flammability of fuels. As these transitions occur, wildfire occurrences and severity could increase with the introduction of more flammable vegetation types or decrease with the introduction of more fire-resistant species.

Wildfire is impacted by climate variability, local topography, and human intervention. Hot, dry spells create the highest fire risk. Increased temperatures may intensify wildland fire danger by warming and drying out vegetation. A warmer climate would result in a longer wildland fire season. When climate alters fuel loads and fuel moisture, this changes the forest susceptibility to wildland fires. Climate change also may increase winds that spread fires. Faster fires are harder to contain and, thus, are more likely to expand into residential neighborhoods and create greater danger and damage.

The USDA Forest Service states that wildland and forest ecosystems are very complex, and it is difficult to project the exact impacts of climate change. As the Flood Hazard Profile discussed that arid areas may become drier and moist areas to become wetter. Florida has weather patterns that lead to both dry and wet periods each year. Climate change may cause one or the other, or both to increase in occurrences and magnitude.

Based on the limited historical data presented above, it can be concluded that small wildfires occur multiple times each year in all participating jurisdictions (Table 5.87). Large events that lead to significant damage and emergency declarations, based on available history, have a 6-16% chance of happening in any given year. Probability estimates are limited by the quality of available historical data and are likely underreported and also increasing due to climate change.

Wildfire Impact Analysis

Large wildfires that are not quickly contained can dramatically alter the terrain and landscape, making land already devastated by fire susceptible to flooding and erosion. Given the immediate response times to reported wildland fires, the likelihood of injuries and casualties is minimal. However, environmental and structural impacts are unavoidable and range in severity based on the duration, intensity, and frequency of the wildfire event. All jurisdictions in this plan are susceptible to the wildfire potential impacts listed below:

- People
    - Injury or death from fire
    - Injury or death from smoke inhalation

---

[164] In Field et al. (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation; A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, pp. 487–542. https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf., p. 519*;* Walsh and Wuebbles (2013).; *Our changing climate*. In, *Draft national climate assessment* (pp. 25–103). *http://ncadac.globalchange.gov/download/NCAJan11-2013-publicreviewdraft-fulldraft.pdf*

    - Injury or death while evacuating
    - Vehicle accidents due to decreased visibility due to smoke
    - Illness or reaction to smoke and air pollutants
- Responders
    - Injury or death during wildfire suppression, especially during high wind conditions
    - Injury or death from vehicle accidents due to decreased visibility
    - Injury or death from evacuation and rescue missions
    - Injury or death from smoke inhalation
- Continuity of Operations (including continued delivery of services)
    - Inability to operate businesses if evacuations are ordered, leading to lost wages and revenue
    - Employee absenteeism if employees are evacuated
    - Blocked transportation routes because of decreased visibility
- Property, Facilities, Infrastructure
    - Damage or loss to personal structures and businesses
    - Damage to utilities, such as power lines, pipelines, and roadways
    - Damage or loss to critical infrastructure such as schools, hospitals, government buildings, utilities, etc.
    - Damage or loss to agricultural crops and timber, leading s to loss of income and revenue
- Environment
    - Damage or loss to large, forested areas
    - Damage or loss to habitats
    - Probability increased of other natural disasters
- Economic Condition
    - Closure of businesses if in evacuation area leading to lost wages and revenue
    - Employee absenteeism forcing businesses to close, resulting in lost wages and revenue
    - Damage or loss to agricultural crops and timber, which leads to loss of income and loss of revenue
    - Loss of tourism if wildfires are in popular tourist areas
- Public Confidence in Each Jurisdiction's Governance
    - Lost confidence if evacuations were not ordered, messaged, and coordinated effectively
    - Lost confidence if many deaths from wildfires from those that did not evacuate

Vulnerability Analysis and Loss Estimation by Jurisdiction

Data obtained from the Southern Wildfire Risk Assessment (SWRA) was used to analyze vulnerability to wildfire in Hillsborough County and the incorporated jurisdictions. This data is available on the Southern Wildfire Risk Assessment website and can be downloaded and imported into ArcGIS. The "Wildland Urban Interface Risk Index" (WUI) layer can be used to determine the wildland fire type and degree of vulnerability at the census block level for properties and populations. The WUI is presented on a scale of 0 to -9. It combines data on housing density with data on the impact and likelihood of a wildfire occurring in a specific area. The primary purpose of the data is to highlight areas of concern that may be considered for mitigation actions. Figure 5.52 shows the SWRA wildfire risk index.

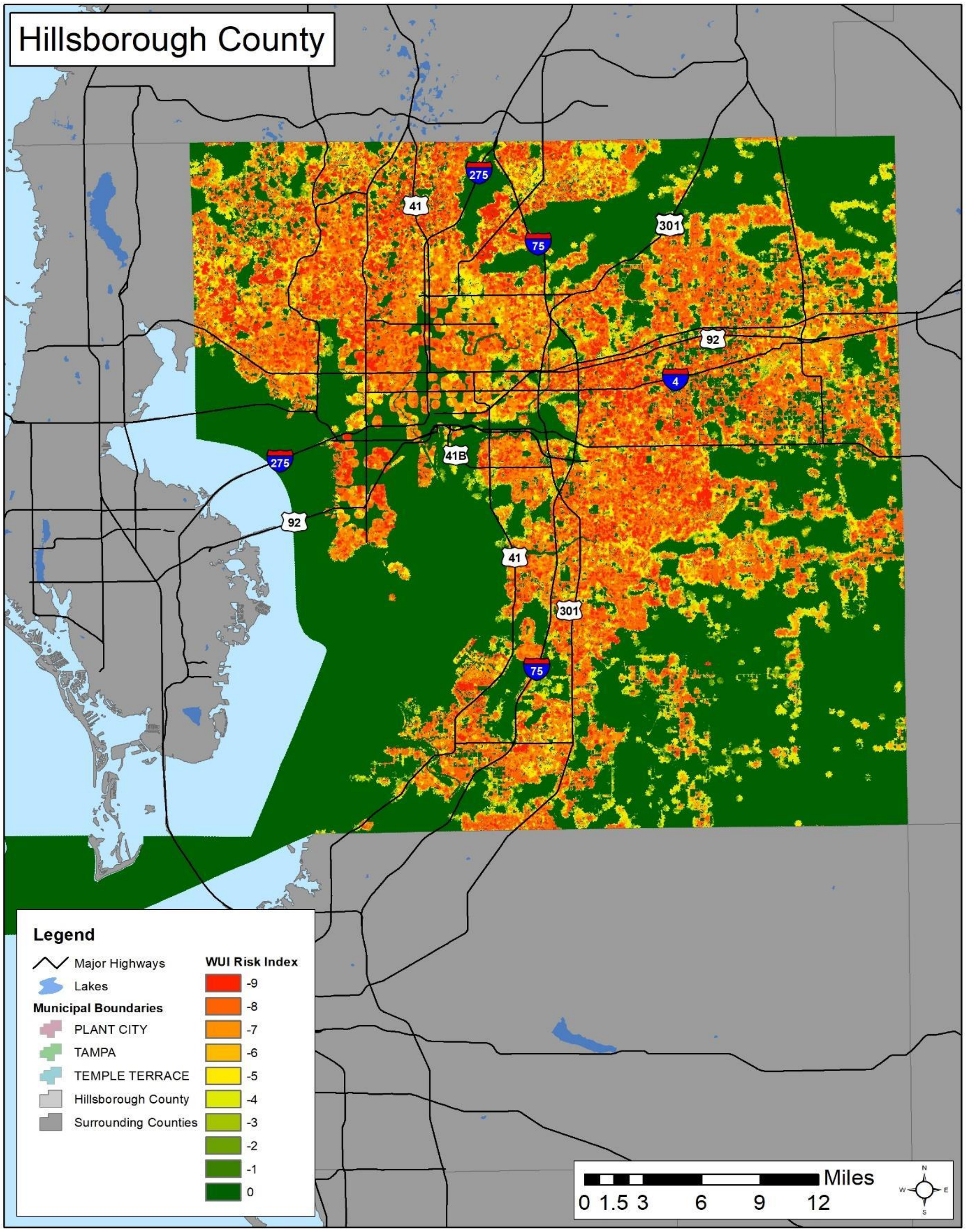


Figure 5.52. WUI Risk Index

For this analysis, vulnerable populations in each participating jurisdiction were estimated by intersecting the high wildland fire density areas, displayed in Figure 5.53 below, with census block group data. Unincorporated areas of Hillsborough County have the highest acreage of high-density interface WUI area and Tampa has the highest acreage of high density intermix WUI area. A breakdown of each jurisdictions' acreage of high density WUI areas is included in Table 5.89.

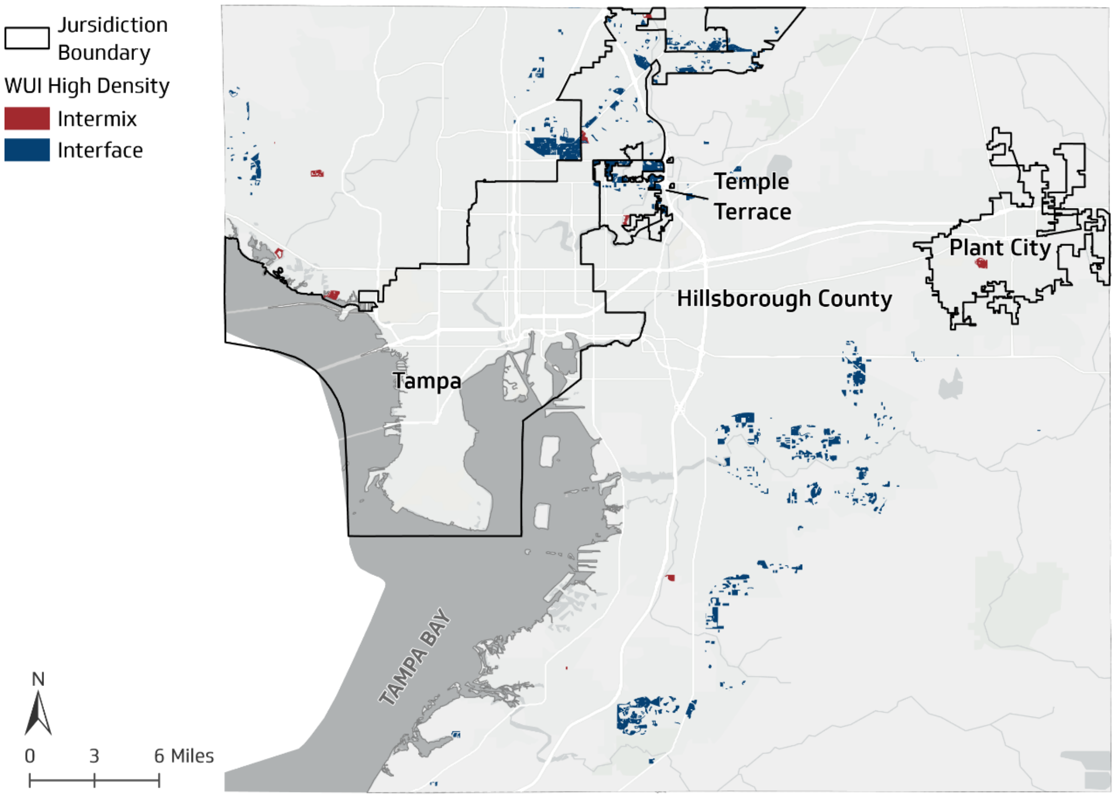


Figure 5.53. High Density Intermix and High Density Interface WUI areas.

Table 5.89. Acreage of High Density Intermix and High Density Interface, by jurisdiction

Jurisdiction	Acreage of High Density Intermix	Acreage of High Density Interface	Total Acreage of High Density WUI
Hillsborough County (Unincorporated)	181	6,098	6,279
City of Plant City	112	0	112
City of Tampa	211	1,647	1,858
City of Temple Terrace	54	638	692
Hillsborough County (Total)	**558**	**8,383**	**8,941**

A breakdown by jurisdiction of the number of people intersecting wildland fire hazards altogether is shown in Table 5.90 and Table 5.91 provides a breakdown of population within high density WUI areas.

In all WUI areas with low to high density, both intermix and interface, was estimated to identify the exposure of populations for each jurisdiction included in the plan. As shown below, roughly 24.9% of Hillsborough County's population as a whole is exposed to at least low density wildland urban interface areas. Out of the 24.9% of the population within an intermix or interface area, unincorporated areas of Hillsborough County contain the highest total population at risk. However, the greatest percentage of the population at risk is within Temple Terrace. Temple Terrace has 57.3% of its population at risk of wildland fire exposure, followed by the unincorporated areas with 28.3% exposure and Tampa with 18.8% exposure. Overall, 24.9% of the entire county's population is exposed to at least a low-density interface or intermix WUI area. Following a similar pattern as the overall intersection of interface and intermix areas, all jurisdictions were analyzed for their population's exposure to only high density interface and intermix WUI areas. Temple Terrace has the highest percent of exposed population, with 33.0% of their population exposed to high density wildland urban areas, followed by unincorporated areas of Hillsborough County and Tampa.

Table 5.90. Population intersecting wildland fire hazard areas, by jurisdiction

Jurisdiction	Total Population	Population Intersecting Intermix	Population Intersecting Interface	Total Population at Risk	Percent of Population at Risk
Hillsborough County (Unincorporated)	989,745	39,439	240,659	280,098	28.3%
City of Plant City	48,289	4,184	17	4,201	8.7%
City of Tampa	382,484	8,848	47,760	56,608	14.8%
City of Temple Terrace	37,764	2,226	19,413	21,639	57.3%
Hillsborough County (Total)	**1,458,282**	**54,697**	**307,849**	**362,546**	**24.9%**

Table 5.91. Population in high wildland fire density area, by jurisdiction

Jurisdiction	Total Population	Total within High Wildland Fire Density Area	Percent within High Wildland Fire Density Area
Hillsborough County (Unincorporated)	989,745	94,026	9.5%
City of Plant City	48,289	1,352	2.8%
City of Tampa	382,484	26,009	6.8%
City of Temple Terrace	37,764	12,462	33.0%

Hillsborough County (Total)	**1,458,282**	**133,849**	**9.2%**

In addition to acreage and population, the number of buildings and parcels exposed in high density WUI areas was analyzed for the participating jurisdictions. As expected, unincorporated Hillsborough County had the highest number of parcels and buildings exposed. The City of Tampa had the second highest estimated tax value at risk, at approximately $1.469 trillion dollars. The City of Plant City had the lowest number of parcels and buildings located within a high density WUI area, with only 41 parcels and 1,003 buildings with an estimated tax value of $60,330,919.

Table 5.92. Estimated Exposure of Improved Property to Wildfire

Jurisdiction	Buildings and Parcels in High Density WUI		
	No. of Parcels	No. of Buildings	Estimated Tax Value ($)
Hillsborough County (Unincorporated)	24,076	108,146	$6,623,426,977
City of Plant City	41	1,003	$60,330,919
City of Tampa	3,601	15,221	$1,469,843,510
City of Temple Terrace	2,544	8,034	$913,129,803
Hillsborough County (Total)	30,262	132,404	$9,066,731,209

Table 5.92 shows overall exposure. An overview of the potential losses due to wildland fire is shown in Table 5.93. FEMA's National Risk Index (NRI) calculates total annual loss by combining building value loss, population loss, and agricultural loss as a result of a hazard. Wildfire loss is calculated using a series of U.S. Forest Service Missoula Fire Sciences Laboratory raster datasets representing burn probability and conditional fire intensity level. This combined dataset models the probability of an area being burned by a large fire. This calculated probability is then used to calculate the exposure value for each census tract based on an intersection with high probability wildfire areas. These calculated wildfire probability and exposure values are then used to determine the expected annual loss of wildfires by census tract by combining the values with a historic loss ratio on the county scale.

For wildfire hazards, the unincorporated areas of Hillsborough County have the greatest total expected annual loss, at roughly $7.4 million, followed by Plant City, with roughly $1.07 million expected total annual loss. Total expected annual losses equal just under 1% of total exposure.

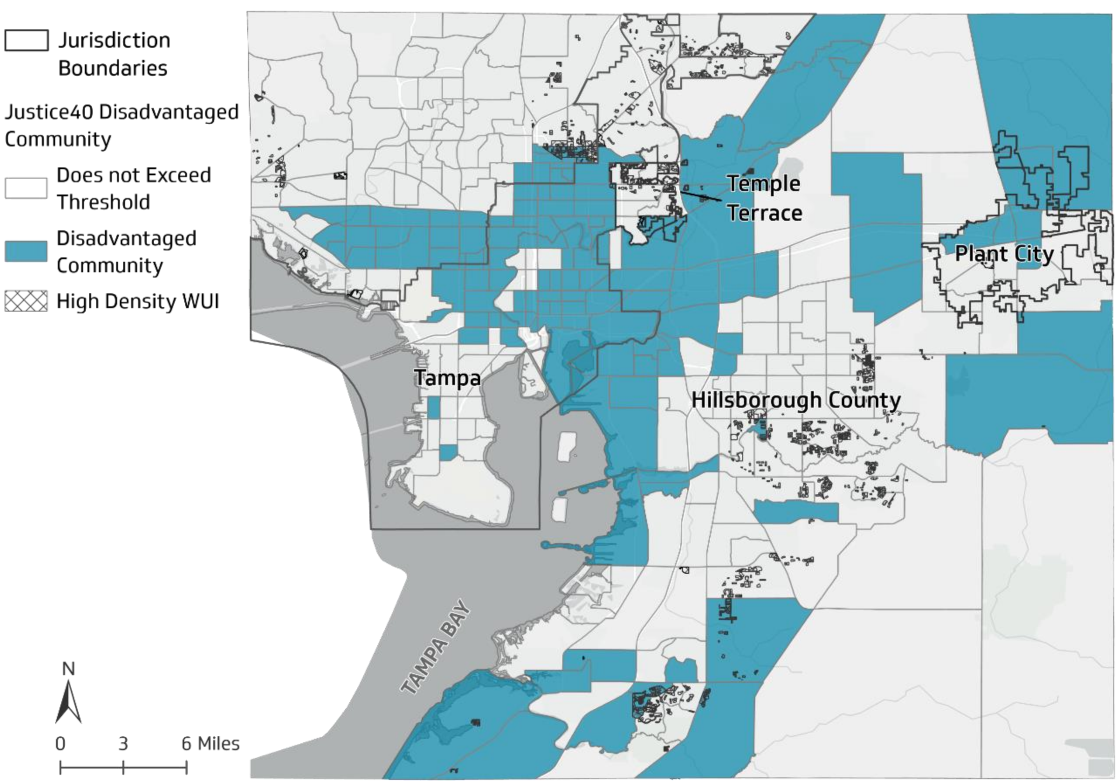
Table 5.93. NRI Total Expected Annual Loss

	NRI Total Expected Annual Loss ($)
Hillsborough County (Unincorporated)	$7,411,195
City of Plant City	$1,077,401
City of Tampa	$860,453

	NRI Total Expected Annual Loss ($)
City of Temple Terrace	$157,118
Hillsborough County (Total)	**$8,429,843**

Justice40 Climate and Economic Justice Screening Tool

The location of high wildland fire density areas in Hillsborough County, including unincorporated areas, Plant City, Tampa, and Temple Terrace overlaid on Justice40 census block groups identified as disadvantaged communities is shown in Figure 5.54, below. Disadvantaged communities and populations may have a higher exposure and vulnerability to wildfires. People in these areas are less likely to have the capacity to adapt fuel management and preventative activities. Lower-income residents are less likely to be able to afford the expense of clearing vegetative fuels, fire-proofing their homes, or rebuilding after a fire.



1

Figure 5.54. Justice40 Disadvantaged Communities overlayed with High Density WUI at risk areas[165][166]

[165] https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

[166] https://www.fs.usda.gov/rds/archive/catalog/RDS-2015-0012-4

Vulnerability Analysis and Loss Estimation of Critical Facilities

Using ArcGIS, WUI hazard areas were overlaid with critical facilities and assets to identify the degree of exposure to wildfires throughout Hillsborough County. Critical assets and infrastructure for wildfire exposure analysis include schools, hospitals, government buildings, utilities, and evacuation routes. As Hillsborough County and its jurisdictions continue to increase growth and experience urban sprawl, critical facilities siting and construction materials should consider this risk while still serving the growing population.

Table 5.94 and Table 5.95 provide a breakdown of the numbers and values of critical facilities intersecting wildland intermix and wildland interface areas by jurisdiction. In total, 577 of the critical facilities throughout Hillsborough County are exposed, which equates to roughly 15.7%. Hillsborough County unincorporated areas had the highest number of assets intersecting WUI intermix or interface, but Temple Terrace had the highest percentage of assets within WUI areas. Temple Terrace has 22.9% of its critical assets exposed to wildland urban fire. However, just in high wildland fire density areas, only 1.7% of critical assets are included as exposed for the entire county. Unincorporated areas remain the highest total of assets within high density WUIs, as does Temple Terrace with the highest percent of critical assets within high wildland fire density areas at 8.3%. Plant City is the only jurisdiction in this plan that does not have any critical assets within a high density WUI area.

Table 5.94. Number of critical assets in WUI, by jurisdiction

Jurisdiction	Total Critical Assets	Assets Intersecting Intermix	Assets Intersecting Interface	Percentage of Assets at Risk
Hillsborough County (Unincorporated)	3,549	221	321	15.3%
City of Plant City	122	5	8	10.7%
City of Tampa	962	4	7	1.1%
City of Temple Terrace	48	0	11	22.9%
Hillsborough County (Total)	**3,681**	**230**	**347**	**15.7%**

Table 5.95. Number of critical assets in the high wildland fire density areas, by jurisdiction

Jurisdiction	Total Critical Assets	Total within High Wildland Fire Density Area	Percent within High Wildland Fire Density Area
Hillsborough County (Unincorporated)	3,549	55	1.5%
City of Plant City	122	0	0.0%
City of Tampa	962	3	0.3%
City of Temple Terrace	48	4	8.3%

Jurisdiction	Total Critical Assets	Total within High Wildland Fire Density Area	Percent within High Wildland Fire Density Area
Hillsborough County (Total)	**3,681**	**62**	**1.7%**

The critical facilities were broken out further into FEMA Community Lifeline categories. These lifelines are categorized as: Safety and Security; Health and Medical; Transportation; Food, Water, Shelter; Water Systems; Communications; Energy; and Hazardous Materials. Several critical facilities were not included as community lifelines, such as solid hazardous waste facilities for example, while evacuation routes were added as community lifelines while not being included in the critical facility asset exposure analysis.

To estimate exposure to wildfire for the community lifeline analysis, WUI Interface and Intermix areas were intersected with community lifeline locations. Table 5.96 summarizes the community lifelines in the county that are located within these WUI Interface and Intermix areas and

Table 5.97-Table 5.100 summarizes this exposure by jurisdiction for Tampa, Temple Terrace, Plant City, and Unincorporated Hillsborough County.

In the county, 23% of Food, Water, Shelter assets are exposed to WUI Interface areas with the next highest exposure rate being Communication assets with 13% exposure. Food, Water, Shelter; Communications; Transportation; and Water Systems, all have greater than 5% of assets exposed to WUI Intermix areas, but no community lifeline category has greater than 8% of assets exposed.

Table 5.96. FEMA Community Lifelines in WUI Interface and Intermix Areas – Exposure to Wildfire

Community Lifeline	Number of Community Lifelines in WUI Interface and Intermix Areas (% of Total)		
	WUI Interface	WUI Intermix	Total Community Lifelines
Safety and Security	92 (10%)	24 (2%)	963
Health and Medical	47 (11%)	5 (1%)	434
Transportation	240 (10%)	182 (7%)	2457
Food, Water, Shelter	201 (23%)	72 (8%)	879
Water Systems	29 (9%)	18 (6%)	317
Communications	67 (13%)	40 (8%)	525
Energy	18 (9%)	3 (2%)	197
Hazardous Materials	0 (0%)	0 (0%)	7
Totals	**694 (12%)**	**344 (6%)**	**5779**

The City of Tampa's only high relative exposure rate to WUI Interface and Intermix areas is within the Food, Water, Shelter category with 26% of assets exposed to WUI Interface areas and 6% of assets exposed to WUI Intermix areas. Food, Water, Shelter assets include drinking water facilities, risk shelters, and emergency shelters.

Table 5.97. City of Tampa FEMA Community Lifelines in WUI Interface and Intermix Areas – Exposure to Wildfire

Community Lifeline	Number of Community Lifelines in WUI Interface and Intermix Areas (% of Total)		
	WUI Interface	WUI Intermix	Total Community Lifelines
Safety and Security	17 (4%)	5 (1%)	428
Health and Medical	0 (0%)	0 (0%)	140
Transportation	14 (2%)	8 (1%)	682
Food, Water, Shelter	16 (26%)	4 (6%)	62
Water Systems	1 (2%)	0 (0%)	61
Communications	7 (5%)	1 (1%)	129
Energy	1 (2%)	1 (2%)	54
Hazardous Materials	0 (0%)	0 (0%)	0
Totals	**56 (4%)**	**19 (1%)**	**1,556**

Over 50% of Energy, Transportation, and Safety and Security assets are exposed to WUI Interface areas in Temple Terrace. In total, zero community lifelines in Temple Terrace are exposed to WUI Intermix areas.

Table 5.98. Temple Terrace FEMA Community Lifelines in WUI Interface and Intermix Areas – Exposure to Wildfire

Community Lifeline	Number of Community Lifelines in WUI Interface and Intermix Areas (% of Total)		
	WUI Interface	WUI Intermix	Total Community Lifelines
Safety and Security	16 (67%)	0 (0%)	24
Health and Medical	4 (44%)	0 (0%)	9
Transportation	19 (70%)	0 (0%)	27
Food, Water, Shelter	2 (22%)	0 (0%)	9
Water Systems	0 (0%)	0 (0%)	2
Communications	1 (17%)	0 (0%)	6
Energy	4 (80%)	0 (0%)	5
Hazardous Materials	0 (0%)	0 (0%)	0
Totals	46 (63%)	0 (0%)	73

In Plant City, zero total community lifelines are in WUI Interface areas. Only Communications; Transportation; and Food, Water, Shelter assets are exposed to WUI Intermix areas with 11%, 8%, and 4% exposure percentages respectively.

Table 5.99. Plant City FEMA Community Lifelines in WUI Interface and Intermix Areas – Exposure to Wildfire

Community Lifeline	Number of Community Lifelines in WUI Interface and Intermix Areas (% of Total)		
	WUI Interface	WUI Intermix	Total Community Lifelines
Safety and Security	0 (0%)	0 (0%)	28
Health and Medical	0 (0%)	0 (0%)	13
Transportation	0 (0%)	15 (8%)	188
Food, Water, Shelter	0 (0%)	1 (4%)	24
Water Systems	0 (0%)	0 (0%)	10
Communications	0 (0%)	2 (11%)	19
Energy	0 (0%)	0 (0%)	7
Hazardous Materials	0 (0%)	0 (0%)	0
Totals	0 (0%)	18 (6%)	289

Unincorporated Hillsborough County has greater than 10% of assets exposed to WUI Interface areas in each community lifeline except for Energy and Hazardous Materials assets with the highest percentage (23%) in the Food, Water, Shelter community lifeline category. For WUI Intermix exposure, Transportation and Communication assets have the highest rate of exposure with 10% of the assets exposed each.

Table 5.100. Unincorporated Hillsborough County FEMA Community Lifelines in WUI Interface and Intermix Areas – Exposure to Wildfire

Community Lifeline	Number of Community Lifelines in WUI Interface and Intermix Areas (% of Total)		
	WUI Interface	WUI Intermix	Total Community Lifelines
Safety and Security	59 (12%)	19 (4%)	483
Health and Medical	43 (16%)	5 (2%)	268
Transportation	215 (13%)	163 (10%)	1,605
Food, Water, Shelter	183 (23%)	67 (9%)	784
Water Systems	28 (11%)	18 (7%)	244
Communications	59 (16%)	37 (10%)	371
Energy	13 (9%)	2 (2%)	131
Hazardous Materials	0 (0%)	0 (0%)	7
Totals	600 (15%)	311 (8%)	3,893

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4 and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0 and the overall vulnerability ranking or high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.8 (Table 5.101).

Table 5.101. Overall Vulnerability to Wildfire for Hillsborough County

<table>
<tr><th colspan="6">WILDFIRE</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="6">Overview</th></tr>
<tr><td colspan="6">Wildfire, or wildland fire, is a fire that was started by lightning or by humans in an area with vegetation. Wildfires occur in Florida every year and at all times of the year and are part of the natural cycle of Florida's fire-adapted ecosystems. Wildfires can cause major environmental, social, and economic damages because of the possible loss of life, property, wildlife habitats, and timber.</td><td colspan="2">MODERATE</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th colspan="2">PRI Score</th></tr>
<tr><td>Likely</td><td>Limited</td><td>Moderate</td><td>< 6 hrs</td><td>Somewhat Concerned</td><td>< 1 week</td><td colspan="2">2.8</td></tr>
</table>

4.5 Suspect Soil Hazard Profile

Suspect Soil Description

Sinkholes are present when the rock below the land surface is limestone, carbonate rock, salt beds, or where rocks are naturally dissolved by groundwater circulating through them. As the rock dissolves, spaces and caverns underground are formed, and subsidence occurs. The ground collapses due to insufficient support for the land above the spaces. Other principal causes of land subsidence are aquifer-system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.[167]

Most sinkholes occur in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania; specific areas of these states tend to have particular rock types (evaporites and carbonates) more prone to water dissolution.[168] Florida is underlain by several thousand feet of carbonate rock, limestone, and dolostone, with a variably thick mixture of sands, clays, shells, and other near-surface carbonate rock units called overburden. Those several thousand feet of carbonate rocks are host to one of the world's most productive aquifers, the Floridian aquifer system. Erosional processes, physical and chemical, have created fissures and cavities within the rock, creating Florida's karst topography, characterized by sinkholes, swallets, caves, submerged conduits, springs, and disappearing and reappearing streams. Sinkholes are unpredictable; they can form rapidly, within minutes to hours, or slowly, within months to years.[169]

Development of Sinkholes

Sinkholes are classified based on their formation rate, process, geological and hydrologeological characteristics. In addition, sinkholes can form by natural and anthropogenic influences. Table 5.102 presents the classifications of sinkholes.

This profile will focus on the two common types of sinkholes in Florida, cover **collapse sinkholes** and **cover subsidence sinkholes**, because of their rate of formation and the risk they pose to human life and property. The profile will also address the location of muck soil. These are characterized by organic soil, and subsidence can occur when wet organic materials are drained and exposed to air.

Table 5.102. Classification of Sinkholes [170]

[167] https://www.usgs.gov/faqs/what-difference-between-a-sinkhole-and-land-subsidence?qt-news_science_products=0#qt-news_science_products

[168] USGS. (2018, June 9). Sinkholes. https://www.usgs.gov/special-topics/water-science-school/science/sinkholes#overview

[169] Florida Department of Environmental Protection Florida Geological Survey. (2017). *The favorability of Florida's geology to sinkhole formation*. Page 4–7. https://www.researchgate.net/publication/321411626_THE_FAVORABILITY_OF_FLORIDA'S_GEOLOGY_TO_SINKHOLE_FORMATION

[170] Kromhout, Clint. (2017, Jan). The Favorability of Florida's Geology To Sinkhole Formation. https://www.researchgate.net/publication/321411626_THE_FAVORABILITY_OF_FLORIDA'S_GEOLOGY_TO_SINKHOLE_FORMATION

Formation Speed	Sinkhole Type	Simplified Name
Rapid	Cover-collapse	Collapse Sinkhole
	Rock-collapse	
Slow	Cover-subsidence	Solution Sinkhole
	Solution	

Types of Sinkholes

Geologists divide sinkholes into three types: dissolution or solution sinkholes, cover-subsidence sinkholes, and cover-collapse sinkholes.

Dissolution Sinkholes

Dissolution of limestone or dolomite is most prevalent where the water first contacts the rock surface; however, if the flow is focused in preexisting openings in the rock, such as along joints, fractures, and bedding planes, and the zone of water, a more aggressive dissolution occurs. Percolation of rainfall and surface water occurs between joints in the limestone; thus, dissolved carbonate rock is carried away from the surface, and a slight depression gradually forms. On exposed carbonate surfaces, a depression may focus on surface drainage, accelerating the dissolution process. Debris carried into the developing sinkhole may plug the outflow, ponding water and creating wetlands. Solution sinkholes create gently rolling hills and shallow depressions, common topographic features throughout much of Florida (Figure 5.55).

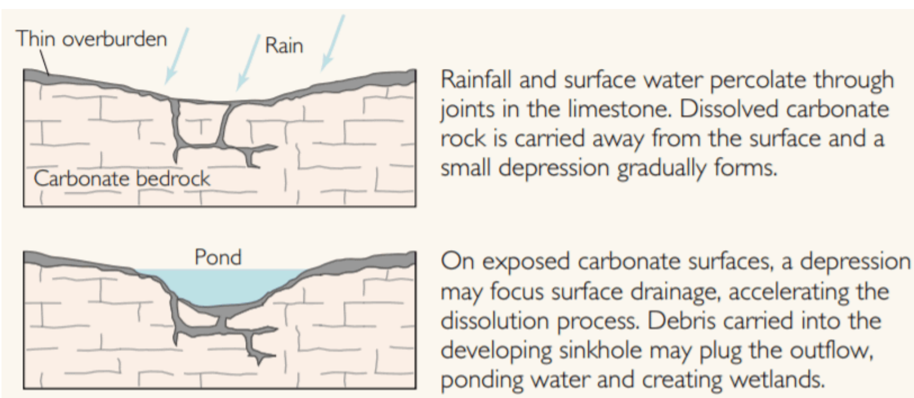


Figure 5.55. Dissolution Sinkholes [171]

Cover Collapse Sinkholes

Cover-collapse sinkholes may develop quickly and cause significant damage. These sinkholes develop when the ceiling of an underground cavity can no longer support the overlying weight, resulting in an abrupt collapse of the overburden into the cavity, thereby forming a hole in the land

[171]USGS. (2018). Sinkholes. https://www.usgs.gov/special-topics/water-science-school/science/sinkholes

surface.[172] This occurs because, over time, surface drainage, erosion, and deposition of materials develop a shallow bowl-shaped depression beneath the surface of the ground (Figure 5.56).

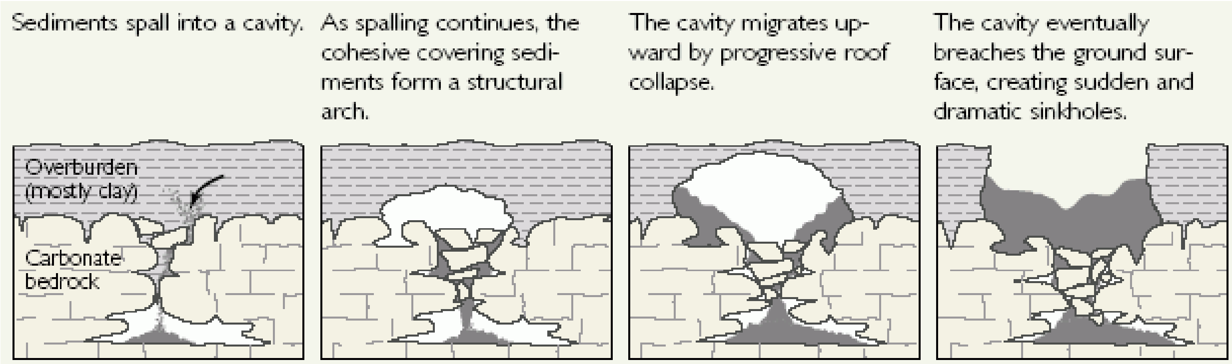


Figure 5.56. Cover Collapse Sinkholes [173]

Cover Subsidence Sinkholes

Cover-subsidence sinkholes develop more gradually, usually where the sediment is permeable and contains sand. The overburden slowly migrates into the fissures and cavities in the underlying rock, which results in a depression in the land surface (Figure 5.57).[174]

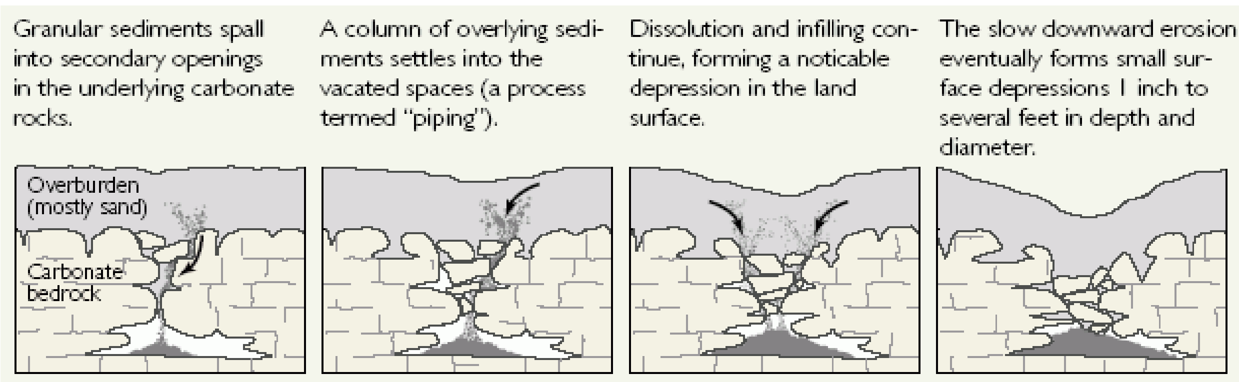


Figure 5.57. Cover Subsidence Sinkholes [175]

Triggers

There are several triggers for sinkhole formation. For example, extended periods of drought can lead to sinkholes, primarily if a heavy rain event occurs after an extended drought. Heavy rainfall can trigger sinkholes for several reasons. For example, heavy rainfall can add additional weight to

[172] Florida Department of Environmental Protection Florida Geological Survey. (2017). *The favorability of Florida's geology to sinkhole formation.* Page 5. https://www.researchgate.net/publication/321411626_THE_FAVORABILITY_OF_FLORIDA'S_GEOLOGY_TO_SINKHOLE_FORMATION

[173] https://water.usgs.gov/edu/sinkholes.html

[174] Florida Division of Emergency Management. (2023). Sinkhole Hazard Profile. https://flshmp-floridadisaster.hub.arcgis.com/pages/sinkhole

[175] https://water.usgs.gov/edu/sinkholes.html

overburden sediments above a cavity, which could cause a cavity ceiling to fail, or heavy rainfall could collect in low-lying areas, adding to the weight and accelerating infiltration at that location, resulting in cavity ceilings falling. Additionally, heavy rainfall could saturate overburdened sediments, making them soft, weakening the overburdened sediments, and causing failure of the cavity ceiling. Sinkholes can also be attributed to anthropogenic triggers, such as significant groundwater withdrawal; terraforming, which is the alteration of the earth's surface without realizing the area has thin overburden sediments; some stormwater management practices; heavy infrastructure over critical areas; and well drilling and development.[176]

Geographic Areas Affected by Suspect Soil

Sinkholes are common wherever there is limestone terrain. The following define areas of sinkhole occurrence in Florida:

- Area I – Few sinkholes, generally shallow and broad, that develop gradually. Solution sinkholes dominate
- Area II – Few sinkholes, shallow and of small diameter, which develop gradually. Consists mainly of incohesive and permeable sand; cover-subsidence sinkholes dominate
- Area III – Sinkholes are most numerous, of varying size, and develop abruptly. Consists mainly of cohesive clayey sediments of low permeability; cover-collapse sinkholes dominate
- Area IV – Very few sinkholes but a large diameter and deep. Consists of cohesive sediments interlayed with discontinuous carbonate beds; cover-collapse sinkholes dominate

Area I, Area III, and Area IV of sinkhole occurrence are all present in Hillsborough County. Figure 5.58 illustrates the delineated locations of these areas as well as the location of documented sinkhole and subsidence incidents. The southern portion of Hillsborough County is covered by sinkholes categorized as Area IV, with the northern portion of Hillsborough County being dominated by sinkholes categorized as Area III. Many of the subsidence incident reports are located in areas categorized as Area I and Area III, which are dominated by solution and cover-collapse sinkholes.

---

[176] Florida Department of Environmental Protection Florida Geological Survey. (2017). *The favorability of Florida's geology to sinkhole formation.* Page 11.

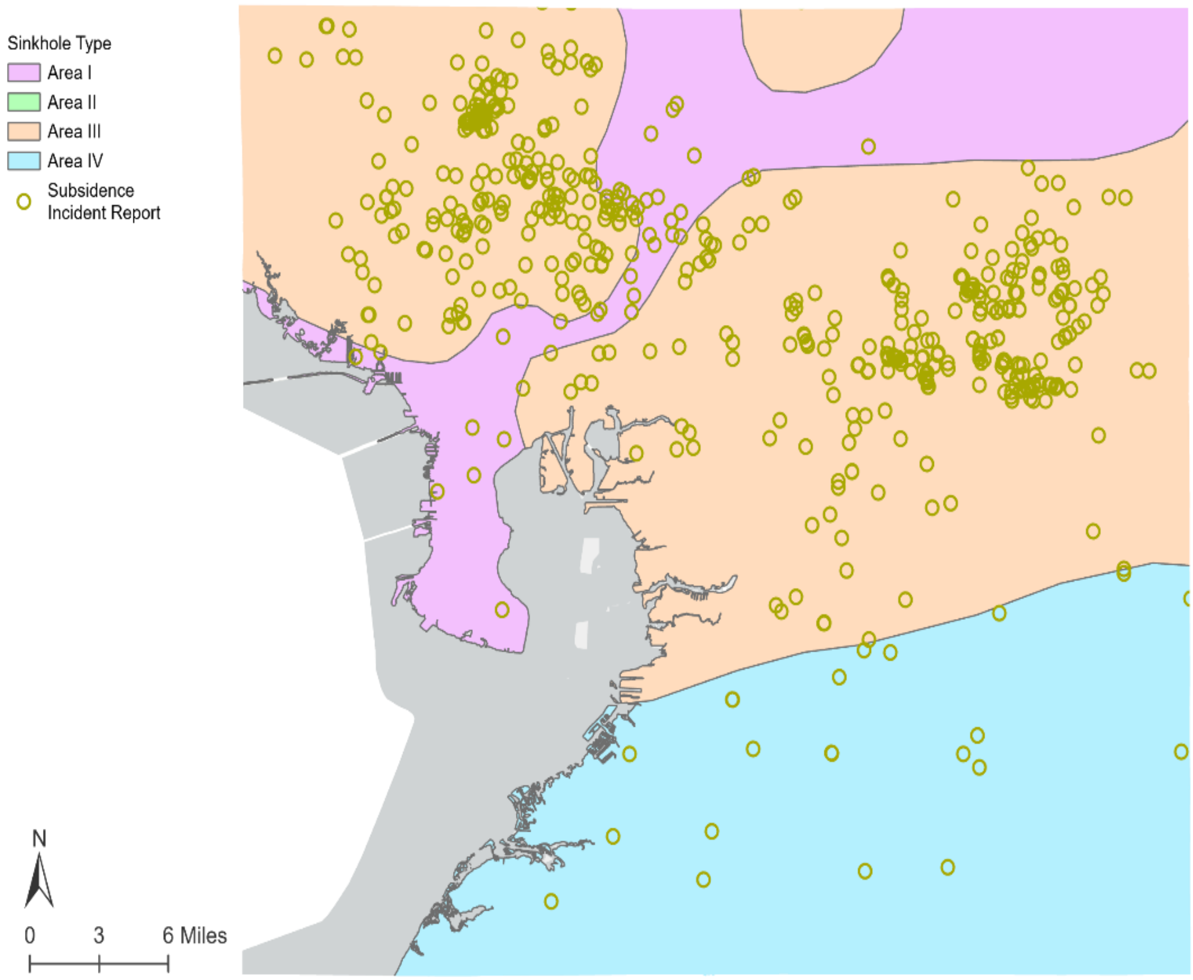


Figure 5.58. Areas of Sinkhole Occurrence[177][178]

Historical Occurrences of Suspect Soil

Sinkholes have a history of occurring in Hillsborough County. Areas of the County north of the Alafia River have had more sinkhole formation, whereas south of the river, sinkhole formation is less common.

There are several significant historical occurrences of sinkholes in Hillsborough County, which are listed below in Table 5.103.

Table 5.103. Significant Sinkhole Incidents in Hillsborough County [179]

[177] https://ca.dep.state.fl.us/mapdirect/?focus=fgssinkholes
[178] https://maps-fdep.opendata.arcgis.com/datasets/04d4cb6b000f451c8513fdc02322736e_5/explore?location=27.934941%2C-82.439596%2C11.74
[179] https://floridadep.gov/fgs/sinkholes/content/subsidence-incident-reports

Date	Event Description
November 10, 1987	At 5:15 PM, a 6-foot hole formed beneath a propane tank. Between 6:00 and 10:00 PM, the hole grew to a 60-foot diameter, and the home went in at 7:00 PM. At 4:00 AM, the porch broke off the house and fell into the hole. Water completely drained and rose slowly in the sinkhole. At 10:00 AM, new cracks formed along the side. The final size was 66-foot long, 60.5-foot wide, and 35-foot deep.
January 1, 1989	A 100-foot long, 100-foot wide, 15-foot-deep sinkhole formed on the bottom of an excavation pit for a phosphate mine. The sinkhole drained water from the excavation pit, and the pit was completely filled with water at the time of occurrence.
December 25, 1989	A 22.83-foot long, 23.17-foot wide, 6-foot-deep sinkhole and an 8.58-foot long, 8.5-foot wide, 4-foot-deep sinkhole both formed at a site located between two strawberry farms that were pumping for freeze protection.
July 20, 2003	A 20-foot long, 20-foot wide, 15-foot-deep sinkhole impacted a residence on private property. The residents were evacuated, and their car was swallowed by the sinkhole.
July 11, 2010	A 35-foot long, 35-foot wide, 35-foot-deep sinkhole formed in the parking lot of Bordeaux Village Condos in Tampa, swallowing a car. Residents of the condos were evacuated, the sinkhole was remediated, and the parking lot was repaired. However, the car was not recovered from the hole, so further investigation of the building structure was required.
December 14, 2010	A 108-foot long, 108-foot wide, 60-foot-deep sinkhole formed on the west slope of Section 9 of the Hillsborough County SE County Landfill in the Capacity Expansion Area (CEA). The landfill liner was breached, releasing leachate into the ground.
March 2, 2013	A 50-foot long, 50-foot wide, 70-foot-deep sinkhole developed under a home, engulfing the bed in which a man was sleeping, resulting in his death. The sinkhole reopened on August 19, 2015, with a diameter of 20 feet and unknown depth.
July 30, 2013	A 4-foot long, 1-foot wide, 2-foot-deep sinkhole occurred over a wastewater asset. A solid waste truck went into the hole and was pulled out without any spills. TECO Gas broke the top of the gravity main while directional drilling.
August 13, 2015	A sinkhole was reported under the foundation of a home in Valrico. Two homes were evacuated, and 10 people were displaced.
January 8, 2018	A 10-foot long, 10-foot wide, 12-foot-deep potential sinkhole was reported at the University of South Florida. The subsidence formed in a parking lot and did not threaten any surface-level structures. However, a stormwater pipe is visible in the subsidence.
October 4, 2022	A 10-foot long, 10-foot-wide* sinkhole formed beneath a swing set, requiring three dump truck loads of soil to fill the sink.

*Depth of sinkhole not listed

Only a small percentage of sinkhole reports are determined to be actual sinkholes. Most are subsidence events resulting from clay shrinkage or fill deterioration. However, most occurrences of subsidence are incorrectly identified as sinkholes.

The Florida Geological Survey maintains a database of sinkholes and subsidence incidents reported throughout the state. As of the last update (August 2023), this database reported 599 incidents for Hillsborough County, 137 of which resulted in property damage (Table 5.104).[180] Due to the high number of occurrences, event details are only provided for those incidents with reported property damage. Many of the events with reported damage were related to freeze protection pumping. Unincorporated Hillsborough County has experienced the most sinkholes, followed by the City of Tampa. Plant City and Temple Terrace have had fewer, mostly due to their smaller geographical size.

Table 5.104. Summary of Sinkhole Occurrences in Hillsborough County

Location	Total Number of Occurrences	Number of Occurrences with Property Damage
Plant City	36	13
Tampa	128	42
Temple Terrace	10	2
Unincorporated	434	87
HILLSBOROUGH COUNTY TOTAL	**599**	**137**

Probability of Future Occurrences of Suspect Soil

There will continue to be incidences of sinkholes in Hillsborough County because, as explained above, Florida's geology is favorable to sinkholes.

As Hillsborough County's population increases, the potential for individuals and property to be negatively impacted by a sinkhole will increase because more people will live in locations that are favorable for sinkhole development.[181] More importantly, as the population increases, so will construction and development, resulting in the subsequent increase in the likelihood of sinkholes due to the modification of surface drainage or altering the loads imposed on the ground without adequate support. Since October 2021, Hillsborough has had 3,411 projects under review for site and subdivision development, with approximately 306 being zoned for restaurants, 68 residential, 73 single-family residential, 44 commercial, 24 warehouses, and the remainder for other site developments.[182]

Potential Impacts of Climate Change on Suspect Soil

[180] https://floridadep.gov/fgs/sinkholes/content/subsidence-incident-reports

[181] Florida Department of Environmental Protection Florida Geological Survey. (2017). *The favorability of Florida's geology to sinkhole formation.* Page 4.

[182] Hillsborough County. (2022, Jan). Site & Subdivision Project Viewer. https://hillsborough.maps.arcgis.com/apps/dashboards/30eb1fb6bf3c4d6382f2f5f8fc65f52a

Sinkhole incidences increase either after severe storm events with associated flooding and soil saturation or during extended periods of drought.[183] With the potential for more prolonged and more intense periods of drought as well as greater intensity and frequency of rainfall and inland flooding *(*see *Flood Hazard Profile)*, sinkholes will likely increase in the coming century in areas with karst geology or areas identified as favorable for sinkhole development.

There is an association between anthropogenic activity (urban infrastructure over undeveloped land) and sinkholes and subsidence development.[184] Since the main trigger for sinkholes is water, whether it is too much or too little, when a drought occurs, the stabilization of karst – a type of terrain with limestone that is formed by water dissolving certain kinds of rocks – is compromised due to the cavities that were once supported by groundwater emptying and becoming unstable.[185] With the risk of drought projected to increase due to climate change and Hillsborough County's population increasing along with urban infrastructure, the development of sinkholes and subsidence is inevitable.[186]

Based on the number of recorded events over the period of history for each jurisdiction, the probability of future occurrences ranges from a 16% annual chance in Temple Terrace and a 90% chance annually in Plant City to well over a 100% annual chance in Hillsborough County and the City of Tampa. These estimates are influenced by the geographical size of the jurisdiction. Also, more populated areas generally have more reporting when sinkholes do occur. Of the historical occurrences, roughly 25% resulted in recorded damage to property. It is reasonable to conclude that sinkholes will occur throughout the county in any given year and damaging sinkholes every two to three years.

Suspect Soil Impact Analysis

All jurisdictions could receive the impacts listed below due to suspect soils. As the county's population increases, the potential for individuals to be negatively impacted by suspect soils increases because more people will live in locations that are favorable for land subsidence.

- Public
    - May fall in or drive into a sinkhole
    - May be injured or killed from structure collapse because of sinkhole
- Responders
    - May be injured or killed when attempting rescue missions

---

[183] Dragoni and Sukhija (2008) *Climate change and groundwater: A short review.* Geological Society, London, Special Publications, 288, 1-12; Hyatt and Jacobs (1996). *Distribution and morphology of sinkholes triggered by flooding following Tropical Storm Alberto at Albany, Georgia, USA.* Geomorphology, 17, 305-316.

[184] Veni, G., Brashear, C., Glasbrenner, D. (2015). Building Codes to Minimize Cover Collapses In Sinkhole-Prone Areas. https://digitalcommons.usf.edu/sinkhole_2015/ProceedingswithProgram/Mgmt_Regs_Education/5/

[185] Bodenner, Chris. (2018). The Science Behind Florida's Sinkhole Epidemic. https://www.smithsonianmag.com/science-nature/science-behind-floridas-sinkhole-epidemic-180969158/#:~:text=The%20main%20trigger%20for%20sinkholes%20is%20water%E2%80%94too%20much,supported%20by%20groundwater%20empty%20out%20and%20become%20unstable.

[186] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought

- Continuity of Operations (including continued delivery of services)
  - If a sinkhole affects structures or critical infrastructure, operations may be interrupted
- Property, Facilities, Infrastructure
  - Critical infrastructure, including structures and roads, may be affected or damaged, causing disruption
- Environment
  - Sinkholes are part of the natural environment, but there may be damage to some natural spaces from a sinkhole; for example, a public park may be damaged and result in closure
- Economic Condition
  - Sinkhole damage repair can be very expensive, so a sinkhole may have a significant negative impact on the property owner; a sinkhole would likely not affect the economy of a community
- Public Confidence in Each Jurisdiction's Governance
  - If there is an increase in sinkhole occurrences and the government does not address the issue, the public may become concerned about what would happen if a sinkhole were to affect their property

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

The Vulnerability Analysis and Loss Estimation findings are valuable to planners and jurisdictions in understanding the potential impacts on buildings, infrastructure, personal property, and humans to assist in decision making. To estimate the exposure of improved property to sinkholes, the approximate number of parcels and their associated improved value located in high sinkhole risk areas were determined using GIS analysis. Areas classified as Area III of sinkhole occurrence were chosen to be displayed as areas of risk because these areas are susceptible to the most numerous sinkholes of varying size and develop abruptly. The results are presented in Table 5.105.

Table 5.105. Estimated Exposure of Improved Property to Sinkholes

Location	Buildings and Parcels in High Sinkhole Risk Area (Area III)		
	No. of Parcels	No. of Buildings	Improved Value (in thousands)
City of Plant City	16,206	58,780	$3,542,704
City of Tampa	60,082	213,252	$19,654,600
City of Temple Terrace	3,320	14,498	$1,037,073
Unincorporated	261,520	1,133,238	$56,201,359
HILLSBOROUGH COUNTY TOTAL	**341,128**	**1,419,768**	**$80,435,736**

Hillsborough County has a total of 341,128 parcels, with 1,419,768 buildings estimated exposed to sinkholes and valued at $80,435,736,000. Out of the four jurisdictions, 80% of the buildings are in a high-risk sinkhole area, which is in Unincorporated Hillsborough with a value of $56,201,359,000;

with 15% of buildings in Tampa valued at $19,654,600,000; 0.4% of buildings in Plant City, and 0.1% of buildings in Temple Terrace.

To estimate the county population's exposure to sinkhole, areas of risk were intersected with census block data. As a result, these population estimates are going to be an overestimate of risk since the entire census block's population count will be included even if only a portion of the census block's area is located in a risk area. However, these estimates still give an idea of the county population's risk of sinkhole. The results are presented in Table 5.106.

Table 5.106. Estimated Exposure of Population to Sinkholes

Location	Population in High Sinkhole Risk Area
City of Plant City	48,289
City of Tampa	249,432
City of Temple Terrace	28,556
Unincorporated	763,302
HILLSBOROUGH COUNTY TOTAL	**1,089,579**

Hillsborough County has an estimated 1.1 million people exposed to high sinkhole risk areas, with 70% of the population residing in the Unincorporated area of Hillsborough, 23% residing in Tampa, 4.4% residing in Plant City, and 2.6% living in Temple Terrace.

The analysis above focuses on overall exposure. Sinkholes vary in size, number, and damage. There is no consistent historic loss data available to enable loss estimation. Since the Area III risk classification covers a large area of Hillsborough County, losses will be a tiny fraction of exposure in any given year. Exposure provides planners with a big-picture view of everything at risk.

Justice40 Climate and Economic Justice Screening Tool (CEJST)

Utilizing the Climate and Economic Justice Screening Tool (CEJST) and areas classified as Area III (high risk) for sinkhole occurrence, disadvantaged communities were overlayed with these areas of high sinkhole risk to determine the vulnerability of each census tract. The CEJST incorporates socioeconomic (i.e., low-income, people of color) and environmental (i.e., air toxics, cancer risk, wastewater discharge) indicators to summarize how these indicators come together in the same location.

Understanding the CEJST allows decision-makers to identify areas that may be considered disadvantaged based on specific indicators. For decision making purposes, it helps us to determine where the intersection of the highest hazard coincides with those less likely to be able to recover quickly from an event. For example, based on the demographic information of the tool, a community can understand what Census block group, an area defined by the Census Bureau that usually has in the range of 600-3,000 people living in it, would most likely be impacted by a sinkhole.

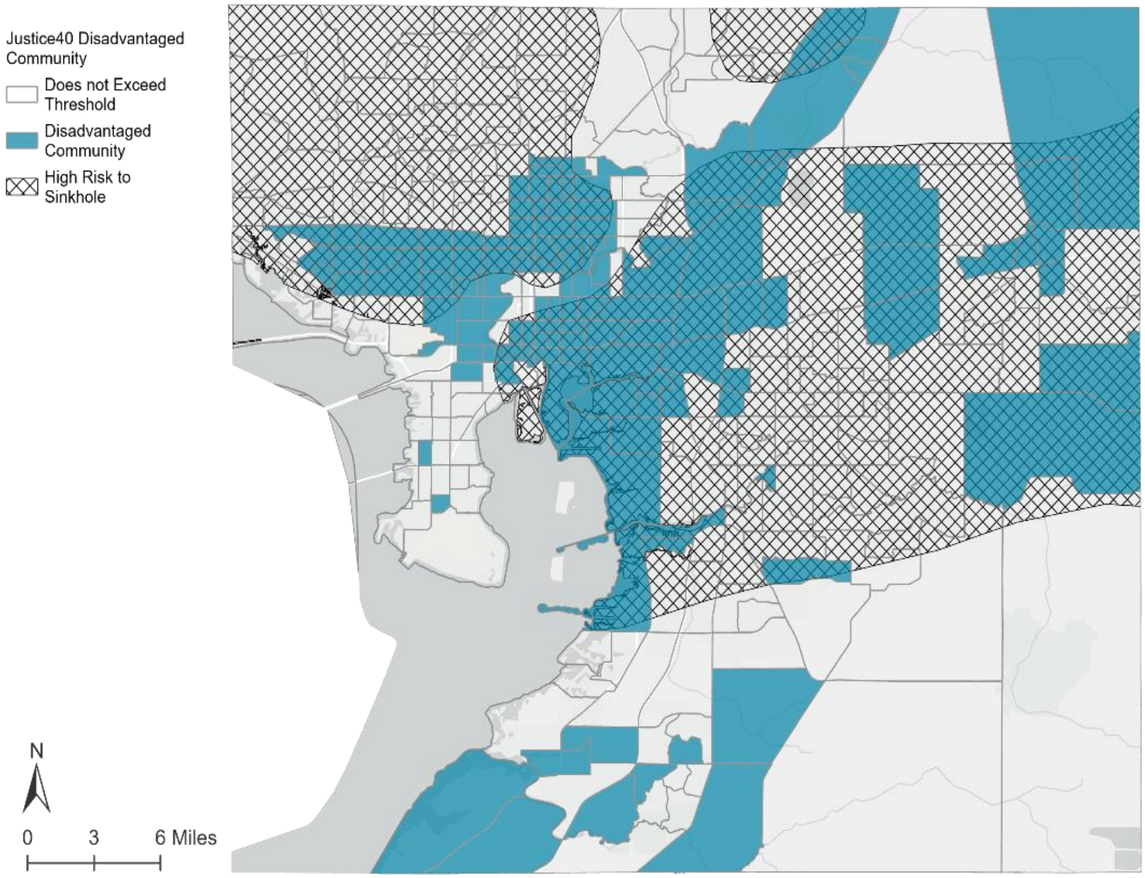


Figure 5.59. Map of Disadvantaged Communities with High Risk of Sinkholes in Hillsborough County

Hillsborough County has a significant percentage of disadvantaged communities exposed to sinkholes, with 92% of the disadvantaged communities being in the high-risk classification area. Unincorporated Hillsborough County and Tampa are more vulnerable to sinkholes than Plant City and Temple Terrace, with 62 disadvantaged communities in Unincorporated Hillsborough County and 44 disadvantaged communities in Tampa at high risk of sinkhole.

Table 5.107 provides a full breakdown.

Table 5.107. Breakdown of Disadvantaged Communities and Risk to Sinkholes in Hillsborough County

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities with High Risk to Sinkhole
Hillsborough County (Unincorporated)	69	62
City of Plant City	6	5
City of Tampa	54	44
City of Temple Terrace	1	1
Hillsborough County (Total)	**131**	**112**

Vulnerability Analysis and Loss Estimation of Critical Facilities

A critical facility is defined as a structure from which essential services and functions for victim survival, continuation of public safety actions, and disaster recovery are performed or provided, including shelters, emergency operation centers, hospitals, and sewer and wastewater facilities.[187] To estimate exposure to sinkholes for the critical facilities, areas of risk were intersected with critical facility point locations. Table 5.108 summarizes the critical facilities in the county that are located in high sinkhole risk areas. Areas classified as Area III were chosen for analysis as areas of risk because these areas are susceptible to the most numerous sinkholes of varying sizes and those that develop abruptly.

Table 5.108. Exposure of Critical Facilities to Sinkhole Risk Areas

Location	Number of Critical Facilities in High Sinkhole Risk Area
City of Plant City	122
City of Tampa	515
City of Temple Terrace	18
Unincorporated	2,096
HILLSBOROUGH COUNTY TOTAL	**2,751**

Hillsborough County has 2,751 critical facilities located in a high sinkhole risk area. 76% of critical facilities are located in Unincorporated Hillsborough County; 19% are in Tampa, and the remainder are located in Plant City (4%) and Temple Terrace (0.7%).

Calculation of estimated annual losses to critical facilities is not possible due to a lack of historic loss data and the unpredictable location of future occurrences. Large sinkholes can cause significant damage or even complete destruction of a particular building.

All of the critical facilities and their associated risk can be found in Appendix B.

The critical facilities were broken out further into FEMA Community Lifeline categories. These lifelines are categorized as: Safety and Security; Health and Medical; Transportation; Food, Water, Shelter; Water Systems; Communications; Energy; and Hazardous Materials. Several critical facilities were not included as community lifelines, such as solid hazardous waste facilities for example, while evacuation routes were added as community lifelines while not being included in the critical facility asset exposure analysis.

To estimate exposure to suspect soil for the community lifeline analysis, areas classified as Area III were chosen for analysis, similar to the above general critical facility exposure analysis, and were

---

187 https://emilms.fema.gov/IS0815/groups/11.html#:~:text=What%20is%20a%20Critical%20Facility%3F%201%20%22Critical%20facilities%22,wastewater%20facilities%20are%20all%20examples%20of%20critical%20facilities.

intersected with community lifeline locations. Table 5.109 summarizes the community lifelines in the county that are located within these sinkhole risk areas and Table 5.110-

Table 5.113 summarizes this exposure by jurisdiction for Tampa, Temple Terrace, Plant City, and Unincorporated Hillsborough County.

The majority of community lifelines in the county are within high sinkhole risk areas. This is due to the extent of the high sinkhole risk encompassing close to half of the county with the majority of it covering Tampa and Plant City among other high population areas of the county.

Table 5.109. FEMA Community Lifelines in High Sinkhole Risk Areas – Exposure to Suspect Soil

Community Lifeline	Number of Community Lifelines in High Sinkhole Risk Areas (% of Total)	
	High Sinkhole Risk	Total Community Lifelines
Safety and Security	658 (68%)	963
Health and Medical	309 (71%)	434
Transportation	1760 (72%)	2457
Food, Water, Shelter	700 (80%)	879
Water Systems	252 (79%)	317
Communications	387 (74%)	525
Energy	137 (70%	197
Hazardous Materials	6 (86%)	7
Totals	**4209 (73%)**	**5779**

In the City of Tampa, every community lifeline category with the exception of Hazardous Materials (which is non-existent in the City of Tampa), Communications (47%), and Health and Medical (45%), have above 50% exposure to high sinkhole risk areas. Water Systems has 72% of the assets in that community lifeline category exposed.

Table 5.110. City of Tampa FEMA Community Lifelines in High Sinkhole Risk Areas – Exposure to Suspect Soil

Community Lifeline	Number of Community Lifelines in High Sinkhole Risk Areas (% of Total)	
	High Sinkhole Risk	Total Community Lifelines
Safety and Security	215 (50%)	428
Health and Medical	63 (45%)	140
Transportation	334 (49%)	682
Food, Water, Shelter	38 (61%)	62
Water Systems	44 (72%)	61
Communications	61 (47%)	129
Energy	28 (52%)	54
Hazardous Materials	0 (0%)	0
Totals	**783 (50%)**	**1,556**

Both Water Systems assets in the City of Temple Terrace are exposed to high sinkhole risk areas. Other than that, most of Temple Terrace is not within the high sinkhole risk extent and thus, most community lifelines are not exposed to a high sinkhole risk.

Table 5.111. City of Temple Terrace FEMA Community Lifelines in High Sinkhole Risk Areas – Exposure to Suspect Soil

Community Lifeline	Number of Community Lifelines in High Sinkhole Risk Areas (% of Total)	
	High Sinkhole Risk	Total Community Lifelines
Safety and Security	3 (13%)	24
Health and Medical	2 (22%)	9
Transportation	4 (15%)	27
Food, Water, Shelter	1 (11%)	9
Water Systems	2 (100%)	2
Communications	1 (17%)	6
Energy	2 (40%)	5
Hazardous Materials	0 (0%)	0
Totals	**15 (21%)**	**73**

The City of Plant City is fully covered by the high sinkhole risk extent. 100% of all community lifelines in Plant City are considered exposed.

Table 5.112. City of Plant City FEMA Community Lifelines in High Sinkhole Risk Areas – Exposure to Suspect Soil

Community Lifeline	Number of Community Lifelines in High Sinkhole Risk Areas (% of Total)	
	High Sinkhole Risk	Total Community Lifelines
Safety and Security	28 (100%)	28
Health and Medical	13 (100%)	13
Transportation	188 (100%)	188
Food, Water, Shelter	24 (100%)	24
Water Systems	10 (100%)	10
Communications	19 (100%)	19
Energy	7 (100%)	7
Hazardous Materials	0 (0%)	0
Totals	**289 (100%)**	**289**

The majority of community lifelines in Unincorporated Hillsborough County are considered exposed to high sinkhole risk areas. Only Transportation (79%) and Energy (76%) have less than 80% of a community lifeline category exposed.

Table 5.113. Unincorporated Hillsborough County FEMA Community Lifelines in High Sinkhole Risk Areas – Exposure to Suspect Soil

Community Lifeline	Number of Community Lifelines in High Sinkhole Risk Areas (% of Total)	
	High Sinkhole Risk	Total Community Lifelines
Safety and Security	412 (85%)	483
Health and Medical	227 (85%)	268
Transportation	1265 (79%)	1,605
Food, Water, Shelter	637 (81%)	784
Water Systems	196 (80%)	244
Communications	306 (82%)	371
Energy	100 (76%)	131
Hazardous Materials	6 (86%)	7
Totals	**3149 (81%)**	**3,893**

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.8 (

Table 5.114).

Table 5.114. Overall Vulnerability to Suspect Soil for Hillsborough County

SUSPECT SOIL					Overall Vulnerability	
Overview						
Subsidence is the gradual settling or sudden sinking of the Earth's surface. Sinkholes are landforms created when overburden subsides or collapses into fissures or cavities in underlying carbonate rocks. Florida is underlain by several thousand feet of carbonate rock, limestone, and dolostone, with a variably thick mixture of sands, clays, shells, and other near surface carbonate rock units, called overburden. Muck soils are also susceptible to subsidence.					MODERATE	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Likely	Limited	Moderate	< 6 hrs	Moderately Concerned	< 24 hrs	2.8

4.6 Tornado Hazard Profile

Tornado Description

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. Tornado wind speed normally ranges from 65 mph to over 200 mph. The maximum winds in tornadoes are often confined to extremely small areas and vary tremendously over very short distances, even within the funnel itself. Additionally, these storms typically travel around 10 to 20 mph but can move at more than 60 mph. Tornadoes can occur at any time of the year and at any time of day.

Tornadoes develop under three scenarios: (1) along or ahead of a squall line ahead of an advancing cold front moving from the north; (2) in connection with thunderstorm squall lines during hot, humid weather; and (3) within a tropical cyclone.

The most common, and often the most dangerous, tornadoes come from a supercell thunderstorm. Non-supercell tornadoes form because of spinning air already near the ground caused by wind shear. These include a gustnado, a whirl of debris with no condensation funnel; a landspout, a narrow condensation funnel that develops while the thunderstorm is still growing; and a waterspout, a landspout that occurs over water.

Florida has two tornado seasons: the spring and summer. The deadly spring season is from February through April and is characterized by powerful tornadoes associated with squall lines. The summer tornado season runs from June until September and has the highest frequencies of storm generation, with usual intensities of EF0 or EF1 on the Enhanced Fujita Scale. This includes those tornadoes associated with land-falling tropical cyclones.

Tornadoes are measured by their intensity or their wind speed, and their area, using the Enhanced Fujita (EF) Scale. The scale ranges from EF 0, with minor damages from winds ranging from 65–85 mph, to EF 5, with severe damages from winds more than 200 mph.

Table 5.115. Enhanced Fujita Scale [188]

EF Number	Estimated 3-second gust (mph)	Typical Damage
0 (Gale)	65–85	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; damaged sign boards.
1 (Weak)	86–110	Surfaces peeled off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads.
2 (Strong)	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
3 (Severe)	136–165	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and

[188] http://climatecenter.fsu.edu/topics/tornadoes

EF Number	Estimated 3-second gust (mph)	Typical Damage
		large missiles generated.
4 (Devastating)	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown, and large missiles generated.
5 (Incredible)	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly in excess of 100 meters; trees debarked; steel-reinforced concrete structures badly damaged.

Advisories

Below are the advisories that the NWS issues regarding tornado hazards:

- Tornado Watch: issued when conditions are favorable for severe thunderstorms and tornadoes to develop.
- Tornado Warning: issued when a tornado is sighted or imminent.

Causes of Fatalities in Tornadoes

The most common cause of death and injury due to a tornado is being hit by flying/falling debris and being picked up or blown by a tornado. Most deaths and injuries happen to people who are unaware and uninformed of the possibility of severe weather and tornadoes.

Geographic Areas Affected by Tornado

Tornadoes occur throughout the state of Florida and thus are possible in Hillsborough County. The National Weather Service ranks the Tampa Bay area as having the greatest occurrence of tornadoes in the State of Florida. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are random, and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. For the purposes of this plan, it is assumed that the county is uniformly exposed to this hazard. With that in mind, Figure 5.60 shows tornado track data for many of the major tornado events that have impacted Hillsborough County based on historical occurrences of tornadoes from 1950 to 2024. While no definitive pattern emerges from this data, some areas that have been impacted in the past may be potentially more susceptible in the future.

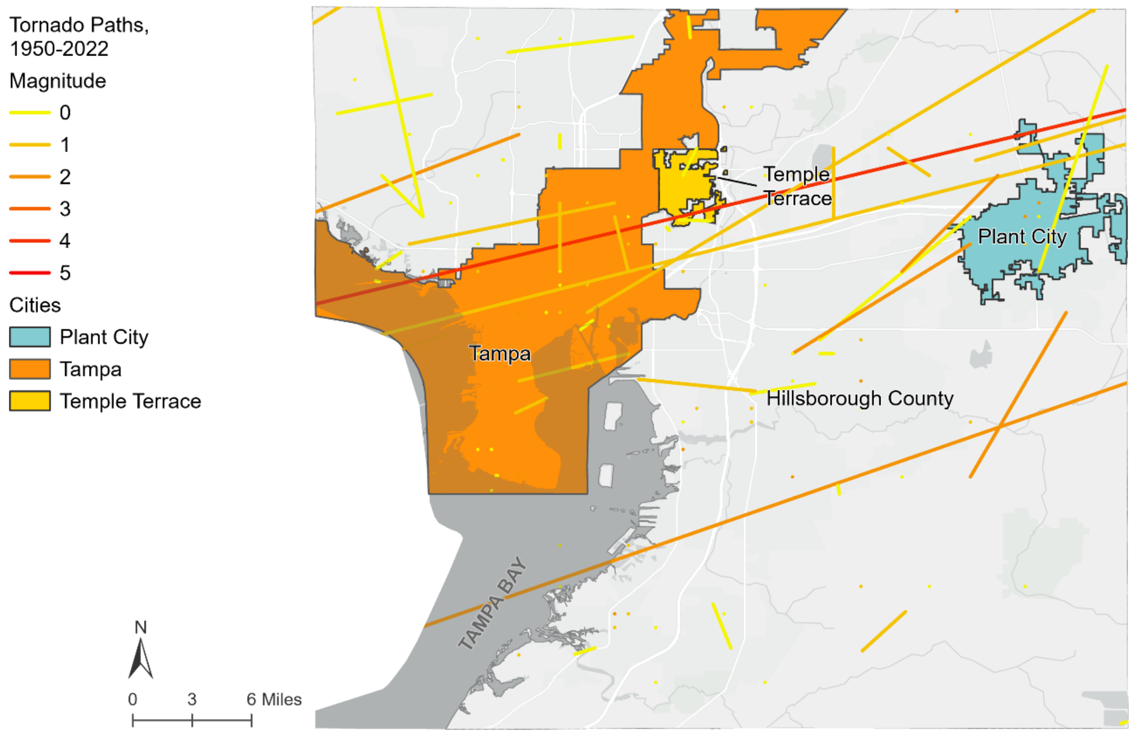


Figure 5.60. Hillsborough County Tornado Events, 1950–2024[189]

Historic data illustrated on this map shows that lower intensity tornadoes, EF-0 through EF-2, are common across Hillsborough County, while stronger tornadoes like EF-3, EF-4, and EF-5 tornados in Hillsborough are less common. The data shows that a single EF-5 tornado occurred in Hillsborough County between 1950 and 2024.

Historical Occurrences of Tornado

Table 5.116 lists significant tornadoes that affected Hillsborough County. These significant occurrences include events from the NCEI storm events database but are not a comprehensive inventory of tornado events, only those with significant impacts.

Table 5.116. Significant Tornado Occurrences in Hillsborough County

Date	Information
October 3, 1992	One of the deadliest tornado events in central Florida history occurred on October 3, 1992, when four people died and more than $100 million in property damage occurred. NOAA estimated approximately $14 million dollars in damage from severe wind events between 1987 and 1996 within Hillsborough County. The damage was the result of 22 tornadoes and 112 downbursts. These occurrences resulted in one death and 16 injuries.

[189] https://gis-fema.hub.arcgis.com/datasets/fedmaps::tornado-tracks-1/about

Date	Information
November 11, 1995	A weak tornado (F0), 150 feet wide along a path of 1.2 miles, combined with a microburst to move east over rural portions of southern Hillsborough County. The tornado touched near the Sundance community along U.S. Highway 301 and Surona Road. The F0 tornado touched down and severely damaged one doublewide mobile home and produced minor damage to five other mobile homes. Two persons sustained minor injuries. A shed and a chain link fence were also destroyed. Power lines, along with several large trees, were downed. The tornado lifted and dissipated near Seminole Trail and Oakwood Drive.
March 31, 2011	Several tornadoes and areas of damaging winds occurred across the greater Tampa Bay area. Twenty-nine residences and businesses suffered minor damage, and six structures suffered major damage in the area around Interbay Boulevard. The area around the Tampa Port Authority and Progress Village suffered extensive damage from an EF1 tornado. Numerous roofs were blown off, and 40-foot-long storage containers were overturned around the Tampa Port Authority. Countywide, there were 118 homes and businesses with minor damage in Progress Village and 40 that sustained major damage. In addition, 245 homes were assisted with tree damage in the Progress Village area.
June 29, 2018	Scattered thunderstorms moved east through the Tampa Bay area throughout the late morning and early afternoon hours. One storm developed a brief tornado as it interacted with an outflow boundary, damaging the roof of an apartment in Tampa. Broadcast media reported moderate roof damage to a 2-story apartment building, where a portion of a roof was removed. Little, if any, surrounding damage was observed. A weak radar rotation was observed in the vicinity at the same time, indicating that the damage was likely caused by a tornado.

Additionally, there have been 5 FEMA major disaster declarations for tornadoes in Hillsborough County.

Table 5.117. FEMA Major Disaster Declarations in Hillsborough County, Tornado, 1953–2023[190]

Disaster Number	Date	Name/Description
DR-586	May 15, 1979	Severe Storms, Tornadoes & Flooding
DR-966	October 3–4, 1992	Severe Storms, Tornadoes & Flooding
DR-982	March 12–16, 1993	Tornadoes, Flooding, High Winds & Tides, Freezing
DR-1195	December 25, 1997–April 24, 1998	Severe Storms, High Winds, Tornadoes, and Flooding
DR-4709	April 12, 2023-April 14, 2023	Severe Storms, Tornadoes & Flooding

[190] https://www.fema.gov/api/open/v2/DisasterDeclarationsSummaries.csv

According to the NCEI Storm Events Database, there were 146 reports of tornadoes in Hillsborough County from 1955 to 2023.[191] It is likely that additional events have impacted Hillsborough County. As additional local data becomes available, this hazard profile will be amended. Note that rows with no losses shown do not necessarily indicate the absence of damages. It is more likely they were not reported.

Table 5.118. Summary of Tornado Occurrences in Hillsborough County 1955-2023

Location	Number of Occurrences	Deaths	Injuries	Property Damage (2023)*	Annualized Property Loss
City of Plant City	4	0	0	$707,408	$10,403
City of Tampa	27	1	2	$5,463,381	$80,344
City of Temple Terrace	0	0	0	$0	$0
Unincorporated	115	0	120	$97,240,966	$1,430,014
HILLSBOROUGH COUNTY TOTAL	146	1	122	$103,411,755	$1,520,761
*Adjusted dollar values were calculated based on the Consumer Price Index for All Urban Consumers (CPI-U) U.S. city average series for all items, not seasonally adjusted. This data represents changes in the prices of all goods and services purchased for consumption by urban households. This monthly index value has been calculated every year since 1913. The 2023-dollar values were calculated based on buying power in December 2023.					

Table 5.119 lists more detailed information on the location and damages of the reported tornados summarized above.

Table 5.119. Historical Tornado Occurrences in Hillsborough County (1955-2023)

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
City of Plant City							
PLANT CITY	10/7/1996	Tornado	F0	0	0	$0	0
PLANT CITY	10/7/1996	Tornado	F0	0	0	$1,934	0
PLANT CITY	10/27/1997	Tornado	F1	0	0	$236,898	0
PLANT CITY	8/6/1998	Tornado	F0	0	0	$468,576	0
City of Tampa							
TAMPA	6/14/1994	Tornado	F0	0	0	$0	$0
N TAMPA	6/27/1994	Tornado	F0	0	0	$0	$0
TAMPA	6/27/1994	Tornado	F1	0	0	$1,033,104	$0
TAMPA	8/25/1995	Tornado	F0	0	0	$0	$0
TAMPA	11/11/1995	Tornado	F0	0	2	$47,781	$0
TAMPA	10/7/1996	Tornado	F0	0	0	$9,674	$0
TAMPA	10/7/1996	Tornado	F0	0	0	$1,934	$0

[191] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
TAMPA	10/7/1996	Tornado	F0	0	0	$19,346	$0
TAMPA	12/7/1996	Tornado	F2	1	0	$193,103	$0
TAMPA	4/23/1997	Tornado	F0	0	0	$9,558	$0
TAMPA	4/28/1997	Tornado	F0	0	1	$955,872	$0
TAMPA	7/5/1997	Tornado	F0	0	0	$190,817	$0
TAMPA	10/27/1997	Tornado	F0	0	0	$189,519	$0
TAMPA	10/31/1997	Tornado	F0	0	0	$18,952	$0
TAMPA	1/23/1998	Tornado	F0	0	0	$142,139	$0
TAMPA	9/25/1998	Tornado	F0	0	0	$0	$0
TAMPA	1/2/1999	Tornado	F1	0	1	$279,606	$0
TAMPA	1/2/1999	Tornado	F1	0	0	$178,770	$0
TAMPA	5/18/1999	Tornado	F1	0	0	$506,751	$0
TAMPA INTL ARPT	6/25/2000	Tornado	F0	0	0	$177,646	$0
TAMPA INTL ARPT	6/5/2002	Tornado	F0	0	0	$255,360	$0
PORT TAMPA	7/9/2005	Tornado	F0	0	0	$0	$0
PORT OF TAMPA PORTS SITE	3/31/2011	Tornado	EF1	0	0	$2,165,391	$0
LUTZ TAMPA DOWNS ARP	6/24/2012	Tornado	EF0	0	0	$120,114	$0
CRUISE TERMINAL 2 PORT SITE	8/27/2012	Tornado	EF0	0	0	$2,659	$0
TPA P O KNIGHT ARPT	2/26/2013	Tornado	EF0	0	0	$46,170	$0
(MCF)MC DILL AFB	10/8/2013	Tornado	EF0	0	0	$0	$0
City of Temple Terrace							
NONE REPORTED	--	--		--	--	--	--
Unincorporated							
HILLSBOROUGH CO.	7/22/1951	Tornado	F2	0	0	$29,517	$0
HILLSBOROUGH CO.	1/9/1953	Tornado	F2	0	12	$287,405	$0
HILLSBOROUGH CO.	12/11/1957	Tornado	F0	0	0	$322	$0
HILLSBOROUGH CO.	1/21/1958	Tornado	F0	0	0	$321	$0
HILLSBOROUGH CO.	4/15/1958	Tornado	F1	0	0	$318	$0
HILLSBOROUGH CO.	5/21/1959	Tornado	F1	0	0	$26,362	$0
HILLSBOROUGH CO.	2/18/1960	Tornado	F1	0	0	$260,033	$0
HILLSBOROUGH CO.	3/16/1960	Tornado	F1	0	0	$312	$0
HILLSBOROUGH	3/16/1960	Tornado	F0	0	0	$2,600,332	$0

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
CO.							
HILLSBOROUGH CO.	3/17/1960	Tornado	F0	0	0	$312	$0
HILLSBOROUGH CO.	6/19/1960	Tornado	F1	0	0	$25,828	$0
HILLSBOROUGH CO.	9/29/1960	Tornado	F1	0	0	$2,582	$0
HILLSBOROUGH CO.	2/25/1961	Tornado	F1	0	0	$25,654	$0
HILLSBOROUGH CO.	11/23/1961	Tornado	F1	0	0	$25,484	$0
HILLSBOROUGH CO.	2/19/1963	Tornado	F2	0	0	$2,514,795	$0
HILLSBOROUGH CO.	7/28/1963	Tornado	F2	0	0	$24,902	$0
HILLSBOROUGH CO.	6/11/1964	Tornado	F0	0	0	$24,662	$0
HILLSBOROUGH CO.	7/2/1964	Tornado	F2	0	6	$245,819	$0
HILLSBOROUGH CO.	7/14/1967	Tornado	F1	0	0	$22,890	$0
HILLSBOROUGH CO.	11/9/1968	Tornado	F1	0	1	$2,159,598	$0
HILLSBOROUGH CO.	11/9/1968	Tornado	F1	0	3	$2,159,598	$0
HILLSBOROUGH CO.	6/4/1969	Tornado	F0	0	0	$20,888	$0
HILLSBOROUGH CO.	6/6/1969	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	7/1/1969	Tornado	F1	0	0	$2,078	$0
HILLSBOROUGH CO.	7/2/1969	Tornado	F2	0	2	$20,774	$0
HILLSBOROUGH CO.	12/10/1969	Tornado	F2	0	0	$202,784	$0
HILLSBOROUGH CO.	1/6/1970	Tornado	F1	0	2	$202,248	$0
HILLSBOROUGH CO.	1/6/1970	Tornado	F2	0	3	$202,248	$0
HILLSBOROUGH CO.	1/6/1970	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	3/3/1971	Tornado	F0	0	0	$19,113	$0
HILLSBOROUGH CO.	3/3/1971	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	4/15/1971	Tornado	F0	0	0	$19,065	$0
HILLSBOROUGH CO.	7/2/1971	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	7/10/1971	Tornado	F1	0	0	$187,837	$0
HILLSBOROUGH	7/20/1971	Tornado	F0	0	0	$0	$0

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
CO.							
HILLSBOROUGH CO.	7/28/1971	Tornado	F1	0	0	$0	$0
HILLSBOROUGH CO.	8/2/1971	Tornado	F1	0	0	$225	$0
HILLSBOROUGH CO.	10/17/1971	Tornado	F1	0	0	$186,919	$0
HILLSBOROUGH CO.	2/7/1972	Tornado	F1	0	0	$185,108	$0
HILLSBOROUGH CO.	3/31/1972	Tornado	F2	0	4	$1,846,612	$0
HILLSBOROUGH CO.	3/31/1972	Tornado	F2	0	0	$184,662	$0
HILLSBOROUGH CO.	1/22/1973	Tornado	F1	0	8	$179,459	$0
HILLSBOROUGH CO.	10/31/1973	Tornado	F2	0	8	$16,765,300	$0
HILLSBOROUGH CO.	2/19/1974	Tornado	F1	0	53	$16,196,984	$0
HILLSBOROUGH CO.	2/19/1974	Tornado	F1	0	0	$16,196,984	$0
HILLSBOROUGH CO.	6/10/1974	Tornado	F0	0	0	$15,602	$0
HILLSBOROUGH CO.	8/26/1974	Tornado	F0	0	0	$15,290	$0
HILLSBOROUGH CO.	5/27/1975	Tornado	F0	0	0	$143,702	$0
HILLSBOROUGH CO.	6/3/1975	Tornado	F1	0	0	$14,263	$0
HILLSBOROUGH CO.	7/29/1975	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	8/8/1975	Tornado	F1	0	0	$140,791	$0
HILLSBOROUGH CO.	9/3/1975	Tornado	F1	0	0	$140,018	$0
HILLSBOROUGH CO.	5/23/1976	Tornado	F1	0	2	$13,530,932	$0
HILLSBOROUGH CO.	6/4/1976	Tornado	F1	0	0	$134,595	$0
HILLSBOROUGH CO.	6/28/1976	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	1/8/1978	Tornado	F2	0	2	$1,223,196	$0
HILLSBOROUGH CO.	1/19/1978	Tornado	F0	0	0	$12,232	$0
HILLSBOROUGH CO.	5/26/1978	Tornado	F0	0	0	$11,852	$0
HILLSBOROUGH CO.	7/12/1978	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	7/26/1978	Tornado	F0	0	0	$0	$0
HILLSBOROUGH	5/8/1979	Tornado	F1	0	1	$1,069,227	$0

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
CO.							
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$1,070	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F1	0	0	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	1	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$1,069,227	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$106,923	$0
HILLSBOROUGH CO.	5/8/1979	Tornado	F0	0	0	$129	$0
HILLSBOROUGH CO.	8/19/1980	Tornado	F1	0	6	$917,764	$0
HILLSBOROUGH CO.	2/2/1981	Tornado	F1	0	0	$869,735	$0
HILLSBOROUGH CO.	6/13/1981	Tornado	F1	0	0	$84,382	$0
HILLSBOROUGH CO.	6/25/1981	Tornado	F0	0	0	$84,382	$0
HILLSBOROUGH CO.	7/30/1981	Tornado	F1	0	0	$834,604	$0
HILLSBOROUGH CO.	7/8/1982	Tornado	F1	0	0	$78,410	$0
HILLSBOROUGH CO.	2/2/1983	Tornado	F2	0	2	$780,897	$0
HILLSBOROUGH CO.	6/8/1983	Tornado	F1	0	2	$768,339	$0
HILLSBOROUGH CO.	9/8/1983	Tornado	F0	0	0	$759,183	$0
HILLSBOROUGH CO.	6/11/1984	Tornado	F0	0	0	$73,722	$0
HILLSBOROUGH CO.	7/25/1985	Tornado	F0	0	0	$709	$0
HILLSBOROUGH CO.	10/31/1985	Tornado	F1	0	0	$703,310	$0
HILLSBOROUGH CO.	8/30/1988	Tornado	F1	0	0	$642,435	$0
HILLSBOROUGH CO.	9/12/1989	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	6/22/1990	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	7/16/1990	Tornado	F0	0	0	$58,627	$0
HILLSBOROUGH	1/19/1991	Tornado	F0	0	0	$0	$0

	Date	Type	Magnitude	Deaths	Injuries	Property Damage*	Crop Damage*
CO.							
HILLSBOROUGH CO.	3/3/1991	Tornado	F0	0	0	$566	$0
HILLSBOROUGH CO.	4/25/1991	Tornado	F0	0	0	$5,655	$0
HILLSBOROUGH CO.	4/25/1991	Tornado	F1	0	0	$565,457	$0
HILLSBOROUGH CO.	10/3/1992	Tornado	F1	0	2	$53,914	$0
HILLSBOROUGH CO.	11/5/1992	Tornado	F0	0	0	$0	$0
HILLSBOROUGH CO.	1/8/1993	Tornado	F0	0	0	$107,223	$0
RUSKIN	7/13/1999	Tornado	F0	0	0	$45,930	$0
BRANDON	7/14/2000	Tornado	F0	0	0	$0	$0
THONOTOSASS A	6/15/2001	Tornado	F0	0	0	$34,411	$0
THONOTOSASS A	7/8/2003	Tornado	F1	0	0	$33,307	$0
BRANDON	7/9/2005	Tornado	F0	0	0	$62,695	$0
MANGO	7/9/2005	Tornado	F0	0	0	$0	$0
HARNEY	5/13/2009	Tornado	EF0	0	0	$107,407	$0
CARROLLWOOD	6/30/2009	Tornado	EF0	0	0	$28,398	$0
RIVERVIEW	7/1/2009	Tornado	EF0	0	0	$7,110	$0
ROCKY CREEK	7/27/2009	Tornado	EF0	0	0	$0	$0
CITRUS PARK	3/31/2011	Tornado	EF0	0	0	$0	$0
CHAPMAN	3/31/2011	Tornado	EF0	0	0	$27,410	$0
RATTLESNAKE	3/31/2011	Tornado	EF1	0	0	$3,111,035	$0
SUN CITY CENTER	6/6/2013	Tornado	EF0	0	0	$47,217	$0
ROCKY CREEK	3/6/2014	Tornado	EF0	0	0	$0	$0
BOYETTE	5/30/2014	Tornado	EF0	0	0	$64,368	$0
FORT LONESOME	2/24/2016	Tornado	EF0	0	0	$0	$0
GULF CITY	4/23/2018	Tornado	EF0	0	0	$61,119	$0
HARNEY	6/29/2018	Tornado	EF0	0	0	$121,537	$0
BALM	12/9/2018	Tornado	EF1	0	0	$12,191	$0
KNIGHTS	12/16/2020	Tornado	EF1	0	0	$35,329	$0
SWEETWATER CREEK	5/31/2022	Tornado	EFU	0	0	$20,670	$0
*Damage is reported in 2023 dollars. All damage may not have been reported.							

Probability of Future Occurrences of Tornado

Based on the number of recorded occurrences over the period of record discussed above, Hillsborough County is likely to experience more than one tornado warning each year. Most tornadoes in Florida are likely to be of lower intensity, usually between an EF-0 and an EF-2. Tornadoes are most likely in Florida in the spring and between 4 pm and 9 pm.

Potential Effects of Climate Change on Tornadoes

Higher temperatures and humidity may increase atmospheric instability associated with the generation of severe thunderstorms and tornadoes. However, vertical wind shear could also decrease, resulting in fewer or weaker severe thunderstorms and tornadoes.[192] However, decreases in vertical wind shear are most likely to occur when convective available potential energy (CAPE) is high in the spring and summer months, which could result in more frequent severe storms. Days with high CAPE are also likely to occur during times of the year with strong low-level wind shear, increasing the likelihood of the most severe storm events, including tornadoes.[193]

There has been an increase in the number of tornado reports over the last 50 years. However, it is believed that this increase is attributed to the technological improvements that allow for better identification and reporting of such storms and increases in population (more observers).

Probability Based on Historical Occurrences

Between 1955 and 2023, there were 146 reported tornados in Hillsborough County. Dividing the number of events by the limited period of record from the NCEI Storm Events Database indicates that there is a probability of approximately two tornado events each year in Hillsborough County.

Table 5.120. NCEI Tornado Reports for Hillsborough County, 1955–2023 [194]

	NCEI Reports	Average per Year
Tornado	146	2.1

Tornado Impact Analysis

All jurisdictions could experience the types of impacts listed below due to tornadoes. Variances in how much damage these storms generate within each community would be dependent upon the magnitude of the tornado and the density and strength of residential and commercial structures.

- Public
    - Injury or death from flying debris
    - Injury or death from tornadoes and not having adequate shelter
    - Car accident
    - Indirect death

---

[192] Seneviratne et al. (2012). *Changes in climate extremes and their impacts on the natural physical environment.* In Field et al. (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation,* p. 159. https://www.ipcc.ch/pdf/special-reports/srex/SREX_Full_Report.pdf., pp. 151–155; National Oceanic and Atmospheric Administration (NOAA) (2013). *Tornadoes, climate variability, and climate change. State of the science fact sheet.* http://nrc.noaa.gov/sites/nrc/Documents/SoS%20Fact%20Sheets/SoS_%20Fact_Sheet_Tornado%20and%20Climate_FINAL_Sept2017.pdf?ver=2017-12-05-115742-360., pp. 1–2. Diffenbaugh, et al. (2013). *Robust increases in severe thunderstorm environments in response to greenhouse forcing.* Proceedings of National Academy of Sciences. doi/10.1073/pnas. 1307758110., http://www.pnas.org/content/110/41/16361.full.

[193] Diffenbaugh et al. (2013), http://www.pnas.org/content/110/41/16361.full., p. 1.

[194] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

- Survivor's guilt if their house was not damaged from a tornado and many neighbors died

- <u>Responders</u>
  - Responding during a tornado can be very dangerous due to strong winds and flying debris
- <u>Continuity of Operations (including continued delivery of services)</u>
  - Tornadoes often cause power outages from wind damage to power lines. They also cause increased public works and public safety expenditures to prepare, respond and recover.
- <u>Property, Facilities, Infrastructure</u>
  - Damage to property, including homes and businesses, can occur from tornadoes. The damage can range from minor roof damage to total structure loss.
  - Damage to critical facilities, such as transformer stations, etc., from fallen trees and limbs, causing a power outage
- <u>Environment</u>
  - Damage to environment from tornadoes
  - There may be severe damage to vegetation in localized areas from a tornado
- <u>Economic Condition</u>
  - Power outages cause lost revenue and lost wages for businesses and employees
- <u>Public Confidence in Each Jurisdiction's Governance</u>
  - Power outages for extended periods give the appearance that the jurisdiction does not know how to restore power

<u>Vulnerability Analysis and Loss Estimation by Jurisdiction</u>

Exposure

Because tornado is a hazard without geographically definable boundaries, spatial analysis of exposure is not possible. Tornados have the potential to affect all buildings and all populations in Hillsborough County.

Tornadoes do not always impact structures but may cause other damage from high wind, falling trees and limbs, and flying debris. Substantial damage could be incurred by government facilities, hospitals, and residential areas. The damage to infrastructure could include lost power, water, sewer, gas, and communications, all leading to hindered emergency response and access to these vital services. This could then lead to increased public health concerns due to poor sanitation, access to clean water, increased susceptibility to foodborne illness, food spoilage, and exposure to hazardous materials. Roadways and bridges could be damaged or blocked due to debris.

People could be impacted by tornadoes in several ways. Wind can cause trees to fall and potentially result in injuries or death, and a tornado can directly damage and destroy buildings and vehicles with occupants inside, as well as create flying windborne debris that can cause serious injuries or loss of life. Mobile homes in the area are particularly at risk due to those structures not offering the same level of protection a single-family, site-built home can provide. Mobile homes, mostly occupied by lower income residents, are some of the most vulnerable populations in Hillsborough County. Populations residing in mobile homes make up a high percentage of fatalities following a tornado, in comparison to traditional site-build houses. Many mobile homes are located in East Hillsborough County, including Zephyrhills, Brandon, Valrico, Thonotosassa, Seffner, Mango, Valrico, Plant City, Progress Village, Riverview, Sun City, and Ruskin. In addition, very few homes in the Tampa Bay area have basements or other underground parts of the dwelling where residents could seek shelter.

National Risk Index (NRI)

FEMA's National Risk Index was used to assess Hillsborough County's vulnerability to tornadoes by census tract. The National Risk Index uses the best available national dataset for tornadoes to estimate annualized frequencies; annualized frequency is calculated by using the historical record of tornado events by census tract. Risk is then calculated utilizing expected annual loss, social vulnerability, and community resilience (the adaptive capacity of a community towards each respective hazard). 63% of the total census tracts in Hillsborough County have a relatively high or very high vulnerability to tornado, with 32% having a relatively moderate vulnerability to tornado. In total, 95% of Hillsborough County could be considered at risk of the impacts of tornadoes.

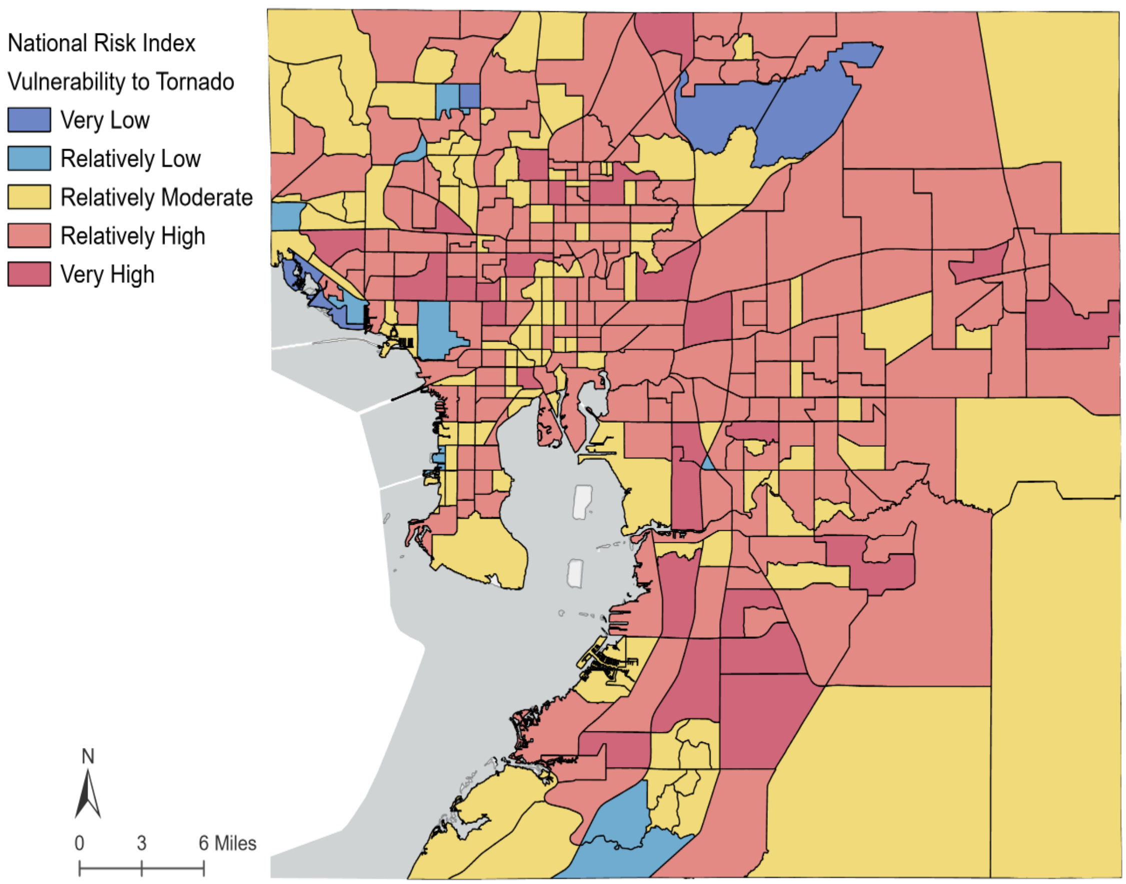


Figure 5.61. NRI tornado risk by census tracts in Hillsborough County[195]

Table 5.121 shows the number of census tracts by jurisdiction and the associated level of risk from tornados, according to the NRI data.

---

[195] https://hazards.fema.gov/nri/

Table 5.121. Census Tracts by Jurisdiction by NRI Classification

Jurisdiction	Census Tracts with Very Low Risk	Census Tracts with Relatively Low Risk	Census Tracts with Relatively Moderate Risk	Census Tracts with Relatively High Risk	Census Tracts with Very High Risk
Hillsborough County (Unincorporated)	5	7	67	113	19
City of Plant City	0	0	1	8	2
City of Tampa	0	3	36	58	6
City of Temple Terrace	0	0	3	5	0
Hillsborough County (Total)	**5**	**10**	**107**	**184**	**27**

Expected annual loss can also be taken from the NRI data (Figure 5.62). Overall, Hillsborough County averages an expected annualized loss per census tract of $200,964, with the highest average expected annual loss occurring in Plant City at $224,299.

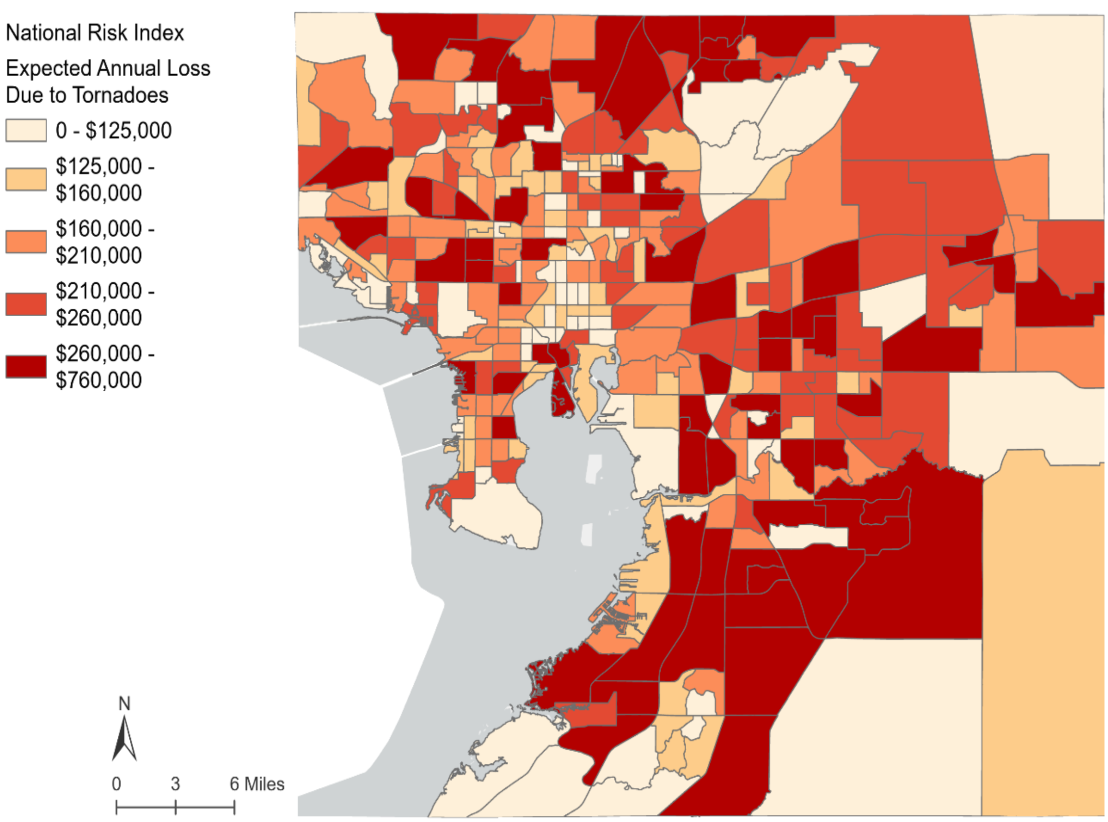


Figure 5.62. NRI expected annual financial loss to tornadoes by census tracts in Hillsborough County[196].

[196] https://hazards.fema.gov/nri/

Average expected annualized losses from tornados in Hillsborough County, by jurisdiction, are summarized in Table 5.122.

Table 5.122. Average Expected Annual Loss Due to Tornado in Hillsborough County, by Jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$43,697,591
City of Plant City	$2,467,291
City of Tampa	$19,000,369
City of Temple Terrace	$1,755,628
Hillsborough County (Total Annualized Loss)	**$66,920,879**

A breakdown of population by jurisdiction within moderate to high risk of exposure to tornado is presented in Table 5.123 with the majority, 98.8%, of the county's population exposed to moderate to high risk of tornado.

Table 5.123. Population by Jurisdiction Exposed to Tornado Risk

Jurisdiction	Total Population	Total Population at Risk	Total % at Risk
Hillsborough County (Unincorporated)	989,745	974,011	98.4%
City of Plant City	48,289	48,289	100%
City of Tampa	382,484	380,249	99.4%
City of Temple Terrace	37,764	37,764	100%
Hillsborough County (Total)	**1,458,282**	**1,440,313**	**98.8%**

Historic Losses

The NCEI Storm Events Database information, presented in the Historical Occurrences section above, also contained property and crop damage dollar amounts, which are shown in Table 5.124 below. The absence of crop damages in the database is likely due to a lack of reporting.

Table 5.124. Tornado Events in Hillsborough County (1955–2023)[197]

Type of Event	Number of Events	Deaths	Injuries	Property Damage (2023 dollars)	Crop Damage (2023 dollars)
Tornado	146	1	122	$103,411,755	$0

[197] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Based on the annual probability of occurrences discussed above and the total damages from the database, average annualized losses have been calculated and are shown in Table 5.125. This number varies from the estimated losses from NRI due to reporting limitations.

Table 5.125. NCEI Tornadoes, 1955–2023

NCEI Storm Event (hazard)	Average Tornadoes per Year	Annualized Property Loss (2023 dollars)	Annualized Crop Loss (2023 dollars)
Tornado	2.1	$1,520,761	$0

Justice40 Climate and Economic Justice Screening Tool (CEJST)

The Justice40 Climate and Economic Justice Screening Tool was paired with the NRI vulnerability data to assess vulnerability to disadvantaged communities within the county. The CEJST planning tool uses burden indicators to determine if the census tract is considered disadvantaged. If the census tract is at or above the threshold for one or more environmental, climate, or other burdens (other burdens being burdens such as housing or transportation-related burdens), and the census tract is above the threshold for an associated socioeconomic burden, then it is considered disadvantaged. The results are shown in Figure 5.63.

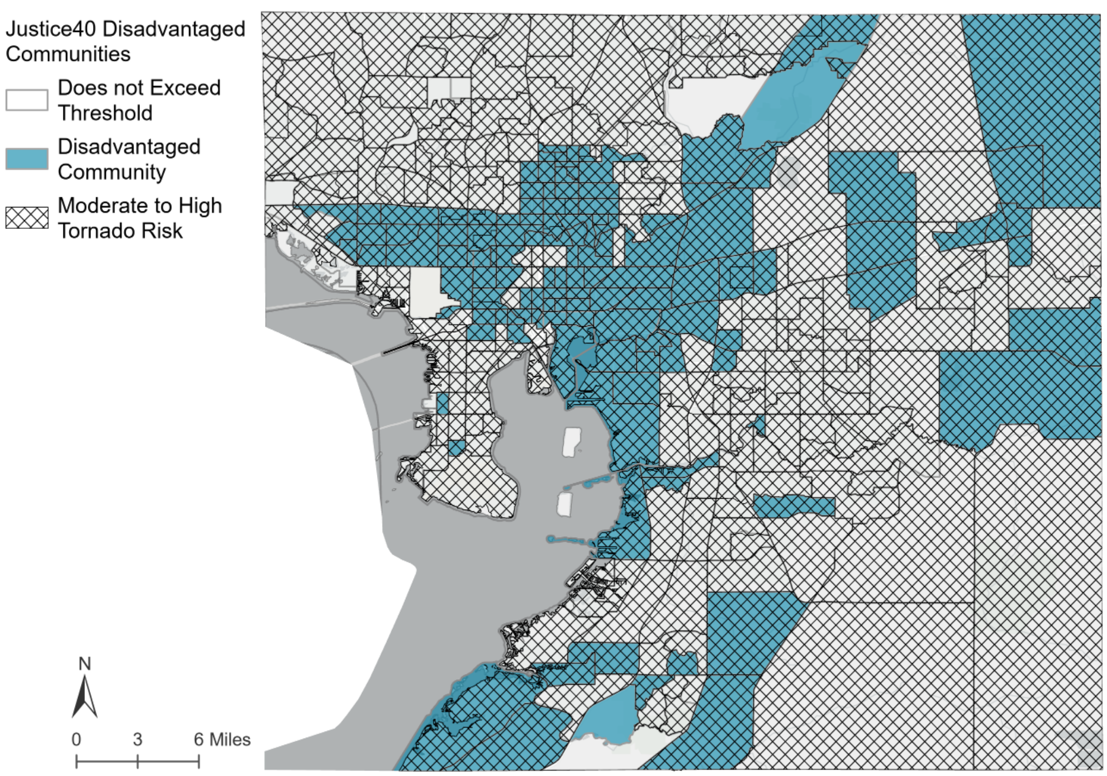


Figure 5.63. Justice40 Disadvantaged Communities Exposed to Tornado Risk[198]

[198] https://screeningtool.geoplatform.gov/en#3/33.47/-97.5

One hundred and twenty of the 131 total disadvantaged communities in Hillsborough, according to the Justice 40 tool, are within moderate to high-risk areas for tornado. These populations will be affected by these potential impacts to a greater degree, as they have higher socioeconomic and environmental burdens throughout their community and fewer resources to respond and recover. Table 5.126 summarizes the total number of disadvantaged communities (by census tract) and the number of those at moderate to high tornado risk, per the NRI, by jurisdiction.

Table 5.126. Count of Disadvantaged Communities Exposed to Tornado Risk by Jurisdiction

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities with Mod/High Tornado Risk
Hillsborough County (Unincorporated)	69	66
City of Plant City	6	5
City of Tampa	54	48
City of Temple Terrace	1	1
Hillsborough County (Total)	**131**	**120**

Vulnerability Analysis of Critical Facilities

Tornadoes can strike anywhere in Hillsborough County; therefore, all the county's critical facilities and community lifelines are equally vulnerable and at risk. However, tornadoes do not always impact structures. The impacts of tornadoes to structures, including critical facilities and community lifelines, are listed above under Exposure.

All the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the six Priority Risk Index (PRI) categories, as described in the Risk Assessment Introduction Section X was assigned a value from 1 to 4 and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0 and the overall vulnerability ranking or high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.7.(

Table 5.127).

Table 5.127. Overall Vulnerability of Hillsborough County to Tornadoes

TORNADO					Overall Vulnerability	
Overview						
A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. Tornado wind speed normally ranges from 65 mph to over 200 mph. The maximum winds in tornadoes are often confined to extremely small areas and vary tremendously over very short distances, even within the funnel itself. Additionally, these storms typically travel around 10 to 20 mph, but can move at more than 60 mph. Tornadoes can occur at any time of the year and at any time of day.					MODERATE	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Likely	Critical	Small	< 6 hrs	Somewhat Concerned	< 6 hrs.	2.7

4.7 Erosion Hazard Profile

Erosion Description

Coastal or riverine erosion is the wearing away of land or the removal of beach or dune sediments by wind, water, wave action, tidal currents, wave currents, or drainage.[199] Waves generated by storms cause erosion, which may take the form of long-term losses of sediment and rocks or merely the temporary redistribution of coastal or riverine sediments. The study of erosion and sediment redistribution is called "coastal morphodynamics," which can also be described as the dynamic interaction between the shoreline, seabed, and water.

The ability of waves to cause erosion depends on several factors, which include:

- Erodibility of the beach, cliff, or rocks;
- Power of the waves to cross the beach;
- Lowering of the beach or shore platform through wave action and
- Nearshore bathymetry.

Waves must be strong enough to remove material from the debris lobe for erosion to occur. Additionally, beaches can help dissipate wave energy on the foreshore and can provide a measure of protection to cliffs, rocks, and other harder formations, as well as any area upland.

Table 5.128 shows most of the contributing factors to erosion. The factors are organized by first, second, and third orders depending on how the erosion occurs.

Table 5.128. Erosion Contribution Factors

First Order	Second Order	Third Order
• Geological structure and lithology: a) Hardness b) Height, etc. c) Fractures/faults d) Wave climate e) Prevailing wave direction f) Sub-aerial climate g) Weathering (frost, etc.) h) Stress relief swelling/ shrinkage i) Water-level change j) Groundwater fluctuations k) Tidal range l) Geomorphology	• Weathering and transport slope processes • Slope hydrology • Vegetation • Cliff foot erosion • Cliff foot sediment accumulation • Resistance of cliff foot sediment to attrition and transport	• Coastal land use • Resource extraction • Coastal management

[199] https://gabionsupply.com/shoreline-defense/#:~:text=Coastal%20erosion%20is%20the%20wearing,of%20coastal%20sediment%20and%20rocks.

As beaches are constantly moving, building up in some locations and eroding in others in response to waves, winds, storms, and relative sea level rise, the issue of erosion requires long-term analysis and planning. The current beach erosion problem has many causes, including the following items:

- The desire by many to live near the sea.
- A historically rapid rise in average ocean levels, now estimated to be rising by 1-1.59 feet by 2050 and 1.7-4.44 feet by 2080 in Hillsborough County, according to the USF conducted Vulnerability Assessment for Hillsborough County utilizing the NOAA 2022 Sea Level Rise Technical Report[200]
- The gradual sinking of coastal land (since the height of the land and the sea are both changing, the "relative sea level rise" is used to describe the rise of the ocean compared to the height of land in a particular location).
- Efforts to reduce erosion have proved to be ineffective and instead increased it.

Some erosion changes are slow, inexorable, and usually gradual. However, the changes on a beach or river can happen overnight, especially during a storm. Even without storms, sediment may be lost to longshore drift (the currents that parallel coastlines), or sediment may be pulled to deeper water and lost to the coastal or riverine system. Coastal erosion may also be caused by the construction and maintenance of navigation inlets. There are over 60 inlets across Florida, many of which have been artificially deepened to accommodate commercial and recreational vessels. Jetties are also installed to prevent sediment from filling in these inlets. A consequence of this practice is that the jetties and inlets interrupt the natural flow of sediment along the beach, leading to an accumulation of sediment in the inlet and at the jetty on one side of the inlet and a loss of sediment to beaches on the other side of the inlet. There are many solutions to the major problem of beach erosion, including:

- <u>Beach re-nourishment</u>: Sand is purposefully deposited onto the beaches by humans; however, there is a very high cost associated with the solution.
- <u>Rebuild rivers</u>: Direct rivers back into places with a lack of sediment with the intention that the rivers will push the sediment back into place.
- <u>Breakwaters, sea walls, and groins</u>: While each location has different requirements that drive specific development and construction, these types of structural projects are intended to interfere with erosion. There are, however, some flaws and issues with these types of projects, as they can trap as much sediment as they deposit with down-drift effects.
- <u>Limits on beach development</u>: Limit, restrict, or prohibit development on the impacted beaches.

Florida has 825 miles of sandy beach coastline fronting the Atlantic Ocean, the Gulf of Mexico, and the Straits of Florida. The beaches in Florida serve many critical purposes. For example, the beaches are home to several species of plants and animals that are dependent upon beaches, dunes, and nearshore waters for all or part of their lives. In fact, there are over 30 rare species within the state that inhabit the beach and adjacent habitats. These species have adapted to living in the beach's harsh environment of salt spray, shifting and infertile sand, bright sunlight, and storms. Additionally,

[200] https://oceanservice.noaa.gov/hazards/sealevelrise/sealevelrise-tech-report.html

people visit Florida beaches at very high rates. Tourists and residents visit the beaches and coastal waters to relax, tan, swim, boat, fish, and dive.[201]

According to the Beach Management Funding Assistance Program (BMFA) within the Florida Department of Environmental Protection (FDEP) (formerly the Beach Erosion Control Program), many stretches of shoreline have been critically eroded. Critically eroded shoreline is defined as,

> *"a segment of the shoreline where natural processes or human activity have caused or contributed to erosion and recession of the beach or dune system to such a degree that upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost. Critically eroded areas may also include peripheral segments or gaps between identified critically eroded areas which, although they may be stable or slightly erosional now, their inclusion is necessary for continuity of management of the coastal system or for the design integrity of adjacent beach management projects."*

Therefore, critically eroded beaches are those in which there is a threat or loss of one of four specific interests: upland development, recreation, wildlife habitat, or important cultural resources. Non-critically eroded beaches are those in which there may be significant erosion conditions, but there is currently no public or private interest threatened.

In Hillsborough County, there is one coastal island, Egmont Key, at the entrance to Tamp Bay. The 2019 Critical Erosion Report from FDEP states that most of the length of Egmont Key (1.6 miles) is critically eroded, threatening recreational interests and important critical resources.[202]

This is shown below in Figure 5.64.

[201] http://www.dep.state.fl.us/beaches/
[202] https://floridadep.gov/sites/default/files/FDEP_Critically%20Eroded%20Beaches_07-2023_0.pdf

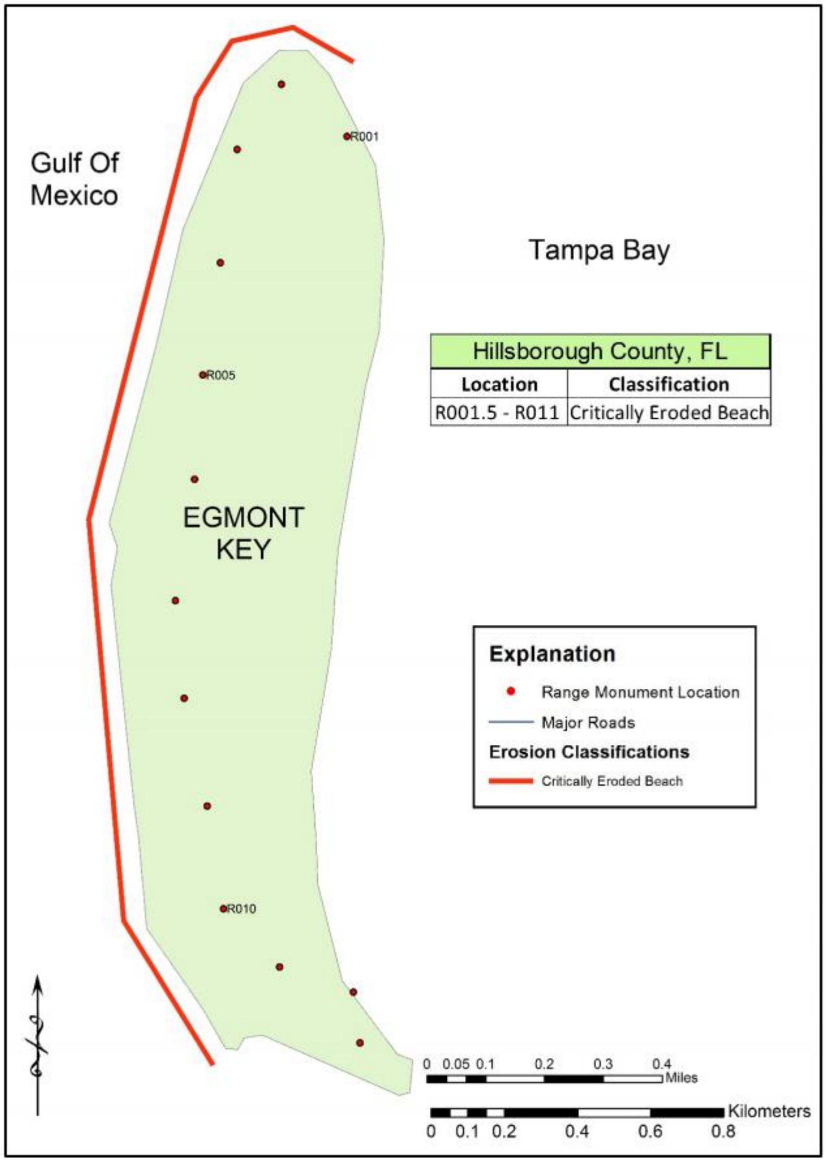


Figure 5.64. Critical Eroded Shoreline, Hillsborough County, 2023 [203]

A St. Petersburg harbor maintenance dredging project in December 2000 provided the material for nourishment of the north end of Egmont Key for the protection of three Spanish-American War-era batteries. Nourishment projects using Egmont Channel maintenance dredging material were also conducted in 2006 and 2015.

According to FDEP, roughly half of the designated critically eroded beaches in the state are currently managed with restoration efforts such as the placement of beach fill material. While these areas are improved from their eroded status, they are kept on the critically eroded list to ensure monitoring and continued eligibility for projects and funding.[204]

---

[203] https://floridadep.gov/sites/default/files/FDEP_Critically%20Eroded%20Beaches_07-2023_0.pdf
[204] https://floridadep.gov/sites/default/files/FDEP_Critically%20Eroded%20Beaches_07-2023_0.pdf

Beach Management Funding Assistance (BMFA) Program

The primary vehicle for implementing the beach management planning recommendations is the Florida Beach Management Funding Assistance Program (BMFA) within FDEP (formerly the Beach Erosion Control Program), a program established to work in concert with local, state, and federal governmental entities to achieve the protection, preservation, and restoration of the coastal sandy beach resources of the state. Under the program, financial assistance in an amount of up to 50% of project costs is available to Florida's county and municipal governments, community development districts, or special taxing districts for shore protection and preservation activities. Eligible activities include beach restoration and nourishment activities, project design and engineering studies, environmental studies and monitoring, inlet management planning, inlet sediment transfer, dune restoration and protection activities, and other beach erosion prevention-related activities consistent with the adopted Strategic Beach Management Plan.

Geographic Areas Affected by Erosion

In Hillsborough County, erosion along Tampa Bay and river shorelines is most noticeable after a significant rain and/or tidal surge event. Although this is a natural effect, shoreline development is at risk when erosion occurs at a rate greater than the natural rate of soil replenishment. The areas of greatest risks of erosion are found along the Hillsborough, Alafia, and Little Manatee Rivers, associated tributaries, and velocity zone areas of the floodplain, as well as the coastal areas in the Apollo Beach Nature Preserve and E.G. Simmons Park.

The Bureau of Beaches and Coastal Systems develops and publishes the Critically Eroded Beaches Report annually. The data from this report is gathered from a set of monitoring locations along the coast throughout the state. Data is collected from each of these stations and then compiled into a GIS database for modeling and analysis. The continual reporting and analysis are combined with historical data to provide detailed records about the status of the state's beaches. Erosion is a constantly changing issue as development continues on the beaches and in the inlets. It can also be instantly changed by a large storm or a hurricane.

The worst erosion in the county is at Egmont Key. The June 2019 Critically Eroded Beaches in Florida Report states that there are 1.6 miles of critically eroded beach at that location. Figure 1, above, depicts the eroded areas of Egmont Key. [205]

According to the Flood Insurance Study for Hillsborough County, the county has 158.3 miles of shoreline that could potentially experience erosion in a storm. In areas where mangrove stands in front of the bay, waves with heights of 3 feet or greater are dissipated within approximately 200 feet of the shoreline.[206]

---

205 https://floridadep.gov/sites/default/files/FDEP_Critically%20Eroded%20Beaches_07-2023_0.pdf

206 Flood Insurance Study, Hillsborough County, Florida and Incorporated Areas, Vol. 1 of 11

Historical Occurrences of Erosion

DEP maintains a database of all the occurrences of erosion in the state, and it has provided high-quality reporting since the inception of the BMFA Program. There are constant cases of beach erosion throughout the state.

The disastrous hurricane seasons of 2004–2005 had a severe impact on the state in terms of erosion, and DEP has published a number of reports about the specific details of these events. A number of these events are listed below in Table 5.129.

Table 5.129. Florida Significant Erosion Contribution Events [207]

Year	Event
1972	Hurricane Agnes
1975	Hurricane Eloise
1979	Hurricanes David and Frederick
1984	Thanksgiving Day Nor'easter
1982	"no-name" storms
1985	Hurricanes Elena and Kate and Tropical Storms Bob and Juan
1992	Hurricane Andrew
1993	Winter storm
1995	Hurricanes Erin and Opal
1998	Hurricanes Earl and Georges
1999	Hurricanes Floyd and Irene
2004	Hurricanes Charley, Frances, Ivan, and Jeanne,
2005	Hurricanes Dennis, Katrina, Ophelia, Rita, and Wilma
2008	Tropical Storm Fay and Hurricane Gustav
2012	Hurricane Isaac and Sandy and Tropical Storm Debby
2016	Hurricanes Hermine and Matthew
2017	Hurricane Irma
2018	Hurricane Michael
2022	Hurricanes Ian and Nicole

In May 2012, during Tropical Storm Debbie, and again in June 2013, during Tropical Storm Andrea, Bayshore Boulevard had water covering both the north and south lanes. In Hillsborough County, frequent wind gusts of up to 51 MPH were measured by the Automated Weather Observing System (AWOS) located at MacDill Air Force Base. Storm total rainfall of greater than 5 inches fell across the county, with the highest report of 11.91 inches at the CoCoRaHS site near Citrus Park. Seventy-four buildings sustained damage, with six being completely destroyed, and damage to public buildings totaled $449,000. The tide gauge at Old Port Tampa measured a peak tide of 5.42 feet. Subtracting the predicted astronomical tide, the highest storm surge was calculated as 3.97 feet late in the evening of the 25th. The tide gauge at McKay Bay measured a peak tide of 4.43 feet MLLW. Subtracting the predicted astronomical tide, the highest storm surge was calculated as 4.07 feet. Storm surge water flooded Bay Shore Boulevard for three days.

[207] https://floridadep.gov/sites/default/files/SBMP-Introduction_0.pdf

Based on the Flood Insurance Study for Hillsborough County published by the Federal Emergency Management Agency, the county has 17 major watershed basins with no less than 14 riverine systems that account for more than 700 linear miles of floodway that are potentially susceptible to erosion. No severe erosion has occurred within riverine systems due to any one hurricane.[208]

Probability of Future Occurrences of Erosion

The coastal and riverine areas in Hillsborough County will continue to shift and change over time, especially when faced with the current levels of development. This hazard will continue to affect the county, and there is considerable work being done regularly to mitigate potential damages. DEP maintains an active and ongoing program to study this issue and mitigate damages as much as possible. This hazard will continue to affect the county in the future, especially in conjunction with hurricanes, winter storms, and coastal flooding, considering the likelihood of future development in coastal and riverine areas. Erosion has occurred in Hillsborough County since the start of such record keeping. Additionally, flooding will continue to occur, whether it is due to tropical storms, sea level rise, or both. While it would be best to keep areas prone to erosion undeveloped, this is unlikely, and future development in coastal and riverine areas will increase the probability of erosion affecting developed areas. At some level, erosion is occurring every day. For erosion amplifying storm events, based on the history in Table 5.129, 19 such events have occurred in the past 50 years. Even if storms do not increase in number, this represents a 38% chance of an erosion-amplifying event happening in any given year. Based on historical information, this hazard was determined to have a probability level of Highly Likely. As erosion is a continual process with higher intensity and frequency, storms combined with sea level rise create a higher magnitude of impacts from erosion, and this probability is expected to increase.

Potential Effects of Climate Change on Erosion

Both increased rates of global eustatic sea level rise and increased frequency of higher intensity hurricanes may affect coastal erosion. As described in the *Flood Hazard Profile*, continued atmospheric warming could increase rates of global eustatic sea level rise. In the absence of offsetting changes in natural sediment supply, sand beaches will erode more rapidly as the rate of sea level rise increases. If the frequency of higher-intensity hurricanes does increase (see *Tropical Cyclone Hazard Profile*), events will occur more often when sand eroded from beaches is transported to depths from which it will not be moved back on shore by swell waves. More frequent Category 4 and 5 hurricanes also would increase the incidence of dune erosion and overwash where beach sediments are carried landward. These processes can damage structures, but where structures are not present, the overwash process can permit a beach and dune system to migrate landward.[209] Rising sea levels also threaten the survival of coastal wetlands when natural rates of sediment accretion and elevation increase are not fast enough to offset the rising sea.[210] However, wetlands may also be able to migrate landward with adequate sediment influx if there are no physical barriers to their movement.

---

[208] Flood Insurance Study, Hillsborough County, Florida and Incorporated Areas, Vol. 1 of 5
[209] *http://papers.risingsea.net/coastal-sensitivity-to-sea-level-rise-3-ocean-coasts.html; http://downloads.globalchange.gov/sap/sap4-1/sap4-1-final-report-all.pdf.)*
[210] *http://papers.risingsea.net/coastal-sensitivity-to-sea-level-rise-4-wetland-accretion.html*

Erosion Impact Analysis

The City of Tampa and the unincorporated coastline could feel high impacts due to coastal erosion. The county as a whole could suffer moderate impacts, and the level of impacts would be much lower for Temple Terrace and Plant City due to their locations further inland. The following is a list of potential impacts due to erosion.

- Public
    - May lose property
    - May lose sandy beaches, dunes, or mangroves, which could lead to storm surge flooding
    - Sandy beaches may have to close
- Responders
    - N/A
- Continuity of Operations (including continued delivery of services)
    - Businesses, critical infrastructure, government buildings, etc., may have operations hindered if erosion leads to damage to surrounding Infrastructure.
    - Operations may be hindered if roads to the structures are damaged from erosion
    - Continuity of transportation network may be interrupted because of erosion damage to roads
- Property, Facilities, Infrastructure
    - Structures may be damaged when erosion damages the ground
- Environment
    - Coastal and riverine areas, marshes, mangroves, sandy beaches, etc., may be severely damaged from erosion, which is a habitat for many species of plants and animals
    - If large portions of riverine and coastal areas and dunes are washed away from erosion, storm surge from the next storm could reach homes, businesses, roads, etc.
- Economic Condition
    - N/A
- Public's Confidence in Jurisdiction's Governance
    - If damage from erosion, such as damage to roads, is not quickly repaired, then the public may be frustrated with the jurisdiction's governance

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

The impact of coastal erosion will occur in two areas: coastal areas and riverine areas. In the coastal areas, significant impacts have been recognized at two county parks: the Apollo Beach Nature Preserve and E.G. Simmons. Each of these parks is part of a major reconstruction project to address previous natural impacts, including erosion. Riverine areas are at risk of the impact of erosion, with communities in unincorporated areas of East Hillsborough County, including Plant City, Zephyrhills, and Thonotosassa, at high risk. Communities in the southeast portion of Hillsborough County, including Apollo Beach, Riverview, and Gibsonton, are at risk as well. Erosion principally affects structures by deteriorating the structural integrity of buildings and undermining the foundation or associated pilings/piers; however, most areas experiencing erosion are undeveloped edges for the bay and rivers. Exposure is primarily environmental.

Historical Losses

After the 2004 tropical hurricane events, the Hillsborough County Parks, Recreation, and Conservation Department requested funding to assist with minor repairs (1,700 cubic yards of sand) associated with shore restoration of a park. Such minor losses could be expected in the future.

The National Risk Index data does not provide any information about erosion risk and, therefore, cannot be used to provide further analysis of Hillsborough County's vulnerability to erosion.

Egmont Key National Wildlife Refuge is the only area identified as critically eroded in Hillsborough County by the FDEP, which does not exceed the disadvantaged community threshold in the Justice40 Climate and Economic Justice Screening Tool (CEJST). Thus, the area of highest vulnerability to erosion is not found in a disadvantaged community. Egmont Key is largely undeveloped. Dollar losses due to erosion are considered minimal and are primarily environmental damages and the cost of shoreline restoration. There is insufficient data to quantify losses for Hillsborough County, Plant City, Tampa, or Temple Terrace.

Vulnerability Analysis and Loss Estimation of Critical Facilities

There are no known critical facilities or community lifelines currently at risk of erosion.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.7 (

Table 5.130).

Table 5.130. Overall Vulnerability to Erosion for Hillsborough County

<table>
<tr><th colspan="6">EROSION</th><th rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="6">Overview</th></tr>
<tr><td colspan="6">Erosion is the wearing away of land or the removal of beach or dune sediments by wind, water, wave action, tidal currents, wave currents, or drainage. Waves generated by storms cause erosion, which may take the form of long-term losses of sediment and rocks or merely the temporary redistribution of coastal or riverine sediments.</td><td>MODERATE</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Highly Likely</td><td>Limited</td><td>Moderate</td><td>> 24 hrs</td><td>Somewhat Concerned</td><td>< 1 week</td><td>2.7</td></tr>
</table>

4.8 Extreme Heat Hazard Profile

Extreme Heat Description

Extreme heat is defined as an extended period where the temperature and relative humidity combine for a dangerous heat index.[211] Extreme heat events occur across the state each year. This profile focuses on extreme heat's impact to the population's, while the drought profile focuses more on environmental impacts.

Heat Index

The Heat Index shown in Figure 5.65 below, provided by the NWS, measures how hot the temperature feels when humidity is factored in with the actual temperature. The red area indicates extreme danger. When the heat index reaches 105° F, or higher, conditions can become dangerous for both people and pets. The NWS will begin to issue alerts when the heat index is expected to exceed this threshold of 105° F or higher for at least two consecutive days.[212]

NWS Heat Index — Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Figure 5.65. Heat Index

Advisories

The National Weather Service issues the following heat-related advisories:

- Excessive Heat Outlook: issued when the potential exists for an excessive heat event within the next 3 to 7 days.

[211] https://www.weather.gov/safety/heat-index
[212] https://emergency.ufl.edu/storm-ready/weather-hazards/extreme-heat/

- Heat Advisory: issued within 12 hours of the onset of extremely dangerous heat conditions, generally when heat index temperature is expected to be 100° F or higher for at least 2 days and night time air temperature will not drop below 75° F.
- Excessive Heat Watch: issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours.
- Excessive Heat Warning: issued within 12 hours of when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and nighttime air temperatures will not drop below 75° F.

Heat-Related Illness

Extreme heat can cause death by making it difficult for a body to cool itself. Heat illnesses occur when the body temperature increases too quickly to cool itself or when too much fluid or salt is lost through dehydration or sweating. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Below are the different types of heat-related illnesses.[213]

Heat Cramps

Heat Cramps are the first sign of a heat illness and can lead to more serious illnesses. Symptoms of heat cramps include muscular pains and spasms, usually in the legs or abdomen.

Heat Exhaustion

Heat exhaustion follows heat cramps if the body cannot cool itself. Symptoms include heavy sweating, weakness, cool, pale, clammy skin, a fast and weak pulse, dizziness, nausea or vomiting, and fainting.

Heat Stroke

Heat stroke usually occurs when the signs of heat exhaustion are ignored. It can be life-threatening. Signs of heat stroke include extremely high body temperature, red skin, changes in consciousness, rapid and weak pulse, rapid shallow breathing, confusion, vomiting, and seizures. This occurs because the body becomes overwhelmed by heat and begins to stop functioning. There are two types of heat stroke: classical and exertional. Classical heat stroke occurs when an individual cannot maintain thermal equilibrium due to medication, injury, chronic illness, or age. Exertional heat stroke occurs when young and healthy individuals are engaged in strenuous activity in hot and humid weather.

Additionally, other chronic illnesses may become exacerbated by heat-related illnesses. For example, those with cardiovascular disease and other heart conditions may not be able to tolerate the increased cardiac output associated with heat illnesses. People with mental health disorders and certain behavioral disorders, such as substance abuse, are at higher risk for morbidity and mortality during extreme heat events. Those with respiratory diseases and Type I and II diabetes are also at higher risk for morbidity and mortality with increased heat exposure.[214]

---

[213] https://www.weather.gov/safety/heat-illness
[214] http://flbrace.org/images/docs/heat-profile.pdf

Geographic Areas Affected by Extreme Heat

Due to the subtropical climate of Florida, the entire state has historically been vulnerable to extreme heat events. Because of the close proximity of large bodies of water, Florida typically experiences fewer days when the temperature reaches 100°F or greater than other states. However, the proximity to large bodies of water also increases the humidity, which decreases the body's ability to dissipate the heat.

Additionally, the expansion of urban development in large cities around the state has increased the magnitude of the urban heat island effect. A heat island occurs when concrete, asphalt, and heat-absorbing buildings replace the natural environment.[215]

Figure 5.66 shows the average number of days with temperatures above 95 degrees each year. This map shows that Hillsborough County experiences between 5 and 28 days of weather above 95 degrees each year.

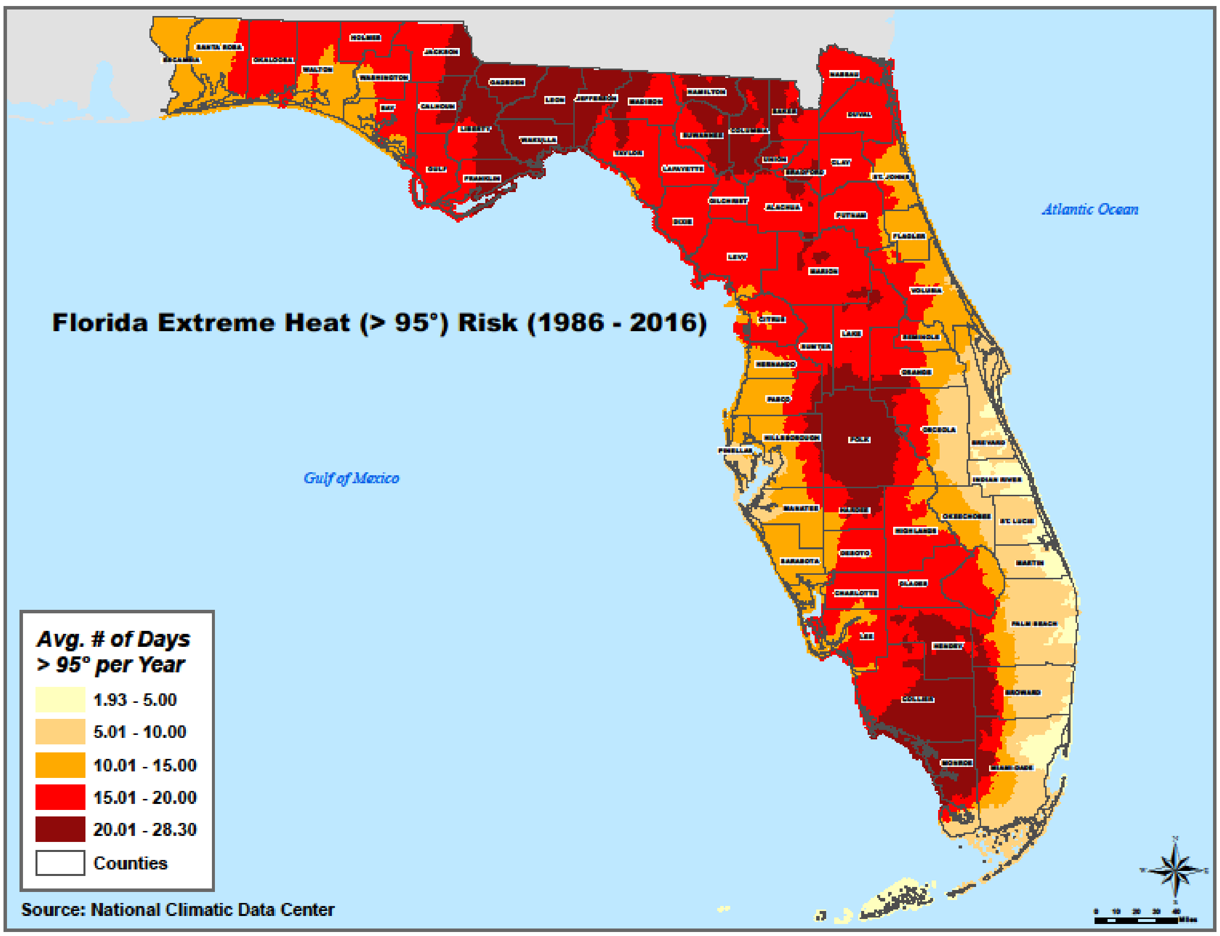


Figure 5.66. Florida Extreme Heat (>95 degrees) Risk, 1986–2016

[215] http://flbrace.org/images/docs/heat-profile.pdf

Extreme heat events typically impact a large area and cannot be defined by geographic or political boundaries. All of Hillsborough County is susceptible to extreme heat conditions. However, the eastern portion of the county, including Plant City, is more likely to experience a higher number of days above 95-degree weather due to its location further inland.

Historical Occurrences of Extreme Heat

Florida is known for its high humidity and heat, which combine to affect its population. However, the NCEI Storm Events Database has no record of extreme heat events reported in Hillsborough County from 1996 to October 2023.[216]

Table 5.131 lists various significant extreme heat incidents that have occurred in the state of Florida. Similar events are also likely in Hillsborough County.

Table 5.131. Significant Extreme Heat Occurrences in Hillsborough County

Date	Description
June 1998	Several long stretches of record-breaking high temperatures, including in Melbourne, Orlando, and Daytona Beach. Temperatures resulted in 1 death.
July 2000	July was the hottest month that had been recorded in northwest Florida. Several cities had multiple days of 100 degrees or higher, including Pensacola, Milton, and Niceville.[217]
August 2008	On August 8, heat advisories were issued in Santa Rosa, Escambia, and Okaloosa Counties for high temperatures and humidities. The heat index values were between 110 and 115 degrees.[218]
July 2010	On July 28, a heat wave began in Florida's panhandle. Above normal temperatures and high humidity produced a heat index above 110 degrees Fahrenheit in Dixie, Franklin, Jackson, Taylor, Leon, and Bay Counties. Heat index values exceeded 115 degrees in a few locations on occasion.[219]
November 2011	In mid-November in South Florida, there was unseasonably warm and humid weather, with heat index values in the mid to upper 80 degrees.[220]
July 2016	Seven cities from across Florida reported their hottest July on record.[221]
August 2023	Excessive heat warning is issued in parts of Hillsborough County, including the city of Tampa. Feels like temperature reached 113 degrees or higher. [222]

[216] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Excessive+Heat&eventType=%28Z%29+Heat&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA
[217] https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=348150
[218] https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=54001
[219] https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=253232
[220] https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=354723
[221] https://weather.com/news/weather/news/record-warm-south-july-2016
[222] https://www.wfla.com/weather/forecast/heat-advisory-again-limited-afternoon-storms/

As stated above, NOAA tracks deaths related to weather events by state. According to their data for Florida from 1995 to 2023, 1 person died from extreme heat in 1995, 1997, 2003, 2006, 2010, and 2022; 2 people died in 2009; and 4 people died in 1998.[223] These numbers are derived from reported incidents and likely significantly under-report deaths related to heat.

Table 5.132 lists the history of maximum daily temperatures over 95 degrees in Hillsborough County based on the NCEI Climate Data Online collection of Local Climatological Data from 2010 to 2023.[224] Data is available for one location at Tampa International Airport that records daily maximum temperatures. Its location is shown in Figure 5.67.

Table 5.132. Extended Periods of Maximum Daily Temperatures over 95°F in Hillsborough County, 2010–2023

Tampa International Airport		
Consecutive Days	**Begin Date**	**End Date**
Maximum Temperature >= 95°F		
6	7/17/2010	7/22/2010
5	5/16/2017	5/20/2017
3	6/23/2010	6/25/1010
3	6/21/2011	6/23/2011
3	5/24/2012	5/26/2012
3	9/9/2016	9/11/2016
3	8/21/2017	8/23/2017
3	9/10/2019	9/12/2019
2	6/26/2020	6/27/2020
2	7/16/2020	7/17/2020
3	9/4/2020	9/6/2020
3	7/15/2021	7/17/2021
5	7/22/2021	7/26/2021
4	6/16/2022	6/19/2022
4	7/28/2022	7/31/2022
4	8/04/2022	8/07/2022
9	8/8/2023	8/16/2023
5	8/21/2023	8/25/2023

[223] http://www.nws.noaa.gov/om/hazstats.shtml#
[224] https://www.ncdc.noaa.gov/cdo-web/

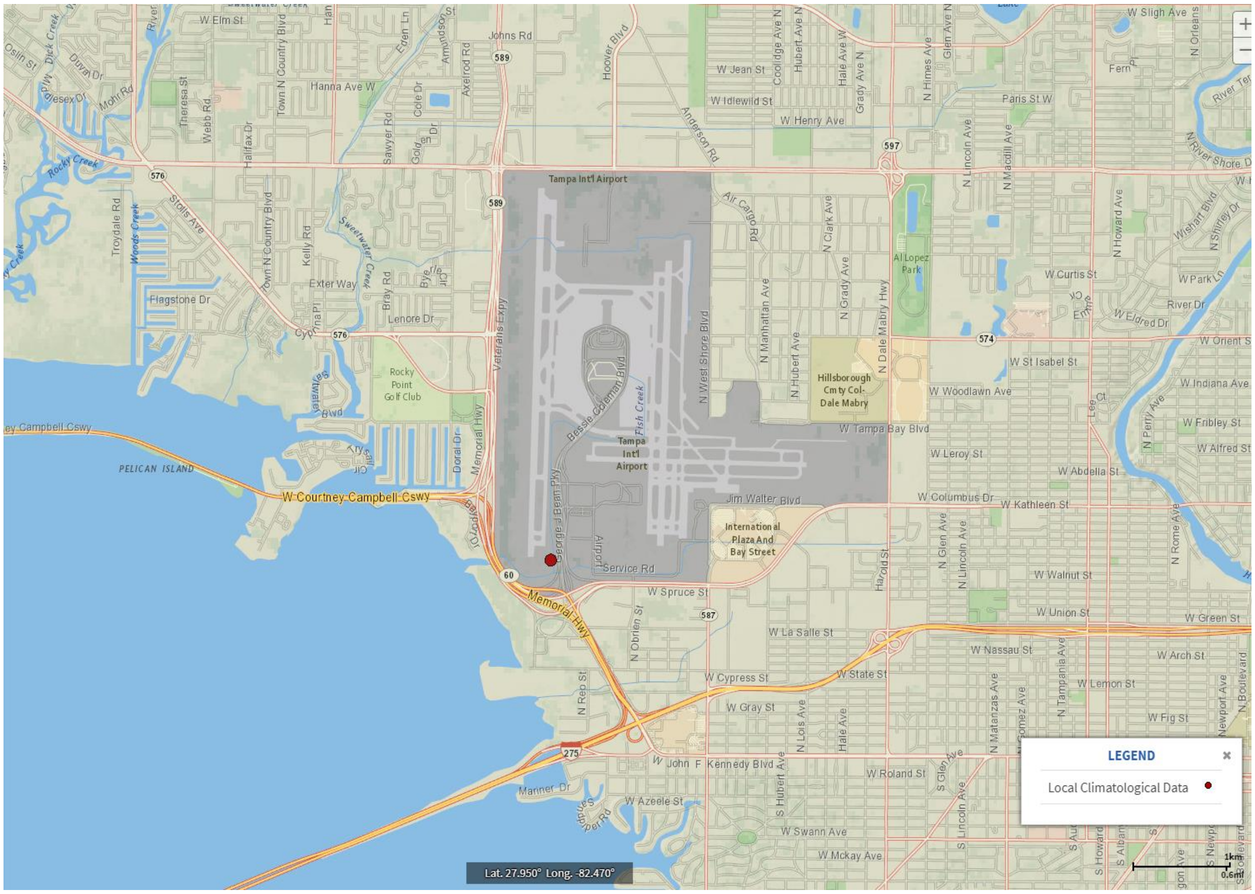


Figure 5.67. NCEI Climate Data Online Local Climatological Data Station Locations in Hillsborough County

Probability of Future Occurrences of Extreme Heat

Extreme heat events can occur throughout the year but typically occurs in the summer between the months of June and September. As shown previously in Figure 5.67, Hillsborough County is likely to experience between 5 and 28 days of temperatures above 95 degrees each year, and incidents of extreme heat are expected to continue in the county.

Potential Effects of Climate Change on Extreme Heat

According to the IPCC's 5th National Climate Assessment, global average temperatures over the past decade (2012–2021) were close to 2°F warmer than the preindustrial period (1850–1899). [225] This warming has been accompanied by several large-scale changes including: loss of glaciers, ice sheet mass, and sea ice; ocean warming, acidification, and deoxygenation; increases in ocean heat content and marine heatwaves; increases in atmospheric humidity; shifting rainfall patterns and more frequent heavy precipitation; seasonal shifts including shorter winters and earlier spring and summer seasons; and changes in the biosphere (such as land and ocean species shifting poleward).

[225] https://nca2023.globalchange.gov/downloads/NCA5_Ch2_Climate-Trends.pdf

Temperatures in the contiguous United States have risen by 2.5°F since 1970, compared to a global temperature rise of around 1.7°F over the same period.[226] Figure 5.68 shows projected temperature changes in the United States.

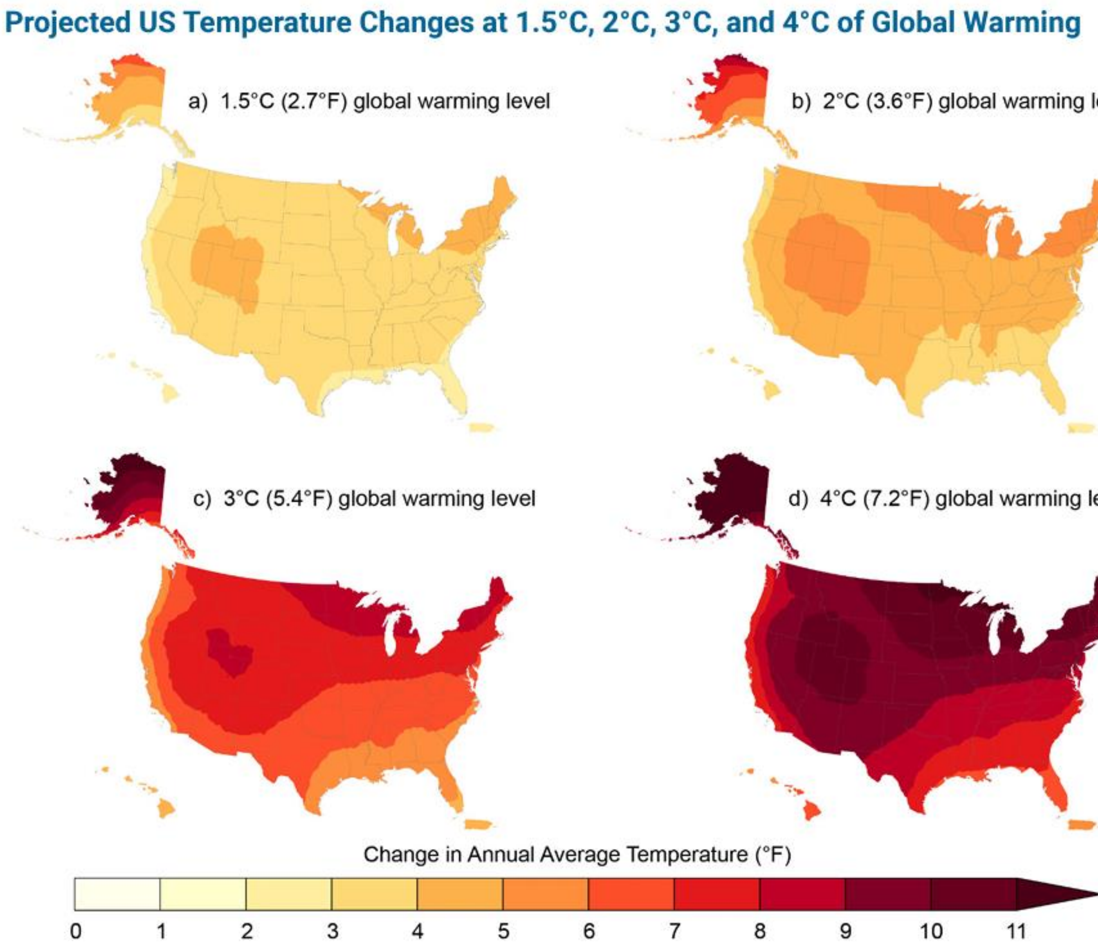


Figure 5.68. Projected Temperature Change due to Climate Change in the US

FEMA's Climate Mapping For Resilience and Adaptation (CMRA) tool projects annual days with maximum temperatures > 90°F, >95°F, and >100°F along with the annual highest maximum temperature averaged over a 5-day period for Hillsborough County. These projections use a lower emission scenario and a higher emission scenario and are projected for early century (2015-2044), mid century (2035-2064), and late century (2070-2099).

By the early century, annual days with a maximum temperature > 95°F are projected to increase by 25.6 days in a lower emission scenario and by 30.3 days in a higher emission scenario compared to current conditions (30.3 days and 35 days respectively). By the late century, annual days with temperature > 95°F are projected to have increased by 67 days in a lower emission scenario and 126

[226]https://nca2023.globalchange.gov/downloads/NCA5_Ch2_Climate-Trends.pdf

days in a higher emission scenario compared to current conditions (71.7 days and 130.8 days respectively).

Similarly, by early century the annual highest maximum temperature averaged over a 5-day period is projected to increase by 2.1 degrees in a lower emission scenario and 2.4 degrees in a higher emission scenario compared to current conditions (96.3°F and 96.6°F respectively). By late century, the annual highest maximum temperature averaged over a 5-day period is projected to increase by 4.2 degrees in a lower emission scenario and 7.5 degrees in a higher emission scenario compared to current conditions (98.4°F and 101.7°F respectively). Figure 5.69 shows these projected changes within Hillsborough County.

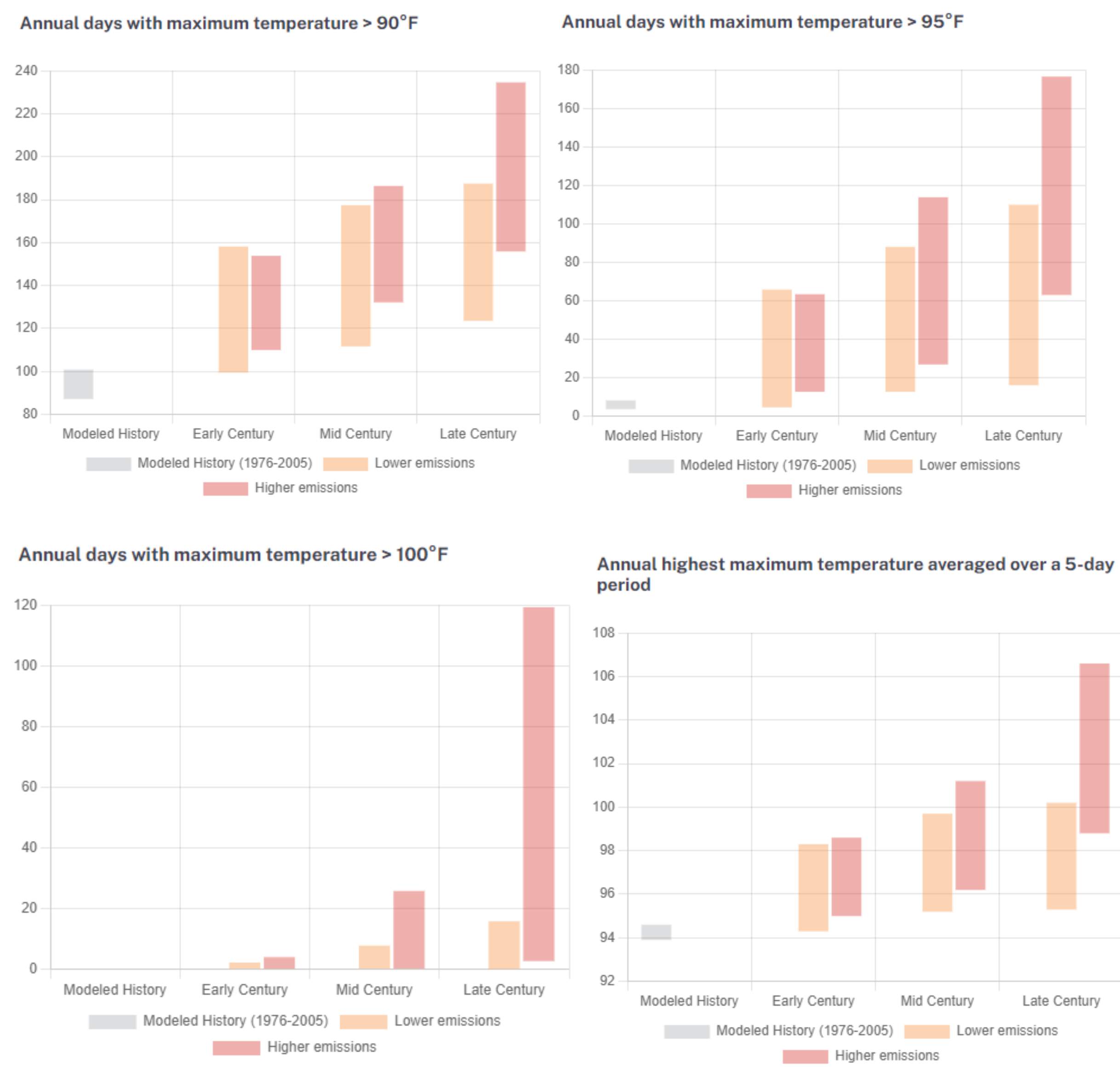


Figure 5.69. CMRA Climate Projections for Increasing Temperature

Based on historical information, this hazard was determined to have a probability level of likely (10 to 100% annual probability).

Extreme Heat Impact Analysis

All jurisdictions could receive the impacts listed below due to extreme heat. Portions of these communities with high concentrations of senior residents and very young individuals could be the most at risk.

- Public
    - Injury or death from overexposure, especially to infants, children, the elderly, those who are overweight, those with chronic illnesses, and those who take certain medications
- Responders
    - Injury or death from overexertion in heat
- Continuity of Operations (including continued delivery of services)
    - Not likely to impact continuity of operations
- Property, Facilities, Infrastructure
    - Less efficient cooling systems or systems that must run constantly to cool a building effectively
- Environment
    - Faster evaporation
    - Damage to green spaces and agricultural lands
    - Death of plants and animals
- Economic Condition
    - Crop damage or loss
    - Increased cooling costs
- Public Confidence in Each Jurisdiction’s Governance
    - If people become ill or die from exposure to extreme heat, the public may believe the government is not doing all that it can to help those in need, whether or not a cooling shelter was opened

Vulnerability Analysis and Loss Estimation by Jurisdiction

Historical Losses

Records of historic losses due to extreme heat are not available.

Exposure

Extreme heat usually does not cause significant damage to the built environment. Although structures are less vulnerable to extreme heat, the areas or regions in which the structures are located are susceptible to extreme heat. The efficiency at which a building operates may be affected (i.e., added load to building cooling systems) if the building is in an area vulnerable to extreme heat.

Extreme heat primarily affects the human population. Extreme heat can ultimately cause death, and most heat disorders occur because the victim has been overexposed to heat or has over-exercised for their age and physical condition. Specific high-risk groups typically experience a disproportionate number of health impacts from extreme heat conditions, including low-income, homeless, sick, elderly, individuals under the influence of drugs or alcohol, and special needs populations who have mobility restrictions, are oxygen dependent, or have mental impairments.

Age does not always equal vulnerability; however, it is a good proxy measure for vulnerability, and a large population is 65 years or older. Those at greatest risk of death in extreme heat conditions are urban-dwelling elderly without access to an airconditioned environment. For example, an elderly person who resides in a high-rise building may have difficulty evacuating following a power outage during a natural disaster, exposing them to this high-risk environment. Elderly populations are concentrated in the Sun City in the south portion of the county and then in the Egypt Lake-Leto and Town' n' Country communities of West Hillsborough County.

Those with special needs are scattered throughout the county. High concentrations of special needs populations residing along the east portion of Interstate 275 from downtown Tampa north to Bearss Avenue.

Heat exposure refers to heightened temperature intensity and spatial distribution, including other factors that can elevate heat conditions. Impervious surface area and lack of tree canopies are two factors that contribute to extreme heat. To better capture heat exposure in Hillsborough County, Impervious Surface and the National Integrated Heat Health Information System's Heat Severity Index were analyzed throughout the county. Impervious Surfaces were downloaded from the NOAA land cover raster for the region. If a surface is impervious (roads, buildings, pavements, etc.) it reflects and retains heat increasing the temperature of the surrounding area and increasing the heat island effect. Figure 5.70 below shows the impervious surfaces in Hillsborough County.

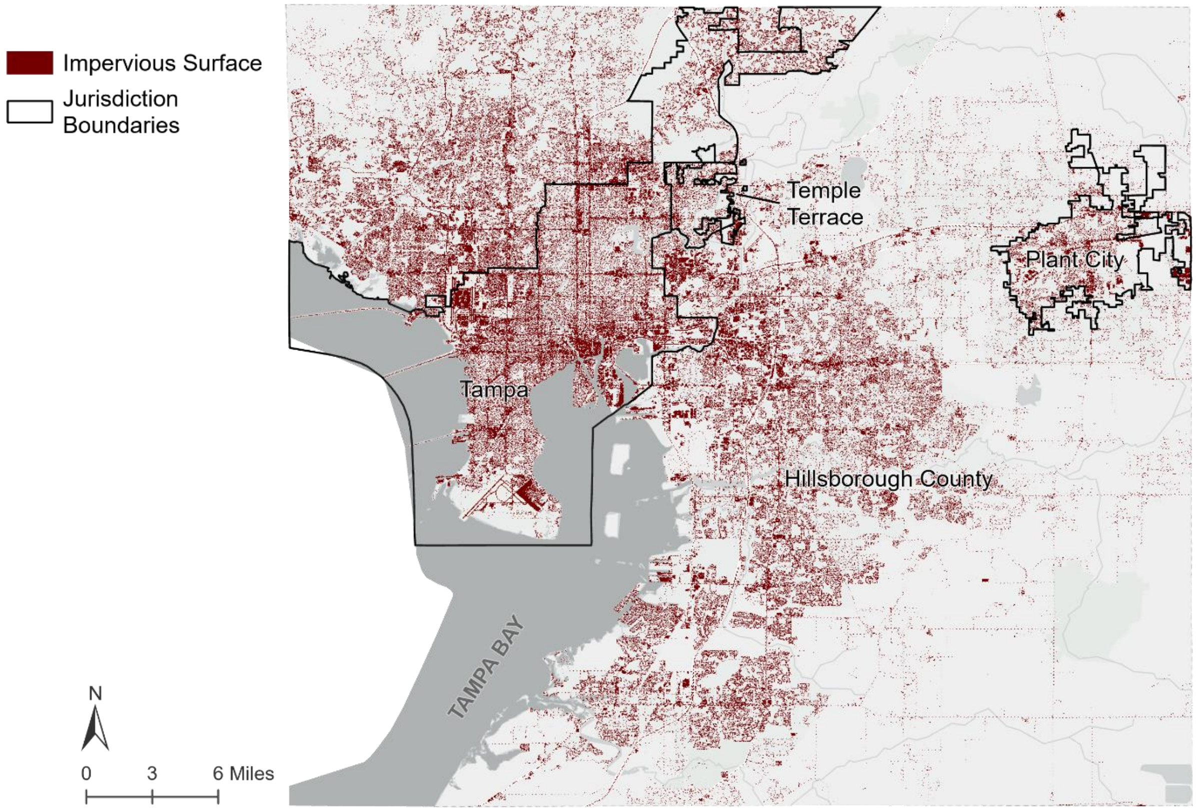


Figure 5.70. Impervious Surfaces in Hillsborough County[227]

The City of Tampa has the highest concentration of impervious surfaces and has a higher exposure to extreme heat based on its urban environment. Similarly, Plant City and Temple Terrace have high concentrations of impervious surface though not quite as extensive as Tampa. The farther out from the urban environments the less impervious surfaces contributes to extreme heat.

To measure exposure, the heat severity index was used. Instead of measuring the air temperature, the 2021 heat severity index data (Landsat 8 imagery band 10) reports on the ground using a ground-level thermal sensor, which is often much hotter than the air. The raster layer identifies areas of the County that are hotter than the average temperature of that same area. The heat severity index in Hillsborough County is shown in Figure 5.71.

[227] https://coast.noaa.gov/digitalcoast/data/nlcd.html

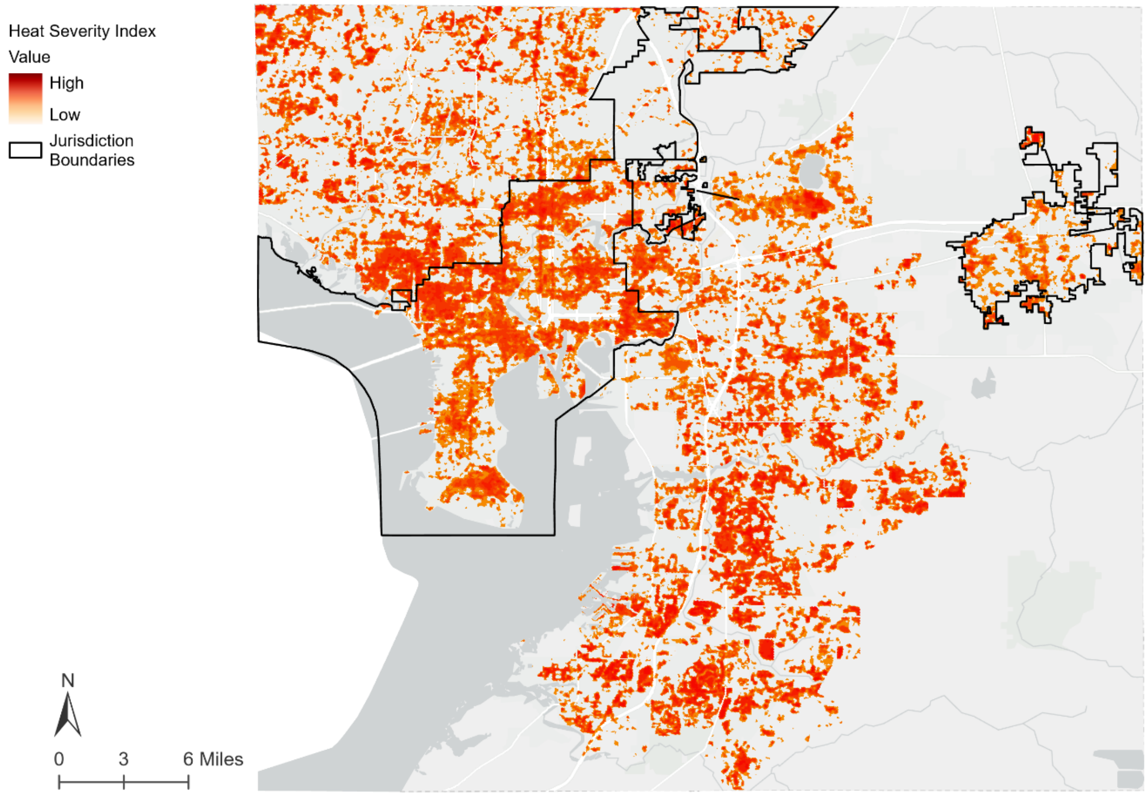


Figure 5.71. Heat Severity Index in Hillsborough County[228]

Similarly to exposure looked at with impervious surfaces, the highest area of heat severity is seen in the City of Tampa, followed by Plant City, and with less concentration of high heat severity in Temple Terrace. These areas shown in Figure 5.71 have higher ground temperatures than surrounding areas.

Green spaces and tree canopy counterbalance the effects of heat exposure is and provide adaptive capacity. Adaptive capacity to heat refers to the ability of a population to mitigate or adapt to exposure using available resources. Tree canopy coverage cools down temperatures by providing shade and relief to the population. Figure 5.72 below shows the tree canopy coverage within the county.

[228] https://www.heat.gov/datasets/TPL::heat-severity-usa-2021/explore

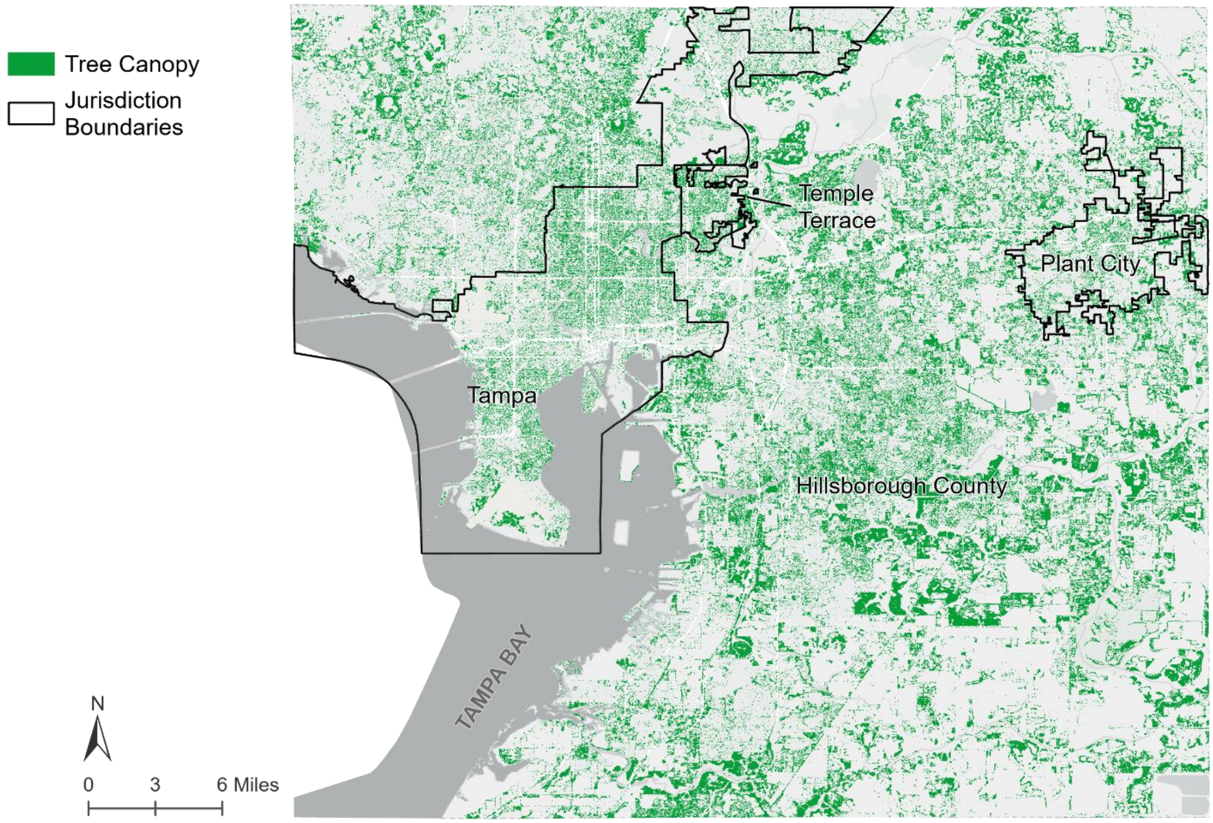


Figure 5.72. Tree Canopy Coverage in Hillsborough County[229]

Tree canopy coverage is for the most part evenly distributed throughout the county. Areas without tree canopy coverage can be seen to have higher levels of the heat severity index in Figure 5.71 although it is not one to one.

Communities that are designated as disadvantaged in the Justice40 Climate and Economic Justice Screening Tool (CEJST) are more vulnerable to the effects of extreme heat. The areas highlighted in blue in Figure 5.73 are more sensitive to the effects of extreme heat.

[229] https://coast.noaa.gov/digitalcoast/data/nlcd.html

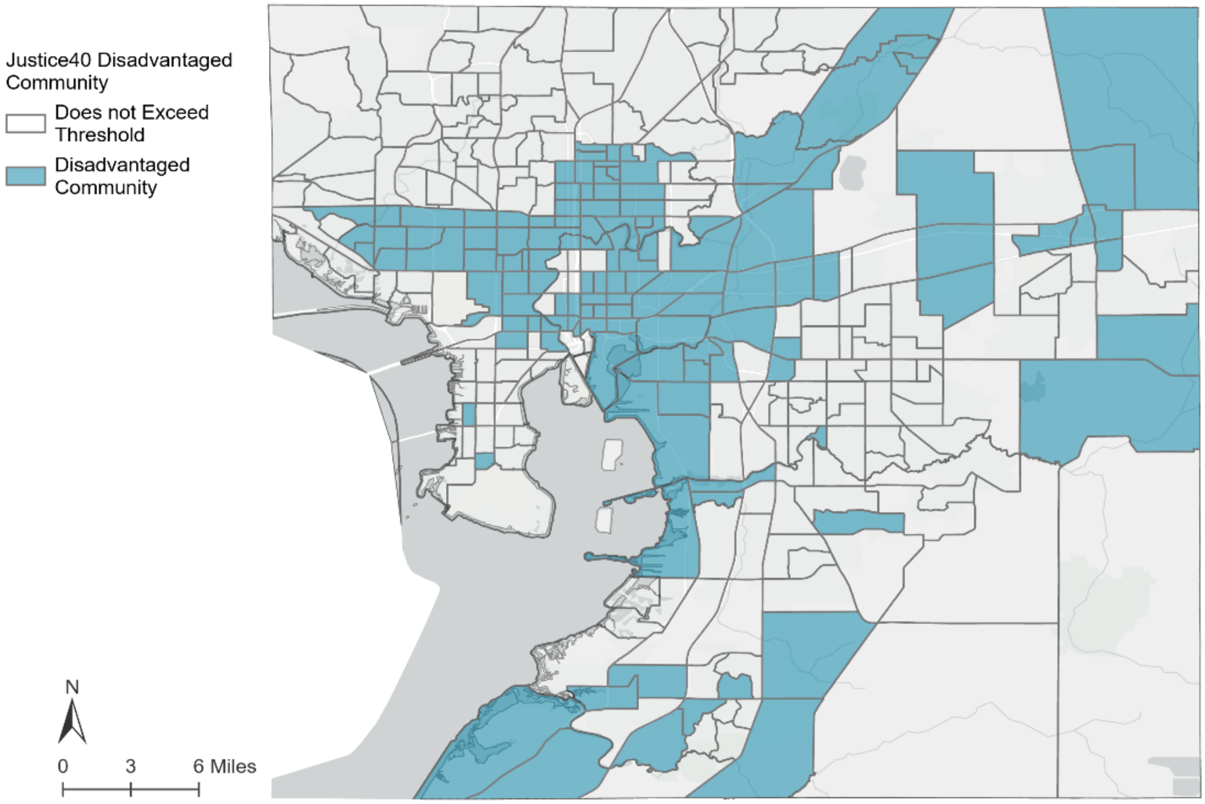


Figure 5.73. Justice40 Disadvantaged Communities in Hillsborough County[230]

Vulnerability Analysis and Loss Estimation of Critical Facilities

Extreme heat events occur across Hillsborough County; therefore, all of the county's critical facilities and community lifelines are at risk. Although, extreme heat usually does not cause direct structural damage to critical facilities and community lifelines, older facilities may experience more issues with cooling equipment. Extreme heat impacts on structures, including critical facilities and community lifelines, are listed above under Exposure.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the six PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.7 (

Table 5.133).

[230] https://screeningtool.geoplatform.gov/en#3/33.47/-97.5

Table 5.133. Overall Vulnerability to Extreme Heat for Hillsborough County

EXTREME HEAT					Overall Vulnerability	
Overview						
Extreme heat is defined as extended period where the temperature and relative humidity combine for a dangerous heat index.					MODERATE	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Likely	Minor	Large	> 24 hrs	Very Concerned	> 1 week	2.7

4.9 Drought Hazard Profile

Drought Description

In healthy ecosystems, **precipitation**—defined as any product of the condensation of atmospheric water vapor that falls from clouds due to gravitational pull—and **evapotranspiration**—defined as the combination of the release of water into the air from the environment (**evaporation**) and from plants (**transpiration**)—are balanced to support life.[231, 232] When precipitation is deficient over an extended period, usually a season or more, this ecosystem may experience a water shortage known as **drought**.

While droughts are a normal and recurring feature of Earth's climate, sometimes they can endanger vegetation, animals, and even people. There are several types of droughts:[233]

- **Meteorological drought** is identified by a level of dryness above what would be considered normal for a region.
- **Agricultural drought** considers conditions that pertain directly to agricultural concerns, such as precipitation shortages and reduced groundwater. The agricultural industry is particularly vulnerable to drought impacts because the crops depend on stored soil water and surface water.
- **Hydrological drought** can be identified by the hydrological impacts caused by extended periods of precipitation deficits. These droughts take longer to occur than meteorological and agricultural droughts.
- **Socioeconomic droughts** occur when the demand for water to produce a specific economic good, such as fish or hydroelectric power, exceeds supply due to a weather-related water shortfall.

Many factors determine whether a return of precipitation will relieve a drought. High temperatures, high winds, and low relative humidity can intensify a drought by increasing the rate at which evapotranspiration occurs, while the timing, duration, and quantity of precipitation can impact how effectively precipitation is absorbed by the environment.

Drought Indices and Measurements

One popular tool to define drought is the **Palmer Drought Severity Index (PDSI)**, which is based on the supply and demand concept of the water balance equation, taking into account more than just the precipitation deficit at specific locations. The objective of the Palmer Drought Severity Index (PDSI), shown in Table 5.134, is to provide standardized measurements of moisture conditions so that comparisons using the index can be made between locations and between months. The index

---

231 American Meteorological Society. (2009). *Glossary of Meteorology*. Precipitation. https://web.archive.org/web/20081009142439/http://amsglossary.allenpress.com/glossary/search?id=precipitation1

232 Green Living Answers. (2024). The Importance of Maintaining Balance in Ecosystems. https://www.greenlivinganswers.com/ecosystem/balance#:~:text=When%20balance%20is%20maintained%2C%20ecosystems%20are%20more%20resilient,soil%20fertility%2C%20pest%20control%2C%20and%20pollination%20of%20plants.

233 https://www.weather.gov/safety/drought

numerical values are standardized indices where values of zero represent near-normal conditions; negative values indicate drought, and positive values indicate wet spell conditions. The PDSI is a combination of precipitation, water demand (evapotranspiration as computed from temperature), and soil moisture.

Table 5.134: Palmer Drought Severity Index [234]

Term	Extreme drought	Severe drought	Moderate drought	Mid-range	Moderately moist	Very moist	Extremely moist
Numerical description	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above

Figure 5.74 shows an example of the PDSI of the United States from March 2024.[235]

[234] https://www.drought.gov/drought/data-maps-tools/current-conditions
[235] https://www.ncei.noaa.gov/access/monitoring/weekly-palmers/

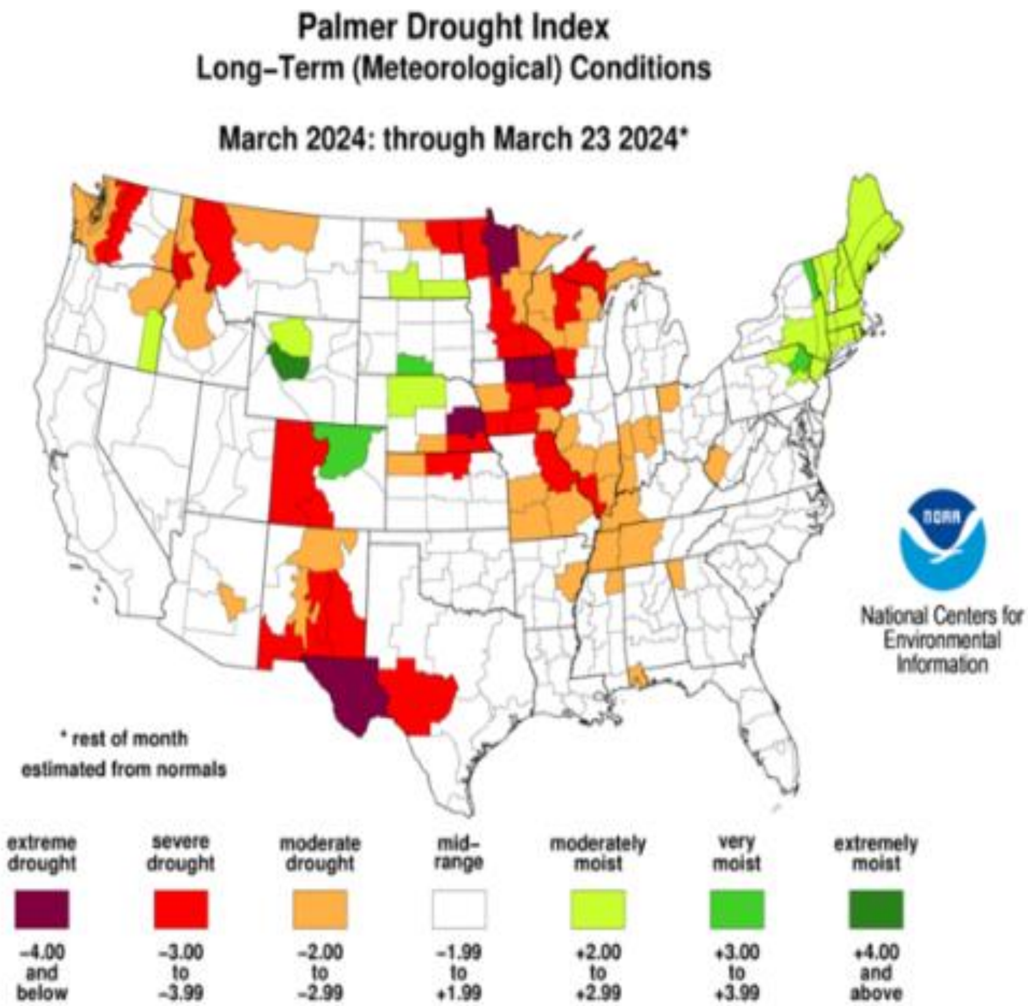


Figure 5.74. United States PDSI, March 2024

Another tool to interpret drought is the **Keetch Byran Drought Index (KBDI)**. The KBDI is a reference scale for estimating the dryness of the soil and duff layers – a layer of partly decayed organic material that accumulates on the forest floor. This estimation can be used to measure the amount of precipitation necessary to return the soil to total field capacity, as well as measure the cumulative moisture deficiency in deep duff and upper soil layers in relation to the likelihood of wildfires.[236]

The scale assumes that 8 inches of saturated soil are readily available to vegetation, and thus, the scale ranges from 0 (no moisture deficit) to 800 (total moisture deficit). An environment's score on

---

[236] Drought Factor Calculator.
http://www.csgnetwork.com/droughtindxcalc.html#:~:text=The%20official%20inputs%20for%20KBDI%20are,This%20information%20is%20from%20public%20domain.&text=The%20official%20inputs%20for,is%20from%20public%20domain.&text=inputs%20for%20KBDI%20are,This%20information%20is%20from

the index increases for each day without rain and decreases when it rains, assuming 8 inches of saturated soil are readily available to vegetation.[237] Table 5.135 depicts how drought conditions are interpreted, progressing from total moisture saturation to an absence of available moisture, as well as provides an explanation of the necessary precipitation amount required to return the soil to full field capacity.

Table 5.135. Measurement of Net Rainfall Required for Soil Saturation and Expected Conditions and Wildfire Threat

KBDI Scale	Inches Required to Achieve Soil Saturation	Expected Conditions and Wildfire Threat
0 - 200	0 - 2	Soil moisture is high. Typical of spring dormant season following winter precipitation.
200 - 250	2 - 2.5	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity.
250 - 300	2.5 - 3	
300 -350	3 - 3.5	
350 - 400	3.5 - 4	
400 - 450	4 - 4.5	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively.
450 - 500	4.5 - 5	
500 - 550	5 - 5.5	
550 - 600	5.5 - 6	
600 - 650	6 - 6.5	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning
650 - 700	6.5 - 7	
750 - 800	7 - 8+	

For different soil types, the soil depth required to hold 8 inches of moisture varies (loam 30 inches, clay 25 inches, and sand 80 inches). An environment with a high KBDI, likely an environment with a prolonged drought, can increase wildfire intensity because more fuel is available for combustion. In addition, the drying of organic material in the soil can lead to increased difficulty in fire suppression.[238] See the *Wildfire Hazard Profile* for more information on Hillsborough County's Wildfire vulnerability.

[237] WFAS. (2024). Keetch-Byram Drought Index.
https://www.wfas.net/index.php?option=com_content&view=article&id=86&Itemid=487

Figure 5.75, shows the KBDI for Florida from April 3, 2024, and shows that most of the state of Florida averages 1 to 3 inches of net rainfall, with Hillsborough County averaging 2 to 3 inches of net rainfall during that time.[239]

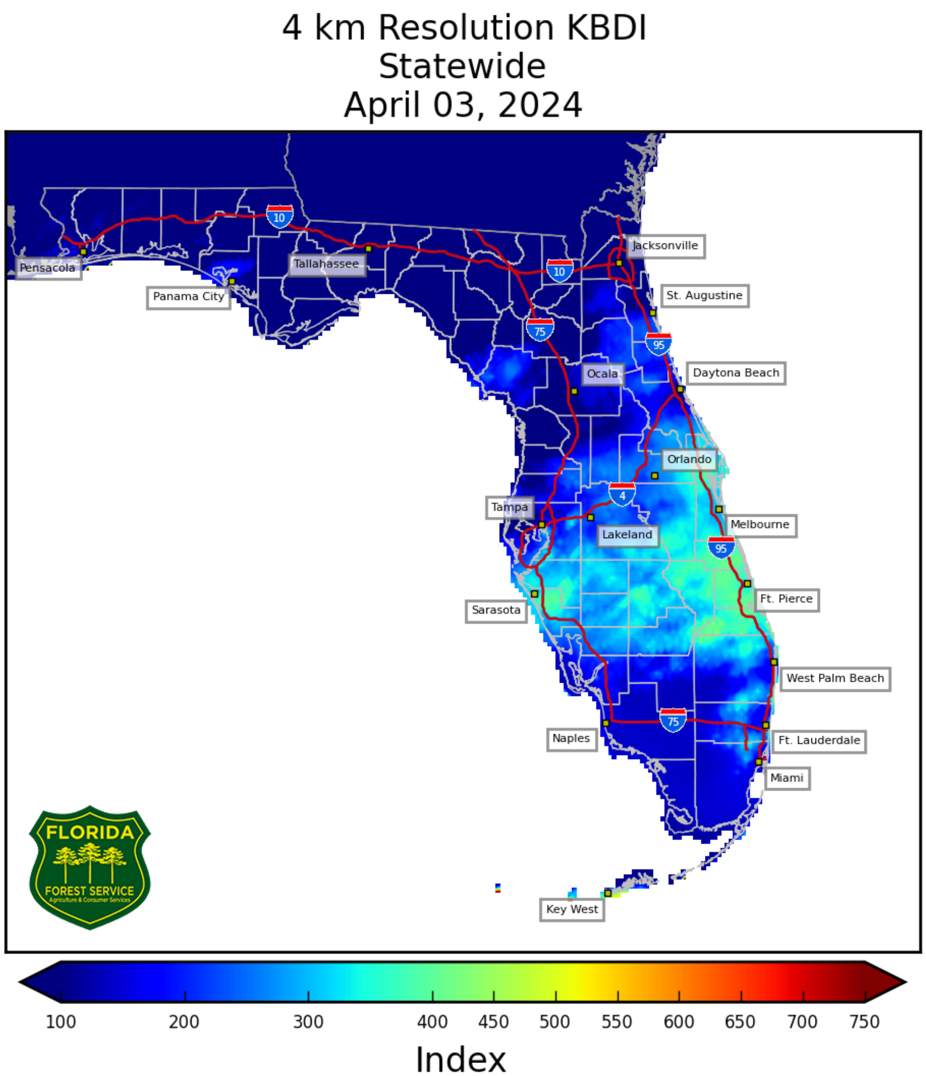


Figure 5.75. Florida KBDI, April 2024 [240]

The **US Drought Monitor** provides a third tool by which drought can be interpreted, focusing on broad drought conditions across the entire United States. This measurement classifies drought intensity from D0, Abnormally Dry, to D4, Exceptional Drought.

---

[240] https://fireweather.fdacs.gov/wx/kbdi_index.html
[240] https://fireweather.fdacs.gov/wx/kbdi_index.html

Table 5.136. United States Drought Monitor [241]

Category	Description	Possible Impacts
D0	Abnormally Dry	Going into drought: • Short-term dryness slows the planting and growth of crops or pastures Coming out of drought • Some lingering water deficits • Pastures or crops are not fully recovered
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells are low; some water shortages are developing or imminent • Voluntary water-use restrictions requested
D2	Severe Drought	• Crop of pasture losses are likely • Water shortages are common • Water restrictions are imposed
D3	Extreme Drought	• Major crop or pasture losses • Widespread water shortages or restrictions
D4	Exceptional Drought	• Exceptional and widespread crop or pasture losses • Shortage of water in reservoirs, streams, and wells, creating water emergencies

Figure 5.76 shows an example of the drought monitor map for Florida from March 19, 2024. Overall, Florida has low drought conditions. However, the southwest section of Hillsborough County is rated as abnormally dry (D0) for this date.

[241] https://droughtmonitor.unl.edu

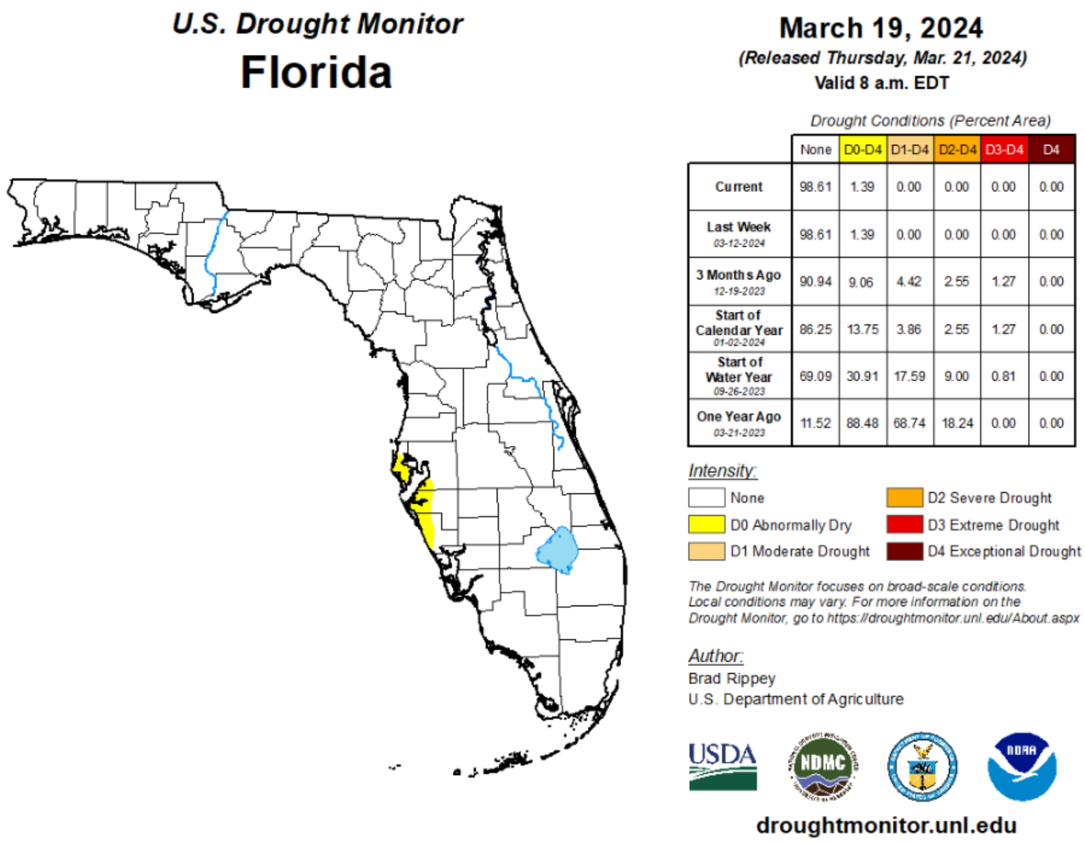


Figure 5.76. Florida U.S. Drought Monitor, March 2024 [242]

Geographic Areas Affected by Drought

Florida experiences cyclical drought on a regular basis. Analyzing past events and current drought conditions has proven that the conditions and severity of drought conditions have been variable over the years, affecting the east, north, south, and central regions randomly and somewhat equally.

Florida drought risk, assessed through the U.S. Drought Monitor between 2000 and 2022, is shown below in Figure 5.77.

---

[242] https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

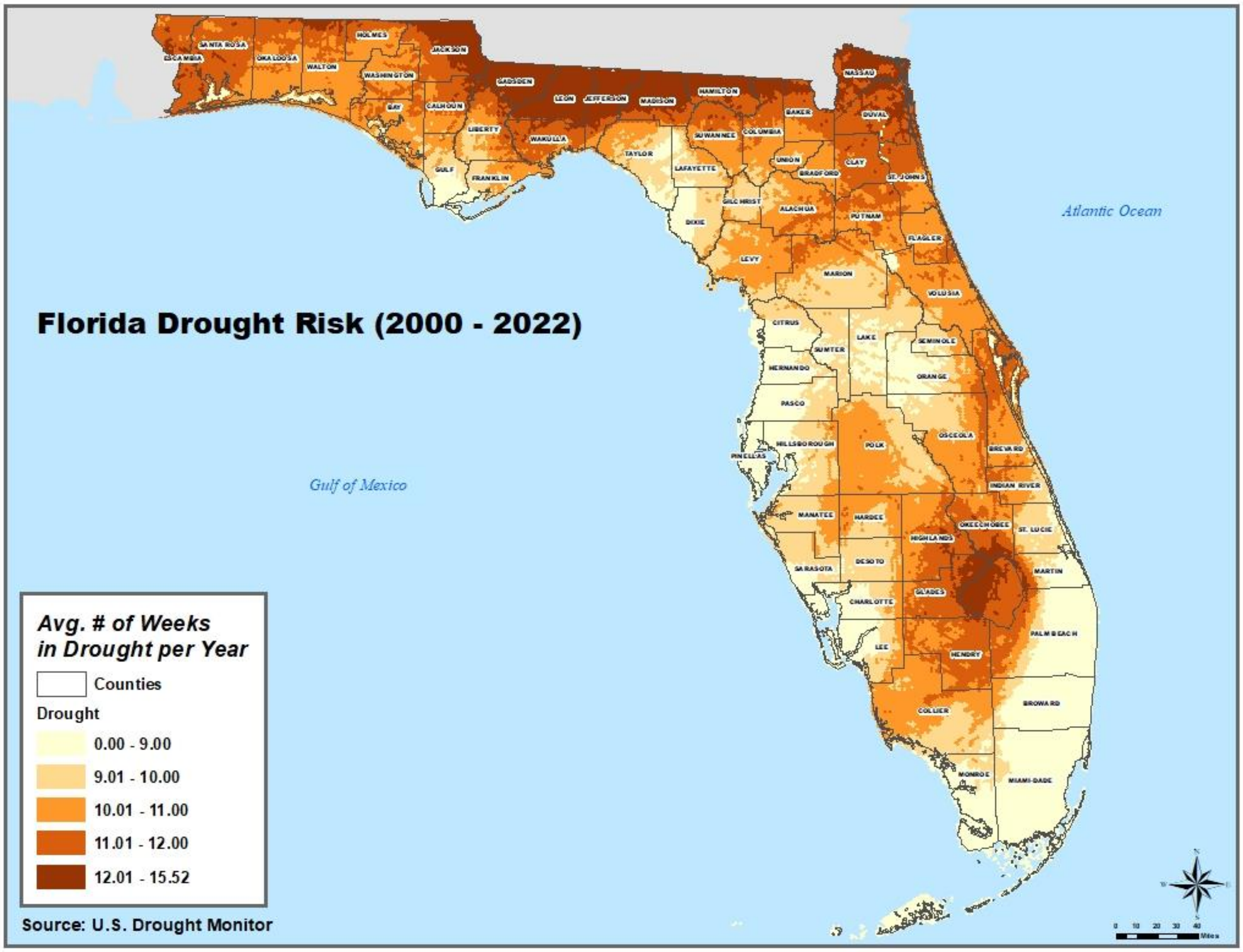


Figure 5.77. Florida Drought Risk, 2000–2022 [243]

Hillsborough County will likely be impacted by drought and experiences up to 15 weeks of drought each year. Drought will vary throughout the county, and accurately pinpointing areas is not easy; in the jurisdictions of the City of Tampa, Plant City, Temple Terrace, and in Unincorporated Hillsborough County, drought will have a mostly uniform reach. However, areas of Unincorporated Hillsborough County and areas surrounding Plant City are at higher risk of drought due to greater agricultural land use in and around those areas. Figure 5.78 below shows agricultural land in the county from Hillsborough County's existing land use data.

[243] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought

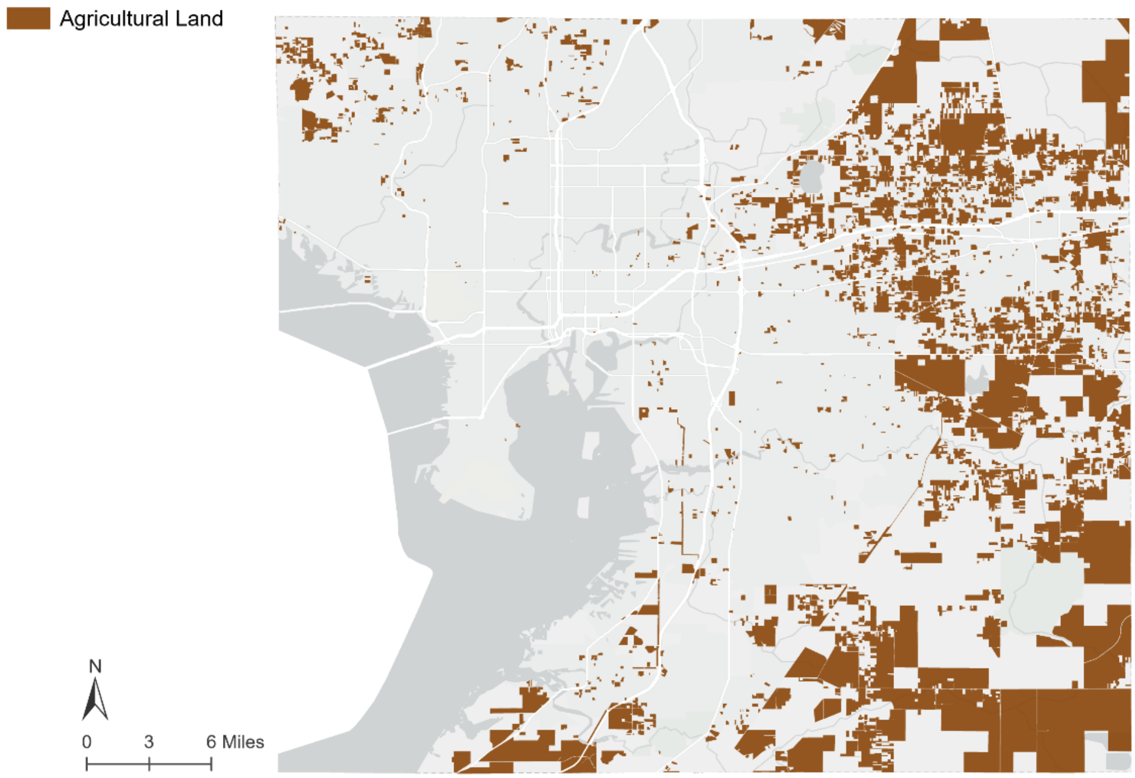


Figure 5.78. Agricultural Land in Hillsborough County[244]

Historical Occurrences of Drought

Florida experienced a destructive drought from 1998 to 2001, where farm crops were ruined, forest fires burned, and lake levels reached an all-time low. From 2006 to 2007, rainfall deficits were the largest observed since the mid-1950s, which led to severe wildfires in 2007.

While drought is a common occurrence in Florida, there has never been a Presidential Major Disaster Declaration for drought in the state. The NCEI Storm Events Database also has no record of drought events reported in Hillsborough County, specifically from 1996 to October 2023.[245]

The table below describes various significant drought events that have occurred in Florida.

Table 5.137. Significant Drought Occurrences in Florida [246]

Date	Description
1954–1956	The most extreme drought in Florida on record occurred during 1954–1956

[244] https://planhillsborough.org/gis-maps-data-files/

[245] https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Drought&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

[246] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought

Date	Description
	when runoff was 8 inches below normal, causing extensive loss of crops and timber. The Panhandle and northern central regions of the state were in a drought for most of 1955, and almost the entire state was in drought for most of 1956.
1981–1982	Rainfall deficiencies caused the water levels in Lake Okeechobee to reach the lowest levels ever recorded. In mid-1981, the entire state was in moderate or severe drought, but most regions were out of drought by the end of the year.
1998–2002	Lower than normal precipitation caused a severe long-term statewide drought in Florida lasting from 1998–2002. This drought was particularly severe over the 5-year period in the northwest, northeast, and southwest regions of Florida. The drought became so severe that in 2001, the following actions were taken: Three of Florida's five water management districts imposed mandatory cutbacks, strictly limiting water use. Several municipalities hiked water-sewer rates, meaning even customers who cut back were paying more. Restaurants in South Florida were ordered to stop serving water, except to diners who asked.
2006–2007	Drought conditions began to develop in 2006 across Florida because of less-than-average rainfall. In 2007, the drought was so severe it was considered a one in 25-year drought. The drought affected most of the state. The 2007 wildfire season was very active because of the extreme drought classification.
2010–2012	Drought conditions began in central Florida in late 2010 and continued into mid-2012. The drought affected most of the state, but the northern central and the Panhandle regions of the state were in "extreme drought" for several months.
2013	Drought conditions developed across portions of northern Jackson, Gadsden, Leon, Jefferson, and Madison counties at the end of January and ended in February due to heavy rain.
2016–2017	Drought conditions developed in late 2016 and persisted into mid-2017, leading to several wildfires across the state.[247]
2018 – 2019	Beginning 1/9/18 and into February, drought conditions developed and expanded across portions of the Florida panhandle and big bend. As dry weather continued into the late winter and early spring, northern Palm Beach County experienced a lack of rainfall combined with lowering groundwater levels, leading to severe drought (D2). [248]
2020 – 2021	Southwest Florida experienced very dry conditions beginning in March, leading to severe drought conditions. Several large wildfires flared up across the Everglades and Big Cypress. [249]
2022	Severe drought conditions developed over the western half of Collier

[247] https://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers/psi/201601-201704
[248] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought
[249] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought

Date	Description
	County, western Palm Beach County, and eastern Glades County due to prolonged dry conditions.[250]

Data from the U.S. Drought Monitor was used to ascertain historical drought conditions for Hillsborough County. (Data were only available at the county level, so each jurisdiction is not shown separately.) The U.S. Drought Monitor provides weekly updates on drought status by county. Drought conditions are classified on a scale of D0 to D4, as described previously in Table 5.136.

According to the U.S. Drought Monitor data from 2000 to 2023, the greatest magnitude of drought, D4 – exceptional drought, occurred in Hillsborough County in 2000 and 2001, and the county has experienced at least abnormally dry conditions every year except 2020 when the county experienced a brief period of severe drought. The table below shows the most severe drought classification for each year and the associated number of weeks reported in that category. It should be noted that the U.S. Drought Monitor also estimates the percentage of the county in each classification of drought severity. For example, the most severe classification reported may be exceptional, but a majority of the county may be in a less severe condition.

Table 5.138. Historical Drought Occurrences in Hillsborough County [251]

Year	Most Severe Drought Condition		Number of Weeks
	Category	Description	
2000	D4	Exceptional Drought	3
2001	D4	Exceptional Drought	18
2002	D0	Abnormally Dry	24
2003	D0	Abnormally Dry	2
2004	D0	Abnormally Dry	2
2005	D0	Abnormally Dry	17
2006	D1	Moderate Drought	13
2007	D2	Severe Drought	3
2008	D2	Severe Drought	14
2009	D2	Severe Drought	10
2010	D1	Moderate Drought	5
2011	D2	Severe Drought	2
2012	D3	Extreme Drought	9
2013	D1	Moderate Drought	11
2014	D0	Abnormally Dry	4
2015	D0	Abnormally Dry	1
2016	D0	Abnormally Dry	2
2017	D3	Extreme Drought	3

[250] Collier County, western Palm Beach County, and in eastern Glades County

[251] https://www.drought.gov/historical-information?dataset=0&selectedDateUSDM=20200407&state=Florida&countyFips=12057

Year	Most Severe Drought Condition		Number of Weeks
	Category	Description	
2018	D0	Abnormally Dry	7
2019	D0	Abnormally Dry	7
2020	D2	Severe Drought	2
2021	D1	Abnormally Dry	10
2022	D1	Abnormally Dry	9
2023	D1	Abnormally Dry	12

Probability of Future Occurrences of Drought

Based on the previous occurrences of drought conditions in the county, future long-term drought events are expected to continue. According to the Florida Drought Risk map shown above in Figure 5.77, Hillsborough County is likely to experience up to 15 weeks of drought each year. As Hillsborough County continues to develop with higher populations and higher water demands, these drought conditions and drier trends may profoundly impact the county and its residents.

The risk of drought is projected to rise with the global temperature, resulting in water supply reductions, disruptions to agriculture, and increased risk of wildfires.[252] Moreover, projected changes in the amount, type, and timing of precipitation and evapotranspiration will affect the balance of water supply and demand. Based on the limited historical record included in the U.S. Drought Monitor, there have been eight severe or exceptional droughts in the last 23 years. This equates to a 35% chance of a severe or exceptional drought in any given year. This figure is likely to increase as climate change continues.

Effects of Climate Change on Drought

The process by which greenhouse gases trapped within Earth's atmosphere capture and retain energy from the sun—is warming Florida's environment. As air and ground temperatures warm, even slight changes impact the balance of precipitation and evapotranspiration and can exacerbate drought.

Increases in temperature can accelerate evaporation, leading to a decrease in runoff rates associated with rainfall events. Moreover, increased rates of evapotranspiration would remove moisture from soil and plants and release it into the atmosphere, creating a dry ground and, conversely, a humid atmosphere that could potentially lead to more frequent rainfall events. (Note – drier soil makes it more difficult for the ground to absorb water, especially during intense rainfalls, resulting in flooding. Regional effects are expected to range widely and are difficult to predict.[253] It is

[252] https://flshmp-floridadisaster.hub.arcgis.com/pages/drought

[253] *(Walsh and Wuebbles (2013). Our changing climate. In, Draft national climate assessment, pp. 25–103.* https://www.nrc.gov/docs/ML1821/ML18215A328.pdf *); p. 113.).*

widely believed that an overall warming trend may intensify and prolong droughts as they occur due to increased rates of evapotranspiration associated with higher temperatures.[254]

The Intergovernmental Panel on Climate Change forecasts with medium confidence both an increase in heavy rainfall periods and an increase in the duration of relatively dry periods for North America, particularly in the subtropics, such as Florida.[255] South Florida, in particular, may see increased dry and hot periods between heavy rainfall events, exacerbating the risk of drought.[256] However, there is significant uncertainty associated with these projections, given the numerous factors that contribute to climatic variability.[257]

Projections from the **FEMA Climate Mapping for Resilience and Adaptation (CMRA) tool** (Figure 5.79), show climate projections under low and high greenhouse gas emission scenarios for Hillsborough County:[258]

- Average annual dry days by the late century (2070-2099) are projected to decrease by 1.3 days in a low-emission scenario, while in a high-emission scenario, they are expected to increase by 3.2 days (184.9 and 189.4 days annually, respectively).
- Days with precipitation are also projected to increase by 1.3 days per year in a low-emission scenario but decrease by 3.2 days in a high-emission scenario by the late century.
- Days with max temperature >90 ˚F are projected to increase by 68.7 days in the lower emission scenario and 108.6 days in the high emission scenario by the late century (162.9 and 202.8 days annually, respectively).

Low- and High-emission scenarios tell two different stories about the future of Hillsborough County in climate change:

- In a low-emission scenario, the dry days may be projected to decrease while wet days increase in Hillsborough County. This would indicate a lower probability of drought within the county.
- Conversely, the high emission scenario indicates an increase in dry days and a decrease in wet days in the county. Paired with this high emission scenario are the increasing days with

---

[254] *(Allen et al. (2012). Summary for policymakers. In Field et al. (Eds.), Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, pp. 3–21., https://www.ipcc.ch/pdf/special-reports/srex/SREX_FD_SPM_final.pdf, p. 13).*

[255] *(Seneviratne et al. (2012). Changes in climate extremes and their impacts on the natural physical environment.* https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/changes-in-climate-extremes-and-their-impacts-on-the-natural-physical-environment/ *); In Field et al. (Eds.), Managing the risks of extreme events and disasters to advance climate change adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, pp. 109–230.* https://www.ipcc.ch/report/managing-the-risks-of-extreme-events-and-disasters-to-advance-climate-change-adaptation/ *, pp. 174–175.).*

[256] *(Karl et al. (Eds.) (2009). https://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf).*

[257] *(Seager et al. (2009). http://journals.ametsoc.org/doi/full/10.1175/2009JCLI2683.1).*

[258] https://livingatlas.arcgis.com/assessment-tool/explore/details

max temperature >90 ˚F with a significant increase expected. Warmer weather creates more of an opportunity for drought to occur.

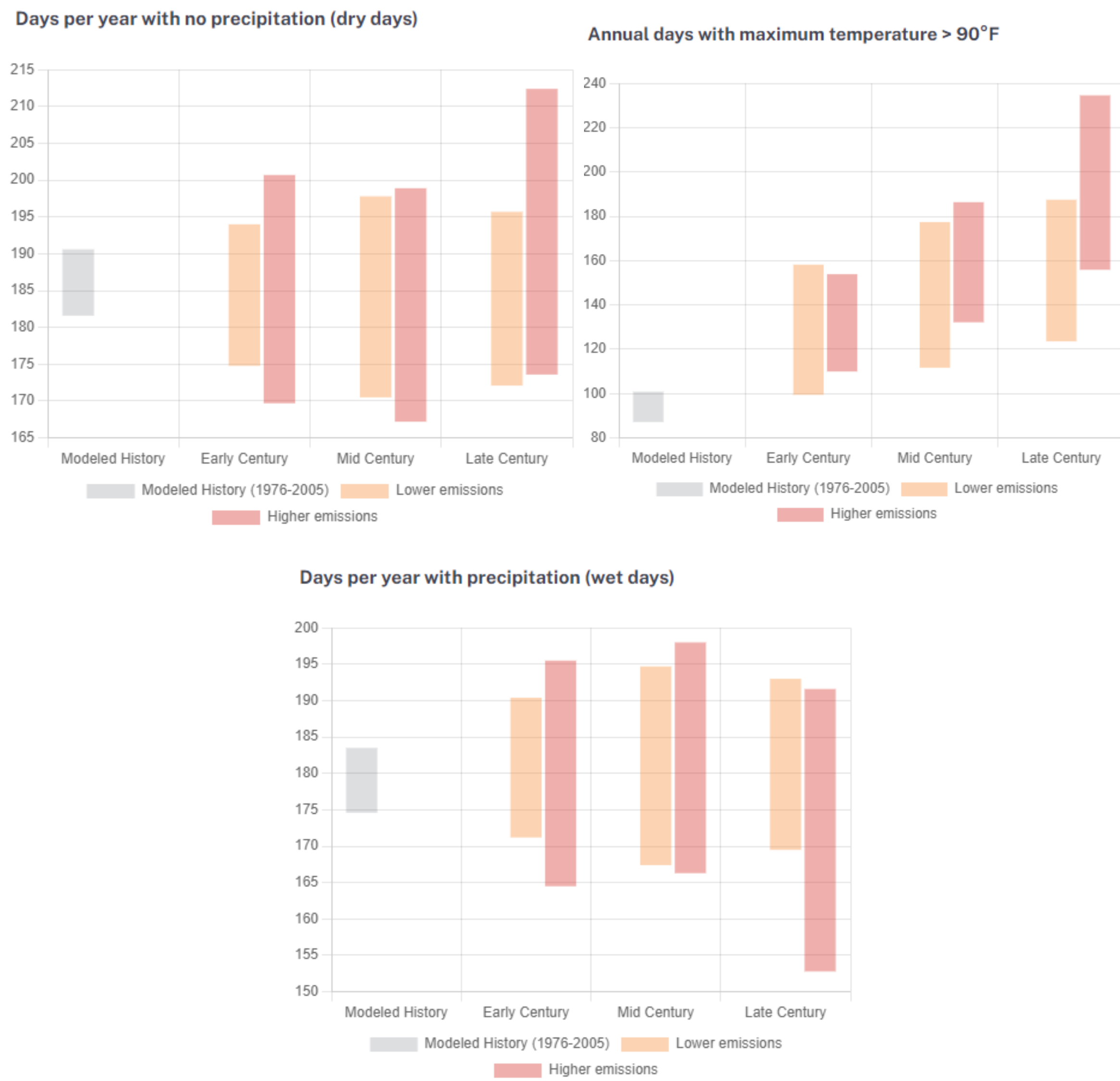


Figure 5.79. CMRA Climate Projections for Drought

Drought Impact Analysis

All jurisdictions could receive the impacts listed below due to drought. As Hillsborough County continues to develop with higher populations and higher water demands, drought conditions and drier trends may begin to have a profound impact countywide on its residents.

- Public
    - Lack of water or water restrictions for personal use
    - Damage to property, such as grass and other vegetation dying from lack of water
- Responders
    - Lack of water for fire suppression

- Continuity of Operations (including continued delivery of services)
    - Lack of water or water restrictions may impact the public use of water and wastewater utilities; the public may have to restrict their showering time and other water use in the restroom, restrict their water usage for cooking and drinking, and restrict from watering their gardens or lawns, or washing vehicles
- Property, Facilities, and Infrastructure
    - Facilities and infrastructure should not be affected by drought
    - Property, such as green spaces, gardens, crops, etc., may be damaged from lack of water
- Environment
    - Areas such as green spaces, gardens, and forests may be damaged by drought.
    - Decrease in water levels in reservoirs, lakes, and ponds
    - Wind and water erosion of soils
    - Loss of wetlands
    - Increase in wildfire occurrences
    - Disruption of wildlife habitat with the possibility of migration and diseases in animals
- Economic Condition
    - Crop damage or loss from drought can severely impact the agricultural economy, which can, in turn, affect an area's economy if it is dependent upon the sales of crops, such as the citrus industry.
    - Employment loss due to lower demand for services such as landscaping, lawn care, car wash, etc.
- Public Confidence in Each Jurisdiction's Governance
    - The public may lose confidence in the jurisdiction's governance if there is no plan in place to deal with the lack of water or water restrictions

Vulnerability Analysis and Loss Estimation by Jurisdiction

Historical Losses and Exposure

Unlike many of the natural hazards in this plan, there is no record of drought events reported by the NCEI Storm Events Database in Hillsborough County, making this source unusable for predicting future losses.

Since drought risk is relatively uniform across the County, it does not lend itself well to spatial analysis. However, because drought is considered atmospheric, it can potentially affect all buildings and all populations in Hillsborough County.

Drought conditions typically do not cause significant damage to the built environment. The efficiency at which a building operates may be affected (e.g., low water pressure) if the building is in a drought-stricken area. Furthermore, drought can also increase the likelihood of wildfires and lower water levels in canals and other surface waters, which could inhibit the ability to fight fires in rural areas, potentially increasing impacts on structures.

The agriculture sector is most vulnerable to drought because crops, pasturelands, and livestock can be impacted by lack of water due to short-term droughts during critical times in the growth cycle and long-term droughts over many years. Hillsborough County farmers grow more than sixty different crops, ranging from blueberries, honey, hops, oranges, strawberries, tomatoes, watermelon, and zucchini.[259] The agricultural business of strawberry and honey production would sustain one of the largest impacts of a drought in east Hillsborough County.[260] Plant City would be most susceptible to agricultural loss. Significant impacts would also occur in fisheries located in the Brandon, Riverview, and Gibsonton areas. Figure 5.78 in Section 2 above shows agricultural land in Hillsborough County, with most of it surrounding Plant City.

Drought conditions may also require water use restrictions, resulting in more water supply shortages. Availability of water during drought conditions is primarily controlled by the topography, geology, hydrogeology, and hydrology of an area. Local conditions, such as the availability of a large impoundment for water storage, may affect drought vulnerability on a local scale.

National Risk Index (NRI)

FEMA's National Risk Index (NRI) was used to obtain information for risk analysis on drought at the census tract level across Hillsborough County, FL. The National Risk Index uses the best available national dataset for drought to estimate annualized frequencies; annualized frequency is calculated by using the historical record of tornado events by census tract. Risk is then calculated utilizing expected annual loss, social vulnerability, and community resilience (the adaptive capacity of a community towards each respective hazard).

---

[259] Hillsborough County. (2024). Homegrown Hillsborough. https://hcfl.gov/residents/sustainability-and-green/homegrown-hillsborough

[260] Agricultural Marketing Resource Center. (2021). AgMRC Commodity Reports: Market and Harvest Trends. https://indicators.extension.iastate.edu/projects/CommodityReport/#

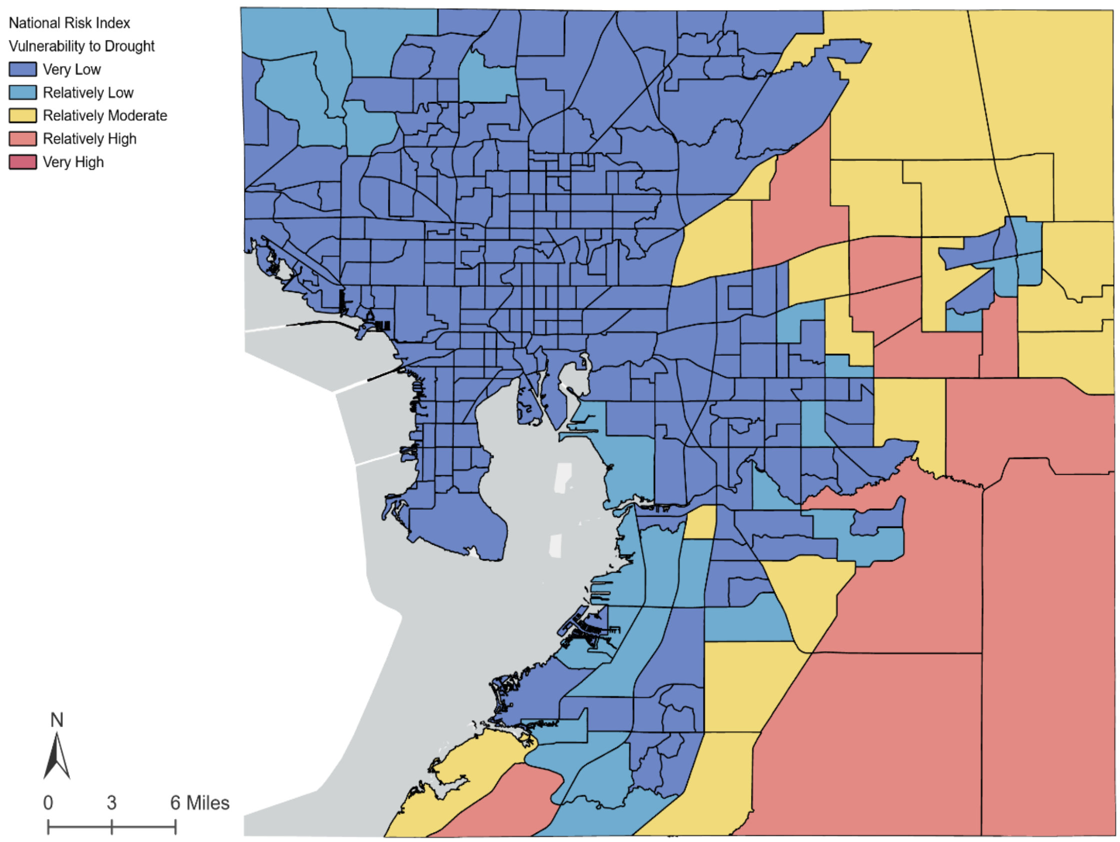


Figure 5.80. National Risk Index Map with Vulnerability to Drought [261]

Figure 5.80 shows drought risk by census tract within Hillsborough County. Not surprisingly, the areas of higher drought risk are rural lands that correspond with the agricultural land in the county shown above in Figure 5.78.

A breakdown of the four jurisdictions is presented in

Table 5.139 (Unincorporated Hillsborough County, Plant City, Tampa, and Temple Terrace) community risk to drought and the degree of risk. Overall, 80% of the four jurisdictions' census tracts are at a very low

[261] https://hazards.fema.gov/nri/

risk of drought, with only ten census tracts having a relatively high risk for drought, and none of the four jurisdictions have census tracts at a very high risk of drought.

Table 5.139. Breakdown of census tract risk to drought, by jurisdiction and degree of risk

Jurisdiction	Census Tracts with Very Low Risk	Census Tracts with Relatively Low Risk	Census Tracts with Relatively Moderate Risk	Census Tracts with Relatively High Risk	Census Tracts with Very High Risk
Hillsborough County (Unincorporated)	165	21	15	10	0
City of Plant City	3	4	4	0	0
City of Tampa	103	0	0	0	0
City of Temple Terrace	8	0	0	0	0
Hillsborough County (Total)	**279**	**25**	**19**	**10**	**0**

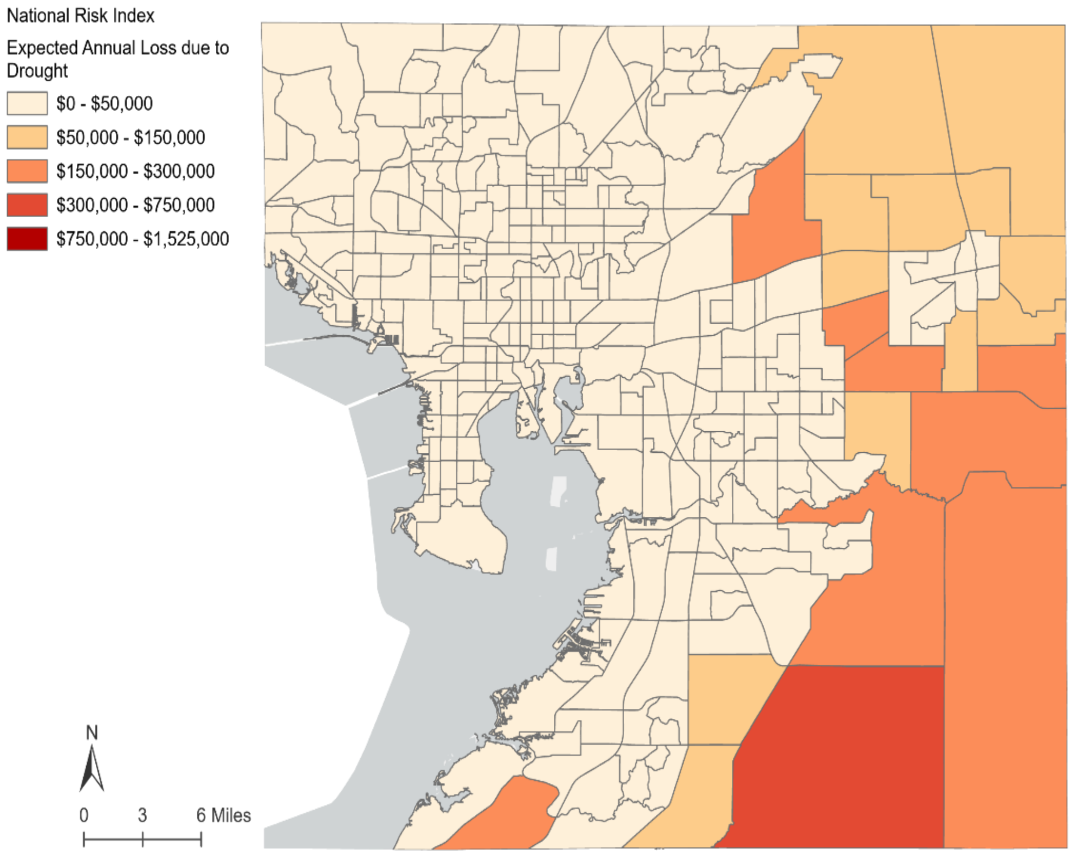


Figure 5.81. Expected Annual Loss due to Drought [262]

Figure 5.81 above depicts the expected annual loss due to drought in Hillsborough County and its surrounding jurisdictions, as well as, a breakdown on the expected annual loss by jurisdiction is below in Table 5.140. The expected annual loss is calculated by taking exposure to drought using historical data and multiplying that by the annualized frequency of drought and a historical loss ratio, which is the percentage of a consequence type (building value, population, and/or agricultural value) that is likely to be lost when drought occurs. The unincorporated area of Hillsborough is projected to experience a total of $5,667,772 of annual loss compared to the City of Plant City, with an expected annual loss of $460,692; this can be induced by population differences and acreage of land, particularly agricultural land. The cities of Tampa and Temple Terrace are not expected to experience economic loss due to drought.

Table 5.140. Average Expected Annual Loss due to Drought, by jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$5,667,772
City of Plant City	$460,692
City of Tampa	$0

[262] https://hazards.fema.gov/nri/

City of Temple Terrace	$0
Hillsborough County (Total)	**$6,128,464**

The breakdown of population by jurisdiction within moderate to high risk of exposure to drought is presented in Table 5.141.

In total, Hillsborough County has an estimated 277,981 of its 1,498,560 population at moderate to high risk of drought exposure, which equates to 18.9% of the population. The City of Plant City has the highest population percent at risk, with 53.4%, followed by Unincorporated Hillsborough County at 25.2%.

Table 5.141. Total population and percentage at moderate to high risk of drought exposure by jurisdiction

Jurisdiction	Total Population	Total Population at Risk	Total % at Risk
Hillsborough County (Unincorporated)	989,745	256,749	25.9%
City of Plant City	48,289	21,232	44.0%
City of Tampa	382,484	0	0.0%
City of Temple Terrace	37,764	0	0.0%
Hillsborough County (Total)	**1,468,560**	**277,981**	**18.9%**

Justice40 Climate and Economic Justice Screening Tool (CEJST)

Using the Climate and Economic Justice Screening Tool (CEJST) and the National Risk Index (NRI) datasets at the census tract level, disadvantaged communities were identified in Hillsborough County, and in addition, a high or moderate risk was identified from the NRI dataset and overlayed with these disadvantaged communities. Figure 5.82Figure 5.82 shows a total of 131 communities across Hillsborough County are identified as disadvantaged, accounting for 53% of total communities at the census tract level. In addition, 94% of the Disadvantaged Communities with moderate to high drought risk are in the Unincorporated Hillsborough County, with Plant City accounting for 6% of the Disadvantaged Communities with moderate to high drought risk.

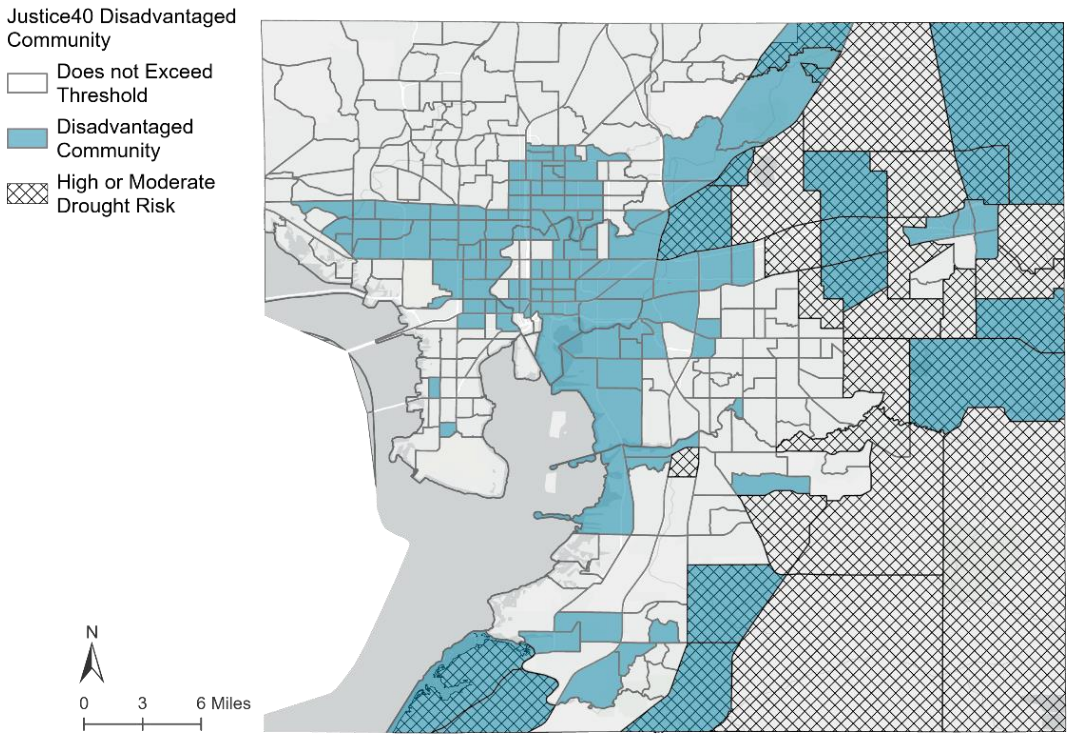


Figure 5.82. Justice40 Disadvantaged Communities with High or Moderate Drought Risk[263]

A breakdown of disadvantaged communities and the number of disadvantaged communities with moderate or high drought risk is shown in Table 5.142 below. The Unincorporated Hillsborough County (69) has the highest number of disadvantaged communities out of the four jurisdictions, with Tampa (54) following closely behind and Plant City and Temple Terrace having 6 and 2. In terms of the number of communities with moderate/high drought risk, overall, the Unincorporated Hillsborough County has the highest number (31), with Plant City only having two, and Tampa and Temple Terrace having no communities at risk.

[263] https://screeningtool.geoplatform.gov/en#3/33.47/-97.5

Table 5.142. Breakdown of disadvantaged communities and risk to drought, by jurisdiction

Jurisdiction	# of Disadvantaged Communities (by Census tract)	# of Disadvantaged Communities with Mod/High Drought Risk
Hillsborough County (Unincorporated)	69	31
City of Plant City	6	2
City of Tampa	54	0
City of Temple Terrace	2	0
Hillsborough County (Total)	**131**	**33**

Vulnerability Analysis and Loss Estimation of Critical Facilities

Drought can strike anywhere in Hillsborough County; therefore, all of the county critical facilities and community lifelines are equally vulnerable and at risk. However, drought usually does not cause direct structural damage to critical facilities and community lifelines. Drought impacts to structures, including critical facilities and community lifelines, are listed above under Exposure.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking or high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.6 (

Table 5.143).

Table 5.143. Overall Vulnerability to Drought for Hillsborough County

<table>
<tr><th colspan="5">DROUGHT</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Drought is a deficiency in precipitation over an extended period, usually a season or more, resulting in a water shortage. While droughts are a normal and recurring feature of our climate, sometimes they can endanger vegetation, animals, and even people.</td><td colspan="2">MODERATE</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Minor</td><td>Large</td><td>> 24 hrs</td><td>Very Concerned</td><td>> 1 week</td><td>2.6</td></tr>
</table>

4.10 Winter Storm and Freeze Hazard Profile

Winter Storm and Freeze Description

Severe winter weather includes extreme cold, snowfall, ice storms, winter storms, and/or strong winds and affects every state in the continental United States. Areas where such weather is uncommon, such as Hillsborough County, may experience a greater impact on transportation, agriculture, and people from relatively small events compared to other states that experience winter weather more frequently.

Winter storm formation requires below-freezing temperatures, moisture, and lift to raise the moist air to form clouds and cause precipitation.

Winter storms move easterly or northeasterly and use both the southward plunge of cold air from Canada and the northward flow of moisture from the Gulf of Mexico to produce ice, snow and sometimes blizzard conditions. These fronts may push deep into the interior regions, sometimes as far south as Florida. The National Weather Service may issue the following advisories when cold weather threatens an area:

- **Winter Storm Watch:** Issued when conditions are favorable for a winter storm event in the next 24 to 72 hours. A watch is generally issued when the risk of a hazardous winter weather event has increased and is intended to give lead time for people to make plans.
- **Winter Storm Warning:** Issued when a winter storm event is expected to meet or exceed local winter storm warning criteria in the next 12 to 36 hours. A warning is generally issued when a hazardous winter weather event is occurring, is imminent, or has a very high probability of occurrence, and is used when conditions pose a threat to life or property.
- **Winter Weather Advisory:** Issued when a winter storm event is expected to meet or exceed local winter weather advisory criteria in the next 12 to 36 hours but stay below warning criteria. An advisory is for less serious conditions that cause significant inconvenience and should lead to cautious behavior to avoid injury or property damage.
- **Freeze Watch:** Issued when there is a potential for significant, widespread freezing temperatures within the next 24 to 36 hours.
- **Freeze Warning:** Issued when significant, widespread freezing temperatures are expected.
- **Frost Advisory:** Issued when the minimum temperature is forecast to be 33 to 36°F on clear and calm nights during the growing season.

Frozen Precipitation: Snow, Sleet, and Freezing Rain

As a hazardous winter weather phenomenon, the National Weather Service (NWS) defines a winter storm as a weather event with accumulating frozen precipitation such as snow, sleet, and/or freezing rain.

- **Snowfall:** steady fall of snow for several hours or more. Heavy snow is defined as either a snowfall accumulating to 4 inches in depth in 12 hours or less or snowfall accumulating to 6 inches or more in depth in 24 hours or less.

- **Sleet:** pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. Heavy sleet is a relatively rare event defined as the accumulation of ice pellets covering the ground to a depth of 0.5 inches or more.
- **Freezing Rain:** freezing rain occurs when the layer of freezing air is so thin that the raindrops do not have enough time to freeze before reaching the ground. Instead, the water freezes on contact with the surface, creating a coating of ice on whatever the raindrops contact.

Because Florida has a lower capacity to respond to winter storm events--even the smallest accumulations can cause impacts--lower thresholds are typically used to define significant winter storms and the issuance of Winter Storm Warnings. In North Florida, a Winter Storm Warning is issued when greater than 1 inch of snow and/or sleet is expected to fall. For Central Florida, any snow or sleet amount over a 1/2 inch is considered a winter storm. Figure 5.83 provides storm advisory, watch and warning definitions used in Florida.

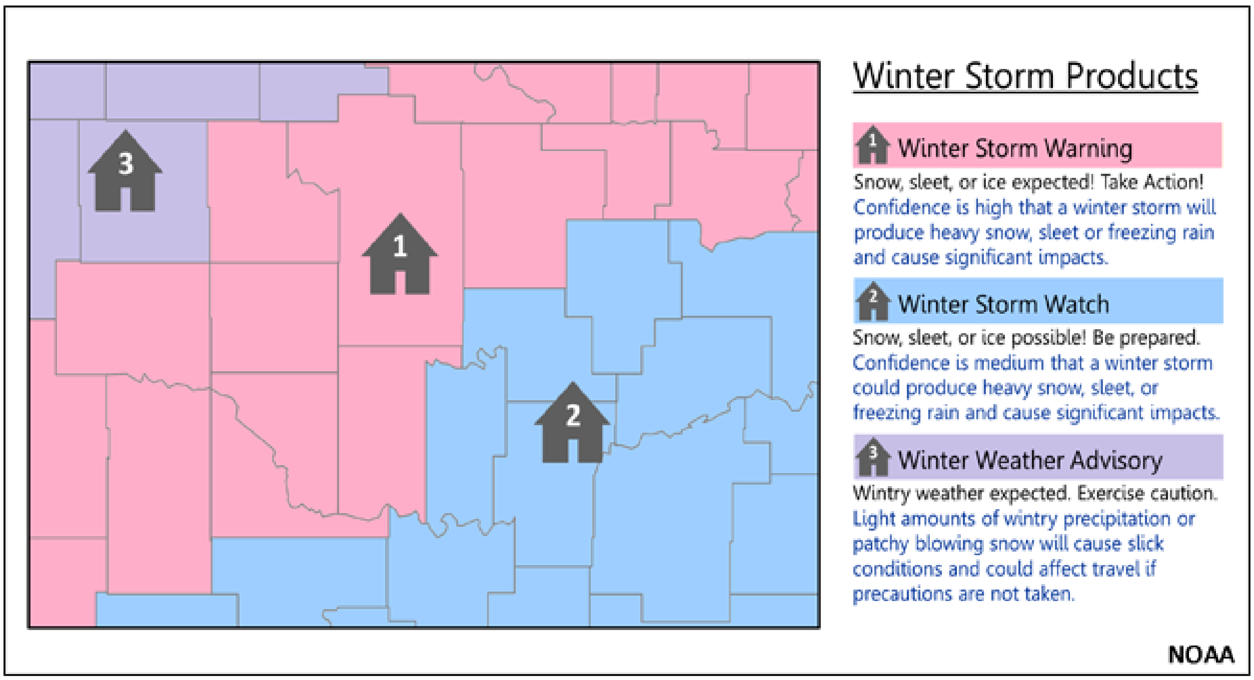


Figure 5.83. Definitions of Winter Storm Products

An ice storm is when ice accumulates on the ground, vegetation, and power lines. Freezing rain falls as liquid rain but then freezes on contact with surfaces when the air temperature is below freezing.

Ice accumulation by an amount as little as 0.1 inches in Florida has a significant impact on those living in disadvantaged communities, transportation, and agriculture and livestock throughout the state. If ice accumulates beyond 0.25 inches, this dense weight of ice can damage buildings and trees, and disrupt power and communications infrastructure, like power lines. A small amount of ice can be dangerous to pedestrians and motorists, with bridges being particularly dangerous because they freeze before other surfaces. A thin layer of ice can cause travel issues on untreated roadways.

Frost, Freeze, and Hard Freeze

Frost is the accumulation of small ice crystals on surfaces, like the accumulation of dew in the mornings. If a frost persists for long enough, it can lead to crop damage or loss. Frost is not a threat to the public but is a concern to the agricultural industry, particularly that of the citrus growing season. Frost can occur when air temperatures fall below 36°F, the wind is light, and there is sufficient moisture in the air.

A freeze occurs when overnight temperatures reach at least 32°F. A hard freeze occurs when the temperature falls below 28°F for four hours or more. While most vegetation can survive a frost, very little vegetation can survive a hard freeze, and this is when the most damage to crops occurs. While cold fronts rarely bring snow or sleet to Hillsborough County, long lasting cold temperatures occur more often and can last for several days. Nighttime temperatures can drop below freezing for periods well in excess of 8 hours.

Nor'easter

A Nor'easter is a storm over the Atlantic coast, typically moving to the northeast, with northeasterly winds blowing from the ocean across the coast. According to the NWS, these storms can occur at any time of the year but are more common and stronger between September and April. These storms bring heavy rain, frozen precipitation, high winds, and rough surf, all of which may impact Hillsborough County. While Nor'easters do not typically bring winter weather, they have contributed to high winds, coastal erosion, and frozen precipitation in Florida.

Cold Illnesses

Frostbite is damage to skin and tissue caused by exposure to below freezing temperatures, typically any temperature below 31°F, and can occur in a matter of minutes when bare skin is exposed to extreme cold. Hypothermia occurs when the body loses the ability to regulate temperature. Both of these illnesses are very dangerous and can be life threatening if not treated immediately. Infants and elderly people are most at risk. When strong winds combine with cold temperatures, the heat loss from a person's skin can be accelerated. This is called the wind chill. The wind chill can make it feel like it is much colder outside than the actual temperature. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." During unexpected or prolonged cold periods in Florida, there are often issues with propane gas supplies, and electrical and natural gas systems are pushed to their limits to meet the record demands. Many residents of Hillsborough County have inadequate heating systems and turn to alternatives such as space heaters and wood fires that increase the likelihood of accidental house fires and deaths from carbon monoxide poisoning.[264]

Cold Wave

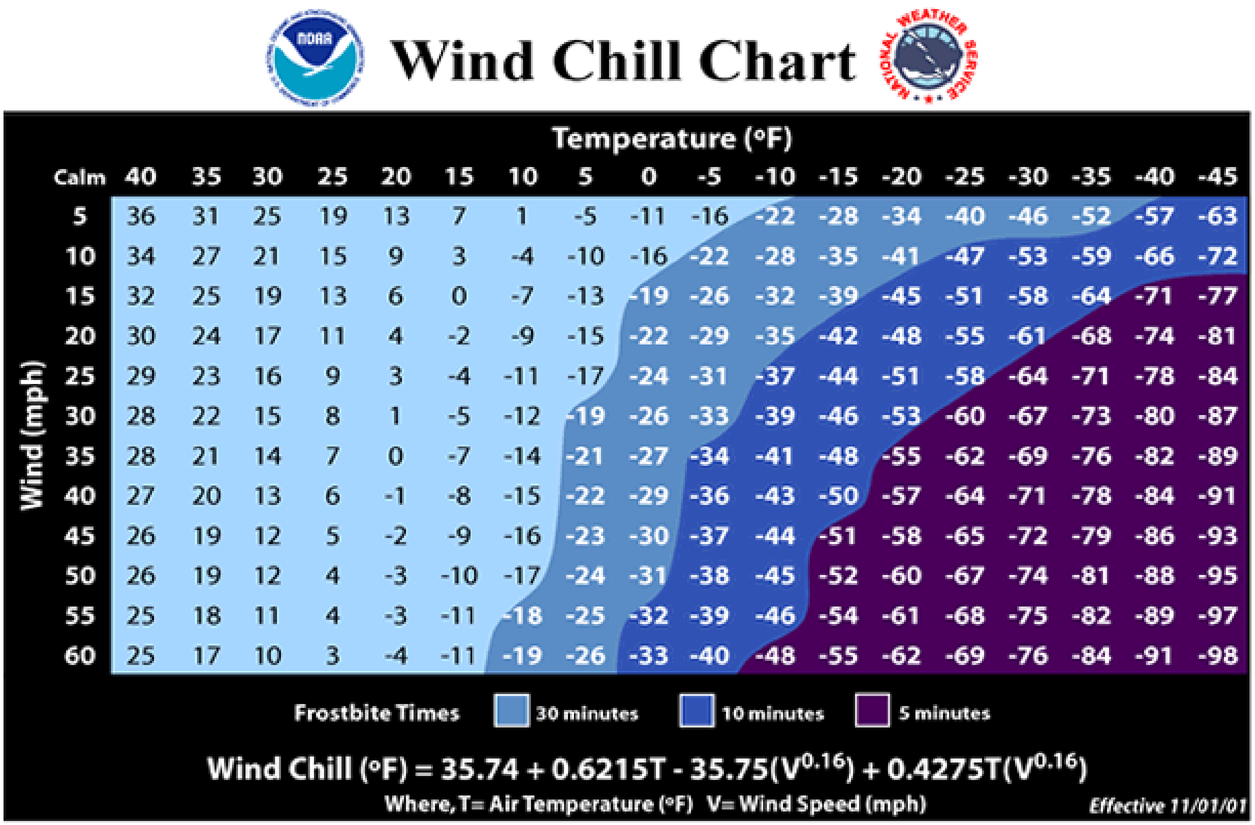
A cold wave is a prolonged period of excessively cold weather, typically characterized by below-normal temperatures. Cold waves often occur during winter months and are caused by various meteorological factors, such as polar air masses, atmospheric pressure patterns, and the movement of weather systems. Cold waves can have significant impacts on the environment,

[264] http://www.nws.noaa.gov/om/winter/index/shtml

economy, and human needs. During these prolonged periods, they can lead to freezing temperatures, frost, ice formation, and an increase in energy demands for heating.

Wind Chill

Wind chill is a measure of how cold it feels outside when the wind is factored in with the air temperature. It accounts for the increased rate of heat loss from exposed skin due to the combination of cold air and wind. The NWS measures wind chill by taking into account the air temperature and the wind speed at standard height of 5 feet above the ground. Figure 5.84 shows windchill measurement as a function of wind and temperature.


Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph) *Effective 11/01/01*

Figure 5.84. Wind Chill Measurement Chart, provided by NOAA

In central Florida, where temperatures are typically mild, wind chill might not have as significant an impact as compared to other parts of the state and the US. However, during cold fronts or windy days, wind chill can make it feel colder than the actual temperature, leading to discomfort and potential health risks for residents who are exposed to the elements. It's important for residents and visitors to be aware of wind chill advisories and take precautions.

Geographic Areas Affected by Winter Storm and Freeze

The northern portion of the state is affected by winter storm and freeze events more frequently than central and south Florida. However, central and southern Florida can still experience freeze events, and given the atmospheric nature of the hazard. The entirety of Hillsborough County has uniform exposure to winter storm and freeze events; however, agricultural damage can be expected to be more severe in Plant City and unincorporated Hillsborough County. Figure 5.85 shows average annual winter weather days in Hillsborough and its incorporated jurisdictions.

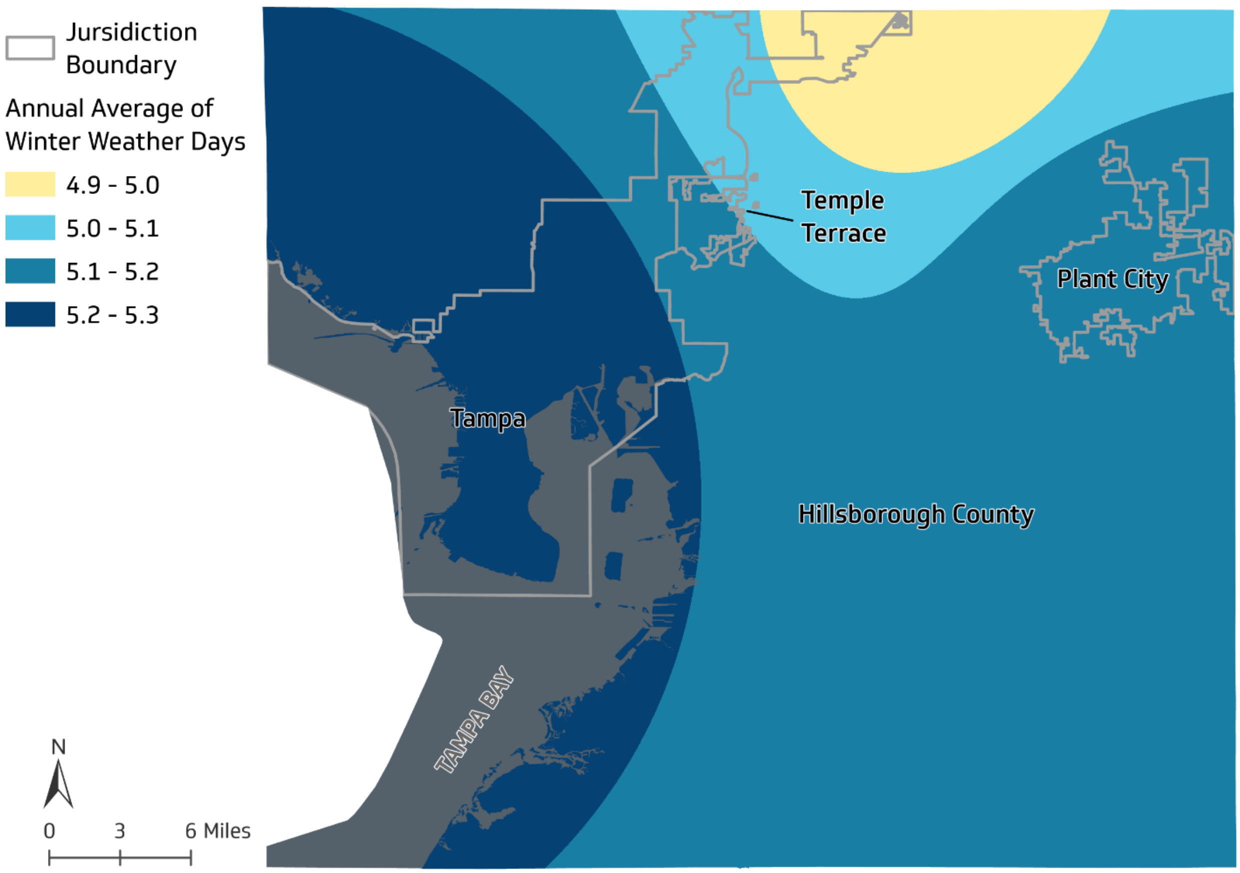


Figure 5.85. Winter Weather Risk, 1991-2020[265]

According to this data provided by the National Climatic Data Center, Hillsborough County is likely to receive less than 4-5 winter weather days each year. Figure 5.86 shows the average annual extreme cold days. Notably, Plant City experiences more extreme cold days than other parts of Hillsborough County. It also has the highest concentration of agricultural land.

---

[265] https://www.ncdc.noaa.gov/cdo-web/

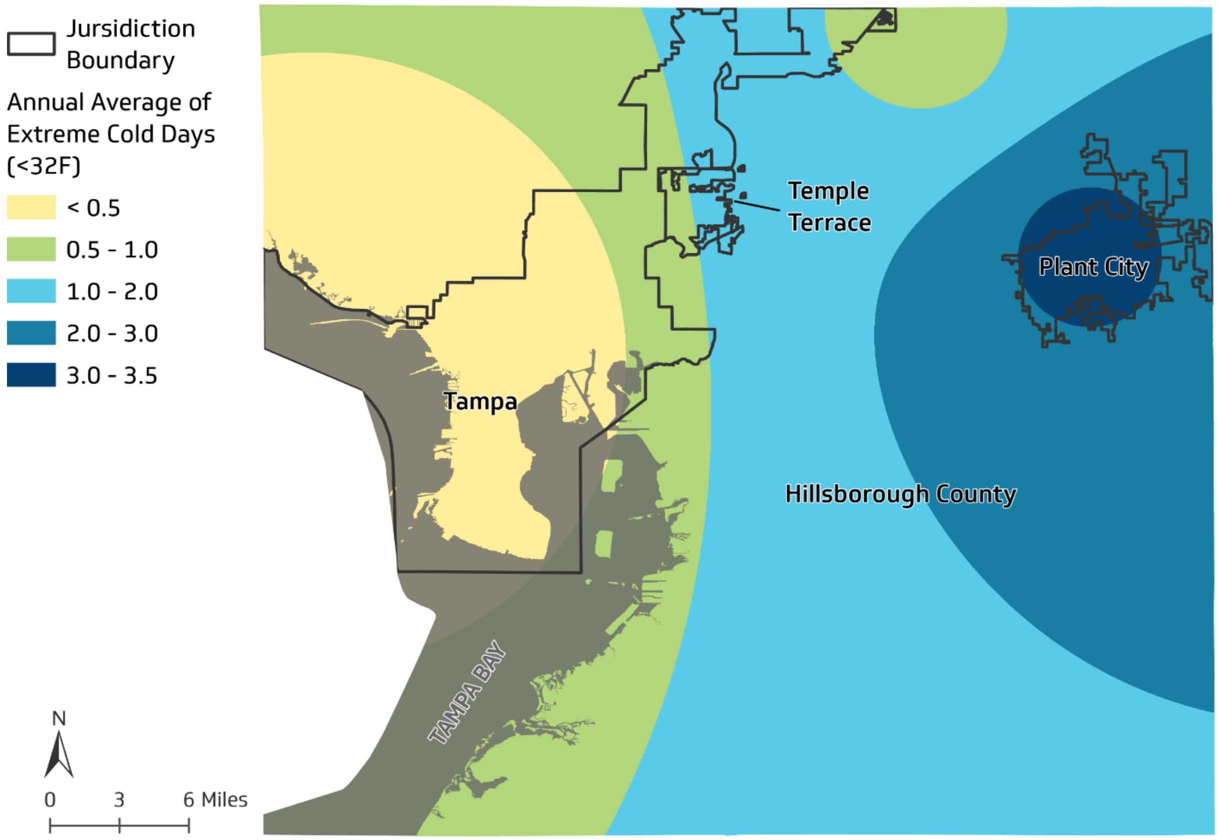


Figure 5.86. Florida Extreme Cold (<32°F) Risk, 1991-2020[266]

Historical Occurrences of Winter Storm and Freeze

Although Hillsborough County is not affected by snow, significant freezes have occurred. Winter storms may also be accompanied by other hazards such as coastal flooding, strong winds (tornadoes), wind chill, and power outages. These effects can disrupt commerce and transportation and may result in the loss of life.

Table 5.144 lists the significant winter storm and freeze events that affected Hillsborough County using data from NOAA's NCEI database. There have been no significant winter storm or freeze events in the county since 2018.

[266] https://www.ncdc.noaa.gov/cdo-web/

Table 5.144. Significant Winter Weather and Freeze in Hillsborough County[267]

Date	Description
March 1993	The winter "No-Name" storm that affected Tampa Bay in March 1993 is considered one of the worst non-tropical storms in United States history. Equivalent to a Category 2 hurricane, it caused a significant amount of flooding and power outages within the Tampa Bay area and accounted for more than $2 billion of damage across the eastern United States.
January 2, 2008	Freezing conditions were felt across much of the county, with several locations reaching lows of 27 to 30°F. Strawberry farms, mainly located in Plant City received damage to several acres as gusty winds prevented sprinklers from evenly coating the plants with ice.
2010	The record for the most days in which temperatures went below freezing was set in 2010. This period was also marked by an extreme amount of aquifer pumping, which was also considered to contribute to sinkholes that occurred during that same period.
January 18, 2018	A strong cold front moved southeast through the Florida Peninsula on the 17th, with strong cold air advection causing a hard freeze over large portions of the Nature Coast and west central Florida during the morning of the 18th. Another hard freeze occurred on the morning of the 19th as light winds and clear skies allowed for strong radiational cooling. The freeze caused unknown amounts of damage to citrus crops in Hernando, Pasco, Hillsborough, Polk, Manatee, Sarasota, Hardee, DeSoto, and Highlands Counties. There was also an unknown amount of damage to strawberries and crops in Hillsborough, Polk, Manatee, Sarasota, and Hardee County. In addition, the freeze also damaged landscaping across west central and southwest Florida. Temperatures dropped into the low to mid-20s across inland portions of Hillsborough County for several hours on the morning of the 18th, causing damage to citrus groves, strawberry crops, and landscaping. The coldest temperature reported was 22°F at the COOP site in Plant City.

Of the 41 FEMA-declared events in Hillsborough County from 1953 through 2023, there have been five events that involved severe winter weather. These events all related to freezing and, to a large degree, focused on the overall impact on the local economy.

Table 5.145 describes Presidential Disaster Declarations related to severe winter weather.

[267]https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Blizzard&eventType=%28Z%29+Cold%2FWind+Chill&eventType=%28Z%29+Extreme+Cold%2FWind+Chill&eventType=%28Z%29+Freezing+Fog&eventType=%28Z%29+Frost%2FFreeze&eventType=%28Z%29+Heavy+Snow&eventType=%28Z%29+Ice+Storm&eventType=%28Z%29+Sleet&eventType=%28Z%29+Winter+Storm&eventType=%28Z%29+Winter+Weather&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

Table 5.145. FEMA Major Disaster Declarations in Hillsborough County, Winter Storm and Freeze, 1953–2023[268]

Disaster Number	Date	Name/Description
DR-526	January 31, 1977	SEVERE WINTER WEATHER – FREEZING
DR-732	March 18, 1985	SEVERE FREEZE
DR-851	December 23–25, 1989	SEVERE FREEZE
DR-982	March 12–16, 1993	TORNADOES, FLOODING, HIGH WINDS & TIDES, FREEZING
DR-1359	December 1, 2000–January 25, 2001	SEVERE FREEZE

According to the NCEI Storm Events Database, there was one report of winter storm and freeze in Hillsborough County that occurred in January 2018, listed below in Table 5.146.[269] These winter storm and freeze events are only inclusive of those reported by NCEI from 1996 through December 2023, and events are only reported at the county level. It is likely that additional events have affected Hillsborough County.

Table 5.146. Historical Winter Storm and Freeze Occurrences in Hillsborough County

	Date	Type	Deaths	Injuries	Property Damage*	Crop Damage*
Hillsborough County						
INLAND HILLSBOROUGH (ZONE)	1/18/2018	Frost/Freeze	0	0	$0	$0
*Damage is reported in 2023 dollars. All damage may not have been reported.						

Probability of Future Occurrences of Winter Storm and Freeze

Based on the historical evidence, it is anticipated that a freeze is possible in Hillsborough County. But there is no record of winter storm or winter weather events. In some years, no freezing temperatures occur, and snowfall is very rare. Looking at the NOAA-listed incidents and the presidential disaster declarations in the tables above and dividing the number of events by the

---

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

269 https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28Z%29+Blizzard&eventType=%28Z%29+Cold%2FWind+Chill&eventType=%28Z%29+Extreme+Cold%2FWind+Chill&eventType=%28Z%29+Freezing+Fog&eventType=%28Z%29+Frost%2FFreeze&eventType=%28Z%29+Heavy+Snow&eventType=%28Z%29+Ice+Storm&eventType=%28Z%29+Sleet&eventType=%28Z%29+Winter+Storm&eventType=%28Z%29+Winter+Weather&beginDate_mm=01&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=10&endDate_dd=31&endDate_yyyy=2019&county=HILLSBOROUGH%3A57&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=12%2CFLORIDA

periods of record, it appears that Hillsborough County has approximately a 10-20% chance of experiencing a winter freeze or related winter weather event in any given year.

Potential Effects of Climate Change on Winter Storm and Freeze

Climate change is not expected to increase the number of occurrences or the magnitude of winter storm and freeze in Florida. However, climate change does not mean that winter storm and freeze will not continue to occur in Hillsborough County. Increased variability in winter weather patterns can potentially result in more winter storms with interspersed periods of warmer weather, making it challenging to prepare and respond effectively to winter weather hazards. Climate change may also alter precipitation patterns, including the type and amount of precipitation during winter months. In areas like Hillsborough County, this could mean changes in the frequency and intensity of rain, sleet, and snow events – potentially impacting water resources, flood risk, and infrastructure. Climate variability will continue to influence daily temperatures, so isolated and prolonged winter storm and freeze events are not unlikely.[270]

Winter Storm and Freeze Impact Analysis

All jurisdictions could potentially experience the following impacts due to winter storm and freeze.

- Public
    - Injury or death, as well as possible property damage from car accidents because of ice on roads and bridges
    - Injury or death from exposure to cold weather, either because of being stranded outside or inside without proper heating systems
    - Deaths and injuries have resulted from accidents, including automobile collisions, due to poor driving conditions; emergency medical response can be severely hindered by the effects of a winter storm event; this is because Floridians are not accustomed to driving in winter weather conditions
- Responders
    - First responders are increasingly at risk as they respond to traffic incidents and calls for medical attention; they are vulnerable to the same transportation dangers as other citizens but often have to go out in hazardous conditions when ordinary citizens would not
- Continuity of Operations (including continued delivery of services)
    - During a winter storm and the days that follow, many people do not travel due to road conditions; the absenteeism of workers affects the overall continuity of operations of the government. Changes from experience based on COVID have likely reduced this impact since the last plan update.
- Property, Facilities, Infrastructure
    - Loss or damage of crops and agricultural revenue because of frost/freeze events

---

[270] *Ingram and Carter (2012). Southeast region technical report to the National Climate Assessment. http://gyr.fortlauderdale.gov/home/showdocument?id=3153*

    - Roads and highways are most vulnerable to the effects of winter storms; roads frequently become iced over, resulting in accidents, injuries, deaths, and traffic congestion; roads can be heavily damaged due to winter weather events; potholes and cracks can be found on roadways after a winter weather event, resulting in the need for repairs, causing further economic losses to the local area
    - Electrical transmission lines are highly vulnerable to severe winter weather; trees frequently fall due to the extra weight of ice accumulating on branches; trees falling on nearby power lines cause disruption of power service, which results in additional costs for repairs and maintenance
    - Other impacts resulting from winter storms include damage to plumbing, sewers, and waterlines, as well as minor roof damage and house fires resulting from portable heaters
- Environment
    - Loss or damage to environment, including green spaces, habitats, and species because of cold weather, winter weather, and/or frost/freeze events
- Economic Condition
    - Loss or damage to crops because of freezes results in the loss of tens and sometimes hundreds of millions of dollars; this affects individual farmers and industries, such as the citrus industry in Florida
- Public Confidence in Each Jurisdiction's Governance
    - A high number of motor vehicle accidents, school closures, power outages, or injuries and deaths may cause the public to believe that the government did not adequately prepare for the incident

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

Because the winter storm and freeze hazard does not have geographically definable boundaries, it was excluded from spatial analysis through GIS. However, because the hazard is considered atmospheric, it has the potential to affect all buildings and all populations in Hillsborough County.

Winter storm and freeze usually do not cause direct damage to structures in the county; however, extreme cold hazards include infrastructure damage to pipes, power lines, and roadways. Additionally, although large-scale property damage is rare with these events, crop damage is much more likely and could significantly impact the local agriculture and livestock industry. Although Hillsborough County and its jurisdictions are not affected by snow, significant freezes have occurred with significant impact on the agricultural industry. A significant area of eastern Hillsborough County is agrarian including crops for strawberries and citrus. Portions of southern Hillsborough County contain tomato fields. All of these areas can be severely affected by just a few hours of below-freezing temperatures.

The large agricultural businesses focusing on strawberry production would sustain one of the largest impacts, primarily in east Hillsborough County. Plant City would be heavily impacted by the freezing temperatures, leading to agricultural losses with direct impacts on the location's economy. Strawberries represent 46.6% of the county's annual agricultural sales while vegetable production is second accounting for 18%. Significant impacts would also occur in fisheries located throughout East Hillsborough County, including the Brandon, Riverview, and Gibsonton areas.

Winter storm and freeze can also have several negative externalities including:

- Hypothermia
- Cost of snow and debris cleanup
- Business and government service interruption
- Traffic accidents, and
- Power outages.

Furthermore, citizens may resort to using inappropriate heating devices that could lead to fire or an accumulation of toxic fumes. The populations most vulnerable to winter storm and freeze is the elderly population, those medically dependent upon power, and the homeless population.

National Risk Index (NRI)

The National Risk Index (NRI) (Figure 5.87) was utilized to obtain information for risk analysis on winter storm and freeze hazards at the census tract level across Hillsborough County, FL. This analysis is limited to cold waves since data are not available in the NRI to address other forms of winter weather events. As displayed in Figure 5.87, the vulnerability to cold wave across Hillsborough

County only ranges from Very Low to Relatively Moderate, with no other risk degrees identified for cold wave in this area.

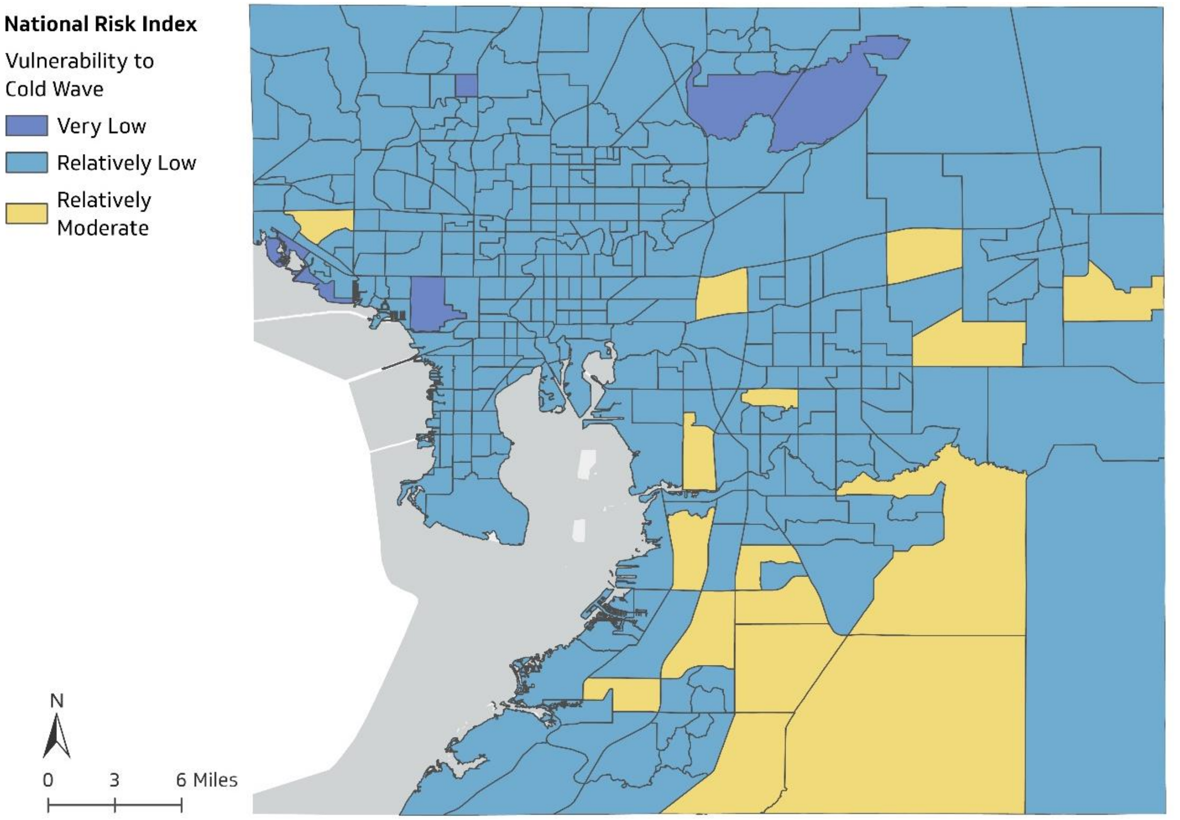


Figure 5.87. Degree of Vulnerability Risk to Cold Wave Exposure, shown at the census tract level[271]

Risk in the NRI is calculated by taking the expected annual loss in the census tract, for cold wave this data was taken from the NCEI Storm Events Database. Multiplying the expected annual loss by the social vulnerability of the census tract using data from the CDC. Then dividing that by community resilience, which is the ability of a community to prepare and plan for, absorb, recover from, and more successfully adapt to the impacts of natural hazards.[272] Community resilience is calculated using the scoring from the Hazards Vulnerability & Resilience Institute (HVRI) Baseline Resilience Indicators for Communities (BRIC). [273]

The highest number of communities with moderate risk in this area are in unincorporated Hillsborough County, accounting for 93.8% of the total. The only other jurisdiction to have relatively moderate risk of cold wave exposure is Plant City with 1 community at risk, Tampa and Temple Terrace have no relatively moderate risk. Table 5.147 provides the total number of communities (census tracts) in each jurisdiction broken down by degree of risk exposure to cold wave. Of the 333

[271] https://hazards.fema.gov/nri/map
[272] https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf
[273] https://www.sc.edu/study/colleges_schools/artsandsciences/centers_and_institutes/hvri/index.php/bric

communities in Hillsborough County altogether, only 16 are at risk of relatively moderate risk of cold wave exposure, equating to approximately 4.8%.

Table 5.147. Breakdown of community risk to cold wave, by jurisdiction and degree of risk

Jurisdiction	# of Very Low Risk to Cold Wave	# of Relatively Low Risk	# of Relatively Moderate Risk
Hillsborough County (Unincorporated)	5	192	15
City of Plant City	0	10	1
City of Tampa	1	101	0
City of Temple Terrace	0	8	0
Hillsborough County (Total)	**6**	**311**	**16**

In addition to analyzing community risk, expected annual loss due to cold wave exposure is included to evaluate an average economic risk impact. Shown Figure 5.88, the range for Hillsborough County as a whole is only $10,000 annually, on average. By individual census tract based on expected loss, unincorporated Hillsborough County has the highest projected loss as a result of cold wave exposure at approximately $9,930 dollars located in the southern portion of the county. These projected loss values in the southern portion of the county can for the most part be attributed to crop damage as the southern portion of the county has a higher proportion of the agricultural land in

Hillsborough County. These losses are calculated using historical data, which is likely underreported. Actual losses are likely higher.

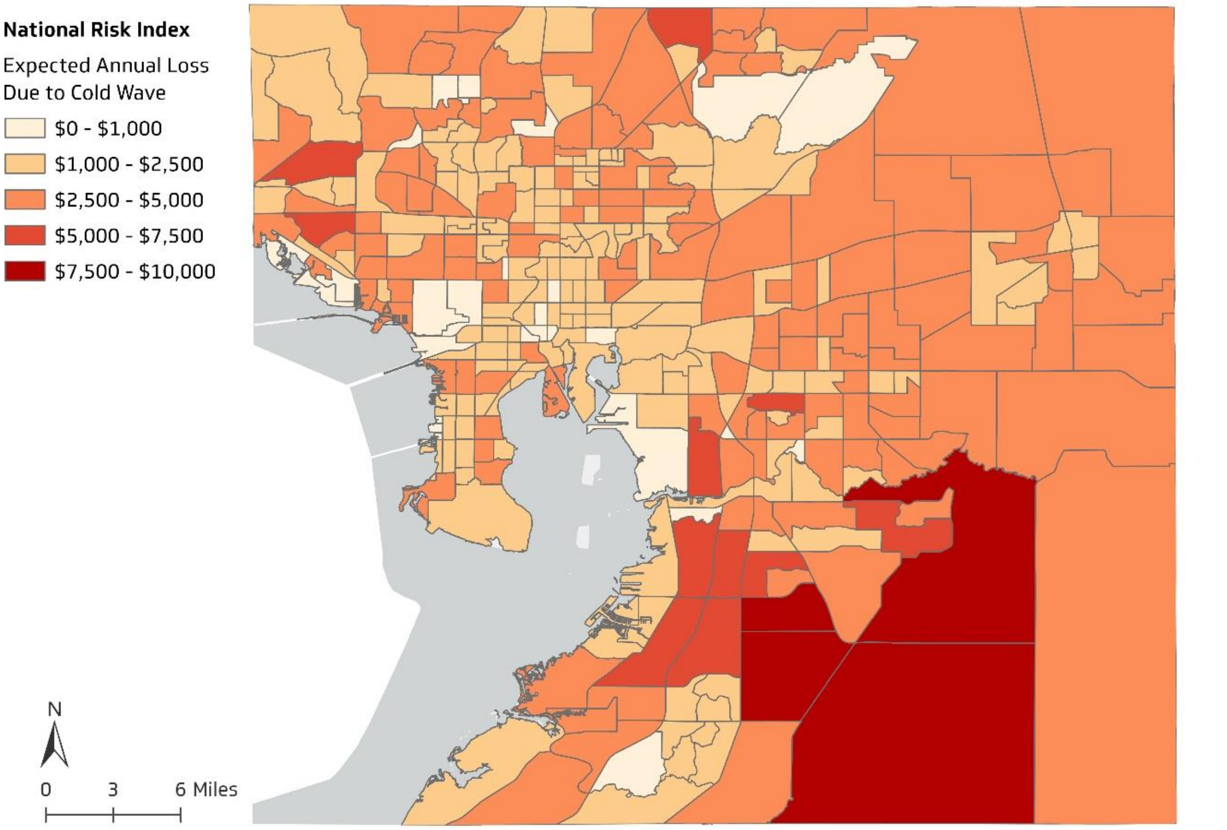


Figure 5.88. Expected Annual Loss due to Cold Wave[274]

Based on NRI data, the expected average loss for the entirety of Hillsborough County due to cold wave exposure is approximately $2,400, for each census tract, with a total annual loss of $801,531 expected countywide. Overall, unincorporated Hillsborough County has the highest expected annual loss because of cold wave exposure at $552,610. Tampa has the second highest expected annual loss, followed by Plant City and Temple Terrace. Table 5.148 below provides the expected annual loss for each jurisdiction.

Table 5.148. Average Expected Annual Loss due to Cold Wave Exposure, by jurisdiction

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Unincorporated)	$552,610
City of Plant City	$26,862
City of Tampa	$201,571
City of Temple Terrace	$20,488

[274] https://hazards.fema.gov/nri/map

Jurisdiction	Expected Annual Loss (2023 dollars)
Hillsborough County (Total Loss)	**$801,531**

Population by jurisdiction within moderate risk of exposure to cold wave events is presented in Table 5.149. The total population at risk is estimated at 149,269, which is 10.2% of the entire county's population. No population is at moderate risk of cold wave in Tampa or Temple Terrace. Unincorporated Hillsborough County has the highest population percent at risk with 14.4%, followed by Plant City at 6.9%.

Table 5.149. Total population and percentage at moderate risk of cold wave exposure, by jurisdiction

Jurisdiction	Total Population	Total Population at Risk	Total % at Risk
Hillsborough County (Unincorporated)	989,745	142,523	14.4%
City of Plant City	48,289	3,332	6.9%
City of Tampa	382,484	0	0.0%
City of Temple Terrace	37,764	0	0.0%
Hillsborough County (Total)	**1,458,282**	**145,855**	**10.0%**

Historic Losses

The NCEI Storm Events Database information, presented in the Historical Occurrences section above, also contained fields for property and crop damage dollar amounts. No damages were recorded. For that reason, the loss estimation analysis is limited to the FEMA National Risk Index calculated losses.

Although no damages were reported by NCEI, significant freezes do have a significant impact to the agriculture industry in the county and agricultural losses have a direct impact on the local economy.

Justice40 Climate Justice and Economic Screening Tool

Social vulnerability is a major contributor to the NRI vulnerability classifications shown in Table 5.149, above. Utilizing the Climate Justice and Economic Screening Tool (CJEST) and the NRI datasets at the census tract level, disadvantaged communities (census tracts) were overlaid with high or moderate risk of cold waves. The results are shown in Figure 5.89. A total of 131 communities across Hillsborough County are identified as disadvantaged, accounting for 53% of total communities at the census tract level.

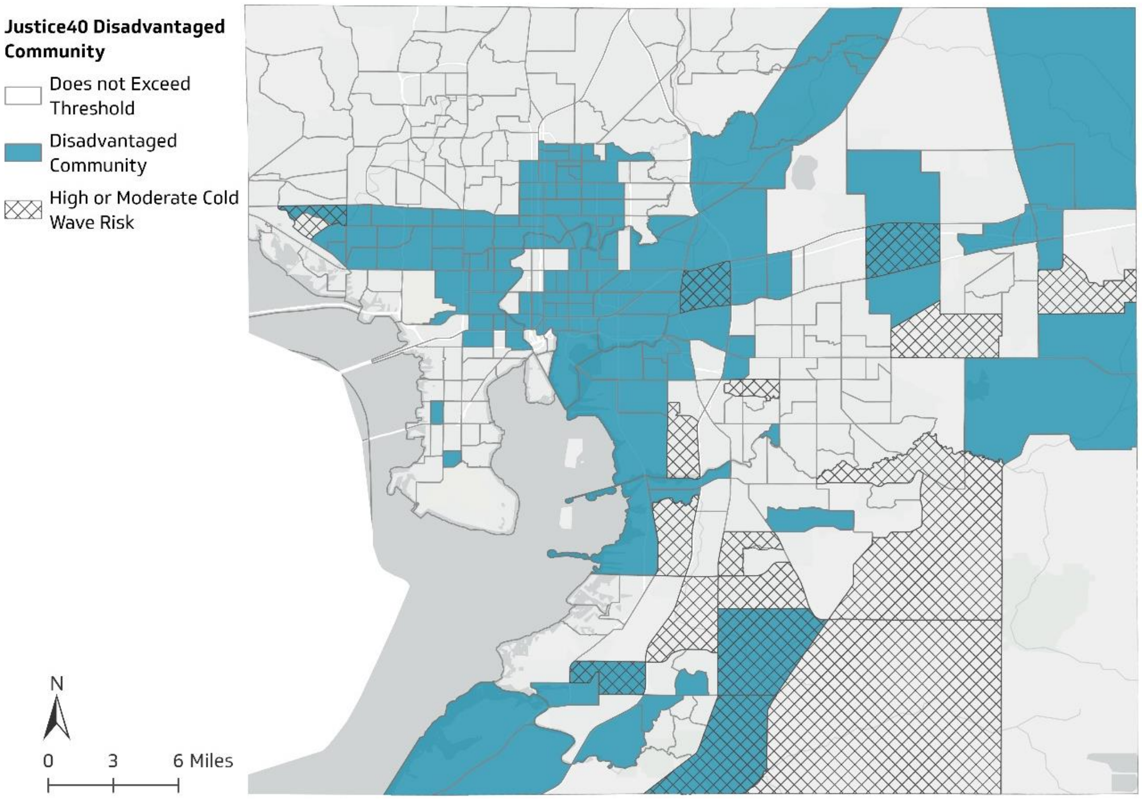


Figure 5.89. High or Moderate Cold Wave Risk Overlayed Disadvantaged Communities[275]

A majority of the disadvantaged communities, 52.7%, are located in unincorporated Hillsborough County followed by the City of Tampa with 41.2% of the total disadvantaged communities. Table 5.150 displays the total number of disadvantaged census tracts in each jurisdiction and the number of those communities at risk of moderate or high risk of cold wave exposure. Of the 131 disadvantaged communities in Hillsborough County altogether, only 6 are at risk of moderate to high cold wave exposure, equating to approximately 4.6%.

Table 5.150. Breakdown of disadvantaged census tracts and risk to cold wave, by jurisdiction

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities with Mod/High Cold Wave Risk
Hillsborough County (Unincorporated)	69	5
City of Plant City	6	1
City of Tampa	54	0

[275] https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

Jurisdiction	# of Disadvantaged Communities	# of Disadvantaged Communities with Mod/High Cold Wave Risk
City of Temple Terrace	2	0
Hillsborough County (Total)	**131**	**6**

Vulnerability Analysis and Loss Estimation of Critical Facilities

Winter storm and freeze can strike anywhere in Hillsborough County as it is an atmospheric hazard; therefore, all the county and city critical facilities and community lifelines are vulnerable and at risk. Winter storm and freeze usually do not cause direct structural damage to critical facilities and community lifelines. Loss of power to facilities from ice or wind issues with continuity of operations are considered the biggest vulnerabilities. Critical facilities and community lifelines without backup generators or other secondary sources of power are at higher risk. There are no historical data on losses due to this hazard, so estimating future losses to critical facilities and community lifelines is not possible within the scope of this plan.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4 and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0 and the overall vulnerability ranking or high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be low, with a PRI score of 2.3 (

Table 5.151).

Table 5.151. Overall Vulnerability to Winter Storm and Freeze for Hillsborough County

<table>
<tr><th colspan="5">WINTER STORM AND FREEZE</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Severe winter weather includes extreme cold, snowfall, ice storms, winter storms, and/or strong winds, and affects every state in the continental United States. Areas where such weather is uncommon, such as Florida, may experience a greater impact on transportation, agriculture, and people from relatively small events compared to other states that experience winter weather more frequently.</td><td colspan="2">LOW</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Minor</td><td>Large</td><td>> 24 hrs</td><td>Not Concerned</td><td>< 1 week</td><td>2.3</td></tr>
</table>

4.11 Seismic Events Hazard Profile

Seismic Event Description

A seismic event, also known as an **earthquake**, is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface that results in vibrations that propagate through the earth. This shaking can collapse buildings and bridges, disrupt gas, electric, and phone service, and sometimes trigger landslides and tsunamis or indirectly cause flash floods or fires.

Measures

Earthquakes are measured in two ways: by magnitude and by intensity.

- The magnitude of an earthquake is measured by the moment magnitude (Mw) scale, which measures how much energy is released, such as the amount of rock movement and the area of the fault or fracture surface. The moment magnitude scale ranges from 0 to 10, and each increase in number is about 32 times greater than the previous number, as illustrated in Figure 5.90.

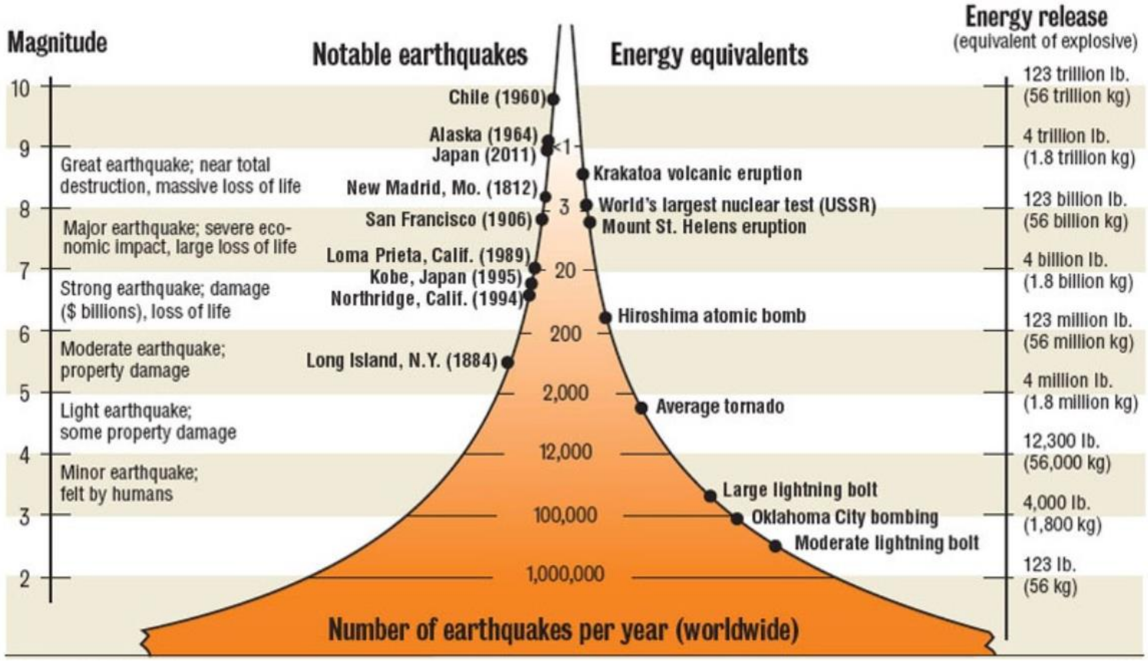


Figure 5.90. Moment Magnitude Scale [276]

- The intensity of an earthquake is measured using the Modified Mercalli (MM) Intensity Scale, which is comprised of 12 increasing levels of intensity that range from imperceivable shaking to catastrophic destruction and is designated by Roman numerals.; It is a ranking based on observed effects, such as people awakening, movement of furniture, damage to chimneys, and finally, total destruction. The observed effects correlate to peak ground acceleration. Table 1 describes observations at various MMI classifications.

---

[276] https://www.usgs.gov/media/images/eq-magnitude-energy-release-and-shaking-intensity-5

Table 5.152. Modified Mercalli Intensity Scale

Modified Mercalli Intensity Scale[277]		
MMI	**Acceleration (%g) (PGA)**	**Description**
I.	< 0.17	Not felt except by a very few under especially favorable conditions.
II.	0.17 – 1.4	Felt only by a few persons at rest, especially on the upper floors of buildings.
III.	0.17 – 1.4	Felt noticeably by persons indoors, especially on the upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
IV.	1.4 – 3.9	Felt indoors by many and outdoors by few during the day. At night, some awakened. Dishes, windows, and doors are disturbed; walls make cracking sounds. Sensation like a heavy truck striking building. Standing motor cars rocked noticeably.
V.	3.9 – 9.2	Felt by nearly everyone, many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI.	9.2 - 18	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII.	18 - 34	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII.	34 - 65	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX.	65 - 124	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X.	> 124	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI.	> 124	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII.	> 124	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

While magnitude is defined as one number, intensity varies based on what is experienced in a specific location and is, therefore, a more meaningful measure of severity to the nonscientist. The closer that a person is located to the epicenter of an earthquake, the more intensity of seismic waves they would experience, and the higher the MM value that would be assigned. Structural engineers usually contribute information for assigning intensity values of VIII or above.

[277] https://mitigation.eeri.org/wp-content/uploads/FEMA_386_2.pdf

Geographic Areas Affected by Seismic Events

Seismic activity is rare in Florida. There are no documented active faults in the state, and no earthquakes have been recorded with an epicenter in the state's history.

Below is a map of fault lines in the southeast United States. When shaking is felt in Florida, the seismic activity has likely come from earthquakes in the Gulf of Mexico, the Caribbean, or more active areas in the southeast United States.

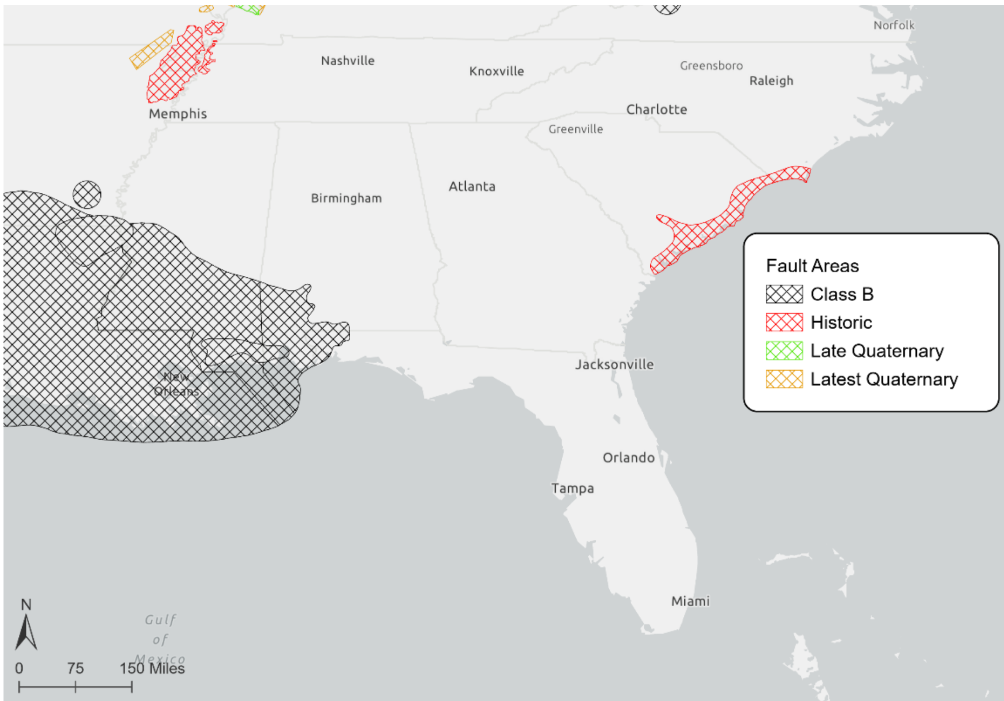


Figure 5.91. Southeast United States Fault Lines

Historical Occurrences of Seismic Events

There are no historical incidents in the state that have caused significant damage. Additionally, many of the reports of earthquakes from before technological advancements have no supporting evidence due to the loss of original reports. Table 5.153 provides a list of historical occurrences of seismic events throughout Florida.

Table 5.153. Florida Historical Occurrences, Seismic

Date	Description
August 31, 1886	Known as the "great earthquake," a severe earthquake hit Charleston, South Carolina. It was so powerful that shaking was felt in St. Augustine and Tampa. There were also several aftershocks in the months after the quake that were felt in Florida.
January 5, 1945	Shaking was felt in Volusia County. Windows in a De Land courthouse shook violently.
October 27, 1973	A shock was felt in Seminole, Volusia, Orange, and Brevard counties with a maximum intensity of MM V.

Date	Description
January 13, 1978	Two shocks were felt in Polk County, each lasting about 15 seconds and one minute apart. It rattled doors and windows, but there were no injuries or damages.
November 13, 1978	A shock was felt in northwest Florida. The seismic station estimated that it originated in the Atlantic Ocean.[278]
September 10, 2006	A strong quake was felt in Florida and other Gulf Coast states. USGS determined it was a magnitude 6 quake originating in the Gulf of Mexico, 250 miles southwest of the Apalachicola area.[279]
July 16, 2016	Some felt small shakes in Florida and USGS rated the event as a 3.7 magnitude. It was later discovered that the "quake" was actually an experimental explosion in the ocean by the U.S. Navy.[280] Experimental explosions roughly 100 miles off the east coast of Florida caused many more "quakes" with similar magnitude between 2016 and the present.
March 7, 2019	This magnitude 2.8 earthquake occurred at a depth of 3.1 miles, originating in the panhandle just northwest of Jay, Florida.
March 24, 2019	This magnitude 2.7 earthquake occurred at a depth of 3.1 miles, originating in the panhandle just southeast of Century, Florida, along the Escambia River.

Many reports of earthquakes felt in Florida before the 1900s are unsubstantiated and only known because of personal accounts of "tremblors." Florida residents have felt activity caused by earthquakes—most notably those originating in Charleston, South Carolina (1886), The Atlantic Ocean (1978), and the Gulf of Mexico (2006)—as well as human activity—explosion tests by the U.S. Navy (2016). Figure 3 shows earthquakes with epicenters that occurred near Hillsborough County between 1985 and 2018. No earthquakes occurred within the county boundaries during this period, but several did occur in the Gulf of Mexico.

Figure 5.92 shows earthquakes with epicenters that occurred near Hillsborough County between 1985 and 2018. No earthquakes occurred within the county boundaries during this period, but several did occur throughout Florida and in the Gulf of Mexico.

[278] http://ufdc.ufl.edu/UF00001039/00001/13x
[279] http://publicfiles.dep.state.fl.us/FGS/FGS_Publications/Forum/forum_oct2006.pdf
[280] https://earthquake.usgs.gov/earthquakes/eventpage/us20006f8n#executive

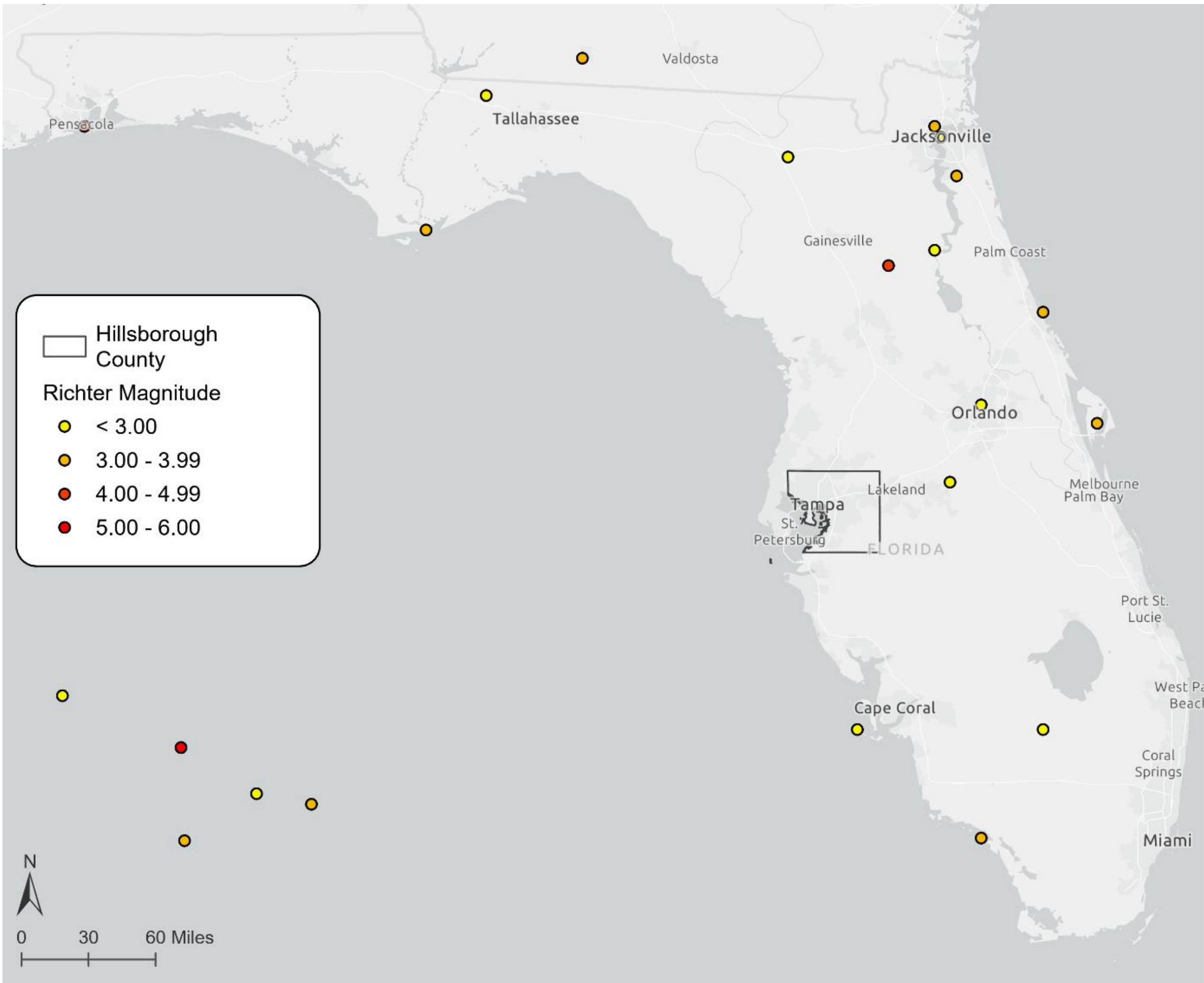


Figure 5.92. Historical Earthquake Epicenters, 1985–2018

Probability of Future Occurrences of Seismic Events

The probability is extremely low that a major earthquake will affect the state of Florida and cause significant damage. According to USGS, Florida is classified as a stable geological area, which means that damage from any shaking or tremors felt from an earthquake is expected to be minimal.

Peak ground acceleration (PGA) is equal to the maximum ground acceleration that occurred during earthquake shaking at a location. PGA is equal to the amplitude of the largest absolute acceleration recorded on an accelerogram at a site during a particular earthquake[281].

Generally, a peak ground acceleration of 0.01 m/s^2 is felt by humans, and a peak ground acceleration of 0.2 m/s^2 can cause people to lose their balance. Figure 5.93 from USGS shows zones of peak ground acceleration as a percentage of gravitational acceleration and demonstrates that most of the state, including Hillsborough County, would experience 0.20 m/s^2 peak ground

---

[281]https://strathprints.strath.ac.uk/53451/1/Douglas_ESR_2003_Earthquake_ground_motion_estimation_using_strong_motion.pdf

acceleration in the event of an earthquake affecting Florida. This does not mean that an earthquake that centered near Florida would be felt by all of Florida, but that shaking may be possible to feel.

There is a two percent probability that the given acceleration range will be exceeded in a 50-year period. Peak ground acceleration refers to the maximum shaking that occurs at a specific location during an earthquake. Based on historical information, this hazard was determined to have a probability level of possible (1-10% probability of annual occurrence).

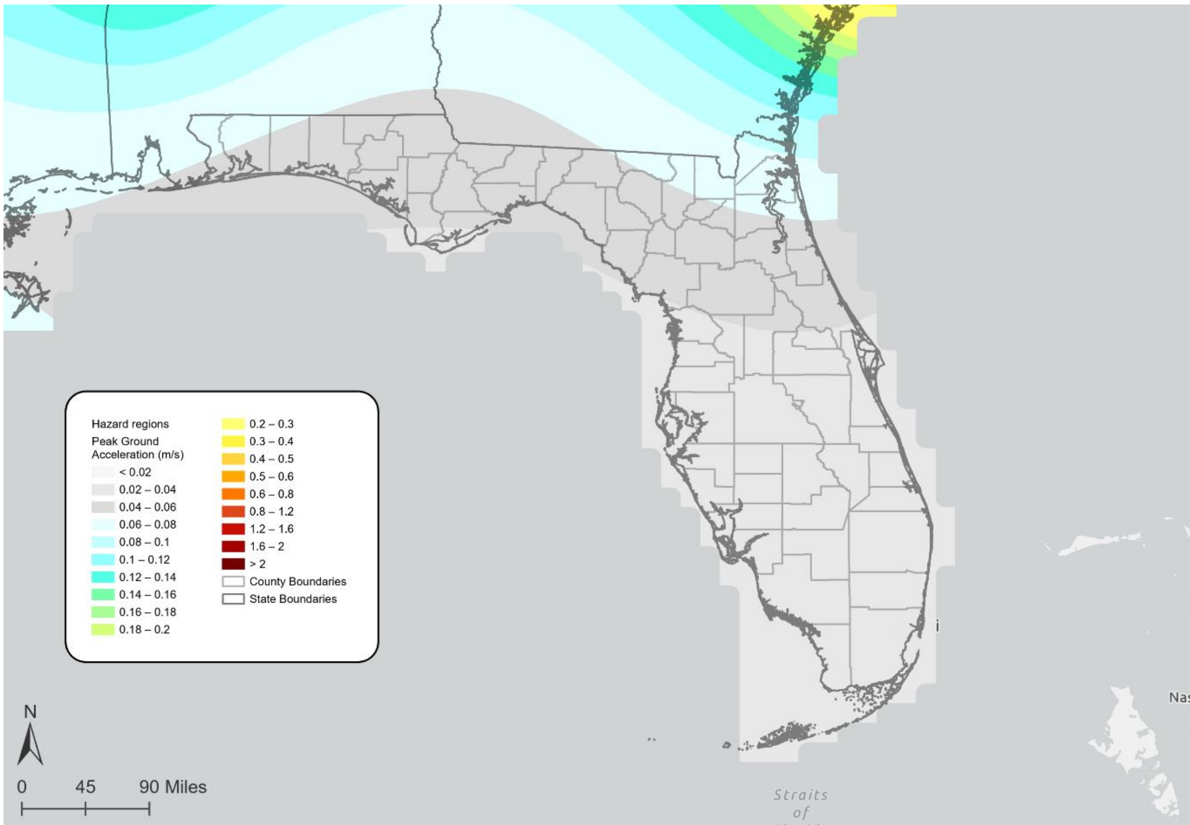


Figure 5.93. Florida Peak Ground Acceleration

Potential Effect of Climate Change

There is no evidence to suggest that Climate change will affect the occurrence or magnitude of seismic events in Florida.

Seismic Events Impact Analysis

All jurisdictions could receive the following impacts due to seismic events.

- Public
    - May feel slight shaking, but no injuries will result in shaking from an earthquake
- Responders
    - Unlikely to experience impacts
- Continuity of Operations (including continued delivery of services)
    - Unlikely to cause interruptions to operations

- Property, Facilities, Infrastructure
    - Some windows may be shattered from a large earthquake that sends shocks and shaking to Florida, but this is very unlikely
- Environment
    - Unlikely to impact the environment
- Economic Condition
    - Unlikely to impact the economy
- Public Confidence in Each Jurisdiction's Governance
    - Unlikely to impact the public confidence in each jurisdiction's governance

Vulnerability Analysis and Loss Estimation by Jurisdiction

According to the peak ground acceleration map presented above, Hillsborough County has a very low vulnerability. The seismic events that Hillsborough is most likely to experience are not ones that would cause significant damage. However, it is possible that the county may experience shaking during a future event centered near Florida.

Hazus-MH

Hazus-MH was used to estimate the county's annualized loss from a probabilistic earthquake scenario, as shown below. A probabilistic scenario accounts for a full spectrum of probable events, producing annualized loss estimates. Since the scenario is annualized, no building counts are provided. Losses reported include losses due to building damage (structural and non-structural), contents, inventory, relocation, capital, wages, and rental income.

Table 5.154. Estimated Annualized Loss for Probabilistic Earthquake Scenario

	Probabilistic Earthquake Scenario
Structural Damage	$74,000
Non-Structural Damage	$103,000
Contents Damage	$16,000
Inventory Loss	$0
Relocation Loss	$52,000
Capital Related Loss	$7,000
Wage Loss	$9,000
Rental Income Loss	$20,000
TOTAL LOSS	**282,000**

Annualized losses by the U.S. Census tract are shown in Figure 5.94 below. Due to the very low dollar amount of losses, they were not parsed out individually for Tampa, Plant City or Temple Terrace.

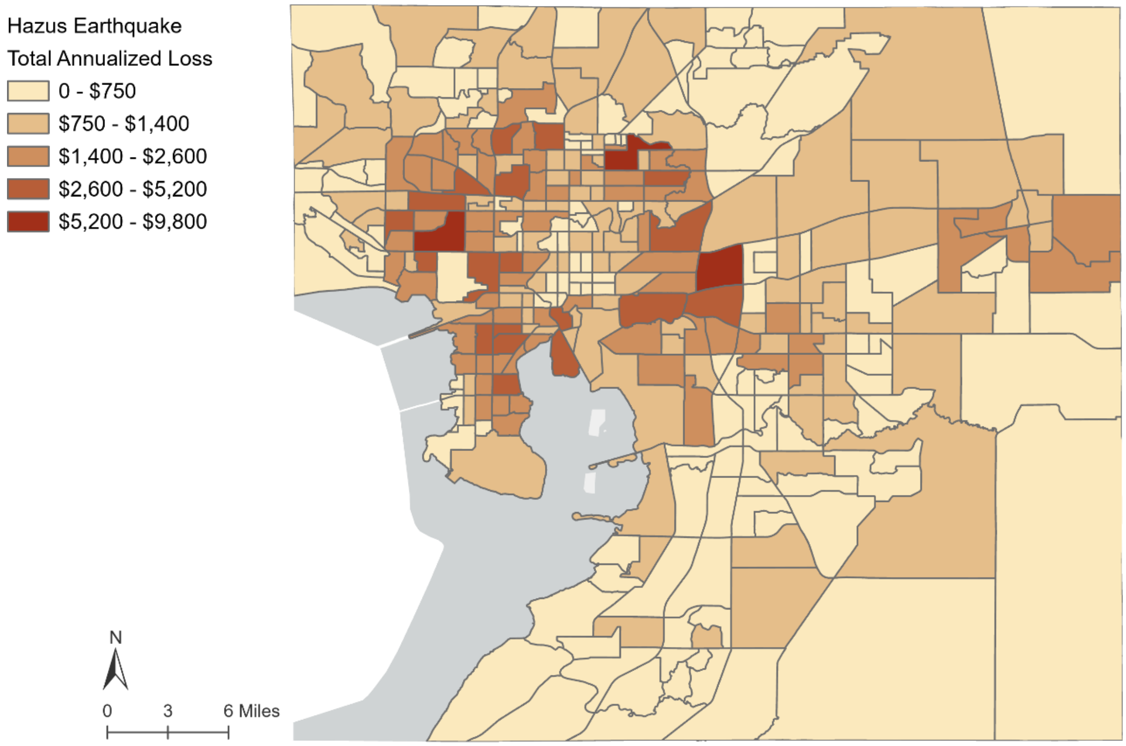


Figure 5.94. Seismic Annualized Losses

Vulnerability Analysis and Loss Estimation of Critical Facilities

Like the jurisdiction vulnerability and loss estimates, critical facilities and community lifelines have a low vulnerability to seismic events, and minimal to no losses are expected. Mitigation in the form of building retrofits to critical facilities and community lifelines would be difficult and highly unlikely to pass a benefit-cost analysis.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be low, with a PRI score of 2.2 (

Table 5.155).

Table 5.155. Overall Vulnerability to Seismic Event for Hillsborough County

SEISMIC EVENTS					Overall Vulnerability	
Overview						
A seismic event, or an earthquake, is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface that creates seismic waves. This shaking can cause buildings and bridges to collapse, disrupt gas, electric, and phone service, and sometimes trigger landslides and tsunamis or indirectly cause flash floods or fires.					**LOW**	
Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Public Sentiment**	**Duration**	**PRI Score**
Possible	**Limited**	**Moderate**	**< 6 hrs**	**Not Concerned**	**< 6 hrs**	**2.2**

4.12 Tsunami Hazard Profile

Tsunami Description

Tsunamis are among the most devastating of geologic disasters. Tsunamis are powerful waves created by another non-meteorological hazard that is geologic in nature, such as earthquakes, underwater landslides, volcanic eruptions, or other displacements of large amounts of water under the sea. As the waves travel towards land, they build up to higher heights as the depth of the ocean decreases and appear as walls of water or turbulent waves that resemble hurricane storm surge. The speed at which a tsunami travels depends on the ocean depth rather than the distance from the source of the wave. Deeper water generates greater speed, and the waves slow down when reaching shallow waters. Where the ocean is deep, tsunamis can travel at speeds up to 500 miles per hour. Tsunamis arrive on land with enormous force and recede with nearly equal force.

A tsunami is not a single wave but rather a series of waves often referred to as a "wave train." There can be as many as 60 miles between the peaks of each wave series, and waves can be as far as one hour apart.[282] Tsunamis have a much smaller amplitude (wave height) offshore and a very long wavelength (often hundreds of miles long), which is why they generally pass unnoticed at sea, forming only a passing "hump" in the ocean. The number of arrivals and the amplitudes of each wave will vary depending on the coastal properties, the exact travel direction, and other specifics of how the tsunami was generated. These attributes of a tsunami will vary from place to place and from event to event. In the largest tsunamis, surge can continue for hours and even go on for more than a day.

Scientists cannot predict when and where the next tsunami will strike, but Tsunami Warning Centers know which earthquakes are likely to generate tsunamis and can issue warnings when they think it is possible.

Tsunami Monitoring and Forecasting

There is often no advance warning of an approaching tsunami. However, since earthquakes are often a cause of tsunamis, an earthquake felt near a body of water may be considered an indication that a tsunami could shortly follow. See the *Seismic Event Hazard Profile* for more information on the earthquake hazard. The first part of a tsunami to reach land is a trough rather than a crest of the wave. The water along the shoreline may recede dramatically, exposing areas that are normally submerged. This can serve as an advance warning of the approaching crest of the tsunami, although the warning only gives a very short time before the crest, which typically arrives seconds to minutes later.[283]

NOAA's Pacific Marine Environmental Laboratory developed Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoys to monitor tsunami systems in real-time. These buoys are positioned at strategic locations throughout the ocean globally and play a critical role in tsunami forecasting. NOAA has two Tsunami Warning Centers:[284]

---

[282] https://www.nationalgeographic.com/environment/article/tsunami-facts-saftey-tips
[283] http://www.tsunami.gov/?page=tsunamiFAQ
[284] https://www.tsunami.gov/?page=history

- The National Tsunami Warning Center in Palmer, Alaska, serves the continental United States, Alaska, Puerto Rico, Virgin Islands, and Canada
- The Pacific Tsunami Warning Center in Honolulu, Hawaii, directly serves the Hawaiian Islands and the U.S. Pacific territories and is the primary international forecast center for the warning systems of the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization in the Pacific and the Caribbean and Adjacent Regions

NOAA's National Centers for Environmental Information (NCEI) has built high-resolution digital elevation models (DEMs) for select U.S. coastal regions. These combined bathymetric-topographic DEMs are used to support tsunami forecasting and modeling efforts at the NOAA Center for Tsunami Research, Pacific Marine Environmental Laboratory (PMEL). The DEMs are part of the Short-term Inundation Forecasting for Tsunamis (SIFT) system currently being developed by the PMEL for the NOAA tsunami warning centers and are used in the Method of Splitting Tsunami (MOST) model developed by the PMEL to simulate tsunami generation, propagation, and inundation. An example of the propagation stage of the MOST model is shown in Figure 5.95 below.

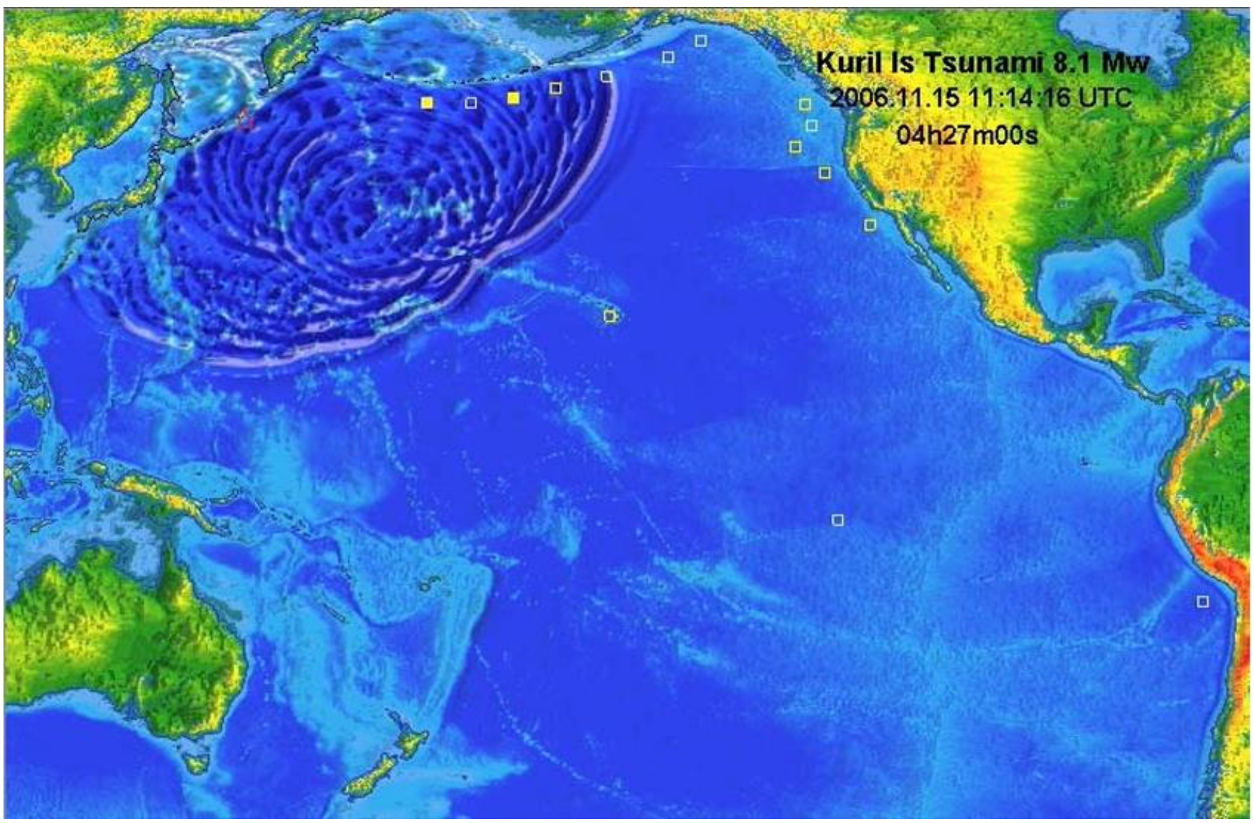


Figure 5.95. Example of DEM and Tsunami Propagation using the MOST Model[285]

[285] https://nctr.pmel.noaa.gov/ComMIT/docs/MOST_manual.pdf

Misnomers

There is another phenomenon often confused with tsunamis called rogue waves. There remains debate as to whether these waves are related to tsunamis. They are included in this section as the mitigation plans address the threat in the same relative manner. Rogue waves are unpredictable, and little is known about their formation, but they may be caused by regularly spaced ocean swells that are magnified by currents or the atmosphere.

Geographic Areas Affected by Tsunami

Tsunami events occur most often in the Pacific Ocean, but they are a global phenomenon. All tsunamis are potentially dangerous, even though they may not damage every coastline they strike. The past 150 years of tsunami records show that the most frequent and destructive tsunamis to affect the United States have occurred along the coasts of California, Oregon, Washington, Alaska, and Hawaii.[286]

Overall, Florida has experienced few destructive tsunami or rogue wave events, but there have been multiple small events.

There are two ways of identifying geographic locations that could be affected by a tsunami event. The first is to consider the fact that there is scientific evidence that shows that there is the potential for a geological event, such as a massive landslide, to take place with Cumbre Vieja in the Canary Islands. If this event were to occur, a large-scale tsunami could affect the United States' eastern coastline, and it is expected that the eastern coastline of the state of Florida would suffer extensive damage and loss of life.

Earthquakes are frequently the cause of tsunami events, and because there is no way of knowing exactly when and where future earthquake events might take place, it has been concluded that all geographic areas of Florida that border the Atlantic Ocean or Gulf of Mexico, including Hillsborough County, are at risk. However, sediment deposits in the Gulf of Mexico and Great Bahama Bank may lead to underwater landslide activity. The following vulnerabilities are organized by threat to the Atlantic Coast or Gulf Coast and Keys and list the potential causes of a tsunami that would put the state at risk:[287]

- Florida's Atlantic Coast
- Puerto Rico Trench
- Cumbre Vieja Volcano in Canary Islands
- Azores-Gibraltar Fracture Zone
- Florida's Gulf Coast and Keys
- Puerto Rico Trench (minor effect as wave wraps around islands)
- Large Meteorite into the Gulf of Mexico

---

[286] http://nws.weather.gov/nthmp/documents/GoM-Final01regionalAssessment.pdf
[287] https://www.nature.com/articles/srep35925

Historical Occurrences of Tsunami

There have been four reported tsunami events in Florida's history. All four of these tsunamis occurred on the Atlantic Coast. Below are the causes of these tsunamis.[288]

- 1 caused by an Atlantic Coast earthquake
- 1 caused by a non-Atlantic earthquake
- 2 caused by a Caribbean earthquake

While no known tsunamis have ever affected the Florida Gulf Coast or Hillsborough County, a tsunami in that location is not impossible. While tsunamis have historically affected the Caribbean many times, it is unlikely that those tsunamis will affect Florida.

While it was not officially a tsunami, there was a tsunami-like event on July 7, 1992, when a large rogue wave suddenly appeared along the coast in the Daytona area. The wave was reportedly about 10 feet above normal waves and stretched 27 miles long from Ormond Beach to New Smyrna Beach. There was 1 death, over 20 people injured, and damage to about 100 cars parked near the coastline. The best theory is that the wave was caused by winds from a storm front.[289]

Probability of Future Occurrences of Tsunami

Potential Effect of Climate Change

Climate change is not expected to affect the occurrence of tsunamis in Florida. However, sea level rise may increase the frequency and intensity of flooding when a tsunami occurs. For example, a study was done in 2018 in Macau, China, showing that a 0.5 meter (around 1.5 ft) rise in sea level will double the frequency of tsunami-induced flooding incidences.[290]

Based on a historical analysis and the frequency of prior tsunami events from around the world, it can be concluded that the probability of future tsunami events affecting the state of Florida, and therefore Hillsborough County, is unlikely (<1% annual probability of occurrence).

Tsunami Impact Analysis

The City of Tampa, as well as the unincorporated county, could suffer the impacts listed below due to tsunami. The cities of Temple Terrace and Plant City are inland and not expected to be impacted.

- Public
    - There could be injury or death
- Responders
    - Rescue missions may be life-threatening if buildings are not structurally stable or if rescuing from waters of unknown depth.
- Continuity of Operations (including continued delivery of services)
    - If a structure were severely damaged or flooded, operations would be disrupted.
- Property, Facilities, Infrastructure

---

[288] http://nws.weather.gov/nthmp/documents/Tsunami_Assessment_Final.pdf
[289] https://www.deseret.com/1992/7/5/18993026/rogue-wave-crashes-ashore-in-florida/
[290] https://www.science.org/doi/10.1126/sciadv.aat1180

- If a major tsunami were to occur in Hillsborough County, many structures and critical infrastructure would be severely damaged by the force of the waters and the flooding effects.

- Environment
  - The coast could be altered, including intra-coastal areas, beaches, mangroves, etc.
- Economic Condition
  - If a major tsunami were to occur in Hillsborough County, businesses could be damaged and forced to close, and employee absenteeism would also be a challenge.
- Public Confidence in Each Jurisdiction's Governance
  - If a major tsunami were to occur in Hillsborough County and response and recovery efforts were not fast enough, the public may lose confidence in the jurisdiction's governance.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

Historically, large-scale tsunami events have not been a major threat to the state of Florida. The East Coast is considered at greater risk than the Gulf Coast. Exposure has increased as more people move into areas of close proximity to the coast and more coastal development occurs.

Approximately 33% of the state's total population lives within 20 miles of the coast, and that number is increasing. The majority of Hillsborough County residents are not educated on the warning signs or effects of a tsunami and would be put at a higher risk of exposure should a large-scale event occur.

Since there are no tsunami inundation zone maps for Florida, exposure analysis is not possible. NOAA is the federal agency charged with tsunami hazard mapping. It has not completed tsunami modeling to date. Analysis using the FEMA National Risk Index data is also not possible, as all tsunami metrics within that dataset are listed as "Insufficient Data."

Vulnerability Analysis and Loss Estimation on Critical Facilities

As noted above, tsunami data for Florida is not available because NOAA has not yet completed the models. As such, the vulnerability of critical facilities and community lifelines cannot be analyzed.

All of the critical facilities and community lifelines and their associated risk can be found in Appendix B.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and based on the PRI scores, the overall vulnerability ranking of high, moderate, or low was assigned.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be low, with a PRI score of 1.8 (

Table 5.156).

Table 5.156. Overall Vulnerability to Tsunami for Hillsborough County

<table>
<tr><th colspan="5">TSUNAMI</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Tsunamis are powerful waves created as a consequence of another non-meteorological, geologic in nature, hazard such as earthquakes, underwater landslides, volcanic eruptions, or other displacements of large amounts of water under the sea. As the waves travel towards land, they build up to higher heights as the depth of the ocean decreases and appear as walls of water or turbulent waves that resemble hurricane storm surge.</td><td colspan="2">LOW</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Unlikely</td><td>Limited</td><td>Small</td><td>< 6 hrs</td><td>Not Concerned</td><td>< 6 hrs</td><td>1.8</td></tr>
</table>

Technological and Human-Caused Hazards

4.13 Agricultural Disruption Hazard Profile

Agricultural Disruptions Description

The Presidential Policy Directive (PPD) on Critical Infrastructure Security and Resilience outlines the Food and Agricultural Sector as one of 16 complex critical infrastructure systems.[291] Sectors identified as critical infrastructure would be debilitating to the economy, public health, national security, and property. The Food and Agriculture Sector is almost entirely private and is comprised of farms, restaurants, and registered food manufacturing, processing, and storage facilities.

The agricultural system in Hillsborough County is not only an essential economic contributor in the state of Florida but could pose unique food safety concerns or lower food access if disrupted. Having a robust food and agricultural sector with an active seaport and airport in the county provides many advantages yet presents various risks to the agricultural systems. These factors need to be considered to ensure that food and agricultural systems are secure and able to withstand and rapidly recover from all hazards. Agricultural disruptions are caused by accidental and intentional food contamination and disruptions, disease and pests, severe weather events (i.e., drought, floods, climate change), and cybersecurity threats.

The Food and Agricultural Sector accounts for roughly one-fifth of the nation's economic activity and has several dependencies with many of the other critical infrastructure sectors, including: [292]

- Water and Wastewater Systems: for clean irrigation and processed water
- Transportation Systems: for movement of products and livestock
- Energy: to power the equipment needed for agriculture production and food processing
- Chemical: for fertilizers and pesticides used in the production of crops

Due to the complexity of agricultural systems, it may not be feasible to prevent disruptions altogether; however, having in place early warning systems or surveillance by veterinarians, agricultural producers, and nationally coordinated disease surveillance programs is important to mitigate these potential threats.

The Florida Department of Agricultural and Consumer Services (FDACS), the Florida Department of Health (FDOH), and the Florida Department of Business and Professional Regulation (FDBPR) are the three primary state agencies tasked with preventing, preparing for, responding to, and ensuring recovery from food and feed emergencies in Florida. Furthermore, animal protection falls directly under Emergency Support Function (ESF) #17. The FDACS created the Florida State Agricultural Response Team to manage animal-related emergencies and provide support for ESF #17. A

[291] https://www.cisa.gov/sites/default/files/2023-01/ppd-21-critical-infrastructure-and-resilience-508_0.pdf
[292] https://www.dhs.gov/cisa/food-and-agriculture-sector

combination of these agencies manage emergencies affecting crops depending on the exact nature of the emergency.[293]

A network of private and state veterinarians monitor the occurrence of disease in animal species. The United States Department of Agriculture (USDA) and World Organization for Animal Health (OIE) maintain a list of reportable infectious diseases known as transboundary disease (TBD) or foreign animal disease (FAD).[294] TBDs (sometimes referred to in the U.S. as FADs) are highly communicable pests and germs that are responsible for high rates of disease and/or death in the affected animal populations. All veterinarians are trained to recognize and report these diseases and must maintain current accreditation (continuing education) in recognition of these diseases. When these diseases are suspected, samples are sent to a National Animal Diagnostic Lab (NADL) , often called the *State Diagnostic Lab*.[295]

In Florida, that lab is the Bronson Animal Disease Diagnostic Lab (BADDL), which is located in Kissimmee, Florida. Similarly, agricultural workers, in partnership with county and state coordinators for the Plant Protection and Quarantine (PPQ) program, monitor the crop systems for pest and disease occurrence.[296] Instances of suspected invasive disease or pests result in reporting/sample submission to the National Plant Diagnostic Network (NPDN). The University of Florida provides regional lab service for the southeastern United States.

Other monitoring and early warning systems include weather and drought monitoring systems, like those implemented by the National Oceanic and Atmospheric Administration (NOAA) and the Florida State University Climate Center. Projections of imminent periods of extreme weather may initiate a disaster declaration by either the state/local leadership, the presidential office, and/or the office of the Secretary of Agriculture.

Agricultural Industry in Hillsborough County

The subtropical climate of Hillsborough County provides a conducive environment for near year-round production of a variety of plant and animal commodities. Agriculture is an important small business industry, with 90% of Hillsborough County farms being family-owned operations.[297] Hillsborough County has 1,992 farms, the 4th and most significant number of farms of any county in the state of Florida and the 49th highest in the country.[298] Diversity is one of the keys to the success of Hillsborough County's agriculture, which includes fruits, tree nuts, berries, swine products, and

---

[293] https://flsart.org/aboutus/overview.jsp

[294] World Organization for Animal Health. (2019). OIE-Listed diseases, infections, and infestations in force in 2019. *Animal Health in the World*. https://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2019/

[295] https://nifa.usda.gov/national-plant-and-animal-diagnostic-laboratory-networks

[296] https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview

[297] https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Florida/cp12057.pdf

[298] https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Florida/cp12057.pdf

aquaculture (especially tropical fish).[299] In addition to major commodities, a variety of specialty crops contributed to the sale of $703 million of products in 2022. According to the USDA (2022), Hillsborough County ranks as the 3rd largest producer of agricultural products in the state (out of 67 counties) and 102nd in the United States (out of 3,078 counties).[300] Hillsborough County is in the top 7% of agricultural counties in the country. In 2022, an estimated 132,651 acres were utilized for agriculture production; this represents approximately 15% of the county's land area.

Local agriculture generates additional local economic impact by supporting related businesses such as banking, real estate, legal services, transportation, packaging, equipment, seed, agricultural suppliers and services, and marketing firms. Most agricultural goods produced in Hillsborough County are sold outside of the county. According to a study completed in 2005, for every dollar of agricultural goods sold outside of the county, an estimated $l.86 is added to the local economy as a result of indirect and induced benefits.[301] This study also calculated that agriculturalists contribute four times more in revenue (taxes, fees, transfer payments, etc.) to local government than they require in government services, effectively subsidizing government services for the urban residential population. Table 5.157 quantifies the top 10 agricultural commodities in Hillsborough County by dollars and acreage.

Table 5.157. Top Agricultural Commodities in Hillsborough County, 2022 [302,303]

Rank	Top Commodities by Value ($)	Top Commodities by Land Use (acres)
1	Strawberries ($477 million)	Forestry/Timber (117,560)
2	Vegetables ($84 million)	Beef Cattle/Pasture (76,859)
3	Ornamental Plants/Nursery ($133 million)	Vegetables (8,383)
4	Miscellaneous ($2 million)	Strawberries (11,224)
5	Aquaculture ($28 million)	Citrus (5,585)
6	Beef Cattle/Pasture ($9 million)	Hay (5,479)
7	Blueberries ($13 million)	Miscellaneous (3,045)
8	Sod ($6.7 million)	Ornamental Plants/Nursery (2,796)
9	Citrus ($6.2 million)	Sod (5,548)
10	Peaches ($3 million)	Blueberries (1,030)
Total	**$865,168,644**	**239,358**

[299] U.S. Department of Agriculture. (2019, February 11). 2017 State and County Profiles. U.S. Agricultural Census (2017). National

[300] https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Florida/

[301] UF/IFAS Hillsborough County Extension. (2019). Military Agricultural Tour (Presentation).

[302] https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Florida/cp12057.pdf

[303] https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Florida/

Strawberries

The strawberry industry is, by far, the top agricultural industry in Hillsborough County, valued at $477 million in sales, revenue, and other income. Strawberry production is a chemical-intensive operation. Because of the great value of this crop, strawberries are exclusively grown on mulch with underlying soil that has been sterilized in some manner using fumigants that are applied approximately two weeks prior to planting. Following fumigation, the beds are covered in plastic white, silver, or black plastic. The primary planting period for strawberries in Florida is in September, with an average harvest period running from late November into early April.

Notes: This is the typical appearance of a strawberry field in Hillsborough County. This picture was taken with the permission of University of Florida's Institute of Flood and Agricultural Services (UF/IFAS). Source: UF/IFAS Hillsborough County Extension. (2019). Military Agricultural Tour (Presentation).

Vegetables and Nursery

Other fruits and vegetables, including tomatoes, melons, peppers, and so on, make up 'Hillsborough County's second highest-valued industry. Nursery and ornamental plants make up the third. The exact appearance of these operations and practices varies depending on the specific crop requirements and best practice experience of the grower. Some fruits and vegetables can be seen growing in small or large open fields, while others require greenhouses. Nursery operations are most often carried out in planting trays or pots inside or outside of greenhouses.

Pasture/Beef

Pasture/beef production is the second highest-valued livestock agriculture in Hillsborough County. About half of all 'Hillsborough County's agricultural land is dedicated to beef and pasture operations. All beef cattle spend a large portion of their life on open pasture, grazing and growing to size. Additionally, 'Florida's pastures, if properly developed, can serve as important green space for wildlife and native plant species, aquifer recharge, and carbon recovery. There is an effort in the cattle ranching community to incorporate best practices in conservation, renewable energy, and improved land development practices. Every year, Florida has several regional winners that go on to compete for the National 'Cattlemen's Beef Association Environmental Stewardship Award Program (ESAP).

Aquaculture

Aquaculture is the process of growing animals or plants in controlled water environments. This industry, specifically tropical fish aquaculture, is the top livestock industry for Hillsborough County. Other forms of aquaculture that may be seen include aquatic plants, shellfish, turtles, and alligators, which may be included under livestock or miscellaneous agriculture codes by the property appraiser. This industry is carried out in small or large above-ground tanks, commonly housed inside sheds, greenhouses, or screen enclosures for protection, and/or in pools seen in the image. These operations involve a complex variety of systems, including water transfer lines, salination systems, aeration systems, water treatment/purification, and small to large tank/pool areas.

Notes: This picture is of a site visited during research and assessment. The facility featured above ground tanks located in sheds with in-ground pools.

Hazards that Lead to Agricultural Disruptions

Agricultural disruptions are not usually a cause for disaster declarations individually but can occur as part of a larger disaster declaration (e.g., hurricanes, flooding, tornados). Many of the same hazards that disrupt civil order and the built environment impact agriculture. Furthermore, agricultural disruption can produce many second-order effects that have significant impacts on the local economy, ecology, and built environment. A list of hazards that impact agriculture and their potential impacts is included in Table 5.158.

Table 5.158. Hazards that Disrupt Agriculture and their Potential Impacts[304]

Hazard	Disruption/Impacts
Extreme Storm Events (Hurricanes/Tropical Storms/ Thunderstorms/Tornadoes) **Extreme Heat Conditions (Heat Wave/Drought/ Wildfires)**	• Stress/damage to crops • Fruit drop and/or down trees • Injury/death of agriculturally significant animals • Increase plant/animal disease transmission (including zoonotic/toxic) • Increased food and waterborne disease risk • Structure and equipment damage • Spoilage and/or rot of product

[304] U.S. Department of Homeland Security. (2019). Critical Infrastructure Sectors. Cyber + Infrastructure. https://www.dhs.gov/cisa/critical-infrastructure-sectors

Hazard	Disruption/Impacts
Extreme Cold Conditions (Frost/Freeze/Snow/Blizzard)	• Contamination of pasture/crops and soil with chemicals or germs • Delay in planting/harvesting periods • Increase agricultural draw on utilities and infrastructure • Market vulnerability & cost fluctuations • Injury/death of agricultural workers, veterinary personnel, and related professions • Mass Migration (movement to work; abandonment of local agriculture)
Sea Level Rise	• Stress/Damage to crops • Spoilage and/or rot of product • Alteration of soil quality • Increase agricultural draw on utilities and infrastructure • Market vulnerability and cost fluctuations
Plant and Animal Disease Outbreak/Biologic Incidents	• Stress/damage to crops • Fruit drop, spoilage, and/or rot of product • Increased food & waterborne disease risk • Increased plant/animal disease transmission (including zoonotic/toxic) • Injury/Illness/Death of agricultural workers, veterinary personnel, and related professionals
Utility Failure	• Spoilage and/or rot of product • Delay in planting/harvesting • Market vulnerability & cost fluctuations • Increase agricultural draw on utilities and infrastructure • Mass Migration (movement to work; abandonment of local agriculture) • Increased food & waterborne disease
Transportation Incidents	• Stress/damage to crops • Spoilage and/or rot of product • Contamination of agricultural products with chemicals or germs • Injury/death of agricultural workers and related professions
Chemical/Radiologic Incidents	• Stress/damage to crops • Contamination of agricultural products with chemicals or radiation • Increased food & waterborne disease risk • Increase draw on utilities and infrastructure • Mass Migration (movement to work; abandonment of local agriculture)

Hazard	Disruption/Impacts
	• Market vulnerability and cost fluctuations
Terrorism (Agroterrorism)	• Stress/damage to crops • Contamination of agricultural products with harmful agents • Increased food & waterborne disease risk • Increased zoonotic disease risk • Increase draw on utilities and infrastructure • Mass Migration (movement to work; abandonment of local agriculture) • Market vulnerability & cost fluctuations
Market Disruption	• Market vulnerability & cost fluctuations • Delay in planting/harvesting • Increase agricultural draw on utilities and infrastructure
Urban Sprawl	• Stress/damage to crops • Contamination of agricultural products with chemicals/germs • Increase food and waterborne disease risk • Increase zoonotic disease risk • Increase agricultural draw on utilities and infrastructure
Notes: Specific hazards for agricultural disruption can be divided into three broad categories: Natural (green), Technological (orange), and Civil (red/gray).	

Effects of Climate Change on Agricultural Disruptions

Climate change can disrupt food availability, reduce access to food, and affect food quality. For example, projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity.

Extreme weather events, especially droughts, heat waves, severe storms, and hurricanes, can be expected to continue or potentially negatively impact the protection of the food chain. Current temperatures are optimal for many Florida crops with lower yields in hot seasons. Potential rising temperatures in the future will decrease annual crop yield, livestock productivity, and water access. This will lower 'Florida's market strength. Increasing carbon dioxide levels may also reduce the nutritional content of many food crops.

Climate change may change the ranges and behavior of agricultural pests and diseases. Rising temperatures and carbon dioxide levels may optimize the growth of some invasive species and fungal diseases. Climate change and globalization are associated with a progressive northward movement of certain fungal and protozoal germs that may produce plant and animal disease outbreaks in new areas.

Sea level rise may be associated with salination of area water sources and aquifers. This can alter soil quality, resulting in lowered yields and failed planting cycles.

Geographic Areas Affected by Agricultural Disruptions

Greater than 20% of the land mass in Hillsborough County has been dedicated to agriculture over the previous 5-year period. Most of that land is in unincorporated Hillsborough County and the City of Plant City. Residential and increasingly urbanized areas exist between those agricultural properties. Although designated existing land use for agriculture shows close to 140,000 acres of agricultural land, the USDA has greater numbers for acreage due to residential, mixed-use, natural infrastructure, recreational/open space, and other land classifications in the existing land use encompassing some of what the USDA defines as agricultural land. The County's land mass dedicated to agriculture, according to the USDA, has increased from 180,300 acres in 2017 to 201,712 acres in 2022, which is the last time the USDA updated the County's profile.[305] Over half of that land is dedicated to the forestry/timber and pasture/beef industries.

Agricultural land is very geographically dispersed throughout the county. Hazards that disrupt agriculture are often widespread throughout the county (e.g., hurricanes, wildfires, extreme heat/cold). It is important to note that the secondary effects of agricultural disruption may not be confined to the impacted farms. Secondary issues of food and waterborne disease outbreaks and quarantine zones may have countywide to national effects.

---

305 https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_2_County_Level/Florida/st12_2_008_008.pdf

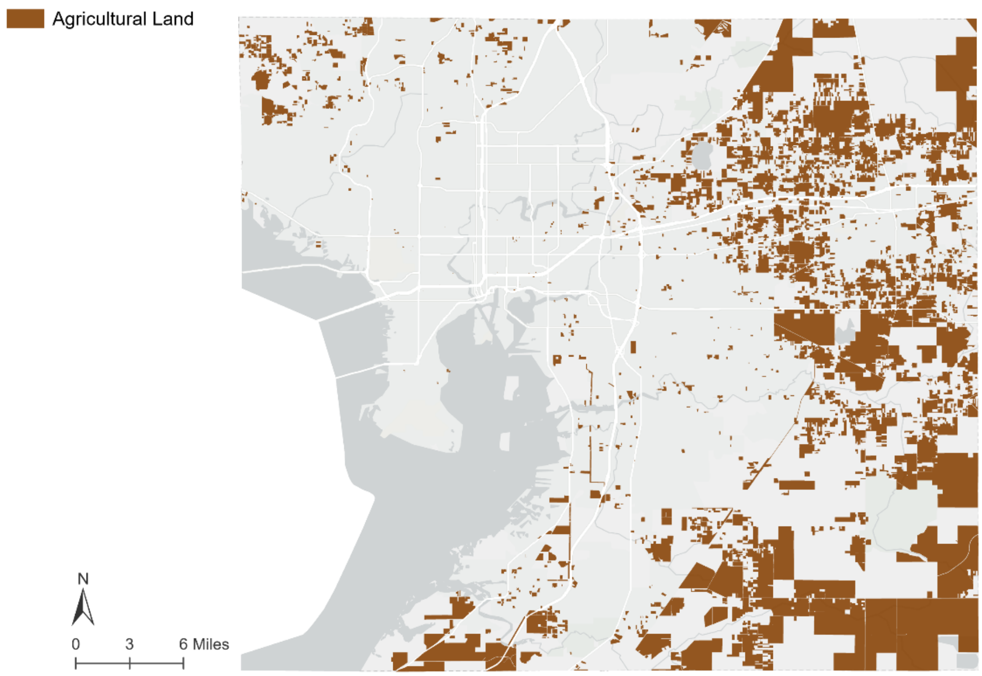


Figure 5.96. Agriculture in Hillsborough County, 2024[306]

Figure 5.96 shows the distribution of agricultural land in Hillsborough County in 2024; these lands include pasture (including beef), livestock (i.e., poultry, fish, bees, dairy, feedlots), crops (field crops, berries, vegetables, berries, melons, other fruit), orchard, citrus, nurseries (ornamental plants), timber, and miscellaneous (all other agriculture not captured above).

Nearly 80% of the agricultural land in Hillsborough County is located in the flood plain. Upland and coastal areas are similarly at risk for inundation flooding. Approximately 4% of agricultural land is at risk for Category 1 hurricane storm surge, and 11% of agricultural land is at risk for Category 5 hurricane storm surge. The most at-risk storm surge areas are in the county's southern portion in and around Riverview, Gibsonton, Ruskin, and Sun City Center. A small area of at-risk land is also located in the county's northwestern corner (north of Westchase), which is located in the Category 5 projected surge. Types of agricultural production that are at-risk in these areas include vegetables, pastures, nurseries, sod, and timber.

Urbanization in Hillsborough County

The most significant and frequent disruptors of agriculture cited by those in the industry are urban sprawl and market vulnerability. Agriculture is geographically dispersed throughout the eastern and southern areas of the county.

The projected population growth in Hillsborough County is depicted in Figure 5.97 below. Comparing Figure 5.97, which indicatesareas with the largest projected areas for growth, with **Error! Reference source not found.** above, it's possible to see where population growth will intersect with current agriculture-dense areas. Mixed land development among agricultural land creates a number of

[306] https://planhillsborough.org/gis-maps-data-files/

challenges, including alteration of local water management, increased soil and land contamination, increased risk of zoonotic disease exposures, greater difficulty in biosecurity, and discontent or conflict between residents and the farm owners and workers.

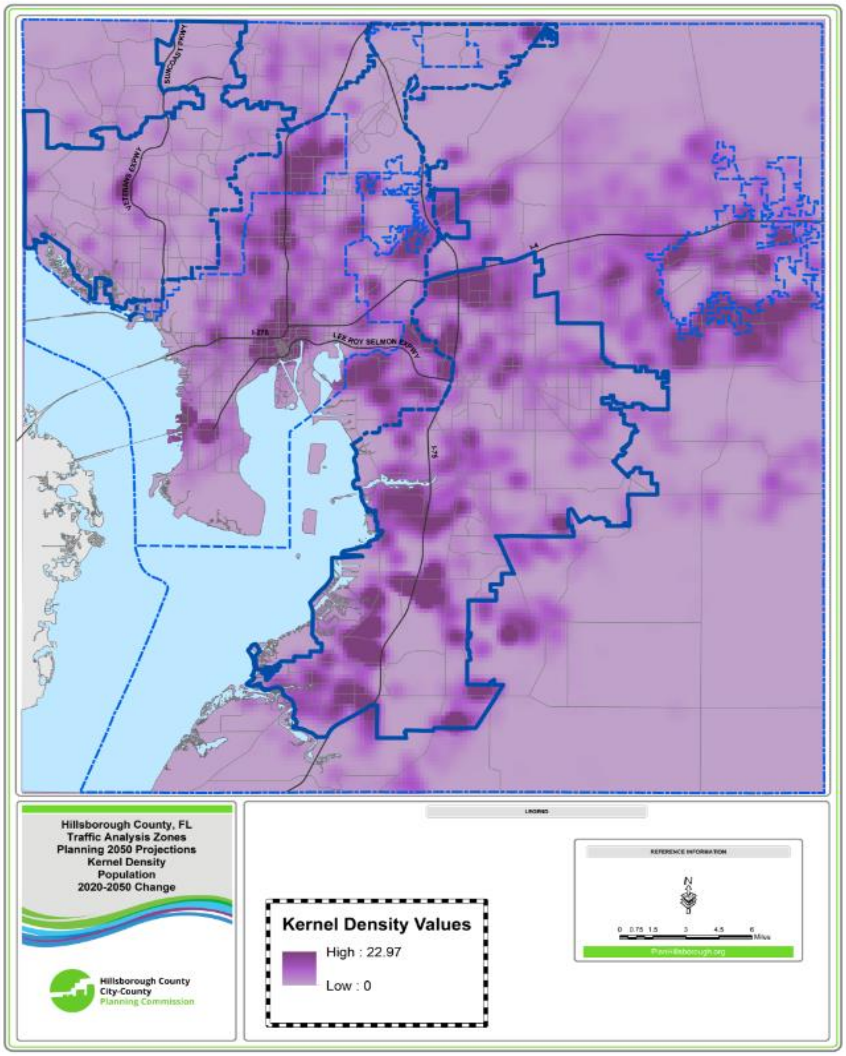


Figure 5.97. Kernel Density of New Persons per Acre through 2050 in Hillsborough County [307]

Historical Occurrences of Agricultural Disruptions

The historical occurrences below present a sampling of significant incidents or hazards that caused excessive risk or harm to the agricultural systems in Hillsborough County. The incidents profiled here have additional notable concurrent or secondary impacts.

Natural Disasters & Extreme Weather

Every year, natural disasters, such as hurricanes, floods, fires, and tornadoes, challenge agricultural production. Since agriculture relies on the weather, climate, and water availability to thrive, it is

---

[307] https://planhillsborough.org/2050-long-range-growth-forecasts/

easily impacted by natural events and disasters.[308] Flooding, severe thunderstorms, and tropical cyclones pose the greatest risk to agricultural disruptions in Hillsborough County.

Furthermore, temperature, precipitation, carbon dioxide, and water availability directly impact the health and well-being of plants and livestock, as well as pasture and rangeland production. The potential impacts from extreme heat, drought, and freezes are relatively rare occurrences in Hillsborough County; however, climate change poses a major challenge as some of these events may become more common.[309] Significant agricultural disruption events in Hillsborough County are described below in Table 5.159.

Table 5.159. Description of Significant Agricultural Disruptions in Hillsborough County, 1910 - 2023

Date	Information
Winter Freeze, January 2010	Freezing conditions (below 34°F) were seen for 11-12 days, and light snow fell in parts of Central Florida. One secondary effect of this event was a rash of sinkholes and karst events in the Plant City and Dover area. A disaster declaration was made for local farmers, and disaster assessment teams were deployed to inspect properties for sinkhole damage.[310]
Drought, Spring/Summer 2017	Moderate to severe drought conditions experienced from April through June prompted a disaster declaration from the Secretary of Agriculture. Heavy rains in late June/July, followed by the impacts of Hurricane Irma, ended this drought period. The exact impacts/losses of this event could not be quantified due to the extreme and widespread impacts produced by Hurricane Irma.[311, 312]
Hurricane Irma, September 2017	In 2017, Hurricane Irma made landfall in southwest Florida as a Category 3 storm. Irma produced tropical storm to hurricane-force conditions in all 67 counties of Florida. The storm produced an estimated $2.5 billion in losses in the state, most of which (78.7%) were experienced in crop commodities.[313] Hillsborough County experienced category 1-2 hurricane conditions during Hurricane Irma and was in the top ten counties that experienced the largest damage, resulting in $45,880,000 million worth of crop losses.[314] Strawberry growers experienced delays in planting and damage to already prepared and planted fields. Citrus growers who were unable to harvest their fruit prior to the storm experienced significant fruit drop, tree damage, and equipment and infrastructure damage. Similarly, vegetable growers and nursery owners experienced wind and water damage to crops and damage

308 https://www.epa.gov/agriculture/agriculture-and-natural-events-and-disasters
309 https://www.dhs.gov/sites/default/files/publications/nipp-ssp-food-ag-2015-508.pdf
310 https://www.swfwmd. state.fl.us/about/newsroom/news/hillsborough-and-polk-county-residents-affected-the-january-2010-freeze-can
311 https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/disaster-designation-information/index
312 http://blogs.ifas.ufl.edu/sarasotaco/2017/05/23/sarasota-florida-counties-get-drought-aid/
313 https://www.fdacs.gov/content/download/77509 /file/FDACS%20Irma%20Agriculture%20Assessment.pdf
314 https://fred.ifas.ufl.edu/destudio/t4/pdf/Economic%20Losses%20of%20Hurricane%20Irma%20on %20ag%20in%20Florida%20counties%2010-26-2018.pdf

Date	Information
	and destruction of light structure greenhouses, barns, and sheds, irrigation, and equipment. Beef/Pasture and aquaculture are the two top livestock operations in Hillsborough. Statewide damage reports estimate up to $21,000 in losses per beef farm and up to $129,000 in losses per aquaculture operation. Loss areas included injured or deceased animals, lower gains (cattle), and damage to farm equipment and light structures, including sheds and barns. In addition to financial losses, the storm displaced up to thousands of documented and undocumented seasonal and migrant workers. Most of them live in mobile homes and migrant housing established on or near farms that are variable in their upkeep and ability to withstand hurricane-force winds.[315]
Winter Freeze, January 2018	Conditions intermittently reached freezing or below freezing in Hillsborough County in January 2018. Despite this incident having a minimal effect on Hillsborough County, monitoring and mitigation measures were put into place. Freezes cause significant crop damage, and crops that have fruits and vegetables that have been previously frozen are considered inedible and must be harvested for destruction.
Hurricane Ian, September 2022	Hurricane Ian made its first landfall on Cayo Costa Island on September 28, 2022, followed by its second landfall on the southwestern peninsula of Florida. The hurricane affected approximately five million acres of agricultural land, impacting over $7.96 billion of agricultural products. The most affected commodities were citrus, vegetables and melons, and greenhouse/nursery within the counties Manatee, Hillsborough, Palm Beach, Hardee, and Hendry. In addition, Hillsborough suffered an estimated 45,158 of acreage damage. [316]
Hurricane Idalia, September 2023	Hurricane Idalia made landfall on August 30, 2023, near Keaton Beach along the Big Bend area of Florida as a Category 3 hurricane. Hurricane Idalia's path coincided with some of Florida's most productive agricultural landscapes for beef cattle, dairy cattle, poultry, aquaculture, horticulture, field corn, cotton, peanuts, and pecans. Although the hurricane did not impact Hillsborough, neighboring counties like Pinellas were impacted. [317]

Table 5.160 Shows a breakdown of agricultural losses as a result of Hurricane Ian in September of 2022.

Table 5.160. Economic Impact on Agricultural Crops in Hillsborough County due to Hurricane Ian, 2023[318]

Field Crops	Citrus	Vegetables and other Fruits	Livestock and Animal Products	Nursery and Timber	Total All Crops
$248,476	$2,800,161	$69,794,542	$54,964889	$120,540,260	$600,827,313

[315] http://flrecruiter.org/files/Effects_of_Hurricane_Irma_on_FL_Ag-Compilation.pdf

[316] https://fred.ifas.ufl.edu/media/fredifasufledu/economic-impact-analysis/reports/FRE-Final-Hurricane-Ian-Report.pdf

[317] https://ccmedia.fdacs.gov/content/download/114349/file/Hurricane-Idalia-Damage-Report-WEB.pdf

[318] https://fred.ifas.ufl.edu/media/fredifasufledu/economic-impact-analysis/reports/FRE-Final-Hurricane-Ian-Report.pdf

Plant and Animal Pests, Pathogens, and Invasive Species

Plant and animal disease outbreaks can lower overall production, destroy crops, and cause illness/death of livestock. Some diseases are common but can rapidly spread under certain conditions, causing extreme disruption of agricultural systems. Plant and animal diseases can also have important public health impacts. Some animal diseases may be zoonotic, which is contagious between animals and humans (e.g., avian and swine flu). Additionally, some fungi are known to produce toxins that cause significant illness in humans (e.g., ergot poisoning and aflatoxin). As previously discussed, the state, county, and USDA monitors for TBDs/FADs and invasive pests and germs pose significant political, economic, and public health consequences for local, state, and national agricultural systems. Those affecting Hillsborough County agriculture are listed below in Table 5.161.

Table 5.161. Pests and Diseases that Affect Hillsborough County Agriculture[319]

Name	Description	Picture
Tetranychus urticae (also known as the Two Spotted Spider Mite[320])	These are some of the most damaging and persistent mite pests of strawberries. These are sucking mites that usually inhabit the undersides of leaves. Damage to leaves can significantly lower crop production.	
Romalea microptera {also known as the Eastern Lubber Grasshopper)	Because of its size and coloration, even one individual in a garden is conspicuous, but occasionally, local populations explode to such an extent that the grasshoppers can seriously damage ornamentals, row crops, and citrus groves.	
Cochliomyia hominivorax (also known as New World Screwworm)	New World screwworms are fly larvae (maggots) that can infest livestock and other warm-blooded animals, including people (rare). They feed on the 'animal's living flesh, and if not treated, infestations can be fatal.	
Foot and Mouth Disease virus	Foot and mouth disease (FMD) is a highly contagious viral disease that causes sores on the feet, mouth, and udders of cattle, pigs, and small ruminants. This disease has been eradicated from the U.S., but it is one of the most important TBDs worldwide.	

[319] U.S. Department of Agriculture. (2018, November 05). Animal Disease Information. Animal Health. https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information
[320] http://entomology.ifas.ufl.edu/liburd/fruitnvegipm/tssm.htm

Name	Description	Picture
Wildlife Predation	There is a vast collection of wild birds and other animal species in Florida. Wild animals – including wild birds, raccoons, deer, and wild pigs – cause significant damage to strawberries and vegetable fields. Wild animals can also carry diseases that can cause serious illness in livestock. Wild birds are important pests in aquaculture.	
Notes: **This table presents a sample of important pests and diseases for Hillsborough County's top agricultural industries. This is not a comprehensive listing of all pests and diseases.**		

Table 5.162 lists significant events, featuring damages from p*lant and animal pests, pathogens, and invasive species in recent years.*

Table 5.162. Description of Plant and Animal Pests, Pathogens, and Invasive Species that Pose a Threat to Hillsborough County, 2016-2023

Date	Information
New World Screwworm Outbreak, October 2016	New World Screwworm (Cochliomyia hominivorax) was detected in the Continental U.S. for the first time in over 30 years in Key Deer (South Florida). Screwworm is a transboundary pest listed in the USDA Grey Book for monitoring and was eradicated from the U.S. in 1966 using a method involving the release of sterilized male flies into the environment. The "worm" is a fly maggot known for burrowing in large numbers into the open wounds of animals, causing significant damage to meat and pelts, leading to severe production losses, including decreased weight gain and lowered milk production. The U.S. Fish and Wildlife Service estimates that 135 Key Deer were killed by the 2016 infestation, reducing the total population of this endangered species to 740. This is in addition to the costly response and risks to the Florida beef and dairy industry. The USDA states that the outbreak response involves the release of 154 million sterile flies, 17,000 animal inspections, and about 700 hours of surveillance. This is the most significant FAD event to impact Florida in the previous five years.
Citrus Canker Outbreak, 2017-2018	In 2017-2018, following Hurricane Irma, there was concern about an outbreak of citrus canker, which is a bacterial disease of citrus trees that is spread by wind-blown rain. Intense wind and rain associated with the storm are believed to not only spread the bacteria across wide geographic areas but also drive the bacteria past the natural innate defenses of the tree. Guidance was released by UF/IFAS on methods to prevent further spread of the disease and treat trees before damage from the infection became apparent. Quarantine zones for citrus cankers are in the following counties: Hendry, Collier, Lee, Charlotte, and the southern area of Polk County.321

[321] Johnson, E. (2018, February). How will Irma affect citrus canker management? *Citrus Industry* (UF/IFAS). https://crec.ifas.ufl.edu/extension/trade_journals/2018/2018_feb_canker.pdf

Date	Information
Coronavirus Disease, (COVID -19), March 2020	Farms and farm households were affected by the Coronavirus (COVID-19) pandemic due to lowered availability of labor and other inputs. Furthermore, output prices were affected by changes in demand for commodities in market segments, such as processors, handlers, retail outlets, and trade.322 The effects of COVID were driven by the shift to food at home due to social distancing measures, the risks of food shortage resulting from outbreaks at packing plants and among farmworkers, and restrictions on cross-border travel and trade.323

Technological and Civil Hazards

There are technological and civil hazards that pose a risk to agricultural systems, and the agricultural industry has an impact on the local community and environment. This is an effect of the globalization of production, an increase in industrialization, and a certain level of risk of accidents connected with production, processes, transportation, and waste management. These risks are associated with the release of substances in accident conditions or with the production of such chemicals under certain conditions, such as fire or environmental impacts that have led to increased sinkholes in nearby agricultural land. In addition, these substances could affect human health or the environment by contamination and their effects on animals and plants.[324] Table 5.163 lists known incidents between 2016 and 2023.

Table 5.163. Description of Technological and Civil Hazards that have Historically Affected Hillsborough County, 2016-2023

Date	Information
Phosphorus Byproduct in the Florida Aquifer, August 2016	A sinkhole occurred at the Mosaic Mulberry phosphate plant, leading to 215 million gallons of the phosphoric acid process water in the holding area falling about 220 feet into the Florida aquifer. The phosphoric acid process water, a byproduct of turning phosphate into fertilizer, is considered a pollutant.

Market Vulnerability

Market vulnerability is another major disruptor of agriculture in Hillsborough County. Any condition that causes a delay in planting, injury, death of livestock, or damage and contamination of crops can alter the market strength of the agricultural industry in Hillsborough County. There are many reasons for variations in market access and sales pricing. Lowered income decreases the ability of farm owners to cope with compounding threats and may result in reduced production in the future or abandonment of the farm.

---

[322] https://www.ers.usda.gov/covid-19/

[323] https://www.pbs.org/newshour/economy/how-the-covid-19-pandemic-has-dramatically-affected-agriculture-and-the-way-we-eat

[324] https://www.preparecenter.org/topics/technological-hazard

By way of example, following Hurricane Irma, in 2017, strawberry growers experienced delays in planting and damage to already prepared and planted fields, resulting in Mexico, which produces at a lower cost, being a highly competitive international market that lowered sales income for U.S. farmworkers.

Terrorism and Cyber Attacks

Although the U.S. has experienced various transboundary disease (TBD) and invasive pest and pathogen events, there have been no reports of agroterrorism or attack on the agricultural system in the U.S. to date. However, intentional contamination of the food supply with germs or chemicals has been documented in food processing facilities, distribution and storage areas, grocery stores, and restaurants.

In 2002, this threat became more credible when documents were found in al-Qaeda strongholds detailing methods of creating plant and animal poisons. U.S. agriculture and food systems are listed as critical infrastructure. Failure of those systems could result in food shortages, civil unrest and violence, and a variety of diseases and conditions related to lower food safety and availability. The U.S. government tracks certain disease-causing germs of particular concern, called select agents. Below, in

Table 5.164, is a select agent listing for plant and animal diseases that should be considered dangerous to agricultural production in Hillsborough County.

Foot and mouth disease (FMD) is one of the most credible and severe threats against the agricultural industry. This viral disease is responsible for billions of dollars in loss worldwide from lowered production and market restrictions. In 2001, the United Kingdom experienced an FMD outbreak that lasted for nearly eight months, resulting in the death or culling of over 6 million sheep, pigs, and cattle. This outbreak cost the United Kingdom (U.K.) an estimated $9.2 billion in direct and indirect losses. In 2011, a South African man was arrested after ransoming the U.S. and UK agricultural systems with the threat of an FMD attack for $4 million, an act that was motivated by political discontent and economic opportunism.

Farm owners are becoming more dependent on satellite imagery, drones, smart tractors, and other technological advancements as they become more helpful in increasing yields and tracing agricultural and food commodities throughout the production and distribution process. Cyber has become an increased threat as many of these devices and technological platforms do not have the best cybersecurity infrastructure in place, which can lead to operational interruptions. Cyber threats can range from data theft to market manipulations, destruction of equipment, or even a national security concern, as outside threats harness remote sensing and global positioning systems to be able to identify potential targets for large-scale disruptions in our food production, processing, and distribution across the United States.

Table 5.164. Important Pests and Diseases of Agriculture in Hillsborough County[325]

Centers for Disease Control and Prevention (CDC) Select Agents	USDA Animal Health Select Agents	USDA Plant Health Select Agents
• **Anthrax (Bacillus anthracis)** • **Tularemia (Fansciella tularensis)** • **Brucellosis (all species)** • **Glanders (Burkholderia mallei)** • **Melliodosis (Burkholderia pseudomallei)**	• African Swine Fever virus • Avian Influenza virus • Classical Swine Fever virus • Foot and Mouth Disease virus • Rinderpest • Peste des pestis virus • Lumpy skin disease • Mycoplasma capricolum • Mycoplasma mycoides • Rabbit Hemorrhagic Disease Virus, *Type 2 (RHDV-2)*	• *Coniothyrium glycines* • *Peronosclerospora philippinensis* • Ralstonia solannacearum • Rathayibacter toxicus • Sclerophthora rayssiae • Synchytrium endobioticum • Xanthomonas oryzae

Probability of Future Agricultural Disruptions

The probability of any specific disease, pest, weather, or technological hazard is impossible to predict precisely. Many of the hazards are seasonal threats that occur annually, like thunderstorms and hurricanes. However, some hazards are continuous or growing concerns, such as urban development, market vulnerability, climate change, and pests or diseases. Some are infrequent occurrences (e.g., freezes, terrorism), while others are more problematic, such as flooding. The geographic position of Hillsborough County, its active international tourism, international trade, and growing population gives the County a high probability of disruptive threats. Based on historical information, this hazard was determined to have a probability level of likely (10 to 100% annual probability).

Agricultural Disruptions Impact Analysis

This section provides a list of potential impacts or agricultural disruptions.

- Public

[325] https://www.selectagents.gov/selectagentsandtoxinslist.html

    - Human health/disease from contaminated crops or livestock
    - Invasive species that are poisonous/dangerous
- Responders
    - Injury/illness/death of agricultural workers or veterinary staff
    - Injuries from high manual labor
    - Accidental injuries from equipment and slip/fall
    - Wildlife contact
    - Zoonotic disease
    - Psychological trauma
- Continuity of Operations (including delivery of services)
    - Reduced supply of crop or livestock product
    - Increased utility and infrastructure draw
- Property, Facilities, and Infrastructure
    - Facility closures during investigation and response
- Environment
    - Homogenization or decline of natural species
    - Loss of habitat for grazing and agricultural ecology
    - Increased chemical use in responses
    - Management of deceased animals and plants
- Economic Condition
    - Cost of quarantines for disease or pest infestation
    - Cost to eradicate invasive species
    - Product/commodity loss or destruction
    - Cost of outbreak investigations and damage surveys
    - Temporary facility closures may become permanent (lowered business economy)
    - Job loss and worker migration
- Public Confidence in Each Jurisdiction's Governance
    - Farmers may feel victimized or targeted by outbreak investigations and public response
    - Public fear may produce a loss of faith in local business owners, the medical community, or government agencies
    - Tourists may reconsider visiting Central Florida

Impact Summary

How widespread the disruption of the agricultural system becomes is dependent upon the size/scope of the causative hazard. How large (scale) these events become depends on the number of individuals exposed, the impact on existing infrastructure and the agricultural systems, and the interdependencies connecting local production with state and national demands. The scale of an agricultural disruption may range from a small number of local farms to a nationwide or international disruption, causing millions of dollar's worth of damages and the need for emergency declarations or the mobilization of public health and emergency management resources from all levels.

Impact on the Built Environment

The agricultural industry and systems are dependent on several other critical infrastructures in Hillsborough County, including water and wastewater systems, transportation systems, energy, and chemicals. The sprawl of urban and residential development presents a variety of significant risks and potential impacts on the existing built environment as well as future developments.

Urban Sprawl

Increased human traffic in and around agricultural areas poses increased challenges for biosecurity and quarantine areas. Furthermore, there is an increased risk of human disease and exposure from agricultural production and exposure to chemicals from zoonic diseases, agricultural byproducts, and chemicals or traffic correlated with the supply chain and production process.

Neighborhoods and urbanized development near agricultural areas may lead to exposure to zoonic diseases. In 2011, the Centers for Disease Control and Prevention (CDC) investigated outbreaks of Q Fever—a zoonotic disease that occurs in livestock. The outbreak included people who had been in contact with sick animals and those who had known animal contact. The investigation found that the disease had become dust-borne, traveling a few miles from the infected farm.[326]

In September 2014, the Florida DOH linked 43 cases of illness to an area exposure to Palidin.[327] Palidin is a commonly used soil fumigant in several agricultural production schemes that produce varying levels of irritation to the eyes and upper respiratory system. In incidents of severe weather, hazards and debris from agricultural areas may be carried miles from the farm into adjacent residential and urban areas. Growing populations and denser peri-agricultural development may increase such events.

Water and Wastewater Systems

Enhanced urban and residential development can alter local water management, which may increase flood risk and contamination of farms with chemicals and germs from surrounding areas. Increasing density and heavier traffic patterns increase costs to farmers in the form of gas consumption in transportation and increase the risk of more transportation incidents. Increasing development also amplifies the competition for water consumption between agriculture and residential areas that may overdraw the aquifers. As a consequence of increased traffic, the number of sinkholes increase in these areas, which has an increased adverse impact on the built environment.

Transportation Systems

Hillsborough County has a high volume of international traffic and a dynamic transportation system due to tourism, the proximity of an active international seaport, and the number of airports in the area. The expansion of international business and international tourism to the area with an expansion of international ships docking in Port Tampa leads to an increased risk of introducing

---

[326] https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6040a5.htm

[327] Mulay, P., Cavicchia, P., Watkins, S., Tovar-Aguilar, A., Wiese, M., and Calvert, G. (2016). Acute Illness Associated with Exposure to a New Soil Fumigant Containing Dimethyl Disulfide-Hillsborough County, Florida, 2014. *Journal of agromedicine*, 21(4), 373–379. https://pubmed.ncbi.nlm.nih.gov/27409156/

significant diseases and pests to the area that may not be endemic to the area or pose a threat to our population and environment.

The County's growing population and dense traffic patterns increase the risk of minor and major transportation incidents. Food and agricultural commodities that are involved in transportation incidents are subject to spoilage or contamination, which means those items cannot proceed into the food chain and must be destroyed.

Ecological Impacts of Agricultural Disruption

The location of Hillsborough County on the Florida peninsula presents a significant vulnerability to extreme weather events. Tropical cyclones and thunderstorms are seasonal risks that threaten agriculture with high winds, hail, flooding, storm surge, and tornadic weather.

Many important agricultural diseases are carried by wildlife. The 2016 screwworm outbreak involved wild deer species in the Florida Keys but presented a heavy risk to the Florida cattle industry.[328] Multiple outbreaks of avian influenza in U.S. and European poultry showed that the spread of the H5N1 and H5N8 viruses strongly correlated with the wild avian flyways.[329] Wildlife and insects can also serve as pests, causing product loss risk of product and economic losses from foraging and predation behaviors.

Societal and Population Impacts from Agricultural Disruptions

Populations that routinely work in and around the agricultural industry are most at risk for harm related to the disruption of agriculture. However, several good programs have emerged to ensure the safety and well-being of farm workers. Low-income farm workers, including documented and undocumented migrant workers, are most vulnerable to displacement and wage loss due to agricultural disruption.[330]

Some housing for undocumented workers may be unregulated and subject to overcrowding and poor maintenance. However, regulated housing for documented migrants and other farm workers are most commonly mobile homes, vulnerable housing that must be evacuated in severe wind events such as tropical storms and hurricanes. Wage loss and damage to housing will likely result in the displacement of these workers to other industries or geographic areas to find work.

Veterinary staff and farm workers are most vulnerable to illness from zoonotic diseases in livestock. Workers who are low-income, foreign-born, and/or have low English proficiency are especially vulnerable if illness should occur from a zoonotic disease due to lower access to care, potentially unknown vaccination and exposure history, and increased difficulty in communicating with English-speaking healthcare providers.

---

[328] https://www.avma.org/News/JAVMANews/Pages/170515i.aspx

[329] Peiris, J.S.; de Jong, Menno; Guan, Yi. (2007). Avian influenza virus (H5N1): a Threat to human health. *Clinical Microbiology Reviews*, 243-267. 10.1128/CMR.00037-06

[330] https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply_.html

Social vulnerability refers to the capacity of a community to respond to an impact and an intrinsic lack of capability of individuals to cope with external stressors – how well does an individual or group of individuals anticipate, cope with, resist, and recover from the impact of a hazard?[331]

To better serve and target the more vulnerable population, the Climate and Economic Justice Screening Tool (CEJST) helps planners identify disadvantaged communities that will benefit from programs included in the Justice40 Initiative. These Justice40 Disadvantaged Communities (DAC) thresholds can be an indicator of where some of these more vulnerable populations will live in Hillsborough County. For example, a community that has a high population with health issues contributes to a community being considered disadvantaged.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.2 (

Table 5.165).

[331] Mah, J.C., Penwarden, J.L., Pott, H. et al. Social vulnerability indices: a scoping review. BMC Public Health 23, 1253 (2023). https://doi.org/10.1186/s12889-023-16097-6 Retrieved from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-16097-6#citeas

Table 5.165. Overall Vulnerability to Agricultural Disruption in Hillsborough County

<table>
<tr><th colspan="5">AGRICULTURAL DISRUPTION</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Hazards in the agricultural industry come in the form of pests, diseases, and severe weather conditions. The Hillsborough County agricultural industry brings in $447 million in cash receipts and an additional $1.86 return to the local economy for every dollar of product sold in the form of jobs and taxes. Weather poses a threat to Florida due to the subtropical nature of the state and the time of year that many of the high-value harvests take place. Weather, specifically wind and rain, also facilitates the transmission of important agricultural pests and diseases. As a popular destination for tourism and international business, Hillsborough faces an increased threat of entry by transboundary disease and pest infestations. Finally, as critical infrastructure, agriculture must also be considered a target for intentional tampering or disruption, which is referred to as agroterrorism.</td><td colspan="2">HIGH</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
</table>

Likely	Limited	Large	< 6 hrs.	Moderately Concerned	> 1 week	3.2

4.14 Terrorism Hazard Profile

Terrorism Description

The population, property, and environmental resources of the state of Florida are vulnerable to a threatened or actual terrorist attack. While there are multiple definitions and political connotations that accompany the term terrorism, for the purpose of this document, the following definition will be used:

"**Terrorism** is defined in the Code of Federal Regulations as 'the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. It is the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom.'"

State and local governments have primary responsibility in planning for and managing the consequences of a terrorist incident using available resources in the critical hours before federal assistance can arrive. If a terrorist incident occurs in a city or county, communities may receive assistance from federal agencies under the existing Integrated Emergency Management System. The Department of Homeland Security (DHS) is the leading federal agency for supporting state and local response to the consequences of terrorist attacks.[332]

Terrorism can be characterized as either domestic, international, or lone wolf.

Domestic Terrorism is the unlawful use, or threatened use, of violence by a group or individual based and operating entirely within the United States or its territories, without foreign direction, committed against persons or property to intimidate or coerce a government, the civilian population, or any group, in furtherance of political or social objectives. This can also include single-issue groups looking to further specific social ideas or practices.[333]

International Terrorism involves groups or individuals whose terrorist activities are foreign-based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries. This distinction refers not to where the terrorist act occurs but rather to the origin of the individuals or groups responsible for it. For example, the 1995 bombing of the Murrah Federal Building in Oklahoma City was an act of domestic terrorism, but the attacks of September 11, 2001, were considered international terrorism.

For consequence management, the origin of the perpetrator(s) is of less importance than the impacts of the attack on life and property; thus, the distinction between domestic and international terrorism is less relevant for mitigation, preparedness, response, and recovery than for understanding the capabilities of terrorist groups and how to respond to the impacts they can generate.

Lone Wolf Terrorism is characterized by violent acts committed by a single perpetrator. The person acts independently and without the help of outside organizations. A lone wolf terrorist may, however,

---

[332] https://www.fema.gov/pdf/plan/managingemerconseq.pdf
[333] https://archives.fbi.gov/archives/news/testimony/the-terrorist-threat-confronting-the-united-states

follow the ideology of a particular organization or group and may commit acts of terror to show their support for a group. Many of these individuals exclude themselves or feel excluded from normal social interactions and day-to-day relationships. In their social exclusion, lone individuals feel deprived of what they perceive as values to which they are entitled and form grievances against the government or people they think are responsible for their problems, such as unemployment, discrimination, and injustices. Their violence is a means to achieve their goals and to punish those responsible.[334]

Typical Locations

A terrorist attack can take several forms depending on the technological means available to the terrorist, the nature of the political issue motivating the attack, and the points of weakness of the terrorist's target. While these constraints make it difficult to anticipate the location of a future target, terrorists typically consider the following motivating factors when selecting a target:

- Produce a large number of victims
- Cause mass panic
  - Target locations that have symbolic or cultural value and areas where large groups congregate
- Garner the greatest possible media attention

Locations that meet these criteria typically include heavily populated, enclosed areas like stadiums, government buildings, places of worship, nightclubs, sporting events, airport terminals, subways, shopping malls, and industrial manufacturing facilities. Other possibilities include an attack on transportation facilities, an attack against utilities or other public services, an incident involving chemical or biological agents, an active shooter, or a cyberattack. Depending on the site of an attack, the effects of a terrorist attack can vary significantly from loss of life and injuries to property damage and disruptions in services such as electricity, water supply, public transportation, and communications.

Based on these criteria, Florida is considered especially vulnerable to terrorist attacks due to the state's status as an international tourism hub—with its large theme parks, beaches, and cruise lines—and its military bases.

Monitoring and Response

Unlike natural disasters, there are relatively few methods to predict the time or place of a terrorist incident. Additionally, the open availability of basic shelf-type chemicals and mail-order biological research materials, coupled with access to even the crudest laboratory facilities, could enable an individual extremist or an organized terrorist faction to (1) manufacture highly lethal substances or to fashion less-sophisticated weapons of mass destruction, and (2) do so without detection.

This inability to anticipate an attack requires alteration of the methods typically used in emergency management to prepare for and respond to a hazard. "Watch" and "Warning" phases are eliminated,

---

[334] https://www.ncjrs.gov/pdffiles1/nij/grants/248691.pdf

and efforts are concentrated on the action phases for a terrorist incident--prevention, protection, mitigation, response, and recovery. Activities associated with each action are detailed below.

- **Prevention Phase**
    - The actions during this phase are those taken by local, state, and federal agencies to monitor and coordinate intelligence and other potential indicators to prevent, defend against, prepare for, and mitigate the impacts of terrorist attacks against the nation.
    - Florida uses intelligence provided by Fusion Centers, Joint Terrorism Taskforces, and Regional Domestic Security Taskforces.
- **Protection Phase**
    - The actions during this phase are those taken by local, state, and federal agencies to limit the impacts of a potential event on a specific area.
- **Mitigation Phase**
    - The actions during this phase require time to be carried out. They include training, planning, public awareness, and any activities that require long-term programs to accomplish their objectives.
- **Response Phase**
    - These actions are those taken immediately after an incident to 72 hours after the incident, with the major goal of saving lives, alleviating suffering, and preventing further disaster.
    - When responding to disaster events, the National Incident Management System (NIMS) is used by qualified staff to manage the response actions.
- **Recovery Phase**
    - The actions during this phase are those taken during the first one to two months after the incident.
    - These actions, which begin immediately after the emergency response operations, aim to return the state and citizens to normal conditions.
    - The emphasis will transition from saving lives to cleanup of the affected areas and returning people to normal activities.

In 2011, DHS replaced the color-coded alerts of the Homeland Security Advisory System (HSAS) with the National Terrorism Advisory System (NTAS), designed to more effectively communicate information about terrorist threats by providing timely, detailed information to the public. The system uses the following three alerts:[335]

- **Bulletin:** describes current developments or general trends regarding threats of terrorism
- **Elevated Alert:** warns of a credible terrorism threat against the United States
- **Imminent Alert:** warns of a credible, specific, and impending terrorism threat against the United States

DHS created the “If You See Something, Say Something” campaign to include and prepare the entire community. It is a national campaign that raises public awareness of the indicators of terrorism and

[335] https://www.dhs.gov/national-terrorism-advisory-system

terrorism-related crime, as well as the importance of reporting suspicious activity to state and local law enforcement. Suspicious activity could include, but is not limited to, unusual items or situations, eliciting information, and observation or surveillance.[336]

Terrorism in Florida

A terrorist event is possible in Florida due to the state's highly visible and popular tourist destinations, as well as its multiple nuclear power plant locations, numerous international shipping ports, cruise ship destinations, and large-capacity arenas.

The State of Florida works to mitigate the risks of terrorist attacks through the disbursement of mitigation and preparedness planning grants. The Florida Division of Emergency Management (FDEM) is the State Administrative Agency (SAA) for the Department of Homeland Security Grant Program (HSGP). HSGP is comprised of three grant programs. The three programs include:

- **State Homeland Security Grant Program (SHGP):** The SHGP assists state, tribal, territorial, and local preparedness activities that address high-priority preparedness gaps across all core capabilities that support terrorism preparedness.
- **Urban Area Security Initiative (UASI):** The UASI program assists high-threat, high-density urban areas in efforts to build, sustain, and deliver the capabilities necessary to prevent, protect against, mitigate, respond to, and recover from acts of terrorism.
- **Operation Stonegarden (OPSG):** The OPSG Program supports enhanced cooperation and coordination between Customs and Border Protection, the United States Border Patrol, and federal, state, local, tribal, and territorial law enforcement agencies. The OPSG Program provides funding to support joint efforts to secure the United States' borders along routes of ingress from international borders, including travel corridors in states bordering Mexico and Canada and states and territories with international water borders.

With the vast majority of America's critical infrastructure owned and/or operated by state, local, and private sector partners, critical infrastructure and key resource (CI/KR) locations within the state determined to be credible targets of a terrorist event can be documented and monitored. Structures selected for inclusion in the CI/KR list are eligible for additional government grant funding to increase their security against a terrorist event.

One example of funding for which CI/KR sites qualify is the Buffer Zone Protection Program (BZPP). The BZPP aims to make it more difficult for terrorists to conduct planning activities or successfully launch attacks from the immediate vicinity of likely targets. The program is based on the premise that local law enforcement agencies and first responders are on the front lines, preventing, defending against, preparing for, and mitigating the impacts of terrorist attacks against our nation. The funds provided by the BZPP are provided to increase the preparedness capabilities of jurisdictions responsible for the safety and security of communities surrounding high-priority CIKR assets through allowable planning and equipment acquisition.

The State of Florida utilizes the Domestic Security Strategic Plan for terrorist attacks. Florida's Domestic Security Strategic Plan remains a working document, reviewed and prioritized each year.

[336] https://www.dhs.gov/see-something-say-something

Seven Regional Domestic Security Task Forces (RDSTFs), co-chaired by a local sheriff or police chief and the local Florida Department Law Enforcement (FDLE) Special Agent in Charge, are the foundation of Florida's Domestic Security Strategy. These multi-jurisdictional and multidisciplinary task forces work together to strengthen Florida's domestic security preparedness, prevention, protection, mitigation, and response. In addition to law enforcement, task force members include first responders in fire rescue, emergency management, public health, and hospitals. The task force also works with schools, businesses, and private industries.[337]

Chemical

Chemical terrorism is the deliberate release of certain chemicals that could poison people, animals, plants, or the environment. Chemical agents can be delivered in various forms, such as vapors, aerosols, liquids, and solids, and by a wide variety of methods, including sprays and explosives. Chemical warfare agents are substances specifically designed to kill, seriously injure, or disable people. In general, terrorists use chemical agents because they are relatively easy and cheap to make.

Most chemical agents, depending on their type, concentration, and length of exposure, can be deadly. These chemicals can be categorized by type or by their effect. The Center for Disease Control (CDC) categorizes the following types:

- Anticoagulants – cause uncontrolled bleeding
- Biotoxins – come from plants or animals
- Blister agents – blister the eyes, skin, throat, and lungs
- Blood agents – absorbed into the blood
- Caustics – burn on contact
- Choking, lung, and pulmonary agents
- Incapacitating agents – alter consciousness or thinking
- Metallic poisons
- Nerve agents – prevent the nervous system from functioning properly
- Organic solvents – damage living tissue by dissolving fats and oils
- Tear gas and riot control agents
- Toxic alcohols
- Vomiting agents

Chemical agents can produce effects quickly, sometimes within a few seconds, or slowly, sometimes as many as two days after exposure, with some agents being odorless and tasteless.[338]

Biological

Bioterrorism refers to the intentional release of toxic biological agents to harm and terrorize civilians in the name of a cause. Biological agents are living organisms, or the products of living organisms, which can be deadly. Biological agents can go undetected for hours to days. Signs and symptoms

[337] https://www.fdle.state.fl.us/Domestic-Security/Documents/2022-Annual-Report.aspx
[338] https://www.ready.marines.mil/Stay-Informed/Terrorism-and-Active-Shooter/Chemical-Terrorism/

might initially look like a bad cold, flu, or other common illness. Some agents can be extremely lethal in very small quantities. Biological weapons fall into three categories: bacteria, viruses, and toxins with bacteria. All three types can potentially be deadly to people and animals. The CDC has classified the viruses, bacteria, and toxins that could be used in an attack. Category A biological diseases are those most likely to do the most damage. They include:

- Anthrax (Bacillus anthracis)
- Botulism (Clostridium botulinum toxin)
- Plague (Yersinia pestis)
- Smallpox (variola major)
- Tularemia (Francisella tularensis)
- Hemorrhagic Fever
- Ebola Virus

Bioweapons can also be spliced to create a super-virus that either has no cure or is resistant to already formulated antidotes. Please see the *Disease Outbreak and Biologic Incident Hazard Profile* for more information on biological hazards.

Nuclear

Nuclear terrorism refers to a number of different ways nuclear materials might be exploited as a terrorist tactic. These include attacking nuclear facilities, purchasing nuclear weapons, building nuclear weapons, or otherwise finding ways to disperse radioactive materials. There are low levels of radiation exposure present in the everyday environment, but the danger in a nuclear terrorist attack comes with the amount and type of radiation given off.

Given the number of capable groups with serious intent, the increasing accessibility of weapons or nuclear materials from which elementary weapons could be constructed, and the countless ways in which terrorists could smuggle a weapon across borders, nuclear terrorism has become a clear and present danger.

Nuclear terrorism can involve the use of weapons of mass destruction. Weapons of mass destruction are defined as (1) any destructive device as defined in 18 USC, Section 2332a, which includes any explosive, incendiary, poison gas, bomb, grenade, or rocket having a propellant charge of more than four ounces, missile having an explosive or incendiary charge of more than one-quarter ounce, mine or device similar to the above; (2) poison gas; (3) any weapon involving a disease organism; or (4) any weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

The effects of a nuclear attack depend on how much radiation is received, how long someone is exposed to the radiation, and how the radiation enters the body.

Bombing

The easiest to obtain and use of all weapons is still a conventional explosive device or improvised bomb, which may be used to cause massive local destruction or to disperse chemical, biological, or radiological agents.

Many of the devices used by terrorists today are improvised explosive devices (IEDs).[339] An IED is a homemade bomb or destructive device used to destroy, incapacitate, harass, or distract. IEDs are categorized as being explosive or incendiary, employing high- or low-filler explosive materials to explode or cause fires. IEDs can come in many forms, ranging from small, easy-to-make pipe bombs to more sophisticated devices capable of mass damage and loss of life. These devices can be lightweight and easy to carry, such as the backpacks of the Boston Marathon bombers; however, they can also be large enough that the use of a vehicle to transport them is necessary, such as the bombing of the Alfred P. Murrah Federal Building in Oklahoma City. IEDs can also be made of numerous chemicals and hazardous materials and may include the use of shrapnel such as nails or ball bearings.

The components and detailed instructions to construct such a device are readily available. Large, powerful devices can be outfitted with timed or remotely triggered detonators and can be designed to be activated by light, pressure, movement, or radio transmission. The potential exists for single or multiple bombing incidents in single or multiple municipalities. Historically, less than five percent of actual or attempted bombings were preceded by a threat. Explosive materials can be employed covertly with little signature and are not readily detectable. Secondary explosive devices may also be used as weapons against responders and the public in coincident acts.[340]

Cyberattack

Cyberterrorism is the premeditated use of disruptive activities, or the threat thereof, against computers and/or networks, with the intention to cause harm or further social, ideological, religious, political, or similar objectives or to intimidate any person in furtherance of such objectives. Cyberterrorists use information technology to attack civilians and draw attention to their cause. This form of terrorism could severely disrupt the US financial sector, banking, communications, transportation systems, business operations, and all major government infrastructure that relies on computers and the Internet.

This may mean that they use information technology, such as computer systems or telecommunications, as a tool to orchestrate a traditional attack. More often, cyberterrorism refers to an attack on information technology in a way that would radically disrupt networked services. For example, cyberterrorists could disable networked emergency systems or hack into networks housing critical financial information.[341] For more information on cyberattacks, please see the *Cyberterrorism Hazard Profile*.

Active Shooter

An active shooter is an individual actively engaged in killing or attempting to kill people in a confined and populated area. Multiple active shooters are a group that participates in a random or systematic shooting spree, demonstrating their intent to continuously harm or kill others. In most cases, active shooters use numerous types of firearms, and there is no pattern or method to their selection of victims. Active shooter situations are unpredictable and evolve quickly, with most active shooter

[339] https://www.dhs.gov/xlibrary/assets/prep_ied_fact_sheet.pdf
[340] https://www.fema.gov/pdf/plan/managingemerconseq.pdf
[341] https://www.crime-research.org/library/Cyberterrorism.html

situations initiating and ending within 10 to 15 minutes. Warning signs that someone may be planning an attack are:[342]

- Increasingly erratic, unsafe, or aggressive behaviors.
- Hostile feelings of injustice or perceived wrongdoing.
- Drug and alcohol abuse.
- Marginalization or distancing from friends and colleagues.
- Changes in performance at work.
- Sudden and dramatic changes in home life or in personality.
- Financial difficulties.
- Pending civil or criminal litigation.
- Observable grievances with threats and plans of retribution.

DHS defines certain characteristics of an active shooter as the following:[343]

- Active shooters are likely to engage more than one target. They may target particular individuals or be intent on killing as many randomly chosen people as possible.
- Active shooters often go to locations with high concentrations of people, such as schools, theaters, shopping centers, or other places of business.
- Active shooters often, but not always, are suicidal and may attempt suicide by police. Escape from the police is usually not a priority of an active shooter. Most active shooters do not attempt to hide their identity.

Special Interest Terrorism

Special interest terrorism differs from traditional right-wing and left-wing terrorism in that extremist special interest groups seek to resolve specific issues rather than effect widespread political change. These groups continue to conduct acts of politically motivated violence to force segments of society, including the general public, to change attitudes about issues considered important to their causes. These groups occupy the extreme fringes of animal rights, pro-life, environmental, anti-nuclear, and other movements. One example of this is ecoterrorism, a recently coined term, which describes violence in the interests of environmentalism. In general, environmental extremists sabotage property to inflict economic damage on industries or actors they see as harming animals or the natural environment. These have included fur companies, logging companies, and animal research laboratories. This can also be known as special interest terrorism.

Some special interest extremists, most notably within the animal rights and environmental movements, have turned increasingly toward vandalism and terrorist activity in attempts to further their causes. The Animal Liberation Front (ALF) and the Earth Liberation Front (ELF) have also become well known for their use of arson to destroy facilities and spread their message.

Geographic Areas Affected by Terrorism

It is almost impossible to predict where and when a terrorist attack could occur. Generally, terrorists target densely populated or high-profile areas, making any of the state's major urban areas a

[342] https://www.cisa.gov/sites/default/files/publications/dhs-pathway-to-violence-09-15-16-508.pdf
[343] https://www.alicetraining.com/active-shooter/

potential target. High-profile infrastructure, such as government and state buildings, amphitheaters, amusement parks, ports, and airports, is also at risk of a potential attack. The specific motivations of terrorists dictate target selection; therefore, any location within the county has the potential to become a target of terrorism, especially since it is one of the most populated counties in the state of Florida.

The City of Tampa contains numerous targets of opportunity for potential terrorist groups. Being one of the top 15 media markets in the country, containing a major seaport and international airport, and hosting major NFL, MLB, and NHL sports teams are all among the top factors that could attract terrorist activity to the area. Tampa houses MacDill Air Force Base, a major military base with a worldwide orientation. MacDill is the headquarters for two major commands: Special US Operations Command and US Central Command. Additionally, MacDill houses Coalition Village, comprised of representatives from 65 nations working together to combat terrorism. An incident involving weapons of mass destruction by a terrorist organization using chemical, biological, or nuclear substances is a distinct possibility in light of contemporary worldwide terrorist threats.

Historical Occurrences of Terrorism

In January 2012, Sami Osmakac, an American citizen born in the former Yugoslavia who is a Florida resident, was charged with plotting a terrorist spree around the City of Tampa, including bombing nightclubs, destroying bridges, and shooting police officers in the name of radical Islam.[344] No additional publicly available occurrences since 2012 were found.

Probability of Future Terrorism Incidents

There is no sure way to predict future terrorism events, as most typically occur without warning. The probability of a major terrorist event in the state of Florida is perceived to be high, and planning must be done as part of the larger national DHS initiatives. The FDLE plays a large part in providing the state with critical intelligence and serves as a prevention measure to the state. FDLE is part of an ongoing assessment of the state's vulnerability and coordinates efforts to prepare for, prevent, mitigate, respond to, and recover from acts of terrorism that affect the state.[345]

It is difficult to determine the probability of a terrorist attack or incident, especially for a specific region. Terrorism has an uncertain probability but must be considered when planning for hazards due to potentially catastrophic and fatal consequences.

Overall, the probability of terrorism in Hillsborough County is considered possible (1-10% annual probability) based on limited historic occurrences.

Terrorism Impact Analysis

Potential impacts of terrorism incidents are listed by type below.

---

[344] Brown, R. (2012, January 9). Florida Man Charged With Plotting Terror Campaign in Name of Islam. The New York Times. Retrieved from http://www.nytimes.com/2012/01/10/us/florida-man-charged-with-plotting-strikes-in-name-of-islam.html?_r=1

[345] https://www.fdle.state.fl.us/CMSPages/logon.aspx?ReturnUrl=%2fcms%2fDomestic-Security%2fDomestic-Security-Home.aspx

- <u>Public</u>
  - Witnesses are at risk of post-traumatic stress disorder (PTSD) and survivor's guilt following a large-scale attack
  - Fear throughout the affected community and the country is high, causing a hazardous environment
  - Civilians are a target for attacks and are at risk
  - Exposure to hazardous materials is a possibility and could affect the nearby population and first responders
  - Lack of clean running water can cause unsanitary conditions and dehydration
- <u>Responders</u>
  - First responders are at risk of PTSD and other health issues following a violent attack
  - First responders are a target for second-wave attacks and are at risk during rescue operations
  - Exposure to hazardous materials is a possibility and could affect the nearby population and first responders
  - Lack of communication and disruption of critical services can delay emergency response times
- <u>Continuity of Operations (including continued delivery of services)</u>
  - Tourism can decline following an attack and could cause lost revenue to a community and the economy
  - Airports in surrounding areas may close, causing delays and leaving travelers stranded
  - Streets blocked with debris or closed due to proximity can cause street congestion and slow down response times and evacuation routes
  - Bridges could be closed, causing issues evacuating and responding
  - Train disruptions can cause delays and stranded passengers
  - Communication grid overload can cause the system to crash following a large attack
  - Damage to phone lines can cause issues getting information and calling emergency services
  - Loss of the internet can affect numerous industries and emergency response
- <u>Property, Facilities, Infrastructure</u>
  - Bridges could be destroyed or damaged, causing issues evacuating a community
  - Train tracks could be damaged or destroyed, causing further delays in passengers and cargo being transported
  - Cars in the vicinity could be damaged or destroyed
  - Roads can be damaged or destroyed, causing prolonged delays and reduced access to evacuation
  - Damage to buildings can include:
    - Collapse (full/partial)
    - Windows blown out
    - Fire
  - Damage or destruction of government buildings could delay necessary services for the community

- Damage or destruction to critical infrastructure, such as places of travel, banks, and utilities, could cause stress and hardship within the community
    - Outages can be widespread
    - Damage to the power grid can prolong outages
- Environment
    - Exposure to hazardous materials is a possibility and could affect the environment and wildlife
    - Could contaminate the food and water sources
    - Damage to green spaces
- Economic Condition
    - Prolonged loss of revenue could cause businesses to close and the economy to suffer
    - Loss of wages could affect citizens' ability to buy necessities and could affect the economy
    - The economy (business, personal, and government) could be affected if banks are closed or not able to access the internet
- Public Confidence in Each Jurisdiction's Governance
    - Lack of communication from leadership to the public
    - Evacuation timeframe
    - Response timeframe
    - Recovery timeframe
    - Not stopping an attack could lead to a loss of respect or confidence

Vulnerability Analysis and Loss Estimation by Jurisdiction

During the Fall of 2023, the County conducted and participated in numerous large-scale multi-jurisdictional terrorism exercises[346]. Joint planning efforts with several response agencies are currently underway. It is expected resultant changes in several procedures will ultimately minimize the potential effects of a terror incident, should one occur. According to the Regional Domestic Security Task Force (RDSTF), the sector most at risk is Commercial Facilities. The category that contributes the most risk is the IED threat category, IED.

Areas with large populations, major transportation hubs, theme parks or cruise ships, and those with a large influx of tourism are the most at risk for a terrorist attack. The impact of a single terrorist attack would vary depending on the attack. A successful terrorist attack could kill or injure many people. An attack also has potential long-term environmental and/or economic impacts.

Vulnerability Analysis and Estimated Losses of Critical Facilities

Though the county recognizes that critical facilities are vulnerable to terrorism, the abstract way in which terrorism occurs creates a vacuum of high-level detailed vulnerability and risk assessment. As such, while it is prudent to recognize the threat, there is no viable way to quantitatively communicate the vulnerability or loss of facilities compared to other hazards.

---

[346] City of Tampa to hold 'mass casualty' drill at convention center (fox13news.com)

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.1 (Table 5.166).

Table 5.166. **Overall Vulnerability to Terrorism for Hillsborough County**

TERRORISM					Overall Vulnerability	
Overview						
In the Florida Code of Regulations, terrorism is defined as “the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives.” This is something that is difficult to mitigate against due to sheer unpredictability. Hillsborough County faces a particular threat from events involving terrorism due to the booming tourist industry, international ports, etc.					HIGH	
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Possible	Critical	Moderate	< 6 hrs	Very Concerned	> 1 week	3.1

4.15 Disease Outbreak and Biologic Incident Hazard Profile

Disease Outbreak & Biologic Incident Description

Infectious disease results from the spread of pathogens and affects a population's health and well-being. Pathogens can be classified as ***organisms or organic agents***—which include viruses, bacteria, fungi, parasitic organisms, organic toxins, and prions—and can be found in the environment, in animals or insects, or moving directly from human to human.

The variety of situations in which pathogens cause disease are collectively called ***biologic incidents*** and can range from the natural occurrence of disease to manufactured biological attacks.

Epidemics

According to the Centers for Disease Control and Prevention (CDC), ***disease outbreaks or epidemics*** are identified by the occurrence of more cases of disease than generally expected within a specific place or among a group of people over a specified time. Many diseases are endemic or routinely circulate in Hillsborough County (e.g., influenza, the common cold, and gonorrhea). Outbreaks of these diseases occur when case numbers increase over a specific period. Other diseases (e.g., measles, dengue, rabies, and polio) occur rarely in Hillsborough County- even one case warrants an outbreak investigation. Newly emerging infectious diseases can have severe impacts: victims generally lack immunity against the disease, and health professionals' unfamiliarity with the disease can delay its identification and the community's initiation of an appropriate response.

Pandemics

The emergence or increase in cases of a disease across multiple countries is called a ***pandemic***. There have been a number of pandemics in the last 20 years, including Sudden Acute Respiratory Syndrome (SARS, 2003), H1N1 Influenza (aka "Swine Flu," 2009), Ebola (West Africa, 2014), Zika virus (2016), Chikungunya virus (2014), Middle Eastern Respiratory Syndrome coronavirus (MERS Co-V, 2014)[347]and, Coronavirus disease (Covid-19, 2019). Characterized by its dense multinational population, active international airports and seaports, and robust international commerce, Hillsborough County must maintain vigilant monitoring systems to prevent and manage the transmission of infectious diseases across county borders. The county serves as both a departure point for U.S. citizens to engage in international travel and a receiving point for international tourists to access the wide variety of attractions Central Florida offers. The county has also served as a receiving point for refugees and evacuees of various global disasters, including Hurricane Matthew in Haiti (2016), Hurricane Maria in Puerto Rico (2017), and The Bahamas following Hurricane Dorian (2019). Global interactions and integration among people, businesses, and governments provide the means for various diseases to enter the country and spread at an accelerated rate if monitoring systems are not in place. During 2014 – 2019, approximately 3.5 million persons moved to the United States from abroad; out of the 3.5 million, 3.2 million were immigrants, and 313,890 were refugees.

[347] Centers for Disease Control and Prevention. (2012, May 18). Epidemic disease occurrence. Principles of Epidemiology in Public Health Practice: An Introduction to Applied Epidemiology and Biostatistics, 3rd ed. Centers for Disease Control and Prevention, Office for Public Health Scientific Services: Atlanta. https://stacks.cdc.gov/view/cdc/6914

Data collected from the CDC's Electronic Disease Notification (EDN) system reported 6,586 cases of infectious TB, 815 cases of syphilis, and 131 cases of gonorrhea.[348] As the diverse population of Hillsborough County grows and international commerce and tourism increases, the risk for disease transmission increases. Florida's Health Department implements the Refugee Health program, which reviews overseas medical examination records and provides health assessments and immunizations to refugees to enhance their personal health status and protect Florida's public health.[349]

Bioterrorism

Bioterrorism is the deliberate release of organisms or organic agents that are used to cause illness or death in people, animals, or plants. The reasons or motivations for such an attack may vary among political, economic, or social agendas. The 2001 anthrax attacks are an enduring example of this threat. Letters containing anthrax spores were mailed to government buildings in the D.C. area, producing cases of anthrax spanning weeks and the closure of the affected buildings. Biological agents are readily available in nature and can be manipulated to increase their infectiveness or virulence to increase the agent's ability to cause illness or death. The CDC has organized potential biologic agents into three categories listed below in Table *5.167*. The occurrence of the diseases featured on this list initiates a special investigation that must include steps to detect potential bioterror threats.[350]

Table 5.167. Center for Disease Control and Prevention (CDC) Bioterrorism Agents and Diseases

Category	Description	Examples
Category A Agents	High-priority agents have the most significant potential for panic and social disruption. These agents can be easily disseminated, result in high rates of illness and death, and require special action for public health preparedness.	• Anthrax • Smallpox • Botulism • Plague • Tularemia • Viral Hemorrhagic Fevers (e.g., Ebola, Lassa, Dengue)
Category B Agents	Second-priority agents have a lower potential for panic and social disruption. These agents are moderately easy to disseminate and produce moderate rates of disease with lower occurrence of death but still require specific enhancements for	• Brucellosis • Food & Water Safety Threats • Glanders • Melioidosis • Q Fever

[348] Christina R. Phares, PhD1; Yecai Liu, MS1; Zanju Wang, MS1; Drew L. Posey, MD1; Deborah Lee, MPH1; Emily S. Jentes, PhD1; Michelle Weinberg, MD1; Tarissa Mitchell, MD1; William Stauffer, MD1,2; Julie L. Self, PhD3; Nina Marano, DVM. (2022, Jan. 21). Disease Surveillance Among U.S.-Bound Immigrants and Refugees — Electronic Disease Notification System, United States, 2014–2019. https://www.cdc.gov/mmwr/volumes/71/ss/ss7102a1.htm

[349] FDOH. (2023, Dec. 19). Refugee Health. https://www.floridahealth.gov/programs-and-services/community-health/refugee-health/index.html

[350] Centers for Disease Control and Prevention. (2018 April 04). Bioterrorism. *Emergency Preparedness and Response*. https://emergency.cdc.gov/agent/agentlist-category.asp

Category	Description	Examples
	response.	• Staph. Enterotoxin B • Viral Encephalitis (e.g., West Nile, Eastern Equine Encephalitis)
Category C Agents	These agents are emerging pathogens that could be engineered for mass dissemination in the future due to availability, ease of production, and potential for disease and death.	• Nipah Virus • Hantavirus

Symptoms and Disease Detection

Symptoms of disease vary widely depending on the type of pathogen, organ systems that are affected by infections, and a person's ability to fight off infection. Fever and the general feeling of unwellness are common signs of infection but may not be present in all sick persons. Common signs of foodborne disease include diarrhea and vomiting, which may also accompany other types of infections. Healthcare professionals trained and experienced in infectious disease diagnosis and control should be consulted when encountering suspected disease outbreaks and biologic incidents.

The risk of disease in Hillsborough County is monitored by local health departments and hospital epidemiologists, doctors, other health professionals, and laboratory professionals. The CDC defines epidemiology as the study of the distribution and determinants of health-related states in specified populations and the application of this study to control health problems.[351] Epidemiology is the scientific method used by disease detectives—epidemiologists—to get to the root of a public health problem or emerging public health event affecting a specific population. In Hillsborough, local medical facilities report specific incidents, known as reportable events, to the Florida Department of Health – Hillsborough County, which uses epidemiology to track, report, prevent, and prepare for outbreaks in the county. These events are then reported to the CDC for tracking or response purposes. Table 5.168 below shows CDC reportable events.

Table 5.168. Centers for Disease Control and Prevention (CDC) Reportable Events

Injuries	• Increased homicides in a community • National surge in domestic violence
Non-infectious Diseases	• Localized or widespread rise in a particular type of cancer • Increase in major birth defect
Natural Disasters	• Hurricanes Katrina and Rita (2005) • Haiti Earthquake (2010)

351 https://www.cdc.gov/reproductivehealth/data_stats/glossary.html#:~:text=The%20study%20of%20the%20distribution,the%20control%20of%20health%20problems.

	• Hurricane Irma (2017) • Hurricane Michael (2018) • Hurricane Ian (2022)
Terrorism	• World Trade Center (2001) • Anthrax release (2001)
Environmental Exposures	• Lead and heavy metals • Air pollutants and other asthma triggers • Red-tide outbreak (2017-2018, 2021-2022)
Infectious Diseases	• Foodborne illness • Reportable diseases • Influenza and pneumonia

Potential Effects of Climate Change on Disease Outbreaks and Biologic Incidents

Environmental changes greatly impact the emergence and reemergence of certain infectious diseases. The relationship between infectious disease outbreaks and climate change events (i.e., El Niño, La Niña, heatwaves, droughts, floods, increased temperature, higher rainfall) or environmental changes (i.e., habitat fragmentation, deforestation, urbanization).

Climate change is expected to continue to alter the behavior and range of certain disease vectors – mosquitoes, ticks, and fleas. Increasing temperature and carbon dioxide levels may optimize growth conditions for some disease-causing fungi. Climate change and globalization are also associated with a progressive northward movement of certain fungal and protozoal pathogens that may produce outbreaks in non-endemic areas. Additionally, rising surface temperatures and acidification of the oceans can increase the development of infectious pathogens, including *Vibrio* bacteria and the microbes that produce ciguatoxin.

Extreme weather events, especially flooding, sea level rise, and tropical cyclones, can be expected to continue or potentially negatively impact the built environment and critical infrastructure, economy, water systems, food production, and vector (insect) control. Extreme events can disrupt services, leading to food and water sources being contaminated with bacteria that can cause illness or increase the potential for an outbreak of zoonotic disease by displacing wildlife. Flooding events may increase the number of insect vectors or mold growth, which negatively impacts population health. Furthermore, the damaged infrastructure that would have otherwise been designed to protect and support the local population may be compromised.

To avoid or control outbreaks, integrated surveillance systems and effective outreach programs are essential. Due to the strong global and local influence on the emergence of infectious diseases, a more holistic approach is necessary to mitigate or control the occurrence of disease outbreaks.

Geographic Areas Affected Disease Outbreaks and Biologic Incidents

Biological incidents may affect all areas of the county. Transportation hubs and places of greater population density, like Downtown Tampa, could be more likely to experience disease outbreaks or biological incidents due to increased opportunities for transmission. High-density population centers are also more likely to experience severe impacts during biological incidents due to proximity social interactions and the transmission of particular airborne diseases that spread via droplets and aerosols, therefore affecting the local environment, i.e., surfaces where they deposit and the pathogen can continue to be infectious for a certain time period.[352][353] The county's central and western regions, including Downtown Tampa, South Tampa, Seminole Heights, Tampa Heights, Temple Terrace, and Westchase, are considered high-density.

The eastern and southern regions of the county currently have lower population densities but are the focus for future growth within the county. There have been cases of zoonotic disease within the county. Zoonotic disease is the transmission between local wildlife, livestock, and human hosts. Brucellosis is a rare but epidemiologically important zoonotic disease caused by Brucella bacterium. The most common species of Brucella is B. suis, which is endemic to feral hogs and attributed to wild pig hunting or the preparation of wild pig meat. Between 2013 and 2023, Hillsborough reported 4 cases of Brucellosis.[354]

Historical Occurrences of Disease Outbreaks and Biologic Incidents

This section discusses significant (involving specific disease outbreak investigation or intervention) disease outbreak events. The most significant events, categorized as incidents affecting more than 50 individuals, are discussed in detail below. Table 5.169 provides a summary of significant disease outbreaks the impacted Hillsborough County between 2014 and 2023.

Table 5.169. Description of Significant Disease Outbreaks that Affected Hillsborough County, 2014 - 2023

Date	Information
Ebola Virus (EVD) Pandemic, 2014-2016	An EVD outbreak in West Africa became the largest EVD pandemic in history. A total of 28,652 cases of EVD were reported in Guinea, Liberia, and Sierra Leone, with over 11,325 deaths. In August 2014, the World Health Organization declared a public health emergency of international concern. Responders returning to Europe and the U.S. carried the disease before becoming ill in their home countries. In the U.S., the CDC confirmed the first travel-associated case of EVD ever diagnosed in the U.S. While no cases were detected in Hillsborough County, a detection and response plan were developed to protect residents.[355]
Chikungunya virus (CHKv), Summer 2014	The first domestic cases of Chikungunya virus were recorded in Hillsborough, Broward, and Palm Beach Counties. A total of 40 cases were reported in Hillsborough County between January 2014 and December 2015, which corresponded to the emergence of the disease in the Caribbean and South America. Positive cases in Hillsborough were found to have had a travel history to Chikungunya endemic or epidemic areas two weeks before onset.

[352] Mazzpli, M. Gallotti, . Privitera, F. *et al*. (2023). Spatial immunization to abate disease spreading in transportation hubs. *Nat Commun* **14**, 1448 https://www.nature.com/articles/s41467-023-36985-0#citeas

[353] Ikonen, N. et al. Deposition of respiratory virus pathogens on frequently touched surfaces at airports. BMC Infect. Dis. 18, 437 (2018).

[354] FDOH. (217, Nov 7). Brucellosis. https://www.floridahealth.gov/diseases-and-conditions/brucellosis/index.html

[355] Centers for Disease Control and Prevention (2019, March 08). 2014-2016 Ebola Outbreak in West Africa. *Ebola (Ebola Virus Disease)*. https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html

Date	Information
	There was no documented local transmission of this disease. Those case numbers declined to one case per year following the initial emergence.[356]
Cryptosporidium Outbreak, Summer 2014	An outbreak of cryptosporidium occurred in the Tampa Bay area, including Hillsborough, Pinellas, and Pasco counties. The outbreak involved 266 cases and was associated with a local water park in Tampa. The investigation found no critical deficiencies but noted a lack of a secondary water disinfection system. In all, Hillsborough County experienced 353 cases of cryptosporidiosis in 2014, most of which were associated with this outbreak[357]. In the summer of 2015, the same Tampa water park was associated with another cryptosporidium outbreak involving 22 suspected or confirmed cases.[358] The latest cases to be reported by the Florida Health Department were for 2023, with 46 cases of the outbreak.
Fecal Coliform, Hurricane Hermine, September 2016	Hurricane Hermine unloaded 22 inches of rain in the Tampa Bay area flooding streets, stalling cars, causing evacuations. Hillsborough Bay became inundated with 938,000 US gallons (3,550,000 L) of partially treated sewage due to power outages affecting the local wastewater treatment plant.[359] Following the incident, Tampa issued detailed reports to the state showing there were elevated fecal coliform levels in the Hillsborough River. In addition to this event, jurisdictions across Pinellas County ended up releasing an estimated 199.4 million gallons of partially treated sewage into the waters of Tampa Bay during this event.
Zika Virus Outbreak, Summer 2016	The first recorded outbreak of the Zika virus in the Americas, with 1,456 cases recorded statewide in Florida, corresponded to the emergence of this disease in the Caribbean and South America. Hillsborough County reported 33 cases, all of which were individuals that had traveled to the county from areas where the virus was circulating readily. Case numbers decreased to 7 in 2017, with no cases reported from 2018 to 2023. While there was no reported local transmission of the Zika virus in Hillsborough, one locally acquired case was reported in Pinellas County. Zika produces mild febrile illness, which is usually self-limiting. However, the disease is known to cause severe congenital malformations, which is the main source of

[356] Florida Department of Health. (2014-2015). Florida Annual Morbidity Statistics Reports. Data and Publications. http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/data-and-publications/fl-amsr1.html

[357] FDOH. (2024). Reportable Diseases Frequency. Report https://www.flhealthcharts.gov/ChartsReports/rdPage.aspx?rdReport=FrequencyMerlin.Frequency&FirstTime=True

[358] https://www.wtsp.com/article/news/health/a-microscopic-parasite-often-found-at-pools-and-daycares-could-make-you-sick/67-1cd5e5fa-0e73-437b-97b0-9eaaa609842f

[359] Frago, Charlie. (2016, Sept 2). "Hurricane Hermine leaves Tampa Bay area befouled". *Tampa Bay Times*. https://www.tampabay.com/news/localgovernment/hurricane-hermine-leaves-tampa-bay-befouled/2292130/

Date	Information
	concern for the disease circulating in the county.[360,361]
Measles Outbreak, 2018	In 2018, 15 measles cases were reported in four Florida counties: Miami-Dade, Duval, Pinellas, and Sarasota, more than two times the number of cases seen in any individual year in the eight years preceding. These cases were a part of national outbreaks that totaled 372 cases of measles in 2018. For 2023, the CDC reported 58 measles cases in 20 states, including Florida, however, Florida's Department of Health's most recent reports for measles cases show 2022 and 2021 reporting zero cases.[362] In 2020, one case of the measles was reported in Hillsborough County. Measles is a highly contagious, vaccine-preventable disease that requires a high vaccination rate to achieve "herd immunity" (i.e., protection of the entire population, including those that cannot be vaccinated due to health restrictions). Hillsborough has been identified as having a higher-than-normal risk for a measles epidemic due to heavy international travel from tourism and international commerce, as well as low vaccination rates.[363,364,365]
Hepatitis A Outbreak, August 2019	The Florida Surgeon General declared a public health emergency related to an ongoing Hepatitis A outbreak. The critically impacted counties were Brevard, Citrus, Glades, Hernando, Hillsborough, Lake, Liberty, Manatee, Marion, Martin, Okeechobee, Orange, Pasco, Pinellas, Sumter, Taylor, and Volusia[366] with 3,392 Hepatitis A cases reported. Following this outbreak, there has been a decline in reported cases from 2020 to 2023, with 1,021 cases reported in 2020, 203 cases in 2021, 319 cases in 2022, and 100 reported cases in 2023.[367]
Coronavirus Disease, (COVID-19), 2020	An outbreak of novel coronavirus (2019-nCoV), a respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), that began in Wuhan, China, had spread rapidly, with the first confirmed case in

---

[360] World Health Organization. (2016, February 09). Zika: the origin and spread of a mosquito-borne virus. *Bulletin of the World Health Organization*. http://dx.doi.org/10.2471/BLT.16.171082

[361] FDOH. (2019, June 30). Reportable Diseases Frequency Report. *FL Health Charts*. www.flhealthcharts.com/ChartsReports/rdPage.aspx?rdReport=FrequencyMerlin.Frequency&FirstTime=True

[362] CDC. (2024). Measles Cases and Outbreaks. https://www.cdc.gov/measles/cases-outbreaks.html

[363] FDOH. (2019). Measles. floridahealth.gov/diseases-and-conditions/measles/#targetText=So%20far%20in%202019 %2C%202,cases%20were%20reported%20in%202018.

[364] Sarkar, S. Zlojutro, A. Khan, K. Gardner, L. (2019, May). Measles resurgence in the U.S.: How international travel compounds vaccine resistance. *The Lancet, 19*(7), 684-686. https://doi.org/10.1016/S1473-3099(19)30231-2

[365] Public Health Dynamics Laboratory. (2019). FRED Measles Simulator. *University of Pittsburgh Public Health Dynamics Laboratory*. https://fred.publichealth.pitt.edu/measles

[366] FDOH. (2019, Aug. 1). Florida Surgeon General Scott A. Rivkees Issues Public Health Emergency in Response to Hepatitis A Outbreak. https://www.floridahealth.gov/newsroom/2019/08/080219-state-of-florida-department-of-health-declaration-of-public-health-emergency.pr.html

[367] FDOH. Hepatitis A Report Archive. https://www.floridahealth.gov/diseases-and-conditions/vaccine-preventable-disease/hepatitis-a/surveillance-data/_documents/2023-december-hep-a-report.pdf

Date	Information
	the United States reported in January 2020 in Washington.[368] In March 2020, the State Surgeon General declared a Public Health Emergency for COVID-19 in Florida. The state experienced 1,317,391 COVID cases at the beginning of the pandemic March 1, 2020[369], with cases increasing from 2021 (2,934,014) to 2022 (3,071,869) and then decreasing in 2023 (582,992)[370]. Hillsborough County is included in this outbreak, with 504,048 cases reported between 2020 and 2023.

Data collected from the Florida Department of Health (FDOH), shown in Table 5.170 below, provides a breakdown of diseases and reported frequency within Hillsborough County.

Table 5.170. Report of Disease in Hillsborough County (2018-2023)[371]

Hazard or Disease	Frequency						
	2018	2019	2020	2021	2022	2023	Assessment
Sexually Transmitted Infections							
Human Immunodeficiency Virus (HIV)[372]	294	269	234	293	294	378	Endemic
Acquired Immunodeficiency Syndrome (AIDS)	143	142	123	165	146	142	Endemic
Bacterial Sexually Transmitted Infections	11,797	12,828	12,727	14,154	14,231	-	Endemic
Vector Borne Disease							
Anaplasmosis	1	1	-	1	2	-	Non-Endemic
Babesiosis	1	-	-	1	-	-	Non-Endemic
Chikungunya Fever*	1	-	-	-	-	-	Non-Endemic
Dengue Fever*	6	23	3	0	77	-	Non-Endemic

368 Holshue, M. L., DeBolt, C., Lindquist, S., Lofy, K. H., Wiesman, J., Bruce, H., Spitters, C., Ericson, K., Wilkerson, S., Tural, A., Diaz, G., Cohn, A., Fox, L., Patel, A., Gerber, S. I., Kim, L., Tong, S., Lu, X., Lindstrom, S., Pallansch, M. A., ... Washington State 2019-nCoV Case Investigation Team (2020). First Case of 2019 Novel Coronavirus in the United States. The New England journal of medicine, 382(10), 929–936. https://doi.org/10.1056/NEJMoa2001191

369 Cutway, Adrienne. (2020, Sept. 25). Timeline: The spread of coronavirus in Florida: COVID-19 situation continues to rapidly evolve. https://www.clickorlando.com/news/local/2020/03/20/timeline-the-spread-of-coronavirus-in-florida/

370 Florida Department of Health FDOH. (2024, March). COVID-18 Cases. https://www.flhealthcharts.gov/ChartsDashboards/rdPage.aspx?rdReport=Covid19.Dataviewer

371 FDOH. (2019, June 30). Reportable Diseases Frequency Report. *FL Health Charts*. https://www.flhealthcharts.gov/ChartsDashboards/rdPage.aspx?rdReport=HIVAIDS.Dataviewer&rdRequestForwarding=Form

372 Data for 2020 and 2021 should be interpreted with caution due to the impact of COVID-19 on HIV testing, care-related services, and case surveillance activities.

Hazard or Disease	Frequency						
	2018	2019	2020	2021	2022	2023	Assessment
Ehrlichiosis	2	-	-	-	-	1	Non-Endemic
Malaria*	6	4	-	2	7	8	Non-Endemic
Q Fever (Coxiella Burnetii)	-	-	-	-	-	-	Non-Endemic
Rocky Mountain Spotted Fever and Rickettsiosis	1	1	1	-	-	1	Non-Endemic
West Nile Virus Disease	-	-	-	1	1	-	Non-Endemic
Zika Virus	-	-	-	-	-	-	Non-Endemic
Other Reportable & Zoonotic Infectious Diseases							
Creutzfeldt-Jakob Disease (CJD)	1	1	-	-	2	3	Non-Endemic
Hansen's Disease (Leprosy)	-	1	-	1	-	1	Non-Endemic
Leptospirosis	2	1	-	-	-	-	Non-Endemic
Meningitis, Bacterial or Mycotic	4	11	1	4	6	2	Endemic
Rabies, Animal	10	1	2	3	5	1	Endemic
Rabies, Possible Exposure	143	142	121	99	7	187	N/A
Staphylococcus Aureus Infection, Intermediate Resistance to Vancomycin	-	-	-	-	-	-	N/A
Streptococcus Pneumoniae Invasive Disease	39	55	33	41	57	65	N/A
Tuberculosis	29	35	22	60	50	-	Endemic
Vaccine Preventable Diseases							
Haemophilus influenza e Invasive Disease	15	14	-	1	17	29	Endemic
Hepatitis B, Acute	49	59	39	45	69	51	Endemic
Hepatitis B, Chronic	325	337	271	267	289	369	Endemic
Hepatitis B, Pregnant Women	9	2	9	22	11	19	Endemic
Hepatitis C, Acute	25	58	148	138	122	97	Endemic
Hepatitis C, Chronic (Including Perinatal)	1,303	1,174	863	832	774	759	Endemic
Deaths from Pneumonia	156	149	198	192	194	-	Endemic
Deaths from Influenza & Pneumonia	180	164	222	194	203	-	Endemic
Preventable Hospitalization from	1,255	-	-	-	-	-	Endemic

Hazard or Disease	Frequency						
	2018	2019	2020	2021	2022	2023	Assessment
Bacterial Pneumonia							
Meningococcal Disease	2	2	1	1	1	3	Non-Endemic
Mumps	1	7	1	1	1	-	Endemic
Pertussis	66	44	34	19	20	13	Endemic
Rubella	-	-	-	-	-	-	Non-Endemic
Varicella (Chickenpox)	68	67	15	20	30	68	Endemic
Food and Water Borne Disease							
Botulism, Foodborne	-	1	-	2	-	-	Non-Endemic
Brucellosis	1	1	-	-	1	-	Non-Endemic
Campylobacteriosis	337	332	274	270	256	352	Endemic
Ciguatera Fish Poisoning	2	2	1	-	-	1	
Cryptosporidiosis	76	74	32	37	58	46	Endemic
Cyclosporiasis**	3	15	16	11	27	28	Endemic
Hemolytic Uremic Syndrome (HUS)	1	-	-	1	1	3	Endemic
Hepatitis A	84	167	23	5	80	25	Endemic
Hepatitis E	2	1	1	-	-	-	Non-Endemic
Giardiasis, Acute	62	75	61	53	64	83	Endemic
Listeriosis	3	4	-	4	3	4	Non-Endemic
Legionellosis	31	18	18	21	26	22	Endemic
Q Fever (Coxiella burnetii)[3]	-	-	-	-	-	-	Non-Endemic
Salmonella Paratyphi Infection	-	2	1	-	-	-	Non-Endemic
Salmonellosis (Typhoidal)	-	4	1	-	1	3	Non-Endemic
Salmonellosis (Non-Typhoidal)	5	2	-	-	-	-	Endemic
Shiga Toxin-Producing Escherichia coli (STEC) Infection	343	152	-	-	-	-	Endemic
Shigellosis	-	-	-	-	-	-	Endemic
Vibriosis (Excluding Cholera)	54	51	28	27	64	85	Endemic
Notes: **The above table depicts the burden of food and waterborne pathogens in Hillsborough County from 2018-2023. Disease burden is determined from the annual case numbers (frequency) and, disease duration, and death rates (severity).**							

Hazard or Disease	Frequency						
	2018	2019	2020	2021	2022	2023	Assessment
Endemic = Diseases that are transmitted locally and circulate annually; Non-Endemic (NE) = Diseases that are not transmitted locally and occur on less than annual basis (sporadic)							

Probability of Disease Outbreaks and Biologic Incidents

Many diseases routinely circulate in Hillsborough County, ranging from low (less than 10 cases annually) to high (10,000+ cases annually) endemicity. Disease outbreaks are frequent occurrences in Hillsborough County, with at least four significant outbreaks affecting the area with cases. The county was additionally named as one of the top high-risk counties for future measles outbreaks. Biologic attacks are relatively infrequent occurrences, and no instances of biologic attacks or bioterrorism have been recorded in Hillsborough County. However, the risk is still present.

The probability of future occurrence of disease outbreaks and biologic incidents is likely (10-100% annual probability).

Disease Outbreaks and Biologic Incidents Impact Analysis

All jurisdictions could receive the impacts listed below due to disease outbreaks and biologic incidents. Portions of these communities with high concentrations of senior residents and very young individuals could be the most at risk.

- Public
    - Illness or death from exposure
    - Mass Casualties
    - Quarantine or Social Isolation
        - Public Fear and Unrest
    - Delays
- Responders
    - Injury/illness/death from treating victims
    - Expose/infect family or friends that may be more vulnerable
    - Psychological Trauma
        - Stress and fear
        - Potential enduring effects
- Continuity of Operations (including delivery of services)
    - Increased disease burden may cause localized to widespread challenges
    - Services may be interrupted from employee absence
    - Increased patient load in hospitals limits operational capacity
- Property, Facilities, and Infrastructure
    - Reduced workforce to maintain workforce, infrastructure, and amenities.
    - Damage to property in cases of vandalism or civil disruption
- Environment
    - Product disposal and other waste management
    - Increased chemical use in response
        - Runoff from decontamination

        - Increased use of sanitizers.
    - Management of deceased
- <u>Economic Condition</u>
    - Hospitalization and insurance costs
    - Work hours lost in convalescence
    - Cost of epidemiologic investigations
    - Cost of downtime for businesses due to employee absence
    - Temporary facility closures may become permanent (lowered business economy)
- <u>Public Confidence in Each Jurisdiction's Governance</u>
    - Public fear may produce a loss of faith in the medical community or government agencies
    - Tourists may reconsider visiting Florida

Impact Summary

How widespread (scope) the outbreak becomes depends on the pathogen type and density of the population susceptible to the disease. Pathogens that can become airborne (e.g., measles or Q fever) have the potential to become widespread in a short time. Hillsborough County has areas of very dense population that may or may not be susceptible to infection with different germs.

How large (scale) an outbreak becomes depends on the number of individuals exposed to the pathogen source, whether a sick person or animal, contaminated food or water, or disease-carrying mosquitoes or ticks. The scale of an outbreak may range from a small number of linked cases to a large regional, national, or international outbreak involving thousands to tens of thousands of cases and the mobilization of public health and emergency management resources.

Impact on the Built Environment

Overcrowding, poor regional design, poor hygiene due to poverty, dirty drinking water, rapid climate change, and natural disasters can lead to conditions that allow for easier disease transmission.

The impact of an outbreak on the built environment is variable depending on the total number of victims or those believed to have symptoms of the disease. The effects on the built environment are likely to be minimal unless an outbreak becomes widespread or enduring. For example, if a disease outbreak or biological incident impacts a large enough number of people, hospitals and clinics could be overwhelmed. In this case, there may be a need to establish a point of distribution off-site to implement a mass vaccination campaign to administer vaccines or antidotes to the affected population.

An increase in public fear or mistrust may have a variety of effects ranging from minor incidents of violence or vandalism to widespread civil unrest and disruption. Employee absence due to illness may result in the closure of local businesses and a lower workforce to maintain infrastructure or lead to a disruption in services. Some facilities or locations may need to be restricted to the public due to contamination or the need for proper decontamination. Controlling vectors such as mosquitos, lice, flies, and rodents in the built environment is also essential to reducing specific diseases.

The effectiveness of a resilient jurisdiction, business, or infrastructure depends on its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event.

In the event of an intentional bioterrorism incident, individuals usually choose their targets to maximize the impact of their attack or, rather, its consequences. Bioterrorists tend to prefer soft targets, such as commercial shopping malls or football stadiums, where a successful attack might produce the greatest effect.

How Does the Built Environment Impact Disease Outbreaks and Biologic Incidence?

While disease outbreaks and biological incidents affect our built environment, conditions within the built environment — the proximity of expanding populations into rural agricultural areas, increased population density in the urban core, and even the design of our buildings and critical infrastructure — can exacerbate the occurrence of disease outbreaks or biological threats.

The design of Hillsborough County communities, poor conditions in which residents live, failing infrastructure, or locations in which many people gather (i.e., malls, public schools, sports complexes, theme parks, concert venues) can lead to heightened exposure or conditions that support disease transmission.

The spread of disease in a contaminated water supply could lead to an uptake of disease incidents and a spike in the number of cases of a specific disease. For example, improper waste disposal and inadequate capacity of sewage systems can lead to heightened exposure to fecal matter that may expose populations, plants, fish, and wildlife to several diseases. Contaminants in the wastewater can negatively impact freshwater ecosystems, coral reefs, and terrestrial ecosystems and potentially expose coastal communities to rotavirus, cholera, and norovirus. [373]

Hospitals and Clinics

For emergency departments—the front-line response system for disease threats—preventing transmission is paramount in maintaining a safe environment. Hospitals and clinics can be designed to handle the isolation of a disease outbreak or biological threat and can, therefore, limit the spread of the disease. If Hillsborough County hospitals and clinics cannot meet the infection control measures are not sufficient, the risk of disease exposure and transmission will be heightened. During the COVID-19 pandemic in 2021, the surge of COVID cases strained the healthcare system so much that hospitals, such as Tampa General Hospital, encouraged potential patients to rethink visiting the emergency departments if they had a minor illness or accident. The volume of calls and backups in the Emergency Department forced ambulances to wait longer before unloading patients, which increased the response times for patients waiting with serious emergencies.[374]

Ecological Impacts of Disease Outbreaks and Biologic Incidents

---

[373] Wear, Stephanie, Acuna, Vicenc, McDonald, Rob and, Font, Carme. (2021, Jan 26). Sewage pollution, declining ecosystem health, and cross-sector collaboration, Biological Conservation, **Vol 255** https://www.sciencedirect.com/science/article/pii/S0006320721000628#:~:text=Recent%20studies%20reveal%20that%20untreated%20and%20poorly%20treated,disruptors%2C%20heavy%20metals%2C%20and%20pharmaceuticals%20in%20natural%20ecosystems.

[374] Greene, Lisa. (2021, Aug 12). Please come to the Emergency Department – but only if it's an emergency. https://www.tgh.org/news/tgh-health-news/2021/august/please-come-to-the-emergency-department-but-only-if-its-an-emergency

Biological threats to Hillsborough County's natural ecosystems should be taken into consideration alongside human health and economic concerns.

Extreme weather events increase the risk of contamination of crops, fisheries, and produce. Increases in over-ground water flow (runoff) due to flooding-related events can cause unintentional contamination of food crops with bacteria or other diseases.

Drought may also increase the production of certain pathogens in the environment. *Aspergillus flavus* is a fungus responsible for aflatoxin, which increases in times of drought. Aflatoxin may enter the food chain either directly through contamination of crops or indirectly through accumulation in milk, eggs, and meat when food animals eat toxin-contaminated feeds.

Bioterrorism and the use of biological weapons can cause death or injury to humans, animals, or plants. Sometimes, the targets of bioterrorism are directed at political figures. For example, the use of the agent ricin, a lectin and highly potent toxin produced in seeds of the castor oil plant, was used in 2003 and 2013 against the United States – ricin-laden letters were mailed to the White House and to offices where senators worked. [375, 376]

Invasive Species

The effects of invasive non-indigenous species comprise one of the most apparent risks of globalization of international trade to both agricultural and natural ecosystems. Once a species or disease is introduced into a region, its risk depends on whether it can establish and thrive in its new environment. In some situations, a species may purposely be introduced to the environment for mitigation purposes to reduce the spread of vectors and control disease threats. However, this could cause other imbalances in the natural system.

Non-endemic Diseases Introduced in the Environment

Some regions may not be susceptible to a particular disease; however, with increases in international travel, some cases have not been detected until the individual has returned from a location where the disease may be more prevalent. For example, Hillsborough County reported 33 cases of Zika, all of which were individuals who had traveled to the county from areas where the virus was circulating readily. Case numbers decreased to 7 in 2017, with no cases reported from 2018 to 2023. While no reported Zika virus cases were being transmitted locally in Hillsborough County, one locally acquired case was confirmed in Pinellas County.[377] Due to the disease being sexually transmitted or spread through mosquito vectors, the state and local response focused on mitigating further risk by closely monitoring the disease, taking measures to reduce mosquito populations in the county, and educating the local population about symptoms, precautions, and the health risks associated with the disease to prevent this disease becoming endemic to the region.

---

[375] CBS News. (2004, Feb 6). Ricin Letters Still a Mystery. https://www.cbsnews.com/news/ricin-letters-still-a-mystery/

[376] Brooks, M. and Bash, D. (2013). Envelope tests positive for ricin at Washington mail facility. https://www.cnn.com/2013/04/16/us/tainted-letter-intercepted

[377] FDOH. (2019, June 30). Reportable Diseases Frequency Report. *FL Health Charts*. www.flhealthcharts.com/ChartsReports/rdPage.aspx?rdReport=FrequencyMerlin.Frequency&FirstTime=True

Social and Population Impacts from Disease Outbreaks and Biologic Incidents

Certain populations may be more susceptible to the adverse effects of disease outbreaks and are considered to be at higher risk of many disease outbreaks. Examples include young children, pregnant women, senior adults, and immune-suppressed individuals (e.g., patients undergoing chemotherapy and organ transplants). For example, immune-suppressed persons already have a weakened immune system, which leads to an increased risk of serious flu complications as they are less likely to fight off an infection. Very old or young people may be less tolerant of nutrition and hydration losses from vomiting or diarrhea.

Social vulnerability refers to the capacity of a community to respond to an impact as well as an intrinsic lack of capability of individuals to cope with external stressors – how well does an individual or group of individuals anticipate, cope with, resist, and recover from the impact of a hazard?[378] For example, a low-income resident may be more vulnerable to disease based on indicators (such as low socioeconomic status, insufficient transportation, and lack of social capital).

To better serve and target the more vulnerable population, the Climate and Economic Justice Screening Tool helps planners identify disadvantaged communities that will benefit from programs included in the Justice40 Initiative.[379] These Justice40 Disadvantaged Communities thresholds can be an indicator of where some of these more vulnerable populations will live in Hillsborough County. For example, a community that has a high population with health issues contributes to a community being considered disadvantaged. Ninety-four percent of disadvantaged communities in Hillsborough County are within the City of Tampa and Unincorporated Hillsborough County, with the City of Plant City and the City of Temple Terrace accounting for the remaining 6%, shown in Table 5.171.

Table 5.171. Breakdown of disadvantaged communities

Jurisdiction	# of Disadvantaged Communities
Hillsborough County (Unincorporated)	69
City of Plant City	6
City of Tampa	54
City of Temple Terrace	2
Hillsborough County (Total)	**131**

[378] Mah, J.C., Penwarden, J.L., Pott, H. et al. Social vulnerability indices: a scoping review. BMC Public Health 23, 1253 (2023). https://doi.org/10.1186/s12889-023-16097-6 Retrieved from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-16097-6#citeas

[379] Climate and Economic Justice Screening Tool: About. (2022, Nov. 2). https://screeningtool.geoplatform.gov/en/about#3/33.47/-97.5

Table 5.172 summarizes vulnerable populations that may increase the severity of disease outbreaks. Understanding demographics and social factors with greater vulnerability allows planners to identify strategies to mitigate risk.

Table 5.172. Vulnerable Populations to Disease Outbreaks and Biological Threats[380]

Vulnerability	Population Statistics[381]		Reason for Concern
	No. (x1000)	Percent (%)	
Elderly (Age 65+)	231.3	15.1	Lowered immunity, Concurrent disease conditions that may complicate treatment/recovery
Young (< 5 years)	92.1	5.7	Lowered immunity, More susceptible to metabolic stress
HIV/AIDS Incidence (2018)	0.5	<1	Lowered immunity, Concurrent disease conditions that may complicate treatment/recovery
Viral Hepatitis Incidence (2018)	1.8	<1	Lowered immunity; Increased risk of septicemia or other complications
Persons Living below Poverty	197.4	13.7[382]	Lower financial flexibility to handle medical costs; Lower access to healthcare
Unemployment[383]	248.6	3.0	Lower financial flexibility to handle medical costs; Lower access to healthcare
Persons without Health Insurance[384]	210.3	13.7	Lower financial flexibility to handle medical costs; Lower access to healthcare
Foreign-Born Persons	287.1	18.7	Different disease and environmental exposures; Vaccination status may be incomplete or unknown; Lower familiarity with systems and infrastructure
Non-English-Speaking	409.5	28.5	Limits ability to communicate with

380 FDOH. (2019, June 30). FL Health Charts. Florida Department of Health Division of Public Health Statistics & Performance Management. http://www.flhealthcharts.com /charts/default.aspx

381 Census. (2023). QuickFacts. https://www.census.gov/quickfacts/fact/table/hillsboroughcountyflorida/AGE135222#AGE135222

382 https://www.flhealthcharts.gov/ChartsDashboards/rdPage.aspx?rdReport=NonVitalInd.Dataviewer&cid=0294

383 Stacker. (2024, Feb). Here's how unemployment in Hillsborough County, Florida, compares. https://stacker.com/florida/hillsborough-county-fl/heres-how-unemployment-hillsborough-county-florida-compares

384 Clavery, D. (2017, May 09). Population without Health Insurance by State and County, 2011-2015 (Map). Https://www.arcgis.com/home/item.html?Id=aa71c1ac3ccd46f08304ac57517d0e95

Vulnerability	Population Statistics[381]		Reason for Concern
	No. (x1000)	Percent (%)	
Persons			English-only persons
Notes: This table presents examples of demographics and social factors with greater vulnerability and the reasons for concern for disease outbreaks.[385]			

Tourism and International Trade

Hillsborough County has a large transient population coming from the national and international communities who visit not only the City of Tampa but also pass through the county on their way to beach destinations in Pinellas County or on their way to various other destinations in Central and South Florida. Investments in the County's marketing campaign during the pandemic brought in an estimated 472,000 visitors to Hillsborough through the first nine months of the 2021 fiscal year.[386] International flights to and from Tampa International Airport Canada, Bahamas, Cuba, Puerto Rico, Mexico, and the United Kingdom. In June 2023, the airport had 966,070 passengers fly in or out of its port in June 2023, representing an increase of 13.04% when compared to June 2022 (854,601).[387]

Hospitals and Clinics

Access to medical care is an important factor in the response and recovery of the community from disease outbreaks. Hillsborough County's social healthcare network includes 19 hospitals (Bed Capacity 4,593) and 28 family care and general health clinics.[388] Additional private medical clinics, urgent care centers, and non-profit/non-governmental health care organizations also exist. Given that most disease cases are asymptomatic or only require outpatient care, the physical volume of care slots is likely adequate for smaller outbreaks (less than 5,000). Outbreaks that become widespread affecting thousands to tens of thousands or more would overwhelm medical capacity and constitute a mass casualty event. In 2018, the annual county-wide full-scale exercise was postponed due to the lowered operational capacity of some hospitals, which was related to a high number of flu-related hospitalizations, affecting preparedness measures already underway for the county's hospital systems response. During the peak of the coronavirus pandemic, COVID-19

---

385 FDOH. (2019, June 30). FL Health Charts. Florida Department of Health Division of Public Health Statistics & Performance Management. http://www.flhealthcharts.com /charts/default.aspx

386 Bowen, C.T. (2021, Aug 12). Hillsborough tourism numbers outpace the record year of 2019. https://www.tampabay.com/news/business/2021/08/12/hillsborough-tourism-numbers-outpace-record-year-of-2019/#:~:text=The%20marketing%20campaign%2C%20emphasizing%20open%20spaces%2C%20safe%20vacation,nine%20months%20of%20the%20fiscal%20year%2C%20Corrada%20said.

387 Tampa Airport (TPA) Airport Statistics. Retrieved April 3, 2024. https://www.americanairportguide.com/tpa/airport-statistics.htm#:~:text=10%2C517%2C678%20passengers%20flew%20in%20or%20out%20of%20Tampa,increase%20of%2019.52%25%20when%20compared%20to%202021%20%288%2C800%2C090%29.

388 Hillsborough County Social Services. (2019). Find Hospitals, Clinics, & Dental Providers. www.hillsborough county.org/en/residents/social-services/health-care-plan/find-hospitals-clinics-and-dental-providers

patients occupied an estimated 44% of Florida's ICU beds, with inpatient beds accounting for 83% occupancy -- straining capacity on the healthcare system.[389] Hospitals could not process new patients quickly enough to keep pace with the surge of their arrival, leading to a cascading effect of ambulances waiting outside for admission rather than answering and responding to new calls.[390]

Psychological Distress during a Disease Outbreak

Individual behavioral changes, such as fear-induced aversion to workplaces and other public gathering places, are a primary cause of negative shocks to economic growth during a large-scale disease outbreak. Furthermore, some disease outbreak mitigation measures can cause significant social and economic disruption, while political stresses and tensions at the local, state, and national levels can increase. In these contexts, outbreak response measures such as quarantines have sparked violence and tension between government entities and citizens.

Vulnerability Analysis and Loss Estimation by Jurisdiction

There is no additional vulnerability analysis that can be conducted for disease outbreaks and biologic incidents.

Vulnerability Analysis and Loss Estimation of Critical Facilities

Critical facilities are not vulnerable to disease outbreaks and biologic incidents. That being said, hospitals and medical facilities will see increased capacity needs due to this hazard.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.0 (

---

[389] Jones, Dustin. (2021, Aug 8). Florida Hospitals Are Filling Up As COVID-19 Cases Hit An All-Time High. https://www.npr.org/sections/coronavirus-live-updates/2021/08/08/1025964502/florida-hospitals-covid-19-cases-record-high

[390] Kennedy, Kelli and Licon, G., Adriana. (2021, Aug 21) Ambulances Wait Outside Florida Hospitals as COVID Infections Spread. https://www.nbcmiami.com/news/local/ambulances-wait-outside-florida-hospitals-as-covid-infections-spread/2526027/

Table 5.173).

Table 5.173. Overall Vulnerability to Disease Outbreak and Biological Incident for Hillsborough County

<table>
<tr><th colspan="5">DISEASE OUTBREAK AND BIOLOGICAL INCIDENT</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Biological incidents are incidents involving bacteria, viruses, or toxins that can all be harmful or deadly to humans and animals. These various actors are called biological agents. It is important to note that these agents can be naturally occurring disease outbreaks or intentionally dispersed. The act of intentionally dispersing these biological agents into a society to harm people or animals is referred to as bioterrorism. As a major population center made up of diverse national and international people, a center for tourism, and the location of a major seaport, Hillsborough is at increased risk for disease outbreaks compared to some other areas of the state.</td><td colspan="2">HIGH</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Critical</td><td>Large</td><td>> 24 hrs</td><td>Moderately Concerned</td><td>< 1 week</td><td>3.0</td></tr>
</table>

4.16 Cyberterrorism Hazard Profile

Cyberterrorism Description

Cyber incidents are becoming more common and more costly in our society. Because of this, cyber incidents were profiled as a hazard to the state of Florida and Hillsborough County, beginning with its 2020 Local Mitigation Strategy update. The word **cyber** refers to anything that contains, is connected to, or is controlled by computers and computer networks. **Cyber-technology** refers to the computers and computer networks and the information and services we rely upon. Critical infrastructure includes systems such as energy and transportation networks, safety and security facilities, health and medical facilities, and communications facilities. All these vital community lifelines rely on computers and the Internet. Thus, a **cyber incident** refers to an incident involving computers, networks, and information or services that affect the daily operations of critical infrastructure, especially when done to intimidate or coerce a government or its people in furtherance of political or social objectives.[391]

Unlike more physical hazards such as flood, a cyber incident usually has a lack of physical presence or evidence, which can make it difficult for Hillsborough County to identify the scope of, respond to, recover from, and mitigate against. Further, the scope of a cyber incident will likely cross municipal, or even state and national, jurisdictions—directly linking the prevention of cyber incidents to national defense.

Cybersecurity and Data Breaches

According to DHS's National Infrastructure Protection Plan (NIPP), **cybersecurity** is defined as the "Prevention of damage to, unauthorized use of, or exploitation of, and if needed, the restoration of electronic information and communication systems and the information contained therein to ensure confidentiality, integrity, and availability; including protection, restoration, when needed, of information networks and wireline, wireless, satellite, public safety answering points, and 911 communications systems and control systems."[392]

A **cybersecurity incident,** then, refers to a data breach, which is when a person's name plus another record (i.e., financial, medical, credit card) is put at risk.

Data breaches and cyber incidents can be the result of a malicious attack, an unintentional system glitch, or human error. Regardless of origin, the average cost of a data breach to an organization in the United States was $9.48 million in 2023.[393]

Responding to a Cyber Incident

The process of ensuring that an agency has developed, tested, and validated its capability to protect against, prevent, mitigate, respond to, and recover from a significant cyber incident is known as

---

[391] Weimann, Gabriel. *Cyberterrorism: How Real Is the Threat?* United States Institute of Peace, 2014.
[392] Department of Homeland Security. National Infrastructure Protection Plan.
[393]https://www.morganlewis.com/blogs/sourcingatmorganlewis/2024/03/study-finds-average-cost-of-data-breaches-continued-to-rise-in-2023#:~:text=For%20the%2013th%20year%20in,a%20breach%20was%20%249.44%20million.

cyber preparedness.[394] Though a cyber incident is different than traditional hazards, all phases of emergency management are still applicable. For instance, the phases of Mitigation, Prevention, and Preparedness occur before a cyber incident when stakeholders implement policies and increase awareness. When a cyber incident has occurred, stakeholders engage in the Response phase, identifying the scope of the incident and attempting to stop it. The Recovery phase, and sometimes the Mitigation phase, occurs after the cyber incident and involves restoring networks, replacing damaged equipment, and eliminating vulnerabilities that allowed the breach.[8]

Cyberattacks

Cyberattacks are cyber incidents with malicious intent to steal proprietary, personal, or financial information. Human error poses the most significant risk for exposure to cyberattacks, and any computer system that is accessible from the Internet is a potential target. When cyberattacks are carried out by other nation-states, these incidents are known as **cyber warfare** or **cyber espionage**.

There are three levels of cyberattacks: unstructured, structured, and highly structured.

- **Unstructured attacks** have little to no organization and no significant funding. These are usually carried out by amateurs who use pre-made tools to take advantage of well-known flaws. These pre-made tools are easily downloadable from the Internet. These attacks are the most common type of threat, but they are also easily spotted by network security.
- **Structured attacks** involve more organization and planning, with specific targets and an intention to disrupt the operations of a specific organization or sector. These attacks have substantial financial backing and are conducted over long periods of time to avoid detection. Potential perpetrators include insider threats, such as a disgruntled employee; industrial competitors, such as rivals stealing company secrets; organized crime groups, such as drug traffickers; hacktivists motivated by a specific cause, such as the hacktivist group named Anonymous; or blackmail and ransom hackers, using extortion to receive money.
- **Highly structured attacks** involve extensive organization, planning, and funding. Attackers conduct reconnaissance and can use multiple attacks to achieve their goal, including physical attacks. Possible attackers conducting highly structured attacks include ideological groups, cyber terrorists, and nation-states.

Malware

Malware is malicious software that can infect a computer or network and cause harm by destroying data, damaging networks, or stealing information. Attackers can introduce malware to a computer or network using methods such as removable media, phishing, and drive-by downloads and tools, for example, a virus, worm, trojan, or adware.

- A **virus** spreads malicious code by copying itself and infecting host computers through downloads, email attachments, or removable media. The virus then corrupts or deletes data on your computer or erases the hard drive.
- A **worm** is a malicious computer program that replicates itself to spread to other computers. It relies on security failures and utilizes the computer network to spread itself. Worms can

[394] https://apps.dtic.mil/sti/trecms/pdf/AD1108414.pdf

cause harm to the network, consume bandwidth, install backdoors (for access later), and allow the creation of botnets.

- A **trojan** is a malicious program that is disguised as legitimate software. It looks useful to an unsuspecting user but is harmful when executed. After installation, the trojan waits silently on the infected machine and invisibly carries out its misdeeds with remote administration capabilities. Trojans can control the mouse and keyboard, format drives, log keystrokes, play sounds, record sound and video, and use the Internet connection to perform attacks.

Methods

Attackers use several methods to complete their goals, including social engineering, botnets, denial-of-service attacks, zero-day exploits, web-based attacks, malicious insider attacks, and unintentional actions or errors.

- **Social engineering** involves manipulating legitimate users and convincing them to perform actions or give confidential information using email, phone, in-person encounters, dumpster diving, or insider threats.
- **Phishing**, the most common type of social engineering, is when an attacker sends an email that appears to originate from a legitimate source, such as a bank, advising that verification of account information is needed immediately to prevent serious consequences. The email usually contains a link to a fraudulent website with a form for customers to enter their information. Spear phishing is when an attacker sends a phishing email to a specific organization or person. Whaling is when attackers attempt to spear phish a high-priority target, such as a CEO.
- **Denial-of-service attacks** are when an attacker prevents legitimate users from accessing information or services of a computer system or network by overwhelming the system with more traffic than it can handle. A computer server can only process a certain number of access requests at one time. When too many access requests are made, the server can become overloaded and will not work. A denial-of-service attack occurs when an attacker overwhelms a server with false requests so that the server cannot process legitimate requests. A distributed denial-of-service attack occurs when attackers use multiple computers and multiple Internet connections to conduct the attack. Attackers sometimes use botnets (see below) to carry out distributed denial-of-service attacks. These types of attacks can be used against a wide variety of targets, from retail websites to nation-states.
- **Botnets** are robot networks of malware-infected computers ("bots") used to conduct malicious activities. A botnet is created when one bot infects several computers and then networks them together. Botnets can be used for denial-of-service attacks, malware distribution, and covert intelligence gathering. Owners of computers that are part of a botnet often have no idea their computer has been compromised. A botnet can include thousands or millions of bots and may remain quietly operational for years. This method is successful because it distributes the activities to several computers, making it more difficult to track and block.
- A **zero-day exploit** is an attack that takes advantage of a security risk on the same day that the risk becomes known to the public. Because there is no known solution to the risk yet,

attackers can conduct attacks without being stopped. These exploits can be purchased from those who find these security risks and choose not to report them to the company but rather sell the information to would-be attackers. Attacks such as these have been used to target programs like Microsoft Word, PowerPoint, Excel, Adobe, and Flash Player.[395]

- **Web-based attacks** involve websites redirecting the browser to a malicious website where malicious software automatically downloads to the computer. These attacks are known as drive-by downloads and involve malicious code downloading in the background of a computer just from visiting a certain site without clicking on anything. These attacks require no action from the target, and they often have no idea their computer has been infected.
- **Malicious insiders** are people who leverage their special advantage, access, influence, or proprietary knowledge of a network or system to conduct a cyberattack with malicious intent. These malicious insiders could be current or former employees or even contractors or vendors.

Humans are the weakest link in cybersecurity. Unintentional actions or errors can provide an opportunity for attackers to steal information and gain unauthorized access. For example, unintentional acts or failures directly compromise the security of a computer network or a resource dependent on the network. This includes not properly updating software or a network and the failure to remove or change system permissions after personnel changes.

Vulnerabilities

As society becomes increasingly reliant upon cyber-technology and the Internet, new vulnerabilities are developing at the personal, local, and national scale. A cyber attacker can steal an individual's identity, take a local 911 system offline for an extended period, cause a multi-state power outage, or hack a large national company (such as Yahoo or Target breaches).

The critical infrastructure of local, state, and national governments, including Hillsborough County, relies upon cyber technology and the Internet to serve constituents and is thus vulnerable to cyber incidents. Even systems that are not as reliant on cyber technology are often interconnected with systems that are, and a cyberattack can have cascading impacts across sectors within and between scales of critical infrastructure.

As it seeks to mitigate this cyberterrorism hazard, Hillsborough County must consider this interconnection, but it must also face challenges with jurisdiction.

- Not all critical infrastructure sectors are controlled by government entities: privately owned companies, like a private energy company, financial institution, or hospital are essential to the functioning of our society but can have differing priorities from those of the government. For example, while the government is concerned with protecting all critical infrastructure from cyberattacks, these privately owned organizations may be more concerned with profits or public reputation.

---

[395] IBM. "What Is a Zero-Day Exploit? | IBM." www.ibm.com/topics/zero-day.

- The interconnectivity of sectors expands the scope from one geographical area to large regional areas that are likely to cross political jurisdictions, making planning more complicated.

Mitigation planning must also consider that the core priorities of cyberinfrastructure are efficiency and access—not security. As cyber-technology and Internet capabilities grow and expand, this alignment of priorities is exposing new vulnerabilities. For example, many critical infrastructure systems are controlled remotely using systems called Supervisory Control and Data Acquisition (SCADA) or Distributed Control Systems (DCS). These systems are used to manipulate functions and services of systems remotely, so people do not have to deploy to sites in the field where equipment is located but can instead alter systems, like adjusting pressure or flow, from their offices. Many of these devices and their connection to the internet are not secure and are extremely vulnerable to cyberattacks.

The explosive growth of internet-connected devices, any of which could be connected to those within Hillsborough County's cyber ecosystem, makes this vulnerability to cyberattacks even more jarring. Between 2012 and 2014, a search engine built to find internet-connected devices – known as SHODAN -- conducted a research project, Project SHINE, to find insecure SCADA and DCS systems and increase awareness of their vulnerability. After two years of research, the project identified hundreds of thousands of vulnerable devices and systems and concluded its work with the understanding that their research could not keep up with the hundreds—sometimes thousands—of devices that were being added every day. Project SHINE's final report concluded that critical infrastructure and cyber security professionals must not continue to use "compliance-based security" but focus on an "attitude of safety, vigilance, and performance awareness."[396]

Cybersecurity and Cyber Preparedness

Policies and procedures need to be adopted by all critical infrastructure sectors using Internet-connected devices. Actors at the national and state levels have enacted policies, made recommendations, and created institutions to strengthen cyber security at all levels of critical infrastructure.

At the federal level, directives and programs seek to address the preparation for and response to cyberattacks:

- Presidential Policy Directive 8 aims to strengthen the security and resilience of the US through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyberattacks, pandemics, and catastrophic natural disasters
- Presidential Policy Directive 41 gives principles for the federal government's response to any cyber incident. It also recognizes that cyber incidents are occurring more frequently and that responding to cyber incidents that pose a significant threat requires deliberative planning, coordination, and exercising of the response plan.

---

[396] ttps://scadahacker.com/library/Documents/ICS_Vulnerabilities/Infracritical%20-%20Project%20SHINE%20Findings%20Report%20-%20Oct%202014.pdf

- The National Cyber Incident Response Plan, published in December 2016 after the issuance of PPD 41, details the response activities and responsibilities of federal agencies during a significant cyber incident.
- The National Institute of Standards and Technology (NIST) has developed the Cybersecurity Framework, which is designed to work with existing business processes and to improve existing cybersecurity efforts through the implementation of standards, guidelines, and practices for organizations to adopt. The framework aligns with typical phases of emergency management.
- The US Computer Emergency Response Team (US-CERT) was created in the early 2000s in response to cyber breaches in the federal government. The team responds to cyber incidents, analyzes data about emerging cyber threats, and provides cybersecurity protection to Federal civilian executive branch agencies through intrusion detection and prevention capabilities. US-CERT also collaborates with foreign governments and international entities to enhance the nation's cybersecurity posture. US-CERT also has a scoring system to determine risk and priority in a national context, which can be viewed online.
- The Federal Bureau of Investigation's (FBI) Cyber Crime Division investigates cyberattacks by criminals, overseas adversaries, and terrorists—their work has demonstrated that cyber intrusions on national critical infrastructure are becoming more common and dangerous. The FBI also has the Internet Crime Complaint Center to report cyber-crimes and the Cyber Action Team, which provides rapid incident response for major computer intrusions and other cyber-related emergencies.
- InfraGard is a partnership between the FBI and private sector organizations dedicated to sharing information and intelligence in order to prevent hostile acts against the US. Florida has several chapters, including Jacksonville, Orlando, South Florida, Tallahassee, and Tampa Bay.
- Agencies and organizations seeking to develop a cyber security program can work with the Department of Homeland Security Cyber Infrastructure Security Agency (CISA) to access information and cyber smart resources.

Individuals can report identity theft to the **Federal Trade Commission.**

At the state level, Florida has deployed several cybersecurity initiatives:

- The Florida Computer Crime Center (FC3) conducts cyber investigations, training, research, and prevention.
- The FC3 also developed the Florida Infrastructure Protection Center (FIPC) to anticipate, prevent, react to, and recover from acts of terrorism, sabotage, and cybercrime. All FDLE regions have sworn agents that conduct high-tech investigations into computer crimes. Additionally, FDLE has strong cyber intelligence efforts within the Cyber Intelligence Unit, and the Domestic Security Critical Infrastructure Unit is expanding as well. There are three components to the FIPC:
    - The "Secure Florida" Education and Awareness campaign conducts business and consumer education awareness and efforts.
    - The Central Analysis and Warning Point monitors and analyzes cyber incident information.

- The Computer Incident Response Team (CIRT) is an on-call service that deploys specialized teams to respond to critical cyber incidents in Florida. Teams like the Regional Network Intrusion Unit or the Cyber Crime Unit will be deployed for smaller-scale incidents– for example, an individual cyber-attack—to investigate a criminal case. Larger-scale cyber incidents, such as those that affect several organizations and systems within Florida's critical infrastructure system, are investigated by the Domestic Security Working Group, which is composed of several agencies, including AST, the FBI, the Florida National Guard, Florida Division of Emergency Management, and other stakeholders.
- Finally, the Florida Division of Emergency Management has a Cyber Incident Plan that details policies and procedures in the event of a cyber incident within the Division.

Geographic Areas Affected by Cyberterrorism

Because cyber incidents occur in "cyberspace," there are not typically geographic areas affected by cyber incidents. However, cyber incidents may cause physical disruptions in critical infrastructure, which could affect any jurisdiction, such as a power grid. It is important to note that power grids are vast, sometimes crossing state lines, meaning that a cyber incident at one facility at one location could cause disruptions at other locations hundreds of miles away.

All jurisdictions within Hillsborough County may be affected by cyberterrorism.

Historical Occurrences of Cyberterrorism

There have been several cyberterrorism incidences in and around Hillsborough County in recent years. In July of 2023, a cyberattack on Tampa General Hospital compromised the data of 1.2 million people.[397] In September of 2023, Hillsborough County Public Schools experienced a security breach. Luckily, no student data was accessed via this breach. [398]

Probability of Future Cyberterrorism

The probability of cyber incidents occurring increases every day. The Ponemon Institute estimates that the chances of experiencing a data breach are as high as 1 in 4.[399]

In Hillsborough County, hospitals, local jurisdictions, and federal and state agencies are more likely targets for a cyberattack. In 2015, the government was among the top five most cyberattacked industries, and that is expected to remain so in the future. However, in 2022, manufacturing saw the highest share of cyberattacks among the leading industries worldwide.

If Hillsborough County's agencies and organizations are future targets of a cyber-attack, the impacts could be costly; the U.S. healthcare sector experienced $7.8 billion in losses due to ransomware

[397] Data breach in Tampa Bay may be linked to Russian gang; over 1 million impacted | WFLA
[398] Investigation underway into cybersecurity breach at Hillsborough County schools (fox13news.com)
[399] The Likelihood of a Cyber Attack Compared (varonis.com)

attacks in the U.S.[400] It is estimated that cyber-attacks will cost $10.5 billion annually by 2025 in the US. [401, 402]

As society becomes increasingly reliant on technology for financial, health, and government services, the risk of a cyberattack increases. The World Economic Forum ranked cyberattacks as a top 3 risk to global stability in their 2024 Global Risk Report.[403] Outcomes of reduced stability, for example, political tension and economic issues, could, in turn, also motivate cybercriminals to conduct a cyberattack.

The probability of a future occurrence of cyberterrorism is estimated to be around 25% likelihood, based on the Ponemon Institute estimates mentioned above. This is classified as a probability of likely (10-100% annual probability).

Cyberterrorism Impact Analysis

A partial list of potential impacts of cyberterrorism is presented below:

- Public
    - release of sensitive information, including bank accounts and social security numbers
    - Financial loss
        - Possible loss of wages if the organization is forced to close
- Responders
    - Long hours outside of regular work hours to stop and/or remediate attack
    - First responders may not be able to respond properly if a cyberattack targets emergency or public safety systems
- Property, Infrastructure, Facilities
    - Incident could lead to damage of equipment for infrastructure
    - The organization may lose revenue and may have significant costs for remediation, legal fees, and public relations
    - The organization may lose customer confidence or may sustain damage to its reputation or its market share
- Continuity of Operations (including continued delivery of services)
    - Incident could take operations offline for any amount of time and/or make information inaccessible or distribute false information
    - Interrupt public safety or other critical services
    - Loss of productivity
    - Loss of critical systems or data
    - May disable emergency or public safety systems
- Environment
    - An incident could cause a release of some material, which could damage the environment

---

[400] The Devastating Business Impacts of a Cyber Breach (hbr.org)

[402] Cybercrime To Cost The World $10.5 Trillion Annually By 2025 (cybersecurityventures.com)
[403] https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2024.pdf

- Economic Condition
  - Incidents cost millions of dollars to consumers and organizations in the form of lost wages, lost revenue, and recovery and remediation costs
- Public Confidence in Each Jurisdiction's Governance
  - Lost confidence in the ability to keep services operational and safe
  - Private organization – loss of public or consumer confidence in an organization, leading to loss of market share and possibly loss of future sales

Vulnerability Analysis and Loss Estimation by Jurisdiction

Without having access to each jurisdiction's Cyber Incident Plan and the ability to analyze that plan, it is impossible to determine the vulnerability of a jurisdiction. However, it is reasonable to assume that Hillsborough County and its municipalities will continue to be vulnerable to cyber incidents. Any jurisdiction that utilizes computers and the Internet for major utilities, transportation routes, or data storage is vulnerable to a cyber incident.

Vulnerability Analysis and Loss Estimation of Critical Facilities

It is reasonable to assume that most jurisdictions will continue to be vulnerable to cyber incidents. Any department that utilizes computers and the Internet is vulnerable to a cyber incident.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 3.0 (

Table 5.174).

Table 5.174. Overall Vulnerability to Civil Disturbance for Hillsborough County

<table>
<tr><th colspan="5">CYBERTERRORISM</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Cyber incidents are described as involving computers, networks, information, or services that affect the daily operations of critical infrastructure. These hazards lack a physical presence as well as physical evidence, making them unlike traditional hazards and, therefore, difficult to plan for, respond to, and recover from.</td><td colspan="2">High</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Limited</td><td>Moderate</td><td>< 6 hrs</td><td>Very Concerned</td><td>< 1 week</td><td>3.0</td></tr>
</table>

4.17 Infrastructure Disruption Hazard Profile

Infrastructure Disruption Description

Infrastructure encompasses all essential systems and facilities that allow the smooth flow of an economy's day-to-day activities and enhance the community's quality of life. Infrastructure can be classified into three categories: hard, soft, and critical.

Hard infrastructure comprises all the physical systems crucial to running a modern, industrialized economy. It includes transportation systems such as roads and highways and telecommunication services such as telephone lines and broadband systems.

Soft infrastructure refers to all the institutions that help maintain a healthy economy. These usually require extensive human capital and are service-oriented toward the population. Soft infrastructure includes all educational, health, finance, law and order, governmental systems (such as social security), and other institutions that are considered crucial to the well-being of an economy.

Critical infrastructure makes up all the assets the government defines as being vital to the functioning of an economy. It includes assets used for shelter and heating, telecommunication, public health, agricultural facilities, etc. Examples of such assets are natural gas, drinking water, and medicine.

A disruption in a community's system can impact the flow of the different systems or infrastructure on which the community depends. The disruption's duration can be hours, days, weeks, or sometimes months, depending on what has impacted the infrastructure. Disruption in hard infrastructure, such as utility, water, transport, and telecommunications, was determined to be the focus of this section and is discussed below.

Utility/Power Outage

A failure in the power distribution network can happen for varying reasons. Some examples include the physical failure of power lines due to hazards such as wind or lightning, as well as problems within the network itself, including faults at a power station, shorts or overloading in a circuit(s), or physical damages at a substation.

There are different types of power outages: transient faults, brownouts, blackouts, and rolling blackouts. A transient fault is a brief outage caused by a fault in a power line. The issue is corrected when the power flow clears the faulty part of the circuit, and the power is returned. A brownout occurs when the voltage falls to an inadequate level. A blackout occurs when there is a complete loss in the power supply. Blackouts are generally longer-lasting outages than the previous two examples and may involve significant repairs. Rolling blackouts are planned power outages that occur when the demand for electricity exceeds the supply. These outages can range from minutes to weeks or more, depending on the significance of the failure in the network.

Water Infrastructure Disruption

Water infrastructure is a general term for water supply, treatment, storage, water resource management, flood prevention, and hydropower systems.[404] A disruption in the water infrastructure can be a very impactful event for a city, county, or jurisdiction. Depending on the duration and extent of the disruption and what water system is affected will also impact the community. Disruption of the water infrastructure can be attributed to a natural disaster, such as a hurricane or a power outage. For example, a disruption in the sanitary sewer system can result in hazardous environments that expose the built environment to waste products. The supply of water can affect critical infrastructures, such as a hospital, which depends on water supply for clinical needs and operational functions such as instrument sterilization, food preparation, and environmental services (ES); a loss of water also could damage or render inoperable crucial medical and infrastructure equipment.[405]

Telecommunication Disruption

The widespread failure or disruption of communications systems is uncommon. In most cases, backup systems are in place to keep communication lines operational. Extreme situations or the presence of several significant hazards would be necessary for an incident that would affect multiple communications systems. Communications infrastructure is designed to withstand high winds and other weather elements; however, failure is a possibility and must be planned for regardless of the lower probability. This kind of disruption can occur without a precipitating event and result in similar impacts on communication among response personnel.

Disruptions are more likely to occur than actual failures. Overloaded systems due to other hazards or disaster circumstances may cause temporary connectivity issues, especially in cell phone networks. The public, government, and business operations have become more reliant on cell phones for communicating. During large-scale events or emergencies when cell phone traffic is high, it can cause overload situations, and disruptions could result.

Transportation Disruption

Transportation disruption occurs when a significant delay, interruption, or stoppage in the network due to an event, such as a natural disaster, heightened threat level, an act of terrorism, or any transportation security incident.[406] Such disruptions in flow affect the following transportation networks: air transportation, maritime shipping, road networks, rail networks, logistical networks, and power grids.[407] Hillsborough County's transportation disruption has mainly been affected by

---

[404] https://simplicable.com/world/water-infrastructure

[405] https://www.hfmmagazine.com/articles/1475-how-to-plan-for-water-outages

[406] https://www.law.cornell.edu/definitions/uscode.php?height=800&def_id=6-USC-1207663097-852031257&term_occur=999&term_src=title:6:chapter:3:section:901#:~:text=The%20term%20%E2%80%9Ctransportation%20disruption%E2%80%9D%20means%20any%20significant%20delay%2C,in%20section%2070101%20%286%29%201%20of%20title%2046%29.

[407] https://transportgeography.org/contents/chapter9/transportation-and-disasters/

weather-related events and the pandemic in 2020, which impacted all infrastructure across the United States and globally.

Geographic Areas Affected by Infrastructure Disruption

Due to the unpredictable nature of where precisely an infrastructure disruption will occur, the county is considered equally susceptible to this hazard. However, in more urbanized areas, the effects of a disruption at a single location or facility would likely impact large numbers of people. Impacts for infrastructure disruption will have no significant difference within the county and the City of Tampa, Plant City, Temple Terrace, and Unincorporated Hillsborough County.

Historical Occurrences of Infrastructure Disruption

Most lengthy infrastructure disruptions have been due to tropical cyclones and severe storm events. Over the Christmas weekend of 1989, extremely cold weather caused extended power outages throughout the county. Table 5.175 lists known major occurrences of infrastructure disruption in the county between 1921 and 2023.

Table 5.175. Historical Occurrences of Infrastructure Disruption, 1920 - 2023

Date	Type of Infrastructure Disruption	Event	Information
Oct. 1921	Roads and power	Tarpon Springs Storm surge	A storm surge that peaked at 11 feet inundated areas along Tampa's Bayshore Boulevard and claimed the lives of eight people. In addition, $10 million was reported in damage as the region's citrus crop was lost and homes were destroyed.[408]
Dec. 1989	Power, roads, bridges, and interstates	Christmas Day Freeze of 1989, severe cold weather	From December 22-26, 1989, Florida experienced one of the most severe cold weather events in its history, with record-breaking temperatures, snow, ice, sleet, and hard freezes. The freezing temperatures claimed at least 26 lives, with power and transportation being shut down over much of Florida, with heavy losses in the agricultural industry.[409]
Feb. 2013	Water Treatment	Broken electric line	A squirrel bit a power line outside

[408] https://www.tampabay.com/hurricane/2021/10/17/100-years-later-tarpon-springs-hurricane-reminds-tampa-bay-it-can-happen-here/

[409] https://www.floridahealth.gov/environmental-health/climate-and-health/_documents/extreme-cold-factsheet.pdf

Date	Type of Infrastructure Disruption	Event	Information
	plant		the David L. Tippin Water Treatment Facility, prompting an unprecedented 48-hour citywide boil-water notice for 560,000 people and businesses.[410]
July, 2021	Power	Tropical Storm Elsa	Over 5,000 customers lost power overnight due to the tropical storm moving up the Florida Gulf coast.[411]
Sept. 2022	Communications, Power	Hurricane Ian	Nearly 508,549 outages reported [412]
Aug. 2023	Bridges, roadways, power	Hurricane Idalia	Hurricane Idalia's flooding resulted in the Sunshine Skyway Bridge closure - impacting connection to mainland Tampa Bay and closure of small bridges and main highways (State Rd 60 and US Rte 92).[413]

Probability of Future Infrastructure Disruption

There is no sure way to predict future infrastructure disruption, as most incidents occur without warning. Infrastructure disruption is most likely to occur during an extreme weather event.

This hazard was determined to have a probability of future occurrence on a wide scale in Hillsborough County of possible (1-10% annual probability) based on the low number of significant historical occurrences. That being said, as extreme weather continues to increase in frequency and intensity due to the impacts of climate change, the probability of the occurrence of infrastructure disruption will also continue to increase in probability.

Infrastructure Disruption Impact Analysis

The following is a list of potential impacts from widespread infrastructure disruptions:

- **Public**
    - Transportation tie-ups and accidents
    - Medical emergencies

---

410 https://www.tampabay.com/news/localgovernment/boil-water-notice-issued-for-all-tampa-water-customers/1276215/

411 https://www.tampabay.com/hurricane/2021/07/07/more-than-18000-without-power-in-tampa-bay/

412 https://www.tampabay.com/hurricane/2022/09/28/power-outages-reported-tampa-bay-area-hurricane-ian-arrives/

413 https://www.cnn.com/us/live-news/hurricane-idalia-path-florida-08-30-23/h_b3004abf7e020a50f88d78e42a0e431e

    - Communications disruptions
- **<u>Responders</u>**
    - Issues related to transportation, medical equipment, extreme weather temperatures, and communications issues
    - Increased call volume
    - Impact on notification processes and increased response times
- **<u>Continuity of Operations (including continued delivery of services)</u>**
    - Power outages and communications disruptions
- **<u>Property, Facilities, Infrastructure</u>**
    - Loss of food/refrigeration
    - Medical equipment failure
    - Grounded flights and suspended operations
    - Transportation infrastructure failure
    - Loss of communications
- **<u>Environment</u>**
    - Minimal
    - Some disruptions may cause spillover effects from cascading events such as fires or sewer backups
- **<u>Economic Condition</u>**
    - Shut down businesses
    - Significant financial impacts
    - Event/commercial activity disruption
- **<u>Public Confidence in Each Jurisdiction's Governance</u>**
    - Disruptions for extended periods give the appearance that the jurisdiction does not know how to restore infrastructure

Social and Population Impacts of Infrastructure Disruption

Social vulnerability refers to the capacity of a community to respond to an impact as well as an intrinsic lack of capability of individuals to cope with external stressors – how well does an individual or group of individuals anticipate, cope with, resist, and recover from the impact of a hazard.[414] Disruption to infrastructure could significantly affect the most vulnerable populations, communities that are identified as Justice40 disadvantaged communities, more than other communities in Hillsborough County. The Justice40 disadvantaged communities are communities that are disproportionately impacted by pollution, climate change, and environmental hazards. Communities are identified as at-risk based on census tracts that are overburdened and underserved. For example, a community in Hillsborough will be considered disadvantaged if it meets more than one burden threshold and the associated socioeconomic threshold; for example, if residents in the community earn income that is less than or equal to twice the federal poverty level

[414] Chang, Stephanie. (2016, Oct. 26). Socioeconomic Impacts of Infrastructure Disruptions. https://oxfordre.com/naturalhazardscience/display/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-66

and live within 5 km of hazardous waste facilities, it will be considered disadvantaged. If an infrastructure disruption occurs due to a power outage at a piece of critical infrastructure, such as one of the hazardous waste facilities in the county. A disadvantaged community is more likely to be vulnerable and exposed to whatever toxic concentrations are present based on their proximity. Lengthy power outages during the hottest months of the year can disproportionately impact socially vulnerable populations who may be elderly or without the means to temporarily relocate to cooling centers and other places with functioning power and air conditioning.

Justice40 disadvantaged communities are identified above in Figure X in Section X.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Exposure

Due to the nature and unpredictability of technological hazards, all property and infrastructure in the county are at risk of these events. While an infrastructure disruption event could happen anywhere in the county, in more urbanized areas, the effects of a disruption at a single location or facility would likely impact larger numbers of people.

Some issues that need to be considered during a power outage include transportation tie-ups and accidents, medical emergencies, and communications disruptions. The transportation problems would likely be related to traffic lights and signals not working or decreased night visibility. Medical emergencies could stem from homes not having power to operate heating and air conditioning systems, particularly during conditions of extreme temperatures. Also, medical equipment that relies on power (e.g., ventilators) could shut off, no longer providing a patient with the treatment they require. Communication issues could prevent the public from being able to call emergency services. Business disruptions could also impact services that the public wants or needs. Lastly, well pumps would not function without power unless they are powered by a backup generator.

Many residential structures do not have backup generators in place. If power fails, the residents of these homes may not be able to refrigerate their food, regulate medical equipment properly (such as oxygen), etc., until power is restored. Power outages can also sometimes lead to sparks that rarely ignite fires or damage other electric grid components, causing extensive damage. Other utility failures, such as sewer systems, may also cause damage when they go down. Shutdowns or damage to these systems can result in hazardous environments that expose the built environment to waste products.

In terms of transportation infrastructure, airports may have to ground flights and suspend operations as a result of a power outage until power can be restored. Extended outages may cause more significant impacts on flight patterns. Signals at railroad crossings may not work appropriately; in more severe cases, networks may be stopped until power is restored to prevent incidents.

Communications infrastructure may also be damaged or disrupted. Cellular telephone towers generally have backup power to function during power outages. However, cell phone reception may be impacted depending on the presence of other hazards or lengthy outages. Internet connections that originate from or are linked to energy sources in affected areas will likely see effects from a power outage.

Understanding population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Population change can influence communities' increased exposure and vulnerability to infrastructure disruption by placing more strain on infrastructure throughout the county. A growing population means more people will travel on the main roads, highways, and bridges, creating congestion during blue-sky, non-crisis periods. Moreover, the maintenance of such infrastructure may be lacking due to the allocation of funding.[415] For utilities like power, the electric grid would be strained due to the growing population's consumption of services, especially if growing numbers of Floridians switch to electric vehicles, as is being encouraged by the federal government.[416] Losses associated with infrastructure disturbances are not well documented since many are secondary impacts are difficult to measure. Disruptions of commerce are a major contributor to losses, for example.

Vulnerability Analysis and Loss Estimation of Critical Facilities

Infrastructure disruption can occur anywhere in Hillsborough County; therefore, all the county's critical facilities are equally vulnerable and at risk. The impact of infrastructure disruptions to structures, including critical facilities, is listed above under Exposure. Secondary hazard losses resulting from infrastructure disruption are not well documented and are challenging to measure within the scope of an LMS.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 2.7 (

Table 5.176).

[415] https://transportgeography.org/contents/chapter9/transportation-and-disasters/
[416] https://www.thecentersquare.com/florida/article_c7802708-16af-11ee-a570-dfdecf805d77.html

Table 5.176. Overall Vulnerability to Infrastructure Disruption for Hillsborough County

INFRASTRUCTURE DISRUPTION						Overall Vulnerability
Overview						
Infrastructure disruption can be divided into four types of events: utility outages, power outages, sanitary sewer disruption, and communication disruption.						MODERATE
Probability	Impact	Spatial Extent	Warning Time	Public Sentiment	Duration	PRI Score
Possible	Limited	Moderate	< 6 hrs	Very Concerned	< 1 week	2.7

4.18 HazMat Incident Hazard Profile

Hazardous Materials Incident Description

A hazardous material is any substance that poses a threat to humans, animals, or the environment. Hazardous materials, commonly called HazMat, generally refer to hazardous substances, petroleum, natural gas, synthetic gas, and acutely toxic chemicals. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the EPA, OSHA, DOT, and the Nuclear Regulatory Commission (NRC).

The Occupational Safety and Health Administration (OSHA) further explains that HazMat is any substance or chemical that is a health hazard or physical hazard, including:

- chemicals which are carcinogens, toxic agents, irritants, corrosives, or sensitizers;
- agents which act on the hematopoietic system;
- agents which damage the lungs, skin, eyes, or mucus membranes;
- chemicals that are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive or water-reactive; and
- chemicals which, in the course of normal handling, usage, or storage, may produce or release dusts, gases, fumes, vapors, mists, or smoke that may have any of the previously mentioned characteristics.

Hazardous materials typically fall into one of three categories: biological hazards, chemical hazards, or radiological hazards. All these hazardous materials have both short-term and long-term effects based on the timing of detection and the response time to mitigate the effects of the hazard.[417]

Biological Hazards

Biological hazards are materials or incidents that involve exposure to a biological or living agent that causes harm. These agents include microorganisms, viruses, and any toxins originating from biological sources. Examples of biological hazards include anthrax, bloodborne pathogens, molds, Ebola, smallpox, and any medical waste that comes into contact with such microorganisms or viruses. Biological hazards are extremely contagious and pose a threat to any populations that are exposed. For more information on biological hazards, please refer to the *Disease Outbreak and Biologic Incident Hazard Profile*.

Chemical Hazards

Chemical hazards are hazards or incidents that involve exposure to chemicals that cause harm. Chemical HazMats include neurotoxins, immune agents, dermatologic agents, carcinogens, and other toxins. Chemical hazards can be introduced to populations through ingestion, inhalation, or physical contact. Chemicals enter the body through the eyes, skin, lungs, and digestive tract. Once in the body, the effect depends on the dosage and toxicity. The type of chemical, how it entered the body, and the susceptibility of the individual all affect the outcome of exposure. Once exposed to chemical substances, there can be acute (immediate) or chronic (long-term) health issues in the

---

[417] https://www.fda.gov/media/99558/download

community. The effects of chemical hazards on an exposed population are not limited to the development of lesions and burns on the skin and respiratory issues.

Radiological Hazards

Radiological hazards are hazards or incidents that involve exposure to materials that have encountered radioactive substances, thus making them contaminated. Exposure to radiological materials has both short-term and long-term effects; some short-term effects include radiation burns and radiation sickness, while long-term effects include radiation poisoning and radiation damage.[418]

With the passage of the Federal Emergency Planning and Community Right-To-Know Act (EPCRA) in 1986, FDEM began implementing a statewide Hazardous Materials Emergency Planning Program. For the first time, the passage of the EPCRA allowed emergency planners, responders, and the public access to facility-specific information regarding the identification, location, and quantity of particular hazardous materials at fixed sites.

The law requires facilities with certain threshold quantities of federally mandated substances to report annually to state and local emergency officials. In addition, facilities must immediately notify officials of any harmful chemical releases that can potentially result in offsite consequences. This information is utilized to prepare emergency plans for HazMat incidents, allow responders to receive training based on specific known threats, and inform and educate the public regarding the chemicals in their communities. The term extremely hazardous substance (EHS) is used in Title III of the Superfund Amendments and Reauthorization Act of 1986 to refer to those chemicals that could cause serious health effects following short-term exposure from accidental releases. Florida has more than 4,500 fixed facility locations reporting an EHS in federally mandated threshold amounts.

The State Emergency Response Commission (SERC) is responsible for implementing Florida's Federal Emergency Planning and Community Right-To-Know Act (EPCRA) provisions. The SERC, along with the Local Emergency Planning Committees (LEPCs), works to mitigate the effects of a release or spill of hazardous materials by collecting data on the storage of hazardous chemicals above planned quantities. The Technological Hazards Unit at the Florida Division of Emergency Management provides programmatic support for the SERC.[419]

Hazardous Waste

Hazardous waste is unwanted or discarded hazardous materials that may harm the health or well-being of people or the environment. As hazardous materials are produced, stored, and used, hazardous waste is created and must be disposed of. A hazardous waste site can be any place, whether a landfill or former industrial facility, where chemicals have made contact with the water, soil, or air. Ensuring that hazardous wastes (HW) are handled in accordance with federal and state rules and laws is the responsibility of the Compliance and Enforcement staff at DEP. This group interacts with the public and with the Resource Conservation and Recovery Act (RCRA) branch of the

---

[418] http://www.floridahealth.gov/environmental-health/chemicals
[419] https://www.floridadisaster.org/dem/response/technological-hazards/serc/

Federal EPA to develop policies and guidance, to provide compliance assistance to the public and the regulated community, and to enforce the laws regulating the handling of hazardous waste.

Due to the unregulated process of dumping hazardous materials and waste, Congress signed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. This became known as the "Superfund" Act and gave the Environmental Protection Agency (EPA) authority to clean up hazardous waste sites and spills. Through the EPA, the Superfund Program is responsible for cleaning some of the most contaminated areas in the United States and responding to environmental emergencies, such as oil spills, hazardous material spills, and hazardous waste sites. The National Priorities List (NPL), which tracks the known releases or threatened releases of hazardous substances, pollutants, or contaminants, was created to assist with this task. The NPL has four distinct categories:

- *Proposed* – The site has been contaminated by hazardous waste and is a candidate for clean-up. The site is not on the list yet.
- *Withdrawn* – The site poses no real or potential threat to the environment or community and was removed from the NPL.
- *Final* – These sites are currently on the list and pose a real or potential threat to the environment or community. The EPA will be part of the clean-up process.
- *Deleted* – These sites have been removed from the NPL because the clean-up goals were accomplished, and the area requires no further response.

As of November 2023, Florida has 54 final sites on the NPL and one proposed site.[420] There are 12 superfund sites in Hillsborough County listed below:[421]

- Alaric Area Groundwater Plume
- Arkla Terra Property
- Helena Chemical Co.
- JJ Seifert Machine
- MRI Corporation
- Peak Oil Co. / Bay Drum Co.
- Raleigh Street Dump
- Reeves Southeast +Galvanizing Crop.
- Southern Solvents, Inc.
- Stauffer Chemical Co.
- Sydney Mine Sludge Ponds
- Taylor Road Landfill

Hazardous Waste Generators

A generator is any person, organization, or agency that produces hazardous waste as listed or characterized in Part 261 of Title 40 of the Code of Federal Regulations (CFR). Recognizing that generators produce waste in different quantities, the EPA established three categories of generators

---

[420] https://www.epa.gov/fl/list-superfund-sites-florida
[421] https://www.epchc.org/divisions/waste/solid-hazardous-waste/superfund

in the regulations. The volume of hazardous waste each generator produces in a calendar month determines which regulations apply to that generator.[422]

Conditionally Exempt Small Quantity Generators (CESQGs) generate less than 220 pounds of hazardous waste per month or less than 2.2 pounds of acutely hazardous waste, such as some pesticides, toxins, or arsenic and cyanide compounds.

Small Quantity Generators (SQG) generate 220 to 2,200 pounds per month and have additional regulations, including emergency planning and storage time limits.

Large Quantity Generators (LQG) generate 2,200 pounds or more of hazardous waste per month or 2.2 pounds or more per month of acutely hazardous waste.[423]

Within the State of Florida, there are 19,052 VSQGs, 3,470 SQGs, and 427 LQGs, as well as 126 Hazardous Waste Transporters that are regulated and overseen by the Florida Department of Environmental Protection.[424]

Pipelines

There is a total of 45,747 miles of pipeline within Florida. The breakdown of pipeline types is as follows:

- 642 miles Intrastate Natural Gas Transmission
- 4,943 miles Interstate Natural Gas Transmission
- 117 miles Propane
- 412 miles Liquid Hazardous Materials
- 44 miles Oil
- 276 miles Refined Petroleum Products
- 31,292 miles Natural Gas Distribution Systems

Energy pipelines are a fundamentally safe and efficient means of transporting materials that are key to the U.S. energy supply, but given that they often carry toxic, volatile, or flammable material, energy pipelines have the potential to cause injury and environmental damage.

The Pipeline and Hazardous Materials Safety Administration (PHMSA) identify “serious” and “significant” pipeline incidents. Serious incidents are those involving a fatality or injury requiring hospitalization. Significant incidents have the following conditions:

a) fatality or injury requiring hospitalization,
b) $50,000 or more in total costs,
c) highly volatile liquid releases of five or more barrels or other liquid releases of fifty barrels or more, and

[422] https://www.epa.gov/hwgenerators/categories-hazardous-waste-generators
[423] https://floridadep.gov/waste/permitting-compliance-assistance/content/hazardous-waste-compliance-and-enforcement
[424] https://flshmp-floridadisaster.hub.arcgis.com/pages/hazardous-materials-incident

d) liquid release that results in fire or explosion.

As of 2004, PHMSA does not include gas distribution incidents caused by nearby fires or explosions that impact the pipelines.

According to PHMSA, there was one natural gas interstate transmission pipeline incident in Florida with no injuries in 2014 and six significant intrastate distribution pipeline incidents resulting in two injuries from 2014 through 2016. These incidents resulted in $5,059,988 in property damages involving natural gas distribution systems incidents and $1,494,000 in property damages involving an interstate natural gas transmission pipeline.[425] No transmission line incidents were identified for Hillsborough County.

Historically, nationwide, the most common threats to energy pipelines have been accidents and seismic activity; however, more recently, DHS has warned that U.S. natural gas pipelines are targets of cyberattacks. DHS has been working with critical infrastructure owners and operators in the oil and natural gas sector to address a series of cyber intrusions targeting natural gas pipeline companies. Publicly available information does not indicate the extent to which systems have been infiltrated. Still, cybersecurity officials warn that, with sufficient access, a hacker could potentially “manipulate pressure and other control system settings, potentially reaping explosions or other dangerous conditions.” Additionally, sufficient access could shut down energy transit, significantly disrupting the U.S. energy supply.

Within Florida, the Department of Environmental Protection is the lead agency of the Emergency Support Function (ESF) that deals with HazMat and environment-affecting incidents. Florida Fish and Wildlife Conservation Committee (FWC) is an additional supporting agency that assists with HazMat incidents in the event that the material or incident in question is an environmental crime. The Department of Health (DOH) is also a supporting agency for radiological incidents. The PHMSA is responsible for the safety of interstate natural gas transmission lines, propane, and liquid transporting pipelines in Florida. The Florida Public Service Commission is responsible for natural gas safety in intrastate and distribution systems.

811 Call Before You Dig

Pipelines exist almost everywhere throughout the country, and Florida has an extensive pipeline and utility grid. One nationwide program that works to mitigate the risks associated with utility or pipeline damage is 811. According to data collected by the Common Ground Alliance (CGA), an underground utility line or pipeline is damaged once every six minutes nationwide. Before digging or excavating, residents or businesses can call 811 to ensure there are no buried utilities or pipelines on the property. Officials will be sent to locate these utilities and pipelines and mark the approximate location. This is a free service and is used to ensure residents proceed without damaging any critical utilities or pipelines.[426]

Oil Spill

[425] http://www.ncsl.org/research/energy/state-gas-pipelines-pipeline-accidents.aspx#Significant_Incidents
[426] http://call811.com/

An oil spill releases crude oil, or liquid petroleum, into the environment. This is usually associated with marine spills but can also happen on land. Oil spills are caused by the release of oil from offshore platforms, drilling rigs, tankers, ships that have sunk, and any vehicle used to transport crude oil over the water or land. These spills have far-reaching effects, including continued environmental damage and financial loss to the affected communities.

As of August 11, 2023, there are 17 operating rigs in the Gulf of Mexico; all are drilling for crude oil.[427] While there are no drilling rigs on the east coast of Florida, the U.S. Chamber of Commerce predicts that rigs could be seen in the future as exploration estimates roughly 4.72 billion barrels of recoverable oil and 37.51 trillion cubic feet of recoverable natural gas from Maine to Florida.[428] As of 2015, Florida produced 2.2 million barrels of crude oil.[429]

Given Hillsborough County's coastal location on the Gulf of Mexico and dependence on tourism and the related sales tax revenue, an oil spill, classified as a type of HazMat event, could affect any of Hillsborough County's many natural resources, which could be catastrophic.

In addition to economic impacts, an oil spill in Florida or off its shores could have severe consequences for wildlife, ecosystems, and ecology. The Deepwater Horizon spill affected the wildlife populations of numerous species of turtles, birds, bottlenose dolphins, whales, and fish. Gulf states saw a decrease in bottlenose reproduction and a rise in deaths; the Kemp's Ridley Sea Turtle, already endangered, saw a massive drop in numbers; and scientists estimate the habitats on the bottom of the Gulf could take anywhere from multiple decades to hundreds of years to recover fully.[430]

Geographic Areas Affected by HazMat Incident

Hazardous material incidents can occur during the production, transportation, use, and storage of those hazardous materials and can happen anywhere within the county. As these materials are processed and stored, those in the immediate vicinity are at risk of toxic fumes, soil contamination, and water contamination. Even those communities removed from production or storage facilities are at risk, given that hazardous materials are routinely and frequently transported via roadways, railways, pipelines, and waterways, concluding that all county areas are potentially at risk.

The Port of Tampa contains the largest concentration of hazardous materials in Hillsborough County. Included are such products as petroleum and ammonia. Although these products are stored within an industrial area, the port is immediately adjacent to downtown Tampa and has large residential concentrations on Harbour Island and Davis Island.

Port vessel collisions and on-water hazardous materials spills are most likely to occur in the shipping lanes serving the Tampa Port Authority.

---

[427] https://www.wtrg.com/rotaryrigs.html

[428] Hackbarth, S. (2014, August 13). Will We See Oil Rigs In The Atlantic? Retrieved from U.S. Chamber of Commerce website: https://www.uschamber.com/above-the-fold/will-we-see-oil-rigs-the-atlantic

[429] https://s3images.americangeosciences.org/agi/statefactsheets/FL_GeoscienceInYourState_AGI.pdf

[430] http://www.nwf.org

Historical Occurrences of HazMat Incidents

Hillsborough County is surrounded by water, with hundreds of commercial and private marine vessels traveling to its waterways daily. The Port of Tampa is one of the busiest ports in the Gulf of Mexico, making the probability of a major spill more likely to occur. There have been hundreds of reported HazMat incidents in Hillsborough County and its municipalities. Listed below in Table 5.177 are known major incidents near Hillsborough County that have occurred since August 1993.

Table 5.177. Significant Historical Occurrences of HazMat Incidents in Florida near Hillsborough County

Date	Description
August 1993	Three ships collided at the entrance to Tampa Bay, causing a major fire and oil spill, which significantly affected the southern third of the county. Over 330,000 gallons of No. 6 oil were spilled following a three-vessel collision. This spill caused significant ecological and economic damage to local shorelines and beaches.
July 1993	The U.S. Coast Guard responded to the worst hazardous materials incident in recent history involving the motor vessel OCELOT.
September 1995	The USCG responded to a 5000-gallon diesel spill in east Tampa Bay, requiring multiple clean-up contractors. The spill would later prove to be the nation's fifth most resource-intensive oil spill that year at a cost of $500,000.
May 31, 2011	The DEP's Bureau of Emergency Response reported a mercury spill in a residential house in Tampa, Florida. DEP personnel observed at least two ounces of visible mercury within the residence. Mercury vapor readings with windows open in two rooms were 43,000 ng/m3 and 47,000 ng/m3, respectively (Lumex readings). Based on the readings, DEP advised the owners and their children to relocate until the hazards could be mitigated. The source of mercury is unknown and was discovered during home renovation activities.
July 22, 2012	Kinder Morgan (Central Florida Pipeline) had an ongoing release of refined petroleum products from a 10-inch pipeline. Kinder Morgan shut off the pipeline and responded with state and local response agencies to locate the source and evaluate the extent of the impact. It was determined that the pipeline failed in a drainage ditch full of water. The ditch flows into a nearby creek, discharging into Tampa Bypass Canal and McKay Bay. Kinder Morgan estimated 750 barrels of refined product were released. About two miles of the creek, which includes ditches, creeks, ponds, and wetlands, were impacted.
September 1, 2023	An oil leak at SeaPort Manatee led to around 20,500 gallons of an oil-and-water mixture leaking into the basin. About 6.4 tons of oily debris was cleaned from the area. Officials from the Coast Guard and the National Oceanic and Atmospheric Administration claimed no wildlife was harmed in the incident, something which environmental advocates disagreed with.

The majority of the transportation hazardous materials events involve tanker trucks or trailers and certain types of bulk-cargo vehicles. Because of the number of miles traveled by these vehicles within the county, daily transportation is a large contributor to potential hazardous material spills. Additionally, rain, high winds, and fires can worsen conditions surrounding these hazardous material events.

For the City of Tampa, approximately 25.3% of the recorded incidents are related to a hazardous condition other than residential gas and fuel spill emergencies. Damage estimates associated with the hazardous conditions are not available. All calls for hazardous incidents within the city are funneled through the Tampa Fire Rescue Department.

Probability of Future HazMat Incident

Reports of hazardous material spills and releases are increasingly commonplace. Thousands of new chemicals are developed yearly and transported domestically and internationally, creating the risk of accidents and spills. Small fuel spills occur in the waters surrounding Hillsborough daily. Most are due to overfilling boat fuel tanks, and a few due to boat sinking. Law enforcement agencies routinely receive reports of illegal oil dumping from the public.

Major chemical spills can occur at any facility that produces, uses, or stores chemicals. These include chemical manifesting plants, laboratories, shipyards, railroad yards, warehouses, or chemical disposal areas. Illegal dumpsites can appear anywhere. Accidents involving the transportation of hazardous materials can occur at any time and severely impact the affected community. Recent evidence shows that hazardous materials incidents may be the most significant threat facing local jurisdictions.

Major HazMat Incidents have a probability level of possible (1-10% annual probability) based on historical occurrences. It is likely that there have been more major incidents for which records are not available, and that this probability is higher.

HazMat Incident Impact Analysis

The following is a list of possible impacts associated with HazMat incidents.

- Public
  - Loss of life or injury from contamination
  - Diseases may be exacerbated
- Responders
  - Loss of life or injury from contamination, explosions, clean-up, and destruction
  - Diseases
  - Clean-up and destruction at waste sites and incident sites
- Continuity of Operations (including continued delivery of services)
  - Lost material, such as gas, is unusable and could lead to shortages and price increases
- Property, Facilities, Infrastructure

- Damage due to excavation and removal of soil and water
    - Inability to rebuild in affected areas
    - Services could be closed or blocked due to the contaminant
        - Roads
        - Trains
        - Airplanes
        - Bridges
        - Waterways
    - Long-term contamination at hazardous waste sites
- Environment
    - Death or illness to pets or wildlife near the spill
    - Damage to plants and wildlife
    - Airborne issues such as toxic fumes, gases, or vapors caused by chemicals
    - Water contamination
    - Soil contamination
    - Loss of critical or endangered species
    - Pollution
- Economic Condition
    - Business closures may lead to lost revenue and wages
    - Loss of tourism and income
    - Loss of product
    - Cost of clean-up and restoration
- Public Confidence in Each Jurisdiction's Governance
    - If the government does not communicate with the public, fear could ensue, leading to a fear of the government
    - If clean-up is slow, the public could believe the government does not know how to clean it up properly or that the accident was malicious
- Socially Vulnerable Populations
    - Justice40 Disadvantaged communities
    - People without vehicles
    - People with disabilities
    - People with special needs
    - Older adults
    - People who have limited English proficiency

Vulnerability Analysis and Estimated Losses by Jurisdiction

Major Hazardous Materials incidents can occur at any facility that produces, uses, or stores hazardous materials. These include chemical manifesting plants, laboratories, shipyards, railroad yards, warehouses, or chemical disposal areas. Illegal dumpsites can appear anywhere. Accidents involving the transportation of hazardous materials can occur at any time and severely impact the affected community. The county's northern half could be largely affected if there was a chlorine release during transport based on the delivery corridor route.

Hazardous material releases pose short- and long-term toxicological threats to humans and to terrestrial and aquatic plants and wildlife. Toxic materials affect people through inhalation, ingestion, and/or direct contact. As noted previously, should a hazardous material spill or accident occur in the Port of Tampa under favorable weather conditions, a significant number of people working, visiting, or living near the port could be adversely affected. As an active port, two factors contribute to the need for vigilance. First, hazardous materials will always be present at a port, either in transit or storage. Second, at a port, the potential for accidents is always present, either in the transfer of hazardous materials from ship to shore to storage or transfer from storage to overland transport. Given the volume of hazardous materials found at the port, should a spill or fire/explosion occur, the impact on the surrounding community could be major.

Vulnerability Analysis and Estimated Losses of Critical Facilities

Hazardous Materials Incidents can and do occur anywhere and at any time. In most cases, they do not seriously impact critical facilities. However, critical facilities that store or handle hazardous chemicals listed in the Environmental Protection Agency (EPA) Superfund Amendments and Reauthorization Act (SARA) Title III are most vulnerable.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 2.9 (Table 5.178).

Table 5.178. Overall Vulnerability to Hazardous Material Incident for Hillsborough County

<table>
<tr><th colspan="5">HAZMAT INCIDENT</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">A hazardous material is any substance that poses a threat to humans, animals, or the environment. Hazardous materials, commonly called HazMat, generally refer to hazardous substances, petroleum, natural gas, synthetic gas, and acutely toxic chemicals. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the EPA, OSHA, DOT, and the Nuclear Regulatory Commission (NRC). Hazardous materials typically fall into one of three categories: biological hazards, chemical hazards, or radiological hazards.</td><td colspan="2">HIGH</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Possible</td><td>Critical</td><td>Moderate</td><td>< 6 hrs</td><td>Somewhat Concerned</td><td>> 1 week</td><td>2.9</td></tr>
</table>

4.19 Transportation Incident Hazard Profile

Transportation Incident Description

Transportation systems are designed to move people, goods, and services efficiently, economically, and safely from one point to another. As the movement of people, goods, and services increases due to population growth and technological innovation, the need to plan for events becomes increasingly important. As one of the critical infrastructure sectors, the Department of Homeland Security (DHS) categorizes the transportation sector into the following seven modes:[431]

- Aviation
- Highway and Motor Carrier
- Maritime
- Mass Transit and Passenger Rail
- Pipeline Systems
- Freight Rail
- Postal and Shipping

Florida has a large transportation network that consists of airports, major highways, passenger railroads, marine ports, and pipelines. These transportation systems provide lifeline services for communities and are vitally important for response and recovery operations. The vast network of public and private critical infrastructure owners and operators, the infrastructure and services they manage, and the extensive interdependencies among the transportation modes and other sectors indicate the need for coordinated planning to manage all hazards efficiently and effectively. Specific to Hillsborough County, the Plant City, Tampa, and Temple Terrace, and unincorporated areas rely on transportation infrastructure to support tourism and service continuity. Within Hillsborough County as a whole, it has one major airport in Tampa Bay and several major highways throughout all jurisdictions, including I-4, I-75, and I-275. 2 passenger railroad routes, one major marine port, and numerous pipelines for transporting goods throughout the county. Railroads, roads, and all airports within Hillsborough County are shown in Figure 5.98.

---

[431] https://www.dhs.gov/sites/default/files/publications/nipp-ssp-transportation-systems-2015-508.pdf

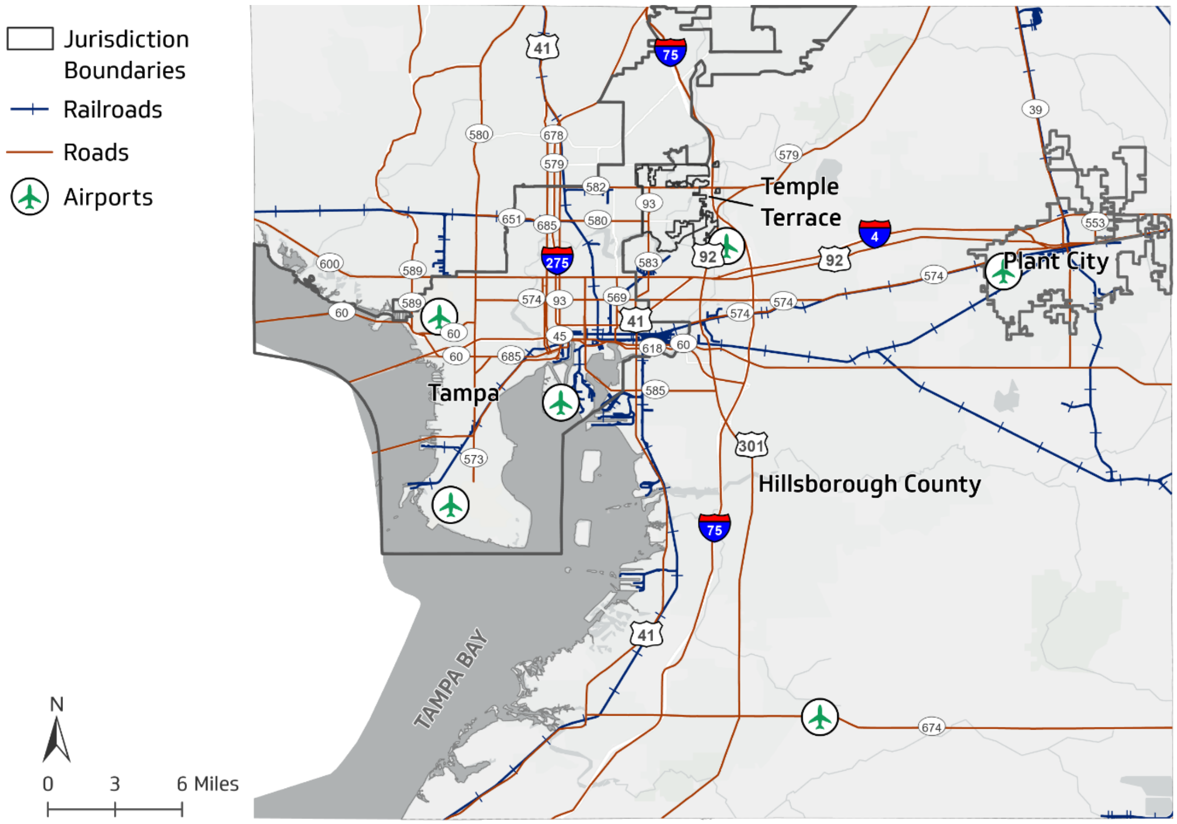


Figure 5.98. Hillsborough County Transportation Assets

The identification of critical transportation infrastructure requires consideration of federal, state, regional, and local jurisdictions, their interests, and a variety of hazards. At the national level, critical infrastructure in each of the four subsectors—aviation, maritime, surface, and postal and shipping—contribute to national security, economic stability, and public health and safety. At the regional, state, and local levels, the necessity of infrastructure is primarily determined by the business, lifestyle, and emergency needs of the community.

Risks to critical transportation infrastructure include natural disasters as well as manmade physical and cyber threats, including terrorism, vandalism, theft, technological failures, and accidents. Cyber threats to the sector are of concern because of the growing reliance on cyber-based control, navigation, tracking, positioning, and communications systems, as well as the ease with which actors can exploit cyber systems that serve transportation. While engineered hazards such as road curve geometry can be addressed through design, hazards such as terrorist attacks and extreme weather can be difficult to predict and mitigate.

Terrorism

Terrorist attacks, whether physical or cyber, can significantly disrupt vital transportation services and cause long-term sociological and economic consequences. The risk of a terrorist attack on transportation infrastructure is typically assessed using attack scenarios to evaluate the threats, vulnerabilities, and consequences. Transport vehicles are abundant, moving virtually unnoticed within industrial locations and major population centers, across borders, and in the case of mail and express package services, to nearly every household, business, and government office in the country. As seen on September 11, 2001, modes of transportation, such as airplanes, can be used as weapons themselves. The very nature of the transportation enterprise is to be open, efficient, and accessible, which can make it a target for terrorist attacks. For more information on terrorism, please see the *Terrorism Hazard Profile*.

Natural Disasters and Extreme Weather

Global transportation infrastructure today is confronted with significant vulnerabilities, including the evolving threats of our changing climate. Natural disaster risks to all Hillsborough County, Tampa, Plant City, and Temple Terrace transportation systems include wildfires, flooding, severe storms, tropical cyclones, and drought, all of which have the potential for widespread disruption of transportation services. Risks from natural disasters have varying regional or local relevance because of prevailing weather patterns, geological trends, topographical features, and population density.

Heavy rainfall events can disrupt transportation services and damage infrastructure and facilities. During or following periods of heavy rainfall, inundation and washouts can block transportation routes, damage facilities, and interrupt power supplies. Increases in severe weather, including high intensity rainfall events, due to climate change are increasing this risk. Tropical cyclones can damage critical infrastructure such as roads and bridges, causing delays in critical response, services, and the ability to move throughout the state. Tornados have similar effects while also creating dangerous situations with people on the roads.

Fog

Fog is a cloud that forms at the surface of the earth made of tiny water droplets suspended in the air. The greatest problem with fog is visibility. Heavy fog is defined as visibility below one quarter of a mile. A Dense Fog Advisory means that dense fog has reduced visibility to 1/4 mile or less within the advisory area. These conditions make travel difficult.[432]

A Freezing Fog Advisory is when fog develops, and surface temperatures are at or below freezing. The tiny liquid droplets in the fog can freeze instantly on any surface, including vehicles and road surfaces. Freezing fog makes driving, boating, flying, and other forms of transportation particularly hazardous. Visibilities are typically at or below one mile.

Fog, particularly when dense, can be hazardous to drivers, mariners, and aviators, contributing to numerous travel accidents every year. Restrictions in visibility resulting from fog can also impact takeoff and landing procedures and requirements for pilots and can be the cause of weather-related aviation delays. The annual average fog days in Hillsborough County are shown below in Figure 5.99.

---

[432] http://www.nws.noaa.gov/om/fog/ww.shtml

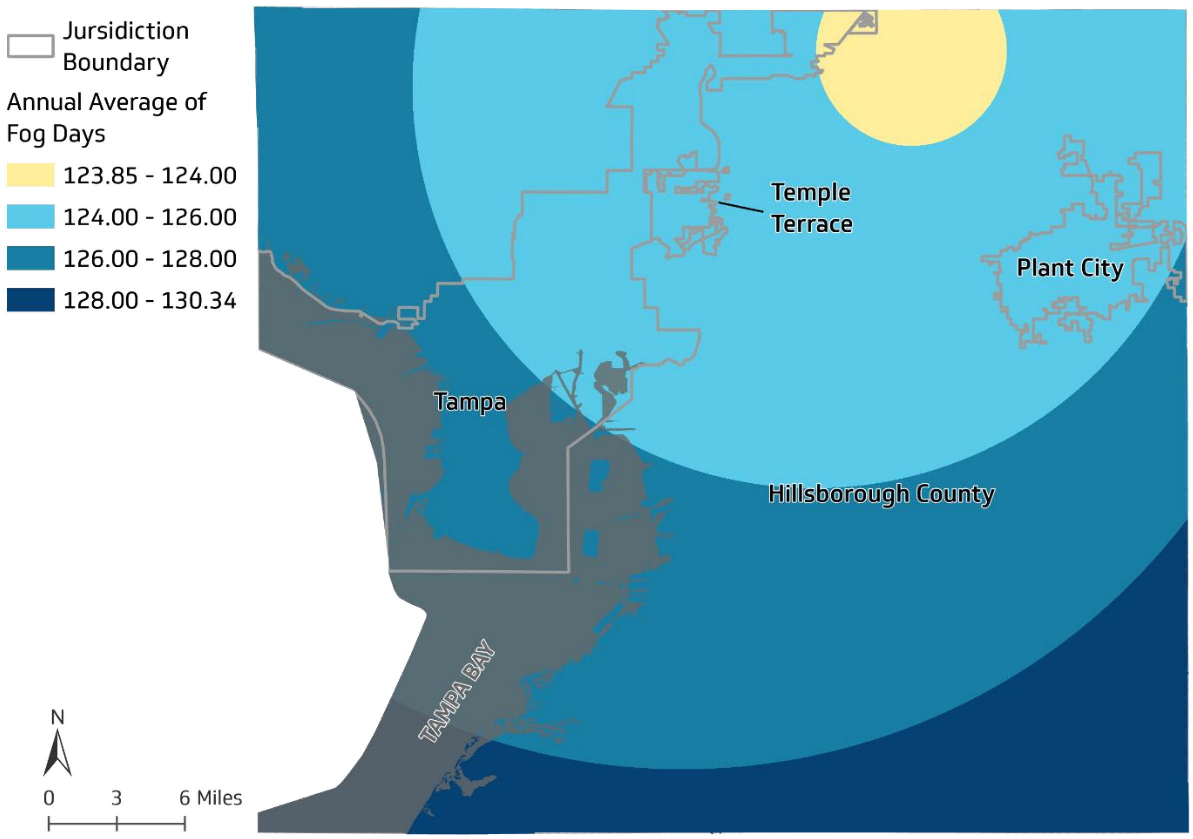


Figure 5.99. Florida Fog Risk, 1991-2020

Aging Infrastructure

The condition of transportation infrastructure in Hillsborough County, and Florida as a whole, is also a concern because of the advanced age and deterioration of many structures throughout the state's transportation network. Aging infrastructure threatens the resilience of these systems and can multiply risks from other factors, such as man-made or natural disasters. The impact of the loss of a key asset, such as a bridge, poses an immediate threat and can have cascading impacts on passenger and freight movement as well as potentially large-scale impacts, such as supply chain disruptions.[433]

More than half of America's natural gas transmission pipelines were installed before 1970; the same holds true for pipelines that carry hazardous liquids such as gasoline, diesel, and jet fuel. Pipelines are just a fraction of the nation's vast network of transportation infrastructure — the roads, cables, wires, conduits, drains, satellites, and switches that enable the flow of everything from sewage to gas. The pipelines within Hillsborough County are owned by numerous private companies and have differing levels of condition, making the system vulnerable to accidents and failure. Meanwhile, the government-owned infrastructure — roads, bridges, and mass transit — is under severe financial

---

433 http://knowledge.wharton.upenn.edu/article/americas-aging-infrastructure-what-to-fix-and-who-will-pay/

strain because maintenance costs have increased. Rail is predominantly privately owned by the company CSX, with a minority share of railroad ownership belonging to TECO. The Federal Railroad Administration reports that there were four railroad incidents on CSXT facilities in the last 20 years. Two were minor accidents at railroad crossings, and two were track defects that caused minor derailments. The last incident occurred at the Tampa Port. There were no injuries or fatalities in any case.

Cyber

Cyber-based technologies in transportation operations enable greater economies and efficiencies, improve customer service, enhance operational controls, and provide better security capabilities. Consequently, transportation companies are increasingly dependent on cyber systems for business, security, and operational functions. Cyber technologies upon which transportation services rely include positioning, navigation, tracking, shipment routing, industrial system controls, access controls, signaling, communications, and data and business management. These technologies are often interconnected through networks and remote access terminals, which may allow malicious actors easier access to key areas. For more information, please see the *Cyberterrorism Hazard Profile*.

Types of Transportation

The Florida Department of Transportation (FDOT) is the lead agency in committing to a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of the environment and communities. FDOT has implemented the Strategic Intermodal System (SIS), the state's highest priority for transportation investments. SIS also has a focus on implementing the Florida Transportation Plan (FTP), which is the state's long-term transportation vision and policy. SIS is a transportation system that:[434]

- Is made up of facilities and services of statewide and interregional significance;
- Contains all forms of transportation for moving both people and goods, including linkages that provide for smooth and efficient transfers between modes and major facilities; and
- Integrates individual facilities, services, modes of transportation, and linkages into a single, integrated transportation network.

The system was established to efficiently serve the mobility needs of all Florida citizens, businesses, and visitors and help the state to become a worldwide economic leader, enhance economic prosperity and competitiveness, enrich quality of life, and reflect responsible environmental stewardship.

SIS is a network of high-priority transportation facilities, including the state's largest and most significant commercial service airports, spaceports, deep-water seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways, and highways. These state facilities carry more than 99% of all commercial air passengers and cargo, virtually all waterborne

[434] http://www.fdot.gov/info/moredot/mvv.shtm

freight and cruise passengers, almost all rail freight, 89% of all interregional rail and bus passengers, 55% of total traffic, and more than 70% of all truck traffic on the state highway system.[435]

Aviation

Hillsborough County has one major commercial airport, the Tampa International Airport in Tampa. In addition to Tampa International, Hillsborough County has five regional or private airports. Of the five airports, two are located in Tampa, one is located in Plant City, and two are located in unincorporated areas of Hillsborough County. In 2022, approximately 21.5 million airline passengers flew through Tampa Bay International Airport.[436] FDOT and the Federal Aviation Administration (FAA) coordinate efforts to ensure safe air travel and mitigate against potential hazards. In 2005, FDOT, in cooperation with the FAA and Florida's Public Airports, developed the Florida Aviation System Plan (FASP). They focused the plan on traditional aviation system planning elements but also included an analysis of the intermodal aspects of the state transportation system. The FASP also includes a strategic planning element, identifying seven strategic goals considered essential.[437]

Air transportation hazards can include crashes and issues with the airplanes themselves but can also include potential hazards at the airport or within the surrounding areas. Causes and contributors to airplane accidents could include faulty parts and defects, operational or pilot error, system malfunctions, and outside forces such as extreme weather. Airports and the surrounding areas could also potentially cause additional hazards. One such hazard is bird strikes, and while unlikely to cause a crash, birds can cause flight delays and emergency landings.[438] Terrorist attacks could be targeted at major airports or involve the use of airplanes as a weapon. Degraded runways and equipment also pose a significant threat to the aviation infrastructure.[439]

Airplane crashes could lead to cascading hazards, such as wildfires, dam or levee damage leading to flooding, roadway blockage and damage, and utility damage from downed power lines leading to outages and potential accidents. Air transportation hazards could also lead to damage or destruction of goods and freight and loss of life.[440]

Highway and Motor Carrier

This mode of transportation includes highways, roadways, bridges, trucks, commercial freight vehicles, motor coaches, and school buses.[441] Hillsborough County has approximately 3,876 miles of highway, over 1,600 miles of total public roadways,290 bridges, and multiple public transit systems. Public transit systems include services such as the Hillsborough Area Regional Transit Authority (HART) and the Hillsborough County Sunshine Line. With more than 12,000 lane miles of road within Hillsborough County, ownership maintenance responsibilities are divided among the local jurisdictions of Hillsborough County, City of Tampa, Plant City, Temple Terrace, Tampa-Hillsborough Expressway Authority, and FDOT. Hillsborough County shares the largest percentage of lane miles at approximately 7,000 miles and owns the most roadway pavement. Following

---

[435] http://www.fdot.gov/planning/sis/about.shtm
[436] FactSheet-0223.pdf (tampaairport.com)
[437] http://www.fdot.gov/planning/fastfacts.pdf
[438] http://www.bne.com.au
[439] http://www.fdot.gov/aviation/planning.shtm
[440] http://www.fdot.gov/aviation/pdfs/Welcome%20to%20Fl%20Aviation112010.pdf
[441] http://www.floridatransportationindicators.org/index.php?chart=13d

Hillsborough County, which has the most roads, is the City of Tampa, which has 2,800 miles, and FDOT, which has 2,000 miles. In 2022, 3,291,729 daily automobile miles were traveled within Hillsborough County. This includes private vehicles, passenger transportation, freight, and hazardous materials transportation. Hillsborough County has experienced significant growth as a whole and is expected to continue growing in terms of population and urban sprawl, increasing the number of passengers and vehicles on the roadways. Consequently, today's roadways are dangerously overcrowded, turning the focus to identifying serious roadway hazards. 2

Accidents are the highest risk on roadways, and according to the Florida Department of Highway Safety and Motor Vehicles, in 2023, there were 27,468 accidents within Hillsborough County.[442] Of the 27,468 accidents, 235 fatalities and 18,873 injuries occurred. Accidents involving freight could lead to loss of revenue for businesses and wages for drivers, as well as affect the consumers waiting for the cargo to be transported. Hazardous materials are routinely transported along Hillsborough's road system and can affect the environment and surrounding population in the event of a spill. For more information regarding the transportation of hazardous materials, please see the *HazMat Incident Hazard Profile*.

Hillsborough's 290 bridges are vulnerable to hazards, such as storm surges, hurricanes, and sea level rise, due to the county's proximity to the coast of the Gulf of Mexico and its varying surface waters. Hazards such as these not only influence roadways but waterway routes as well.[443]

Good, efficient roads make commuting feasible; however, aging roads can lead to hazards and accidents. As of 2021, the Hillsborough Planning Commission allocated funding to improve roughly 26% of its roadways that were in poor condition and subject to failure. This includes roads and bridges that need to be repaved, are crumbling, or have significant damage.[444]

Maritime

Hillsborough County, exclusive of Tampa Bay and Hillsborough Bay, has a total surface water area of approximately 98 square miles with more than 246 miles of coastline, which can be seen in Figure 5.100. There are a total of 138 named lakes throughout the county and many more unnamed or private water bodies. Popular water resources used throughout Hillsborough County include, but are not limited to, the Hillsborough River, Hillsborough Bay, Lake Thonotosassa, Old Tampa Bay, Alafia River, and the Hillsborough River Watershed. The map below shows Hillsborough County's surface water.[445]

---

[442] Crash Dashboard - Florida Department of Highway Safety and Motor Vehicles (flhsmv.gov)

[443] http://www.smartmotorist.com/traffic-and-safety-guideline/roadway-hazards.html

[444] Hillsborough Commission approves $40 million to improve 285 miles of roadway (floridapolitics.com)

[445] http://www.stateofflorida.com/facts.aspx

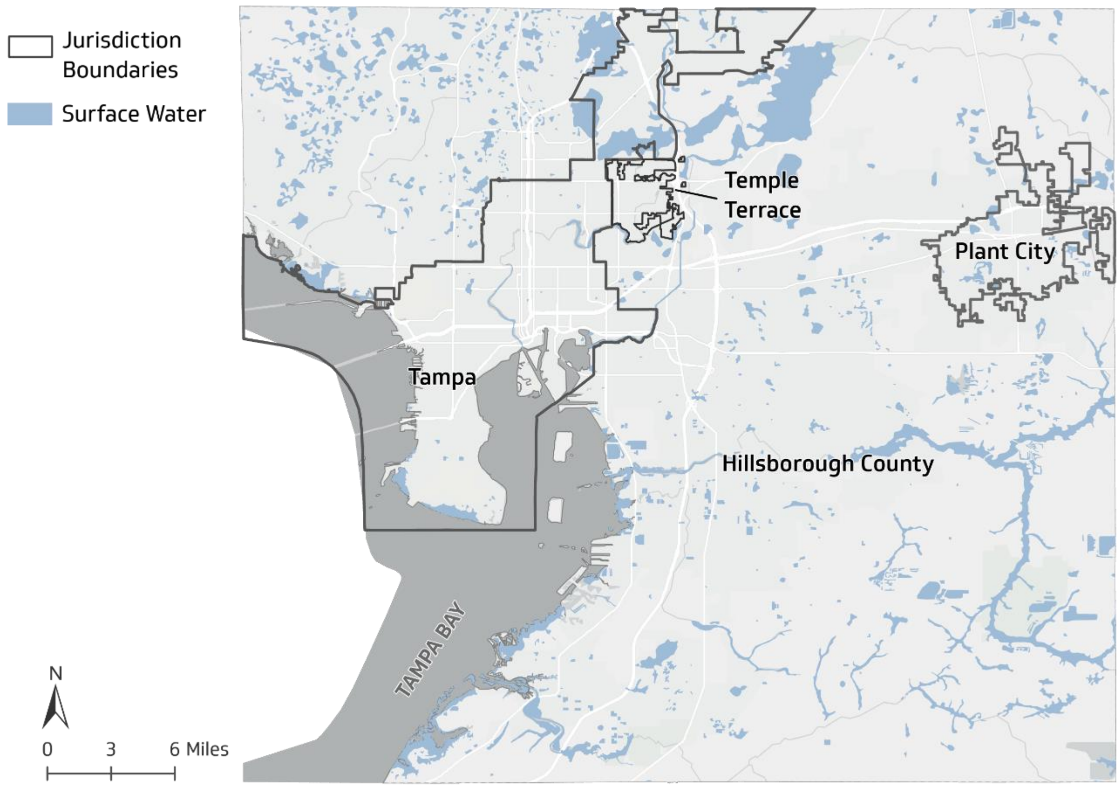


Figure 5.100. Hillsborough County Surface Water

There is one seaport, Port Tampa Bay, within Hillsborough County that accommodates cruise lines, passenger and private vessels, and freight vessels.[446] Port Tampa Bay has a critical role in the lives of citizens and continues to drive Tampa's economy and surrounding jurisdictions. From what we wear to what we eat, from building materials to automobiles, essentials for everyday use are passed through the marine port. Roughly 33 million tons of cargo go through Port Tampa Bay, and it contains a major shipyard repair center for a diverse mix of bulk, break-bulk, and containers. In 2023, an estimated 1.2 million cruise passengers made port in Tampa Bay, and many more made port on private vessels. The cruise business accounts for nearly 20% of Port Tampa Bay's revenue. [447] Currently, Port Tampa Bay generates nearly 85,000 direct and indirect jobs and contributes approximately $17 billion in economic value to Central Florida through cargo and cruise activities.

The Maritime Administration (MARAD) is the agency within the U.S. Department of Transportation regarding waterborne transportation. Its programs promote the use of waterborne transportation and its seamless integration with other segments of the transportation system, and the viability of the U.S. merchant marine. MARAD works in many areas involving ships and shipping, shipbuilding, port operations, vessel operations, national security, environment, and safety. [448]

[446] http://flaports.org/about/the-florida-system-of-seaports/
[447] https://flaports.org/port-tampa-bays-cruise-season-is-back-with-record-numbers/
[448] https://www.marad.dot.gov/

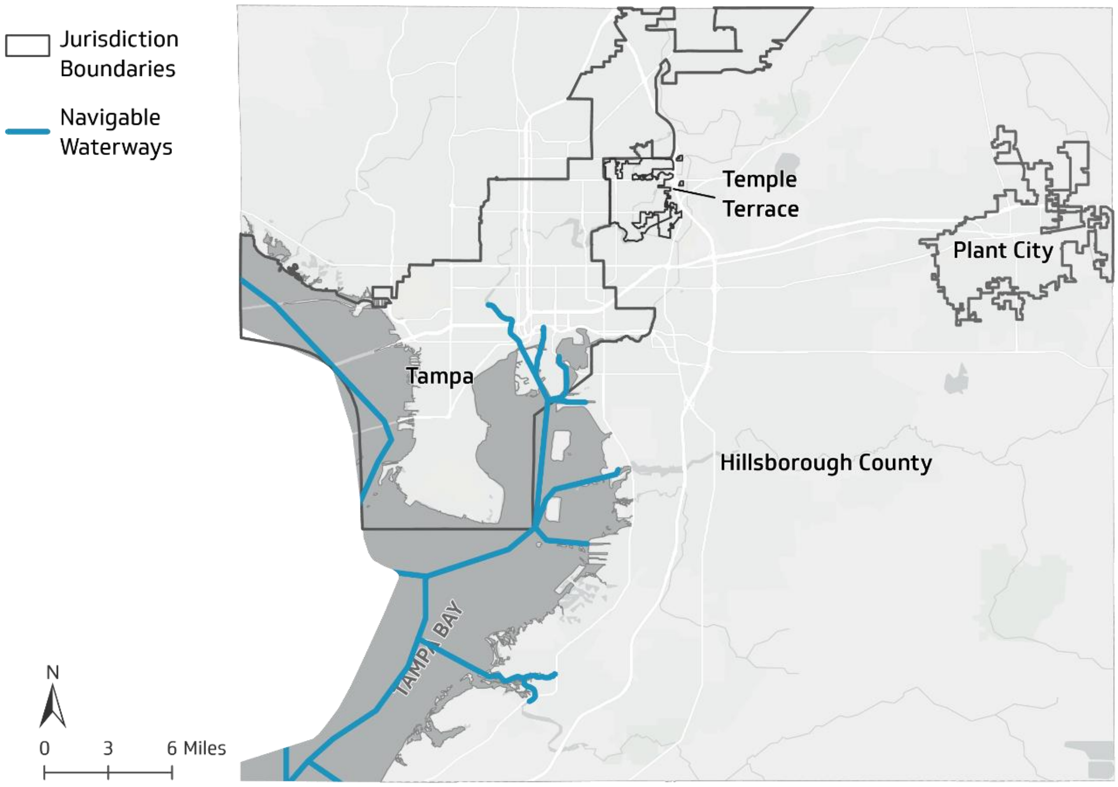


Figure 5.101. Hillsborough County Navigable Waterways

FDOT and The Maritime Administration (MARAD), along with Customs and Border Patrol (CBP), monitor the maritime transportation system in Florida, including waterborne transportation, landside infrastructure, the shipbuilding and repair industry, and labor.[449] These navigable waterways are shown above in Figure 5.101. They integrate the economy with a vast network of systems that moves large quantities of consumer goods, people, agricultural products, energy, and raw materials.

The United States Coast Guard (USCG) and CBP work together to ensure secure borders. U.S. Customs and Border Protection is also part of this comprehensive effort to improve security at the nation's borders while enhancing legitimate travel, including private boaters, established the Local Boater Option (LBO). This means boaters can register with CPB and then make phone-in entry into the U.S. from a foreign country instead of reporting in person. This reduces the number of undocumented individuals coming to Florida shores and works to reduce drug smuggling operations into the state. On an average day, the USCG conducts search and rescue operations, saves lives and property in peril, conducts waterborne patrols of critical maritime infrastructure, seizes drugs, conducts security boarding in and around Florida ports, and interdicts undocumented migrants.[450]

[449] https://www.cbp.gov/
[450] http://www.uscg.mil

Florida Fish and Wildlife Conservation Commission (FWC) oversees and coordinates statewide regulatory waterway markers to ensure compliance with the uniform marking system and to improve compliance of state boating and resource protection zones for the long-term well-being and benefit of all waterway users and the fish and wildlife resources. FWC regulates licenses and permits related to boating and fishing and manages waterways within the state.[451]

Mass Transit and Passenger Rail

Mass transit and passenger rail include terminals, operational systems, and supporting infrastructure for passenger services by transit buses, trolleybuses, monorail, heavy rail—also known as subways or metros—light rail, passenger rail, and vanpool or rideshare. In the 2022 Fiscal Year, Hillsborough County's public transportation network served over 10.9 million public transit riders within the county annually. Public transportation in Hillsborough County is a crucial part of the solution to the state's economic, energy, and environmental challenges – helping to bring a better quality of life and economic prosperity. In increasing numbers, people are using public transportation, and local communities are expanding public transit services. The Florida Public Transportation Association (FPTA) is one of the most active state transit associations in the nation. FPTA is a nonprofit association whose members include every major public transit agency in Florida, as well as interested citizens and businesses. Hillsborough Area Regional Transit Authority (HART) is a dominant public transportation system in Hillsborough County, a part of the FPTA, and operates throughout Hillsborough County to improve connections and transportation. Public transportation provides access to job opportunities for Floridians as well as a transportation option to get to work, school, visit friends, or go to a doctor's office.

Pipeline Systems

Energy pipelines are a fundamentally safe and efficient means of transporting materials key to the U.S. energy supply, but, given that they often carry toxic, volatile, or flammable material, energy pipelines have the potential to cause injury and environmental damage.[452] There is a total of 161 miles of interstate natural gas transmission pipelines and 474 miles of hazardous liquid pipelines within Hillsborough County:[453] Florida Gas Transmission is the primary operator of the interstate pipelines within Hillsborough County in addition to Gulf Stream Natural Gas operating approximately 40 miles of the natural gas pipelines.

FDOT and the Pipeline and Hazardous Materials Safety Administration (PHMSA) work together to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to citizens' daily lives. To do this, PHMSA establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents. PHMSA also prepares the public and first responders to reduce consequences if an incident does occur.[454]

Increased urbanization is resulting in more people living and working closer to existing transmission pipelines. Growth in population, urbanization, and land development near transmission pipelines,

---

[451] http://myfwc.com/

[452] http://hazardmitigation.calema.ca.gov/plan/state_multi-hazard_mitigation_plan_shmp

[453] https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.npms.phmsa.dot.gov%2FDocuments%2FNPMS_Active_Pipe_County_Mileage.xlsx&wdOrigin=BROWSELINK

[454] https://www.phmsa.dot.gov/about/mission

together with the addition of new facilities to meet demands, may increase the likelihood of pipeline damage due to human activity and the exposure of people and property to pipeline failures. Compounding the potential risk is the age and gradual deterioration of the transmission pipeline system due to natural causes.[455]

Causes and contributors to pipeline failures include construction errors, material defects, internal and external corrosion, pressure buildups, operational errors, control system malfunctions, and outside force damage. Natural hazards such as sinkholes or land subsidence, earthquake or seismic activity, and flooding can all put pressure on existing pipelines, resulting in bursts, spills, or leaks of natural gas, oil, and hazardous substances. For more information on pipelines, also see the *HazMat Incident Hazard Profile*.

Freight Rail

Freight rail companies are shippers that depend on rail to transport their goods in the global marketplace, stock their shelves with the latest products for Florida residents and visitors, and haul construction materials to keep pace with the rapid population growth.

Hillsborough County has approximately 381 main rail corridor miles, owned by two operating railroads and terminal or switching companies, CSX and TECO. The largest operator in the county is CSX Transportation, operating 99% of the railroad mileage throughout the county.

Railroad hazards could include train collisions, derailments, accidents involving cars or pedestrians, rail worker accidents, and hazardous materials spills. Natural hazards also cause issues for railways, including freezing tracks and malfunctioning train car operations, such as brakes. Dense fog could cause visual obstructions, animals on the tracks could lead to derailments, and all accidents can lead to damage or destruction of freight, property, and loss of life. These accidents could also be caused by equipment failure, operator error, signal failure, and track damage or failure.[456]

65Phosphates and Fertilizers

Mineral deposits in West Central Florida make the state a world leader in the production of phosphate rock. With the exception of Hamilton County in northern Florida, the state's phosphate production is concentrated in Polk, Hillsborough, and Hardee counties. Florida accounts for just over half of the nation's production of phosphate fertilizers. The phosphates and fertilizers produced in Florida are shipped nationwide and to markets throughout the world, with China, India, Australia, and Brazil ranking among the leading foreign destinations.

Distribution and Retail

The distribution and retail trade industry is comprised of several key economic sectors – wholesale trade, retail trade, and transportation and warehousing. Hillsborough County's distribution and retail trade industry depends on the efficient movement of goods to keep costs down and to remain competitive. Rail is crucial for long hauls that bring goods into the state from distribution hubs such as Chicago, Atlanta, and Dallas-Fort Worth, as well as from more distant gateways, including the

---

[455] https://s3images.americangeosciences.org/agi/statefactsheets/FL_GeoscienceInYourState_AGI.pdf
[456] http://www.fdot.gov/rail/PlanDevel/Documents/FinalInvestmentElement/G-Chapter2-FreightRail.pdf

West Coast ports, which are the leading point of entry for consumer items entering the United States from Asia.

Food and Agriculture

Rail plays a crucial role in Hillsborough County's food and agriculture industries through freight transportation. Railroads provide a cost-effective and efficient means of transporting agricultural products, such as fruit, vegetables, grains, and livestock, within and outside of the county. In areas that are predominately agricultural, such as Plant City, rail is extremely essential to transport strawberry and other berry products to the rest of the country. Not only does it allow connection to other parts of the country, but it also supports the economic stability of agriculturally based areas.

Paper and Fiber

In Hillsborough County, the paper and fiber industry play a vital role in the local economy and ecosystem. With the diverse landscape and favorable climate, the county supports the growth of various trees and plants suitable for paper and fiber production. Some trees that are commonly sold, processed, and/or manufactured include pine, hardwoods, eucalyptus, and bamboo. The county is home to several pulp and paper mills, as well as facilities specializing in fiber processing and manufacturing. As for the shipment of paper and fiber, rail remains popular for long hauls following the processing of timber into paper and wood products. Rail is also the best option for hauling lumber long distances.

Automotive Distribution

The expanding population stimulates demand for automobile retail sales while millions of tourists visiting the state on an annual basis depend on rental cars for mobility. The combination of retail sales and rental cars makes the state of Florida overall the second largest market for new vehicles in the country, only surpassed by the much more populous state of California. Whether new or used, meeting Floridians' demand for vehicles requires thousands of truck and rail trips annually as part of a system to transport vehicles to dealers and wholesalers, with cargo likely having to pass through the Port of Tampa Bay and out through central Florida.

Energy

The transport of fuels (i.e., coal and petroleum) by rail is one of the leading inputs in the energy industry. Rail, joined by coal and petroleum commodity purchases, construction, and business services, is a principal cost factor in electricity production that affects the overall price of energy. Rail is the primary mode of transportation to bring coal into Hillsborough County and Florida as a whole. Natural gas pipelines also share a large portion of the transportation of fuel into the county through the Florida Gas Transmission Corporation and the Gulf Stream Natural Gas System Pipeline.

Construction

Transportation is crucial for construction activities in Hillsborough County, facilitating the movement of materials, equipment, and personnel to and from construction sites. Specifically, railroads are involved in the movement of many of the materials essential within the construction industry, including metals, lumber, and cement.

Postal and Shipping

Postal and Shipping in the United States moves roughly 720 million letters and packages each day and includes large integrated carriers, regional and local courier services, mail services, mail management firms, and chartered and delivery services.

The United States Postal Service delivers more mail to more addresses in a larger geographical area than any other post in the world. The Postal Service delivers to more than 156 million addresses in every state, city, and town in the country. Everyone living in the United States and its territories has access to postal products and services and pays the same for a First-Class postage stamp regardless of their location.

114Geographic Areas Affected by Transportation Incidents

Transportation incidents can occur anywhere within the county. Areas of high traffic are particularly vulnerable to transportation hazards. Large urban areas with large populations and different forms of transportation are considered high-traffic areas, meaning the risk is elevated. Due to the large number of railways, roadways, airports, pipelines, and seaports, the entire county is at risk for transportation hazards. Areas surrounding the airports and ports are even more susceptible. Numerous major roadway corridors service the county from the north, south, east, and west. Marine delivery routes border the county on the east. Several main railroad corridors service the county. Thus, the county is vulnerable to a transportation accident.

Aviation

The crash of a large passenger aircraft into a densely populated area in either Tampa or unincorporated Hillsborough County represents the maximum threat in the western and central portions of the County.

Railroad/Waterway Incidents

An incident such as the MV Summit Venture in 1980, which struck the Skyway Bridge, represents a serious threat impacting the transportation infrastructure (highway and port) and economy, as well as injuries and loss of life. A derailment of a rail car carrying hazardous materials could also pose a significant threat to local neighborhoods and major transportation facilities.

Hazardous Materials (Fixed Facilities)

The largest threat is from one of the anhydrous ammonia tanks operating at the port.

Hazardous Materials (Transportation)

Rail deliveries of anhydrous ammonia via ships to the port pose the largest threat, followed by rail deliveries of chlorine to one of the two water treatment plants in Tampa. The threats would exactly duplicate the Hazardous Materials (fixed facility) scenarios above, except that the location would be unknown. This incident could occur at any point along the rail delivery corridor throughout the northern half of the county. Hazardous material transportation buffers, or areas that could be impacted if a transportation incident occurred while carrying hazardous materials, can be seen below in Figure 5.102.

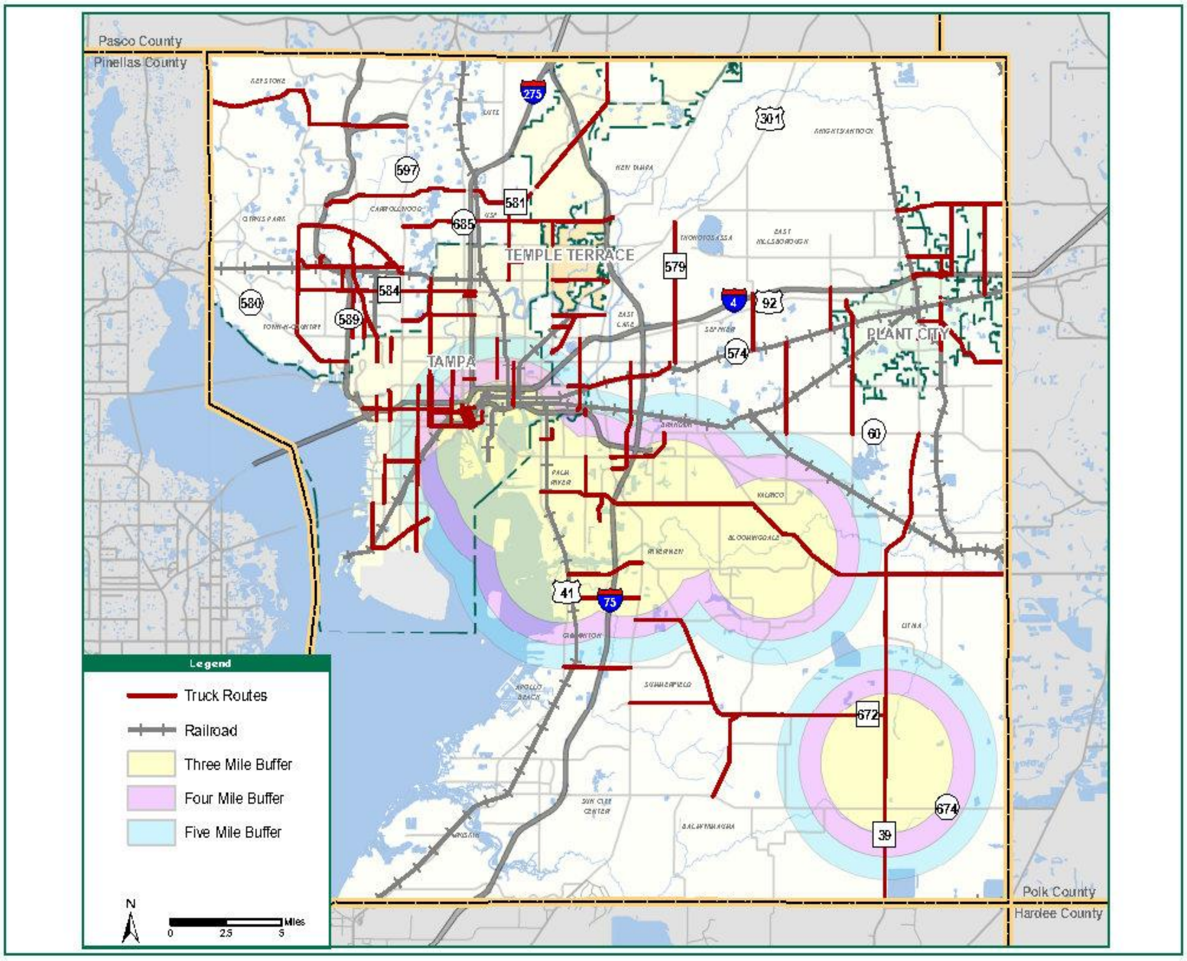


Figure 5.102. Hillsborough County Hazardous Materials Transportation Buffers

Historical Occurrences of Transportation Incident

Due to the vast number of transportation routes, transportation incidents are common. Below are some of the major incidents that have occurred in Hillsborough County.

The following, in Table 5.179, are significant historical waterway accidents in/near Hillsborough County:

Table 5.179. Historical Occurrences of Transportation Incidents

Date	Description
January 28, 1980	USCGC *Blackthorn*, a 180-foot seagoing buoy tender, and the tanker SS *Capricorn* collided near the Sunshine Skyway Bridge. The *Blackthorn* capsized and sank, killing 23 of her crew.

Date	Description
May 9, 1980	The freighter MV Summit Venture collided with a support column of the Sunshine. Skyway in a thunderstorm, causing a section of the bridge to collapse. Six cars, a truck, and a passenger bus fell into the water, killing 35 people.
August 10, 1993	Two fuel barges and a phosphate freighter collided near the entrance to Tampa Bay, causing a spill of about 330,000 gallons of heavy fuel oil and 32,000 gallons of jet fuel, diesel, and gasoline.
December 11, 2018	A casino boat caught fire; reason unknown. 1 passenger died while more than 50 others suffered injuries.

Probability of Future Transportation Incident

There is no sure way to predict future transportation incidents, as most typically occur without warning. The probability of a major transportation event in the county is perceived to be high. The Florida Department of Transportation (FDOT) is part of an ongoing assessment of the state's vulnerability and coordinates efforts to prepare for, prevent, mitigate, respond to, and recover from transportation events that affect the state. In coordination with other transportation agencies such as the FAA, PHMSA, USCG, and CBP, FDOT ensures the safe travel and transportation of people and goods throughout the state.

Potential Effects of Climate Change on Transportation Infrastructure

A changing climate can modify the types and quantity of food we eat, where we live, the types of available jobs, and how people and goods move. Climate change is projected to have significant impacts on transportation infrastructure and operations. Increase in other hazards, such as increased storm frequency and severity, higher drought probability, extreme precipitation events, rising temperatures, and an increased risk of wildfires. These changes will result in rising maintenance costs, higher costs for erosion and flood control prevention, and increased energy costs for transportation facilities. Coastal infrastructure will become more vulnerable to extreme weather events due to rising sea levels and storm surges, leading to degradation and loss of infrastructure. Additionally, the effects on transportation will also cause negative impacts and transportation time on supply chains, commercial fishing, and cargo ships' ability to navigate through commonly dredged channels.

Transportation Incident Impact Analysis

- Public
    - Mass casualties
    - Injury or death
    - Delays

- Responders
    - Danger in reaching victims/survivors.
    - Injury or death during rescue efforts
- Continuity of Operations (including continued delivery of services)
    - Normal transportation operations may not return to normal for a significant time due to repairs.
    - Goods cannot be delivered or accepted.
- Property, Facilities, Infrastructure
    - Potential damage to infrastructure and public transportation programs
    - Shutting down affected highways, railways, airports, etc.
- Environment
    - Hazardous material spills
    - Pipeline burst/leak
- Economic Condition
    - Cost for repairs and down time
    - Could cause loss in revenue or wages
        - Loss in shipping revenues
        - Loss of tourism
- Public Confidence in Each Jurisdiction's Governance
    - Citizens may lose trust in particular public transportation services
    - Tourists may reconsider visiting Florida

Vulnerability Analysis and Loss Estimation by Jurisdiction

Due to the nature and unpredictability of technological hazards, all property and infrastructure in the county are at risk to these incidents and events. Due to the significant tourism in the county, all the municipalities are at risk. Hillsborough is at a higher risk with large transportation hubs, especially within the metropolitan area of Tampa, such as the airports, port, and the three cruise terminals.

Major HazMat incidents can occur at any facility that produces, uses, or stores hazardous materials. These include chemical manifesting plants, laboratories, shipyards, railroad yards, warehouses, or chemical disposal areas. Illegal dumpsites can appear anywhere. Accidents involving the transportation of hazardous materials can occur at any time and severely impact the affected community. The shipping channel and port area would be most impacted by an ammonia transportation incident. The northern half of the county could be largely affected if there was a chlorine release during transport based on the delivery corridor route.

Vulnerability Analysis and Loss Estimation of Critical Facilities

Due to the nature and unpredictability of technological hazards, all property and infrastructure in the county are at risk to these events. Large transportation hubs such as airports or ports are at a higher risk.

The county recognizes that critical facilities are vulnerable to transportation incidents, but there is a lack of data to quantify the vulnerability of facilities to these hazards compared to natural hazards.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.8 (Table 5.180).

Table 5.180. Overall Vulnerability to Transportation Incidents for Hillsborough County

<table>
<tr><th colspan="5">TRANSPORTATION INCIDENT</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Transportation systems are designed to move people, goods, and services efficiently, economically, and safely from one point to another. As the movement of people, goods, and services increases due to population growth and technological innovation, the need to plan for events becomes increasingly important. Hillsborough County has a large transportation network that consists of airports, major highways, passenger railroads, marine ports, and pipelines. These transportation systems provide lifeline services for communities and are vitally important for response and recovery operations. The vast network of public and private critical infrastructure owners and operators, the infrastructure and services they manage, and the extensive interdependencies among the transportation modes and other sectors indicate the need for coordinated planning to manage all hazards efficiently and effectively.</td><td colspan="2">Moderate</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Possible</td><td>Critical</td><td>Moderate</td><td>< 6 hrs</td><td>Somewhat Concerned</td><td>< 1 week</td><td>2.8</td></tr>
</table>

4.20 Space Weather Hazard Profile

Space Weather Description

Space weather is a broad term used to describe atmospheric events that have the potential to adversely affect conditions on Earth. Space weather events are caused by the interaction of Earth with emissions from the Sun. There are two causes of space weather events, coronal mass ejections (CMEs) and solar flares, which are different incidents that occur on the Sun. CMEs and solar flares can cause three different types of space weather events on Earth - geomagnetic storms, solar radiation storms, and radio blackouts.

When space weather does interact with Earth and its magnetic field, technology on Earth can be disrupted. This disruption can include technologies which operate critical infrastructure. For example, communications networks, satellite and airline operations, navigation systems, and the electric power grid could be disrupted, causing severe problems and damage.

According to the National Space Weather Strategy, published in October 2015 and updated in October of 2019, space weather poses a significant risk to the security of our country, including infrastructure and the economy. This is because our nation is becoming more and more dependent on technology, and the failure of one critical infrastructure facility or system could lead to failures in many other systems.[457]

The Space Weather Operations, Research and Mitigation (SWORM) Task Force was created in 2014 with the goal of uniting the national and homeland security field with the science and technology industry to formulate a cohesive vision to enhance national preparedness for space weather. The SWORM Task Force created the Space Weather Strategy and Action Plan, a consolidated document to guide federal level actions to achieve the goal. [458] This document builds on recent efforts to reduce risks associated with natural hazards and improve resilience of essential facilities and systems. It contains objectives and sets of actions to take in order to improve preparedness and resilience. An implementation plan of the National Space Weather Strategy was published in December of 2023.

Causes

As stated before, space weather events are caused by two types of incidents on the surface of the Sun. These will be discussed below.

Coronal Mass Ejections

Coronal mass ejections (CMEs) are large eruptions of plasma and magnetic field structures in the Sun's atmosphere, which then travel through space at millions of miles per hour, eventually reaching Earth and affecting Earth's own magnetic field. When CMEs erupt from active regions on the Sun, they are often accompanied by large solar flares.

---

[457] https://trumpwhitehouse.archives.gov/wp-content/uploads/2019/03/National-Space-Weather-Strategy-and-Action-Plan-2019.pdf

[458] https://trumpwhitehouse.archives.gov/wp-content/uploads/2019/03/National-Space-Weather-Strategy-and-Action-Plan-2019.pdf

Solar Flares

Solar flares are sudden bursts of electromagnetic radiation, including x-rays and ultraviolet light. The Sun continually streams out solar wind, which consists of charged particles, or plasma, travelling at high speeds. Solar wind carries the solar magnetic field into space where it interacts with magnetic fields of planets. When solar wind is very fast or turbulent, it can cause changes in the magnetic fields of planets; this is the basis of a geomagnetic storm. X-rays from solar flares affect Earth's ionosphere by causing a prompt loss of its ability to reflect long-range radio waves, which results in a radio blackout event. The plasma from solar flares can damage satellites and cause high-frequency radio blackouts in polar regions and the sun-facing side of Earth.

Space Weather Events

CMEs and solar flares can cause three different types of space weather events on Earth, discussed below.

Geomagnetic Storms

Geomagnetic storms occur when CMEs affect Earth's magnetic field. Earth's magnetic field attempts to adjust to the large amounts of energy from the Sun carried in solar wind. CMEs from the Sun can disturb Earth's geomagnetic field for days, and several CMEs at once may cause prolonged disturbed periods. Geomagnetic storms usually last from a few hours to a few days, but stronger storms can last up to a week.

These storms induce currents that can have significant impacts on technological systems and critical infrastructure, including electrical transmission equipment. Electric power companies have procedures in place to mitigate the impact of geomagnetic storms. Strong geomagnetic storms are visible from Earth, in the form of aurora, which becomes brighter and moves closer to the equator during a storm.

Geomagnetic storms are measured on a scale from G1: Minor to G5: Extreme.

Table 5.181, below, from the National Oceanic and Atmosphere Administration (NOAA) describes the effects and frequency in detail. [459]

[459] https://www.swpc.noaa.gov/noaa-scales-explanation

Table 5.181. Geomagnetic Storm Scale

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
G5	**Extreme**	**Power systems:** Widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G4	**Severe**	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF	Kp = 8	100 per cycle (60 days per cycle)

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
		radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).		
G3	**Strong**	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).	Kp = 7	200 per cycle (130 days per cycle)
G2	**Moderate**	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (900 days per cycle)
G1	**Minor**	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

Solar Radiation Storms

Solar radiation storms occur when there is a giant eruption from a sunspot region, causing large quantities of charged particles, or plasma, to accelerate through space and cover the near-Earth satellite environment with high-energy particles. These storms occur about 30 minutes to several hours after a solar flare, and they can last from a few hours to a few days. Sometimes these storms can penetrate down to Earth's surface.

Solar radiation storms cause the loss of high frequency (HF) radio communications in the polar region. Because of the increase in radiation, astronauts, as well as passengers and crew in aircraft at high altitudes and latitudes, are at risk of increased radiation exposure. Additionally, these storms can cause navigation position errors and damage to satellite systems.

Solar radiation storms are measured on a scale from S1: Minor to S5: Extreme. Table 5.182 from NOAA describes the effects and frequency in detail. [460]

Table 5.182. Solar Radiation Storm Scale

Scale	Description	Effect	Physical measure	Average Frequency
S5	**Extreme**	**Biological:** Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. **Other systems:** Complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S4	**Severe**	**Biological:** Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions	10^4	3 per cycle

[460] https://www.swpc.noaa.gov/noaa-scales-explanation

Scale	Description	Effect	Physical measure	Average Frequency
		and increased navigation errors over several days are likely.		
S3	**Strong**	**Biological:** Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	**Moderate**	**Biological:** Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. **Satellite operations:** Infrequent single-event upsets possible. **Other systems:** Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S1	**Minor**	**Biological:** None. **Satellite operations:** None. **Other systems:** Minor impacts on HF radio in the polar regions.	10	50 per cycle

Radio Blackouts

Radio blackouts are caused by the bursts of x-rays and ultra-violet radiation from solar flares. These x-ray and ultra-violet ray emissions that come along with solar flares ionize (by increasing electron densities) the sunlit side of Earth, which increases the amount of energy lost as radio waves pass through the region. These blackouts are the fastest and among the most common of space weather events to affect Earth. Earth is impacted after about eight minutes because the x-rays travel at the speed of light, and it takes about eight minutes for the light from the Sun to reach Earth. This makes advance warning for these events difficult. These blackouts usually last for several minutes but can last up to a few hours.

High frequency (HF) communications ranging from 3 to 30 MHz can be disrupted by solar flares. Very high frequency (VHF) communications range from 30 to 300 MHz can be faded or have diminished reception because of solar flares. Like solar radiation storms, radio blackouts affect HF and VHF communications, polar regions, and the sunlit side of Earth, with impacts being primarily felt by aviation and marine industries.

Radio blackouts are measured from R1: Minor to R5: Extreme.

Table 5.183 below from NOAA describes the effects and frequency in detail.[461]

Table 5.183. Radio Blackout Scale

Scale	Description	Effect	Physical measure	Average Frequency
R5	**Extreme**	**HF Radio:** Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for several hours. This results in no HF radio contact with mariners and en-route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20	Less than 1 per cycle
R4	**Severe**	**HF Radio**: HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation**: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10	8 per cycle (8 days per cycle)
R3	**Strong**	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for	X1	175 per cycle (140 days per

461 https://www.swpc.noaa.gov/noaa-scales-explanation

Scale	Description	Effect	Physical measure	Average Frequency
		about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.		cycle)
R2	**Moderate**	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.	M5	350 per cycle (300 days per cycle)
R1	**Minor**	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.	M1	2000 per cycle (950 days per cycle)

Protection

Earth's magnetosphere, ionosphere, and atmosphere protect us from the most hazardous effects of space weather. However, the amount of protection from space weather events depends on the location of impact. The polar regions are most affected because the magnetic field lines at the poles extend vertically downwards, allowing particles to spiral down the field lines and penetrate the atmosphere, increasing ionization. Extreme storms can produce disruptive and potentially damaging effects to medium and low Earth orbit satellites and lower mid-latitude terrestrial electric grids. Both satellite communications and ground-based utilities have mitigation measures that can be activated, such as temporarily ceasing non-essential maintenance operations, reducing the load on vulnerable equipment, increasing reactive reserve power, and taking steps to maximize system reliability.

Forecasting

Space weather can be predicted and forecasted. There are three levels of alerts that can be sent out for space weather: a watch, a warning, and an alert.

A **watch** is when the risk of a potentially hazardous space weather event has increased significantly, but its occurrence or timing is still uncertain. A space weather watch is intended to provide enough advance notice, usually a few hours or days, for protection plans to be implemented.

Warnings are sent out when a significant space weather event is occurring, imminent, or likely. These alerts are short term and there is a high confidence of occurrence. The warning is intended to give a lead time of a few minutes to a few hours.

An **alert** is sent out to indicate observed conditions, usually after a warning has been sent out, to inform that a space weather event has already started.

Solar Cycle

The solar cycle is a 9- to 14-year period, or an 11-year average, that the Sun goes through to release magnetic energy. The peak is the solar maximum, when there may be hundreds of sunspots visible at any time. The low is the solar minimum, when there can be many days in a row with no sunspots visible.

The first recorded solar cycle began in 1755. We are currently in year 5 of cycle 25, which began in 2019.[462] Solar maximum is expected in July 2025, with a peak of 115 sunspots.

Geographic Areas Affected by Space Weather

Any region of Earth is susceptible to the effects of space weather. The sunlit side of Earth – whichever happens to be at the time of impact – will have more effects than the unlit side of Earth. Additionally, there are stronger effects to communication systems and radiation exposure at higher altitudes and higher latitudes, such as in the polar regions.

The effects of space weather can affect more than the physical location of the impact. In fact, space weather could affect the whole of North America at the same time and potentially become a global incident. For example, there may be cascading impacts. Because our power grids and communication systems are interconnected, an outage in one location could have far-reaching effects.

Florida has not been significantly affected by space weather since modern infrastructure began to be built in the 1950's. However, due to the high uncertainty of the location of geomagnetically induced impacts, extreme geomagnetic storms could produce electrical system disturbances and possibly widespread disruptions or blackouts. Figure 5.103 demonstrates that Florida, and Hillsborough County, are potentially vulnerable due to both ground connectivity and proximity to the ocean coastline. The spots in green are geomagnetically induced currents (GIC) that flow out of the power grid network and the spots in red are GICs that flow into the power grid network.

[462] https://www.nws.noaa.gov/om/space/index.shtml

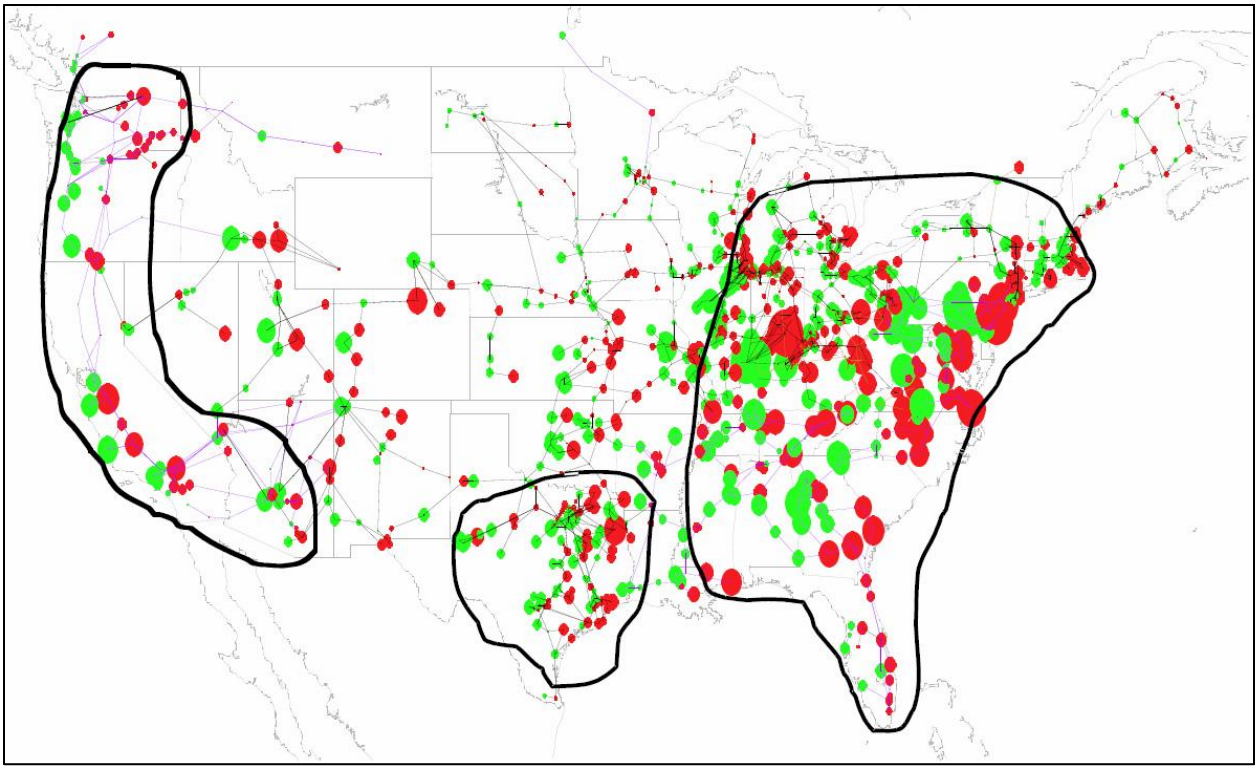


Figure 5.103. United States Regions Susceptible to Electric System Collapse, 100-year Geomagnetic Storm 45-degree Latitude Scenario [463]

[463] https://www.ferc.gov/sites/default/files/2020-05/ferc_meta-r-319.pdf

Figure 5.104 depicts the electric field amplitudes (color-scale) and direction (barbs) during a simulated Carrington-level storm. Regions shaded in dark purple are experiencing the strongest surface electric fields at that time.

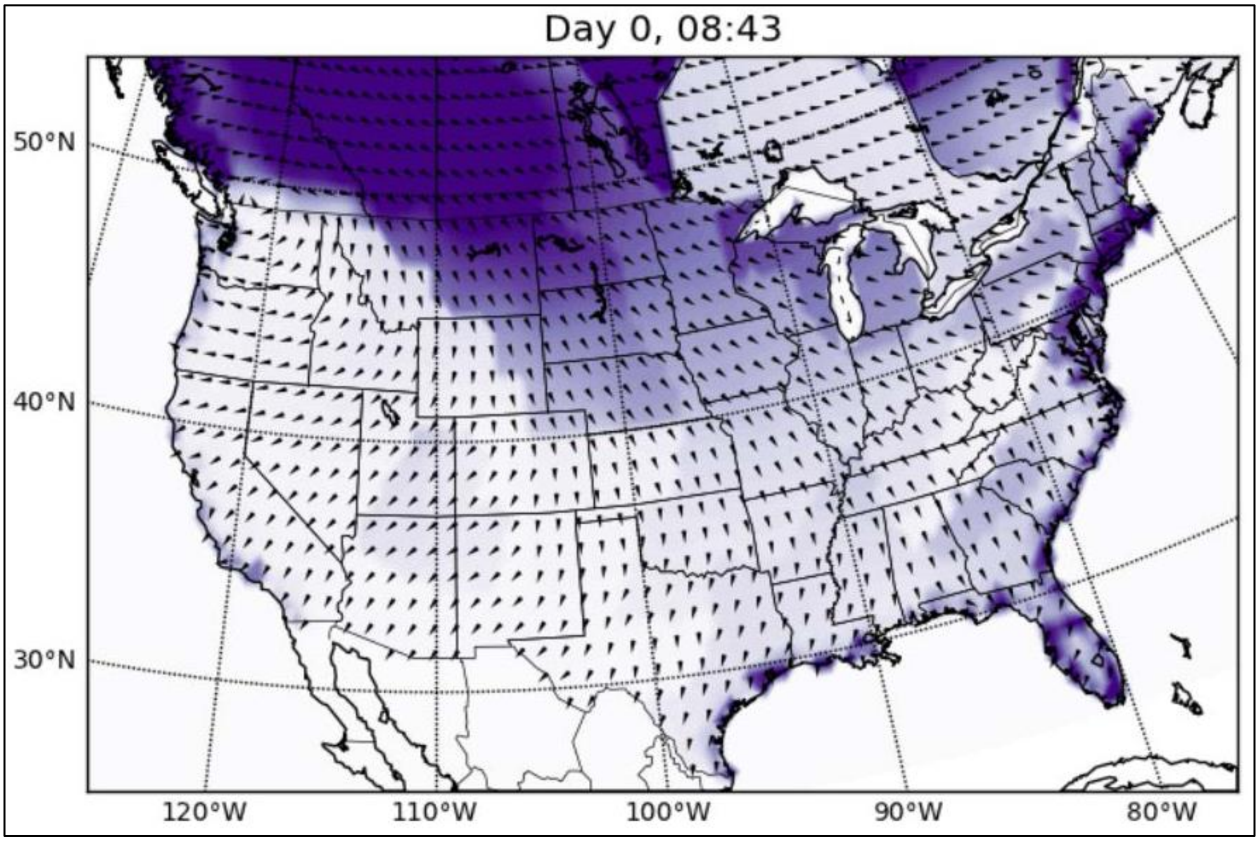


Figure 5.104. Carrington Level Storm Electric Field Amplitudes Model[464]

Historical Occurrences of Space Weather

There has not been a space weather event to significantly affect Florida since the United States began recording such incidents in the 1950s. However, space weather can affect any region at any time. Table 5.184 provides examples of significant historical events.

Table 5.184. Notable Historical Occurrences, Space Weather

Date	Description
September 1859	The strongest Geomagnetic Storm in recorded history, called the Carrington Event, occurred. Excess currents caused telegraph lines to fail. Technicians were shocked, and some telegraph equipment even caught fire. The Aurorae from this event were seen as far south as Cuba and Hawaii.
May 1921	A powerful geomagnetic storm called the New York Railroad Storm caused similar effects as the Carrington Event. There was interference in telegraph

[464] https://assets.lloyds.com/assets/pdf-solar-storm-risk-to-the-north-american-electric-grid/1/pdf-Solar-Storm-Risk-to-the-North-American-Electric-Grid.pdf

Date	Description
	equipment, trans-Atlantic cable communications (telephone and telegraph), and railroad switching systems. Fires were also ignited in telegraph switchgear.
August 1972	A large solar flare disrupted long distance telephone communications across Illinois.
March 1989	A very powerful Geomagnetic Storm led to a major blackout in Canada, which left 6 million people without electricity for 9 hours. The storm disrupted electric power transmission from a generating station in Quebec and damaged power transformers in New Jersey.
October and November 2003	The Halloween geomagnetic storms were the strongest since March 1989. Both terrestrial electric utilities, aviation and spacecraft operations were affected by storms, but most were recoverable without incident. Temporary blackouts were reported in northern Europe. The November 20th storm also caused blackouts in northern Europe and South Africa. Several high-voltage transformers were damaged or destroyed in South Africa.
December 2005	X-rays from a solar storm disrupted satellite to ground communications and global positioning systems (GPS) navigation systems for 10 minutes.
September 2017	Solar flares disrupted radio communications during the September 2017 Atlantic hurricane relief effort. Radio blackouts occurred for hours as relief efforts were underway dealing with the impacts of Hurricane Irma, Tropical Storm Katia, and Tropical Storm Jose.
December 2023	A NASA telescope captured the biggest solar flare since 2017, which temporarily knocked out radio communication on Earth. The sun spit out the huge flare along with a massive radio burst, causing two hours of radio interference in parts of the U.S. and other sunlit parts of the world. The radio burst was extensive, affecting even the higher frequencies.

Probability of Future Space Weather

Power outages due to space weather are rare; however, significant effects could occur. The probability of future occurrences requires historic data on past occurrences. Lack of historically recorded events makes predicting future probability difficult.

The entire state of Florida and its population and infrastructure is susceptible to solar storms; however, the effect that minor solar events could have on the public, property, environment, and operations would be minimal. If a rare, major solar storm were to occur, there could be a much larger impact on the population, property, and operations. However, the environment would still not be affected.

Geomagnetic Storms

The frequency of geomagnetic storms depends on where Earth is in the average 11-year solar cycle, with most storms occurring around the solar maximum. The current solar cycle (cycle 25) maximum will occur in July 2025. These storms are also common in the declining phase, due to an increase in solar wind speeds. However, severe space weather can be observed at any time during the solar cycle.

Additionally, a CME may intensify a geomagnetic storm as it approaches the Earth. With sufficient time, a CME with a southward oriented magnetic field will cause geomagnetic storming by compressing and agitating Earth's magnetic field. Weak sub-storm to strong storming is common with hundreds of occurrences per solar cycle, less than 10-year long-term occurrence rates.

Storm intensity can also be measured in Disturbance storm time (*Dst*) with greater intensity represented by a more negative *Dst* value. Geomagnetic storms that cause the most significant disruptions and damage have Dst values of more than -300 nT (nanotesla), which may occur on Earth about 4 days per solar cycle. This means the probability of a storm with a Dst intensity value of about -450 nT occurs about once per solar cycle. A storm with an intensity similar to the March 1989 Great Storm may occur about one every 60 years, or about once per five solar cycles. Larger geomagnetic storms with intensities similar to the Carrington Event are rare and may occur about once every 250 years or more.

Furthermore, periods with very active sunspot groups, features such as corotating interaction regions, can create an interstellar environment where unexpectedly intense and prolonged geomagnetic storming can occur.

Long-term geomagnetic occurrence rates do not necessarily reflect the sun's potential to produce extreme storms at any time when active sunspot groups are present, even during lower-than-normal sunspot cycles. As an example, the STEREO A spacecraft orbits the sun at a location that is 1 AU distant from the sun, but with a view of the farside. At least twice during solar cycle 24, the sun produced major farside CME that would have likely impacted Earth if it had been in the path. The STEREO A spacecraft was able to directly observe the extreme interstellar conditions of a major CME in July 2012 and July 2017. Academic publications indicate that the July 2012 storm could have rivaled the Carrington Event.

Solar Radiation Storms

Solar radiation storms can occur at any time during the solar cycle but are most common around solar maximum.

Radio Blackouts

Radio blackouts are caused by solar flares, which are quite common. In fact, minor events or R1 events, occur about 2,000 times each solar cycle.

In the 2023 Florida State Hazard Mitigation Plan update, this hazard was determined to occur, overall, every 5 to 10 years, giving it a Probability ranking of Likely.

Space Weather Impact Analysis

The following are potential impacts of space weather on various populations and sectors.

- Public
    - Traffic accidents caused by power outages
    - Power outages
        - Lost wages
        - Perishable food and medications

- Responders
    - N/A
- Continuity of Operations (including continued delivery of services)
    - Power outages may interrupt operations or delivery of services in government, private businesses, etc.
- Property, Facilities, Infrastructure
    - Damage to electrical lines, transformers, etc. may take several days or weeks to repair
    - Damage to lines may cause fires
    - Disruptions to computer systems, telephone systems, and other communications systems
    - Water and wastewater distribution systems
    - Public transportation systems
    - All electrical systems that do not have backup power
    - Heating/air conditioning and electrical lighting systems
    - Fuel distribution systems and fuel pipelines
- Environment
    - N/A
- Economic Condition
    - Extensive power outages would close businesses, causing them to lose revenue and employees to lose wages
    - High cost of repairing damage to utilities may put a burden on utility companies and they may have to raise rates
- Public Confidence in Each Jurisdiction's Governance
    - May lose confidence in jurisdiction if communications or utilities are disrupted for an extended period of time

Vulnerability Analysis and Estimated Losses by Jurisdiction

As noted in the 2023 State Hazard Mitigation Plan update there is no way to accurately assess risk and vulnerability of jurisdictions to space weather. This is because no one county or area in Florida is more vulnerable to space weather than another. Additionally, space weather impacts are not distributed geographically like natural hazards often are, but instead are based on the power grid. Because of this, there may be impacts in Florida from damage in another state caused by space weather. A lack of historical damage prevents Hillsborough County from estimating potential future losses.

Vulnerability Analysis and Estimated Losses of Critical Facilities

Consistent with the 2023 Florida State Hazard Mitigation Plan update's treatment of state facilities, there is no way to assess the risk and vulnerability of County Facilities to space weather. This is not a geographically based vulnerability. No county facilities are particularly more vulnerable than others to being affected by space weather because the geographic distribution of impacts would be based on the power grid.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.7 (Table 5.185).

Table 5.185. Overall Vulnerability to Space Weather for Hillsborough County

<table>
<tr><th colspan="5">SPACE WEATHER</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Space weather is a broad term used to describe atmospheric events that have the potential to adversely affect conditions on Earth. Space weather events are caused by the interaction of Earth with emissions from the Sun. There are two causes of space weather events, coronal mass ejections (CMEs) and solar flares, which are different incidents that occur on the Sun. CMEs and solar flares can cause three different types of space weather events on Earth, geomagnetic storms, solar radiation storms, and radio blackouts.</td><td colspan="2">Moderate</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Critical</td><td>Moderate</td><td>< 6 hrs</td><td>Not Concerned</td><td>< 6 hrs</td><td>2.7</td></tr>
</table>

4.21 Civil Disturbance Hazard Profile

Civil Disturbance Description

FEMA defines civil disturbance, also referred to as civil unrest, as an activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain public safety.[465]

While most protestors intend to conduct demonstrations lawfully and nonviolently, these situations can become emotional and tense, sometimes turning a peaceful crowd into a violent riot.

Gatherings and Crowds

According to the U.S. Army Civil Disturbance Operations Manual, civil disturbances and riots can arise from crowds. Crowds are gatherings of many individuals and small groups temporarily assembled in the same place, usually representing a group belief or cause. [466]

There are two types of gatherings: impromptu and organized.[467] Impromptu gatherings develop informally and by word of mouth, while organized gatherings involve well-established groups that plan and organize the gathering.

There are three phases of gatherings: the assembly process, the building of the crowd, and the dispersal process.

- The assembly process phase refers to the movement of people to a common location within a given period, usually coinciding with activities of individuals or groups with a specific agenda.
- The building of the crowd phase is when individuals and smaller groups gather into a larger group to create a mass gathering event. Not all participants in a crowd have the same motivations: the majority of crowds are comprised of several small groups and only some individuals. This may make it difficult for crowd control and dispersal as some individuals and groups within the larger group will be peaceful while others may have violent intentions.
- The dispersal phase is the movement of people from the assembly location to one or more alternate locations. Dispersal can be routine, emergency, or coerced. Routine dispersal is often specified in advance by organizers, while emergency dispersal occurs when people evacuate an area in response to an unexpected crisis. A coerced dispersal involves the use of force from law enforcement at some level; however, this is not necessarily the best or safest way to force crowd dispersal.

There are several types of crowds, including casual, sighting, agitated, and mob-like. **Casual crowds** consist of people gathered in the same place but have nothing in common, such as a crowd at a mall. **Sighting crowds** are those where people have gathered in the same location for a specific event, such as a concert. **Agitated crowds** are similar to sighting crowds, but strong emotions are also

[465] https://training.fema.gov/programs/emischool/el361toolkit/glossary.htm#C
[466] https://irp.fas.org/doddir/army/fm3-19-15.pdf
[467] https://irp.fas.org/doddir/army/fm3-19-15.pdf

present, which can spread, developing a sense of unity and changing the crowd's demeanor from pleasant to yelling, screaming, crying, and name-calling. Finally, **mob-like crowds** are agitated crowds that are also aggressive, physical, and sometimes violent. While all types of crowds can turn violent and agitated, mob-like crowds have the greatest tendency to do so.

Escalation

While most gathered crowds are orderly, nonviolent, and demand attention from authorities, the character of a crowd or gathering can change, and circumstances can escalate to create a civil disturbance. A **public disorder** is a basic breach of civic order, meaning the crowd tends to disrupt the normal flow of the environment around them, such as traffic. A disorder is escalated to a **public disturbance** or a demonstration designed to cause turmoil and disruption. These crowds chant, yell, and sing to voice collective opinions. Finally, a disturbance escalates to a **riot** when violence is perpetrated by crowd members, potentially destroying property, assaulting others, and creating an extremely volatile environment.

Riots can be further categorized into communal, protest, commodity, and celebration riots.

- **Communal riots** are those involving a group of people with deep-seated ethnic, religious, or language differences.
- **Protest riots** are those involving people aggressively and sometimes violently opposing something.
- **Commodity riots** involve an attack on property with vandalism, looting, or arson.
- **Celebration riots** involve a group of people celebrating some event, usually a sports team victory.

The escalation of the character of a crowd from peaceful to violent is a complex process that is connected to individual actions within a crowd and overarching crowd dynamics. Depends on how Crowd dynamics and how people act as part of a crowd are complex topics. Crowds provide a sense of anonymity and, therefore, a sense of invulnerability, and anyone in a crowd is susceptible to behaving contrary to their normal behavior. Emotional contagion is a serious psychological factor of crowd dynamics, which provides a temporary bond of unity and can push a simple, organized crowd into a mob.

Crowds, especially angry and organized crowds, can use certain tactics to provoke law enforcement and fight with the authorities. One common tactic is verbal abuse, such as obscene language, racial remarks, taunts, and ridicule, to anger, demoralize, and provoke a physical response from law enforcement. Another tactic is throwing rocks, bottles, smoke grenades, or Molotov cocktails to disrupt and confuse the control force. Other tactics include creating barricades to protect themselves and feinting and flanking actions to engage, surround, or overpower the control force.

Crowds can become a riot or a violent mob very quickly. These types of civil disturbances are of primary concern to the State of Florida. Violent crowds strike out physically at bystanders and others in the crowd, destroy private and government property, and often set fires and smash glass. Riots or mobs also often create barricades or physical barriers, using any available materials, such as vehicles, trees, furniture, and fencing, to impede authorities' movement and provide a source of protection against law enforcement.

Although violent riots or mobs are a serious concern, nonviolent crowds can also be considered a civil disturbance. Nonviolent actions can be disruptive if they are in direct conflict with instructions from authorities. Examples of disruptive nonviolent actions are refusing to leave when instructed, locking arms, and sitting in areas authorities are attempting to clear.

Geographic Areas Affected by Civil Disturbance

Civil disturbances tend to occur in urban areas but can occur anywhere. Below is a map depicting major incidents of civil disturbance in Florida, which are discussed below in Historical Occurrences.

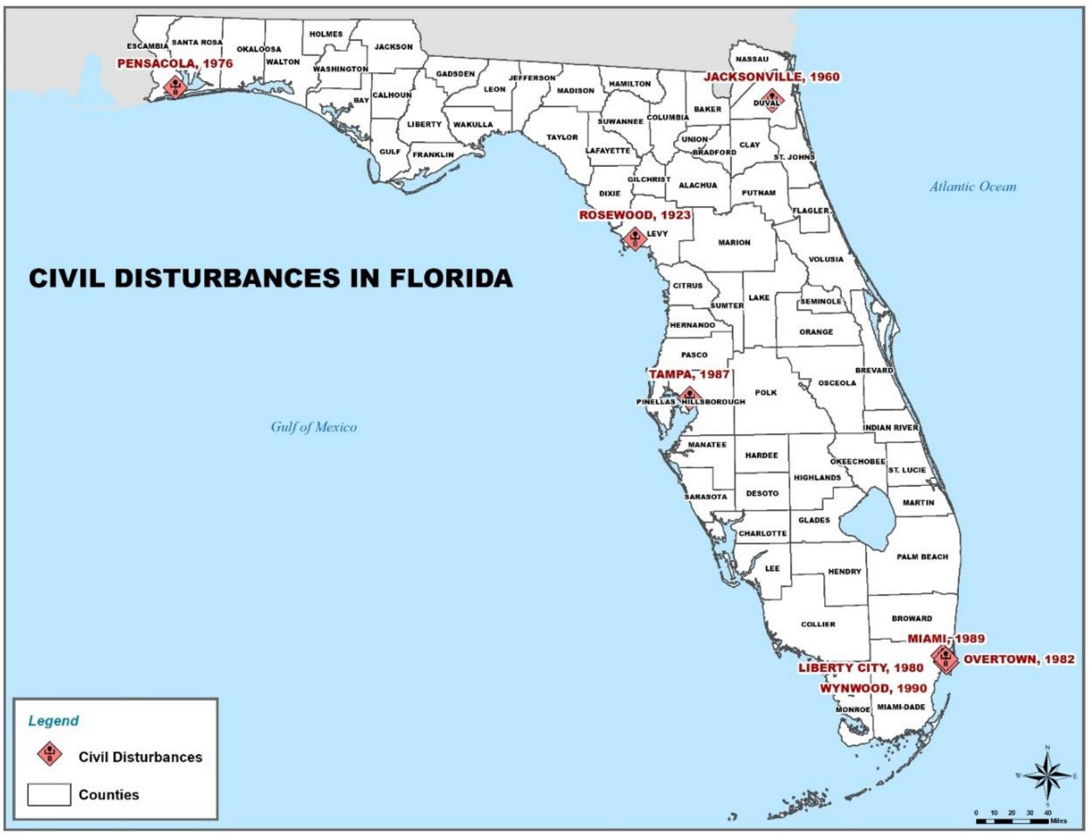


Figure 5.105. Florida Historical Occurrences, Civil Disturbance

Civil disturbances can affect any part of Hillsborough County at any time; however, areas of higher population density, particularly within the city of Tampa and Temple Terrace and Plant City, are more likely to see civil disturbances occur. Figure 2 shows the population density per square mile in Hillsborough County.

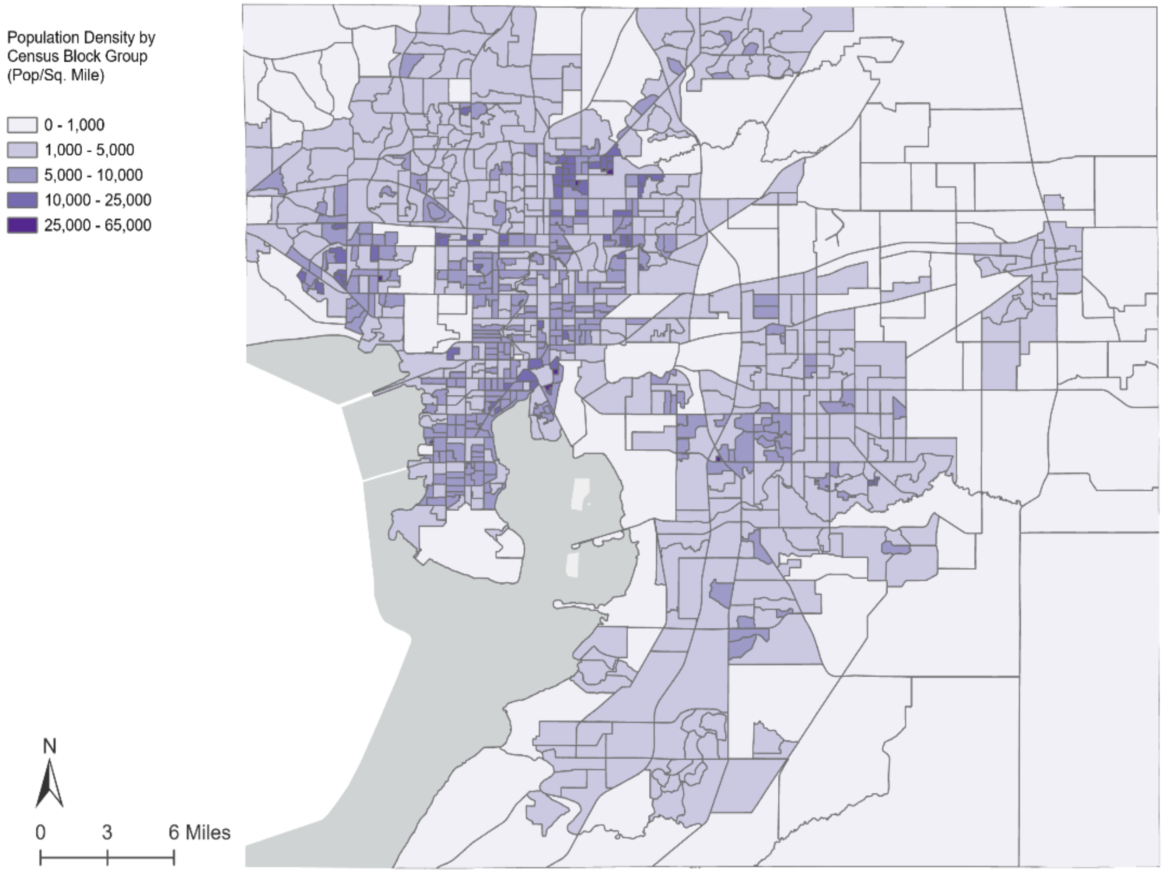


Figure 5.106. Population Density by Census Block Group

Historical Occurrences of Civil Disturbance

Hillsborough County has been impacted by several large civil disturbances during the last several decades. The 1967 Tampa Riots took place in June 1967 after a white officer of the Tampa Police Department, Patrolman James Calvert, fatally shot a 19-year-old Black man named Martin Chambers. The ensuing riot lasted for four days as citizens clashed with the police, 100 people were arrested, and $2 million in damages were to be dealt with.

Two separate events spurred a series of civil disturbances in February 1987. A Tampa Police Officer, David D'Agresta, used a controversial chokehold to subdue a Black man named Marvin Eugene Hair in custody, who later died of suffocation. Later that evening, the media reported the arrest of a famous black athlete, Dwight Gooden, a pitcher for the New York Mets, In which the same controversial chokehold was used. That night, a riot broke out with angry citizens throwing rocks and bottles. The violence lasted for several nights until it finally subsided. After the death of Hair, the usage of chokeholds by the police was banned, and the officer, David D'Agresta, was suspended without pay.

Probability of Future Occurrences of Civil Disturbance

The civil disturbance will continue in the future. Not only is the potential for civil disturbance always present--regardless of a gathering's intent--but the fundamental right to protest is protected by the U.S. Constitution.

Acknowledging this, Hillsborough law enforcement and community agencies have instituted several successful programs that open communication lines between opposing parties in order to prevent the escalation of conflicts. [468] One such program, introduced in 1996, is community policing, in which Community Resource Deputies (CRD) are assigned designated geographic areas and work across divisions such as patrol, investigations, and inspection services.[469] In this program, CRDs, rather than police, are responsible for solving problems between parties. In 2009, the U.S. Department of Justice found that community policing initiatives in Hillsborough County decreased the intensity and frequency of the occurrence of civil disturbances in the future.

Even with thoughtful programmatic intervention, the probability of future civil disturbance cannot be reduced completely: social, political, and economic factors are dynamic and must be monitored to gauge the threat of civil unrest.

The probability of future occurrence of civil disturbance is possible (1-10% annual probability).

Civil Disturbance Impact Analysis

- At-risk Population
    - Exposure is found to encompass all populations statewide. Populations in urban areas may be at greater risk of injury, death, and private property damage due to incidences of civil disturbance. Vulnerable populations, such as those in Justice40 designated disadvantaged communities and minority populations, may face a greater risk of injury, death, and private property damage due to possible discrimination. Individuals and populations whose jobs involve public safety, such as law enforcement officers, may also face a greater risk of the impacts of civil disturbance, such as injury and death.
- Responders
    - First responders may be more at risk of injury or death from attempting to control crowds and maintain order.
- Built Environment (Property, Facilities, Infrastructure)
    - Damage or destruction of buildings, such as government property, may occur.
    - Traffic congestion or temporary closure of major roadways may occur.
- Natural Resources
    - Although civil disturbances may not directly impact the environment, environmental issues can inspire the formation of organized gatherings in protest of a jurisdiction's environmental policy.
- Economy

[468] https://www.ojp.gov/ncjrs/virtual-library/abstracts/testing-agency-wide-hillsborough-county-implements-community
[469] https://portal.cops.usdoj.gov/resourcecenter/RIC/Publications/cops-w0746-pub.pdf

  - Loss of function and/or inventory to local businesses, i.e., vandalism, looting, or arson caused by riots may occur.
- Government
  - Continuity of operations, including damage to facilities/personnel and continued delivery of services, are likely to be impacted. Damage to facilities/personnel in the area may require temporary relocation of operations. There could be localized disruption of lines of communication, and the destruction of facilities may postpone the delivery of some services.
  - If people are injured and/or die from civil disturbances, the local communities may believe the government is not doing all that it can to protect the safety of its citizens, e.g., whether proper safety precautions were taken to prevent a disturbance from becoming violent. Losses to state facilities may occur because of damage to infrastructure caused by riots.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Conducting a vulnerability analysis and loss estimation by jurisdiction for civil disturbances is impossible. While peaceful protests or demonstrations occur frequently, it is difficult to determine when a protest will become a civil disturbance or riot by disrupting daily operations or becoming violent. Historical experience indicates that urban (population-dense) areas of the state, such as the City of Tampa, Temple Terrace, and Plant City, are more likely to be affected by civil disturbances than the rural (population-sparse) areas.

Vulnerability Analysis and Loss Estimation of Critical Facilities

Critical facilities are not particularly vulnerable to civil disturbances. However, government buildings are often gathering locations for such events. There is a chance the group would protest in a critical facility and that the protest might turn violent or destructive. There is also the chance that since some critical facilities are in downtown areas, a facility may be damaged during civil disturbances or riots in the general downtown area. A loss estimation of critical facilities for civil disturbances is not possible to conduct.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be high, with a PRI score of 2.7 (

Table 5.186).

Table 5.186. Overall Vulnerability to Civil Disturbance for Hillsborough County

<table>
<tr><th colspan="5">CIVIL DISTURBANCE
Overview</th><th colspan="2">Overall Vulnerability</th></tr>
<tr><td colspan="5">Civil disturbance is an activity such as a demonstration, riot, or strike that disrupts a community and requires intervention to maintain safety in the community. The different types of gatherings include impromptu and organized. Civil disturbance incidents tend to occur in urban locations but can realistically happen anywhere.</td><td colspan="2">Moderate</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Possible</td><td>Critical</td><td>Moderate</td><td>< 6 hrs</td><td>Moderately Concerned</td><td>< 1 week</td><td>2.7</td></tr>
</table>

4.22 Food and Waterborne Disease Outbreak Hazard Profile

Food and Waterborne Disease Outbreak Description

Waterborne and foodborne disease outbreaks occur when people are exposed to unsafe levels of man-made or naturally occurring contaminants in recreational water, drinking water, and foods. Each year, waterborne and foodborne disease outbreaks affect millions of people across the United States. Caused by bacteria, viruses, parasites, or chemical contaminants in food and water, the health effects from these outbreaks can range from gastrointestinal illness to respiratory issues to even death. Estimates of acute gastrointestinal illness associated with public drinking water systems underestimate the true incidence of waterborne disease because they do not include illnesses associated with recreational water.

The Presidential Policy Directive 21 (PPD-21) names food and agricultural systems as one of the 16 critical infrastructure sectors.[470] As of the 2020 Census, the food service and accommodation industries are among the top three industries as a source of employment for Hillsborough County residents, with 828,153 people. In 2017, agribusiness, which encompasses food production and processing phases, was valued at over $865 million, with further commercial food processing, distribution, and preparation contributing $80-100 million annually to the local economy in sales, jobs, and tax revenue.[471] [472] Outbreaks of foodborne illness can produce a loss of faith by consumers in the commercial food industry, which can cause a significant loss of jobs and revenue for agribusiness and food/accommodation industries.

The Center for Disease Control and Prevention (CDC) defines food and waterborne disease outbreaks as incidents in which two or more persons experience a similar illness resulting from the ingestion of a common food item. Foodborne illness, also known as food poisoning and foodborne infections, may result from contamination of food and water items with bacteria, viruses, parasites, fungi, and toxins. This contamination may occur during any point in the process of bringing food from the farm to the table, collectively known as the *food production chain* or *food chain*.[473] Figure x illustrates the food production chain.

The food chain can be divided into four main phases, shown below in Figure 5.107: (1) Production, (2) Processing, (3) Distribution, and (4) Preparation. [474] This hazard assessment will focus on public food chain activities.

[470] https://www.dhs.gov/cisa/critical-infrastructure-sectors

[471] Hodges, A., & Stevens, T. (2016). Economic contributions of agribusiness and food industries in Hillsborough County, Florida. Retrieved from https://fred.ifas.ufl.edu/pdf/Extension/Economiccontributionsagribusinessfoodindustrieshillsboroughcounty.pdf

[472] UF/IFAS Hillsborough County Extension. (2019). Military Agricultural Tour (Presentation).

[473] Food and Drug Administration. (2018, September 05). What you need to know about foodborne illness. FDA Consumers.https://www.fda.gov/food/consumers/what-you-need-know-about-foodborne-illnesses

[474] Centers for Disease Control and Prevention. (2017, September 05). How Food Gets Contaminated. Food Safety. https://www.cdc.gov/foodsafety/production-chain.html

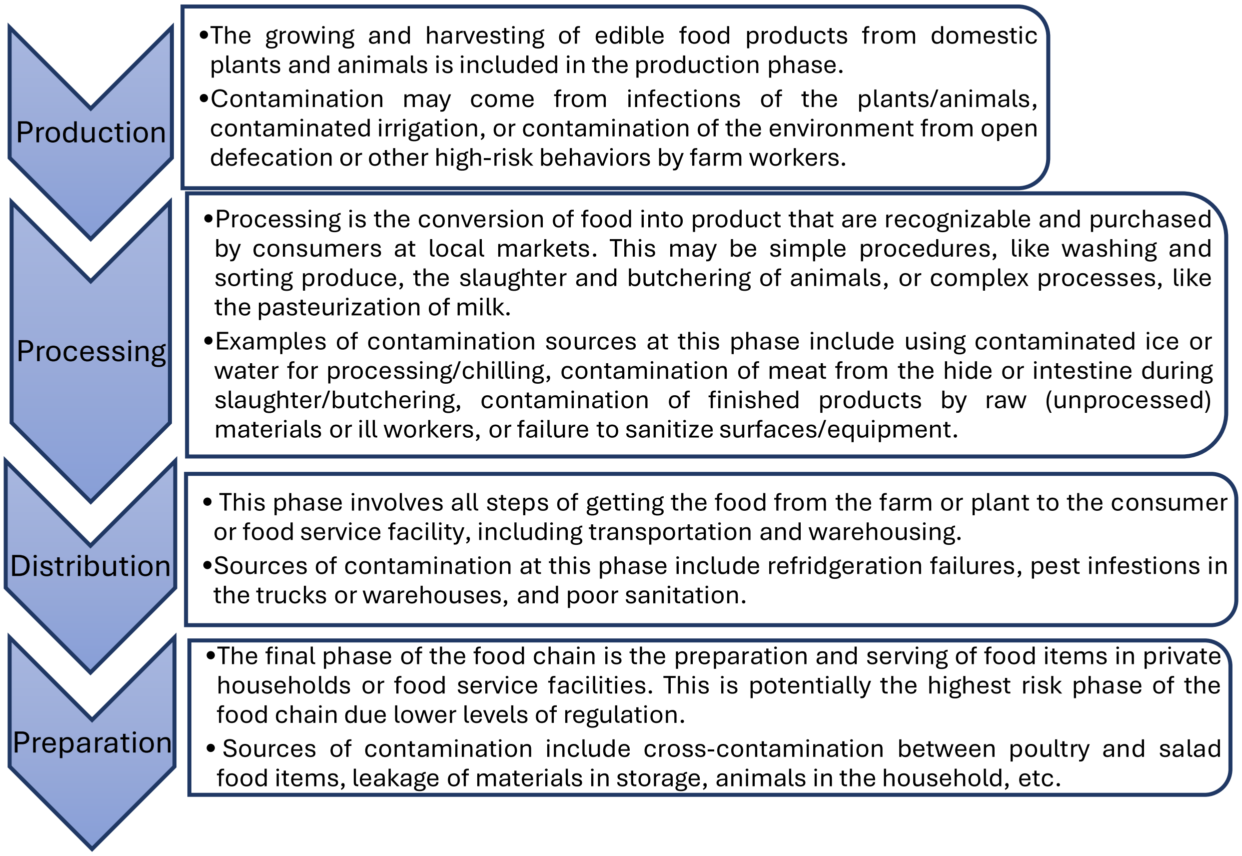


Figure 5.107. Food Production Chain Scheme

Understanding food production and food/waterborne disease outbreaks requires an understanding of the following definitions:

- **Food Security**: the reliable availability of a sufficient quantity of food that is safe and nutritious and appropriate for that population (i.e., does not conflict with intrinsic religious or cultural preferences)
- **Food Safety**: the protection of food products from **unintentional** contamination by germs or chemicals reasonably **likely to occur** in that food chain scheme (e.g., E.coli, Listeria, or chemicals/sanitizers used in production)
- **Food Defense**: the protection of food products from **intentional** contamination by biological, chemical, physical, or radiological agents that are **not likely to occur** in that food chain scheme.
- **Consumer Product Tampering**: this refers to the intentional contamination of food or water items at the consumer level (i.e., in grocery stores and food service facilities); it includes contamination of products with bodily fluids (e.g., spitting), opening of packages/containers to taste or alter contents, etc.; consumer product tampering is a punishable offense.
- **Agroterrorism**: the deliberate introduction of an animal or plant disease with the goal of generating fear over the safety of food, causing economic loss, and/or undermining social stability; usually considered a subset of bioterrorism; sometimes referred to as food terrorism

Symptoms and Disease Detection

Food and waterborne illnesses often result in generalized gastrointestinal symptoms, including diarrhea, intestinal cramping, vomiting, fevers, and a general feeling of unwellness (malaise). These symptoms are usually self-limiting and mild in the average healthy individual but can become severe in some situations. *Clostridium botulinum* produces the most toxic substance on the planet, resulting in profound weakness and respiratory arrest, a syndrome known as botulism. Listeria species can cause infections of the brain coverings (meninges) and failure of pregnancy in women. Biologic and non-biologic chemical contaminants can cause any number of symptoms ranging from mild to severe acute to severe chronic effects.[475]

Most of the food and waterborne disease outbreaks occur due to food safety challenges or failures. These failures may stem from pathogens routinely carried by food animal sources, contamination from sick or ill food handlers, refrigeration failures, or consumption of raw or undercooked food products. For example, the well-known Listeria outbreak related to Blue Bell Ice Cream products (2015) was traced to contaminated fruit and nuts that were added to the ice cream in the final stages of processing.[476] The more recent *Escherichia coli* O157:H7 outbreak (2018) linked to romaine lettuce grown in northern and central California likely occurred due to contamination of the lettuce at the production (farm) phase.[477] More locally, a Hillsborough County restaurant was sued recently due to a foodborne disease incident that resulted in Guillain Barre syndrome and the permanent debilitation of a Florida resident. News reports surrounding this incident indicate that the disease was the result of consuming raw oysters.

Each of the following agencies is responsible for regulating specific types of food-handling facilities:

Florida Department of Health (FDOH), Division of Environmental Health

- Institutional settings
- Civic and fraternal organizations
- Theaters
- Drinking water safety/testing
- Food safety and sanitation ratings

Florida Department of Business and Professional Regulation (DBPR), Division of Hotels and Restaurants

- Public Lodging

Florida Department of Agriculture and Consumer Services (DACS), Division of Food Safety

- Grocery stores

---

[475] Centers for Disease Control and Prevention. (2015, October 15). Confirming Diagnosis. Foodborne Outbreaks. Https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html
[476] Centers for Disease Control and Prevention. (2015, June 10). Blue Bell Creameries Ice Cream Products. Listeria (Listeriosis). https://www.cdc.gov/listeria/outbreaks/ice-cream-03-15/index.html
[477] Centers for Disease Control and Prevention. (2019, January 09). Outbreak of E. coli Infections Linked to Romaine Lettuce. E. coli (Eschericha coli). https://www.cdc.gov/ecoli/2018/o157h7-11-18/index.html

- Gas stations
- Food Recalls

Institutional customers, like food service vendors or non-regulatory government agencies, can require customer audits of food production and processing facilities to guarantee that products purchased meet their standards. Local governments, private customers, and non-governmental organizations can set requirements and standards for food production/processing/service facilities. However, these organizations cannot set standards that deviate from the minimum level of safety set by the federal equivalent agencies (i.e., U.S. Department of Agriculture, Environmental Protection Agency, Food and Drug Administration, and CDC) and code of federal regulation.

In addition to food safety issues, there are documented cases of threatened or actual intentional tampering with the food chain. Intentional food chain contamination or tampering may stem from a variety of political, economic, or social motivations.[478] Consumer product tampering is most often non-malicious acts of mischief, which are rarely investigated or reported. Cases of disgruntled food industry workers sabotaging the food chain in retaliation to an employer are another relatively frequent occurrence, according to the Food and Drug Administration (FDA). Larger offenses stemming from specific political or economic agendas, agroterrorism, or food-terrorism attacks are rare occurrences. Efforts to prevent these types of malicious activities fall under the definition of food defense.

Geographic Areas Affected by Food and Waterborne Disease Outbreaks

Any person or facility that produces or handles food and drink products has the potential to cause a foodborne illness among consumers of the contaminated products. Public facilities such as restaurants, grocery stores, farmer’s markets, cafeterias, and gas stations are examples of facilities that pose a higher risk of foodborne disease outbreaks. Public recreational water facilities, including pools, fishing areas, and waterparks, are an additional source of food and waterborne disease outbreaks. About half of Hillsborough’s land mass is dedicated to some phase of the commercial food chain.

The food chain is pervasive throughout the county, as seen on the map below. Food production (agriculture) is localized most intensely to the eastern and southern areas of the county, with a large majority of the food chain in Plant City and Tampa. Post-production activities (i.e., food processing, distribution, and preparation) are localized to population-dense areas in the central area of the county (downtown, South Tampa, and along major traffic corridors), along State Road 60 in Brandon, US 301 in Riverview, and in the Plant City area.

---

[478] Mackzka, C. (2008, January). Food Safety vs. Food Defense: Differences and Similarities (Presentation). Office for Food Defense and Emergency Response, Food Safety and Inspection Services. https://www.slideshare.net/ AhmedGamalAbdElhamid/food-safety-vs-food-defense

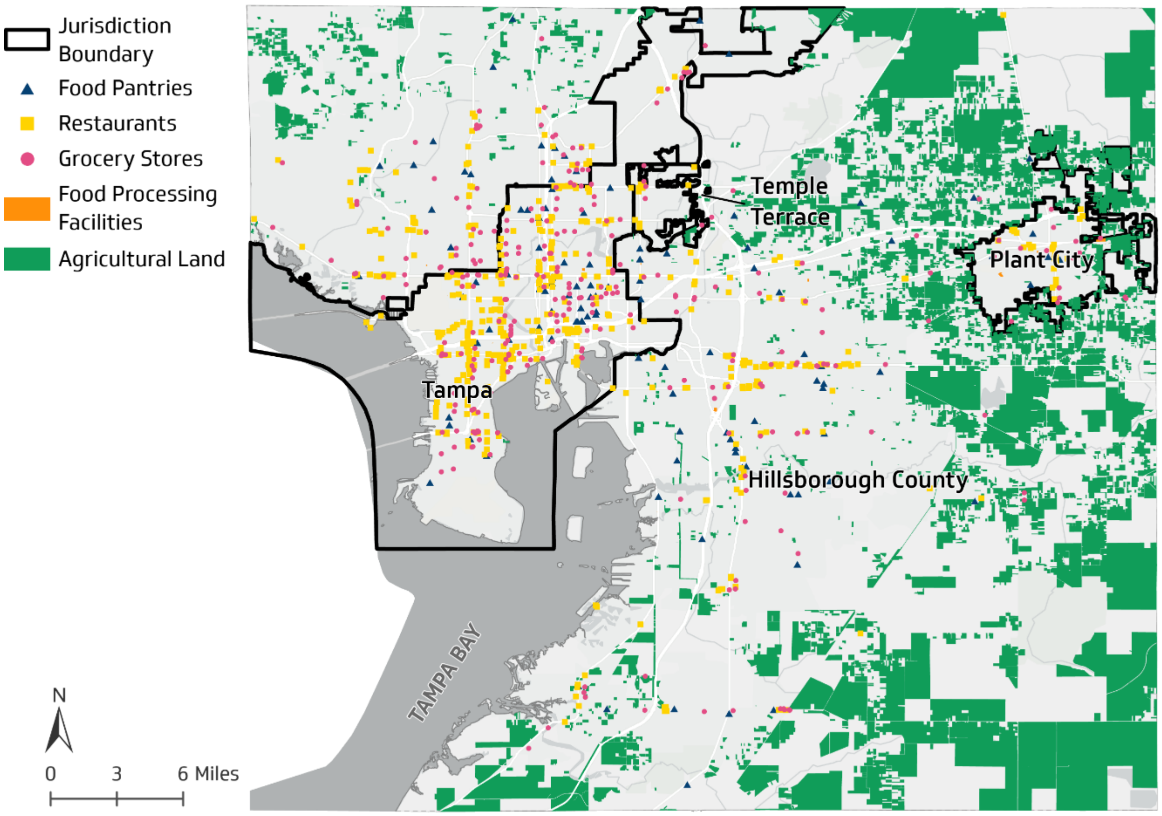


Figure 5.108. Map of the Food Chain in Hillsborough County, 2024[479] [480]

Figure 5.108 shows a representative distribution of businesses and facilities that are dedicated to some aspect of the food chain in Hillsborough County and may not show all possible locations where food is prepared and served. Assisted living facilities, hospitals, hotels, daycare facilities, schools, and private residents are additional locations where food is likely being prepared and served that are not depicted in this map.

Historical Occurrences of Food and Waterborne Disease Outbreaks

This section discusses major, specific disease outbreak investigations or interventions and food and waterborne disease outbreak events. The most significant events, categorized as incidents affecting over 50 individuals, are discussed below (Table 5.187).

Table 5.187. Description of Significant Food and Waterborne Disease Outbreaks in Hillsborough County

Date	Information
Lysergic Acid	The Florida Department of Health received notification of two separate

[479] Hillsborough County Property Appraiser. (2018). Hillsborough County Parcels. Hillsborough County Property Appraiser Downloadable Maps and Data. https://www.hcpafl.org/Downloads/Maps-Data.

[480] Tampa Bay Network to End Hunger. (2018, May 31). Hillsborough County Food Pantries. http://networktoendhunger.org/web/wp-content/uploads/2018/06/Hillsborough-Pantries-May-2018.pdf.

Date	Information
Diethylamide (LSD), Spring 2014	instances of suspected intoxication with Lysergic Acid Diethylamide (LSD) associated with meat products. The first cluster involved a family treated for symptoms consistent with LSD intoxication and the presence of the drug confirmed in a skirt steak consumed by the family. The second instance involved potentially contaminated ground beef that was consumed by person(s) that died shortly following. Autopsy results indicate that the LSD exposure was not the direct cause of death. These occurrences represent a possible intentional or unintentional contamination of the food chain by a chemical agent not normally found in the food production chain scheme. Although not proven, this incident represents a case of food defense-related issues. LSD is not a chemical routinely found in the meat industry and may be the result of consumer product tampering or intentional/accidental release of the LSD chemical by a worker somewhere along the food chain.481 482
Cryptosporidium Outbreak, Summer 2014	An outbreak of cryptosporidium occurred in the Tampa Bay area, including Hillsborough County. The outbreak involved 266 cases and was associated with a local water park located in the City of Tampa. The investigation found no critical deficiencies but noted a lack of a secondary water disinfection system. In all, Hillsborough County experienced 348 cases of cryptosporidiosis in 2014, most of which were associated with this outbreak. In the summer of 2015, the same Tampa water park was associated with another cryptosporidium outbreak involving 22 suspected or confirmed cases.
Hepatitis A Outbreak, August 2019	The Florida Surgeon General declared a public health emergency related to an ongoing Hepatitis A outbreak. Since the start of 2018, Florida has seen 2,961 cases of hepatitis A, which is nearly five times more than has been seen from 2014 to 2017 combined. Hillsborough County is included in this outbreak, with 200 cases seen between January 2018 and August 2019. The exact source of the outbreak has not been identified. Hepatitis A is spread through the contamination of food, water, and environmental surfaces with infected fecal material. The disease causes significant inflammation and dysfunction of the liver. The Surgeon General's public health emergency declaration signals healthcare professionals to give special emphasis to diagnosis, vaccination, and public education.[483]

Based on Florida DOH records, of the 20 most diagnosed food and waterborne pathogens, there have been over 7500 reported cases between 2014 and 2024.

---

[481] https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5218a3.htm

[482] http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/data-and-publications/fl-amsr1.html

483 Florida Department of Health. (2019, September 03). Protect Yourself: Hepatis A is on the rise in Florida counties. Hepatitis A. http://www.floridahealth.gov/diseases-and-conditions/vaccine-preventable-disease/hepatitis-a/index.html

Table 5.188 shows the results of Facility Inspections (2004-2023), Outbreak Investigations (2016-2021), and Food Safety Recalls (2020-2023).

Table 5.188. Facility Inspections (2004-2023); Outbreak Investigations (2016-2021); Food Safety Recalls (2020-2023)

Over 213 food product recalls were initiated by the U.S. Department of Agriculture and the Florida Department of Health.[484]	**Top 5 Reasons for Recalls** • Listeria Contamination • Salmonella Contamination • *E.coli* Contamination • Quality Assurance or General Spoilage • *Clostridium* spp. Contamination
Florida Department of Health investigated 39 total food and water-borne disease outbreaks in Hillsborough County.[485]	**Top 5 Reasons for Outbreaks** • Norovirus • Unidentified/Not Specified • Scombroid Toxin • Legionella • Ciguatera Toxin and Staphylococcus - Tied
In 2023, the Florida Department of Health issued 1,211 unsatisfactory Ratings to water and food-related Hillsborough County Facilities.[486]	Average of 124 unsatisfactory ratings to Food Service Operations annually since 2004. Average of 352 unsatisfactory ratings to Pools/Spas/Recreation Water Facilities annually since 2004.

News media reports for the last year were reviewed to assess the potential occurrence of other consumer product tampering or food defense cases. Over two dozen cases were reviewed nationwide, ranging from opening sealed food containers in local grocery stores to cases of licking and urination on food items. There were at least two reported instances of consumer product tampering impacting Hillsborough County residents.

One Pinellas County woman is facing felony charges after spitting and urinating in the products of a local ice cream parlor. Her motivations were not disclosed. In another incident, a local mother reported that the baby formula she had purchased had been replaced with flour. This is not the first instance of this kind of tampering. Nationwide, the USDA FSIS and FDA have initiated two separate food recalls for incidents of employee tampering in the previous five years.

Probability of Future Occurrences of Food and Waterborne Disease Outbreaks

Food and waterborne disease outbreaks and related activities, including food product recalls, are frequent occurrences in Hillsborough County. There are hundreds of cases of food and water-related illness reported on an annual basis.

484 Inspections and Complaints | Florida Department of Health (floridahealth.gov)
485 Florida Department of Health. (2024, April 23). Food and Waterborne Disease. Florida Health: Diseases and Conditions.http://www.floridahealth.gov/diseases-and-conditions/food-and-waterborne-disease/
486 Florida Department of Health.). FL Health Charts. Florida Department of Health Division of Public Health Statistics & Performance Management. http://www.flhealthcharts.com /charts/default.aspx

As mentioned above in the table, the Florida Department of Health has investigated over 39 separate outbreaks of food and waterborne disease between 2016 and 2021 in the entire Hillsborough County. Two of the incidents were significant outbreaks (affecting more than 50 persons). That is an average of 7-8 food and waterborne disease outbreaks per year. Additionally, in the past five years, the U.S. Department of Agriculture and FDA have initiated over 213 food recalls in Florida for issues ranging from quality control to potential contamination of food and water products by disease-causing germs and chemicals. Any one of these recalls may be impacting Hillsborough food processing facilities, grocery stores, or food service facilities.[487] [488]

In general, intentional contamination of the food chain is less common than unintentional incidents but still occurs at least annually nationwide. There has been an investigation by the Florida Department of Health in the last five years into contamination of food products by chemicals/germs that are not a part of the normal food chain. Two separate food product recalls were initiated due to known instances of employee tampering. Additionally, the FDA cites that contamination from consumer product tampering is likely a daily occurrence that is rarely reported. Specific food terrorism attacks are relatively rare occurrences, only occurring every 10-20+ years.

Potential Effects of Climate Change on Food and Waterborne Disease Outbreaks

Extreme weather events, especially droughts, heat waves, severe storms, and hurricanes, can be expected to continue and potentially negatively impact the safety of the food chain. Warmer temperatures increase the growth of pathogens in food and water, leading to more frequent contamination. Flooding and hurricanes can disrupt water supplies and sanitation systems, facilitating the spread of diseases. Change in precipitation patterns also affects crop growth and food production, potentially leading to food shortages and malnutrition – which can weaken the immune system and increase susceptibility to diseases. Additionally, shifts in ecosystems and habitats may alter the distribution of disease vectors.

Climate change and globalization are also associated with a progressive northward movement of certain fungal and protozoal germs that may produce outbreaks in non-endemic areas. Rising surface temperatures and acidification of the oceans can also increase infectious germs, including *Vibrio* bacteria and the microbes that produce ciguatoxin. Increasing solubility due to rising ocean temperatures may also increase concentrations of non-organic toxins, like mercury. Chemicals that are absorbed by plants, which are then eaten by animals, can become widespread and increase in concentration, affecting all areas of the food chain. This process is known as biomagnification. The rising risk of food poisoning from a variety of food and water sources should be considered in the

[487] Florida Department of Health (2019, August 29). Florida Food Recalls Search: *Food and Waterborne Disease*. http://www.floridahealth.gov/diseases-and-conditions/food-and-waterborne-disease/florida-food-recalls.html

[488] Food and Drug Administration. (2019, August 28). Recalls, Market Withdrawals, & Safety Alerts dataset. *Safety* website. https://www.fda.gov/safety/recalls-market-withdrawals-safety-alerts

future. Improved monitoring, sanitation measures, and public health interventions are essential to mitigate these risks throughout Hillsborough County and its jurisdictions. [489]

Based on historical information, this hazard was determined to have a probability level of likely (10-100% annual probability).

Food and Waterborne Disease Outbreak Impact Analysis

The following is a list of potential impacts associated with Food and Waterborne Disease Outbreak by population and sector:

- Public
    - Injury/illness or death
    - Mass casualties
    - Public fear and unrest
    - Delays
- Responders
    - Injury/illness/death from similar food and water sources
    - Injury/illness/death from treating victims
    - Decreased availability of responders due to illness
- Continuity of Operations (including delivery of services)
    - Increased disease burden may cause localized challenges
    - Increased patient load in hospitals limits operational capacity
- Property, Facilities, and Infrastructure
    - Facility closures during investigation and response
- Environment
    - Product disposal and other waste management
    - Increased chemical use in response
    - Management of deceased
- Economic Condition
    - Hospitalization and insurance costs
    - Work hours lost in convalescence
    - Cost of investigations
    - Cost of downtime and response/cleaning for businesses
    - Product loss/destruction
    - Temporary facility closures may become permanent (lowered business economy)
- Public Confidence in Each Jurisdiction's Governance
    - Business owners may feel victimized or targeted by outbreak investigations and public response

---

[489] U.S. Global Change Research Program. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, DC. Http://dx.doi.org/10.7930/JOR49NQX

- Public fear may produce a loss of faith in local business owners, the medical community, or government agencies
- Tourists may reconsider visiting Hillsborough County and its amenities

Vulnerability Analysis and Loss Estimation by Jurisdiction

Due to no geographic area with a definable extent, all areas of unincorporated Hillsborough County, Plant City, Tampa, and Temple Terrace are considered to have the same level of exposure and vulnerability to food and waterborne diseases. How widespread an outbreak becomes and the extent it reaches is dependent upon the phase when the food product becomes contaminated. Contamination of food products in the production or processing phases may result in a multi-state outbreak, while contamination of food products at the grocery store or food service locations is more geographically confined to a single city or region. Food- and waterborne disease outbreaks affecting Hillsborough County from 2016-2023 have been localized to the greater Tampa area except for the Hepatitis A outbreak, which is part of a statewide outbreak. However, as a major seaport and tourist destination, there is a strong risk of connection with national or international disease outbreaks.

The scale of an outbreak is dependent on the number of individuals exposed to the contaminated food or water source before the contamination is recognized and/or eliminated. The scale of an outbreak may range from a small number of linked cases to a nationwide or international outbreak of thousands or more involving the mobilization of public health and emergency management resources from all levels. The scale of local outbreaks in Hillsborough (2016-2023) ranged from a few index cases to several hundred cases. No single foodborne disease outbreak was associated with case numbers above 500 within the county or associated jurisdictions, including Plant City, Tampa, or Temple Terrace.

Certain populations may be more susceptible to the negative effects of illness from food and waterborne germs and toxins. These include, but are not limited to:

- Very young (less than five years old)
- Very old (older than 65 years)
- People with certain diseases and conditions that lower the capability of their immune system (e.g., HIV/AIDS, leukemia, multiple myeloma, and some congenital and autoimmune diseases)
- People with hepatitis from a virus, toxin, or other cause
- People undergoing treatment for cancer and autoimmune disease
- Pregnant women

There are four groups of people that are at higher risk of foodborne illness: young children, pregnant women, senior adults, and immune-suppressed individuals (i.e., patients undergoing chemotherapy and organ transplants). Immune-suppressed persons and those with hepatitis infections may not be able to fight off germs associated with food and water contamination. Very old or young people may be less tolerant of nutrition and hydration losses from vomiting or diarrhea. Contamination of food items with some toxins or germs can cause specific and severe illnesses.

The association of viral hepatitis with worsening food and waterborne illness is an important concern given the current Hepatitis A outbreak in Florida. The Florida Surgeon General has declared a public health emergency in response to this outbreak, which has been ongoing since 2018. There is a strong association between outbreak cases and homelessness, but the exact risk factors are still unknown. Persons with ongoing hepatitis infections experience lower gastrointestinal health and innate immunity, which increases the risk of severe illness with food and waterborne germs. People with concurrent hepatitis are more likely to experience sepsis, multi-organ dysfunction, and other complications as a result of food and waterborne infections.[490]

Socially vulnerable populations are displayed in Figure X. Additionally, Table 5.189 below is a summary of select vulnerable populations that may increase the severity of disease outbreaks. Understanding demographics and social factors with greater vulnerability allows planners to identify strategies to mitigate risk.

Table 5.189. Vulnerable Populations in Hillsborough County to Food and Waterborne Disease Outbreaks

Vulnerability	Population Statistics[491]		Reason for Concern
	No. (x1000)	Percent (%)	
Elderly (Age 65+)	231.3	15.1	Lowered immunity, Concurrent disease conditions that may complicate treatment/recovery
Young (< 5 years)	92.1	5.7	Lowered immunity, more susceptible to metabolic stress
HIV/AIDS Incidence (2022)	0.5	<1	Lowered immunity, Concurrent disease conditions that may complicate treatment/recovery
Viral Hepatitis Incidence (2018)	1.8	<1	Lowered immunity; Increased risk of septicemia or other complications
Persons Living below Poverty	197.4	13.7 [492]	Lower financial flexibility to handle medical costs; Lower access to healthcare
Unemployment	248.6	3.0	Lower financial flexibility to handle medical costs; Lower access to healthcare
Persons without Health Insurance	210.3	13.7	Lower financial flexibility to handle medical costs; Lower access to healthcare
Foreign-Born Persons	287.1	18.7	Different disease and environmental

---

[490] Florida Department of Health. (2019 September). Protect Yourself: Hepatis A is on the rise in Florida counties. Http://www.floridahealth.gov/diseases-and-conditions/vaccine-preventable-disease/hepatitis-a/index.html

[491] Hillsborough Planning Commission. (2018). Facts and Figures 2018. Plan Hillsborough. http://www.planhillsborough.org/demographic-economic-data/ PowerPoint Presentation (planhillsborough.org)

[492] https://www.flhealthcharts.gov/ChartsDashboards/rdPage.aspx?rdReport=NonVitalInd.Dataviewer&cid=0294

Vulnerability	Population Statistics[491]		Reason for Concern
	No. (x1000)	Percent (%)	
			exposures; Vaccination status may be incomplete or unknown; Lower familiarity with systems and infrastructure
Non-English-Speaking Persons	409.5	28.5	Limits ability to communicate with English-only persons
Notes: This table presents examples of demographics and social factors with greater vulnerability and the reasons for concern in food and waterborne disease outbreaks. [493]			

Vulnerability Analysis and Loss Estimation of Critical Facilities

Since this hazard primarily impacts people, vulnerability of and losses to critical facilities is not given high consideration. Economic losses to the food industry and healthcare sectors are likely highest. The food chain is a complex system that is vulnerable to many hazards in the built environment. Food production and food processing facilities range from light construction to large concrete structures. Additionally, the construction of food chain facilities has variable food safety and defense capabilities depending on time, money, attention, and awareness of the facility owners/managers. Any of these hazards may produce a breach in the protections that prevent germs and chemical contamination in our food and water. The complexity of the system can also be a vulnerability. The more complex and tightly organized a system becomes, the more opportunity there is for error, and the severity of consequences increases should error, or breach occur.

Food processing, storage, and distribution are also affected by variability in the climate and extreme weather events. In 2017, Hurricane Irma prevented raw milk sales from processing for several days, costing the Florida dairy industry approximately $1 million in lost revenue from milk spoilage and milk dumping. Widespread power outages also impacted the food chain, from food material stored in processing plants to distribution facilities to local grocery stores and restaurants to individual consumers. Heat waves also present unique challenges to food distribution and preparation due to some foods being sensitive to increased temperatures.

Access to medical care is an important factor in the response and recovery of the community from disease outbreaks. Hillsborough County's social healthcare network includes 19 hospitals (Bed Capacity of 4,593) and 28 family care and general health clinics.[494] There are more private medical clinics, urgent care centers, and non-profit/non-governmental health care organizations. Given that most of the food and waterborne disease cases are asymptomatic or only require outpatient care, the physical volume of care slots is likely adequate. However, if the source of illness is geographically localized, certain facilities can become overwhelmed.

---

[493] Florida Department of Health. (2019, June 30). FL Health Charts. Florida Department of Health Division of Public Health Statistics & Performance Management. http://www.flhealthcharts.com /charts/default.aspx

[494] Florida Hospital Association (FHS), 2019. http://www.fha.org/reports-and-resources/hospital-directory.aspx

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be moderate, with a PRI score of 2.4 (Table 5.190).

Table 5.190. Overall Vulnerability to Food and Waterborne Disease Outbreak for Hillsborough County

<table>
<tr><th colspan="5">FOOD AND WATERBORNE DISEASE OUTBREAK</th><th colspan="2" rowspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="5">Overview</th></tr>
<tr><td colspan="5">Food and waterborne disease outbreaks are a subcategory of biologic incidents where food or water has become contaminated with bacteria, parasites, fungi, viruses, prions, or toxic chemicals. These incidents are commonly referred to as “food poisoning.” Intentional contamination of food and water sources may be referred to as bioterrorism or food terrorism. The symptoms of food and waterborne illness vary with the exact causative agent. Hillsborough County business and tourism industries rely heavily on the safety and reliability of food and water sources, and outbreaks in the county can lead to multistate or even international disease transmission due to the high traffic of people in and out of the county.</td><td colspan="2">MODERATE</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th>Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Likely</td><td>Limited</td><td>Small</td><td>> 24 hrs</td><td>Moderately Concerned</td><td>< 1 week</td><td>2.4</td></tr>
</table>

4.23 Dam/Levee Failure Hazard Profile

Dam/Levee Failure Description

Dams serve as barriers to hold back water and can be used to regulate water supply, control floods, provide hydroelectric power, or create recreational opportunities. They are typically constructed of earth, concrete, steel, or rock. Dams can cause serious harm when they fail, putting lives and properties at risk. Dam failure is characterized by a sudden, rapid, and uncontrolled release of water. The amount of water impounded by a dam is measured in acre-feet; an acre-foot of water is the volume that covers an acre of land to a depth of one foot. Dam failures are not routine. Two factors influence the potential severity of full or partial dam failure: (1) The amount of water impounded, and (2) the density, type, and value of development downstream.

Dam failures are caused by natural events, human-induced events, or a combination of both. Failures caused by natural events, such as prolonged periods of rainfall and flooding, result in overtopping of the dam, which is the most common cause of dam failure. Overtopping occurs when a dam's spillway capacity is exceeded, and portions of the dam not designed to convey flow begin to pass water, erode, and ultimately fail. Other causes of dam failure include design flaws, foundation failure, internal soil erosion, inadequate maintenance, or negligent operation. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-laden water, and causing potentially catastrophic impacts to life and property downstream. An additional hazard concern is the cascading effect of one dam failure, resulting in multiple dam failures downstream due to the sudden release of flow and increased pressure. Failure due to natural events such as earthquakes or tornadoes is significant because there is little to no advance warning. Improper design and maintenance, inadequate spillway capacity, internal erosion or "piping" within a dam, or a deliberate attack may also cause dam failure.[495]

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Inspection Act. USACE has inventoried dams and surveyed each state and federal agency's capabilities, practices, and regulations regarding the design, construction, operation, and maintenance of the dams.

National statistics show that overtopping of dams due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest accounts for 34% of all dam failures. Foundation defects, including settlement and slope instability, account for 30% of all failures. Piping and seepage cause 20% of national dam failures. This includes internal erosion caused by seepage, seepage, and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The remaining 16% of failures are caused by other means, including the failure of conduits and valves.[496]

When the term "dam" is used, it is normal to think only of structures associated with the impounding of rivers for use as drinking water reservoirs, the production of electricity, or flood control. In Florida, the term can take on an additional meaning, that of impounding clay settling ponds or

---

[495] http://www.damsafety.org/news/?p=412f29c8-3fd8-4529-b5c9-8d47364c1f3e
[496] http://www.ecy.wa.gov/PROGRAMS/wr/dams/failure.html

phosphogypsum stacks associated with the mining and processing of phosphate. Both types of structures can be found within Hillsborough County. Dam/Levee failure is a collapse or breach in a dam or levee. While most dams have storage volumes small enough that failures have little or no repercussions, dams with large storage amounts can cause significant downstream flooding.

Geographic Areas Affected by Dam/Levee Failure

The National Inventory of Dams (NID) documents all known dams in the United States and its territories that meet certain criteria. The NID classifies dams into hazard categories based on the based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests in the case of a dam failure. The NID classifications directly align with the FEMA dam hazard classification. Dam hazards indicate the potential hazard to the downstream area resulting from failure or operational errors of the dam or facilities. The level of risk associated with dams is classified into three categories based on definitions from USACE below. More detailed descriptions of the classifications are provided in Table 5.191:

- Low: A dam where failure or operational error results in no probable loss of human life and low economic and/or environmental loss. Losses are principally limited to the owner's property.
- Significant: A dam where failure or operational error results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or affect other concerns. These dams are often located in predominantly rural or agricultural areas but could be located in areas with more dense populations and significant infrastructure.
- High: A dam where failure or operational error will probably cause loss of human life.

It is important to note that a dam's hazard classification has nothing to do with its condition.

Table 5.191. U.S. Army Corps of Engineers Hazard Potential Classification

Hazard Category	Direct Loss of Life	Lifeline Losses	Property Losses	Environmental Losses
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural locations, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required
High	Certain (one or more) extensive residential, commercial, or industrial	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

Hazard Category	Direct Loss of Life	Lifeline Losses	Property Losses	Environmental Losses
	development			

a. Categories are assigned to overall projects, not individual structures at a project.

b. Loss-of-life potential is based on inundation mapping of area downstream of the project. Analyses of loss-of-life potential should take into account the population at risk, time of flood wave travel, and warning time.

c. Lifeline losses include indirect threats to life caused by the interruption of lifeline services from project failure or operational disruption; for example, loss of critical medical facilities or access to them.

d. Property losses include damage to project facilities and downstream property and indirect impact from loss of project services, such as impact from loss of a dam and navigation pool, or impact from loss of water or power supply.

e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Source: U.S. Army Corps of Engineers 1995

In addition to the hazard potential classification, the NID includes a condition assessment for each dam. According to the NID Data Dictionary, as of March 2024, the condition assessment parameter identifies the condition of the dam to aid in better identifying dam safety risk. The level of dam safety and safety deficiencies is defined by USACE in Table 5.192.

Table 5.192. Condition Assessment Descriptions in the NID

Condition	Description
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the minimum applicable state or federal regulatory criteria or tolerable risk guidelines.
Fair	No existing dam safety deficiencies are recognized for normal operating conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.
Poor	A dam safety deficiency is recognized for normal operating conditions which may realistically occur. Remedial action is necessary. POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Investigations and studies are necessary.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution
Not Rated	The dam has not been inspected, is not under state or federal jurisdiction, or has been inspected but, for whatever reason, has not been rated.
Not Available	Dams for which the condition assessment is not provided to the NID.

There are 93 dams in Hillsborough County and its jurisdictions that meet NID criteria, as shown in Figure 5.109. Of these 93 dams, nine are classified as high hazard potential, 52 are classified as significant hazard potential, 18 have low hazard potential, and 14 are undetermined, as shown in

Table 5.193. The unincorporated area of Hillsborough County is home to 8 of the 9 high hazard potential dams. The remaining one is in the City of Tampa. Additionally, the unincorporated areas of Hillsborough County have the highest number of significant dam hazard classifications, with a total of 51, followed by Plant City, with one significant hazard classification. Temple Terrace has no dams listed within its jurisdiction. A list of all high and significant hazard potential dams in Hillsborough County, Tampa, Plant City, and Temple Terrace can be found in

Table 5.193.

Significant and High Hazard dams are the primary focus of this risk assessment. A list of all known dams in Hillsborough County is available in Appendix B.

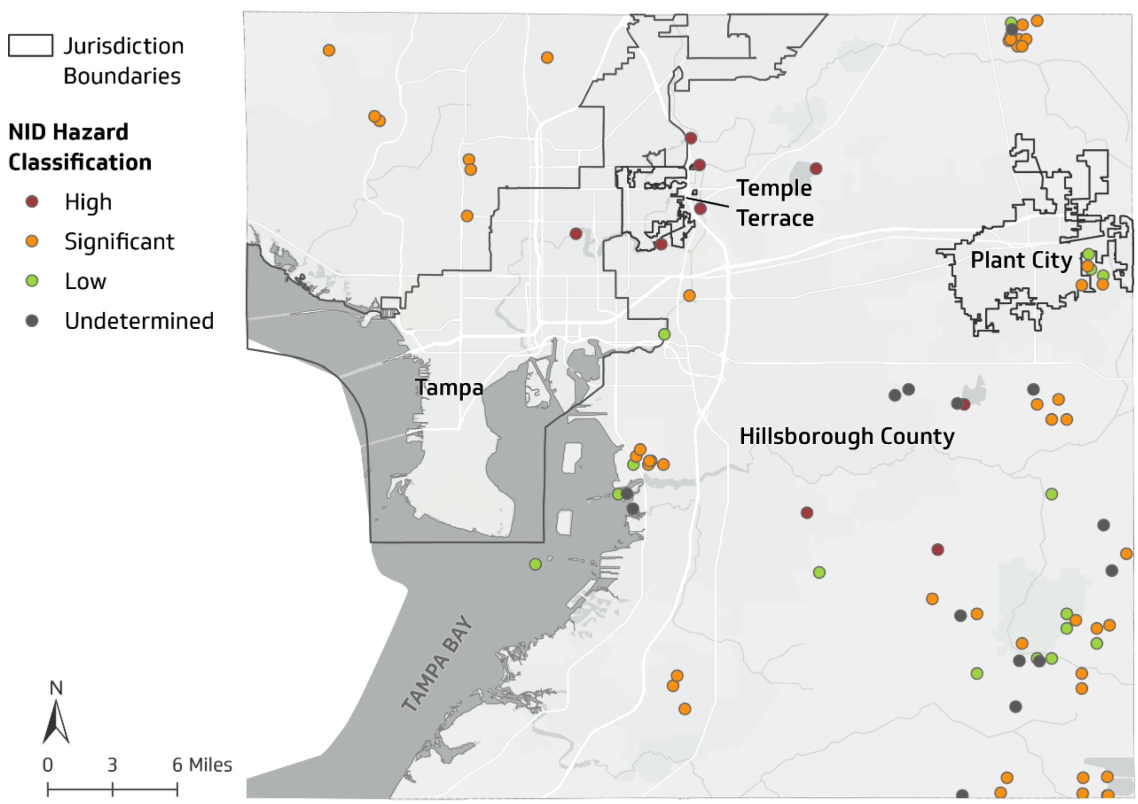


Figure 5.109. Location of dams in Hillsborough County, including the City of Tampa, Plant City, and Temple

Terrace[497]

Table 5.193. NID Dam Hazard Potential Classification, by Jurisdiction

Jurisdiction	High Hazard	Significant Hazard	Low Hazard	Undetermined	Total Dams
Hillsborough County, Unincorporated	8	51	17	14	90
Plant City	0	1	0	0	1
Tampa	1	0	1	0	2
Temple Terrace	0	0	0	0	0
Total	9	52	18	14	93

Dam ownership varies across Hillsborough County and its jurisdictions. Local agencies own 2; state agencies own 15; and most of the others belong to private entities or individuals at a total of 76 dams. 81.7% of the dams within all of Hillsborough County are owned privately, and local agencies own the least number (~2.15%) of all NID dams in the four jurisdictions in the plan. The NID categorizes dams based on their primary function (see Table 5.194).

Table 5.194. Number of Dams in NID, by Primary Function

Primary Function	Number of Dams	Percentage of Dams in Hillsborough County
Flood Risk Reduction	13	13.98%
Irrigation	1	1.08%
Other	3	3.23%
Recreation	4	4.3%
Tailings	68	73.12%
Water Supply	4	4.3%

The Florida DEP coordinates the Florida Dam Safety Program and maintains information for over 1,200 federal and non-federal dams in the state.[498] It has been determined that the river systems and

[497] https://nid.sec.usace.army.mil/#/
[498] https://floridadep.gov/water/engineering-hydrology-geology/content/florida-dam-safety-program

the immediate areas around these dams are the zones with the highest vulnerability to flooding resulting from dam failure. Overall, dam failure is a low priority with respect to flooding since the risks of coastal, riverine, and drainage flooding are much higher.

The specific locations of privately owned dams are not provided in the plan due to security and privacy concerns.

The City of Tampa's Hillsborough River Reservoir is located east of 28th Street, just downstream from the City of Temple Terrace. The Reservoir is approximately 1,300 acres in size and contains up to 1.6 billion gallons of water. The Reservoir has served as the City of Tampa's water source since the mid-1920s. In southeastern Hillsborough County, near CR 672 and SR 39 and south of the Alafia River, is the Tampa Bay Regional Reservoir. The Reservoir is being built by Tampa Bay Water to provide an additional source of potable water for the residents of the Tampa Bay area. The 1,100-acre Reservoir has a total volume of 15 billion gallons.

During the 1950s and 1960s, residents along the Hillsborough River experienced several serious flood events. As a result, in the 1960s and 1970s, the Tampa Bypass Canal was constructed. Following the course of Palm River, the 14-mile waterway, with its flood-control structures, is intended to redirect rising waters from the Hillsborough River to McKay Bay. In addition to the Tampa Bypass Canal, flood control structures can be found along several of the creeks in the western portions of Hillsborough County. These creeks flow into the northern reaches of Tampa Bay.

Additionally, phosphate mining activities are found in the eastern portions of Hillsborough County. Dams are often utilized in the mining process to manage water flow and create retention ponds for waste byproducts. Phosphate mining and processing require water impoundments associated with clay settling ponds at the mining site and phosphogypsum stacks associated with the phosphate processing plant. Generally, phosphate processing plants are in proximity to the mine sites. The exception to this is the Mosaic Riverview Plant, located at the mouth of the Alafia River on Hillsborough Bay.

The dam inundation areas shown in Figure 5.110, are for three of the High Hazard dams in Hillsborough County. Inundation mapping was not identified for the others. These inundation areas were not used for spatial analysis since usable GIS layers are not available per FDEP.

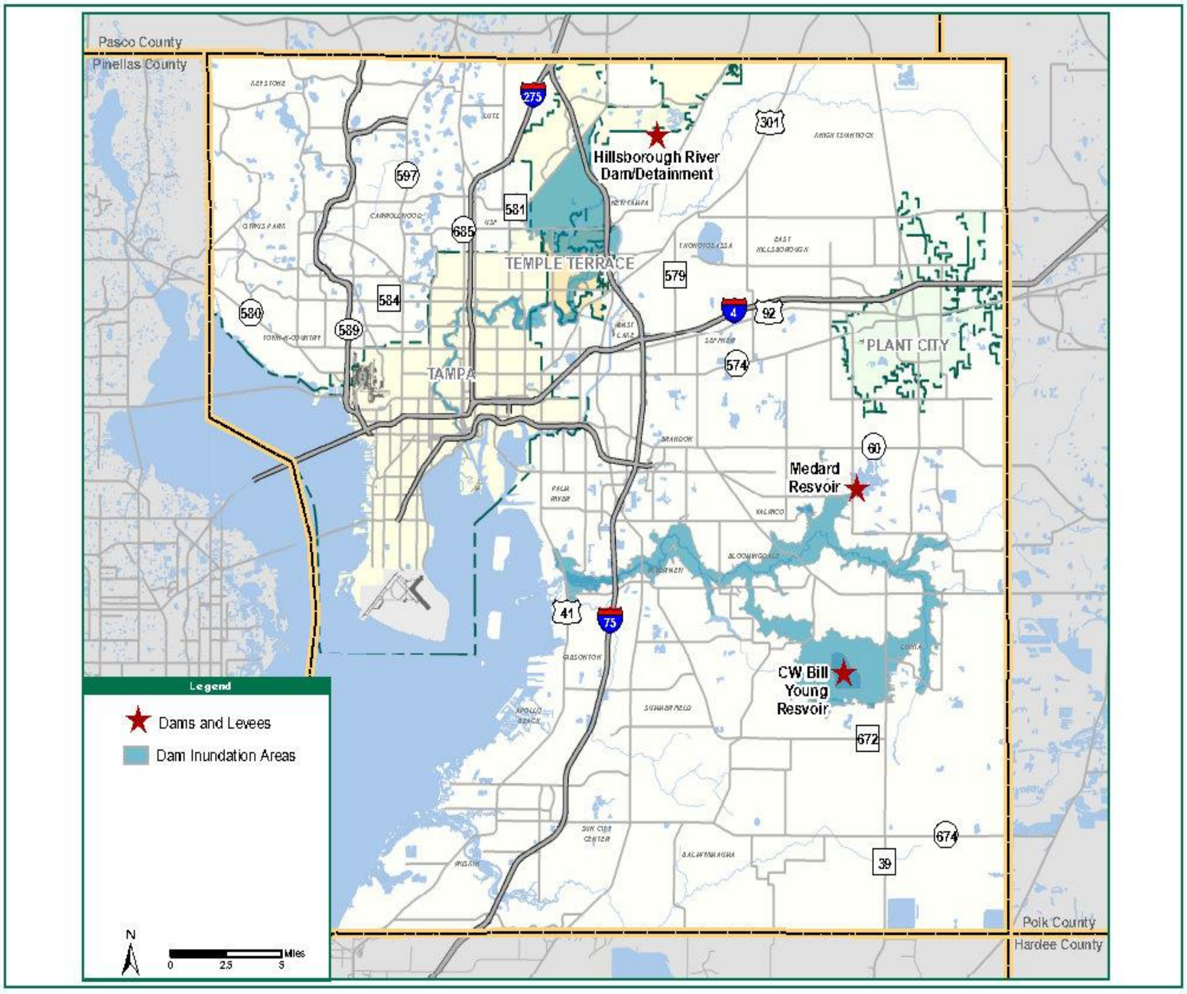


Figure 5.110. Hillsborough County Dam Inundation Areas

Historical Occurrences of Dam/Levee Failure

The construction and safety of dams and levees in Florida is governed by Chapters 62 and 373, FS. Through design and permitting, there is little danger of failure from the Hillsborough River Reservoir, Tampa Bypass Canal, or Tampa Bay Regional Reservoir. Reported failures have been associated with clay settling ponds and phosphogypsum stacks. Since 1988, there have been four failures of such facilities either in or directly impacting unincorporated areas of Hillsborough County, Tampa Bay, Plant City, and Temple Terrace (

Table 5.195).

Table 5.195. Historical Occurrences of Dam/Levee Failures[499]

Jurisdiction	Date	Description
Unincorporated Hillsborough County	1988 and 1993	Acidic water spill at the Mosaic Riverview (aka Gardinier) phosphate processing plant located at the mouth of the Alafia River.
Unincorporated Hillsborough County	November 1994	Failure of a clay settling pond at the Hopewell Mine spilled approximately 1.9 million gallons of water into the Alafia River. In addition, some flooding occurred in the Keystone area.
Unincorporated Hillsborough County	September 5, 2004	A dike at the top of a 100-foot-high gypsum stack holding 150 million gallons of polluted water broke after waves driven by Hurricane Frances bashed the dike's southwest corner. Nearly 60 million gallons (227,000 m3) of acidic liquid spilled into Archie Creek that leads to Hillsborough Bay.

Probability of Future Dam/Levee Failure

Predicting the probability of future dam and levee failure in Hillsborough County and participating jurisdictions is difficult as incidents can occur without warning, and failure history is limited. Unlike hazards that are more common, history is not necessarily a good indicator of future potential in the case of dam failure. Monitoring several factors, including the condition of existing infrastructure, environmental conditions, and development changes, provides insight into potential risks and failure events, as well as the opportunity to take preventive action.

Climate Change Impacts

Climate change increases the complexity of preparing for dam/levee failure events. With the region experiencing more frequent and intense storms and changing precipitation patterns, the stress on existing dam infrastructure is heightened. Increased rainfall can lead to higher water levels behind dams, putting additional pressure on infrastructure designed to manage water flow. Sea level rise can exacerbate erosion, inundation extent, and overall risk to coastal and riverine areas throughout Hillsborough County. Solar intensity and temperature can catalyze erosion and stress of dams based on building material not being designed to withstand certain conditions over a sustained period. For example, concrete-built dams will deteriorate quickly when exposed to higher temperatures and solar exposure. Projected increases in temperature and sun exposure also pose a threat to the integrity of dams through the potential loss of vegetation cover change in soil type to decrease the speed and volume of surface water.

Significant dam/levee failures are low probability but have a high level of consequence, especially in areas exposed to inundation. Given the current dam inventory, historical data, and ongoing maintenance efforts, a high hazard dam/levee failure is unlikely. However, as existing dam infrastructure ages, it can be expected that failure events may occur in the future.

[499] https://www.wise-uranium.org/mdaf.html

Based on very limited history, this hazard was determined to have a probability level of unlikely (< 10% annual probability).

Dam/Levee Failure Impact Analysis

Potential losses from dam failure include human life, structures, and natural resources. Potential impacts of dam failure are detailed below:

- Public
  - Injury/Death
    - Drowning
    - Vehicle accidents
    - Extended wait for emergency response
    - Become stranded on rooftop or trapped inside building or car
  - Exposure to hazardous materials or wastewater
    - Panic in evacuation
    - Accidents from driving through flooded roads – car washed away, water deeper than expected
  - Damage to property
    - Mold infestation
    - Need to replace property damaged, furniture, clothes, etc.
    - Repairing damaged property
    - Issues with damage to uninsured property
- Responders
  - Injury/Death
    - Responding to calls during flooding, traversing flooded roads
    - Drowning
    - Dangerous rescue missions, from roofs, unstable buildings, stranded cars
    - Exposure to hazardous materials or wastewater
    - Power outage dangers, such as being electrocuted by live downed wires
- Continuity of Operations (including continued delivery of services)
  - Floodwaters may damage buildings, electrical systems, paperwork, etc. making continued operations difficult or impossible
  - Floodwaters may hinder access to buildings (roads or sidewalks), preventing employees and the public from entering a building
- Property, Facilities, Infrastructure
  - Property damage
    - Floodwaters can damage property or carry heavy debris that could cause damage
  - Infrastructure damage
    - If water overwhelms the drainage systems, it can backup and cause damage to drains or even result in wastewater release
- Environment

- Release of wastewater could damage environment
- Damage to habitat for plants and animals
- Inundation of agricultural areas could destroy crops
- Event-generated debris impacting waterway navigation and submerged wetland habitats

- Economic Condition
  - Closure or delay of businesses because of flooded roads or water damage, leads to loss in revenue
  - Crop damage or loss leads to decline in agricultural revenues
- Public Confidence in Each Jurisdiction's Governance
  - If floodwaters do not recede quickly, it appears as though the water utilities and government are not able to manage water properly, which calls into question the capability of the government
  - If public or government offices must close because of restricted access due to floodwaters, people may think the government is not able to handle emergency events and lose confidence in their capabilities.

Vulnerability Analysis and Loss Estimation by Jurisdiction

Residents of Tampa living downstream of the Hillsborough River Reservoir are the most vulnerable should there be a dam failure. The exact number of residents who would be affected by such an event would be dependent upon the degree of the failure.

Concern with flooding was a major issue for residents and elected officials during the permitting of the Tampa Bay Regional Reservoir. The potential for such an event was deemed to be slight during the review of the Reservoirs Environmental Impact Statement by the U.S. Environmental Protection Agency and the construction permit by the Florida Department of Environmental Protection.

Although it is possible, it is not probable that the failure of clay settling pond or phosphogypsum stack would adversely impact county residents. This determination can be made based on the general isolated nature of these operations. Still, as noted in the 1994 event, flooding of residences can occur. As a result of their general isolation, it is not possible to determine the potential number of residents in the unincorporated county who could be affected. The major consequence of a failure event would be the resulting environmental damage if contaminated water reached a creek or river or infiltrated into the groundwater supply.

When trying to complete a loss estimation for dam failure, some limitations in available data were identified. Using HAZUS for dam failure is not an accepted practice by GIS professionals. The more accepted approach is to run failure scenarios using inundation modeling. This data and modeling can be found in the Emergency Action Plans (EAP) for the dam. Currently, there is no law requiring dam owners to develop EAPs. FDEP is currently in the process of proposing legislation that would require dams to go through major modification to complete inundation modeling and reclassification (if applicable), but there is no current inundation data available in the county.

DSS-WISE Lite (Decision Support System for Water Infrastructural Security Web) is a screening tool used to run inundation scenarios of potential dam failures. A current limitation of the tool for Florida is that the default elevations (topography) do not represent Florida's relatively flat topography well, which could result in misleading aerial representation of flood extents. According to the State Dam Safety Officer, FDSP is in the process of updating the current digital elevation model (DEM) to provide higher resolution topography in DSS-WISE Lite to better represent Florida's topography. It is anticipated that FDSP will begin running DSS-WISE Lite simulations on Florida's dams statewide later this year. Due to the current status of the project, a loss estimation by jurisdiction was not completed for dam failure.

Vulnerability Analysis and Loss Estimation of Critical Facilities

For the three dams with inundation areas mapped, GIS data needed for a spatial analysis of critical facilities is not available. Using the static map in Figure 5.110, and a map of critical facilities in the county, a visual analysis was conducted.

Based on this visual inspection, an estimated 34 critical facilities in Tampa, 27 in Temple Terrace, and 69 in Unincorporated Hillsborough County are within the available dam inundation areas and areas at risk of dam/levee failure. No critical facilities in Plant City are at risk. In total, an estimated 130 critical facilities are at risk out of 3,681 total critical facilities in the county. Given the other high hazard dams in the County that do not have inundation mapping, this number is likely an underrepresentation of critical facilities at risk. Exposure analysis and loss estimation are not possible with the data available.

The locations of all critical facilities in Hillsborough County are shown below in Figure 5.111.

Figure 5.111. Critical Facilities in Hillsborough County

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4 and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0 and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be low, with a PRI score of 2.2 (Table 5.196).

Table 5.196. Overall Vulnerability to Dam/Levee Failure for Hillsborough County

DAM/LEVEE FAILURE					Overall Vulnerability	
Overview						
The failure of a dam or dike may also result in a flood event. The amount of water impounded by a dam is measured in acre-feet; an acre-foot of water is the volume that covers an acre of land to a depth of one foot. Dam failures are not routine. Two factors influence the potential severity of full or partial dam failure: (1) The amount of water impounded, and (2) the density, type, and value of development downstream.					Low	
Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Public Sentiment**	**Duration**	**PRI Score**
Unlikely	**Critical**	**Moderate**	**< 6 hrs**	**Not Concerned**	**< 6 hrs**	**2.2**

4.24 Mass Migration Hazard Profile

Mass Migration Description

Florida's proximity to the Caribbean Basin makes it a vulnerable point of entry for a massive influx of immigrants and refugees entering the United States; 21% of Florida's population is made up of immigrants, making Florida the fourth state to have the highest percentage of foreign-born population.[500] While most come from the Caribbean, they can come from other locations such as Mexico and South America. Even though all Florida counties are subject to receiving such arrivals, the most vulnerable counties are Monroe, Miami-Dade, Broward, Palm Beach, Martin, St. Lucie, Indian River, Lee, and Collier. The consequences of a mass arrival of undocumented entrants include the threat to the health, safety, and welfare of citizens and that of entrants who may be detained for an extended length of time. Florida has participated with the federal government in developing a federal Mass Immigration Annex that bridges components of the federal Mass Immigration Plan with the National Response Framework.

Mass Migration

According to United States Code Title 8, Chapter 12, the definition of mass migration is a migration of undocumented individuals of such magnitude and duration that it poses a threat to the national security of the United States as determined by the President. This usually refers to an event or series of events that may take place over several years or even decades. [501]

The event could be economic, social, or political in nature, but it is something that causes a mass exodus from the country of origin. While some counties and state agencies use a specific number that determines when an emergency exists for operational purposes, the State of Florida understands that a continuous and high-volume flow of migrants over some time could exceed the standard capabilities of the local offices of the United States Coast Guard and Customs and Border Protection.[502]

The main problem posed by undocumented individuals is the inability of the system to assimilate them without affecting already strained local economies and infrastructure such as health, medical, and social services. The Pew Research Center estimates that, in fiscal year 2021, Florida had an influx of 9020,000 (+/- 22,926) undocumented migrants and that the state experienced growth of the undocumented population at the national average of 250%.[503]

Unaccompanied Minors

Children who arrive in the United States alone or who are required to appear in immigration court on their own are referred to as unaccompanied children or unaccompanied minors.[504] Unaccompanied

---

[500] Migration Policy Institute. (2022). Florida. https://www.migrationpolicy.org/data/state-profiles/state/demographics/FL

[501] https://www.law.cornell.edu/uscode/text/8/chapter-12

502 http://www.floridadisaster.org/documents/CEMP/2012/MASS%20MIGRATION%20ANNEX.pdf

[503] https://www.pewresearch.org/short-reads/2023/11/16/what-we-know-about-unauthorized-immigrants-living-in-the-us/

[504]https://www.americanimmigrationcouncil.org/sites/default/files/research/a_guide_to_children_arriving_at_the_border_and_the_laws_and_policies_governing_our_response.pdf

alien child (UAC) is a technical term defined by law as a child who has no lawful immigration status in the United States, has not attained 18 years of age, and whom there is no parent or legal guardian in the United States or no parent or legal guardian in the United States is available to provide care and physical custody. Unaccompanied children generally leave their home countries to join families already in the United States, escape abuse, persecution, or exploitation in their home country, or seek employment or educational opportunities in the United States. The age of these individuals, their separation from parents and relatives, and the hazardous journey they take make unaccompanied children especially vulnerable to human trafficking, exploitation, and abuse. When a child not accompanied by a parent or legal guardian is apprehended by immigration authorities, the child is transferred to the care and custody of the Office of Refugee Resettlement (ORR).[505] Federal law requires that ORR feed, shelter, and provide medical care for unaccompanied children until it can release them to safe settings with sponsors (usually family members) while they await immigration proceedings.

Table 5.197 shows the total number of unaccompanied children released to sponsors by county in fiscal year 2024 as of July 2024. Only counties with over 100 are listed in the table below.

Table 5.197. Unaccompanied Minors Released to Sponsors, FY 2024 [506]

County	Total Number of Children
Brevard County	100
Broward County	747
Collier County	405
Duval County	422
Escambia County	108
Hillsborough County	622
Lee County	721
Manatee County	217
Martin County	135
Miami-Dade County	1,276
Monroe County	134
Orange County	831
Osceola County	107
Palm Beach County	1,304
Polk County	214
St. Lucie County	134

Mass Immigration

Immigration is the movement of people to another country in which they are not natives and where they do not possess citizenship to settle or reside. The definition of an immigrant or alien from the United States Code Title 8 means" an applicant for admission coming or attempting to come into the United States at a port-of-entry, or an alien seeking transit through the United States at a port-of-

[505] https://www.acf.hhs.gov/orr/programs/ucs/about
[506] https://www.acf.hhs.gov/orr/resource/unaccompanied-alien-children-released-to-sponsors-by-county

entry, or an alien interdicted in international or United States waters and brought into the United States by any means, whether or not to a designated port-of-entry, and regardless of the means of transport."[507] The Bureau of Economic and Business Research shows that migration or immigration is the primary source of 'Florida's population growth, and the USS Census Bureau shows that there was a 14.6 percent resident population increase from the 2010-2020 Census. Palm Beach, Broward, Miami-Dade, Orange, and Hillsborough counties see the highest influx of immigration, and Miami-Dade alone accounted for a quarter of 'Florida's total foreign immigrants between 2018 and 2022, 1,453,000 foreign-born persons accounted for Miami-Dade's population in comparison to Hillsborough's 275,000 foreign-born population, according to the Migration Policy Institute[508]. As with mass migration, an influx of immigrants to any particular county could overwhelm the local economy and infrastructure.

Repatriation

Repatriation is the procedure where United States citizens and their dependents, who have been identified by the USS Department of State, are returned from a foreign country to the United States because of destitution, illness, war, threat of war, or a similar crisis. This could also include third-country nationals (TCNs) who are individuals approved by the Department of State and are neither USS Department of Defense dependent nor USS citizens. Emergency repatriation is the influx of 500 or more USS citizens or dependents from foreign countries. Through ORR agreements, states that are designated as ports of entry will be asked to activate their state emergency repatriation plan during an emergency repatriation.[509] Florida has three designated debarkation ports, and the bases and installations designated with primary responsibilities will be the lead agent. The American Red Cross is the lead entity in providing shelters, mass feeding, first aid, emergency communications, and access to financial assistance to those in need. Florida currently has a repatriation plan that can be activated should the need arise.

Geographic Areas Affected by Mass Migration

Hillsborough County could see mass migration, by sea or air, or instate migration from other south Florida counties. Where migrants originate from would determine where they would settle in the county. All of Hillsborough County is susceptible to mass migration. Areas heavy in agriculture, such as Plant City, could see surges or migrants seeking work in the agriculture industry.

Historical Occurrences of Mass Migration

The 1980 Mariel Boatlift was one of the largest mass migration incidents affecting Florida. From April 1980 to October 1980, over 125,000 Cubans and between 40,000 and 80,000 Haitians made their way to South Florida. The Cuban President at the time, Fidel Castro, granted permission to all Cubans who wanted to leave access to the Port of Mariel. The United States Coast Guard was tasked

---

[507] https://www.ecfr.gov/cgi-bin/text-idx?SID=29f9238515a0b92dcfa5f8f11f2d5abb&mc=true&node=se8.1.1_12&rgn=div8

[508] Migration Policy Institute. (2022). U.S. Immigrant Population by State and County. https://www.migrationpolicy.org/programs/data-hub/charts/us-immigrant-population-state-and-county

[509] https://portal.floridadisaster.org/preparedness/External/CEMP/2022%20State%20CEMP%20Base%20Plan.pdf

with assisting the boats and rafts in making their way to Florida, and it became one of the largest operations they had ever undertaken during peacetime.[510]

In the autumn of 1991, a military coup overthrowing Haitian President Aristide led to a mass exodus of roughly 38,000 people toward South Florida. Many perished at sea on failing vessels or homemade rafts, and those who survived were detained and interviewed at Guantanamo Bay before being forcibly sent back to Haiti. Of the thousands that left, roughly 200 were granted asylum in the United States, many of whom settled in 'Florida's metropolitan areas.[511]

The Cuban Exodus in August 1994 saw over 35,000 refugees on often handmade boats and rafts, fleeing to South Florida. Many died at sea, but those who survived were apprehended by the United States Coast Guard and detained at Guantanamo Bay. In May 1995, almost all those detained, roughly 30,000 people, were released and allowed entry into the United States. Many settled in South Florida, and this exodus would lead to a change in public policy and the creation of the "Wet foot, Dry foot" policy.[512]

While not an incident of mass migration, the 2010 Haiti Earthquake resulted in several unique immigration situations and challenges. Florida supported the repatriation of USS citizens, as well as helped Haitians and other foreign nationals with passports or visas into the United States. 50,000 Haitians were brought into the United States under Temporary Protected Status (TPS), with many resettling in Miami and Orlando. Some Haitians visiting or residing in Florida at the time of the earthquake were unable or unwilling to return to their newly devastated homeland and were given TPS to remain in the United States.[513]

In 2016, 800 unaccompanied minors were transported to Homestead, Florida, and placed within a temporary tent city. They came from multiple countries, including Honduras, Guatemala, and El Salvador, to escape violence, poverty, or abuse. The American Red Cross and the Office for Refugee Resettlement worked together to care for these children and ultimately placed them with sponsors throughout the State.[514]

The number of migrants from the historical events noted above who made their way to Hillsborough County is unknown. In 2023, an influx of immigrant students from more than 20 countries, with the majority from Cuba (2,655), Honduras (890), Venezuela (883), and Colombia (703), impacted the Hillsborough County Public Schools.[515]

Hillsborough County does not have a history of mass migration; adding to the already dense population of the county, any mass migration to the area would be difficult to absorb.

---

[510] https://fas.org/sgp/crs/row/R40566.pdf

[511] http://www.crf-usa.org/bill-of-rights-in-action/bria-10-2-b-haiti-and-the-boat-people

[512] https://www.hrw.org/legacy/reports/pdfs/c/cuba/cuba94o.pdf

[513] http://www.migrationpolicy.org/article/haitian-immigrants-united-states/

[514] https://www.local10.com/news/tent-village-near-homestead-air-reserve-base-prepared-to-shelter-refugee-children

[515] https://www.tampabay.com/news/hillsborough/2023/01/23/florida-immigration-influx-cuba-venezuela-nicaragua-tampa-bay/

Probability of Future Mass Migration Events

There is no sure way to predict future mass migration events, as most typically occur without warning. The probability of a migration influx in Florida is perceived to be high, and planning must be done as part of the larger national DHS initiatives.[516] As political unrest and large-scale natural disasters continue to increase within the Caribbean[517] and South American regions[518], there will be people wanting to leave. South Florida is in close proximity and has an extensive network of people from these countries in place. The Mass Migration Annex of the Florida State Comprehensive Emergency Management Plan provides augmentation information that connects with the USS Department of Homeland Security Plan entitled "Operation Vigilant Sentry" and subsequent revisions.[519]

The 2023 Census projections examine immigration's impact on future national growth by assuming four scenarios over the 2022 – 2100 period based on different annual net immigration levels (i.e., in-migration minus out-migration to the US).[520] The four scenarios are explained in the following:

- High immigration assumes a consistent annual net immigration of roughly 1.5 million people per year, a level that has only occasionally approached in the recent past.
- Main immigration assumes annual net immigration levels between 850,000 and 980,000 people, the most consistent scenario in recent history, apart from the immediate pre- and post-pandemic years.
- Low immigration – assumes a trajectory of 350,000 and 600,000 net migrants annually.
- Zero immigration assumes a modest negative annual net immigration resulting from some out-migration and no in-migration; it provides a benchmark to show future population changes primarily due to the forces of fertility and mortality.

Figure 5.112 depicts the alternative immigration scenarios projected by the U.S. Census.

---

516 https://flshmp-floridadisaster.hub.arcgis.com/pages/mass-migration

517 https://www.nbcnews.com/news/world/haiti-crisis-what-know-president-violence-government-rcna143000

518 https://slate.com/news-and-politics/2023/01/brazil-riots-peru-chile-latin-america-instability-crisis.html

519 Groll, Nicole. (2023). United States Coast Guard News. Operation Vigilant Sentry: Stopping illegal migration at sea https://www.news.uscg.mil/Press-Releases/Article/3280774/operation-vigilant-sentry-stopping-illegal-migration-at-sea/

520 Census. (2023). U.S. Population Projected to Begin Declining in Second Half of Century https://www.census.gov/newsroom/press-releases/2023/population-projections.html#:~:text=NOV.%209%2C%202023%20%E2%80%94%20The,Bureau%20population%20projections%20released%20today

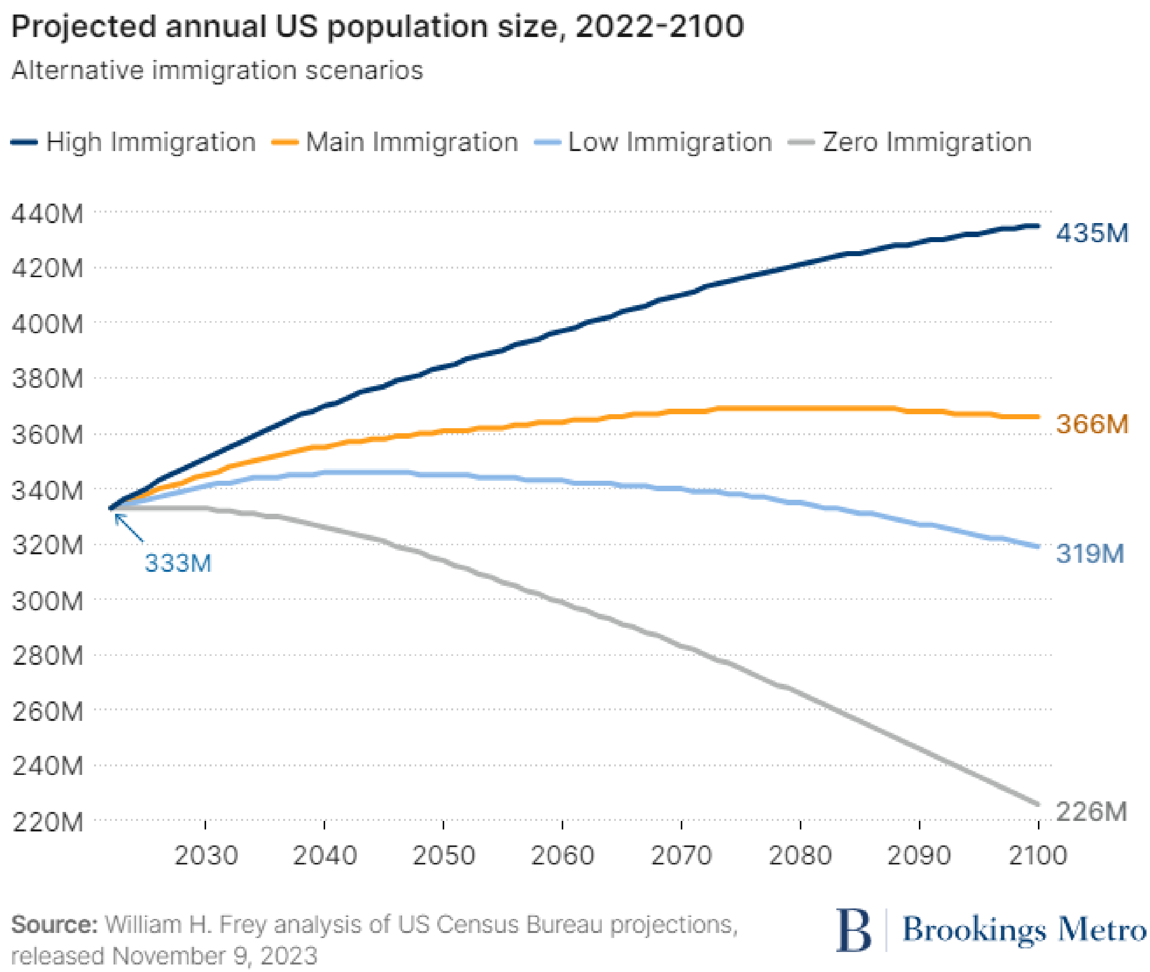


Figure 5.112. Projected annual US population size, 2022-2100[521]

Under these scenarios, the exact percentage of immigration that will impact Hillsborough County is unknown.

Potential Impacts of Climate Change

Climate change will affect the way undocumented workers are able to come into Florida due to the likely increase in storms; undocumented workers may migrate more into Florida in the hopes of helping Florida rebuild from large disasters. The increase of storms across the US, not just in Florida, has also resulted in a transient undocumented workforce that can help cities rebuild. For example, after Hurricane Ian struck Southwest Florida in 2022, documented and undocumented migrant

[521] William H. Frey analysis of US Census Bureau projections, released November 9, 2023. https://www.brookings.edu/articles/new-census-projections-show-immigration-is-essential-to-the-growth-and-vitality-of-a-more-diverse-us-population/

workers from Central America, Venezuela, New York, Louisiana, Houston, and Dallas came to Florida to help with disaster recovery efforts[522].

According to a study, due to climate change affecting sea-level rise, people are forecasted to move, notably in the case of coastal communities in Florida, where mass migration is most likely to occur in younger populations migrating inland; this is also referred to as climate migration. Due to mass migration, the older population will likely be left behind in these coastal communities with fewer vital human infrastructure, such as health care workers.[523]

North Central Florida's protection from sea-level rise, freshwater resources, and quality indicators make it a major hub for coastal migrants. The severe drought in the West has put pressure on water resources, causing more migrants to the southeastern United States for farmland. Therefore, more migrants are coming to Florida for the "extra" resources for agriculture. Before the signing of the immigration bill SB 1718 in June 2023, immigrants would migrate to South Florida to work on farms during the harvesting season. However, since its signing, an exodus of undocumented workers has left the state, impacting farmers.

Based purely on the definition of mass migration, this hazard was determined to have a probability level of unlikely (<1% annual probability).

Mass Migration Impact Analysis

The following list shows the potential impacts of mass migration incidents on populations, the built environment, natural resources, the economy, and the government.[524]

- Public
  - Loss of life
  - Injury
  - Fear of going to law enforcement can lead to undocumented individuals not seeking help or evacuating in the event of a hazard
  - Few resources available:
    - Food
    - School
    - Water
    - Work
    - Translators
    - Housing
- Responders

---

[522] Newsweek. (2022, Oct 8). Migrants Rebuilding Florida After Hurricane Ian Face New Battle with Julia. https://www.newsweek.com/migrants-rebuilding-florida-after-hurricane-ian-face-new-battle-julia-1750141#:~:text=A%20number%20of%20immigrants%20came%20to%20Florida%20from,workers%20who%20help%20respond%20to%20America%27s%20natural%20disasters.

[523] https://www.wusf.org/environment/2024-01-26/coastal-populations-age-sharply-climate-migration-fsu-study

[524] https://flshmp-floridadisaster.hub.arcgis.com/pages/mass-migration

  - Public safety resources could be strained or depleted, causing community-wide problems
  - Local law enforcement is affected by added population and confrontation with undocumented individuals
  - Customs and Border Protection is responsible for ensuring all incoming immigrants have proper documentation and intervening with unauthorized entry into the state; this can lead to a strain on the agency
  - The Coast Guard is responsible for protecting the shores and intervening with any unauthorized entry into the state; this can lead to a strain on the agency
- Continuity of Operations (including continued delivery of services)
  - Evacuations in the event of a hazard can get congested with additional population numbers
  - Overwhelmed public service by too many people going to the same places, such as schools or jobs
- Property, Facilities, Infrastructure
  - Strain on detention facilities following mass undocumented intervention could lead to economic strain and a lack of space
  - Undocumented families use education and can place a strain on local schools and facilities within a community
  - Social services can be strained to accommodate incoming immigrants/migrants and unaccompanied children
- Environment
  - Additional pressure on the environment and natural resources
  - Could bring invasive species
- Economic Condition
  - A financial strain on communities is present when the population grows quickly and local communities, or the state, cannot account for them all in terms of services and emergency needs
  - Growth of population can cause impacts on urban planning and resources such as local economies and social services
- Public Confidence in the Jurisdictions' Governance
  - Lack of ability to integrate these people reflects poorly on the government
  - Reports of mistreated detained immigrants reflect poorly on the government

Vulnerability Analysis and Loss Estimation by Jurisdiction

Due to the nature and unpredictability of human-caused hazards, all property and infrastructure in the state of Florida is at risk of these events. Even though all of Florida's counties are subject to receiving such arrivals, Hillsborough County is not one of the most vulnerable.

Florida recognizes that jurisdictions are vulnerable to human-caused hazards, but there is a lack of data to quantify the economic vulnerability or losses from these hazards compared to others.

Vulnerability Analysis and Loss Estimation of Critical Facilities

Due to the nature and unpredictability of human-caused hazards, all critical facilities could potentially be at risk. The facilities could become overwhelmed, there could be a lack of space, and programs could become drained.

Though the county recognizes that critical facilities are vulnerable to human-caused hazards, there is a lack of data to quantify the vulnerability of facilities to these hazards or to estimate losses compared to natural hazards.

Overall Vulnerability

Each of the five PRI categories was assigned a value from 1 to 4, and the pre-determined weighting factor was applied to calculate a PRI score. PRI scores can range from 1.0 to 4.0, and the overall vulnerability ranking of high, moderate, or low was assigned based on the PRI scores.

Based on the probability, impact, spatial extent, warning time, and duration, the overall vulnerability of this hazard was determined to be low, with a PRI score of 1.8 (Table 5.198).

Table 5.198. Overall Vulnerability for Mass Migration in Hillsborough County

<table>
<tr><th colspan="6">MASS MIGRATION</th><th rowspan="2" colspan="2">Overall Vulnerability</th></tr>
<tr><th colspan="6">Overview</th></tr>
<tr><td colspan="6">Florida's proximity to the Caribbean Basin makes it a vulnerable point of entry for a massive influx of immigrants and refugees entering the United States. While the majority come from the Caribbean, they can come from other locations such as Mexico and South America. The consequences of a mass arrival of undocumented entrants include the threat to the health, safety, and welfare of citizens and that of entrants who may be detained for an extended length of time.</td><td colspan="2">LOW</td></tr>
<tr><th>Probability</th><th>Impact</th><th>Spatial Extent</th><th>Warning Time</th><th colspan="2">Public Sentiment</th><th>Duration</th><th>PRI Score</th></tr>
<tr><td>Unlikely</td><td>Minor</td><td>Moderate</td><td>> 24 hrs</td><td colspan="2">Somewhat Concerned</td><td>> 1 week</td><td>1.8</td></tr>
</table>

Future Land Use

Local Hazard Mitigation Plan Requirements	
Section	**Description**
S1 (C1-a)	The plan must describe how resources of each participant the existing authorities, policies, programs, and funding are available to support the mitigation strategy. This must include a discussion of the existing building codes and land use and development ordinances or regulations. Capabilities may be described in a table or narrative.

Overview

The Code of Federal Regulations, 44 CFR § 201.6 Local Mitigation Plans, requires Local Mitigation Plans to provide a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions (eCFR.gov, 2014).[525]

The Planning Commission of Hillsborough County is currently updating Hillsborough County's Comprehensive Plan and shaping the anticipated future land use and development patterns through the year 2045, providing a ripe opportunity to ensure future growth is resilient to the impacts of disasters.

In coordination with the Comprehensive Plan, the 2025 Local Mitigation Strategy (LMS) update includes a future land use section to determine where hazards might impact areas of future growth. This analysis was conducted to help the County, Cities, and developers, make decisions about future development policy and determine areas needing outreach to warn of these risks that exist to the population. This analysis is limited to flood and wildfire. By analyzing the change in land use and the intersections between planned future land use in the county and the flood and wildfire hazards, the County will have a better understanding of what areas are at risk and what land use policies and regulatory decisions may need to be altered due to these hazard-based risks.

The jurisdictional future land use data is a generalized depiction created and intended to be used in coordination with Hillsborough County Property Appraiser's Parcel data. In cases where a land use boundary falls within a right-of-way or water body, those boundaries have been brought to the approximate center of that feature. To determine proper land use category acreage, GIS analysis was performed utilizing current parcel data and water boundaries.[526]

---

[525] https://www.ecfr.gov/current/title-44/chapter-I/subchapter-D/part-201/section-201.6
[526] https://planhillsborough.org/gis-maps-data-files/

Method

To understand how and where land use in Hillsborough is changing and how it might be impacted by hazards, The County started by comparing existing and future land use data in GIS (Figure 5.113 and Figure 5.114).

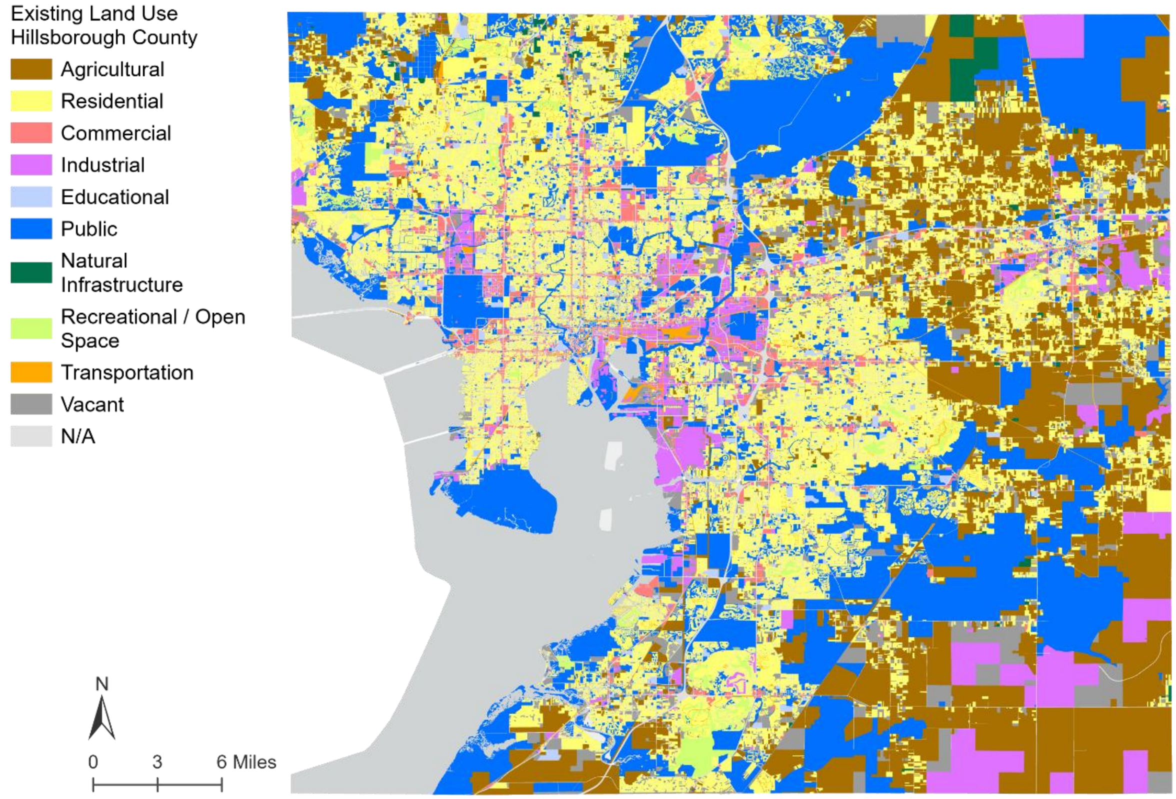


Figure 5.113. Existing Land Use in Hillsborough County

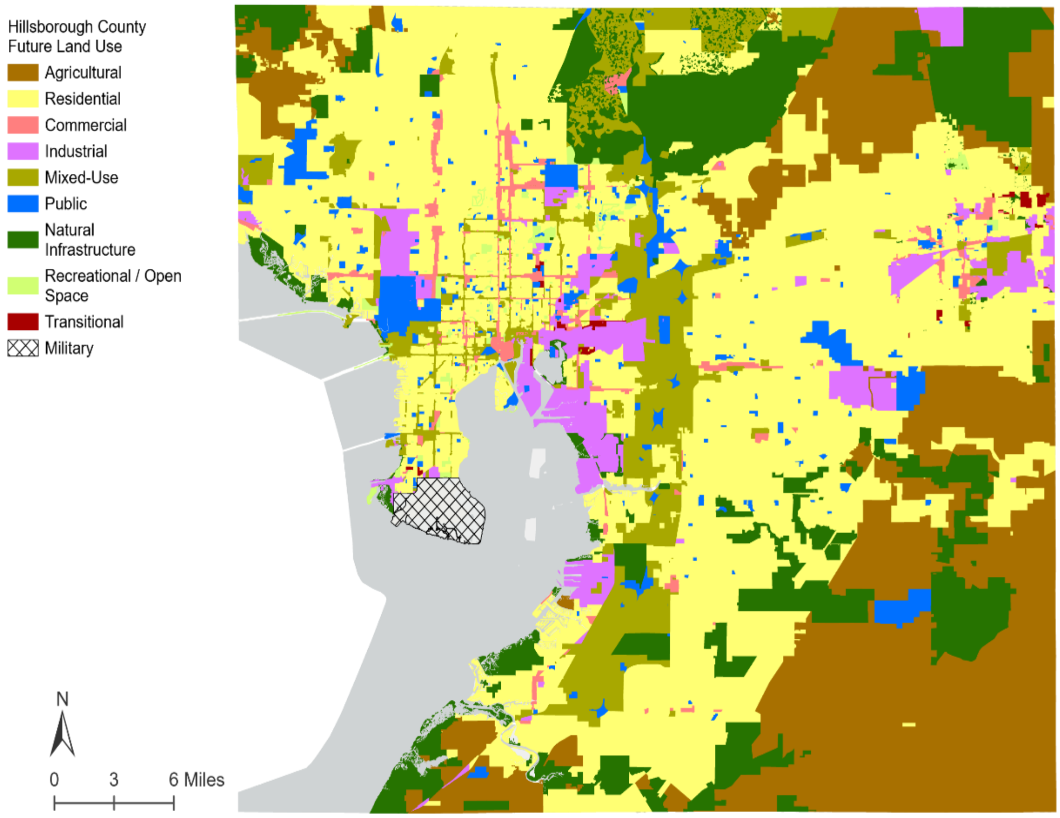


Figure 5.114. Hillsborough County Future Land Use

Land Use Categorization

Future land use in the county, shown in Figure 5.114**Error! Reference source not found.**, when compared to existing land use, shown in Figure 5.113, includes a variety of updates based on this pattern of development and population growth in the county. The future land use data reclassifies the land use categories from the existing land use data while also adding in additional land use categories.

To understand the anticipated change between existing and future conditions, differences in land use categorization were realigned as shown below in Table 5.199,**Error! Reference source not found.** "N/A" indicates that the land use category is present in either the existing or future land use data, but not in the other. The full crosswalk can be found in Appendix B.

Table 5.199. Land Use Categories for LMS

Land Use Category	In Existing Land Use	In Future Land Use
Agricultural	X	X
Residential	X	X
Educational	X	N/A
Commercial	X	X

Land Use Category	In Existing Land Use	In Future Land Use
Industrial	X	X
Public	X	X
Natural Infrastructure	X	X
Recreation / Open Space	X	X
Mixed-Use	N/A	X
Transitional	N/A	X
Military	N/A	X
Transportation	X	N/A
Vacant	X	N/A
N/A	X	N/A

The acres of land for each land use categorization were calculated in GIS. The largest change in land use acreage, from existing to future land use, was residential land use, with just over 100,000 added acres of planned residential land use.

Additional changes in land use categorization include a decrease in public land use by a little over 150,000 acres, an increase in natural infrastructure land use by close to 95,000 acres, and the addition of a mixed-use land use category with close to 60,000 acres of land categorized as mixed-use where it previously was categorized as a variety of different land use types (residential, industrial, commercial, etc.). The mixed-use land use category does not exist in the County's existing land use dataset. The change in land use from existing to future is represented in Table 5.200 below for the county. Note, there is a slight difference in the total acreage from existing to future land use, with a 23-acre difference. This is due to some small differences in the GIS data provided. This difference is not significant for the scale of this exercise. The acreage per jurisdiction is presented in Appendix B.

Table 5.200. Future and Existing Land Use Change in Acres in Hillsborough County

Land Use Categories	Existing Land Use (Acres)	Future Land Use (Acres)	Percent Change (%)
Agricultural	137,391.44	157,631.69	14.7%
Educational	7,044.56	N/A	N/A
Residential	188,794.05	293,752.33	55.6%
Commercial	18,457.44	11,206.26	-39.3%
Industrial	37,609.45	30,200.76	-19.7%
Natural Infrastructure	4,345.04	97,962.53	2,154.6%
Public	173,110.40	21,795.98	-87.4%
Recreational / Open Space	7,560.55	3,816.22	-48.9%
Transportation	6,695.47	N/A	N/A
N/A	47,841.45	N/A	N/A
Vacant	53,811.33	N/A	N/A
Military	N/A	5,518.61	N/A
Transitional	N/A	1,267.95	N/A
Mixed-Use	N/A	59,485.69	N/A

Land Use Categories	Existing Land Use (Acres)	Future Land Use (Acres)	Percent Change (%)
Total	682,661.17	682,638.02	0%

Population

Figure 5.115 below shows a kernel density map, created by Hillsborough County's Planning Commission, of new persons per acre through 2050. According to this projection, Hillsborough County anticipates that the residential population will increase in areas like South City, Downtown Tampa, and Brandon.

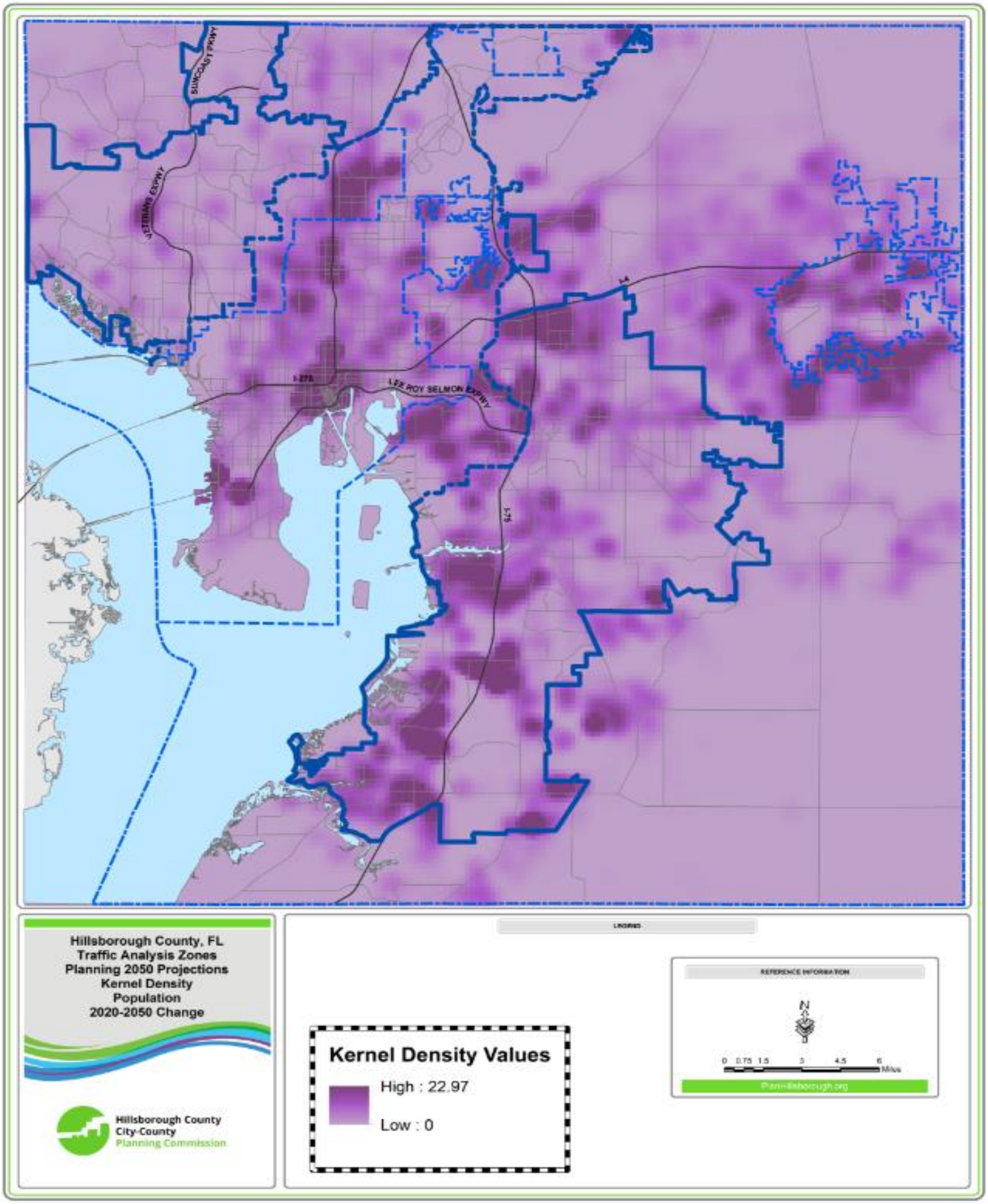


Figure 5.115. Kernel Density of New Persons per Acre through 2050 in Hillsborough County[527]

---

[527] https://planhillsborough.org/2050-long-range-growth-forecasts/

Anticipated Development

Since October 2021, Hillsborough has had 3,411 projects under review for site and subdivision development with approximately 306 being zoned for restaurants, 68 residential, 73 single family residential, 44 commercial, 24 warehouses and the remainder for other site developments.[528] These project locations, shown in Figure 5.117, show a correlation with the growth pattern shown above in Figure 5.115.

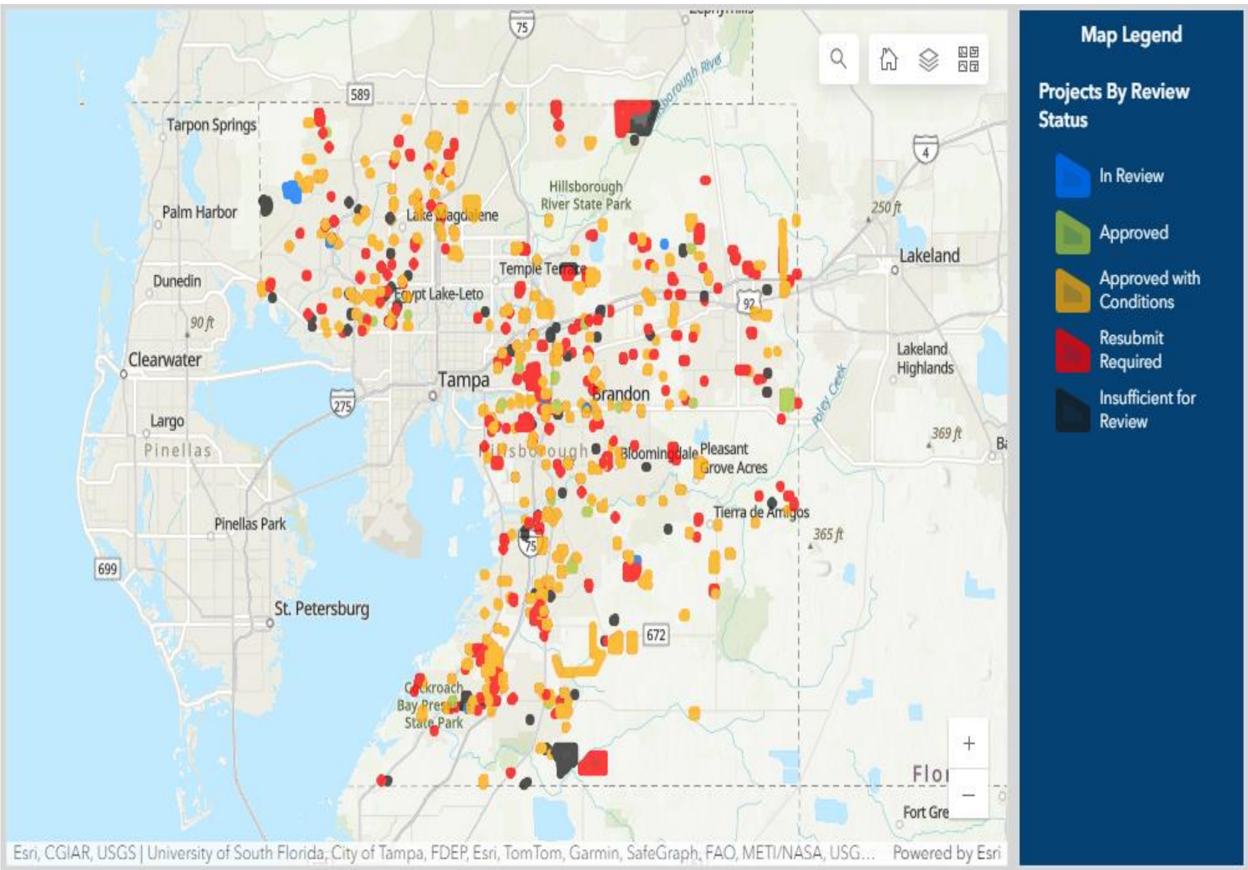


Figure 5.116. Map of Project Activity Status [529]

Hazard Analysis

Flooding

As development increases, risk and exposure to hazards increase. To mitigate the effects of hazards, future land use planning must consider the approximate locations and impacts of various hazard events by siting development in lower-risk areas of the community. The following maps (Figure 5.117

528 Hillsborough County. (2022, Jan). Site & Subdivision Project Viewer. https://hillsborough.maps.arcgis.com/apps/dashboards/30eb1fb6bf3c4d6382f2f5f8fc65f52a

529 Hillsborough County. (2022, Jan). Site & Subdivision Project Viewer. https://hillsborough.maps.arcgis.com/apps/dashboards/30eb1fb6bf3c4d6382f2f5f8fc65f52a

through Figure 5.120) depict the future land use from Figure 5.114 overlaid with the 1% AEP (annual exceedance percentage) floodplain, typically referred to as the 100-year floodplain.

City of Tampa

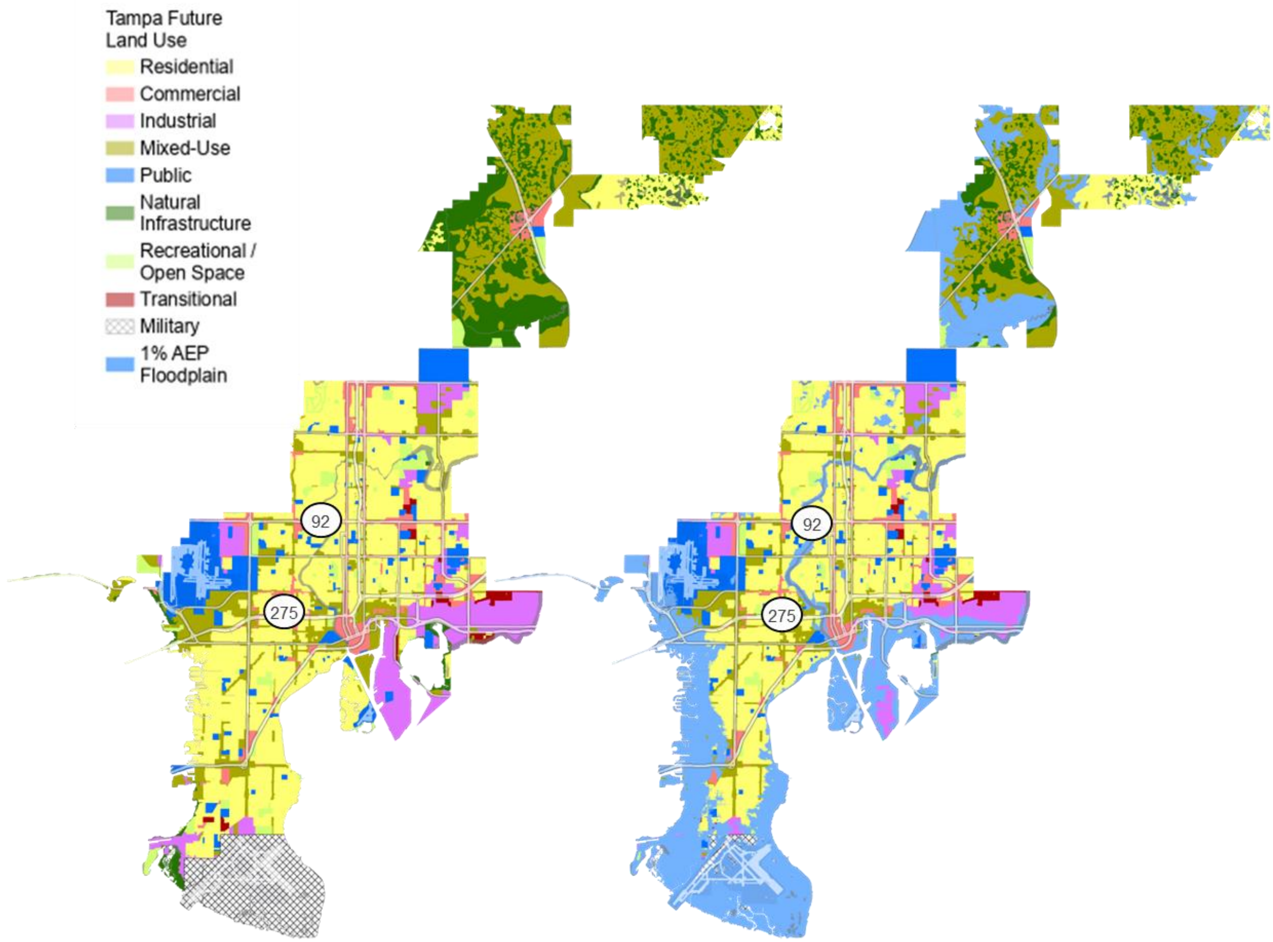


Figure 5.117. City of Tampa's Future Land Use Intersected with 1% AEP Floodplain

For the City of Tampa, the land use categories with the highest acres of land exposed in the 1% AEP floodplain are the military land use category, with close to 5,200 acres of land in the floodplain, the natural infrastructure land use category, with nearly 5,000 acres of land in the floodplain, and the residential land use category, with just over 4,700 acres of land in the floodplain. For natural infrastructure, and similarly, for recreational/open space, the land being exposed to the floodplain is often intentional as natural areas and open space are areas without development and are often a first line of defense for adjacent development, absorbing and storing floodwaters that may otherwise reach and flood properties in the adjacent development. Although just over 4,700 acres of residential land will be exposed to the floodplain in the City of Tampa, this does not mean that properties have been built or are being planned for development in those areas intersecting the floodplain. This only means that the land itself will be categorized as residential and will be exposed to the floodplain. Land categorized as mixed-use and industrial also see high acres of exposure, with just over 3,600 acres and 2,700 acres, respectively. Appendix B has the full exposure statistics for the City of Tampa.

City of Temple Terrace

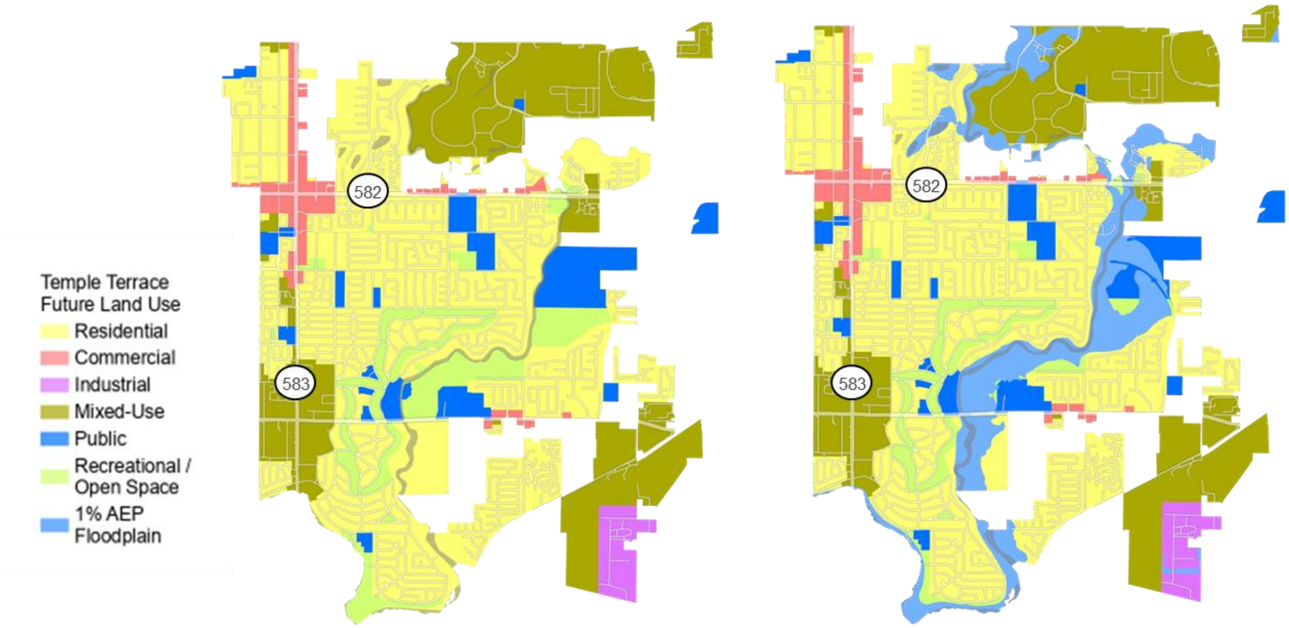


Figure 5.118. City of Temple Terrace's Future Land Use Intersected with 1% AEP Floodplain

The City of Temple Terrace has 312 acres of residential land exposed to the 1% AEP floodplain and around 190 acres of recreational/open space land exposed to the floodplain. Land categorized as mixed-use and public also see relatively high land area of exposure to the floodplain, with just over 90 acres and 70 acres exposed, respectively. Appendix B has the full exposure statistics for the City of Temple Terrace.

City of Plant City

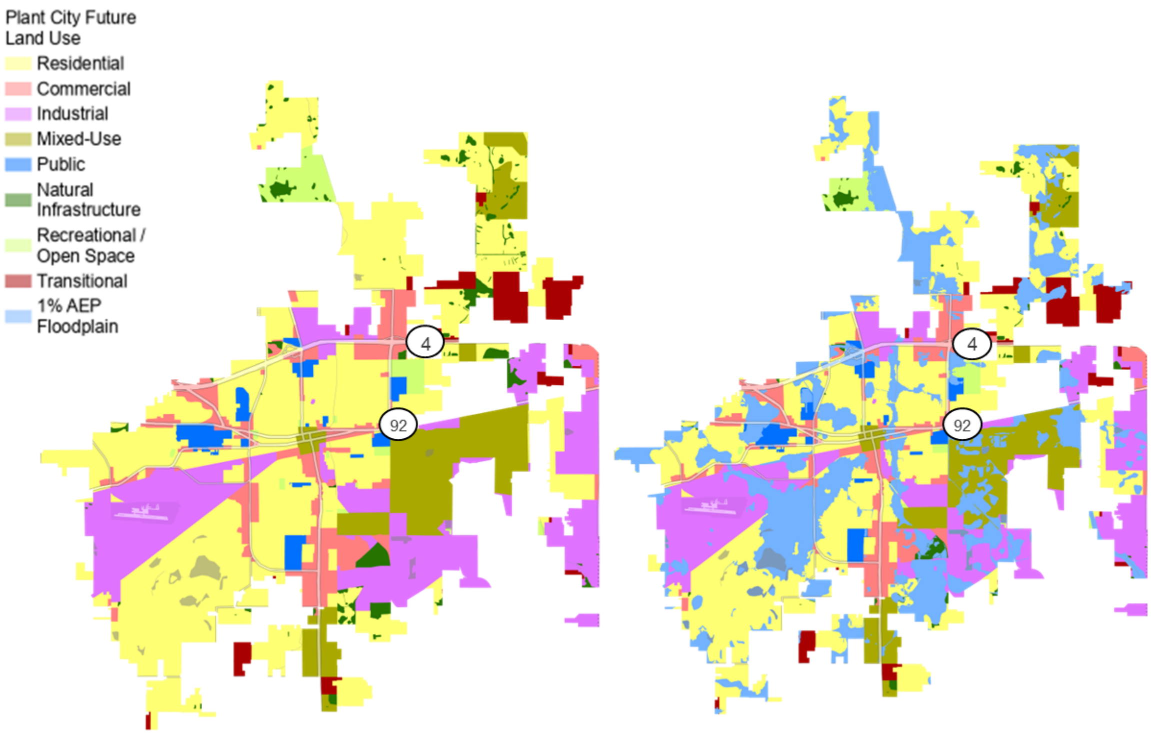


Figure 5.119. City of Plant City's Future Land Use Intersected with 1% AEP Floodplain

The City of Plant City also sees most of its exposure in its residential land, with over 2,700 acres of land exposed to the 1% AEP floodplain. Industrial land, mixed-use, and natural infrastructure are the next highest in acres exposed, with just over 780 acres, 550 acres, and 300 acres, respectively. Appendix B has the full exposure statistics for the City of Plant City.

Unincorporated Hillsborough County

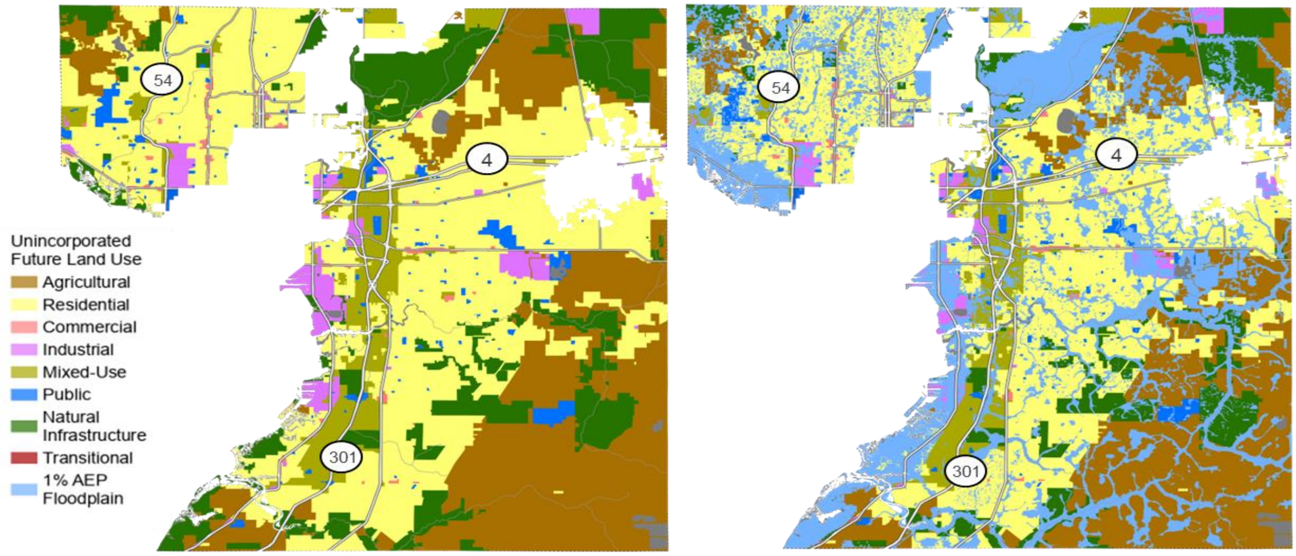


Figure 5.120. Unincorporated Future Land Use Intersected with 1% AEP Floodplain

Unincorporated Hillsborough County's future land use has over 70,000 acres of residential land exposed to the 1% AEP floodplain, over 46,000 acres of natural infrastructure exposed, and over 41,000 acres of agricultural land exposed. Appendix B has the full exposure statistics for Unincorporated Hillsborough County.

Wildfire

Similarly, wildfire risk to future land use was mapped for the County and its jurisdictions with acres of land area by land use type at risk to wildfire calculated. The Wildland Urban Interface (WUI), defined as the area where structures and other human development meet or intermingle with undeveloped wildland, is a good measure of what areas are most vulnerable to wildfires and where wildfires can cause significant property damage. The WUI is separated into two different types of areas: interface areas and intermix areas. The interface areas are where urban sprawl presses up against public and private natural areas, bringing a distinct line between urban and rural areas to mind. By contrast, the intermix areas are areas undergoing a transition from agricultural and forest uses to urban land uses. These areas are both at risk to wildfire. The 2020 WUI mapping used in the Wildfire Profile is the current available mapping. More information about these risks can be found in the Wildfire Hazard Section in Section 4 of the plan – Risk Assessment. The following maps (Figure 5.121 through Figure 5.124) depict the future land use from Figure 5.114 overlaid with the WUI areas of wildfire risk.

City of Tampa

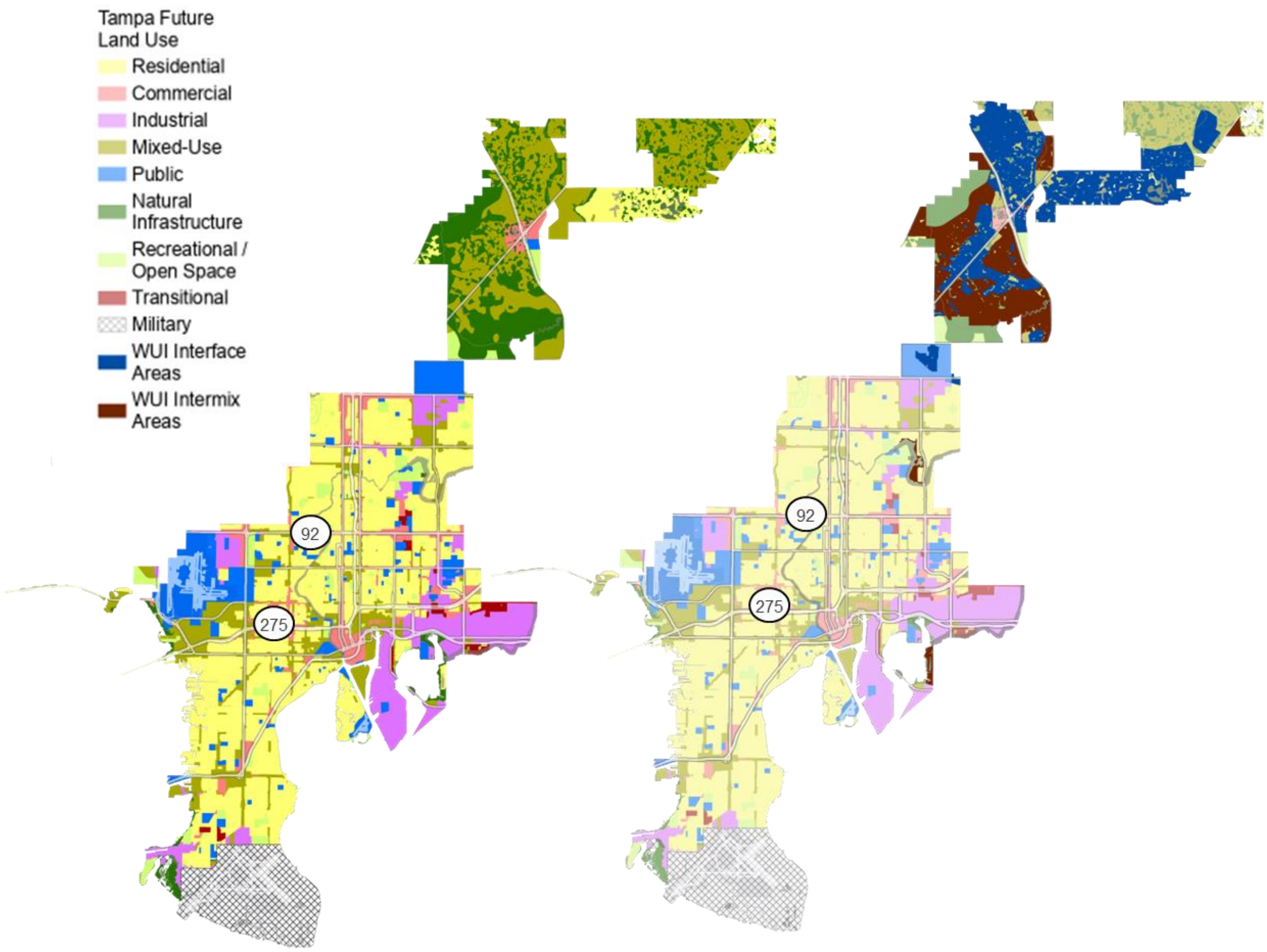


Figure 5.121. City of Tampa's Future Land Use Intersected with Areas of Wildfire Risk

Over 12,700 acres of land (or 17% of total acres) in the City of Tampa is at risk to wildfire (either in an interface or intermix area from the WUI). The majority of this is mixed-use land use, with just under 6,000 acres of vulnerable land. Natural infrastructure has over 4,600 acres at risk, and residential land has over 1,600 acres at risk. However, the residential land at risk is only 6% of the total acres of residential land in the City of Tampa, but 59% of the total natural infrastructure land area is vulnerable in the City. Appendix B has the full exposure statistics for the City of Tampa.

City of Temple Terrace

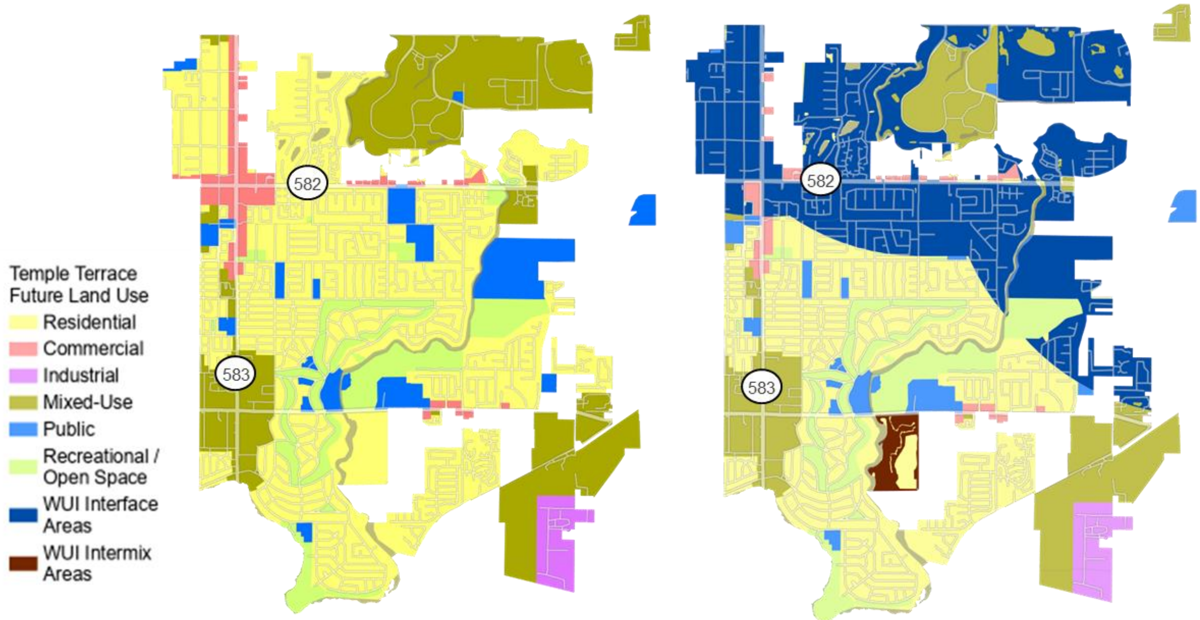


Figure 5.122. City of Temple Terrace's Future Land Use Intersected with Areas of Wildfire Risk

The City of Temple Terrace has the most acres exposed to wildfire in its residential land use category, with over 1,100 acres at risk to wildfire (42%). Mixed-use has just under 400 acres (32% of total mixed-use land use in the City of Temple Terrace), public has just under 200 acres (55%), and commercial land has just over 100 acres (57%) at risk to wildfire. Appendix B has the full exposure statistics for the City of Temple Terrace.

City of Plant City

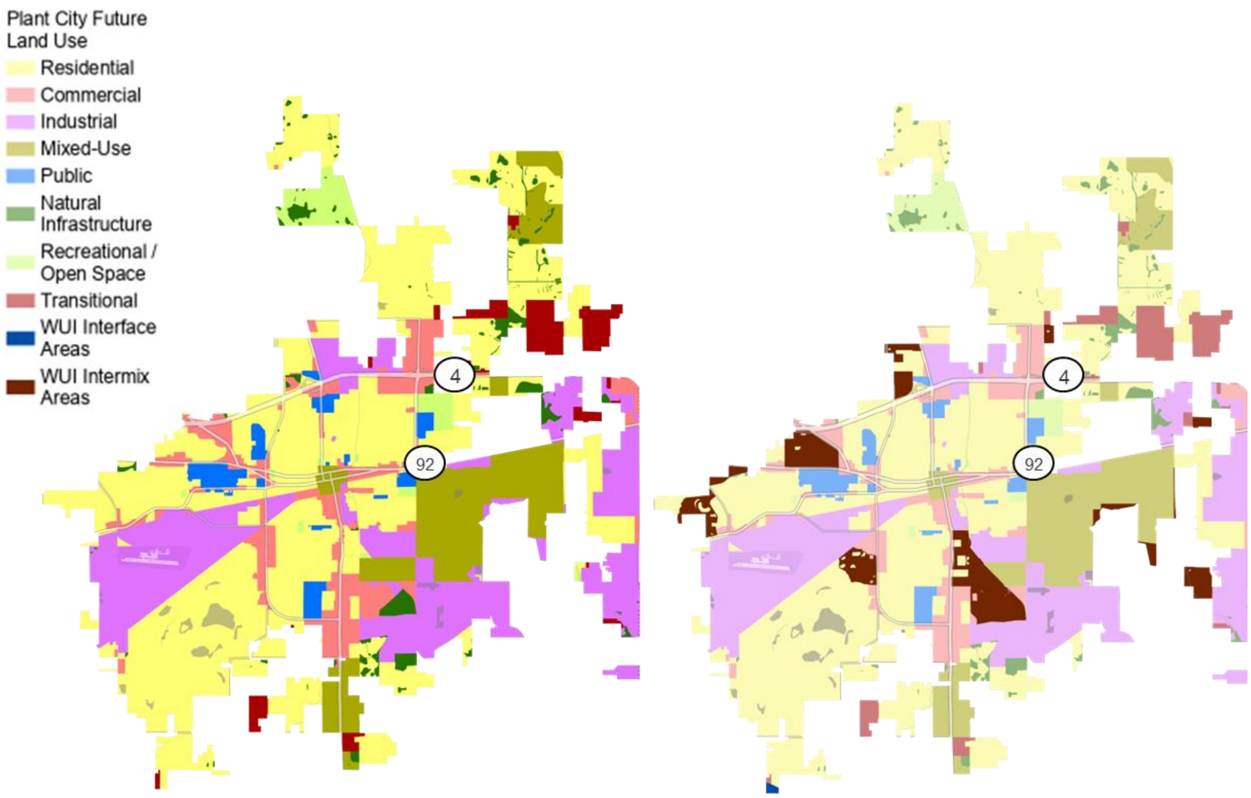


Figure 5.123. City of Plant City's Future Land Use Intersected with Areas of Wildfire Risk

The City of Plant City has the lowest area at risk to wildfire in any of the County's jurisdictions. Around 470 acres of residential land (5% of total residential land use in the City of Plant City) is at risk to wildfire. Commercial has just over 250 acres (15%), industrial has just under 150 acres (4%), and natural infrastructure has around 88 acres (18%) at risk to wildfire in the City of Plant City. Appendix B has the full exposure statistics for the City of Plant City.

Unincorporated Hillsborough County

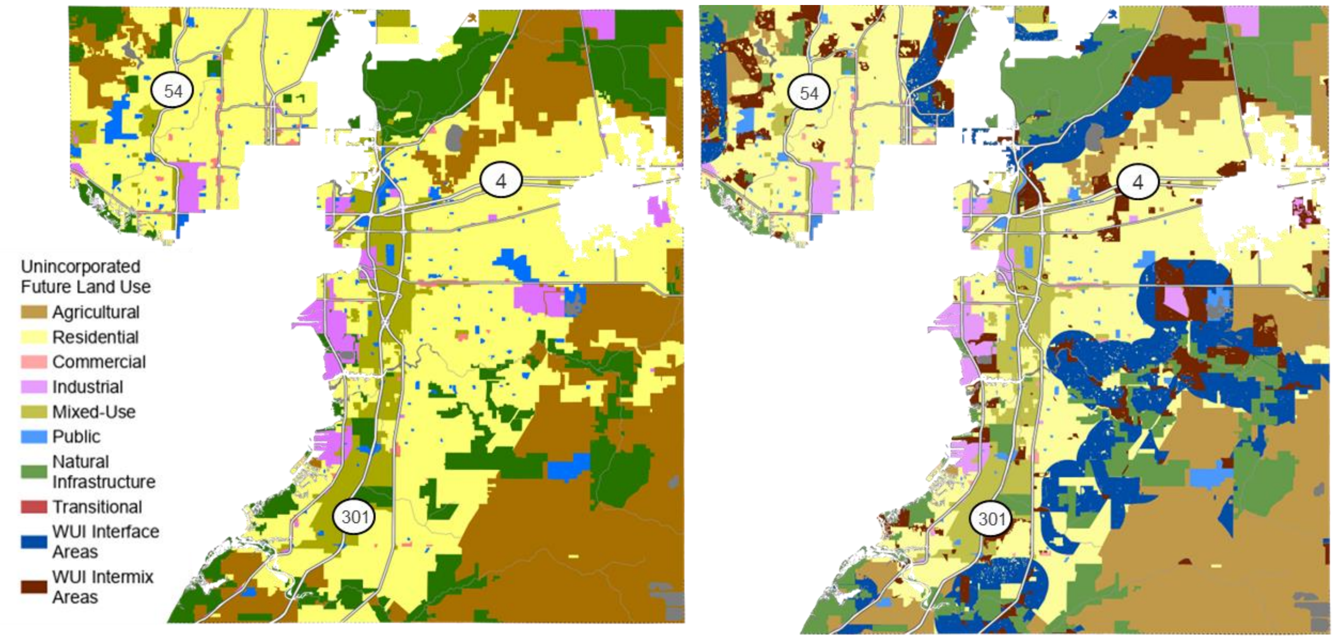


Figure 5.124. Unincorporated Hillsborough County's Future Land Use Intersected with Areas of Wildfire Risk

Finally, Unincorporated Hillsborough County has around 80,700 acres of residential land at risk to wildfire (32% of total residential land in Unincorporated Hillsborough County). Agricultural land has over 31,600 acres (20%) at risk to wildfire, and both industrial and public land have just over 3,800 acres (19% and 25%, respectively) at risk to wildfire. Appendix B has the full exposure statistics for Unincorporated Hillsborough County.

Conclusion

The foregoing analyses focus on flooding and wildfire, and how they intersect with the planned future land use in the county. This data, and subsequent enhancements, can inform the way that Hillsborough County and the Cities of Tampa, Temple Terrace and Plant City continue to plan future development. In fast growing areas with large amounts of at risk land, development in these areas is inevitable. Where development is allowed, land use, building code and design standards should be employed to minimize vulnerability.

SECTION 5 - MITIGATION STRATEGY

Local Hazard Mitigation Plan Requirements	
Section	**Description**
S1 (C1-a)	The plan must describe how resources of each participant the existing authorities, policies, programs, and funding are available to support the mitigation strategy. This must include a discussion of the existing building codes and land use and development ordinances or regulations. Capabilities may be described in a table or narrative.
S2 (C1-b)	The plan must describe the ability of each participant to expand on and improve the capabilities described in the plan (see S1).
S3 (C2-a)	The plan must describe participation in the NFIP for **each participant**, as applicable, in accordance with NFIP regulatory requirements.
S4 (C3-a)	The plan must include **goals** to reduce the risk of the identified hazards.
M5 (D3-a)	The plan must describe the community's process to **integrate** the plan's data, information, and hazard mitigation goals and actions into other **planning mechanisms**.
M6 (D3-c)	A multi-jurisdictional plan must describe **each participant's** individual process for integrating information from the mitigation strategy into their identified planning mechanisms.
M7 (D3-b)	The plan must identify the local planning mechanisms where hazard mitigation information/actions may be integrated. The identified list of planning mechanisms must be applicable to the plan participant(s) and not contradict the identified capabilities.

Introduction

The purpose of the Local Mitigation Strategy (LMS) is to develop a comprehensive "blueprint" aimed at providing a unified and consistent course of action to eliminate or reduce the impact of disasters threatening Hillsborough County and its municipalities. This section outlines the processes through which the County and its municipalities develop and prioritize actions in alignment with countywide goals and objectives. The updated strategy aims to enhance the resilience of Hillsborough County, ensuring that mitigation efforts are robust, inclusive, and forward-thinking, ultimately safeguarding the community against future disasters.

Originally developed in the late nineties, the framework of Hillsborough County's LMS was built to align with the Florida Department of Community Affairs publication, *The Local Mitigation Strategy: A Guidebook for Florida Cities and Counties*, as well as other guidance from the Florida Department of Economic Opportunity (DEO) and Florida Department of Commerce (formerly the Department of Community Affairs (DCA)), the Florida Division of Emergency Management (DEM), and the Federal Emergency Management Agency (FEMA).

The 2025 LMS update builds upon the thorough strategies that preceded it by: (a) reflecting the evolving capabilities of Hillsborough County governments and incorporating priorities and focus areas derived from newly published or updated guidance documents from city, state, and federal stakeholders; (b) integrating substantial public input gathered through diverse engagement methods, ensuring that community voices are heard and considered in the planning process; and (c) reflecting the most up-to-date climate science and projections, including social vulnerability data sets.

Goals and Objectives

Goals and objectives help capture the overall purpose of the plan and assist with determining possible new directions for hazard mitigation efforts. Setting goals and objectives ensures that the County is headed in the right direction when it comes to hazard mitigation planning by providing ways in which success can be measured. The goals and objectives below are intended to reduce long-term vulnerabilities. It is important that both the goals and objectives are reviewed regularly for continuing relevance to the County's hazard mitigation strategy.

Overview

The overarching purpose for the County's LMS is "to minimize the effects of any potential natural or man-made disasters on the community and its infrastructure;" however, using the new hazards and vulnerability analyses, goals were crafted along with specific objectives to fully recognize the overall intentions of the County. The table below outlines the new goals and objectives for the County.

The priority changes for the County, as a whole, shifted somewhat to focus on goals underneath the overall goal of the LMS, which is to establish and maintain an ongoing process that continually assesses potential disasters, develops corresponding mitigation techniques, and incorporates preparedness and response into the consciousness of the entire community.

There were **15 focused objectives developed across the 4 goal areas**. For each objective, a description of the activity was created as well as a type of metric to begin measuring progress.

The four goal areas are:

1. **Improved Human Environment *(People and Businesses)*** **–** Provide guidance on activities that protect and improve the quality of life and standard of living for residents and businesses. Specific actions are intended to focus on education, safety, health, and finances that reduce social vulnerability and improve business retention.
2. **Improved Built Environment *(Housing, Commercial Facilities, and Infrastructure)*** **–** Provide guidance on activities that improve levels of service through risk assessments, assess benefits of development/retrofits in low-risk areas, and consider higher standards.
3. **Improved Natural Environment *(Land, Vegetation, Animals)*** **–** Provide guidance on activities that promote natural and beneficial functions of floodplains, consider natural protection measures, and support healthy air and water quality for people and animals.
4. **Resiliently Designed Environments *(Strengthened Human, Built, and Natural Environments)*** **–** Provide guidance on activities that integrate lessons learned and best practices, while considering current and future hazard vulnerabilities, to provide a more disaster-resilient community.

The table below *(*Table 0.1*)* clearly outlines the County's focused goals, their associated objectives, and the related strategic measures for each objective. These priorities were identified and discussed during a series LMS Working Group (LMS WG) meetings in January and February of 2020. The finalized list of new objectives was approved by the LMS WG for inclusion in the update. Objectives that have been updated since the 2020 LMS are indicated with an “^”, while new objectives are indicated with an “*”.

Table 0.1. Hillsborough County Goals and Objectives

Goal	Obj. #	Strategic Objective	Strategic Measures
1	**1.1**	Provide guidance to promote education of residents and businesses about their vulnerability to hazards.	% of community vulnerable to high-priority hazards reached
1	**1.2**	Provide within areas of community needs, guidance regarding emergency response, warnings, and related activities.	% of Residents and businesses understand what warnings mean and how to take appropriate actions
1	**1.3^**	Promote awareness of locational vulnerability to businesses, including non-profits (such as public service and public facility providers)and facilities in order to become more sustainable to disasters.	% of businesses vulnerable to high-priority hazards reached
2	**2.1**	Provide a higher prioritized rank to LMS projects that will mitigate impacts within areas that have had, and will continue to have, significant flood impacts to human, natural and built environments.	Reduction of repetitive loss structures in the county
2	**2.2**	Provide guidance using LMS Strategies for vulnerable areas to community stakeholders to consider natural-beneficial functions, higher standards for design, resilient structures, and sustainable infrastructure.	New codes with higher standards adopted
2	**2.3^**	Provide guidance to community entities about mitigation initiatives that considered repetitive-loss analyses and lead to healthier, sustainable, resilient, safer and secure areas. Include guidance for housing developers, management companies, and HOAs that are located within floodplains about how to keep wetlands intact.	Reduction of the number of repetitive loss structures in the county with consideration given to the matrix of hazards
2	**2.4**	Assistance in guidance for watershed management plans and maintenance for storm water systems.	Adequate community budgets
2	**2.5***	Promote future resilient water utilities to safeguard water quality.	Number of retrofitted water utilities or new utility components built to resilient standards.
3	**3.1^**	Provide guidance to community stakeholders about mitigation initiatives to protect the	% of vulnerable coastline protected

Goal	Obj. #	Strategic Objective	Strategic Measures
		coastal areas of the community against erosion and encroachment of sea level rise.	
3	**3.2^**	Promote regulations that protect, maintain, and restore natural habitats that sustain all species.	Regulatory Changes
3	**3.3^**	Identify mitigation initiatives that may be used to integrate the use of natural habitats and living shorelines with man-made maintenance activities.	Number of mitigation initiatives used
3	**3.4***	Promote the protection, maintenance, and deployment of heat-abating features, whether man-made or natural.	Number of trees added or other green infrastructure projects that abate heat.
3	**3.5***	Promote the maintenance and improvement of water quality in natural environments to ensure thriving biodiversity.	Water quality measurements
4	**4.1***	Evaluate county policies to include language that promotes low-impact development and green infrastructure scenarios as considerations for future development.	Regulatory language recommendations or changes
4	**4.2***	Promote resiliency in critical assets. Create plans, conduct analyses, or execute measures to ensure that critical assets such as pump stations, fire stations, and evacuation routes are resilient to hazards to ensure continuity of operations. This would include measures like elevation, repairing and replacing generators, and hardening infrastructure along evacuation routes.	Number of resilience projects implemented

Appendix D: Mitigation Projects details which mitigation actions address each of these sets of objectives. **Appendix I: Mitigation Initiatives** outlines additional mitigation actions that are already being implemented by Hillsborough County and its jurisdictions, as well as actions that were proposed, but ultimately not included in Appendix D and are still under consideration.

Specific Mitigation Measures

Mitigation tools and techniques fall into three broad categories: (1) **structural techniques** - including design and construction; (2) **environmental interventions** and (3) **non-structural interventions**. Structural mitigation projects include the strengthening of vulnerable structures and public facilities to withstand wind, fire and other forces, elevation of structures to protect them from flood damage, construction of storm water control facilities and drainage improvements. Environmental intervention refers to actions that reduce the vulnerability of communities by armoring them against the elements. This term includes beach restoration and stabilization projects. Non-structural mitigation refers to policies avoiding hazard impacts, applying zoning restrictions, land acquisition in the floodplain, promoting citizen awareness and public education initiatives.

Each jurisdiction identified mitigation actions which fell into one of six (6) specific measures:

A. Prevention:

Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulation.

B. Property Protection:

Actions that involve the modification of existing building or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and impact-resistant glass.

C. Public Education and Awareness:

Actions to inform and educate citizens, elected officials and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

D. Natural Resource Protection:

Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

E. Structural Projects:

These are actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls, floodwalls, seawalls, retaining walls, and safe rooms. The implementation of a mitigation program is a key component in the achievement of a “sustainable community”, one in which citizens, businesses, and institutions are protected from the disruptions and impacts of disasters. In an urbanized metropolitan county such as Hillsborough County, coordination among and between levels of government is critical to the success of the program.

F. Emergency Services:

These actions support and provide emergency services in response to an emergency or disaster in the county. It may include early warning systems, sirens, or equipment for actual response.

The LMS Project List for Hillsborough County and its municipalities can be found in Appendix D. During the 2020 LMS update, all stakeholders were asked to update the status of existing projects to either active or archived. For the 2025 LMS update, archived projects from 2020 were completely removed from the LMS. The 2025 LMS update reflects the current status of all projects listed as active in the 2020 LMS update, as well as any new projects that have been added. Within the 2025 LMS Update, all active projects include an estimated completion year and list their current status (new or deferred). Archived projects are listed as completed or deleted – if deleted, have an explanation as to why. From 2020 to 2025, new projects continued to be self-scored by the applicants' organizations, reviewed by the LMS WG, and then presented to the LMS WG to provide any clarification on details before being approved to the LMS Project List by the LMS WG. There are two tables per jurisdiction: (1) Active Projects (the new or deferred projects) and (2) Archived Projects (those projects that are completed, deleted, or unknown).

SECTION 6 - POTENTIAL FUNDING AND TECHNICAL ASSISTANCE

Potential Funding and Technical Assistance	
Section	**Description**
S1 (C1-a)	The plan must describe how resources of each participant the existing authorities, policies, programs, and funding are available to support the mitigation strategy. This must include a discussion of the existing building codes and land use and development ordinances or regulations. Capabilities may be described in a table or narrative.

Introduction

This section supplements ***Section 3: Capability Assessment*** by providing an overview for funding and technical assistance potentially available to Hillsborough County for plan implementation. One of the requirements for the LMS is the identification of potential funding for mitigation projects. Federal, state, and local governments have programs that provide funding for various types of mitigation. Some funding is available prior to a disaster, while other programs are initiated in a post-disaster environment.

Local and state agencies have dedicated financial resources to funding mitigation projects. The majority of the state funds that indirectly support mitigation-related activities are provided for land acquisition, water quality, and quantity-related issues, as well as meeting non-federal match requirements for various federally funded mitigation assistance programs. Similarly, local governments fund various projects, including implementation of growth management initiatives; planning, permitting, and code enforcement; acquisition and maintenance of parks and conservation areas; stormwater projects; housing mitigation assistance programs for low- and moderate-income citizens; and construction and structural hardening of critical facilities, such as public safety and emergency operations centers, fire and police stations, city halls, etc.

Both the State of Florida and local governments leverage funds available from federal and state sources to provide financial assistance to implement the hazard mitigation projects that have been identified, prioritized, and documented by the LMS WG

The County uses a variety of programs and funds to achieve its mitigation goals. Various programs and sources of project funding are described throughout this section.

Federal Funding

While many opportunities exist to fund projects at the local level, both the state and local applicants rely heavily on the use of federal funds to implement mitigation projects. The following federal funding sources are some of the most popular programs used to help achieve the County's mitigation goals. More information regarding federal funding sources can be found on FEMA's website.

Federal Emergency Management Agency (FEMA)

Hazard Mitigation Assistance (HMA) Programs

All mitigation measures submitted to the state for funding under FEMA's Hazard Mitigation Assistance (HMA) programs must:

- Be consistent with the State Hazard Mitigation Plan (SHMP)
- Solve or, at the very least, address a problem
- Be technically feasible
- Be cost-effective
- Comply with environmental regulations
- Identify a non-federal match (if required)

For all HMA grants, the State of Florida is the grantee, and Hillsborough County its jurisdictions are subgrantees. The Florida Department of Emergency Management (FDEM) has its own prioritization and eligibility review when grant applications are submitted to FEMA. These criteria are reflected in Florida Administrative Code 27P-22.005, in which Florida requires the prioritized project list to outline the estimated costs and associated funding sources for each project listed. Florida is the only known state to have a legislatively approved process for distributing Hazard Mitigation Grant Program (HMGP) funds. The law serves to strengthen local planning processes while providing autonomy in how funds are distributed.

In the instances where a cost-effective, eligible, and technically feasible project submitted under a specific grant program fails to receive a grant due to lack of funds, FDEM will provide information on the next available qualifying funding source. For example, if an acquisition is submitted under HMGP and meets all program eligibility requirements but is not funded due to limited HMGP funds, this project will be provided to the FMA staff for consideration under the next open cycle.

Building Resilient Infrastructure and Communities (BRIC)

The BRIC Program is authorized by Section 203 of the Stafford Act, as amended by Section 1234, National Public Infrastructure Pre-Disaster Hazard Mitigation, of the Disaster Recovery Reform Act (DRRA) of 2018. FEMA funds BRIC with a six percent set-aside from federal post-disaster grant funds, such as public assistance and individual assistance grants. It was created to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. FEMA anticipates BRIC funding projects that demonstrate innovative approaches to partnerships. For complete information about eligible applicants, see FDEM's *State Agency Capability Assessment*.

Eligible project activities under BRIC include:

- Acquisition/Demolition
- Acquisition/Relocation
- Structure Elevation
- Mitigation Reconstruction
- Dry floodproofing
- Generators
- Localized and Non-localized flood reduction projects
- Protective measures for utilities
- Retrofitting
- Safe rooms
- Soil Stabilization
- Wildfire Mitigation
- Hazard mitigation planning
- Project scoping
- Building code activities
- Earthquake early warning activities

Through BRIC, (as previously with Pre-Disaster Mitigation) Florida plans to provide protection to local government structures and critical facilities, as well as reduce flooding in neighborhoods. Although the BRIC program is federally funded, the program is administered through a partnership arrangement with FDEM. In this capacity, the key responsibilities of the state are to:

- Solicit and review BRIC – subapplications from subapplicants
- Prepare and submit eligible subapplications to FEMA
- Manage the BRIC Program
- Fully utilize the funds available under the program

Eligibility for BRIC Program Grants

State mitigation staff evaluates the projects to be sure that the subapplicant and project are eligible according to FEMA's most recent (2023) HMA Guidance. The project must conform to regulations found in this Guidance, including:

- Be in conformance with the LMS, local ordinances, planning requirements, and floodplain management plans (FMPs, as applicable)
- Be cost-effective
- Be long-term and technically feasible
- Reduce or eliminate risk and damage from future natural hazards
- Meet the latest international building codes
- Conform to all applicable environmental and historic preservation requirements
- Benefits must not duplicate those available through another primary source or program

Prioritization for BRIC Grant Program

Florida will only consider BRIC applications from communities that have a FEMA-approved LMS. Typically, BRIC funds are available to all eligible applicants statewide for projects that are designed to reduce future risk to individuals and property from natural hazards. While not required to be approved nor prioritized by the local LMS WGs, projects submitted for funding under the BRIC must be consistent with the LMS and documented as such.

Since funding for BRIC is competitive nationwide and the federal guidance material may or may not limit the total number of subapplications a state may submit, FDEM provides technical assistance to all eligible subapplicants with a FEMA-approved LMS. When these funds are available, the review of subapplications submitted for funding will consist of a Project Review Team composed of subject matter experts.

FDEM will limit its submittals to eligible cost-effective subapplications, utilizing benefit cost ratio and technical feasibility reviews, as required in the federal guidance. FEMA outlines priorities for the program in each Notice of Funding Opportunity (NOFO). There is no limit on the number of subapplications that the state can submit; however, each project has a funding cap of $50 million.

Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized by Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (PL 93-288 as amended). This program is designed to help states, local governments, private non-profit organizations, and tribes implement long-term hazard mitigation measures following a major disaster declaration. Funds may be used to protect public or private property. They may also be used to purchase property that has been subjected to or is in danger of, repetitive damage. Projects include acquisition and relocation, multi-hazard retrofits, minor flood control projects, and construction of safe rooms.

The standard federal mitigation funding allocation for this program is fifteen percent of allocated disaster relief (the sum of public assistance, individual assistance, and Small Business Administration (SBA)). States with an approved Enhanced SHMP are eligible to receive an additional five percent of the disaster relief funds. Up to seven percent of HMGP money can be used for mitigation planning activities.

In Florida, the state determines how those planning funds will be allocated. Often, seven percent of planning funds are used for state-level planning initiatives. Under this program, the state requests the additional seven percent set aside, which requires approval from FEMA. Other set-asides can include a five percent initiative for special state initiatives and potentially another five percent for activities that address promoting disaster-resistant codes for all hazards.

The State's five percent initiative funds are used to implement special mitigation priorities set by the Governor and the Governor's Authorized Representative (GAR). These statewide projects include those mitigation activities that are proposed by state and regional agencies. This includes activities proposed by FDEM that are regional or statewide in scope. If there are no priorities set for these initiative funds, the five percent can be applied to local initiatives at the discretion of the state.

Key objectives of the HMGP are to:

- Prevent future losses of lives and damage to property due to disasters
- Implement state or local hazard mitigation plans
- Enable mitigation measures to be implemented during immediate recovery from a disaster
- Provide funding for mitigation measures that benefit the disaster area

Eligibility for HMGP

To be eligible for mitigation funding, a project must be listed in the community's LMS and satisfy the requirements listed below.

These criteria are also listed in the HMGP Administrative Plan, which is used for all federal hazard mitigation programs:

- Be in conformance with the SHMP.
- Have a beneficial impact on the declared disaster area. A project located outside the declared disaster area cannot be eligible unless it has a direct and beneficial impact on the disaster area or until all projects within the declared disaster area have been funded.
- Conform to 44 CFR, Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR, Part 10, Environmental Considerations.
- Solve a problem independently or constitute a functional portion of a solution where there is assurance that the project will be completed as a whole. Projects that merely identify or analyze hazards or problems are not eligible.
- Be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster. The grantee must demonstrate this by documenting that the project:
    - Addresses a problem that has been repetitive or a problem that poses a significant risk to public health and safety if left unsolved
    - Will not cost more than the anticipated value of the reduction in direct damages and subsequent negative impacts to the area if future disasters were to occur
    - After consideration of a range of options, has been determined the most practical, effective, and environmentally sound alternative
    - Contributes to a long-term solution to what it is intended to address
    - Considers long-term changes to the areas and entities it protects and has manageable future maintenance and modification requirements

FEMA defines hazard mitigation as an action intended to reduce repetitive losses from future natural disasters. In this context, "repetitive" refers to similar types of losses caused by a recurring natural hazard. The term "losses" refers to expenditures for the repair or replacement of public and private property and for the relief of personal loss or other hardship. Post-disaster projects that simply repair and reconstruct damaged property to pre-disaster conditions are not eligible. Rather than mitigating loss, these types of projects serve to perpetuate the cycle of damage, reconstruction, and repeated damage.

Any HMGP construction project located within a Special Flood Hazard Area (SFHA) must comply with the minimum National Flood Insurance Program (NFIP) standards for such projects.

The Disaster Mitigation Act of 2000 (DMA2K) requires, as a condition for receipt of federal mitigation assistance funds, local governments to develop a FEMA-approved local mitigation plan. The plan must contain locally prioritized projects that are technically feasible, cost-effective, and environmentally sound. In addition to the federal criteria, Florida requires, through 27P-22.005 of the Florida Administrative Code (FAC), the prioritized project list to list the estimated costs and associated funding source for each project listed. Florida is the only known state to have a legislatively approved process for distributing HMGP funds.

Prioritization for HMGP

Upon notice from FEMA of the availability of HMGP funds, the mitigation staff determines the amount of funds that have been dispersed in each of the declared counties from the Individual Assistance (IA) Program, the Public Assistance (PA) Program, and the SBA Disaster Loan Program. Each county receives a proportional HMGP allocation based on these figures.

FDEM will use the 120-day estimate to determine the percentage of funds allocated to each county. This process repeats after each successive estimate, and the allocations are adjusted accordingly. When county allocations have been determined, a Notice of Funding Opportunity (NOFO) is published in the Florida Administrative Register and distributed to mitigation partners throughout the state.

Local mitigation projects are prioritized by each LMS WG. Prioritized lists are submitted to the state each year as a part of the FAC 27P-22 rule update process and again with five-year plan updates. Under the HMGP, FDEM has delegated its authority to set priorities and select projects to the LMS WGs in order to validate the local mitigation planning process embodied in the LMS. Under the rule, only prioritized projects from the LMS WG are eligible for HMGP project funding. LMS WGs are encouraged to gather estimates of costs and conduct a simple benefit-cost review as part of the priority-setting process, not only to help meet federal planning requirements but also because it is critical to early implementation of projects in a disaster's aftermath.

A letter from the LMS WH Chairperson must accompany each application submitted endorsing the project and assigning a funding priority. To meet the requirements of DMA2K, the letter must indicate the LMS goal (and objective where appropriate) addressed by the project. The state mitigation staff verifies that the community is listed as an approved participant in the LMS.

To ensure that all of the HMGP project funds are used, FDEM uses a three-tiered distribution system, as described in Table 6.1 below.

Table 6.1. Hazard Mitigation Grant Program Distribution System

Tier 1	HMGP funds are allocated to counties included in the relevant Presidential disaster declaration. Funds are allocated in proportion to each county's share of federal disaster funding from the PA, IA, and SBA Disaster Loan Program as of the date of

	receipt of the FEMA NOFO. Eligible projects are funded in order of LMS priority until allocations (through the 12-month lock-in) are exhausted or all eligible projects are funded.
Tier 2	Any funds remaining after all eligible projects are funded are reallocated to declared counties with insufficient allocations to fund all submitted eligible projects. Priority for reallocating funds begins with the declared county with the lowest initial allocation.
Tier 3	If funds remain, they shall be applied to fund eligible projects submitted on a first-come-first-served from counties that did not receive a Tier 1 allocation because they were not included for IA, PA, or SBA loans.

Prioritization for HMGP Set-Asides

The State's 5 Percent Initiative funds are used to implement special mitigation priorities set by the Governor and the GAR. The initiative funds are portioned from the State's overall HMGP ceiling for the relevant disaster. These statewide projects include mitigation activities that are regional or statewide in scope and are proposed by state and regional agencies. If there are no priorities set for these initiative funds, the five percent can be rolled back into the regular funding, which will go toward those applications submitted by the counties and in accordance with FAC 27P-22.

Prioritization for special set-asides under the HMGP is handled a different way: if the state chooses to use the 5 Percent Initiative funding under HMGP, the Governor and the GAR, in consultation with the state legislature, set priorities for the funding based upon the hazard, type of damages, and identified need resulting from a hazard event. If the Governor and legislature do not set statewide priorities for funds, projects will be deferred to a Project Review Committee of subject matter experts. In all cases, the projects recommended for funding must be in compliance with all other applicable federal requirements.

Prioritization for HMGP Planning (Seven Percent) Funds

When these funds are available, the review of projects submitted for funding will consist of a Project Review Committee comprised of subject matter experts. A standardized process has been developed to rank planning grants for when the amount of available funding is not enough to cover all projects submitted or when similar projects are received from different jurisdictions or agencies.

The scoring system in the below table (Table 6.2), as established by FDEM, determines how HMGP planning projects will be prioritized for funding.

Table 6.2. Hazard Mitigation Grant Program (HMGP) Prioritization Scoring System

The clarity of the defined mitigation need and the degree to which the projected outcome of the planning project addresses the need.	**20 points**
The suitability of the proposed planning process to address the need, including proposed actions to involve the public and participants from neighboring communities, appropriate state and local agency personnel, and NGO representatives, where appropriate.	**20 points**

The consistency of the planning project with risk analysis and the goals and objectives of the relevant LMS, other local plans, and the SHMP.	**15 points**
Ability to meet the local match.	**10 points**
The capability of the applicant to complete the project based on experience, resources and demonstrated ability.	**10 points**
Proposed project benefits two or more counties (wider impact of planning efforts).	**10 points**
Proposed project outlines inclusion of or benefit to underserved and/or vulnerable populations.	**5 points**
Proposed project addresses planning for future conditions and/or the effects of climate change.	**5 points**
Proposed project integrates with other local planning mechanisms (i.e., used as an annex, incorporated into other plans, used as the basis for other planning efforts, etc.).	**5 points**
TOTAL Scoring	**100 points**

Tiebreaker: The degree to which the planning project builds on earlier planning projects.

Public Assistance (PA) Mitigation (406 Mitigation)

The Public Assistance (PA) 406 Mitigation program funds mitigation measures for permanent work. The mitigation measures must directly reduce the potential of future damage to the damaged portion(s) of the facility. Generally, eligible PA mitigation measures are those the applicant performs on the damaged portion(s) of the facility. The four basic components of PA eligibility are applicant, facility, work, and cost. The applicant must be a state, tribe, or local government. A facility must be a building, public works system, equipment, or improved and maintained natural feature. Work is categorized as either "emergency" or "permanent." It must be required as a result of the declared incident, located within the designated disaster area, and is the legal responsibility of the eligible applicant. Costs are expenses tied directly to eligible work and must be adequately documented, authorized, necessary, and reasonable. Eligible costs include labor, equipment, materials, contract work, and management costs. Emergency work must be completed within six months and includes debris removal and emergency protective measures. Permanent work must be completed within eighteen months and includes roads, bridges, water control facilities, public buildings and equipment, public utilities, and parks, recreational and other facilities.

Informally, FDEM, while practicing equity, has always made a good-faith effort to ensure critical infrastructure is prioritized. Officially, increasing resiliency throughout the disaster-affected areas through critical infrastructure prioritization has been FDEM's focus during the Hurricanes Ian and Nicole response/recovery process. It is anticipated that approach will continue during recovery for Hurricanes Debby, Helene, and Milton.

Hazard Mitigation Grant Program (HMGP) Post-Fire

The HMGP Post-Fire program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. HMGP Post-Fire funding is authorized under Sections 404 and 420 of the Stafford Act and provides hazard mitigation grant funding to the state, local, and tribal governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration. States and territories that have received an FMAG declaration and certain federally recognized tribes are eligible to apply for assistance under HMGP Post-Fire. The application period opens with the state or territory's first FMAG declaration of the fiscal year and closes six months after the end of that fiscal year.

Most activity development, application, submission, and grants management processes that apply to HMGP will also apply to HMGP Post-Fire. In addition, all eligible activities under HMGP are also eligible under HMGP Post-Fire. Eligible project types that address wildfire mitigation include defensible space measures, ignition-resistant building materials, hazardous fuels reduction activities, erosion control measures, slope stabilization, and post-wildfire flood reduction measures.

Flood Mitigation Assistance (FMA) Program

The FMA program is authorized by Section 1366 of The National Flood Insurance Act of 1968, as amended (Pub. L. No. 90-448) (42 U.S.C. § 4104c) and appropriated annually by the Consolidated Appropriations Act. Since the last plan update, consistent with the legislative changes made in the Biggert-Waters Flood Insurance Reform Act of 2012, the established partnership was designed to help states, local, and tribal governments reduce or eliminate long-term risks of flood damage to repetitively flooded structures insured under NFIP. The goals of the FMA are to:

- Fund cost-effective and technically feasible measures that reduce or eliminate the long-term risk of flood damage to structures insured through NFIP
- Encourage long-term, comprehensive mitigation planning against repetitive flooding
- Reduce repetitively or substantially damaged structures and associated claims on the National Flood Insurance Fund (NFIF) by giving priority to Severe Repetitive Loss (SRL) structures
- Complement other federal and state mitigation programs with similar goals

The types of grants available through FMA are: Community Flood Mitigation Advance Assistance, Community Flood Mitigation Projects, Mitigation Planning, and Residential Mitigation Projects. Projects include the following eligible activities:

- Development of mitigation strategies and/or data to prioritize, select, and develop viable community flood mitigation projects
- Projects that integrate cost-effective natural floodplain restoration solutions and improvements to NFIP-insured properties
- Development of state or local flood plans and flood plan updates
- Acquisition and demolition
- Acquisition and relocation
- Structure elevation
- Mitigation reconstruction
- Dry flood-proofing
- Flood control projects
- Structural non-structural retrofitting of existing buildings

- Infrastructure retrofit
- Soil stabilization

Although the FMA Program is federally funded, the program is administered through a partnership with FDEM. In this capacity, the key responsibilities of the State are to:

- Solicit and review FMA subapplications from applicants
- Prepare and submit eligible subapplications to FEMA
- Manage the FMA program
- Fully utilize the funds available under the program

Eligibility for FMA Grants

State mitigation staff evaluate all applications to ensure that the applicant and proposed projects are eligible according to 44 C.F.R. Part 79 and the HMA Guidance. Projects must conform to regulations found in 44 C.F.R. Part 79 and the HMA Guidance. Projects must be:

- Eligible, cost-effective, and technically feasible.
- In conformance with applicable environmental laws and regulations.
- Included in, and in conformance with, the FMP.
- Physically located in a participating NFIP community, not on probation, or the project must benefit such a community directly by reducing future flood damage.
- NFIP insured at the time of the opening of an application period and maintained through at least the completion of the project. For projects where a structure remains in the SFHA, properties must maintain a flood insurance policy for the life of the structure.

State agencies, federally recognized tribes, and local governments/communities are eligible to apply.

Prioritization for FMA

The State of Florida supports and encourages multi-hazard planning, and each LMS must include a flood component. Specialized flood planning is an eligible activity through FMA to augment multi-hazard plans. FEMA outlines priorities for the program in each NOFO. As the FMA applicant, FDEM will limit its submittals to eligible cost-effective subapplications, utilizing benefit cost ratio and technical feasibility reviews. FDEM also has the authority to decide whether or not to submit sub-applications to FEMA for FMA-related activities.

FDEM utilizes FEMA's priorities to assist communities with determining if they may benefit from FMA projects and/or planning opportunities. In conjunction with communities, staff considers various circumstances to make this determination. These include the impact of flooding on the community and the desire to initiate new and improved flood hazard initiatives or implement strategies to improve their usage of FMA project funds.

There was never a case in which the number of projects exceeded the FMA allocation, but in the event there was, the following method would have been used to review and rank local government applications:

- Priority #1: Local governments that have experienced a significant flood event and did not receive a presidential disaster declaration.
- Priority #2: Local governments that have severe repetitive loss structures but have never submitted or infrequently submitted applications to FMA for flood mitigation projects.
- Priority #3: Local governments that have a high number of FEMA repetitive loss structures.
- Priority #4: Local governments that have targeted repetitive loss structures.
- Priority #5: Those who participate in CRS with ten or more FEMA repetitive loss properties.

Should multiple applicants rank equally, the highest number of severe repetitive loss structures will have priority. FDEM elects not to provide FEMA with sub-applications that exceed its annual allocation of FMA funds.

Rehabilitation of High Hazard Potential Dam (HHPD) Grant Program

The HHPD Grant awards provide technical, planning, design, and construction assistance in the form of grants for the rehabilitation of eligible high hazard potential dams. A state or territory with an enacted dam safety program, the State Administrative Agency (SAA), or an equivalent state agency, is eligible for the grant. Projects are approved by the dam safety agency in the state or territory where the dam is located. It is also strongly recommended that the state or territorial dam safety officer coordinate with the state or territorial hazard mitigation officer to assist with various requirements of this grant, such as: NFIP participation, hazard mitigation plan, floodplain management plan, and risk prioritization. It is within the SAA's authority to disburse funds to subrecipients once projects are completed and approved. The cost share requirement for the state, territory, or agency (the non-federal participant) will be no less than thirty-five percent, which may partially or fully be in-kind funding.

The following dams are eligible for HHPD funding:

- Dams located in a state with a dam safety program
- Classified as "high hazard potential" by the state dam safety agency in which the dam is located
- Has an Emergency Action Plan (EAP) approved by the state dam safety program or is in conformance with state law and pending approval by the state dam safety agency
- Located in a jurisdiction with a FEMA-approved hazard mitigation plan that includes dam risk and
- Fails to meet minimum state dam safety standards and pose an unacceptable risk to the public

The HHPD Grant program may provide assistance for technical, planning, and design activities towards the following types of projects: repair, removal, or structural/nonstructural rehabilitation of eligible high hazard potential dams.

Prioritization for HHPD Grant Program

Previously, Florida has not been active in the HHPD program due to a lack of capacity to administer the grant and a lack of contributing resources by Florida's dam owners. In 2022, FDEM began coordinating with FDEP and the State Dam Safety Officer to develop and make the program available to Florida's dam owners. To implement the program, FDEM must receive budget authority and approval from the Florida Legislature via the annual budget. This program is being added to the FDEM multi-year strategy and will be submitted as a Legislative Budget Request in the coming years. Once FDEM has received this authority and approval, the Mitigation Bureau will establish standard operating procedures for application review, project awards, grant management, and closeout in coordination with the State Dam Safety Office. Specifically, these procedures will include risk prioritization for the HHPD grant projects. As FDEM does not currently have approval to apply for the program, it would be premature to establish the prioritization process at this time.

Fire Management Assistance Grant (FMAG) Program

The FMAG Program is available to state, local, and tribal governments for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands that threaten such destruction as would constitute a major disaster under CFR 44.1(d)(204). The Fire Management (FM) declaration process is initiated when a state submits a request for assistance to the FEMA Regional Director at the time a "threat of major disaster" exists. The entire process is accomplished on an expedited basis, and a FEMA decision is rendered in a matter of hours. Before a grant can be awarded, a state must demonstrate that total eligible costs for the declared fire meet or exceed the individual fire cost threshold. This threshold applies to single fires, or the cumulative fire cost threshold, which recognizes numerous smaller fires burning throughout a state. The federal cost share for FMAG is seventy-five percent.

The eligible expenses must be associated with the incident period of a declared fire and include the following:

- Personal comfort and safety items for firefighter health and safety
- Repair or replacement of equipment lost or destroyed in firefighting activities
- Overtime and regular labor costs
- Travel and per diem costs of employees providing services directly associated with fire-related activities
- Provision of field camps and meals when made available
- Pre-positioning costs associated with Federal, out-of-state (including compact), and international resources for a limited period
- Emergency work that may include search and rescue, extraordinary emergency operations center, and evacuations and sheltering
- Temporary repair of damage caused by eligible firefighting activities
- Costs for mobilization and demobilization and fires on co-mingled federal/state lands

Safeguarding Tomorrow Revolving Loan (RLF) Program

The Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act became law on January 1, 2021, and authorizes FEMA to provide capitalization grants to states, eligible federally recognized tribes, territories, and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters. These low-interest loans will allow jurisdictions to reduce vulnerability to natural disasters, foster greater community resilience, and reduce disaster suffering.

The Infrastructure Investment and Jobs Act (IIJA) became law on November 15, 2021, fully funding the RLF program and appropriating $500 million over five years. In the first year, FEMA is making $50 million available to eligible entities to establish revolving loan funds. FEMA will not limit or restrict project types beyond the limitations in statute. These loans may be used as a non-federal cost match for another HMA grant application. These loans are awarded directly to the applicants.

The priorities of the Safeguarding Tomorrow RLF program are to:

- FEMA collaborating with eligible entities to help them increase their capacity and capability through focused engagement activities
- Allowing applicants to leverage loans for non-federal cost share with other FEMA HMA programs
- Delivering forty percent of the overall benefits generated by the entity loan funds flowing to underserved communities
- Reduce program complexity by breaking down barriers and increasing access to mitigation funding
- Identify administrative burdens and reduce them to the greatest extent possible

FEMA will provide capitalization grants for entities to establish revolving loan funds for mitigation projects and activities to increase resilience and mitigate the impacts of events such as drought, extreme heat, severe storms, wildfires, floods, and earthquakes. This is an opportunity to prioritize low-impact development, wildland-urban interface management, conservation areas, reconnection of floodplain and open space projects, and building code adoption and enforcement.

More detailed allowable uses include:

- **Mitigation Activities:** Eligible project types under this program will include activities that mitigate the impact of natural hazards, zoning and land use planning changes, and building code enforcement.
- **Non-Federal Cost-Share:** Loans may be used by local governments to satisfy a local government's non-federal cost-share requirement for other FEMA HMA grant programs, such as the HMGP, HMGP Post-Fire, BRIC and FMA grant programs.
- **Local Government Technical Assistance:** Entities may provide technical assistance to local governments applying for and receiving loans. Technical assistance provided by entities to local governments shall not exceed five percent of the capitalization grant the entity received.
- **Entity Administrative Costs:** Entities may use a portion of the capitalization grant for costs associated with administering their revolving loan fund. The statute requires entity loan fund

administrative costs that shall not exceed the following limits, whichever is greatest: $100,000 per year; two percent of the capitalization grants made in that fiscal year; or one percent of the value of the entity loan fund.

Emergency Management Performance Grant (EMPG)

FEMA is responsible for leading and supporting the nation in a comprehensive, risk-based, all hazards emergency management program. The primary means of ensuring the development and maintenance of such a program is FEMA funding to states through the EMPG. The purpose of the EMPG program is to provide federal funds to states to assist state, local, territorial, and tribal governments in preparing for all hazards. The U.S. Department of Homeland Security (DHS)/FEMA make grants available for the purpose of providing a system of emergency preparedness for the protection of life and property in the United States from hazards and to vest responsibility for emergency preparedness jointly in the Federal Government, states, and their political subdivisions. The federal government, through the EMPG Program, provides necessary direction, coordination, and guidance, as well as assistance in supporting a comprehensive emergency preparedness system for all hazards.

FDEM uses EMPG funding for programs in all four phases of emergency management: preparedness, response, recovery, and mitigation. Examples of EMPG-funded mitigation activities include initiating or achieving a whole community approach to security and emergency management; updating emergency plans; completing the State Preparedness Reports (SPR), including the Threat and Hazard Identification and Risk Assessment (THIRA) process; designing and conducting exercises that engage a whole community of stakeholders and validate core capabilities; and conducting training.

U.S. Army Corps of Engineers Grant Sources

Beach Erosion Control Projects

The U.S. Army Corps of Engineers provides a funding program to control beach and shore erosion occurring on public shores through programs not specifically authorized by Congress.

Flood Control Projects

The U.S. Army Corps of Engineers provides a funding program to reduce flood damages through projects not specifically authorized by Congress.

Floodplain Management Services

The U.S. Army Corps of Engineers provides a full range of technical services and planning guidance to communities to support effective local floodplain management. Services may include site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Studies can also be conducted for floodplain delineation/hazard, dam failure analyses, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of flood-prone structures.

Emergency Advance Measures for Flood Prevention

This source of funding is from the U.S. Army Corps of Engineers to perform activities prior to flooding or flood fight that would assist in protecting against loss of life and damages to property due to flooding. The governor of the state must request assistance.

National Fish and Wildlife Foundation (NFWF)

Resilient Communities 2020

Enhancing community capacity to plan and implement resiliency projects and improve the protections afforded by natural ecosystems by investing in green infrastructure and other measures. Specifically, they request proposals involving conservation projects, community capacity building, and adaptation focused on small businesses and affordable housing.

Five Star and Urban Waters Grant Program[530]

The Five Star and Urban Waters Restoration grant program seeks to develop community capacity to sustain local natural resources for future generations by providing modest financial assistance to diverse local partnerships focused on improving water quality, watersheds, and the species and habitats they support.

Environmental Protection Agency (EPA)

Development of community capacity by providing modest assistance to diverse local partnerships for river, wetland, riparian, forest and coastal restoration, and wildlife conservation. Water monitoring, stormwater management, source water protection, urban tree canopy restoration, and projects designed to prevent trash from entering waterways are just some of the types of projects that are awarded grants.

Brownfield Program

The EPA provides a wide variety of grants for brownfield assessment, cleanup, loans, technical assistance, and research. Within the category of pre-disaster, the Revolving Loan Fund Grants, Cleanup Grants, and Multipurpose Grants are of relevance.

Environmental Justice Small Grants Program [531]

This program supports grants that aim to engage, educate, and empower communities for environmental and public health issues, specifically emphasizing projects that address emergency preparedness and increase resiliency or projects that include needs for veterans and the homeless

[530] https://www.epa.gov/urbanwaters/urban-waters-small-grants

[531] https://www.epa.gov/environmentaljustice/environmental-justice-small-grants-program

population. Some other categories of projects include clean air, healthy waters, land revitalization, and environmental health projects.

Section 319 Polluted Runoff: Nonpoint Source Pollution[532]

This grant, which can be applied for by eligible state and tribal governments, is used to implement and monitor approved nonpoint source management programs. This grant money can be used to provide technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring.

Clean Water State Revolving Fund[533]

This program allows states to gain funding for projects that address their highest-priority water quality needs. This can include the construction of municipal wastewater facilities, nonpoint sources of pollution control, construction of decentralized wastewater treatment systems, green infrastructure projects, protection of estuaries, and more.

Department of Housing and Urban Development (HUD)

Community Development Block Grant Disaster Recovery (CDBG-DR)

In the wake of a disaster, Congress may appropriate funding for long-term recovery needs to HUD. The funding may be utilized for disaster relief, long-term recovery, restoration of infrastructure, housing, and economic revitalization. Funding can be awarded directly to state and local governments. The funding is supplemental and may be combined with other federal recovery assistance programs. This program is administered at the state level through the Florida DEO (see section below).

Economic Development Administration

Public Works Program

The EDA's Public Works Program helps distressed communities revitalize, expand, and upgrade their physical infrastructure. This program's investments facilitate the transition of communities from being distressed to becoming competitive by developing key public infrastructure, such as technology-based facilities, multi-tenant manufacturing facilities, business and industrial parks, telecommunication and development facilities, water and sewer system improvements, business incubator facilities, port and harbor expansions, skill-training facilities, and brownfield redevelopment.

---

[532] https://www.epa.gov/nps/319-grant-program-states-and-territories
[533] https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities

United States Department of Agriculture (USDA)

Disaster Water Grants Program

The USDA's Disaster Water Grants Program helps eligible communities pay expenses related to damages to rural water systems as a result of events each year. Water grants can be applied to all water resource infrastructure, including drinking water, wastewater, stormwater drainage, and solid waste facilities. To be eligible for USDA funding under this program, a system must have been damaged by a Presidentially Declared Disaster in that calendar year. An applicant must have the legal authority to own and operate the water system and meet certain other criteria. The following types of organizations may apply:

- Municipalities, counties, districts, authorities, or other political subdivisions of a state, commonwealth, or territory
- Nonprofit organizations
- Federally recognized Tribes
- Community-based prefabricated home organizations

Watershed Protection and Flood Prevention

The U.S. Department of Agriculture's Watersheds and Wetlands Division provides resources to support technical and financial assistance in carrying out works of improvement to protect, develop, and utilize the land and water resources in small watersheds.

Department of Energy

Energy Efficiency and Conservation Block Grant Program (EECBG)

DOE's EECBG is a $550 million grant program funded through the Bipartisan Infrastructure Law. It is designed to assist states, local governments, and Tribes in implementing strategies to reduce energy use, reduce fossil fuel emissions, and improve energy efficiency. The grant program provides funding for planning, design, and construction of energy-efficient projects and clean energy programs and projects. Hillsborough County is currently eligible, having been allocated over $800,000 in 2021.

U.S. Department of Transportation, Florida Department of Transportation (FDOT), and Metropolitan Planning Organization (MPO)

Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Grant

The PROTECT program provides funding to ensure surface transportation resilience to natural hazards, including climate change, sea level rise, flooding, extreme weather events, and other natural disasters, through support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure. The PROTECT discretionary program offers two types of awards: planning grants and Competitive Resilience Improvement Grants. Eligible applicants include states (or a political subdivision of a state), metropolitan planning organizations (MPOs), local governments, special purpose districts or public authorities with a transportation function, Tribal governments, and federal land management agencies (FLMAs) when applying jointly with states.

Additionally, FDOT offers technical assistance to local municipalities that want guidance on how to apply for competitive grants for their community.

Rebuilding American Infrastructure with Sustainability and Equity (RAISE)

This program provides funding for capital investments in surface transportation that will have a significant local or regional impact on safety, environmental sustainability, quality of life, mobility and community connectivity, economic competitiveness, and opportunity, including tourism, state of good repair, partnership and collaboration, and innovation.

State Funding

The following is an overview of available state funding sources that have been used as non-federal shares for federal grant programs and to fund non-federally funded local projects.

State Board of Administration (SBA)

Florida Hurricane Catastrophe Fund (FHCF)

The FHCF is a tax-exempt trust fund created by the Florida Legislature in November 1993. Following Hurricane Andrew in August of 1992, numerous problems developed in the residential property insurance market, and the availability of reinsurance for hurricanes became scarce and extremely expensive. Many insurers were forced to re-evaluate their exposure in Florida. State action was deemed necessary to maintain a stable property insurance market.

Section 215.555, Florida Statutes, created the FHCF with the purpose of providing a stable and ongoing source of reimbursement to insurers for a portion of their catastrophic hurricane losses in order to provide additional insurance capacity for the state. The FHCF operates as a public-private partnership, supporting the private sector's role as the primary risk bearer.

The FHCF plays a significant role in the provision of property insurance coverage for Florida residents. Eleven consecutive seasons with limited claims payment activity have given the FHCF an opportunity to accumulate sufficient reserves to prepare for future storms. As of December 31, 2021, the FHCF had an estimated fund balance of approximately $11.3 billion. The FHCF also had $3.5 billion in Series 2020A pre-event bond proceeds, providing additional liquidity for the 2021 season. Nonetheless, the FHCF might still need to rely on emergency assessments and/or post-event bonding to pay claims if a storm or storms of sufficient magnitude impacted Florida.

The 2022 Legislature enacted Ch. 2022-132, *Laws of Florida,* which, among other provisions, authorizes the State Board of Administration to provide Florida Hurricane Catastrophe Fund (Cat Fund) coverage to authorized insurers or Citizens Property Insurance Corporation (Citizens) for the policies of unsound insurers that the authorized insurer or Citizens assumes or otherwise provides coverage. The authorized insurer or Citizens may obtain Cat Fund coverage for such policies either through the authorized insurer's or Citizens' reimbursement contract with the Cat Fund or by accepting an assignment of the unsound insurer's contract with the Cat Fund.

Florida Division of Emergency Management (FDEM)

Hurricane Loss Mitigation Program (HLMP)

FDEM created the HLMP with the purpose of minimizing damages caused by hurricanes. The program began as an active response to the devastation brought by Hurricane Andrew, specifically to the insurance market in the State of Florida. With an annual budget of $10 million, provided by the Florida Hurricane Catastrophe Trust Fund, the program is funding activities that promote property resiliency through retrofits made to residential, commercial, and mobile home properties, the promotion of public education and public information, and through hurricane research activities.

The specific areas funded by the $10 million appropriation include retrofits for existing public facilities, projects to develop public shelter space, the Mobile Home Tie Down program administered by Tallahassee Community College, a hurricane research program conducted by Florida International University, wind-mitigation retrofit projects, and public outreach programs.

Up to $3.5 million is to be used to improve community resiliency through the Hurricane Loss Mitigation Program Grant. Through partnering with local housing authorities and non-profit organizations, the Division has been able to promote wind and flood mitigation and provide hazard mitigation retrofitting to residential and commercial properties. Funded activities include retrofits, inspections, and construction or modification of building components designed to increase a structure's ability to withstand hurricane-force winds and flooding. The Retrofit Program utilizes the Florida Building Code as its standard for all retrofitting.

Florida Department of Economic Opportunity (DEO) with U. S. Department of Housing and Urban Development (HUD)

Florida Small Cities Community Development Block Grant Program

The Florida Small Cities Community Development Block Grant Program provides federal funding for low-income housing rehabilitation and community development. The program, regulated by HUD, assists smaller local governments in providing water and sewer infrastructure, housing rehabilitation opportunities for low-income homeowners, commercial revitalization, and economic development projects.

Eligibility for Florida Small Cities Community Development Block Grant Program

The following communities are eligible to apply for funds:

- Non-entitlement cities with fewer than 50,000 residents
- Counties with fewer than 200,000 residents
- Cities that opt out of the urban entitlement program

Prioritization for Florida Small Cities Community Development Block Grant Program

To be eligible for funding, an activity must meet at least one of the following national objectives:

- Low-Moderate National Objective: At least fifty-one percent of the beneficiaries must be low- and moderate-income persons (total family income is at or below eighty percent of the area's median income).
- Slum and Blight National Objective: The area must be a slum or blighted area as defined by state or local law.
- Urgent Needs National Objective: The activity must alleviate existing conditions that pose a serious and immediate threat to those living in the area and are 18 months or less in origin. The local government must demonstrate that it is unable to finance the activity on its own and that other funding is not available.

Community Development Block Grant (CDBG) Disaster Recovery Initiative

Congress began allocating CDBG Disaster Recovery funds to Florida following the 2004 Hurricane Season in response to unusual hurricane activity. Subsequent allocations for 2005 and 2008 storms assist with disaster relief, long-term recovery, restoration of infrastructure, and mitigation efforts in the most impacted and distressed areas.

Eligibility for CDBG Disaster Recovery Initiative

CDBG Disaster Recovery funds are made available to states, units of local governments, and insular areas designated by the President of the United States as disaster areas. Communities must have significant unmet recovery needs and the capacity to carry out disaster recovery. Disaster Recovery funds are most appropriate for long-term recovery needs. Grantees may use funds for recovery efforts that involve housing, economic development, infrastructure, and prevention of further damage to affected areas.

Examples of eligible activities include restoration of affordable housing, rehabilitation, demolition, replacement, acquisition, new construction, transitional housing, emergency shelter facilities, and complementary housing activities.

Prioritization for CDBG Disaster Recovery Initiative

Activities must meet at least one of three program national objectives:

- Benefit persons of low and moderate-income
- Aid in the prevention or elimination of slums or blight
- Meet other urgent community development needs

Community Development Block Grant Mitigation (CDBG) Program

In February of 2018, Congress appropriated $12 billion dollars in (CDBG funds specifically for mitigation activities for qualifying disasters in 2015, 2016, and 2017. HUD was able to allocate an additional $3.9 billion, bringing the amount available for mitigation to nearly $16 billion. CDBG Mitigation (CDBG-MIT) is a unique and significant opportunity for eligible grantees to use this assistance in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigate disaster risks and reduce future losses.

CDBG-MIT action plans must include a risk-based Mitigation Needs Assessment that identifies and analyzes all significant current and future disaster risks, which provides a substantive basis for the activities proposed. The mitigation needs assessment requires grantees to collaborate with a variety of stakeholders that currently administer (FEMA's HMGP funds. This collaboration is essential as it helps ensure the goals of CDBG-MIT funding. Grantees are required to use the most recent risk assessment from their state, local, or Indian tribal governments' Hazard Mitigation Plans (HMP). The HMP is used as a starting place for outlining current risks within the HUD-identified "most impacted and distressed" areas.

Florida Department of Commerce with the U.S. Department of Energy (DOE)

The Weatherization Assistance Program (WAP)

The WAP provides grants to community action agencies, local governments, Indian tribes, and non-profit agencies to fund energy-saving repairs to low-income homes throughout the state. The grants may be used for insulation, weather stripping, water heater wraps, and the reduction of air infiltration. The program may also fund the repair or replacement of inefficient heaters and air conditioners.

Eligibility for the WAP

The total household income may not be more than two-hundred percent above the national poverty level. Preference is given to elderly (60 years plus) or physically disabled residents, families with children under 12, and households with a high energy burden (repeated high utility bills).

Prioritization for WAP

The revised WAP allocation formula is based on three factors for each state:

- Low-income population: This number represents how many low-income households live in each state and is expressed as a percentage of the total for the country.
- Climatic conditions: These data are obtained from the heating and cooling degree-days for each state and deal proportionally with the energy needed for heating and cooling.
- Residential energy expenditures by low-income households: This number is an approximation of the financial burden that energy use places on low-income households in each state.

Florida Department of Financial Services

My Safe Florida Home Program

The My Safe Florida Home Program was re-enacted during the most recent Special Session of the Florida Legislature to help homeowners harden their homes against wind damage due to hurricanes and save money. The program consists of two primary components: Wind Mitigation Home Inspections and Wind Mitigation Grant awards for home repairs. Local government or community partners are not able to apply for this grant on a homeowner's behalf.

Eligibility for My Safe Florida Home Program

All owners of site-built, detached, single-family, residential homes are eligible to apply for a Wind Mitigation Home Inspection without any further obligation to apply for a grant. This inspection will identify those elements of your home's construction that could be improved to mitigate your home against future wind damage. All inspections will be provided to eligible homeowners free of charge by the State. Applications will be reviewed and approved in the order in which they are received until current funding is exhausted.

Homeowners who have received a Wind Mitigation Home Inspection may be eligible to apply for matching grant funds to make improvements to their homes. The following eligibility criteria will be used to approve grant applicants:

1. The homeowner must provide proof of homestead exemption; if you need assistance obtaining a copy of your homestead exemption information, please confer with your local Property Appraiser or Tax Collector's Office. Click here to find your local officials.
2. The homeowner must provide documentation that their home is insured for $500,000 or less. Please have a copy of your current property insurance declaration page ready. If you do not have a copy, contact your insurance company.
3. The home must be in the wind-borne debris region of the state. Please review the map of the region to determine if you live in the eligible area. View Map Here.
4. The initial building construction permit for the home must have been issued prior to January 1, 2008. If you do not know when your home was built, please contact your local officials. This information is frequently available through your Property Appraiser's office or website.
5. The homeowner must allow their home to be re-inspected after construction work has been completed.

The Legislature has authorized the Department of Financial Services (DFS) to provide a matching grant to eligible homeowners up to $10,000 for the actual cost of qualifying home hurricane mitigation projects. The program will provide $2 in grant funds for every $1 the homeowner provides. In order to receive the maximum grant amount, homeowners must provide $5,000 of their own funds toward the project.

When recommended by a Wind Mitigation Home Inspections, grants may be used for roofs and structures (upgrade roof coverings, improve strength of roof deck attachments, reinforce roof-to-wall connections, install secondary water barrier for the roof) and openings (exterior door upgrades, garage door upgrades, window upgrades). DFS will provide a list of contractors that have agreed to participate in the program. Applicants will be provided with that list of approved contractors to select from after they have been approved for their grant.

Florida Department of Environmental Protection (FDEP)

Florida Communities Trust Fund (FCT)

FCT is a state land acquisition grant program housed within the FDEP. Funding for FCT grants comes from the Florida Forever program. When Florida Forever funding is available, FCT's Parks and Open Space program receives twenty-one percent of the funds, and FCT's Stan Mayfield Working Waterfronts program receives two and a half percent of the funds.

The FCT was created to help implement the goals, objectives, and policies outlined in the conservation, recreation, open space, and coastal management elements of local comprehensive plans. It also helps local governments bring their comprehensive plans into compliance as well as conserve natural resources and resolve land use conflicts. As of 2023, the FCT has acquired over 96,931 acres of private lands to be placed in public trust free from future development. Many of these lands are in floodplains along the State's vast rivers and coastal lands.

The FCT makes grants available to local governments and non-profit environmental organizations through a competitive application cycle to help purchase parks, greenways, and open spaces identified in local comprehensive plans. Under this program, all local governments are required to provide a minimum twenty-five percent match, except small local governments (counties with a population of fewer than 75,000 and cities with a population of fewer than 10,000) who would qualify for a one-hundred percent grant.

Coastal Partnership Initiative (CPI) Grant Program

The Coastal Partnership Initiative (CPI) grant program promotes the protection and effective management of Florida's coastal resources at the local level. The Florida Coastal Management Program (FCMP) makes National Oceanic and Atmospheric Administration (NOAA) funds available, on a competitive basis, to eligible local governments. The project must be feasible and completed within one year. The project is governed by Rule 62S-4 of the Florida Administrative Code.

Eligibility for CPI Grant Program

Eligible local governments are defined as Florida's 35 coastal counties and all municipalities within their boundaries that are required to include a coastal element in their local comprehensive plan. Florida's public colleges and universities, regional planning councils, national estuary programs, and non-profit groups may also apply if an eligible local government agrees to participate as a partner. Each year in the fall, the FCMP publishes a notice of the availability of funds in the Florida Administrative Register to solicit CPI applications from eligible entities. CPI grants provide support for innovative local coastal management projects in four program areas: resilient communities, coastal resource stewardship, access to coastal resources, and working waterfronts.

Prioritization for CPI Grant Program

CPI applications are reviewed by a technical evaluation committee with knowledge of coastal resource management. The highest-rated projects will be considered for funding, subject to the availability of funds from NOAA. All applications are evaluated using the following criteria:

- Project Location
- Project Description
- Demonstrated need and benefit to coastal resource management
- Objectives, tasks, deliverables, and timelines that clearly relate to the project
- Cost-effectiveness
- Technical feasibility

Hurricane Restoration Reimbursement Grant Program

The special legislative session concluded on December 15, 2022, and the FDEP Office of Resilience and Coastal Protection agreed to implement several initiatives resulting from Senate Bill 4A, Chapter 2022-272 Laws of Florida, in early 2023. Key inclusions are the receipt of $100 million in recovery dollars for beach erosion projects for impacted counties and the ability for the department to waive local match for Hurricane Ian or Nicole impacted counties through July 1, 2023. The bill also created the Hurricane Restoration Reimbursement Grant Program, which will distribute up to $50 million to qualifying coastal homeowners to help remedy the damages from coastal erosion during the storms.

The $100 million in recovery dollars for beach erosion projects will be dispersed to local governments for beaches impacted by either Hurricane Ian or Nicole and includes the potential waiver of local match requirements. The department is developing guidelines to expedite the allocation of funds to affected counties, which will outline the approximate impacts in each county, as well as the estimated non-federal costs to restore their beaches, and will assist the department in allocating recovery funds.

To be eligible to apply for the $50 million through the reimbursement grant program, the homeowner must be a coastal property owner who experienced significant impacts from either Hurricane Ian, Nicole, or both and live within the listed impacted counties. The grant program applies to single-family homes, residential condominiums, and cooperatives. The activity must be permitted before implementation, be related to sand placement, temporary or permanent armoring, and have occurred after Sept. 23, 2022. The department cost-shares on a 1:1 basis with the homeowner(s) for a maximum amount of up to $150,000 toward the actual project costs. The department initiated emergency rulemaking for the grant program to adopt emergency rules in January 2023 and expanded in July 2023.

Resilient Florida Grant Program

The FDEP Resilient Florida Program includes a selection of grants that are available to counties, municipalities, water management districts, flood control districts, and regional resilience entities. To effectively address the impacts of flooding and sea level rise that the state faces, eligible applicants may receive funding assistance to analyze and plan for vulnerabilities, as well as implement projects for adaptation and mitigation.

Applications submitted for funding consideration require a comprehensive evaluation to ensure that funds are allocated timely, appropriately, and pursuant to Florida Statute. Additional funding awards will be provided when funding becomes available.

There are planning and implementation projects. The planning project and regional resilience grant helps provide technical assistance to counties and municipalities, coordinate multijurisdictional vulnerability assessments, and develop project proposals to be submitted for inclusion in the Statewide Flooding and Sea Level Rise Resilience Plan. The implementation projects are only eligible after local governments have conducted a vulnerability assessment, evaluation, report, or other similar documentation demonstrating a risk of flooding or sea level rise to critical assets or the project area. Beginning in 2024, a Vulnerability Assessment meeting the requirements of section 380.093, F.S., will be required to receive funding for implementation projects. In 2024, the Florida legislature increased funding for this program through the Seminole Gaming Compact, and it is anticipated that $100 M more will be added in 2025.

Beach Management Funding Assistance (BMFA) Program

This program provides and manages grants for local governments to:

- Plan and implement beach and inlet management projects
- Protect upland structures and infrastructure
- Provide critical habitat for threatened and endangered species
- Provide recreational opportunities, and
- Support local economies through tourism.

This program is managed by the FDEP's Division of Water Resource Management.

Eligibility for BMFA Program

Financial assistance in an amount of up to fifty percent of project costs is available to local governments, including county and municipal governments, community development districts, and special taxing districts. Potential activities can include beach restoration and nourishment activities; project design and engineering studies; environmental studies and monitoring; inlet management planning; inlet sand transfer; dune restoration; beach and inlet protection activities; and other beach erosion prevention related activities consistent with the adopted Strategic Beach Management Plan.

Projects must be accessible to the public, located on the Gulf of Mexico, Atlantic Ocean, or Straits of Florida, as well as within an area listed as critically eroded.

Water Quality Improvement Grant

This grant program provides funding for areas within a Basin Management Action Plan (BMAP) area and with Total Maximum Daily Loads (TMDLs). Hillsborough County was granted over $6 Million for Low Pressure Sewer System/Septic-to-Sewer Project in 2024. The grant portal closed in July 2024.

Alternative Water Supply (AWS) Grant

Projects funded through this program are intended to help communities plan for and implement water conservation, reuse, and other water supply and water resource development projects. Eligible projects are alternative water supply projects (involving reclaimed water, water conservation, stormwater, surface water, brackish groundwater, desalination, other non-traditional sources, and other water quantity project types) that are submitted by a water management district and approved by a water management district governing board. In recent years, funding for local projects has been redirected to larger regional projects that are anticipated to occur in the next five years.

Nonpoint Source Grant

The program administers both the Federal Clean Water Act Section 319(h) grants administered through the Environmental Protection Agency (also known as "319 Grants") and the State Water-quality Assistance Grants (also known as "SWAG"). The goal of these grants is to implement eligible shovel-ready stormwater treatment projects that reduce nonpoint source pollution from land use activities. The total funding amounts available each year in these two grant programs depend on federal and state appropriations but are approximately $8 million.

Florida Recreation Development Assistance Program (FRDAP)

The FRDAP is a competitive program that provides grants, subject to legislative appropriation, to local governmental entities for the acquisition and development of land for public outdoor recreation use or to construct recreational trails.

Parks and Open Space Florida Forever Grant Program

The Parks and Open Space Florida Forever grant program provides funding to local governments and eligible nonprofit environmental organizations for the acquisition of community-based parks, open space, and greenways that further outdoor recreation and natural resource protection needs identified in local government comprehensive plans. The program provides local governments the opportunity to leverage local dollars with state dollars to optimize conservation benefits and encourages both public-private partnerships and land acquisition initiatives.

Land and Water Conservation Fund (LWCF) Program

The LWCF supports increased public access to and protection for federal public lands and waters — including national parks, forests, wildlife refuges, and recreation areas — and provides matching grants to state governments for the acquisition and development of public parks and other outdoor recreation sites. Agencies also partner with landowners to support voluntary conservation activities on private lands.

Recreational Trails Program (RTP)

The RTP is a federal grant initiative funded by the Federal Highway Administration (FHWA) and administered at the state level by the FDEP in coordination with FDOT. The purpose of the RTP is to provide financial assistance for the development and maintenance of recreational trails, trailheads, and trailside facilities for both nonmotorized and motorized recreational trail uses.

Local Funding

Local Mitigation Strategy (LMS) projects funded by grants usually require a local match for implementation. LMS projects span a wide range of mitigation issues, including coordination/ integration of public and private sector mitigation projects, post-disaster planning, long-term redevelopment, and public education.

The following provides a synopsis of local funding sources that have been used in the past to fund local mitigation-related projects. This list contains funding sources that have been used as a match for federal grant programs as well as to fund non-federally funded local projects.

Ad Valorem Tax

The ad valorem tax is levied based on the value of real and tangible personal property as of January 1 of each year and is intended to increase the total revenue of local governments.

Stormwater Tax Assessment

The fee is based on the total amount of a property's impervious surface and has been used to prepare a stormwater program and fund a wide range of drainage improvements.

In-Kind Services

Services or equipment for projects provided by those in the community. In-kind services can be anything from labor to supplies and equipment that are donated for purposes of supporting the project. For instance, volunteer agencies can contribute labor to a construction project where the hours worked are documented at a flat rate. Similarly, a contractor or someone can offer their expertise for free, but the hours they worked can be documented at their rate of pay toward the project itself. Also, a third party can donate equipment or supplies, and the operating expense or fair market value can be used toward helping a sub-grantee meet its non-federal share target.

Impact Fees/ Development Exaction

Impact fees on new development such as: 1) Water and Sewer Connection Fee, 2) Fire Impact Fee, 3) Law Enforcement Impact Fee, 4) Transportation Impact Fee, and 5) School Impact Fee are used for the purchase and construction of capital assets. (School impact fees may be remitted periodically to the County School Board).

Tourist Tax Local Option

A local tax is levied on most rents, leases or lets, and living accommodations in hotels, motels, apartments, houses, and mobile homes (contracted for periods of less than six months or less) in the promotion of tourism and tourist-type activities.

Revenue Bonds

This is revenue derived from the issuance of long-term debt, such as bonds or commercial paper. Proceeds are deposited into capital projects funds and/or debt service funds.

Permit Fees

This is revenue derived from the issuance of local licenses and permits. Exceptions include occupational licenses and building permits.

State Revenue Sharing

Two tax sources are earmarked for sharing with counties: 2.9 percent of net cigarette tax collections and 41.3 percent of net intangible tax collections. Intangible tax collections provide ninety-five percent of total revenue shared with counties in this category.

Cooperative Funding Initiative (CFI)

Administered through the Southwest Florida Water Management District (SWFWMD), this program allows local governments and private entities to share costs for projects that assist in creating sustainable water resources, provide flood protection, and enhance conservation efforts. This funding source can be applied to infrastructure and utilities projects, stormwater infrastructure improvement projects, and disaster recovery projects.

SECTION 7 - PLAN MAINTENANCE SECTION

Overview

The Count's LMS serves as a guide for hazard mitigation activities on a county-wide basis. The strategy is intended to be a dynamic document that will be updated regularly.

An LMS must present a plan maintenance process that includes the following (44 CFR Section 201.6.c.4):

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over a 5-year cycle.
- A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate.
- A discussion on how the community will continue public participation in the plan maintenance process.

Consistent with federal and state requirements, the LMS WG meets to monitor, update and evaluate the effectiveness of the LMS at least four times a year and submits an annual LMS update to the FDEM no later than January of the following year. This update follows an annual review of the plan by the LMS WG. The County's LMS Coordinator will be responsible for monitoring the plan on an ongoing basis. If by email or other communication, the LMS Coordinator or LMS Chair receives information to warrant a meeting, then a special meeting is called to discuss the changes. LMS WG members may also request a special meeting, if needed. The LMS Coordinator and the LMS Chair coordinate scheduling and notification of WG meetings. A minimum of thirty (30) days' advance notice is given for annual meetings. As much advance notice as possible is given for regular and special meetings including conference calls or online virtual meetings.

On an ongoing basis, new initiatives and projects will be considered by the LMS WG for inclusion into the strategy and the project list within the LMS Plan. Completed projects will be removed from the Active Project List and detailed in the Archived Project List. The new projects will be added as they are identified, ranked, and approved/added by the WG. Every five years the strategy will be resubmitted to municipal councils/commissions and to the Board of County Commissioners (BOCC) for re-adoption.

Plan maintenance is part of a continuing assessment of current policies, programs and plans by local governments as part of the adopted growth management initiatives, floodplain management strategies and countywide emergency management plans. Updates to critical facilities, repetitive flood loss or hazards analysis are reflected on all maps as required. Integration of the LMS with other plan and policy updates are also monitored and reported.

<u>Timeframe and Agenda for LMS WG Meetings</u>:

The following describes the process by which the LMS WG will maintain the LMS.

- Meetings are noticed. The community will continue public participation in the plan maintenance process by noticing LMS WG meetings on the County's events calendar and by sending notices to the LMS WG members with the date, time, and location of meetings. Information regarding the LMS will be furnished at expos and neighborhood conferences and on the Hillsborough County website (http://www.hillsboroughcounty.org/). Both the private and public members of the LMS WG will provide notice of meetings or information to local governments, planning commission, community organizations and agencies. Information will be disseminated at neighborhood meetings, State Emergency Response Team (SERT) training and other outreach activities.
- The LMS WG will continue meet at least four times a year to review the LMS and submit annual updates to FDEM no later than January of the following year as required by Florida Administrative Code (FAC) 27P-22.004 (4)(e). At a minimum, annual updates shall address:
    - Changes to the hazard assessment
    - Changes to the project priority list
    - Changes to the critical facilities list
    - Changes to the repetitive loss list
    - Revision to maps
- To guide every update process, the LMS WG will continue to consider the following questions:
    - Have there been any new mandates from federal, state, or local agencies that require changes to the LMS? Have there been any new or changing laws, policies, or regulations?
    - Are there any societal developments or significant changes in the community that must be added to the current LMS? Does the LMS still reflect the concerns of the community? Are the demographics the same? Has there been any growth or development in hazard areas?
    - Have there been any changes in funding sources or requirements?
    - Are there any recent technological developments that should be reviewed for inclusion in the LMS?
    - Should the LMS be updated to include any new forms of hazards or areas of vulnerability within our community?
    - Have there been any changes in the Comprehensive Plans or any other form of standard operating procedure?
    - Have any of the mitigation opportunities been implemented? Are the priorities for implementation the same?
    - What are the recommendations or lessons learned from any major incidents that have occurred during the past year?
    - What specific pre-disaster mitigation projects can be identified from the Post Disaster Redevelopment Plan (PDRP)? What new projects from the PDRP can be included as part of the LMS?

- The LMS Coordinator, under the direction of the Environmental Services Director, Water Resources Department, is assigned the responsibility of monitoring and coordinating annual tasks associated with the implementation of the plan. The LMS Coordinator is responsible for: scheduling meetings, collaborating on the agendas, maintenance of meeting minutes, monitoring the plan, maintaining the list of completed projects, documenting newly approved projects, collecting comments and/or answering questions related to the LMS, maintaining an official copy of the LMS, having the annual update approved, and forwarding the annual update to the State.

- Specific sections updated annually include the list of critical facilities and the repetitive flood loss property list. Each jurisdiction is responsible for submitting this information to the LMS Coordinator no later than December 31 of each year.
- Additional LMS WG meetings should be convened after any significant event such as a hurricane, tornado, flooding, or a severe hazardous materials spill where a review of the event, responses and effectiveness of current mitigation techniques could serve to formulate more effective responses, mitigation strategies, and techniques.

Five-Year Update

In addition to these annual progress reports and reviews, the LMS shall be updated every five years, in accordance with 44 CFR 201.4. The five-year updates are labor intensive and can take over a year to complete. Each section of the 2025 LMS update will be reviewed and updated accordingly. Every five years, or after any significant change, the LMS will be resubmitted to the County's BOCC, the City of Tampa City Council, the City of Plant City Council, and the City of Temple Terrace City Council for re-adoption.

Since 2007, the LMS WG has met four times a year as a minimum, usually in January, May, August, and November. During the year prior to the expiration of the LMS, the LMS WG, with representation from all four jurisdictions and other community members and organizations wishing to participate, will review the LMS and make recommendations for revisions. Neighboring communities, community stakeholders, and the public are be notified that an update to the 5-year planning process has begun. All LMS WG members are be invited and encouraged to attend. At these meetings, the LMS WG evaluates and updates the LMS with recommendations approved by the LMS WG. During the final meeting of the year the LMS WG evaluates the actions of the year and incorporate them into the document as required for the yearly update and the LMS Coordinator will submits it to the State.