

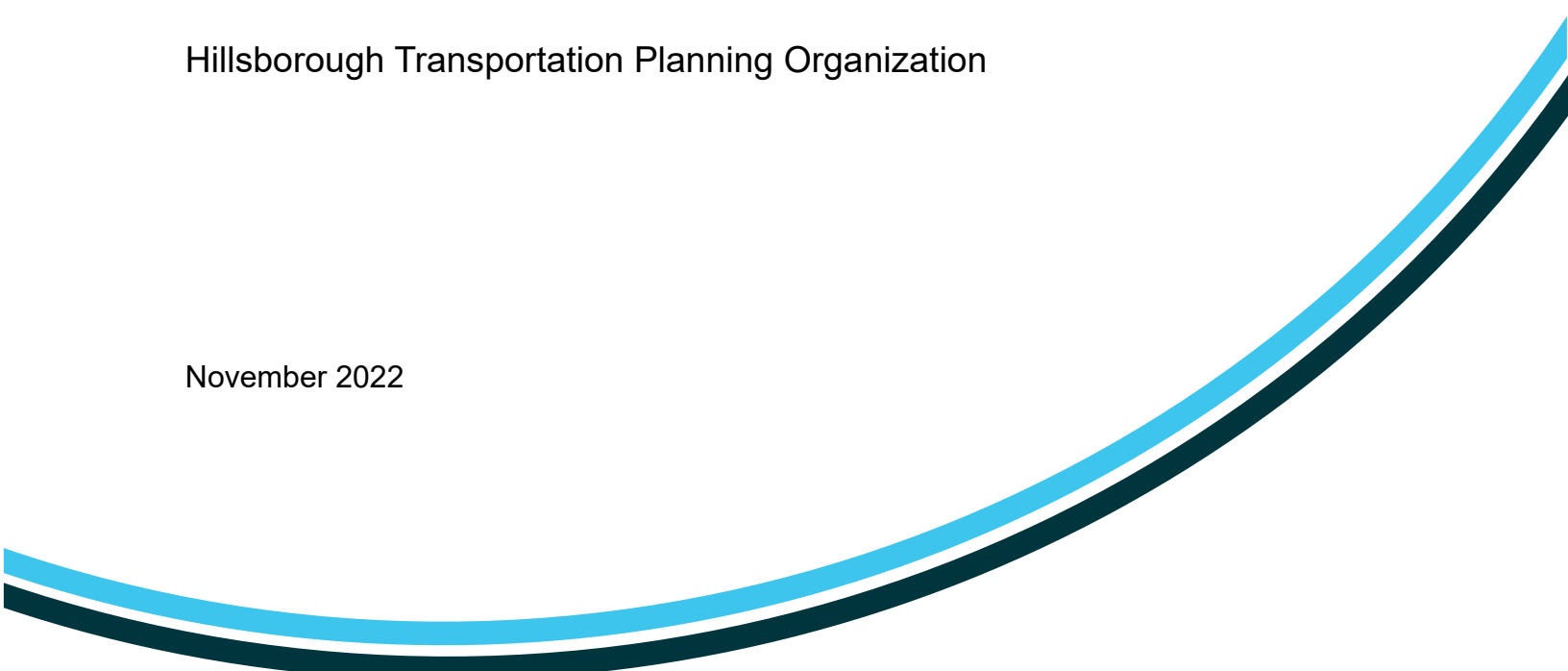


Hillsborough TPO
Transportation
Planning Organization

Freight Supply Chain Resilience Study Executive Summary

Hillsborough Transportation Planning Organization

November 2022



The preparation of this report has been financed in part through grants from the Federal Highway Administration and Federal Transit Administration, United States (U.S.) Department of Transportation, under the Metropolitan Planning Program, Section 104(f) of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views of policy of the U.S. Department of Transportation.

The Hillsborough Transportation Planning Organization (TPO) assures that no person shall, on the grounds of race, color, national origin, sex, gender, sexual orientation, age, familial status, disability, religion, or income, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any Hillsborough TPO program, plan, or activity. For more information, please visit our Title VI and Accessibility page located here: [LINK](#).

The Hillsborough TPO will take reasonable steps to provide meaningful access to our services for persons with limited English proficiency and persons with disabilities. Persons needing assistance reading or interpreting items in this document, free of charge, are encouraged to contact Joshua Barber at (813) 272-5940 or barberj@plancom.org. Plan Hillsborough (the Planning Commission, the Hillsborough TPO, and the Hillsborough River Board) cannot ensure accessibility for items produced by other agencies or organizations.

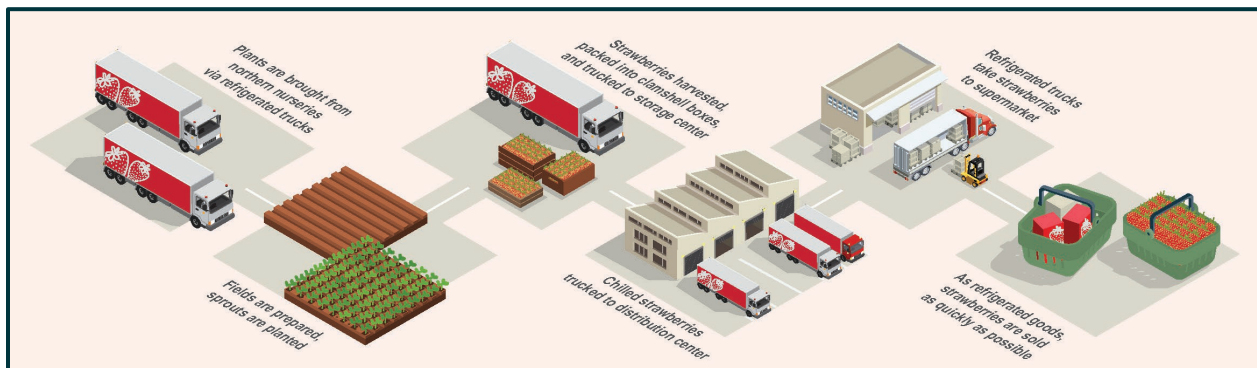
EXECUTIVE SUMMARY

Why Are Supply Chains Important to Communities?

Supply chains are vital in creating livable, prosperous, and resilient communities. Just about every item in your home or workplace has been touched by a supply chain. A supply chain is defined as the entire system to produce and deliver a consumer good, from the raw materials and machinery used to manufacture the product through to the final delivery of the good to a retail store or to a customer. A supply chain map depicts the components of the supply chain in a process flow-like layout and includes information flows, supplier tiers, natural resource inputs, labor, transportation modes, and other elements that contribute to completing and delivering the product or service. These elements are commonly referred to as supply chain enablers.

A supply chain is the whole system to produce and deliver a consumer good. Supply chains are essential in creating livable, prosperous, and resilient communities.

Supply chains sustain essential services and economies of communities. The figure below showcases the supply chain of Plant City strawberries. The supply chain starts with strawberry plants being trucked in from northern states where they are grown in greenhouses. The sprouts are then planted in fields of Plant City that have been prepared (i.e., the soils have been treated and the beds have been formed by tractors). Once the strawberries have matured, they are harvested and packed into plastic clamshell boxes and stored in climate-controlled facilities. Chilled strawberries are then shipped from the farms by refrigerator trucks to distribution centers, and finally to supermarkets where they are sold to consumers.



This is the production and distribution process (or supply chain) for Plant City strawberries under normal (or pre-disaster) conditions. We know from past and more current events, such as hurricanes and pandemics, that supply chain disruptions may occur not only when production is stopped by a manufacturer but also when transportation network

Supply chain disruptions can leave those in a disaster area without certain necessities, such as food, clean water, shelter, medicine, and fuel.

facilities are blocked, congested, slowed-down, or damaged. Products that we rely on can sometimes be hard to find or delayed in their arrival as a result of supply chain disruptions. Who doesn't recall the great toilet paper shortage of 2020?

In the instances of Hurricanes Katrina and (most recently) Ian, supply chain impacts surfaced in multiple forms: roadways were washed out (including Interstate 10 and the bridge connecting Sanibel Island to the mainland, respectively) and ports were shut down hindering transportation access; millions of pounds of perishable food spoiled in warehouses without electricity; and thousands of residents were without drinking water for weeks due to disruptions in treatment plant operations, lack of stockpiling adequate supplies, and impeded delivery due to damaged transportation infrastructure.



Within the top image, sections of Interstate 10 are underwater in the City of New Orleans post Hurricane Katrina.

Within the bottom image, portions of Sanibel Causeway (including sections of the bridge) are washed away in the aftermath of Hurricane Ian. Sanibel Causeway connects Sanibel Island to the mainland of Florida.



Recognizing the importance of supply chains in our daily lives as Hillsborough County citizens, the Hillsborough Transportation Planning Organization (TPO) initiated the Freight Supply Chain Resilience Study to:

- Better understand the supply chains of **five critical commodities/services** (referred to as commodities from this point forward) applicable to Hillsborough County;
- Determine potential impacts/vulnerabilities/disruptions to these supply chains as a result of **three individual disaster or hazard scenarios and two combinations of concurrent disaster scenarios**, as well as climate change factors (such as sea level rise); and
- Identify actions that can mitigate potential supply chain disruptions, address ways to help the supply chains recover quickly under various disaster scenarios, and strengthen the resilience of the supply chains (and their enabling functions) along with the communities that they support.

By understanding the criticality of supply chain resilience as a vehicle for community habitability and interoperable lifeline resilience, the recommendations of this study establish a process for continued engagement with key Hillsborough County supply chain actors, stakeholders, and communities that will help define current resiliency and optimal, holistic future outcomes for sustainable and equitable systems planning. By having a strong communication network in place along with equitable, resilient, and sustainable Hillsborough County communities that thrive under normal circumstances, Hillsborough County as a whole will be more resilient during emergency situations and better prepared to address them. The recommendations of this study are intended to be implemented with neighborhood context, roadway safety/Vision Zero initiatives, and quality of life goals at the forefront, ensuring that safety and critical lifelines of Hillsborough County communities are sustained.

The end game after any disaster is habitability... supply chains make this possible.

What Commodities Were Assessed?

The study examined five commodities and their associated supply chains. The five commodities originated from the community lifelines described in the Federal Emergency Management Agency’s (FEMA) *Supply Chain Resilience Guide*. Community lifelines are defined as those essentials which allow for the continuous operation of government and business functions to enable human health and safety or economic security. The commodities were selected based on relevancy to the Tampa Bay region and Hillsborough County, criticality pertaining to emergency preparedness and response and recovery operations, ubiquity of need during and after a disaster or disruption, and availability of data/information to be able to perform an assessment and develop

The five commodities were selected based on their necessity to Hillsborough County residents, especially before, during, and after emergency events.

recommendations. Those elements that were noted to be universal to all supply chains (either needed for a supply chain to function or more susceptible to supply chain impacts) were defined as supply chain enablers. The figure below shows the five commodities selected,

including **food/groceries, water and wastewater utilities, housing material, urgent healthcare services and medicine, and fuel distribution systems**. The seven supply chain enablers included **workforce, vulnerable populations/neighborhoods, financial flows, utilities, communications, transportation, and supply chain partners**.



What Disaster Scenarios Were Analyzed?

Before the disaster scenarios were created, a number of Hillsborough County, regional, and State of Florida plans and studies were reviewed to determine the types of disasters or hazards to analyze. The Hillsborough County Multi-Jurisdictional Local Mitigation Strategy: 2020 Plan Update (LMS) and the 2018 Enhanced State Hazard Mitigation Plan: State of Florida (SHMP) served as the foundation for the identification of potential disasters to study. Both sources are comprehensive emergency planning documents that consider the most probable disasters that could occur in Hillsborough County and the State of Florida.

The study considered multiple sources when selecting a disaster, leveraging previous work of local and state organizations.

The disaster types were selected based on which event would be the most probable to occur within Hillsborough County, be the most acute, and majorly impact the transportation network and supply chains, as well as has data/ information available to be able to perform an assessment and develop recommendations. Recognizing that disasters often occur simultaneously or in a cascading fashion (and rarely take place in a vacuum), the factors listed above were also considered for two disasters happening concurrently.

The three individual disasters and two different combinations of the individual disasters that were selected include **cyber attack, transportation incident (such as a major roadway accident), flood/wind event, cyber attack and transportation incident, and cyber attack and flooding/wind event**. The following climate change factors were also identified for analysis within the study based on consultation with the Hillsborough TPO and availability of data: **10-Year and 25-Year inundation events within the next 20 years (2040) pertaining to sea level rise and nine inches of rainfall in 24 hours**.

Once the types of disasters to be studied were determined, specific scenarios were created for each disaster and the concurrent disasters. The disaster scenarios were designed to examine supply chains under severe conditions. The concurrent disaster scenarios allowed for examination of extreme stress on supply chains and potential subsequent impacts with the simultaneous occurrence of two disasters. While these scenarios are unlikely to take place, they could result in major disruptions to supply chains and impacts to Hillsborough County communities.

The disaster scenarios were designed to examine supply chains under severe conditions. While these scenarios are unlikely to occur, they could result in major disruptions to supply chains and impacts to Hillsborough County communities.

Narratives of the specific scenarios created for the three individual disasters and two concurrent disasters are presented below:

Cyber Attack

A Supervisory Control and Data Acquisition (SCADA) system of the Tampa Electric network has been infiltrated and compromised by malware, disabling operators from making necessary commands and creating subsequent blackouts.

Transportation Incident	A tanker truck heading eastbound on I-4 at 3:00 PM collides with the median supports of the southbound I-75 overpass which sparks a fire causing the I-75 southbound bridge to collapse. This incident results in traffic coming to a standstill on I-75 southbound and on I-4 in both directions.
Flooding/Wind Event	Category 5 Hurricane Chaos makes landfall in Downtown Tampa lasting 24 hours.
Cyber Attack & Transportation Incident	A SCADA system of the Tampa Electric network has been infiltrated and compromised by malware, disabling operators from making necessary commands and creating subsequent blackouts. During this disruption, a tanker truck heading eastbound on I-4 collides with the median supports of the southbound I-75 overpass which sparks a fire causing the I-75 southbound bridge to collapse. The combined events cause traffic to come to a standstill in both directions on I-75 and on I-4.
Cyber Attack & Flooding/Wind Event	As residents are evacuating and Hillsborough County officials and staff are preparing for landfall of Category 5 Hurricane Chaos, a SCADA system of the Tampa Electric network has been infiltrated and compromised by malware, disabling operators from making necessary commands and creating subsequent blackouts.

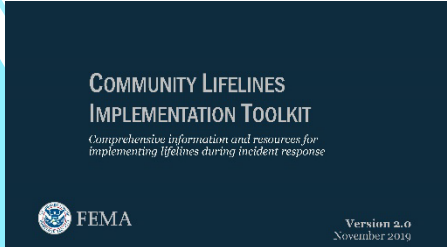

How Were Impacts on Supply Chains Assessed?

A number of inputs/factors were used to not only determine the types of commodities and disasters to be studied and to create the disaster scenarios to analyze (as described above), but these factors were used to assess the severity of impacts and implications of the different disaster scenarios and climate change elements on the commodity supply chains (specifically the supply chain enablers) and develop actions to mitigate potential disaster effects and build resilient supply chains. The inputs/factors included:

Literature

Federal, state, regional, and local guidance and emergency management related documents were reviewed to identify relevant Hillsborough County commodities and disaster types to be studied.

(e.g., Federal Emergency Management Agency’s Supply Chain Resilience Guide, 2018 Enhanced State Hazard Mitigation Plan: State of Florida, and Hillsborough County Multi-Jurisdictional Local Mitigation Strategy: 2020 Plan Update, etc.)

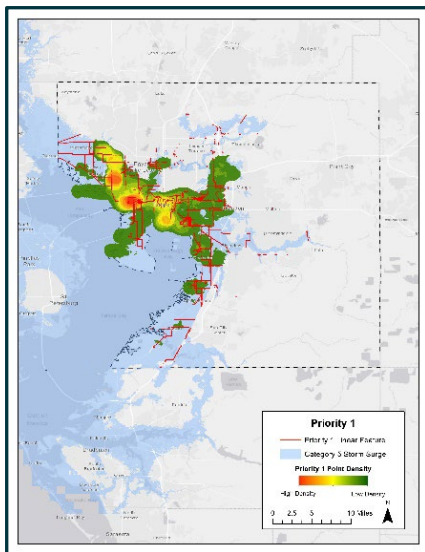
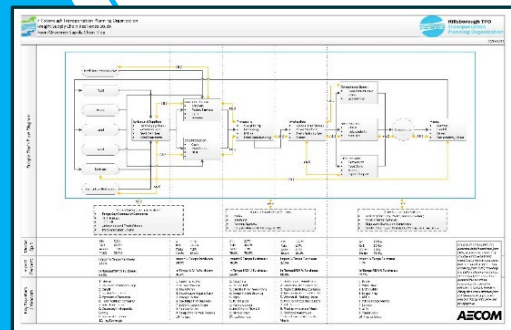


Case Studies

Case studies of disaster incidents at local, regional, national, and global scales were identified based on the disaster types selected and applicability to Hillsborough County. They provided context to help shape the disaster scenarios. Findings from the case studies were also extrapolated to determine specific impacts of each hypothetical disaster to the supply chain enablers under each commodity.

Commodity Supply Chain Maps

A supply chain map (or process flow diagram) was created for each commodity. The map depicts the nodes (points where the good may be stored, refined, or processed), links (how the good is moved through different transportation modes), and supplier tiers needed to make the commodity available to consumers within Hillsborough County and the Tampa Metropolitan Statistical Area, including proportions of imported versus locally produced resources pertaining to the commodity. It establishes a baseline of typical (non-disaster) flow patterns and supply chain conditions for each commodity.

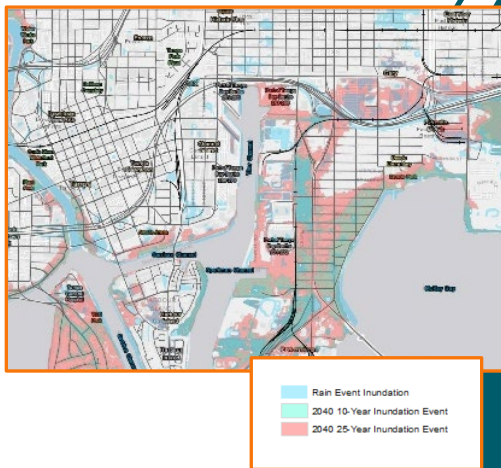
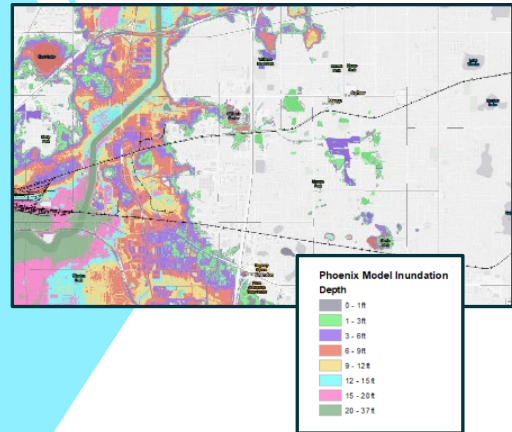


Geographic Information System Data

The commodity supply chains depend on transportation and utility infrastructure within Hillsborough County and the surrounding area. Multiple Geographic Information System (GIS) layers were obtained and ranked to depict locations of transportation facilities and critical facilities/infrastructure pertaining to the five commodity supply chains and seven supply chain enablers. The geographic distribution and concentration of this infrastructure helped inform potential disaster event impacts on the commodity supply chains from a transportation network perspective and geographic standpoint.

HAZUS and Project Phoenix Model Results

A Federal Emergency Management Agency HAZUS model (which simulated a Category 3 hurricane making direct landfall in downtown Tampa) and the Tampa Bay Regional Planning Council Project Phoenix model (which simulated a Category 5 hurricane making landfall in the Tampa Bay area) informed the weather related disaster scenarios. GIS layers of these models were superimposed on the mapped critical supply chain facilities and infrastructure to determine potential supply chain impacts.



Climate Change Factors

Hillsborough TPO GIS layers for various climate change factors (10-Year and 25-Year inundation events within the next 20 years (2040) pertaining to sea level rise and nine inches of rainfall in 24 hours) were overlaid on the mapped supply chain facilities and infrastructure to understand compounding impacts to critical supply chain facilities as a result of climate change (with and without a disaster event).

Project Team Expertise

By drawing on years of experience in the realms of supply chains, resilience, and emergency management and response, the project team filled in gaps where possible disaster impacts to areas of the commodity supply chains were less defined. The project team offered direct, practical input and lessons learned that contributed to a holistic understanding of potential commodity supply chain impacts/vulnerabilities/disruptions and how to mitigate potential disaster effects.

Stakeholder and Community Input

Input from public and private supply chain actors and community members (relevant to Hillsborough County, the Tampa Metropolitan Statistical Area, and surrounding region) was obtained at various stages during the study through stakeholder group meetings (small and large), individual stakeholder interviews, and community sessions. The invaluable input collected through conversations with these persons contributed to the study framework and helped to identify supply chain vulnerabilities and ways to mitigate potential disaster effects.

The five commodity supply chains were analyzed under the different disaster scenarios in two stages.

The first stage of the analysis involved (1) identifying potential impacts of the different disaster scenarios through assessment of the inputs/factors presented above and (2) documenting the findings in a matrix pertaining to each of the five commodities. The five disaster scenarios populated the rows and the seven supply chain enablers populated the columns of each matrix. **As such, the five individual matrices displayed how each supply chain enabler would be impacted by each disaster scenario as related to a single commodity.** Levels of severity (low to severe) and scope/geographic scale (in terms of impact ranging from local to widespread) were assigned to each supply chain enabler for each particular disaster scenario as specific to the assessed commodity supply chain. These designations helped to focus the study recommendations to address more severe and/or widespread level impacts to supply chain enablers.

In the second stage of the analysis, the most salient points from the matrices (i.e., the most important impacts of each disaster scenario that pertain to the supply chain of an individual commodity) were incorporated into the disaster scenario write-ups. This also helped to narrow down and focus the impacts to be considered/addressed in the development of the study recommendations.

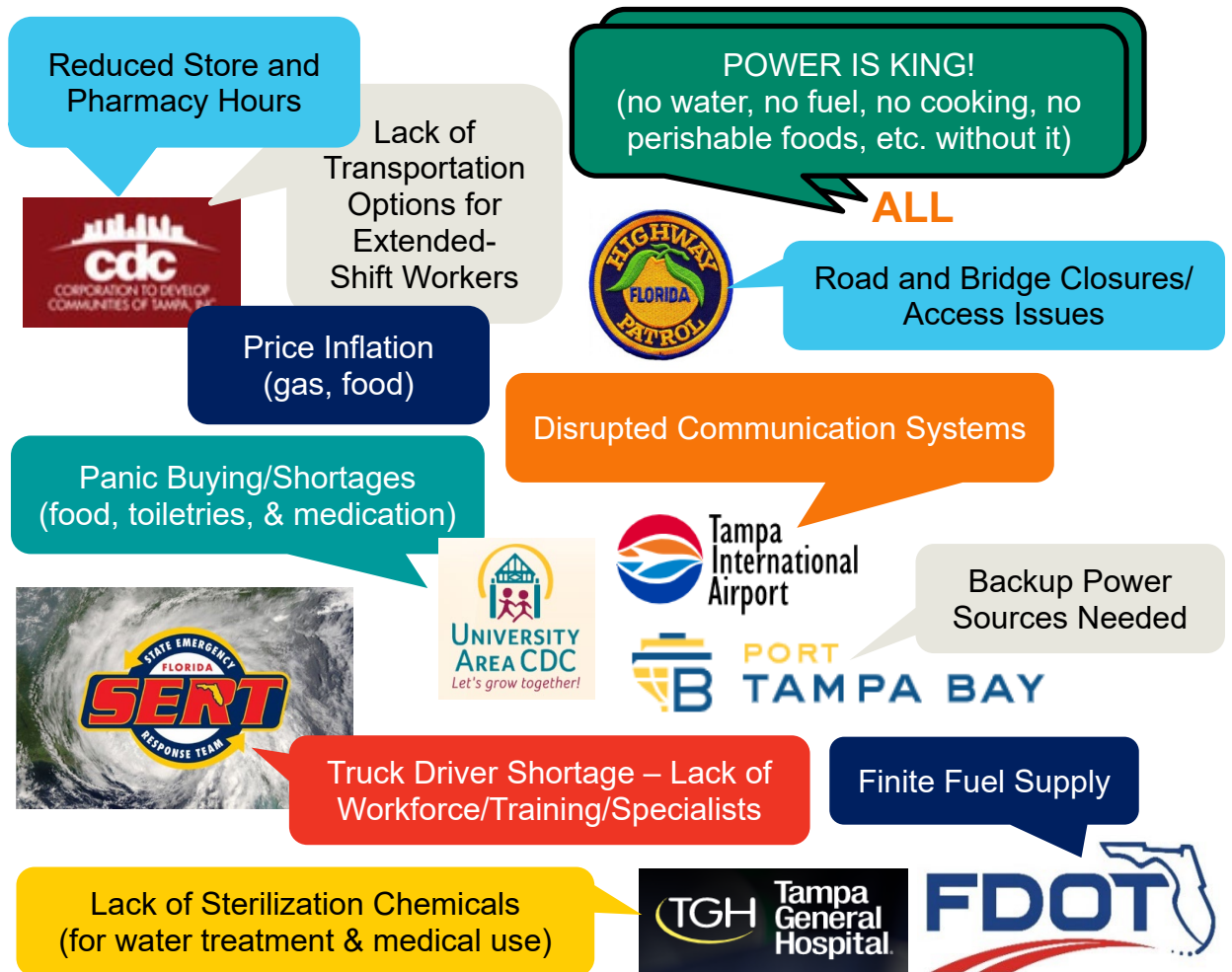
Value of Stakeholder and Community Input

Public and private supply chain actors and community members vetted the commodities and disaster scenarios that were studied; relayed personal experiences, challenges, and lessons learned in reacting to/preparing for disaster events, specifically regarding access to essential goods before, during, and after disasters; identified vulnerabilities and gaps that need to be addressed within supply chains;

Invaluable input provided by stakeholders and community members helped to define realistic disaster effects to supply chains, supply chain vulnerabilities, and practical actions to mitigate impacts and strengthen commodity supply chains within the area.

and relayed best practices to incorporate within the study recommendations. Stakeholders also provided insight on preparations/trainings their respective company/ agency had established or ways their organization would react to disaster events and subsequent impacts. This input helped to define realistic disaster effects and better understand access to essential goods during disasters, identify weaknesses in supply chain flows that could lead to supply chain disruptions during a disaster event, and develop practical actionable recommendations to mitigate impacts and strengthen the individual commodity supply chains. A snapshot of input received is presented as follows:

Challenges/Disruptions to The Five Commodity Supply Chains



Lessons Learned from Disasters

- REDUNDANCY IS KEY!
- Have Emergency Staffing Plans in Place
- Have Resource Substitutions Available
- Cross Training of Staff on Use of Equipment/Operations is CRITICAL

Observations/What Was Learned

A number of key observations/findings were revealed through the supply chain resiliency analysis that guided the development of the study recommendations:

- There is a link between climate change; Environmental, Social, and Corporate Governance (ESG) principles; and supply chain resilience – these factors create habitability and interoperable lifelines. By having a strong communication network in place along with equitable, resilient, and sustainable Hillsborough County communities that thrive under normal circumstances, the more resilient and better prepared Hillsborough County as a whole will be to withstand and recover from emergency situations.
- Many of the critical supply chain facilities are susceptible to inundation during storm events; climate change makes maintaining access to these facilities even more critical.
- There are clusters of critical freight facilities located throughout the county; these areas should be prioritized for resiliency solutions (e.g., redundant infrastructure, raised profiles, etc.). Improved access and redundant access to those facilities that currently have circuitous and/or limited access are essential, especially during an emergency.
- Hillsborough County has redundant transportation infrastructure overall; however, there are network gaps at critical facilities and backup facilities are not equipped to handle the demand of primary facilities.
- Pedestrian and bicycle safety is a major issue in many Environmental Justice communities that are bordering strategic freight facilities or freight heavy areas, such as the Port. While bicycle/pedestrian infrastructure and safety are extremely important in meeting community needs within all areas of Hillsborough County, these factors are especially important in EJ communities where these populations have a higher propensity to bike and/or walk to access essential services. It will be necessary to better define space and enhance safety for these roadway users. Solutions must balance freight needs, community needs, and resilience.
- Beyond hurricanes and weather-related events, other hazards (such as cyber attacks, transportation incidents, etc.) need to be considered universally in emergency planning by public agencies and private industries.
- Redundant infrastructure/facilities and resources, including having available and redundant resource substitutions, are critical in mitigating effects of a disaster.
- Having emergency staffing plans in place and cross training staff on use of equipment/operations are critical in sustaining supply chain operations and flows.

(This space is intentionally left blank.)

Study Recommendations

The recommendations were based on the key observations/findings that stemmed from the consulted inputs/factors, which contributed to the disaster scenario descriptions and identification of impacts as recorded within the five commodity-based matrices.

The recommendations propose measures to:

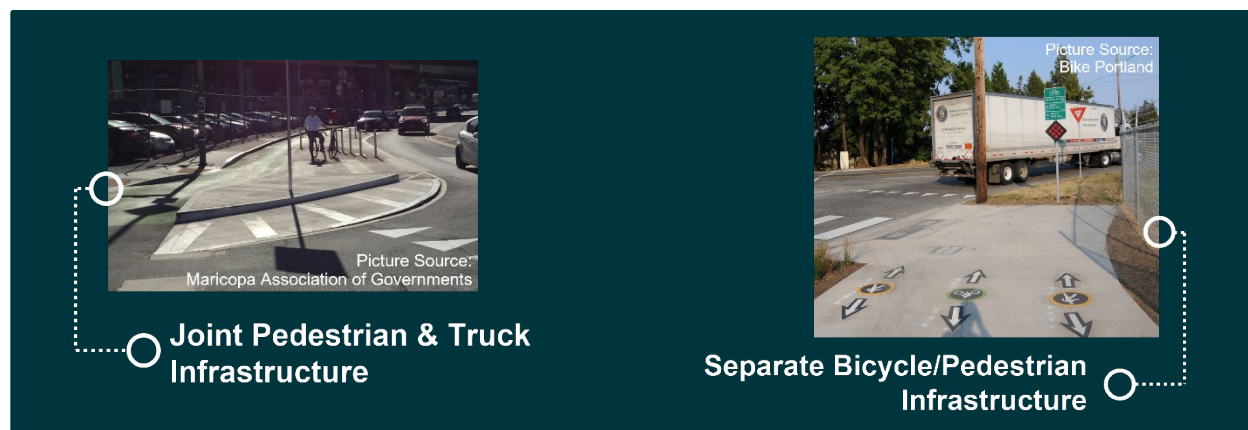
- Address vulnerabilities of critical facilities and infrastructure relevant to the five commodity supply chains to help mitigate potential impacts/disruptions to these supply chains,
- Address ways to help the supply chains recover under various disaster scenarios, and
- Build the resilience of the supply chains in the long term along with the communities that they support to sustain safety and essential lifelines.

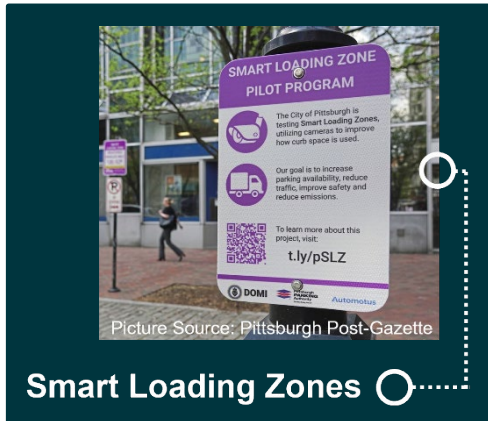
The recommendations are intended to be implemented in partnership with Hillsborough County supply chain actors, stakeholders, and communities to ensure neighborhood context, roadway safety/Vision Zero initiatives, and quality of life goals are integrated and upheld.

The study resulted in 81 actionable recommendations categorized by (1) action type (**Transportation, Study/Guide/Research, Coordination, Training/Tool/Education, and Grant Opportunity**) and (2) role the Hillsborough TPO is to serve in executing the recommended actions (**Leader, Collaborator, and Facilitator**).

Seven specific locations within Hillsborough County were identified for potential implementation of Transportation recommendations oriented to the Hillsborough TPO serving in the role of Leader. These recommendations consist of a series of studies to be performed that will identify opportunities to enhance access to Port Tampa Bay facilities as well as throughput of freight on the interstate system (for instance). However, community need will be at the forefront of all studies. The recommendations of this study and suggested example improvements are intended to balance bicycle/pedestrian safety, freight access, and resiliency. For example...

Mountable curbs and bicycle/pedestrian infrastructure in freight areas mean that safety is not sacrificed to allow freight vehicles critical access.

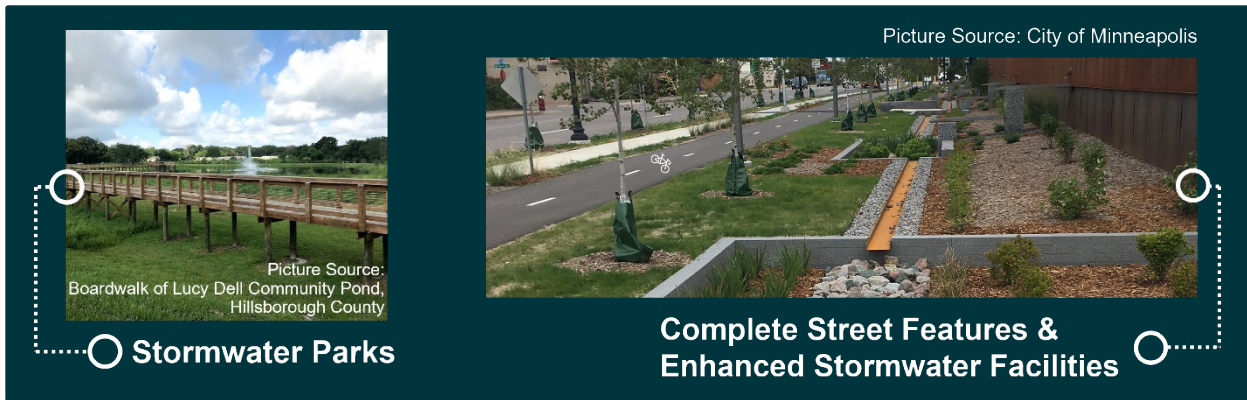




Improvements such as smart loading zones can help prevent freight vehicles from blocking sidewalks, bicycle lanes, and/or traffic.

Smart Loading Zones

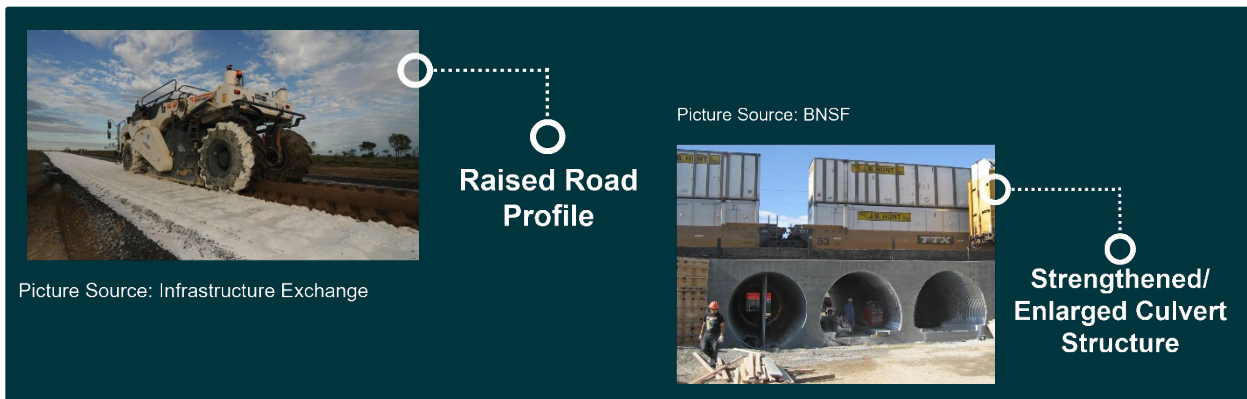
Activated stormwater infrastructure (such as the Lucy Dell Community Pond in Hillsborough County) can improve resiliency while giving the community increased recreational resources and open space.



Stormwater Parks

Complete Street Features & Enhanced Stormwater Facilities

Finally, improved stormwater facilities, raised roadway profiles, and strengthened/enlarged bridges and culverts will not only help maintain access to critical supply chain facilities but will also address flooding in neighboring residential areas.

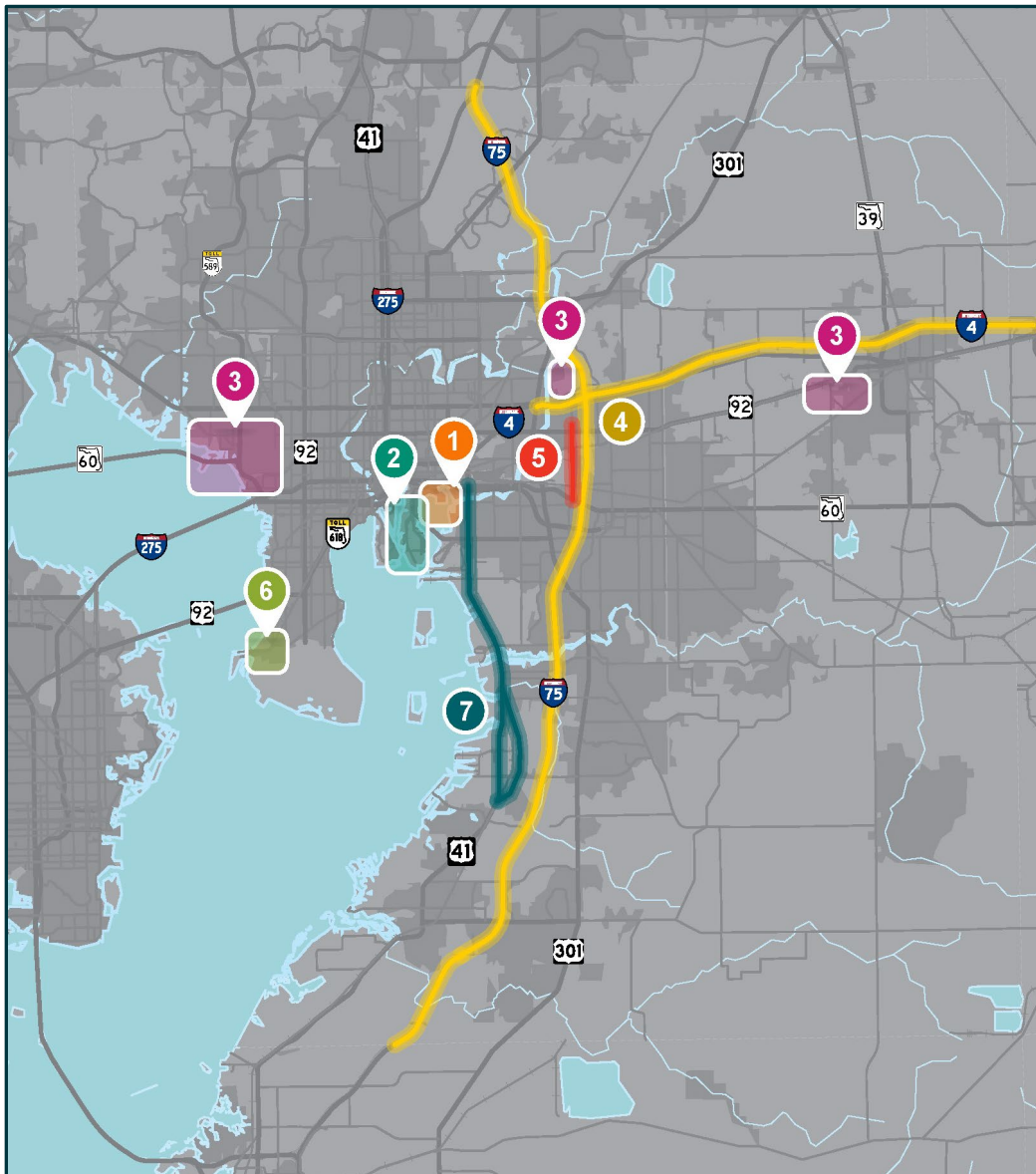


Raised Road Profile

Strengthened/ Enlarged Culvert Structure

The locations of these noted recommendations are displayed in the provided figure below.

Locations of Transportation Categorized Recommendations



- | | | | |
|---|---|---|---|
| 1 | Ybor Channel Complete Street/Freight Access/Resilience Study | 4 | Study Managed Lanes Infrastructure/ Policies to Enhance Access to Port |
| 2 | Hooker's Point Road/Rail Access Resilience Study | 5 | Falkenburg Road County Facility Access Resiliency Study |
| 3 | Hillsborough County Airports Access Study | 6 | Port Tampa Bay Road/Rail Access Resilience Study |
| | | 7 | US 41 Corridor Road/Rail Access Resilience Study |

