AECOM

**To:**
Vincent Murphy, Town of Nantucket
Sakiko Isomichi, Martha's Vineyard Commission
Stewart Young, Town of Gosnold

**CC:**
Ellen Douglas
Joe Famely
Linnea Laux
Kendall Myers
Carey Barr

**Project name:**
Islands Supply Chain Resilience

**From:**
AECOM
250 Apollo Dr.
Chelmsford, MA 01824

Woods Hole Group
107 Waterhouse Group
Bourne, MA 02532

**Date:**
June 24, 2026

# Memo

**Subject: Task 5 Phase 1 Summary Memo – DRAFT**

## Table of Contents

# List of Tables

# Executive Summary

## Purpose and Scope

The Town of Nantucket, the Martha's Vineyard Commission (MVC), and the Town of Gosnold, were granted funding by the Massachusetts Office of Coastal Zone Management to complete a preliminary risk assessment of the supply chain of the ResilientCoasts Islands District (a.k.a. "the Islands," comprised of Dukes and Nantucket counties) through the ResilientCoasts Initiative. A team of consultants was contracted to complete the project, which was intended as Phase 1 of a long-term effort. Work occurred between April and June of 2026 and was primarily focused on identifying data gaps and high-priority next steps for future work.

## Summary of Key Findings

Phase 1 of the Islands Supply Chain Resilience Study ("the Study" hereafter) aimed to summarize relevant previous work, complete a preliminary coastal flood vulnerability and risk assessment of supply chains, and engage partners and stakeholders. The Town of Nantucket, Town of Gosnold, Martha's Vineyard Commission, AECOM, Woods Hole Group, and Jamie Caplan Consulting worked collaboratively to complete the project.

Previous studies relevant to the supply chain of the Islands district were compiled in a shared online folder by project partners and consultants and are listed in Section 2.0 of this memo.

Phase 1 stakeholder engagement confirmed that the Islands' supply chain functions as a tightly interconnected but highly fragile system, dependent almost entirely on marine transportation and a small number of critical operators. Interviews and partner discussions revealed consistent vulnerabilities, including single points of failure in infrastructure and service providers, limited on-island supply reserves (often less than one week), and heavy exposure to weather-related disruptions that can quickly cascade into shortages. At the same time, stakeholders emphasized that the system is sustained by strong informal coordination and institutional knowledge, rather than formalized protocols or shared data systems. Key lessons from this phase underscored the need for more structured, system-wide coordination, improved data visibility, and targeted investments in redundancy and pre-storm planning.

A preliminary coastal flood vulnerability assessment of infrastructure relevant to the Islands' supply chain found high vulnerability to fair weather operations for several sites in the near- and mid-term. The Cuttyhunk and Chappaquiddick ferries, as well as the Hyannis to Nantucket Hy-Line ferry, are expected to experience interruptions to fair weather operations as soon as 2030, and numerous other sites are expected to experience interruptions to fair weather operations as soon as 2050.

The frequency of New Bedford Hurricane Barrier ("Barrier") closures emerged as the most pressing source of disruptions to the Islands' supply chains. Barrier closures occur when the Fairhaven waterfront begins to flood; it currently closes 17 times per year on average, and the length and frequency of closures is expected to increase over time. Further assessment is required to identify the highest priority adaptation actions for ferry terminals, barge landings, and approach roads, but as all of the communities in the Islands region depend on freight arriving via barge from New Bedford through the Barrier, the regional significance and urgency of maintaining or decreasing the annual number of Barrier closures is clear.

The preliminary Supply Chain Risks Assessment found that the Islands' supply system is highly efficient but fundamentally vulnerable due to its near-total dependence on maritime transportation, limited redundancy, and exposure to climate-driven hazards. Ferry terminals, barge facilities, and a small number of mainland ports (particularly New Bedford, Hyannis, and Woods Hole) function as critical nodes, creating systemwide risk if disrupted by storms, flooding, mechanical failures, or workforce shortages. Across key sectors—food, fuel, healthcare, and workforce mobility—the Islands rely on frequent, just-in-time deliveries with minimal on-island storage, meaning even short-term interruptions can quickly cascade into shortages and service disruptions. Increasing threats from sea level rise, Barrier closures, and aging infrastructure further amplify these risks, while workforce constraints and housing challenges limit operational flexibility. Without targeted infrastructure adaptation and improved operational resilience, disruptions to ferry and barge systems will pose growing challenges to the Islands' economic stability, public service provision, and daily life.

## Recommended Next Steps

Overall, the findings highlight that while the Islands supply chain performs reliably under normal conditions, its resilience to disruptions will depend on formalizing coordination mechanisms and addressing critical infrastructure and operational gaps. Phase 2 of this risk assessment to refine the flood vulnerability assessment and economic analysis, understand the potential impact of storm damage, and identify priority adaptation projects, is recommended. Concurrently, ongoing projects that increase supply chain redundancy, strengthen critical infrastructure, and address workforce issues should be prioritized. As work moves forward, regional coordination and the recognition of regional project impacts will be essential.

# 1.0 Introduction

## 1.1 Background and Purpose

In the spring of 2026, the Massachusetts Office of Coastal Zone Management issued a request for proposals for regional coastal resilience projects as part of the ResilientCoasts Initiative. The Town of Nantucket, the Martha's Vineyard Commission (MVC), and the Town of Gosnold were granted funding to complete a preliminary risk assessment of the supply chain of the ResilientCoasts Islands District ("the Islands," comprised of Dukes and Nantucket counties). AECOM, Woods Hole Group, and Jamie Caplan Consulting were contracted to summarize relevant previous work, complete a preliminary coastal flood vulnerability assessment of ferry terminals, assess risks to supply chains, and engage relevant partners and stakeholders. Work occurred between April and June of 2026 and was primarily focused on identifying data gaps and high-priority next steps for future work.

## 1.2 Phase 1 Methodology

The project was structured as a series of tasks, completed collaboratively by the consultant team. Tasks 2 and 3 were completed concurrently, and results from Tasks 2 and 3 informed Task 4.

### A. Task 1: Project Initiation and Project Management

Task 1 convened with a kickoff meeting with all project consultants and partners, and included regular check-in meetings throughout the project. Ongoing time devoted to project management was also covered under Task 1.

### B. Task 2: Gather Existing Information and Input

In Task 2, relevant previous studies were gathered in a shared online folder. Partner interviews were also conducted with ferry services, freight barge operators, and regional partners to build an understanding of the current state of the supply chain.

### C. Task 3: Summarize Coastal Hazard Vulnerability for Ferry Terminals

Task 3 consisted of a preliminary coastal flood vulnerability assessment of all relevant supply chain infrastructure. Data gaps were identified and next steps for future studies recommended.

### D. Task 4: Assess Supply Chain Risks

Task 4 incorporated information from Tasks 2 and 3, as well as economic research, into an assessment of risks to the supply chain of the Islands.

### E. Task 5: Final Project Memo

Task 5, the final task of the project, involved drafting this memo to summarize the outcomes of all tasks and recommendations for next steps.

The remainder of this memo summarizes the outcomes of the tasks in the order that they appear above, with Tasks 1 and 5 omitted.

# 2.0 List of Previous Reports

The following studies and reports were compiled in an online folder for reference during project work:

**Mainland**

- *Marine Oil Spill Threats to Massachusetts Coastal Communities: Updated Assessment* – Nuka Research, January 2024
- *Hyannis Harbor Municipal Vulnerability Preparedness Resilience Plan* – Woods Hole Group, June 2024

- *Cape Cod Low Lying Roads Project* – Woods Hole Group, June 2024
- *New Bedford/Fairhaven Municipal Harbor Plan Resiliency Memo* – Woods Hole Group, December 2025
- *ResilientWoodsHole Phase 2 Report* – Woods Hole Group, January 2022

### Dukes County (Martha's Vineyard and Gosnold)

- *Dukes County Hazard Mitigation Plan* – The Olson Group, June 2026
- *Dukes County Community Wildfire Protection Plan* – SWCA, September 2021

### Gosnold

- *Gosnold Community Development Strategy* – April 2026
- *Open Space and Recreation Plan for the Town of Gosnold* – MVC, September 2025
- *Site Investigation & Evaluation of 2024 Emergency Actions at Church's Beach* – Woods Hole Group, September 2024
- *Updated Study on Coastal Resiliency Alternatives for Barges Beach, Cuttyhunk, Gosnold, Massachusetts* – Woods Hole Group, April 2024
- *The Gosnold Climate Action Plan* – January 2024
- *Town of Gosnold MVP Community Resilience Building Workshop, Summary of Findings* – MVC June 2018
- *Cuttyhunk Island: A Plan to Plan* – The Cecil Group, December 2012

### Martha's Vineyard

- *Martha's Vineyard Beach Road Study* – MassDOT, June 2025
- *Beach Road Resiliency Improvements* – Tighe & Bond, September 2025
- *Tisbury Master Plan* – Barrett Planning Group, April 2024
- *Martha's Vineyard Hospital Resilient Access Plan* – Fuss & O'Neill, June 2024
- *Chappy Ferry Climate Change Resilience Alternatives Assessment* – Fuss & O'Neill, December 2024
- *Alternatives Analysis for Vineyard Haven* – Sustainable Coastal Solutions, June 2023
- *Edgartown Climate Change Vulnerability Assessment and Adaptation Plan* – Woods Hole Group, June 2021
- *Evaluation of Coastal Processes and Storm Impacts to Support Resilient Planning and Mitigation Strategies for the Vineyard Haven Harbor Shoreline* – Applied Coastal, June 2021
- *Tisbury Municipal Vulnerability Preparedness Workshop Summary* – Horsley Witten Group, October 2018

### Nantucket

- *Nantucket Coastal Resilience Plan* – ARCADIS, November 2021

- *Resilient Nantucket: Flooding Adaptation & Building Elevation Design Guidelines* – Thomason & Associates, 2021
- *High Tides and Flooding on Easy Street* – Town of Nantucket, July 2020
- *Town of Nantucket Coastal Risk Assessment and Resiliency Strategies* – Milone & MacBroom, January 2020
- *Town of Nantucket MVP Workshop Summary* – Milone & MacBroom, April 2019
- *Town of Nantucket Natural Hazard Mitigation Plan* – Milone & MacBroom, February 2019
- *Nantucket Coastal Management Plan* – Town of Nantucket, March 2014

# 3.0 Engagement with Partners and Stakeholders

The Study engaged a cross-section of stakeholders, representing the critical members of the marine-based supply chain serving Nantucket, Martha's Vineyard, and Gosnold. Participants included ferry operators, barge and towing companies, fuel distributors, aggregate suppliers, food retailers, and municipal emergency management officials. These actors collectively manage the movement of essential goods—food, fuel, construction materials, and waste—across an inherently fragile, water-dependent system.

Engagement confirmed that the Islands' supply chain operates as an integrated but highly interdependent network, with limited redundancy and heavy reliance on a small number of operators. The Steamship Authority (SSA) emerged as the central backbone of freight and passenger movement, while private operators such as RM Packer, JP Noonan, and local ferry services provide specialized logistics capacity.

Stakeholder participation also highlighted the importance of informal relationships and coordination practices that have evolved over time, particularly during disruptions such as COVID-19 and major weather events. However, these relationships are not consistently formalized, creating potential risks in emergency scenarios or leadership transitions.

## 3.1 Meeting Structure and Design

Engagement during Phase 1 consisted primarily of semi-structured interviews conducted in May 2026, supplemented by written responses and a convening of project partners on June 11, 2026. Interviews were conducted in person, by phone, or via written submission by the Project Team; Vince Murphy, Town of Nantucket Sustainability Programs Manager; Stewart Young, the Town of Gosnold, Selectboard Member; and Sakiko Isomichi, Climate Resilience Planner, MVC.

The Study examined current operations, past disruptions, vulnerabilities, and gaps in coordination to develop recommendations for improved resilience. The stakeholders interviewed represented the principal members of the Islands' marine supply chain: ferry operators, barge and towing companies, fuel distributors, aggregate suppliers, food retailers, and emergency management officials.

This structure allowed for consistent data collection while providing flexibility for stakeholders to highlight unique operational realities within their respective sectors. The June 11 partner meeting served as a validation and synthesis session, enabling cross-stakeholder discussion of shared challenges and opportunities.

**Table 1: Stakeholder Participation During Phase 1**

| Name | Role | Organization | Interview Date | Interviewer |
|---|---|---|---|---|
| **Seth Garfield & Asa Lombard** | Solid Waste & Emergency Management | Town of Gosnold | May 23, 2026 | |
| **Debby Packer** | Owner/Operator | RM Packer Company (Tisbury Transportation) | ~May 2026 | Project Team |
| **Marianne Jenkinson** | Office Manager | Nantucket Energy | May 21, 2026 | Vince Murphy |
| **Shane Corry** | Director of Operations | Toscana (aggregate supply) | May 21, 2026 | Vince Murphy |
| **Jono Billings** | Captain & Owner | Cuttyhunk Ferry | ~May 2026 | |
| **Alex Kryska** | General Manager | Steamship Authority (SSA) | ~May 19, 2026 | Sakiko Isomichi (written response) |

| Name | Role | Organization | Interview Date | Interviewer |
|---|---|---|---|---|
| **Andrea Donnelly** | Owner | Cronig's Market (Martha's Vineyard) | ~May 2026 | Sakiko Isomichi |
| **Stop & Shop** | — | Stop & Shop (Nantucket / MV) | ~May 2026 | Written response via Sakiko |

*Note: Stop & Shop's response was a brief written statement provided via Sakiko Isomichi. Additional interviews (e.g., JP Noonan, Chappy Ferry) were identified as critical but remain pending, indicating some remaining gaps in stakeholder coverage.*

## 3.2 Emerging Themes

Several consistent themes emerged through these stakeholder interviews and the June 11 meeting:

1. **Extreme Dependence on Marine Transportation**

All essential goods reach the Islands by water, with no viable alternative for bulk freight. The SSA serves as the primary conduit, supported by barge operators and niche carriers. This creates a structurally constrained system with limited flexibility.

2. **Weather is the Dominant Disruptor**

Weather events—including high winds, coastal flooding, and winter storms—are the most frequent and impactful sources of disruption. Even short-term, weather-related service interruptions can cascade into supply shortages, particularly during winter when fewer sailings reduce redundancy.

3. **Single Points of Failure Across the System**

Stakeholders consistently identified critical, “single point of failure” vulnerabilities, including:

- Only one provider each for key services (e.g., JP Noonan for Nantucket fuel, single barge providers for Gosnold)
- Limited terminal infrastructure (e.g., Woods Hole for SSA, Tisbury for barge access)
- Dependence on specific vessels, facilities, and personnel

These single points of failure extend across infrastructure, operators, and workforce capacity.

4. **Limited On-Island Supply Buffers**

Typical supply reserves are extremely constrained:

- ~3 days of food on Martha’s Vineyard
- ~4–6 days of food, upwards of 3-5 days of fuel, and 3-5 days general medical supplies on Gosnold
- ~4 days of winter fuel supply, weeks in summer on Nantucket

A disruption exceeding 4–7 days could thus create significant shortages, especially during peak population periods.

5. **Informal Coordination vs. Lack of Formal Systems**

While stakeholders reported strong working relationships and effective informal coordination (e.g., freight prioritization, communication during disruptions, etc.), these practices have not been formalized. There are no standardized protocols for freight prioritization, emergency stockpiling, or shared situational awareness.

6. **Growing Climate and Infrastructure Risks**

Sea level rise, increased storm intensity, aging infrastructure, and constrained capital investment are compounding risks. Most operators lack formal climate adaptation plans, further increasing long-term vulnerability.

## 3.3 Lessons Learned

The Phase 1 engagement process yielded several key lessons relevant to future planning and implementation:

1. **Resilience Requires System-Level Coordination**

The Islands' supply chain functions as an interconnected system, yet planning and decision-making remain fragmented. Improved resilience will require coordinated engagement across public agencies, private operators, and critical suppliers (e.g., grocers and fuel providers), supported by formal mechanisms such as a standing coordination forum.

2. **Data Gaps Limit Preparedness**

There is limited visibility into key metrics such as inventory levels, disruption frequency, and supply chain flows. The absence of shared data—particularly on food, fuel, and medical supplies—constrains proactive decision-making and emergency response.

3. **Informal Practices Need Formalization**

Existing informal coordination, while effective in many cases, introduces risk due to its reliance on personal relationships and institutional knowledge. Formalizing protocols for pre-storm staging, freight prioritization, and emergency operations is a high-impact opportunity.

4. **Redundancy Is Limited but Critical**

Across all Islands, redundancy in transportation, infrastructure, and workforce is minimal. Targeted investments (e.g., additional barge capacity, alternate terminals, storage expansion) could significantly improve system resilience.

5. **Social Infrastructure Is a Key Constraint**

Workforce availability—driven in part by housing affordability—and the concentration of institutional knowledge among long-tenured staff represent emerging risks that are often overlooked in infrastructure-focused planning.

6. **Early Planning and Pre-Positioning Are Essential**

Stakeholders emphasized the importance of pre-storm coordination and supply pre-positioning. While some ad hoc practices exist, establishing clear triggers and responsibilities for early action could substantially reduce disruption impacts.

Overall, Phase 1 engagement underscored that the Islands' supply chain is both highly functional and highly fragile; it performs well under normal conditions but is vulnerable to disruption due to limited redundancy, heavy reliance on marine transport, and insufficient formal coordination structures. The findings strongly support advancing to a second phase focused on system mapping, protocol development, and targeted resilience investments.

# 4.0 Coastal Hazard Vulnerability for Ferry Terminals

To understand the coastal flood vulnerability of the Islands' supply chain, projected Mean High Water (MHW) datums and results from the Massachusetts Coast Flood Risk Model (MC-FRM) were used to assess the vulnerability to inundation of physical assets relevant to the supply chain. This assessment was originally scoped to focus on ferry terminals but was expanded to include a variety of sites relevant to the current or potential supply chain. A list of ferry terminals, barge landings, and other sites relevant to the supply chain was composed through interviews and research, elevation data were gathered, and the probability of flooding was assessed. Based on these results, data gaps and next steps for future work were identified and summarized.

## 4.1 Results

Table 2 summarizes the results of the preliminary coastal flood vulnerability assessment for infrastructure relevant to the supply chain of Gosnold, Martha's Vineyard, and Nantucket. Assets highlighted in gray in the table were evaluated as secondary priorities. These sites had enough relevance to the supply chain to include in the assessment, but did not provide year-round passenger or freight service to the Islands. Where a ferry terminal had multiple loading locations, each location was evaluated as an individual point. Other sites were assigned a point approximating the ferry or barge loading location. This point was assigned a critical elevation, which was compared to projected tidal datums and results from the MC-FRM to estimate its probability of flooding over the 2030-, 2050-, and 2070-time horizons. The flood risk model and tidal projections used in this analysis assume a high rate of sea level rise, which was a deliberate choice made during the modeling process to reduce the risk of underestimating the vulnerability of important infrastructure. In interpreting model results, 2030-, 2050-, and 2070 are generally treated as the soonest that corresponding flood probabilities could be projected, and a 20-year range will be applied. In practice, 2030 projections are treated as occurring sometime between 2030 and 2050, and the same applies to 2050 and 2070.

A variety of elevation data sources was used for this preliminary vulnerability assessment. Some sites, noted in Table 2 with "High" elevation data confidence, were in locations where high-quality elevation survey data was available from other projects. Ideally, all critical elevations would have "High" confidence and be sourced from an elevation survey conducted with an RTK GPS unit. Sites with "Medium" elevation data confidence were sourced from 2021 LiDAR data or, in the case of the Woods Hole ferry terminal, from construction plans provided to the ResilientWoodsHole project. For docks located over water, where no LiDAR data is available, elevation was estimated from LiDAR on adjacent areas, resulting in "Low" or "Very Low" elevation confidence. Vulnerability assessment results from sites with "Low" or "Very Low" elevation confidence may not be accurate, and filling these elevation data gaps should be prioritized in future work. Sites with "Medium" elevation data confidence can also be considered data gaps to be filled.

The results presented in Table 2 aim to provide an understanding of how likely fair weather supply chain operations are to be disrupted by high water levels. Ferry terminals and barge docks are generally not expected to operate during storms and can be designed to flood with little-to-no damage. Therefore, the goal for these facilities is generally to avoid fair weather and small storm inundation and preserve daily operations, in addition to minimizing damage during more significant storms.

The column titled "Onset of Daily Inundation" identifies the time horizon when the projected Mean High-Water datum exceeds the asset's critical elevation. Normal operations are not possible under these conditions, and highly vulnerable assets such as the Chappy Ferry in Edgartown and the docks on Cuttyhunk are vulnerable to daily inundation as soon as 2050. The columns titled "MC-FRM AEP 20XX" show the asset's probability of flooding as soon as the corresponding year. Results labeled with an * represent situations where data for higher probability water levels were not available, and the result may represent an underestimate of vulnerability. Risk tolerance for individual facilities may vary, but the sites evaluated in this vulnerability assessment can generally be thought of as operating normally up to a 10% annual chance of flooding. Ferry and barge operations are generally paused in response to wind and wave conditions rather than specific water levels, making it difficult to directly correlate service interruptions with a defined annual flood probability. For the purposes of this study, sites with a 20%, 50%, or 100% Annual Exceedance Probability (AEP) within a given time horizon are considered vulnerable to fair weather operational disruptions.

Assets in New Bedford Harbor have low coastal flood vulnerability because they are protected by the Barrier. However, ferry and barge operations cannot continue when the Barrier is closed. The Barrier generally closes when water surface

elevations reach approximately 3.48' NAVD88, corresponding to the onset of flooding on the Fairhaven waterfront. Closures during storms are of less concern to the supply chain of the Islands because it is assumed that ferries and barges would not operate during storms; fair-weather closures, on the other hand, are disruptive. Currently, the Barrier closes an average of 17 times per year, and that frequency occasionally impacts the Cuttyhunk Ferry. The three primary sites in New Bedford Harbor are over two feet higher than the current closure threshold, meaning that adaptation at the sites themselves would likely not change the Barrier closure threshold.

Sites behind the Barrier that are critical to Island supply chains thus effectively have the same probability of operational interruption as the lowest part of the Harbor's waterfront; if a specific part of the waterfront begins to flood, the Barrier closes, and these sites cannot operate, *despite not being flooded*. Therefore, while Table 2 shows low vulnerability to flooding, sites within the Barrier will begin to experience monthly operational interruptions at fair weather high tide as soon as 2030 if the threshold for Barrier closure does not change.

Further detail and interpretation of these results, as well as a summary of previously available approach road vulnerability data, is available in the Task 3 Memo.

## 4.2 Data Gaps and Recommendations

Gaps in elevation data, approach roadway vulnerability data, and high probability water elevation data contributed to the limitations on this analysis. Ideally, each asset would be assessed using survey quality elevation data and a full spectrum of projected water surface elevation data, including Highest Annual Tide datums. A roadway vulnerability assessment should also be conducted for all asset approach roads. A table summarizing these data gaps can be found in the Task 3 memo. The following next steps are recommended:

1. **Conduct a Detailed Flood Vulnerability Assessment of Primary Sites**

The list of primary sites should be revisited and finalized with input from stakeholders and this project's economic research. For each primary site, all data gaps should be filled by conducting elevation surveys and flood modeling. All critical equipment at ferry terminals and barge landings should be included, rather than just a single loading and unloading point. The vulnerability of all approach roads should also be assessed in a desktop analysis. The results of this assessment can be used to identify adaptation actions to reduce the impacts of storm damage and ensure supply chain continuity under higher water levels.

2. **Identify Projects to Raise the Threshold for New Bedford Harbor Barrier Closure**

This preliminary vulnerability assessment clearly identifies the frequency of Barrier closures as a threat to the supply chains of all Island communities. The onset of flooding within the Barrier is currently used to make decisions about closures, so adaptation projects on the Fairhaven and New Bedford waterfronts have the potential to have wide-ranging regional impacts by enabling the Barrier to close less frequently. Waterfront adaptation projects should be identified and prioritized for further development, with local stakeholders such as the Town of Fairhaven and the Port of New Bedford engaged in future project phases.

3. **Identify and Address Key Vulnerabilities for Each Island**

Based on the results of Step 1 and an economic or materials flow analysis, key vulnerabilities in the supply chain of each island should be identified and prioritized for action in order of their criticality. These actions may include physical infrastructure projects, but may also include actions to ensure the availability of critical supplies or workers. Priorities on both the Islands and mainland should be included and should be highlighted as regionally significant in planning and funding work.

**Table 2: Coastal Flood Vulnerability Assessment Results for all Sites.**

| Harbor | Facility | Critical Elevation | Elevation Confidence | Onset of Daily Inundation | MC-FRM AEP 2030 | MC-FRM AEP 2050 | MC-FRM AEP 2070 | Notes |
|---|---|---|---|---|---|---|---|---|
| NEW BEDFORD | Cuttyhunk Ferry Dock New Bedford | 10.17 | Medium | - | - | - | - | |
| | RM Packer Co - New Bedford | 5.87 | Medium | 2070 | - | - | MHW | |
| | Fish Island Barge Landing | 7.15 | Medium | - | - | - | 5%* | |
| | Seastreak New Bedford | 10.12 | Medium | - | - | - | - | Also a secondary barge loading/unloading site |
| | 100 Herman Melville Blvd Barge Landing | 6.96 | Medium | - | - | - | 5%* | Currently leased by Robert B. Our Company, no ramp |
| | 302 Herman Melville Blvd Barge Landing | 5.71 | Medium | 2070 | - | 0.1% | MHW | Currently leased by Robert B. Our Company, no ramp |
| WOODS HOLE | Woods Hole SSA Terminal (North) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole SSA Terminal (Middle) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole SSA Terminal (South) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole Naushon Ferry Landing | 4.125 | Medium | 2070 | 100% | 100% | MHW | Private |
| | USCG Woods Hole Dock | 5.1 | Medium | 2070 | 20% | 100% | MHW | Post-disaster operations would likely come from Newport |
| FALMOUTH | Falmouth Patriot Shuttle Dock | 3.72 | Medium | 2070 | 100% | 100% | MHW | |
| | Falmouth Pied Piper Ferry Dock | 3.5 | Low | 2070 | 100% | 100% | MHW | Seasonal/Passenger only |
| | Falmouth Island Queen Dock | 3.25 | Medium | 2070 | 100% | 100% | MHW | Seasonal/Passenger only |
| HYANNIS | Hyannis SSA Terminal (West) | 6.59 | Medium | - | 20% | 20% | 100% | |
| | Hyannis SSA Terminal (East) | 6.57 | Medium | - | 20% | 20% | 100% | |
| | Hyannis Hy-Line Dock | 4.38 | High | 2050 | 100% | MHW | MHW | |
| | Hyannis Commercial Fishing Loading/Unloading Zone | 3.31 | High | 2050 | 100% | MHW | MHW | Occasionally used for barges under 150' long |
| CUTTYHUNK | Cuttyhunk Ferry Dock | 4.1 | Low | 2050 | 5%* | MHW | MHW | also used by Coast Guard |
| | Cuttyhunk Fuel Dock | 4.3 | Low | 2050 | 5%* | MHW | MHW | |
| NAUSHON | Naushon Ferry Landing | 3.8 | Very Low | 2050 | 5%* | MHW | MHW | Private |
| VINEYARD HAVEN | Vineyard Haven SSA Terminal (North) | 4.4 | Low | 2070 | 50%* | 50%* | MHW | |
| | Vineyard Haven SSA Terminal (South) | 4.4 | Low | 2070 | 50%* | 50%* | MHW | |
| | Vineyard Haven RM Packer Co. Dock | 6.38 | Medium | - | 10% | 50%* | 50%* | |
| OAK BLUFFS | Oak Bluffs SSA Terminal | 4 | Very Low | 2070 | 50%* | 50%* | MHW | |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 4.36 | High | 2070 | 50%* | 50%* | MHW | |
| | Oak Bluffs Hy-Line Dock | 3.883 | High | 2070 | 50%* | 50%* | MHW | Seasonal/Passenger only |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Oak Bluffs Seastreak Dock | 4 | Very Low | 2070 | 50%* | 50%* | MHW | Seasonal/Passenger only |
| ***EDGARTOWN*** | Chappy Ferry Landing (Edgartown) | 3.47 | High | 2050 | 50%* | MHW | MHW | |
| | Chappy Ferry Landing (Chappaquiddick) | 2.6 | High | 2050 | 50%* | MHW | MHW | |
| | Edgartown Pied Piper Ferry Dock | 5.11 | High | 2070 | 20% | 50%* | MHW | Seasonal/Passenger only |
| ***NANTUCKET*** | Nantucket SSA Terminal (North) | 6.34 | Medium | - | 20% | 20% | 50%* | |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | 6.93 | Medium | - | 10% | 20% | 50%* | |
| | Nantucket Hy-Line Dock | 4.46 | Medium | 2070 | 50%* | 50%* | MHW | |
| | Nantucket Steamboat Wharf Barge Landing | 6.47 | Medium | - | 20% | 20% | 50%* | |
| | USCG Nantucket Dock | 3.02 | Medium | 2050 | 50%* | MHW | MHW | May be used in case of storm damage to primary sites |
| ***OTHER*** | USCG Cape Cod Canal | 7.71 | Medium | 2070 | 100% | 100% | MHW | Post-disaster operations would likely come from Newport |
| | Chatham Fish Pier (USCG Chatham) | 6.63 | Low | 2070 | 100% | 100% | MHW | Post-disaster operations would likely come from Newport |
| | USCG Menemsha Dock | 5.14 | Medium | 2070 | 5%* | 5%* | MHW | May be used in case of storm damage to primary sites |

# 5.0 Islands Supply Chain Risk Assessment

## 5.1 Overview and Context

The Islands region—including Martha's Vineyard, Nantucket, and the Elizabeth Islands—relies almost entirely on maritime transportation systems to sustain its economy, population, and essential services. Ferries, barges, and supporting mainland logistics networks form the backbone of this system, moving nearly all goods, services, and a significant portion of the workforce between the Islands and mainland Massachusetts.

This dependence creates a structurally constrained supply chain characterized by geographic isolation, limited redundancy in transportation routes, and heavy reliance on a small number of critical facilities and operators. While efficient under normal conditions, the system is highly sensitive to disruptions, particularly those affecting ferry operations or key ports such as Hyannis, Woods Hole, and New Bedford.

Seasonal population fluctuations further stress this system. Peak summer populations can increase by a factor of four-to-five, sharply increasing demand for goods and services, while placing additional strain on transportation and storage capacity.

## 5.2 Supply Chain Structure and Dependencies

The Islands' supply chain is defined by several key structural characteristics:

- Centralized transportation points: A limited number of ferry terminals and barge landings serve as critical gateways for both freight and passenger movement.
- "Just-in-time" delivery systems: Limited on-island storage capacity necessitates frequent deliveries, particularly for perishable goods such as food.
- Mainland staging dependence: Regional distribution centers on Cape Cod and in southeastern Massachusetts function as essential buffer points, staging goods before shipment.
- Limited local production: The Islands produce only a small portion of their own food and goods, reinforcing reliance on imports.

The Steamship Authority (SSA) plays a central role, transporting millions of passengers and large volumes of freight annually. Private ferry operators and barge services supplement this capacity, particularly for bulk goods such as fuel, construction materials, and waste removal.

Supporting infrastructure assets—including low-lying roadways, port access points, and electrical systems—are integral to supply chain functioning. However, these assets are often exposed to flooding and other hazards, introducing additional vulnerability even when ferry service remains operational.

## 5.3 Disruption Types and System Vulnerability

Supply chain disruptions fall into two primary categories: environmental and logistical. Environmental disruptions—such as storms, high winds, coastal flooding, sea level rise, and ice—are the most significant and expected to increase in frequency over time. Logistical disruptions, including mechanical failures, crew shortages, scheduling conflicts, and maintenance downtime, also pose meaningful risks.

Because the system lacks redundancy, even short-term disruptions can cascade across the supply chain. For example, interruptions to ferry service can delay deliveries of food, fuel, and medical supplies, while also disrupting workforce movement and essential services. Unlike in mainland systems, there are few alternative transportation routes to compensate for these disruptions.

## 5.4 Sector-Specific Dependencies

**Food and Drinking Water**

The Islands rely heavily on imported food, with only minor local production. Inventory levels are typically limited to a few days due to constrained storage capacity and reliance on frequent deliveries. This creates vulnerability from even short-term supply interruptions.

Drinking water is primarily sourced locally, but extreme conditions (e.g., drought or system disruptions) could necessitate imported water, adding further strain to the supply chain.

**Medical and Emergency Services**

Healthcare systems depend on ferry access for both supplies and personnel. Many specialized medical services are available only on the mainland, requiring reliable passenger transport. Flooding of hospital access roads and disruptions to ferry service could significantly affect emergency response and patient care.

**Fuel and Energy**

Fuel is a critical dependency with limited redundancy. Nantucket relies on a single transporter (JP Noonan), with approximately four days of winter fuel reserves. Gosnold also has no alternative provider. Disruptions to fuel deliveries can quickly affect power generation, heating, and transportation systems.

**Workforce and Passenger Movement**

Passenger transportation supports essential workforce commuting and public services. A significant share of the workforce travels daily between the mainland and the islands, and many essential roles—such as healthcare workers, legal personnel, and emergency responders—depend on reliable ferry access. Disruptions can therefore impact both economic activity and critical services.

**Other Goods and Services**

Construction materials, waste removal, and other critical services rely on consistent freight movement. Bulk goods are typically transported via barge, adding another layer of dependency on specialized operators and infrastructure.

## 5.5 Critical Risks to the Supply Chain

The assessment identifies four primary risk categories that pose systemic threats:

1. **Dependence on New Bedford Harbor**

Barge operations rely heavily on New Bedford Harbor, which is subject to closures of the hurricane barrier. Increasing frequency of fair-weather closures—potentially monthly by 2030—could disrupt freight movement across the Islands.

2. **Ferry Terminal Vulnerability**

Key ferry terminals, particularly Vineyard Haven, Hyannis, and Nantucket, face increasing flood risk. Regular flooding could disrupt operations as early as mid-century (or sooner in some locations), affecting both freight and passenger transport.

3. **Key Route Disruptions**

Specific routes—such as the Hyannis-to-Nantucket Hy-Line ferry and the Chappaquiddick Ferry—are highly exposed to flooding and other hazards. Disruptions to these routes could occur frequently without adaptation measures, reducing system reliability.

4. **Workforce Constraints**

Aging workforce demographics, combined with housing affordability challenges, threaten the availability of skilled ferry and barge operators. Loss of experienced personnel could significantly reduce operational capacity and resilience.

Recommendations for future study, including of capital investments, operational changes, and other critical lifelines, were provided in this risk assessment and are incorporated into Section 6.0 Recommendations for Next Steps.

## 5.6 Recommendations for Future Study

### 5.6.1 Capital Investments

- Flood mitigation at ferry terminals and approach roads
- Raising bulkheads and docks
- Improvements to roadway elevation and drainage near ports
- Expansion of local storage capacity and food production
- Development of affordable housing to support essential workers
- Detailed infrastructure assessments to identify high-priority adaptation needs

### 5.6.2 Operational Improvements

- Enhanced coordination among ferry and freight operators
- Pre-storm stockpiling and logistics planning
- Diversification of suppliers and ports
- Improved communication systems during disruptions
- Greater reliance on local vendors where feasible

### 5.6.3 Future Study Areas

Future studies should evaluate vulnerabilities in:

- Power generation and transmission
- Water supply and wastewater systems
- Telecommunications infrastructure

# 6.0 Recommendations for Next Steps

The combined findings underscore that improving supply chain resilience across the Islands will require targeted infrastructure investments, stronger operational coordination, and better data visibility. While the system performs adequately under normal conditions, its dependence on marine transportation, limited redundancy, and exposure to flooding and weather disruptions create systemic risk.

1. **Refine Supply Chain Risk Assessment**

The coastal vulnerability assessment should be developed further to identify storm damage vulnerability for primary sites and quantify each site's role in the supply chain. The results of this assessment can be used to specify priority actions and projects in line with the recommendations below. A detailed economic analysis should be developed to inform the redirection of critical supply flows through less vulnerable supply chains.

2. **Strengthen Critical Infrastructure**

Priority investments should focus on protecting and adapting key ferry terminals, barge facilities, and access roads vulnerable to flooding, particularly in Vineyard Haven, Hyannis, and New Bedford. Elevating infrastructure, improving drainage, and expanding capacity—such as adding barge ramps—will help reduce reliance on single points of failure.

3. **Formalize Coordination and Emergency Protocols**

A standing coordination group should be established to bring together ferry operators, freight providers, municipalities, and major suppliers. This group should develop formal protocols for pre-storm staging, freight prioritization, and emergency response. Currently, these functions rely heavily on informal coordination, which poses risk during disruptions. There is also room for resilience coordination beyond disaster planning to support daily operations, improve infrastructure, and identify and support grant opportunities.

4. **Improve Data and System Visibility**

Developing a shared data system to track fuel reserves, food inventory, and medical supplies would significantly improve decision-making during disruptions. This should be paired with an end-to-end supply chain mapping effort to identify chokepoints, dependencies, and opportunities for targeted investment.

5. **Increase Redundancy and Storage Capacity**

Efforts should focus on expanding on-island storage for critical goods and establishing clear protocols for pre-positioning supplies ahead of disruptions. Reducing reliance on single providers, particularly for fuel, barge transport, and waste removal, will also improve system resilience.

6. **Address Workforce and Continuity Risks**

Workforce constraints, driven in part by housing affordability, represent a growing risk. Strategies to support workforce retention and succession planning should be paired with formal continuity-of-operations plans for critical operators, particularly for the Steamship Authority.

7. **Advance Integrated Resilience Planning**

Future work should integrate climate adaptation into all infrastructure and operational planning and expand analysis to interconnected systems, such as power, water, and telecommunications.

A coordinated Phase 2 effort should begin with Recommendation 1 to fill the data gaps identified during Phase 1 and identify specific priority projects in line with Recommendations 2-7.

# Appendix A

# Task 2 Summary of Partner and Stakeholder Engagement Findings.

MASSACHUSETTS ISLANDS SUPPLY CHAIN RESILIENCE STUDY

# Stakeholder Interview Synthesis & Summary

*Nantucket · Martha's Vineyard · Gosnold (Elizabeth Islands)*

June 2026



PREPARED BY

**Jamie Caplan Consulting LLC (JCC)**

PREPARED FOR

**Massachusetts Office of Coastal Zone Management (CZM)**

In partnership with the Towns of Nantucket, Gosnold, and the Martha's Vineyard Commission

## Table of Contents

## Introduction

These interviews were conducted as part of a CZM-funded study to assess supply chain resilience for Massachusetts' island communities — Nantucket, Martha's Vineyard, and Gosnold (Cuttyhunk / Elizabeth Islands). The study examines current operations, past disruptions, vulnerabilities, and gaps in coordination to develop recommendations for improved resilience. The stakeholders interviewed represent the principal nodes of the islands' marine supply chain: ferry operators, barge and towing companies, fuel distributors, aggregate suppliers, food retailers, and emergency management officials.

## Participants

The following stakeholders participated in the Islands Supply Chain Resilience interviews. Interviews were conducted in person or via phone/written response by Project Team, Vince Murphy, Town of Nantucket Sustainability Programs Manager, Stewart Young, Town of Gosnold, Selectboard Member, and Sakiko Isomichi, Climate Resilience Planner, Martha's Vineyard Commission.

| Name | Title / Role | Organization | Interview Date | Interviewer |
|---|---|---|---|---|
| Seth Garfield & Asa Lombard | Solid Waste & Emergency Management | Town of Gosnold | May 23, 2026 | |
| Debby Packer | Owner / Operator | RM Packer Company (Tisbury Transportation) | ~May 2026 | Project Team |
| Marianne Jenkinson | Office Manager | Nantucket Energy | May 21, 2026 | Vince Murphy |
| Shane Corry | Director of Operations | Toscana (aggregate supply) | May 21, 2026 | Vince Murphy |
| Jono Billings | Captain & Owner | Cuttyhunk Ferry | ~May 2026 | |
| Alex [GM] | General Manager | Steamship Authority (SSA) | ~May 19, 2026 | Sakiko Isomichi (written response) |
| Andrea Donnelly | Owner | Cronig's Market (Martha's Vineyard) | ~May 2026 | Sakiko Isomichi |
| Stop & Shop | — | Stop & Shop (Nantucket / MV) | ~May 2026 | Written response via Sakiko |

*Note: Stop & Shop's response was a brief written statement provided via Sakiko Isomichi. Interviews with Chappy Ferry and JP Noonan (primary liquid fuel transporter to Nantucket) are pending.*

# Current Operations & the Island Supply Chain

## Marine Transportation Backbone

Every commodity that reaches the islands arrives by water — primarily via the Steamship Authority (SSA) ferry system for Nantucket and Martha's Vineyard, and the Cuttyhunk Ferry for Gosnold. Barge operations through RM Packer Company (Tisbury Transportation) are the primary mode for bulk freight, liquid fuels, and waste removal. Key operational facts from interviewees include:

- The SSA is the statutory backbone of both the Martha's Vineyard and Nantucket supply chains — the sole public authority mandated by Massachusetts law to provide year-round vehicle and passenger ferry service to both islands regardless of season, weather, or route profitability. SSA operates two corridors: Woods Hole–Vineyard Haven (and Oak Bluffs seasonally), with 20+ round trips per day at peak; and Hyannis–Nantucket, with year-round vehicle service and seasonal high-speed passenger service. SSA moves perishable food and grocery stock, fuel and propane, construction materials, medical supplies and pharmaceuticals, mail and package delivery (USPS, UPS, FedEx, Amazon), retail inventory and restaurant supplies, and outbound waste and recycling. Its 10-vessel fleet is crewed by approximately 400 employees, coordinated 24/7 during summer. SSA operates no conventional alternative: for Martha's Vineyard there is no bridge, tunnel, or air freight substitute for vehicle and bulk freight; for Nantucket, the island's heating oil and propane supply has no pipeline and depends almost entirely on SSA freight service.
- RM Packer conducts approximately 13,000 round trips per year and 1,500 fuel-related trips. Packer operates the only deep-water accessible terminal in Tisbury (MV) with a transfer slip that accommodates barges for oversized loads.
- Toscana (Nantucket aggregate supplier) brings over 60 barges per year of sand, bluestone, mulch, and other construction materials, subcontracting barge operations to 41 North Offshore out of New Bedford.
- Nantucket Energy receives approximately 5 fuel deliveries per week in winter (Dec–March) via JP Noonan, which is the sole transporter of all liquid fuels to Nantucket — transporting gasoline, diesel, heating oil, and propane for all distribution companies and gas stations. JP Noonan books SSA freight ferry space 6–7 days per week.
- The Cuttyhunk Ferry (Jono Billings, Captain/Owner) is the sole year-round carrier for Gosnold, transporting roughly 250 tons of cargo annually — food, mail (USPS), freight, fuel, and passengers. The ferry has maintained unbroken daily service for 20+ years (weather excepted).
- The Town of Gosnold manages 8–10 trash barges per year, 4–6 fuel barge runs, and daily summer ferry service, coordinating with Tucker Roy Towing and RM Packer for barge operations. New Bedford's RM Packer barge ramp is the primary mainland staging point.

## Seasonality

All operators note a sharp seasonal surge from approximately May through October. The SSA's capacity is most constrained during summer months; Toscana reports only 2 available barge days in a given week during peak season due to competition for SSA dock space. For Gosnold, the busy season runs March–November. Nantucket Energy's fuel demand is the inverse — highest in the December–March heating season, when 14,000–18,000 gallons are distributed daily. SSA provided additional seasonal context: the islands' year-round population of

approximately 20,000 swells to over 100,000 in peak summer, and SSA freight and vehicle volume more than doubles, requiring additional sailings, larger vessels, and additional crew. The early 5:30 AM departure from Woods Hole exists specifically to accommodate the freight surge. Critically, SSA noted that winter vulnerability is higher despite lower volume: fewer sailings means less redundancy if a vessel goes down or weather causes cancellations. A single cancelled sailing in winter can have a materially larger impact on island inventory than a cancelled summer sailing when multiple alternatives exist the same day.

## Key Coordinators & Relationships

Interviewees identified SSA's trucking division (contact: Donny) as a critical coordination node for barge operators. RM Packer deepened its relationship with SSA significantly during COVID-19. USCG maintains strong emergency communications with the Cuttyhunk Ferry. The Town of Gosnold coordinates an annual pre-hurricane season meeting with all departments, ferry service, and barge operators, and has mutual aid MOUs with Dartmouth, New Bedford, and Fairhaven for fire and rescue.

# Past Disruptions & Consequences

## Weather as the Primary Disruptor

Across all interviewees, weather is the single most cited cause of supply chain disruption. Relevant events include:

- Winter 2026 (Gosnold): Weather prevented the fuel barge from reaching Cuttyhunk; subsequent snow and lack of snow removal equipment on the mainland further delayed deliveries to seasonal homes needing propane and heating oil.
- Nantucket Energy (ongoing): Harbor freezing has historically blocked fuel deliveries. When Nantucket's new freight boat came online, compatibility issues with certain trucks temporarily disrupted delivery.
- Nantucket Steamship dock (historical): Shallow depth at low tide previously limited barge unloading to high-tide windows only, compressing the operational schedule.
- Martha's Vineyard: Coastal flooding events — wind holding tides into the harbor — have disrupted port access in Tisbury and other ports. Debby Packer described two such storms in winter 2025–2026 that also caused harbor ice.
- Toscana notes that sustained winds over 30 mph cancel barge runs, and the 50-nautical-mile run from New Bedford to Nantucket at 5–6 knots makes the route inherently weather-sensitive.

## Gosnold 10-Year Trash Barge Failure

Approximately a decade ago, Gosnold experienced a 10-day barge delay due to equipment availability and mechanical failures. All solid waste compactors filled to capacity; daily trash collection was stored on the floor of the boathouse for 10 days, followed by an extensive and costly cleanup. While there was no immediate health crisis, the event illustrated the fragility of single-provider solid waste removal.

## Fuel Shortage, Cuttyhunk — Spring 2026

Just prior to the interview (approximately April–May 2026), Cuttyhunk experienced a two-week fuel outage that impacted both commerce (visiting yachtsmen) and island consumption. No alternative fuel delivery provider exists for Gosnold.

## SSA Disruptions

The SSA provided a detailed written response describing its disruption experience and resilience gaps. The most significant recent event was a major late-February 2026 winter storm that caused a five-day power outage in Falmouth and Woods Hole, preventing crews and staff from reaching terminals and suspending ferry operations. Although demand was suppressed during the storm itself, the aftermath produced a large backlog of freight, passengers, and emergency vehicles once roads reopened. SSA noted that supply chain disruptions almost always cascade: a cancelled sailing pushes freight into competition with the next day’s already-full reservations, and grocery shelves on both islands reflect SSA service reliability within 48–72 hours during high-demand periods.

SSA characterized the consequences of extended outages as follows: a one-day closure is manageable for most residents and businesses, with the greatest impact falling on time-sensitive freight and commuting workers; one week creates significant strain as grocery inventory on both islands runs thin within 3–5 days under normal consumption; two weeks or

more constitutes a crisis, with food security issues, fuel shortages, and constrained emergency medical capacity. SSA noted that extended winter storms have already created multi-day backlogs requiring MEMA coordination. The Bourne Bridge repair and upcoming Sagamore Bridge replacement have prompted SSA to explore alternative mainland ports, including New Bedford, to supplement the traditional Hyannis and Woods Hole routes — though a transfer bridge for freight operations is not currently available in New Bedford.

### Cronig's Market (MV)

Cronig's experienced a temporary suspension of a food distributor's operations, forcing a switch to an alternative distributor and the loss of certain product lines. During an anticipated electricity outage in 2023, the store deployed a refrigerator truck on-site to protect perishables. The store depends on two drivers who live off-island and arrive on early ferries each day — a vulnerability if ferry service is disrupted.

## Vulnerabilities & Single Points of Failure

### Infrastructure

- Cuttyhunk barge ramp: 20+ years old; needs upgrade. As sea level rises, the barge/ramp angle interface becomes problematic at high tide, limiting the window for barge arrivals. A ramp extension is a potential solution.
- Dredged channel (Cuttyhunk): Monitored by USACE but channel depth is a severe limiting factor for barge operations. Channel silting is a longer-term risk; if significantly filled in, small vessels would need to substitute for the ferry and barge.
- SSA identified as the single most critical bottleneck by Toscana — both for dock/terminal capacity and fleet reliability. Only the Tisbury terminal accommodates barges for MV.
- New Bedford barge ramp (Packer facility): The primary mainland staging point for MV and Gosnold supply chains. Vulnerability to storm gates adds a regulatory timing layer to pre- and post-storm resupply.
- Nantucket Steamship dock: Barge scheduling access in summer is constrained; only 2 days per week available at times, creating backlogs for aggregate suppliers.
- Dock and electrical infrastructure: Gosnold's docks are 6–15 years old; electrical systems 15+ years old; fuel system ~3 years old.

### Fleet & Operator Redundancy

- Gosnold solid waste and fuel: No alternative barge providers. If Tucker Roy Towing or RM Packer are unavailable, there is no backup. Local captains can handle short-term passenger, and small supply runs but cannot replace barge capacity.
- Cuttyhunk Ferry maintains two vessels (90' MV Cuttyhunk with 7' draft; 40' Godfrey with 3' draft) for redundancy. In the event the channel is blocked, the operator's plan is to anchor offshore and lighter passengers and goods via water taxi. However, the ferry is still a single commercial operator for Gosnold.
- Nantucket liquid fuels: JP Noonan is the sole transporter. Nantucket Energy has 210,000 gallons of storage (185,000 usable at peak), normally maintained at ~60% capacity — approximately 4 days of supply in winter.
- SSA confirmed its own single points of failure: (1) The Woods Hole terminal — the entire MV vehicle ferry operation routes through one terminal at the end of one two-lane road through a residential village with no meaningful expansion room and no alternate terminal on the Woods Hole side. (2) Largest vessels — losing MV Island Home or MV Woods Hole without a replacement would reduce MV capacity by roughly one-third. (3) Mariner workforce — limited redundancy at the licensed officer level means loss of key personnel to illness, injury, or market competition has outsized impact. (4) On the Nantucket side, there is no alternate terminal option if Hyannis were compromised, and no commercial waterfront alternative within practical range. SSA acknowledged it does not have a comprehensive written continuity of operations plan covering vessel loss, terminal loss, or workforce shortage scenarios. Fleet age is significant: SSA is planning vessel replacement over a 30-year horizon, but the 2026–2031 window involves real risk from aging vessels that are increasingly expensive to maintain. SSA also noted that it receives no direct federal or state operating subsidy and is almost entirely self-funded through fares and fees, which constrains capital investment decisions.

## Workforce & Institutional Knowledge

- RM Packer (32 employees, Tisbury Towing 8): Staff with 35 years of specialized institutional knowledge. Succession planning is a concern. Affordable housing is a growing risk to crew retention.
- Toscana notes workforce instability — workers cannot easily find stable housing on Nantucket. The company provides some employee housing.
- Gosnold: Small, cross-trained workforce where personnel fill multiple roles across departments.

## Climate & Sea Level Rise

- All operators noted increasingly intense and frequent weather events over the past 10–20 years, with ferries and barges canceling service more often.
- Sea level rise is specifically flagged by Cuttyhunk Ferry (channel silting risk), RM Packer (building infrastructure to SLR standards; seeking a second barge ramp), Toscana (SLR and storm risk at the SSA facility), and Nantucket Energy (using 3-year demand averages that must account for severe winters).
- No formal climate adaptation plans exist among most interviewees; Debby Packer is the exception — she is actively building infrastructure to SLR standards and has a pending $1.5M MARAD grant application for a second barge ramp (shovel-ready with permits in hand).

## On-Island Supply Reserves

Interviewees provided the following estimates of typical on-island supply reserves:

| Island / Location | Food | Fuel | Medical Supplies |
|---|---|---|---|
| Gosnold (Cuttyhunk) | 4–6 days (residents/visitors) | Many days if tanks full; 3–5 days if low | 3–5 days general; no pharmacy on island |
| Nantucket (Nantucket Energy) | — | ~4 days propane in winter; weeks in summer | — |
| Martha's Vineyard (Cronig's) | ~3 days for year-round population (~20,000) | — | — |

A disruption lasting more than 4–7 days — particularly during peak season when populations swell 5x or more — would begin to create meaningful shortages across all critical supply categories.

# Gaps, Coordination & Recommended Actions

## Coordination Strengths

- The Town of Gosnold holds an annual pre-hurricane planning meeting with all departments, the ferry, and barge operators — a model worth documenting and potentially replicating.
- RM Packer and SSA developed close operational coordination during COVID-19, including trading freight reservations.
- The Cuttyhunk Ferry reports strong communication with USCG and the commercial marine sector.
- The MV EMS group recently completed a strategic plan with Gosnold, and Gosnold expects to act on recommendations from it.

## Identified Gaps

- No supply chain mapping has been conducted end-to-end for any island to identify where the marine leg creates the greatest vulnerability.
- No formal data collection on disruption frequency, duration, or impact across supply chain operators.
- No backup barge provider for Gosnold solid waste or fuel.
- No formal emergency stockpiling protocols; most operators rely on existing storage with no pre-agreed triggers for early restocking ahead of storms.
- The decarbonization requirement (net zero by 2050) is identified by SSA as a major operational challenge with no clear solution path currently.
- SSA has no formal pre-storm freight prioritization or surge protocol coordinated across grocers, fuel distributors, and island emergency managers. Pre-storm staging has been done informally but never formalized.
- SSA has no written continuity of operations plan covering vessel loss, terminal loss, or workforce shortage scenarios.
- SSA has no documented freight prioritization protocol for crisis scenarios (e.g., which commodities are loaded first when vessel capacity is severely constrained). Medical supplies, food, and fuel would be prioritized by convention, but the protocol is unwritten.
- No island-wide supply inventory visibility system exists. SSA does not have visibility into island hospital, pharmacy, or grocery buffer stock levels. A shared real-time dashboard showing fuel levels, grocery buffer stock, and medical supply status would substantially improve emergency decision-making but does not currently exist.
- SSA’s freight reservation system is mid-transition to a new platform. The transition creates temporary vulnerability and is worth tracking in the study’s planning timeline.
- Climate adaptation is not yet explicitly integrated into SSA capital planning frameworks, despite sea level rise posing a direct threat to the Woods Hole terminal (at near sea level) and SSA terminal infrastructure more broadly. SSA has begun factoring climate projections into capital planning but has no formal climate adaptation plan.
- ICE enforcement concerns were raised by Cronig's Market as a risk to off-island delivery staff who travel to the island daily — a workforce vulnerability not addressed in emergency planning frameworks.

- No backup fuel delivery provider for Gosnold; no alternative mainland commercial waterfront within practical range of Nantucket (closest is New Bedford at 50 nautical miles).
- New Bedford's reluctance to accept island waste as backhaul freight limits barge efficiency. Debby Packer identified an opportunity to work with Bruno's Trucking to bail recyclables for backhaul through New Bedford, but coordination and economics have not yet aligned.

## Recommended Actions for Further Study / Planning

Based on these interviews the following next steps were suggested.

- Conduct a full end-to-end supply chain mapping exercise for each island, identifying chokepoints and single points of failure.
- Develop a mutual aid framework for barge backup capacity, particularly for Gosnold solid waste and fuel.
- Support RM Packer's MARAD grant application for a second barge ramp at the Tisbury terminal; this is shovel-ready and directly addresses a critical resilience gap.
- Explore pre-positioning and emergency stockpile protocols with island municipalities and supply chain operators, including pre-agreed storm triggers.
- Convene a working group (including Packer, Bruno's, New Bedford Port, and municipal waste officials) to develop a viable backhaul waste/recyclables model that improves barge economics.
- Engage JP Noonan as a priority follow-up interviewee given its role as the sole liquid fuel transporter to Nantucket.
- Assess the Cuttyhunk channel's dredging schedule and advocate for Federal/USACE prioritization given single-point-of-failure status.
- Encourage the State of MA to provide greater support and recognition of the Cuttyhunk Ferry's infrastructure role, given that Gosnold is the smallest town in Massachusetts.
- Work with SSA to formalize a pre-storm freight surge and prioritization protocol, coordinating SSA, island emergency managers, major grocers (Stop & Shop, Market Basket), and fuel distributors. SSA has identified this as its highest-priority resilience gap and is willing to engage collaboratively.
- Convene a standing resilience coordination forum for island supply chain stakeholders — SSA, grocers, fuel distributors, utilities, emergency managers, and municipalities — that meets regularly rather than only during active emergencies. SSA specifically identified the absence of such a forum as a high-leverage gap.
- Commission an island-wide supply buffer study (days of inventory by commodity — food, fuel, medical supplies) conducted with input from private sector operators. SSA has acknowledged it lacks visibility into island inventory levels and identified this as a data gap; the MVC study is a natural vehicle for developing the methodology collaboratively.
- Support advocacy for federal ferry operating support for the SSA. Unlike comparable ferry systems in other states, SSA receives no direct federal or state operating subsidy and is almost entirely self-funded through fares and fees, creating structural constraints on capital investment and resilience planning. Federal ferry programs (FTA, MARAD) provide some capital support but no operating subsidy.

## Supply Chain Resilience Planning Meeting

A partner meeting for the Massachusetts Coastal Zone Management-funded Islands Supply Chain Resilience Study was held on June 11, 2026. The meeting was conducted via Zoom and included all project partners, with key contributions from **Debby Packer** (Owner/Operator, RM Packer Company / Tisbury Transportation, Martha's Vineyard) and **Alex Kryska** (General Manager, Steamship Authority). The meeting was the second partner check-in following the May 19–23, 2026 stakeholder interview round.

### Island Supply Chain Vulnerabilities — Key Discussion Points

The group discussed critical supply chain vulnerabilities across the three island communities. Key points raised included:

- **Reliance on ferries:** The group confirmed the very heavy reliance on ferry service for all islands. Some individuals have capable boats on Gosnold and drop supplies in homes since they don't have good on island options. Having a doctor on the island in summer is noted as very helpful.
- **Tank farms — Debby Packer:** There was a tank farm on Nantucket previously — delivered last decade to a Packer tank truck. Cuttyhunk previously had storage tanks as well. It is a bit unclear why the tanks were removed. On Nantucket there was some demand from yacht owners to remove tanks. It was on the water's edge about 25' from the bridge, included aging infrastructure and had the potential for leaks. This removal created downstream supply chain challenges for liquid fuel delivery.
- **SSA moving things into New Bedford makes sense — Alex Kryska:** SSA moving operations toward New Bedford makes logistical sense, but they don't want waste going there.
- **Pre-position supplies / emergency stockpile:** The group discussed the idea of pre-positioning supplies and coordinating ahead of a storm. Debby described that happens in the winter. Would be good to go to the grocery stores — would help them to plan ahead of time, Nantucket's vulnerability: only a 4–6 day warehouse supply, which could possibly be extended to 1 week.
- **Would be good to go to the grocery stores:** The group agreed it would be valuable to engage Stop & Shop and Drop Shop managers for their planning inputs. Debby noted the grocery stores are "not on their radar" in terms of planning and that coordination would help them plan ahead of time.

### Collaboration and Next Steps Discussed

Several action items and recommendations were raised by the group:

- Map the supply chain end to end and identify the most isolated and vulnerable points. Cuttyhunk gets the most attention as the most isolated community.
- Explore the potential for schools to serve as emergency food storage and shelter sites, given their buffer and sizing capacity.
- Follow up with Chappy Ferry and Stop & Shop to understand how they use the supply chain in more detail.
- Seek assistance from the State or Steamship Authority to identify contacts at Stop & Shop and Drop Shop's managers for their planning inputs on their own planning and stocking strategies.

- Consider next steps from the vulnerability assessment, including qualifying flows through visual infrastructure elements as well as social infrastructure such as housing costs and aging fleet concerns.
- Work on a proposal to extend the project into a second phase to address identified vulnerabilities and improve supply chain resilience.

## Meeting Summary

The June 11 meeting confirmed and deepened the findings from the May 2026 stakeholder interview round. Infrastructure vulnerability was a unifying theme — from the fragile tank farm history on Nantucket and Cuttyhunk, to the SSA's interest in New Bedford routing, to Debby Packer's concerns about the compressed on-island supply buffer. Both Debby Packer and Alex Kryska reinforced that informal coordination has historically filled gaps that no formal protocol currently addresses — particularly around pre-storm freight staging, grocery store inventory visibility, and barge backhaul logistics. The conversation underscored the need for a formal second phase of work to translate vulnerability findings into actionable resilience strategies, with particular attention to social infrastructure (workforce housing, institutional knowledge retention) alongside physical infrastructure improvements.

## Future Interviewees

The first phase of the project included development of a potential stakeholder engagement list. The list was shortened to reflect priorities in the three month project period. The list below reflects stakeholders who were not interviewed in Phase 1 but should be considered if there is a Phase 2.

- Chambers of Commerce for Nantucket and Martha's Vineyard
- Chappy Ferry (Martha's Vineyard inter-island ferry)
- Cutty Hunk Water Taxi (travel from New Bedford to Cutty Hunk and back up to Gosnold)
- Hy-Line Cruises (alternate transportation routes to Nantucket and Martha's Vineyard)
- Island Energy Services (backup energy for Nantucket)
- JP Noonan (sole liquid fuel transporter to Nantucket; critical for understanding fuel supply chain vulnerability)
- Seastreak (high-speed ferry New Bedford to Martha's Vineyard and Nantucket)
- Stop & Shop (Nantucket / MV) — written response received but limited in detail; in-person follow-up recommended.
- Tisbury Wharf Company (private wharf/dock infrastructure in Vineyard Haven harbor)
- Town of Edgartown (manage Edgartown Harbor, Pied Piper Ferry terminus and supply Martha's Vineyard)
- Town of Oak Bluffs (seasonal SSA ferry terminus)
- USACE (responsible for some harbor maintenance, dredging, and channel navigation assessments)

## Summary of Findings

This stakeholder interview synthesis documents the supply chain vulnerabilities facing Massachusetts' three island communities — Nantucket, Martha's Vineyard, and Gosnold — as identified through interviews with eight key operators and a June 2026 partner meeting. The findings confirm that the island supply chains are structurally fragile, highly weather-dependent, and largely reliant on single providers at every critical node.

**Marine transportation is the backbone — and the bottleneck.** Nearly every commodity reaching the islands travels by water. The Steamship Authority serves as the statutory carrier for Nantucket and Martha's Vineyard, moving food, fuel, construction materials, medical supplies, and waste; RM Packer / Tisbury Transportation handles bulk barge freight for Martha's Vineyard and Gosnold; and the Cuttyhunk Ferry is Gosnold's sole year-round lifeline. There are limited alternatives to these primary operators. The loss or extended disruption of any one would rapidly escalate to a supply crisis.

**On-island buffer stocks are thin.** Grocery reserves on Martha's Vineyard stand at approximately three days for the year-round population. Nantucket's warehouse supply runs four to six days at most. Gosnold has four to six days of food on hand under typical conditions, with no pharmacy and no store for resupply. These margins shrink further when populations surge five-fold or more during peak season. A disruption lasting more than four to seven days — caused by severe weather, a vessel loss, or infrastructure failure — would generate meaningful food, fuel, and medical supply shortages across all three communities.

**Single points of failure are pervasive.** JP Noonan is the sole liquid fuel transporter to Nantucket. The Woods Hole terminal is the only SSA departure point for Martha's Vineyard vehicle freight, accessible by a single two-lane road with no alternate terminal option. Gosnold has no backup barge provider for solid waste or fuel. The Cuttyhunk channel, if significantly silted, would eliminate barge access entirely. The RM Packer Tisbury terminal is the only deep-water facility on Martha's Vineyard capable of handling barge freight. Formal backup plans were not shared and may not exist.

**Coordination is informal.** The most effective resilience mechanisms identified — pre-storm freight staging by RM Packer, cooperative freight scheduling between Packer and SSA during COVID-19, and Gosnold's annual hurricane planning meeting — exist through informal relationships and institutional knowledge, not written protocols.

**Climate change is compounding existing vulnerabilities.** All operators reported increasingly intense and frequent weather events over the past decade, with more frequent service cancellations. Sea level rise poses a direct threat to the Cuttyhunk barge ramp, SSA's Woods Hole terminal, and the Cuttyhunk channel. RM Packer is actively building to sea level rise standards and pursuing a MARAD grant for a second barge ramp that would address a critical resilience gap.

**Priority actions emerging from these interviews include:**

- Formalize a pre-storm freight surge and prioritization protocol with SSA and island grocers
- Develop a mutual aid framework for barge backup capacity
- Support RM Packer's shovel-ready MARAD grant application for a second barge ramp at the Tisbury terminal

- Conduct a full end-to-end supply chain mapping exercise for each island
- Establish a standing inter-agency resilience coordination forum
- Commission an island-wide buffer supply study by commodity

## Stakeholder Interview Guide

# Islands Supply Chain Resilience

### Stakeholder Interview Guide

Nantucket · Martha's Vineyard · Gosnold (Elizabeth Islands)

| DATE | INTERVIEWER |
|---|---|
| INTERVIEWEE NAME & TITLE | ORGANIZATION |
| PHONE NUMBER | EMAIL ADDRESS |

**How to use this guide**

Each question is the primary ask. Use the bulleted sub-questions only if the conversation stalls or to prompt specifics. Record responses in the shaded notes box below each question. Supplemental questions in Section 5 are tagged by meeting type — use only those relevant to your interviewee. Rename and save each interview and email them to Jamie Caplan at jamie@jamiecaplan.com. Goal: Have these interviews before Memorial Day if possible.

## 1 Current Operations & Known Issues

**Walk us through your role in supporting the island supply chain. What does a typical day or week look like for your operations? How well do you anticipate problems before they become major delays or impacts?**

- What goods, services, or resources do you move or depend on?
- What is the approximate volume or frequency of your supply/delivery operations?
- Who are the key organizations you coordinate with?
- Are there seasonal differences in how your supply chain operates?

NOTES

**What supply chain challenges do you deal with on a routine basis — issues that happen regularly even when nothing dramatic is going wrong?**

- Recurring bottlenecks, scheduling constraints, or capacity limits?
- Infrastructure conditions (dock condition, channel depth, terminal capacity) that create friction?
- Crew shortages, vessel maintenance, or equipment reliability challenges?
- Weather or seasonal patterns that predictably disrupt operations?

NOTES

**How dependent are island communities on your operations specifically? What happens — and what are the impacts — if you cannot operate for a day? For a week? Are there special actions taken (e.g., shifting supply to air cargo)?**

- Which goods or services would be most immediately affected?
- Are there alternative providers or routes that could substitute?
- How long before residents or businesses feel a significant impact?

NOTES

## 2 Past Disruptions & Consequences

**Describe a significant supply chain disruption you have experienced or witnessed. What happened, and what caused it? What is considered a major, sustained disruption from your perspective?**

- Was the cause weather, equipment failure, infrastructure damage, workforce shortage, vessel grounding, or something else?
- How long did the disruption last?
- Was the disruption isolated to your operation, or did it cascade to others?
- Were there disruptions related to COVID-19, major storms (hurricanes, nor'easters), or other named events?

NOTES

**What were the consequences of that disruption for island residents, businesses, or critical services? Do you collect data on customers and impacts during delays or cancellations? What is collected and how long is the history?**

- Were there food, fuel, medical supply, or construction material shortages?
- Were there price impacts or economic consequences?
- Were vulnerable populations (elderly, low-income, medically dependent) disproportionately affected?
- Were there public safety or emergency response implications?
- How was the situation resolved, and how long did it take?

NOTES

**How have you worked with other organizations — grocery stores, food distributors, fuel delivery companies — to improve supply chain resilience and minimize the impact of delays?**

- Do formal agreements exist?
- Have you conducted joint after-action reviews with supply chain partners after significant events — and what changed as a result?
- Are there pre-agreed triggers (weather threshold, declared emergency) that automatically activate specific supply chain protocols with partners?
- Has anyone mapped the full supply chain for critical goods end-to-end to identify where the marine leg creates the greatest vulnerability?

NOTES

**Are there capacity issues — frequency and number of ships, number of terminals — that affect your ability to support demand and growth? Are there locations where demand is near or exceeding current capacity?**

- Which commodities are most dependent on marine transport with no viable alternative if service is disrupted?
- Are there specific supply chain nodes (fuel depots, aggregates, food distribution) where a disruption would trigger cascading effects?
- How do you currently handle surges in demand (e.g., post-storm debris removal, emergency resupply)?

- If a primary terminal were taken offline due to a hazard event, what is the backup plan — and has it been tested?
- Are there terminals or routes that are single points of failure in the regional supply chain?

NOTES

**Have there been "near misses" — situations where a disruption almost occurred or was narrowly avoided? How many, and with what frequency?**

- What conditions created the near miss?
- What prevented the disruption from occurring?
- Do you think that outcome would be repeatable, or did you get lucky?

NOTES

**In your experience, what types of disruptions tend to have the longest duration and/or most severe consequences for the islands? Are specific consequences tracked, and what information is available?**

- Is it duration, timing (season, time of year), the specific commodity affected, or something else?
- Are there particular facilities or chokepoints whose failure would be most catastrophic?

NOTES

## 3 Vulnerabilities & Future Risk

**What supply chain scenarios worry you most looking forward — things that haven't happened yet but could? What are your known worst-case scenarios, and do you have contingency plans, or have you done tabletop exercises for them?**

- Are there infrastructure conditions that are deteriorating and could cause a future failure?
- Are there workforce, vessel fleet, or organizational vulnerabilities that concern you?

- Are there climate-related risks (sea level rise, more intense storms, increased flooding) you are already planning for?
- Are there geopolitical, economic, or regulatory changes on the horizon that could affect operations?

NOTES

**How resilient is the current supply chain to a major, sustained disruption — for example, a Category 2 or 3 hurricane causing significant port and infrastructure damage?**

- How many days of supplies are typically available on the island at any given time?
- Are there emergency stockpiles, backup suppliers, or contingency arrangements in place?
- Could operations shift to an alternate port or vessel if the primary route were disrupted?
- Is there a plan for prioritizing which goods and who gets served first in a shortage?

NOTES

**Are there single points of failure in the supply chain — one facility, vessel, route, or person — whose absence would be severely disruptive?**

- Is it a specific terminal, channel, barge ramp, or fuel depot?
- Is there a specific vessel or small fleet without adequate redundancy?
- Are there key personnel or contractors without backup capacity?
- For Gosnold specifically: how fragile is the Cuttyhunk supply chain given its single ferry operator?

NOTES

**How is climate change — particularly sea level rise, extreme temperatures, and more intense storms — affecting or likely to affect your operations and the island supply chain?**

- Have you observed changes in operational conditions compared to 10 or 20 years ago?
- Are there facilities or access routes you are concerned about as sea levels rise?
- Have storm patterns or intensity changed in ways that affect your planning?
- Is your organization doing adaptation planning or infrastructure investment in response?

NOTES

## 4 Gaps, Coordination & Solutions

**What are the most important things NOT being done today that would most improve supply chain resilience for the islands? What can the municipalities do to help?**

- Is it infrastructure investment, emergency planning, regulatory change, or something else?
- Are there specific studies, data, or assessments that don't exist but should?
- Is there emergency stockpiling, pre-positioning, or mutual aid that isn't happening?

NOTES

**How well do organizations involved in the island supply chain communicate and coordinate with each other — especially during disruptions? Which organizations do this well?**

- Are there information-sharing relationships that work particularly well?
- Are there gaps — organizations that should be talking but aren't?
- Is there a common operating picture or communication protocol during emergencies?
- Are federal, state, and local emergency management agencies appropriately connected to supply chain operators?

NOTES

**Is there anything we haven't asked about that you think is important for us to understand about supply chain risk for these islands?**

- Are there issues that tend not to get discussed publicly but are significant operational realities?
- Are there other organizations or individuals we should be talking to?
- Is there any data, reports, or documentation you could share with us?

NOTES

## 5 Supplemental Questions

### Partner Meetings — Commercial, Government & Infrastructure

**Partner Meetings**

**How many days of inventory — and what types — do you typically hold on island, and how quickly does that deplete during a disruption?**

NOTES

**Partner Meetings**

**How does the island's supply chain affect the cost of goods for residents? Are there population groups priced out of adequate supplies even under normal conditions?**

NOTES

**Partner Meetings**

**Based on your operational experience and data, what do you consider the highest-probability and highest-consequence supply chain disruption scenarios for these islands? What data and measures are used to track disruptions?**

NOTES

**Partner Meetings**

**What regulatory, jurisdictional, or coordination gaps limit the ability to respond effectively to a major supply chain disruption? What improvements could be considered?**

NOTES

Partner Meetings

**What is the current condition of the town's port infrastructure at each location used — docks, ramps, channel markers, fuel infrastructure?**

NOTES

Partner Meetings

**What is your community's emergency supply plan? How many days of food, fuel, and medical supplies can the island sustain after a disruption? What capacity exists for additional storage ahead of a severe storm, and how is it managed?**

NOTES

Partner Meetings

**What is the current fuel storage capacity on each island, and how many days of supply does that represent at normal consumption? What locations have fuel offloading capabilities, and how vulnerable is that infrastructure to storm damage or sea level rise?**

NOTES

Partner Meetings

**For Vineyard Wind: How does your marine vessel traffic interact with existing ferry routes and harbor approaches?**

NOTES

## SSA & Ferry / Marine Transportation Meetings

SSA / Ferry Meetings

**What is the realistic minimum service guarantee? What conditions force cancellations, and how many occurred last year? Is there a measure of level of service?**

NOTES

SSA / Ferry Meetings

**What is your current freight capacity and vehicle capacity, and how close to capacity do you operate on a typical versus peak day?**

NOTES

SSA / Ferry Meetings

**What are your vessel maintenance and reliability concerns? Is your fleet aging, and are spare parts or dry-dock capacity adequate? How quickly can ships be replaced and brought into service if there is an immediate need?**

NOTES

SSA / Ferry Meetings

**What categories of bulk goods do you carry to the islands, and what is your fleet capacity and availability? Do you track the types and quantities of goods or materials transported between ports?**

NOTES

SSA / Ferry Meetings

**What are the most significant physical constraints on barge operations — channel depth, dock conditions, tidal windows?**

NOTES

## Additional Notes & Follow-up Items

NOTES

# Appendix B

# Task 3 Climate Vulnerability Assessment for Ferry Terminals

# MEMORANDUM

**DATE** May 15, 2025

**TO** Vincent Murphy, Town of Nantucket
Sakiko Isomichi, Martha's Vineyard Commission
Stewart Young, Town of Gosnold

**FROM** Linnea Laux and Joe Famely
Woods Hole Group
107 Waterhouse Road
Bourne MA, 02532

**Supply Chain Coastal Flood Vulnerability Assessment for the Islands Region – Preliminary Assessment**

***Introduction***

Martha's Vineyard, Nantucket, and the Elizabeth Islands (the Islands) rely on ferries, barges, private boats, and air travel to access critical goods and services and transport workers. This memo presents the results of a preliminary coastal flood vulnerability assessment of sites critical to the supply chains of these communities, including ferry terminals and barge landings, focusing on direct flooding impacts to daily operations. Data gaps and next steps for more detailed analysis are identified at the memo's conclusion.

***Scope***

This vulnerability assessment evaluates ferry docks, barge landings, and other waterfront sites playing a critical role in moving people and supplies to and from the Islands. Sites were gathered through research on ferry companies, freight operations, and conversations with the client, and sorted by harbor and priority. Primary sites host ferries providing year- round passenger and/or freight service to the public or sites commonly used for freight barge service to the Islands. Other barge sites and seasonal passenger ferries were evaluated as secondary priorities, and are shown as gray lines on Table 1. The ferry to Naushon was also placed in this category given that it is not open to the public. Additional Coast Guard sites in harbors already being examined were evaluated as tertiary priorities. These facilities may be used in post-disaster operations in case of severe damage to ferry terminals. Where a ferry terminal has multiple loading locations, each location is evaluated as an individual point. Other sites were assigned a point approximating the ferry or barge loading location. This memo will focus on results for primary sites, but a full table of results is available in Appendix A to allow for flexibility in future work. More detailed assessments may be undertaken for all facilities in the future.

| Harbor | Facility | Priority | Type | Notes |
|---|---|---|---|---|
| NEW BEDFORD | Cuttyhunk Ferry Dock New Bedford | 1 | Freight/Passenger Ferry | |
| | RM Packer Co - New Bedford | 1 | Freight | |
| | Fish Island Barge Landing | 1 | Freight | |
| | Seastreak New Bedford | 2 | Passenger Ferry | Also a secondary barge loading/unloading site |
| | 100 Herman Melville Blvd Barge Landing | 2 | Freight | Currently leased by Robert B. Our Company, no ramp |
| | 302 Herman Melville Blvd Barge Landing | 2 | Freight | Currently leased by Robert B. Our Company, no ramp |
| WOODS HOLE | Woods Hole SSA Terminal (North) | 1 | Freight/Passenger Ferry | |
| | Woods Hole SSA Terminal (Middle) | 1 | Freight/Passenger Ferry | |
| | Woods Hole SSA Terminal (South) | 1 | Freight/Passenger Ferry | |
| | Woods Hole Naushon Ferry Landing | 2 | Freight/Passenger Ferry | Private |
| | USCG Woods Hole Dock | 3 | Coast Guard Facility | Post-disaster operations would likely come from Newport |
| FALMOUTH | Falmouth Patriot Shuttle Dock | 1 | Freight/Passenger Ferry | |
| | Falmouth Pied Piper Ferry Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| | Falmouth Island Queen Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| HYANNIS | Hyannis SSA Terminal (West)/SSA Fast Ferry Ramp | 1 | Freight/Passenger Ferry | |
| | Hyannis SSA Terminal (East) | 1 | Freight/Passenger Ferry | |
| | Hyannis Hy-Line Dock | 1 | Passenger Ferry | |
| | Hyannis Commercial Fishing Loading/Unloading | 2 | Freight | Occasionally used for barges under 150' |
| CUTTYHUNK | Cuttyhunk Ferry Dock | 1 | Freight/Passenger Ferry | also used by Coast Guard |
| | Cuttyhunk Fuel Dock | 1 | Freight | |
| NAUSHON | Naushon Ferry Landing | 2 | Freight/Passenger Ferry | Private |
| VINEYARD HAVEN | Vineyard Haven SSA Terminal (North) / VH Seastreak Terminal | 1 | Freight/Passenger Ferry | Also seasonal Seastreak terminal |
| | Vineyard Haven SSA Terminal (South) | 1 | Freight/Passenger Ferry | |
| | Vineyard Haven RM Packer Co. Dock | 1 | Freight | |
| OAK BLUFFS | Oak Bluffs SSA Terminal | 1 | Freight/Passenger Ferry | |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 1 | Freight/Passenger Ferry | |
| | Oak Bluffs Hy-Line Dock | 2 | Passenger Ferry | Seasonal/Passenger only, also MV to ACK service |
| | Oak Bluffs Seastreak Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| EDGARTOWN | Chappy Ferry Landing (Edgartown) | 1 | Freight/Passenger Ferry | |
| | Chappy Ferry Landing (Chappaquiddick) | 1 | Freight/Passenger Ferry | |
| | Edgartown Pied Piper Ferry Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| NANTUCKET | Nantucket SSA Terminal (North) | 1 | Freight/Passenger Ferry | |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | 1 | Freight/Passenger Ferry | |
| | Nantucket Hy-Line Dock | 1 | Passenger Ferry | Also seasonal MV to ACK service |
| | Nantucket Steamboat Wharf Barge Landing | 1 | Freight | |
| | USCG Nantucket Dock | 3 | Coast Guard Facility | May be used in case of storm damage to primary sites |

**Table 1: Sites evaluated for coastal flood vulnerability. SSA stands for Steamship Authority.**

In emergency situations or when sites related to the usual supply chain have been damaged, Coast Guard infrastructure may be used to maintain a lifeline to the Islands. Primary post-disaster operations would likely run out of Naval Station Newport, Rhode Island given the volume of resources stationed there, but in the interest of thoroughness US Coast Guard docks in Menemsha (Table 2), Woods Hole (Table 1), Nantucket Harbor (Table 1), and Sandwich (Table 2) were included in this assessment. The Chatham Fish Pier, which is used by the Coast Guard in Chatham, was also included (Table 2). These sites are considered tertiary priorities for the purposes of this assessment. Naval Station Newport was not included in this analysis given the lack of equivalent sea level rise projections and flood modeling data sets available for Rhode Island.

| *Harbor* | *Facility* | *Priority* | *Type* | *Notes* |
|---|---|---|---|---|
| *OTHER* | USCG Cape Cod Canal | 3 | Coast Guard Facility | Post-disaster operations would likely come from Newport |
| | Chatham Fish Pier (USCG Chatham) | 3 | Coast Guard Facility | Post-disaster operations would likely come from Newport |
| | USCG Menemsha Dock | 3 | Coast Guard Facility | May be used in case of storm damage to primary sites |

**Table 2: Additional Coast Guard sites evaluated for coastal flood vulnerability.**

The following sections and Figures 1-9 provide an overview of harbors that contain primary sites. Preliminary research has been conducted on these sites and their uses, but further research would be required to determine the exact purpose each site serves in the supply chain.

**New Bedford**


**Figure 1: Primary (red dots) and secondary (white dots) sites in New Bedford Harbor.**

New Bedford Harbor is a major industrial waterfront for the fishing and offshore wind industries, and also hosts the primary mainland barge loading and unloading sites in southern Massachusetts. The RM Packer Co. Barge Landing is owned by the same company as Martha's Vineyard's only formal barge landing. Fish Island Barge Landing also has a ramp and similar capabilities, and is operated by 41 North Offshore, LLC. Multiple attempts were made to contact Tucker-Roy Marine, the company providing waste disposal services to Cuttyhunk via barge, but it was not possible to determine which landings in New Bedford they use.

Two additional barge landings, located at 100 and 302 Herman Melville Boulevard, were included as secondary priorities. These landings do not have ramps, but load and unload barges via crane. There are many other sites on the New Bedford waterfront where loading and unloading a barge by crane is theoretically possible, but the four sites evaluated in this analysis were highlighted by the New Bedford Port Authority during an informal interview.

Cuttyhunk's only public ferry, operated by the Cuttyhunk Ferry Company, docks at State Pier in New Bedford, and was evaluated as a primary priority. The New Bedford Seastreak terminal, offering seasonal passenger

service to Nantucket and Oak Bluffs, is located on the northern side of the same pier. This site was evaluated as a secondary priority, but it should be noted that it hosts a ramp that can also be used to load and unload barges.

**Woods Hole**


**Figure 2: Primary (red dots) and secondary (white dots) sites in Woods Hole Harbor.**

Woods Hole is the mainland port for lifeline passenger, car, and freight ferry service to Martha's Vineyard, which is operated by the Steamship Authority (SSA). All three loading ramps at the SSA terminal in Woods Hole were evaluated as primary priorities. The lifeline ferry for the private island of Naushon in the Town of Gosnold, which can accommodate passengers and up to one vehicle, also operates out of Woods Hole. This docking location is considered secondary given its private nature. The Coast Guard dock in Woods Hole was included as a tertiary priority for the reasons previously discussed.

The Woods Hole Oceanographic Institution's Iselin dock was not evaluated in this assessment given its lack of current relevance to the supply chain and private ownership. However, it should be noted as a possible alternate freight loading location that has the ability to accommodate large vessels and is slated to be reconstructed at a higher elevation in the coming years.

**Falmouth**


**Figure 3: Primary (red dots) and secondary (white dots) sites in Falmouth Harbor.**

Falmouth Harbor is the mainland port for the Patriot Shuttle and Island Queen Ferry to Oak Bluffs, as well as the Pied Piper Ferry to Edgartown. The Patriot Shuttle provides critical commuter and light freight (packages, boxes, tires, etc.) service to Martha's Vineyard all year long, and was evaluated as a primary priority. The Island Queen and Pied Piper are seasonal passenger ferries, and were considered secondary priorities for the purposes of this assessment.

**Hyannis**


**Figure 4: Primary (red dots) and secondary (white dots) sites in Hyannis Harbor.**

Hyannis Harbor is the mainland port for lifeline passenger, car, and freight ferry service to Nantucket. The SSA has two car ferry loading and unloading locations and a passenger loading ramp for the fast ferry at the northern end of the Harbor, which were evaluated as primary priorities. The fast ferry and the western ramp have very similar elevations, and were evaluated as the same location. The Hy-Line ferry provides year-round fast ferry service to Nantucket for passengers, and was also evaluated as a primary priority.

Commercial fishing catch is loaded and unloaded in Hyannis directly next to the Hy-Line terminal. The Hyannis Harbormaster reported that this location is occasionally used to load and unload barges shorter than 150’ in length. This location was included as a secondary priority.

**Cuttyhunk**


**Figure 5: Primary (red dots) and secondary (white dots) sites in Cuttyhunk Harbor.**

The Island of Cuttyhunk depends on two docks located at the eastern end of the harbor for passenger ferry, fuel, and freight service. More research is needed to determine the exact usage patterns of these docks, but they were both included as primary priorities.

### Vineyard Haven


**Figure 6: Primary (red dots) and secondary (white dots) sites in Vineyard Haven Harbor.**

Vineyard Haven Harbor is Martha's Vineyard's year-round passenger, car, and freight ferry port. The SSA operates two loading locations, which are also used by Seastreak to operate a seasonal New Bedford to Vineyard Haven ferry. The Seastreak ferry has piloted year-round service in the past, and may again in the future. The two SSA loading ramps were evaluated as primary priorities.

The RM Packer Co. barge landing in Vineyard Haven is Martha's Vineyard's only formal barge landing with a ramp and permanent crane. It functions as critical infrastructure for the whole island and was evaluated as a primary priority.

**Oak Bluffs**


**Figure 7: Primary (red dots) and secondary (white dots) sites in Oak Bluffs Harbor.**

Oak Bluffs has a high volume of seasonal ferry service, as well as year-round service through the Patriot Shuttle. The Patriot Shuttle docking location is also used by the Island Queen and Rhode Island Fast Ferry, and was evaluated as a primary priority for the reasons discussed in the Falmouth section. Oak Bluffs also has a Steamship Authority terminal, which is used seasonally for car and passenger service, as well as by the Seastreak ferry from New Bedford. More research is required to determine the Seastreak's exact docking location. The Hy-Line ferry provides seasonal passenger service from Hyannis to Oak Bluffs, and docks inside Oak Bluffs harbor. Both Seastreak and Hy-Line provide seasonal inter-Island service between Oak Bluffs and Nantucket. All seasonal service locations were evaluated as secondary priorities.

**Edgartown**


**Figure 8: Primary (red dots) and secondary (white dots) sites in Edgartown Harbor.**

The Chappy Ferry, offering continuous back-and-forth car, passenger, and light freight (under 40,000lbs) service to Chappaquiddick Island, operates in Edgartown Harbor. The size of truck that can be accommodated is limited to the size of the vessel, which is currently 55 feet. The Chappy Ferry provides critical lifeline service to Chappaquiddick residents, as well as access to popular recreation and conservation areas for all Martha's Vineyard residents and visitors, and was therefore evaluated as a primary priority.

The Pied Piper, a seasonal passenger ferry from Falmouth, also docks in Edgartown. Its docking location on Memorial Wharf was evaluated as a secondary priority.

**Nantucket**


**Figure 9: Primary (red dots) and secondary (white dots) sites in Nantucket Harbor.**

Nantucket's Steamboat Pier hosts lifeline car, passenger, and freight ferry service through the SSA, as well as Nantucket Island's only formal barge landing. The SSA's two loading locations, the southern of which is also used by the Seastreak ferry from New Bedford seasonally, were evaluated as primary priorities. The barge landing at the end of the wharf was also considered a primary priority.

The Hy-Line terminal on Straight Wharf provides year-round fast ferry service to Hyannis, and was also evaluated as a primary priority. The Coast Guard dock in Nantucket Harbor was included as a tertiary priority for the reasons previously discussed.

***Methods***

State standard sea level rise projections and coastal flood modeling for Massachusetts were used in this analysis. To determine the impact of future water levels, Mean High Water (MHW) tidal datums have been developed for the Massachusetts coastline for 2030, 2050, and 2070 conditions. Mean High Water refers to the average of all high tides over a tidal epoch. The future MHW elevations are based on projections of future mean sea level elevation for use in climate change planning that are locally downscaled from global climate models (DeConto & Kopp, 2017). These scenarios include different levels of greenhouse gas emissions and different contributions from global ice sheet melt.[1] The state uses the High scenario for climate change planning, which for the MC-FRM's South region corresponds to 1.4 feet of sea level rise from a 2008 baseline as soon as 2030, 2.7 feet as soon as 2050, and up to 4.5 feet as soon as 2070 (Figure 10). These projections were derived using data from the Woods Hole and Nantucket tide gauges, and are appropriate for the Islands region. Use of the High scenario is deliberately conservative and ensures that future sea levels are not being underpredicted in large infrastructure and planning projects. This sea level rise projection is used to calculate local tidal datums for 2030, 2050, and 2070 time horizons and is also incorporated into the Massachusetts Coast Flood Risk Model (MC-FRM). Figure 10 shows how the "High" scenario compares to other scenarios, as well as the probability that it is not underpredicting sea level rise under RCP 4.5, RCP 8.5, and both of those scenarios with additional contributions from ice sheet melt. In the near term, most of the projected relative sea level rise comes from thermal expansion and land subsidence, and there is little uncertainty in projections. After 2050, contributions from ice sheet melt are uncertain, and the scenarios diverge significantly. The choice to use the "High" scenario for MC-FRM means that flood probabilities from the model may occur later than their corresponding year. In interpreting model results, 2030, 2050, and 2070 are generally treated as the soonest that corresponding flood probabilities could be projected, and a 20-year range is applied. In practice, 2030 projections are treated as occurring sometime between 2030 and 2050, and the same applies to 2050 and 2070.

[1] https://doi.org/10.1038/nature17145

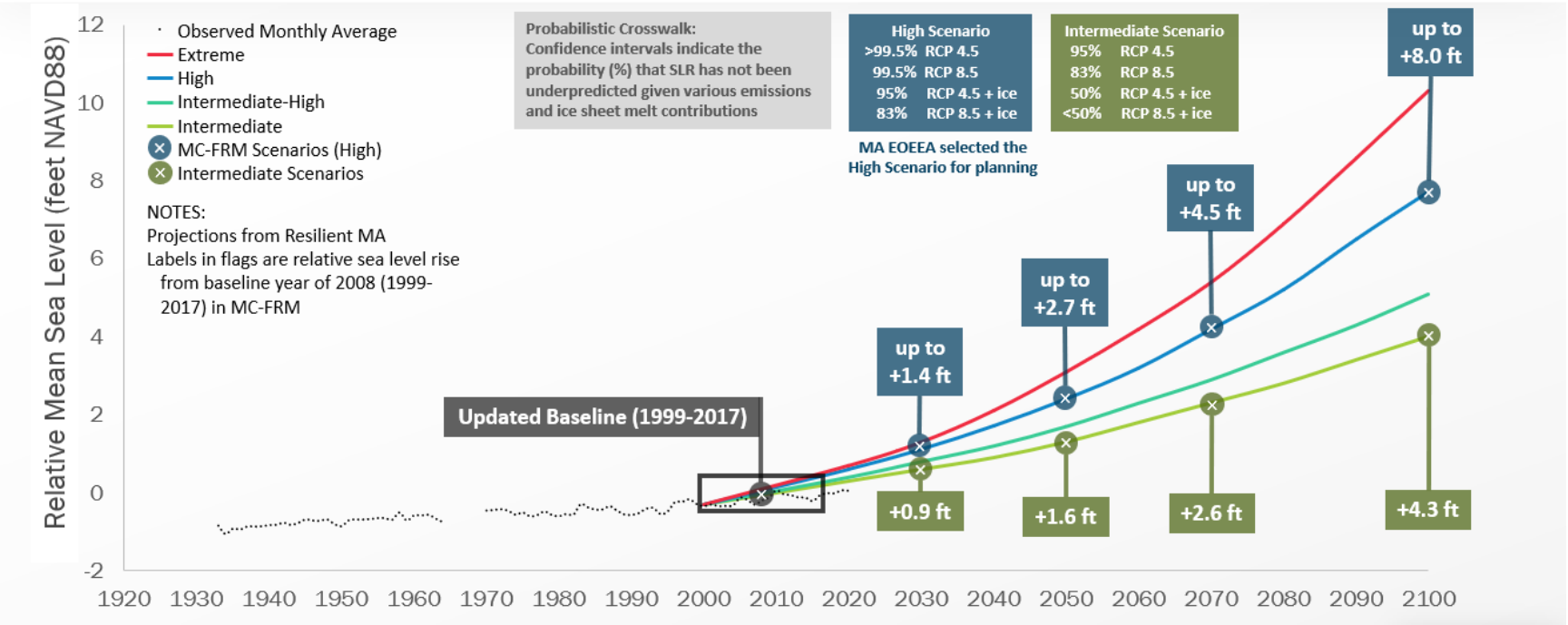


**Figure 10:** Massachusetts Executive Office of Energy and Environmental Affairs (MA EOEEA) Probabilistic Sea Level Rise Projections for the South region.

Based on MC-FRM projected tidal benchmarks, MHW in Woods Hole could reach 2.1 ft NAVD88 as soon as 2030, 3.4 ft NAVD88 as soon as 2050, and 5.2 ft NAVD88 as soon as 2070 (Table 2). In Nantucket Harbor, MHW could reach 3.1 ft NAVD88 as soon as 2030, 4.4 ft NAVD88 as soon as 2050, and 6.2 ft NAVD88 as soon as 2070 (Table 2). An updated tidal epoch centered around 2008 (1999-2017) was used as the "present-day" sea level for MC-FRM. The rate of sea level rise in Woods Hole and Nantucket is similar to the rate across the Islands and all harbors evaluated in this analysis.

**Table 2:** MC-FRM Projected Tidal Benchmarks for Woods Hole and Nantucket, MA

| | **MC-FRM Projected Tidal Benchmarks (elevation in ft. NAVD88)** | | | | | |
|---|---|---|---|---|---|---|
| | **Woods Hole** | | | **Nantucket** | | |
| | 2030 | 2050 | 2070 | 2030 | 2050 | 2070 |
| MHHW | 2.3 | 3.6 | 5.4 | 3.4 | 4.7 | 6.5 |
| MHW | 2.1 | 3.4 | 5.2 | 3.1 | 4.4 | 6.2 |
| MLW | 0.25 | 1.5 | 3.3 | -0.2 | 1.1 | 2.8 |
| MLLW | -0.3 | 1 | 2.7 | -0.4 | 0.9 | 2.6 |

In 2023, the Massachusetts Office of Energy and Environmental Affairs and ResilientMA contracted Woods Hole Group to develop statewide future Mean High Water Shorelines. The shorelines are GIS representations of the projected future MHW extents for each local area, and were developed by extracting corresponding elevation contours from the most current terrain elevation measurements available from the MassGIS LiDAR Terrain Data. LiDAR, which stands for Light Detection and Ranging, is a remote sensing technology that uses laser light to create highly accurate and detailed maps of the contours of Earth's surface.

### MC-FRM Background

Data from the Massachusetts Coast Flood Risk Model (MC-FRM) were used to assess the vulnerability of the sites listed in Table1 to storm surge flooding with 1.4, 2.7, and 4.5 feet of sea level rise (2030, 2050, and 2070 time horizons). Projected Mean High Water (MHW) datums used as the basis for MC-FRM were used to evaluate the vulnerability of the same sites to daily tidal inundation. The MC-FRM is a probabilistic hydrodynamic model that is used as the state standard for coastal climate change planning in Massachusetts.[2] The MC-FRM considers a variety of factors such as sea level rise projections, historical and projected future tropical and extratropical systems, elevation data, and land cover data to provide an accurate representation of potential flood impacts along the state's coast. The outputs of the model include storm surge flooding projections for the three time horizons and a range of annual exceedance probabilities (AEPs). The Annual Exceedance Probability of a point refers to that point's probability of flooding at least once in a given year. This vulnerability assessment evaluated future flood risk to facilities on a site-specific basis.

[2] https://eea-nescaum-dataservices-assets-prd.s3.amazonaws.com/cms/GUIDELINES/MC-FRM_FAQ_04-06-22.pdf

MC-FRM results include a range of flood probabilities (AEPs) and associated water surface elevations, which can be used to assess the vulnerability of buildings and other assets. A 1% AEP water level has a 1 in 100 chance of occurring in any given year, while a 50% AEP water level has a 1 in 2 chance of occurring at least once in a given year. Areas and assets within the 1% AEP flood extent and lower in elevation than the 1% AEP water surface elevation have a 1% or greater probability of flooding in a given year. This logic was applied across AEP levels and assets to assign each asset an annual probability of flooding for each time horizon.

**Vulnerability Assessment Process**

To assess the probability of flooding of critical supply chain sites, water surface elevations corresponding with different AEPs obtained from the MC-FRM are compared to the critical elevations of built infrastructure. For the purposes of this study, the critical elevation was defined as the elevation at which flood water would disrupt operations or use of a facility, which was generally a ground elevation point on the dock or bulkhead. A variety of elevation data sources were used for this preliminary vulnerability assessment. Some sites, noted in Table 3 with "High" elevation data confidence, were in locations where high quality elevation survey data was available from other projects. Ideally, all critical elevations would have "High" confidence and be sourced from an elevation survey conducted with an RTK GPS unit. Sites with "Medium" elevation data confidence were sourced from 2021 LiDAR data or, in the case of the Woods Hole ferry terminal, from construction plans provided to the ResilientWoodsHole project. For docks located over water, where no LiDAR data is available, elevation was estimated from LiDAR on adjacent areas, resulting in "Low" or "Very Low" elevation confidence. Vulnerability assessment results from sites with "Low" or "Very Low" elevation confidence may not be accurate, and filling these elevation data gaps should be prioritized in future work. Sites with "Medium" elevation data confidence can also be considered data gaps to be filled. Data gaps will be discussed in detail at the end of the Results section.

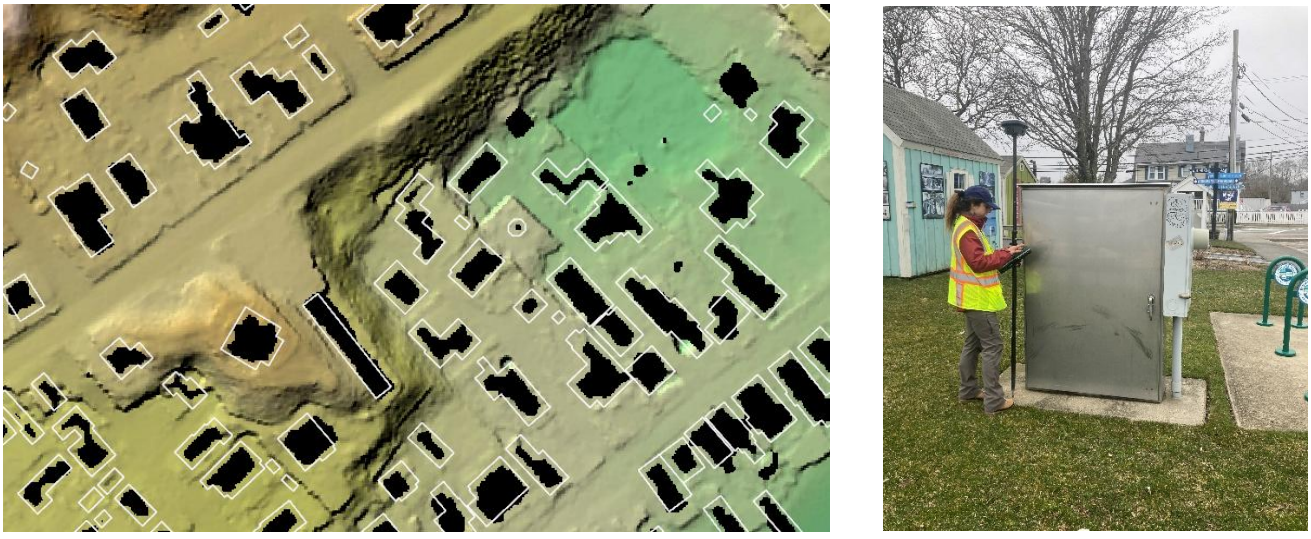

**Figure 11**: **Critical Elevation Methods – High-Resolution LiDAR (Left) and In-Field RTK Surveying (Right)**

| Harbor | Facility | Crit.Elev | Confidence | Elevation Source |
|---|---|---|---|---|
| NEW BEDFORD | Cuttyhunk Ferry Dock New Bedford | 10.17 | Medium | LiDAR |
| | RM Packer Co - New Bedford | 5.87 | Medium | LiDAR |
| | Fish Island Barge Landing | 7.15 | Medium | LiDAR |
| | Seastreak New Bedford | 10.12 | Medium | LiDAR |
| | 100 Herman Melville Blvd Barge Landing | 6.96 | Medium | LiDAR |
| | 302 Herman Melville Blvd Barge Landing | 5.71 | Medium | LiDAR |
| WOODS HOLE | Woods Hole SSA Terminal (North) | 9.0 | Medium | ResilientWoodsHole Phase 2 Vulnerability Assessment (WHG) based on construction plans |
| | Woods Hole SSA Terminal (Middle) | 9.0 | Medium | ResilientWoodsHole Phase 2 Vulnerability Assessment (WHG) based on construction plans |
| | Woods Hole SSA Terminal (South) | 9.0 | Medium | ResilientWoodsHole Phase 2 Vulnerability Assessment (WHG) based on construction plans |
| | Woods Hole Naushon Ferry Landing | 4.13 | Medium | LiDAR |
| FALMOUTH | Falmouth Patriot Shuttle Dock | 3.72 | Medium | LiDAR |
| | Falmouth Pied Piper Ferry Dock | 3.5 | Low | LiDAR, estimated from adjacent elevation |
| | Falmouth Island Queen Dock | 3.25 | Medium | LiDAR |
| HYANNIS | Hyannis SSA Terminal (West)/SSA Fast Ferry Ramp | 6.59 | Medium | LiDAR, 6.96 was used for HHMP VA |
| | Hyannis SSA Terminal (East) | 6.57 | Medium | LiDAR, 6.96 was used for HHMP VA |
| | Hyannis Hy-Line Dock | 4.38 | High | Survey data from 2024 Hyannis Harbor Master Plan vulnerability assessment (WHG). Bulkhead elevation. |
| | Hyannis Commercial Fishing Loading/Unloading | 3.31 | High | Survey data from 2024 Hyannis Harbor Master Plan vulnerability assessment (WHG). Exact point location, RTK accuracy. |
| CUTTYHUNK | Cuttyhunk Ferry Dock | 4.1 | Low | LiDAR at the edge of road and dock |
| | Cuttyhunk Fuel Dock | 4.3 | Low | LiDAR at the edge of road and dock |
| NAUSHON | Naushon Ferry Landing | 3.8 | Very Low | LiDAR on road |
| VINEYARD HAVEN | Vineyard Haven SSA Terminal (North) / VH Seastreak Term. | 4.4 | Low | LiDAR on adjacent bulkhead |
| | Vineyard Haven SSA Terminal (South) | 4.4 | Low | LiDAR on adjacent bulkhead |
| | Vineyard Haven RM Packer Co. Dock | 6.38 | Medium | LiDAR |
| OAK BLUFFS | Oak Bluffs SSA Terminal | 4 | Very Low | Estimated from LiDAR at adjacent area |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 4.36 | High | Survey data from 2026 Town of Oak Bluffs vulnerability assessment (WHG). Point at edge of bulkhead where Patriot shuttle loads. |
| | Oak Bluffs Hy-Line Dock | 3.88 | High | Survey data from 2026 Town of Oak Bluffs vulnerability assessment (WHG). Point at start of passenger loading ramp on dock. |
| | Oak Bluffs Seastreak Dock | 4 | Very Low | LiDAR, estimated from adjacent area |
| EDGARTOWN | Chappy Ferry Landing (Edgartown) | 3.47 | High | Survey data from 2022 Chappy Ferry approach modification design project (WHG). Lowest point labeled "edge of ramp", RTK accuracy. |
| | Chappy Ferry Landing (Chappaquiddick) | 2.60 | High | Survey data from 2022 Chappy Ferry approach modification design project (WHG). Average of ramp plate elevations (all were 2.6...), RTK accuracy. |
| | Edgartown Pied Piper Ferry Dock | 5.11 | High | Survey data from 2022 Chappy Ferry approach modification design project (WHG). Exact point location, RTK accuracy. |
| NANTUCKET | Nantucket SSA Terminal (North) | 6.34 | Medium | LiDAR |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak | 6.93 | Medium | LiDAR |
| | Nantucket Hy-Line Dock | 4.46 | Medium | LiDAR |
| | Nantucket Steamboat Wharf Barge Landing | 6.47 | Medium | LiDAR |

**Table 3: Elevation information for primary and secondary sites. Secondary sites are highlighted in gray. Critical Elevations in ft, NAVD88.**

All data were compiled into a GIS database including critical elevations, elevation sources, and a confidence level for each elevation source. These critical elevations were then compared to the projected water surface elevations from the MC-FRM across different time horizons (as soon as 2030, 2050, and 2070, or 1.4, 2.7, and 4.5 feet of sea level rise) and for different flood probability levels (AEPs ranging from 0.1% to 100% annually). Data availability varied for AEPs higher than 5%, and the resulting uncertainty is indicated in the results section. Detailed source information for high AEP water level data is included in Appendix B. Assets were then assigned an AEP based on the highest probability water level that would exceed their critical elevations in a given projected year. The results of this process for priority sites can be found in Tables 4-12. Detailed results for all sites are included in Appendix A.

***Results***

The following sections display the results of the vulnerability assessment for primary assets by harbor. A table of results for all sites is available in Appendix A. The tables list the harbor, facility name, critical elevation, confidence level in that elevation, year of onset of daily inundation according to projected Mean High Water (MHW) datums, and annual coastal flood exceedance probability as soon as 2030, 2050, and 2070 according to MC-FRM. Results for sites with low or very low elevation confidence should be treated as correspondingly low confidence.

Ferry terminals and barge docks are generally not expected to operate during storms, and can be designed to flood with little to no damage. Therefore, the goal for these types of facilities is generally to avoid fair weather and small storm inundation and preserve daily operations, in addition to minimizing damage during storms. Risk tolerance for individual facilities may vary, but the sites evaluated in this vulnerability assessment can generally be thought of as operating normally up to a 10% annual chance of flooding. Sites with a 20% or 100% AEP in a given time horizon may have some fair weather interruptions to their operations. Sites where “MHW” is indicated in the table can expect daily inundation as soon as the corresponding time horizon and would not be operational under those conditions. In Woods Hole, Falmouth and Hyannis, 100% AEP (floods at least once per year) water surface elevation data were available from the Cape Cod Low Lying Roads project. In Cuttyhunk and New Bedford, no higher probability water surface elevation data were available than 5% AEP. Nantucket, Vineyard Haven Oak Bluffs, and Edgartown had 50% AEP (50% chance of flooding in a given year) water surface elevation values available from previous work. A detailed discussion of high AEP water surface elevation data sources is available in Appendix B.

**New Bedford**

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***NEW BEDFORD*** | Cuttyhunk Ferry Dock New Bedford | 10.17 | Medium | - | - | - | - |
| | RM Packer Co - New Bedford | 5.87 | Medium | 2070 | - | - | **MHW** |
| | Fish Island Barge Landing | 7.15 | Medium | - | - | - | **5%*** |

**Table 4: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in New Bedford Harbor. Critical Elevations in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

New Bedford Harbor’s three primary sites are the Cuttyhunk Ferry Dock, RM Packer Co.’s New Bedford Facility, and the Fish Island Barge Landing. All three of these sites are located inside the New Bedford Hurricane Barrier,

a flood barrier maintained and operated by the United States Army Corps of Engineers. MC-FRM modeling was conducted with the barrier in the "closed" position, and that is reflected in the results in Table 4. This assumption is valid for large, low probability storms, but it may not be feasible to close the barrier for every small storm or high tide in the future. According to the New Bedford – Fairhaven Municipal Harbor Plan Resiliency Memo (Appendix C), the barrier generally closes when water surface elevations reach approximately 3.48' NAVD88. This corresponds to the onset of flooding on the Fairhaven waterfront. If low-lying areas within the harbor were raised, the threshold for closing the barrier could also be raised, and the number of closures per year could be kept consistent even as sea level rises. Closures during storms are of less concern to the supply chain of the Islands because it is assumed that ferries and barges would not operate during storms, but fair weather closures are disruptive. Currently, the barrier closes an average of 17 times per year, usually for storm events or astronomical high tides coinciding with south wind. Without adaptation, monthly fair weather closures could begin as early as 2030, and daily closures could begin as early as 2070. The current frequency of closures occasionally impacts the Cuttyhunk Ferry. The three primary sites in New Bedford Harbor are over two feet higher than the current closure threshold, meaning that adaptation at the sites themselves would likely not change the barrier closure threshold. Sites behind the New Bedford Harbor Barrier that are critical to Island supply chains effectively have the same level of vulnerability as the lowest part of the Harbor's waterfront—if a specific part of the waterfront begins to flood, the barrier closes, and these sites cannot operate despite not being flooded. **Therefore, while the vulnerability assessment shows low vulnerability to flooding, sites within the New Bedford Hurricane Barrier will begin to experience monthly operational interruptions at fair weather high tide as soon as 2030 if the threshold for Harbor Barrier closure does not change.**

Further complicating this analysis, high probability (10%, 20%, and 50% AEP) water surface elevation data are not available for this area. Filling this data gap, as well as gaining an understanding of the vulnerability of New Bedford sites in storm conditions where the Harbor Barrier stays open, would require modeling and analysis specific to New Bedford Harbor.

### Woods Hole

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***WOODS HOLE*** | Woods Hole SSA Terminal (North) | 9 | Medium | - | **1%** | 5% | **20%** |
| | Woods Hole SSA Terminal (Middle) | 9 | Medium | - | **1%** | 5% | **20%** |
| | Woods Hole SSA Terminal (South) | 9 | Medium | - | **1%** | 5% | **20%** |

**Table 5: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Woods Hole Harbor. Critical Elevations in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

The Steamship Authority's three vehicle loading ramps are the three primary sites in Woods Hole Harbor. These docks were reconstructed from 2018-2022 to modern standards. As soon as 2030, this facility has a 1% chance of flooding in a given year, and as soon as 2050 that chance is 5%. These levels of vulnerability are not expected to interrupt operations. As soon as 2070, this facility has a 20% chance of flooding in a given year, and may experience occasional interruptions from high water levels in conditions where the ferry would otherwise operate. Daily inundation is not expected to impact this facility until after 2100 according to tidal benchmarks developed for the ResilientWoodsHole project.

High annual exceedance probability (10%, 20%, and 100% AEP) water surface elevations were developed for this area as part of the Cape Cod Low Lying Roads project and were used in this assessment.

### Falmouth

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***FALMOUTH*** | Falmouth Patriot Shuttle Dock | 3.72 | Medium | 2070 | **100%** | **100%** | **MHW** |

**Table 6: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for the primary site in Falmouth Harbor. Critical Elevation in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

The Patriot Shuttle Dock is the single primary site in Falmouth Harbor. This facility has a very high level of vulnerability, and is expected to flood at least once per year as soon as 2030. Even more frequent flooding is expected as soon as 2050, but not yet to the level of daily inundation, meaning that the facility remains in the 100% AEP category. The Patriot Shuttle has a reputation of operating in minor storm conditions, meaning that the onset of service interruptions may not be as early as this level of vulnerability would suggest, although docking and loading in Falmouth would be complicated by water on the dock. Regardless, operations are expected to be interrupted by monthly inundation as soon as 2050 and by daily inundation as soon as 2070.

High annual exceedance probability (10%, 20%, and 100% AEP) water surface elevations were developed for this area as part of the Cape Cod Low Lying Roads project and were used in this assessment.

### Hyannis

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***HYANNIS*** | Hyannis SSA Terminal (West)/SSA Fast Ferry Ramp | 6.59 | Medium | - | **20%** | **20%** | **100%** |
| | Hyannis SSA Terminal (East) | 6.57 | Medium | - | **20%** | **20%** | **100%** |
| | Hyannis Hy-Line Dock | 4.38 | High | 2050 | **100%** | **MHW** | **MHW** |

**Table 7: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Hyannis Harbor. Critical Elevations in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

The Steamship Authority's Hyannis terminal has a relatively high level of vulnerability. It has a 1 in 5 chance of flooding in a year as soon as 2030, and is expected to flood at least once per year as soon as 2070. More frequent flooding is expected as soon as 2050 relative to the 2030 time horizon, but not yet to the level of annual inundation, meaning that the facility remains in the 20% AEP category. Ferries are cancelled frequently due to weather conditions on the Hyannis-Nantucket route, so a 20% annual chance of flooding alone may not cause additional disruptions. However, this facility can expect interruptions to operations from fair weather flooding as soon as 2050.

The Hy-Line dock in Hyannis, providing high speed passenger ferry service to Nantucket, is highly vulnerable to flooding. It is expected to flood at least once per year as soon as 2030, and experience daily inundation as soon as 2050. Inundation frequency would continue to increase with rising sea levels, and may be continuous as soon as 2070. Based on two and a half years of data from the Hohonu tide monitoring station in Hyannis, this site already floods on an annual or near-annual basis, but only during storms that cancel ferry operations. Interruptions to operations due to flooding alone can be expected to begin as soon as 2030.

High annual exceedance probability (10%, 20%, and 100% AEP) water surface elevations were developed for this area as part of the Cape Cod Low Lying Roads project and were used in this assessment.

### Cuttyhunk

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***CUTTYHUNK*** | Cuttyhunk Ferry Dock | 4.1 | Low | 2050 | 5%* | **MHW** | **MHW** |
| | Cuttyhunk Fuel Dock | 4.3 | Low | 2050 | 5%* | **MHW** | **MHW** |

**Table 8: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Cuttyhunk Harbor. Critical Elevations in ft, NAVD88. *Likely an underestimate**

The Ferry and Fuel docks on Cuttyhunk appear to be highly vulnerable to coastal flooding. High annual exceedance probability (>10% AEP) water surface elevations were not available for this area. Therefore, the 5% AEP indicated as soon as 2030 is likely an underestimate of vulnerability for these sites. Further compounding the issue, elevations for these docks were estimated from LiDAR on the adjacent roadway, and may not be accurate. Multiple data gaps on Cuttyhunk should be addressed in later stages of this work. Regardless, daily inundation can be expected for either the docks or their access roads as soon as 2050, and continuous inundation is likely as soon as 2070.

### Vineyard Haven

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| ***VINEYARD HAVEN*** | Vineyard Haven SSA Terminal (North) | 4.4 | Low | 2070 | **50%** | **50%** | **MHW** |
| | Vineyard Haven SSA Terminal (South) | 4.4 | Low | 2070 | **50%** | **50%** | **MHW** |
| | Vineyard Haven RM Packer Co. Dock | 6.38 | Medium | - | **10%** | **50%** | **50%** |

**Table 9: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Vineyard Haven Harbor. Critical Elevations in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

The Steamship Authority's Vineyard Haven terminal is highly vulnerable to coastal flooding. Both the North and South loading ramps appear to have at least a 50% chance of flooding in a year as soon as 2030. Flooding is expected to increase in frequency in the 2050 time horizon, but not enough to reach the daily inundation threshold. As soon as 2070, this facility is inundated daily by tides. The elevation of these loading ramps was estimated from adjacent LiDAR, and may not be accurate, but disruption to operations from fair weather flooding is expected as soon as 2050.

The RM Packer Co. barge landing in Vineyard Haven has slightly lower vulnerability than the SSA terminal, with a 10% AEP as soon as 2030 and onset of tidal inundation after the 2070 time horizon. Flooding is expected to increase in frequency in the 2070 time horizon relative to 2050, exceeding the 50% AEP threshold but not yet reaching daily inundation. The onset of disturbance to fair weather operations for this asset is as soon as 2050.

High annual exceedance probability (10%, 20%, and 50% AEP) water surface elevations were developed for this area as part of the Martha's Vineyard Hospital Access project and were used in this assessment.

### Oak Bluffs

| Harbor | Facility | Critical Elevation | Elevation Confidence | Onset of Daily Inundation | MC-FRM AEP 2030 | MC-FRM AEP 2050 | MC-FRM AEP 2070 |
|---|---|---|---|---|---|---|---|
| OAK BLUFFS | Oak Bluffs SSA Terminal | 4 | Very Low | 2070 | 50% | 50% | MHW |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 4.36 | High | 2070 | 50% | 50% | MHW |

**Table 10: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Oak Bluffs Harbor. Critical Elevations in ft, NAVD88.**

The Steamship Authority terminal in Oak Bluffs does not provide year-round service, but it is included as a primary asset because it provides car and freight service in the summer. Elevation confidence for this dock is extremely low. However, based on a possibly inaccurate elevation, this facility is highly vulnerable. The car loading ramp appears to have at least a 50% chance of flooding in a year as soon as 2030. Flooding is expected to increase in frequency in the 2050 time horizon, but not enough to reach the daily inundation threshold. As soon as 2070, this facility is inundated daily or continuously by tides.

The dock serving the Patriot Shuttle, Island Queen, and Rhode Island Fast Ferry provides year-round passenger and light freight service through the Patriot Shuttle. This facility has a very high level of vulnerability, and has a 50% chance of flooding in a year as soon as 2030. Even more frequent flooding is expected as soon as 2050, but not yet to the level of daily inundation, meaning that the facility remains in the 50% AEP category. The Patriot Shuttle often operates in small storm conditions, meaning that the onset of service interruptions may not be as early as this level of vulnerability would suggest, although docking and loading in Falmouth would be complicated by water on the dock. Regardless, operations are expected to be interrupted by daily inundation as soon as 2070.

High annual exceedance probability (10%, 20%, and 50% AEP) water surface elevations were developed for this area as part of the Martha's Vineyard Hospital Access project and were used in this assessment.

### Edgartown

| Harbor | Facility | Critical Elevation | Elevation Confidence | Onset of Daily Inundation | MC-FRM AEP 2030 | MC-FRM AEP 2050 | MC-FRM AEP 2070 |
|---|---|---|---|---|---|---|---|
| EDGARTOWN | Chappy Ferry Landing (Edgartown) | 3.47 | High | 2050 | 50% | MHW | MHW |
| | Chappy Ferry Landing (Chappaquiddick) | 2.60 | High | 2050 | 50% | MHW | MHW |

**Table 11: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Edgartown Harbor. Critical Elevations in ft, NAVD88.**

The Chappy Ferry is Edgartown Harbor's sole primary site. Both the Edgartown and Chappaquiddick landings are highly vulnerable to flooding, and currently experience operational issues multiple times per year. This is reflected in their greater than 50% AEP as soon as 2030 and the onset of daily inundation as soon as 2050. Given that these sites already flood annually, the vulnerability level in the 2030 time horizon should be interpreted as somewhere between 50% AEP and daily inundation, and be expected to cause regular interruptions to operations.

High annual exceedance probability (10%, 20%, and 50% AEP) water surface elevations were developed for this area as part of the Martha's Vineyard Hospital Access project and were used in this assessment.

**Nantucket**

| *Harbor* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| *NANTUCKET* | Nantucket SSA Terminal (North) | 6.34 | Medium | - | 20% | 20% | 50% |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | 6.93 | Medium | - | 10% | 20% | 50% |
| | Nantucket Hy-Line Dock | 4.46 | Medium | 2070 | 50% | 50% | MHW |
| | Nantucket Steamboat Wharf Barge Landing | 6.47 | Medium | - | 20% | 20% | 50% |

**Table 12: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for primary sites in Nantucket Harbor. Critical Elevations in ft, NAVD88. Blank cells indicate no modeled vulnerability.**

Nantucket's primary facilities include the two SSA loading locations and the barge landing at Steamboat Wharf, as well as the Hy-Line terminal on Straight Wharf. The Steamship Authority terminals are very close in elevation, but fall into different vulnerability categories as soon as 2030. They have a 10% and 20% AEP soon as 2030, and a 50% AEP as soon as 2070. More frequent flooding is expected as soon as 2050 relative to the 2030 time horizon, but not yet to the level of 50% AEP, meaning that the facilities remain in the 20% AEP category. Ferries are cancelled frequently due to weather conditions on the Hyannis-Nantucket route, so a 20% annual chance of flooding alone may not cause additional disruptions. However, this facility can expect interruptions to operations from flooding alone as soon as 2070.

The Nantucket Hy-Line terminal is more vulnerable than the SSA facilities, with a 50% AEP as soon as 2030 and daily inundation expected as soon as 2070. More frequent flooding is expected as soon as 2050 relative to the 2030 time horizon, but not yet to the level of daily inundation, meaning that the facility remains in the >50% AEP category. This facility may experience disruptions to operations caused by fair-weather flood conditions as soon as 2050.

### *Critical Facility Access*

The supply chain of the Islands also depends on the roads used to access the critical sites in the previous section. In 2020, the Cape Cod Commission contracted Woods Hole Group to assess the projected flood vulnerability of all coastal roads on Cape Cod using the results of MC-FRM. In 2024, Woods Hole Group conducted a similar analysis on the roads surrounding the Martha's Vineyard Hospital in Oak Bluffs and Vineyard Haven. Those two projects resulted in the data displayed below in Figures 12-16, which show the vulnerability of roadways surrounding the harbors at points at 20-foot intervals. More information and a full road point viewer for all of Cape Cod are available on the Cape Cod Commission website.[3] Note that the highest vulnerability level for MC-FRM used on Cape Cod was 100% AEP, and the highest level used on Martha's Vineyard was 50% AEP, and these AEP levels are indicated as ">50%" on all maps for uniformity.

[3] https://www.capecodcommission.org/our-work/llr-dataviewer/

**Woods Hole**

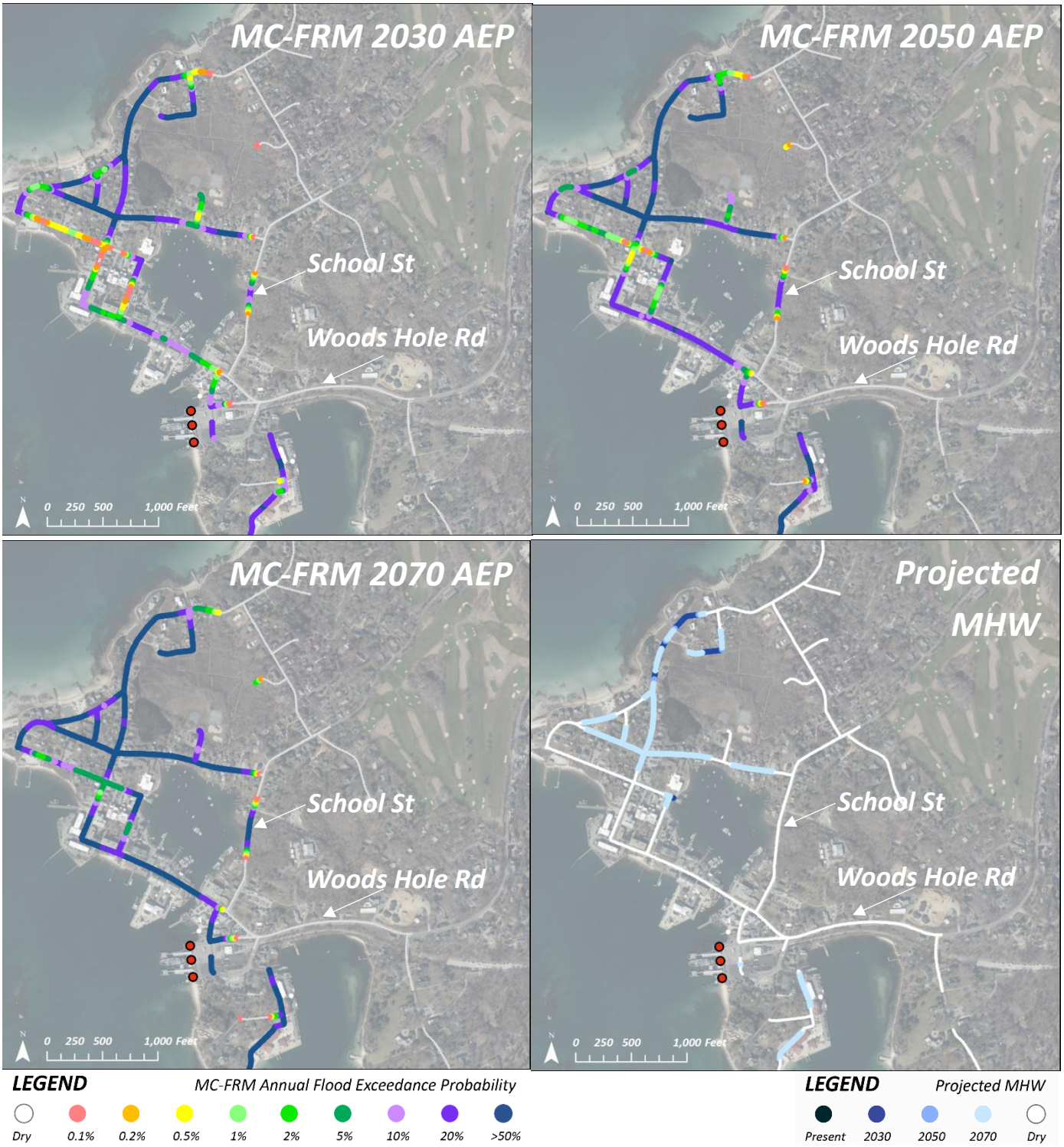


**Figure 12: Ferry approach road vulnerability in Woods Hole. Primary assets are indicated by red dots.**

The primary approach road for Woods Hole Harbor is Woods Hole Road, which has no coastal flood vulnerability in any MC-FRM time horizon. A secondary approach road, School Street (leading directly north from the harbor) has an area of significant vulnerability with a 20% AEP as soon as 2030 and a >50% AEP as soon as 2070. School Street is not projected to experience daily inundation in the MC-FRM time horizons.

**Falmouth**

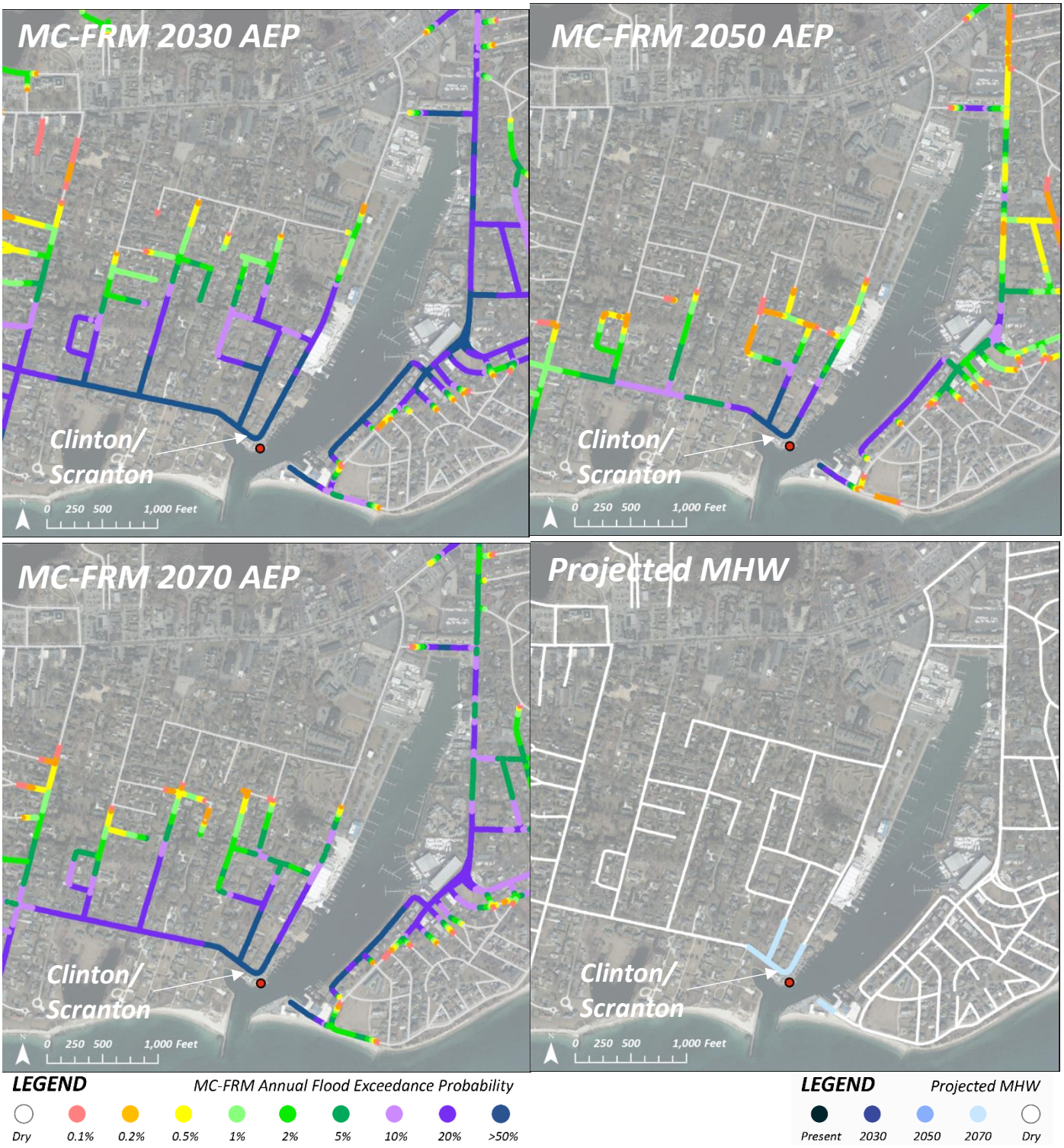


**Figure 13: Ferry approach road vulnerability in Falmouth. Primary assets are indicated by red dots.**

Access roads leading to the Patriot Shuttle dock in Falmouth Harbor gradually slope down to the corner of Clinton and Scranton Aves. No roads leading to the dock are lower in elevation than the dock itself. Road flooding is not expected to cause access challenges to the Patriot Shuttle unless the dock is rebuilt at a higher elevation than the road.

**Hyannis**

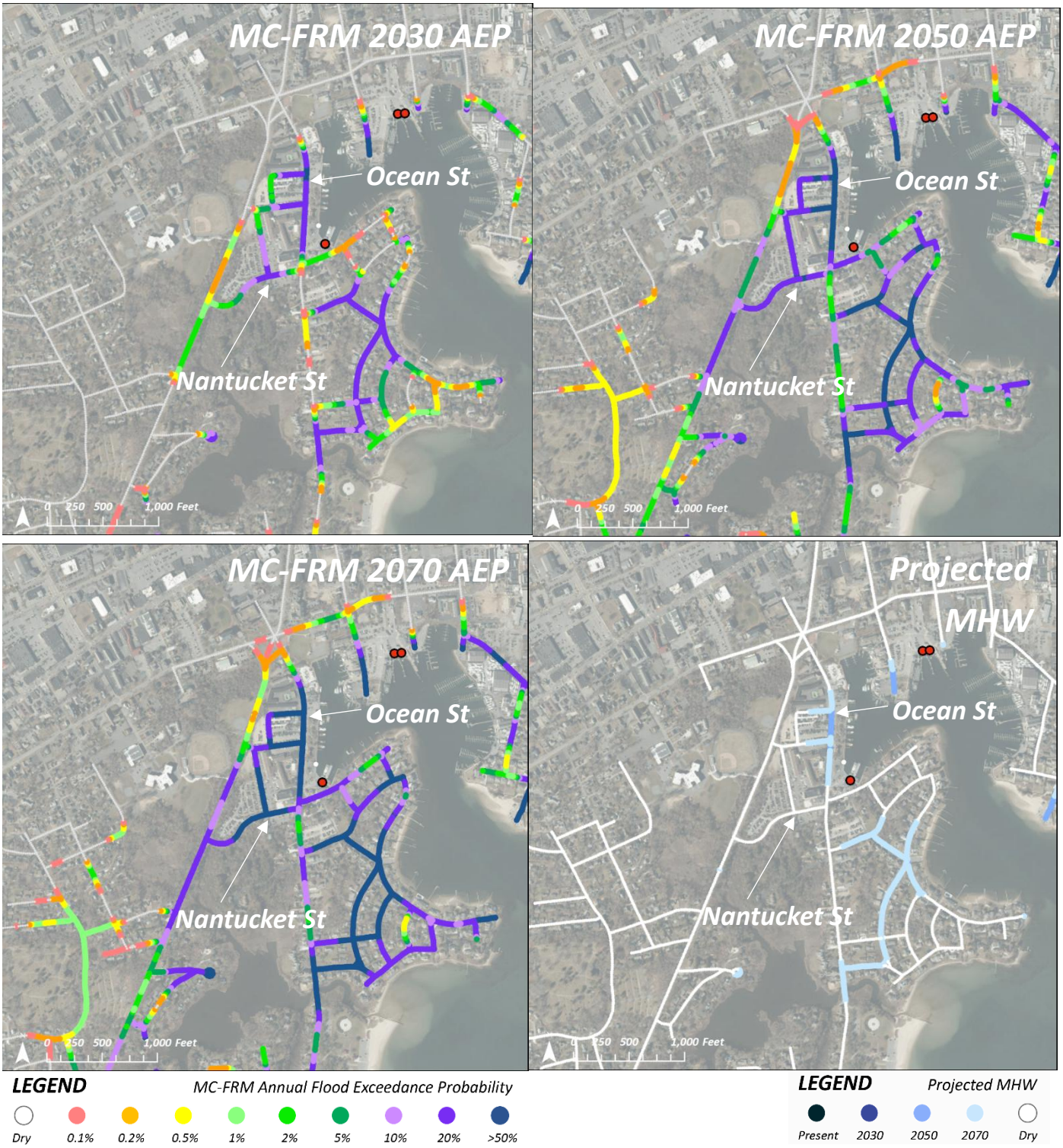


**Figure 14: Ferry approach road vulnerability in Hyannis. Primary assets are indicated by red dots.**

Approach roads to the Steamship Authority terminal in Hyannis are high in elevation, and coastal flooding is not expected to restrict access. The Hy-Line ferry is accessed via Ocean Street and Nantucket Street, which are both highly vulnerable. Portions of Ocean Street are at risk of daily inundation as soon as 2050, and compound coastal and rainwater flooding are already an issue there. Ocean Street can be considered a critical vulnerability for Hy-Line operations.

**Vineyard Haven**

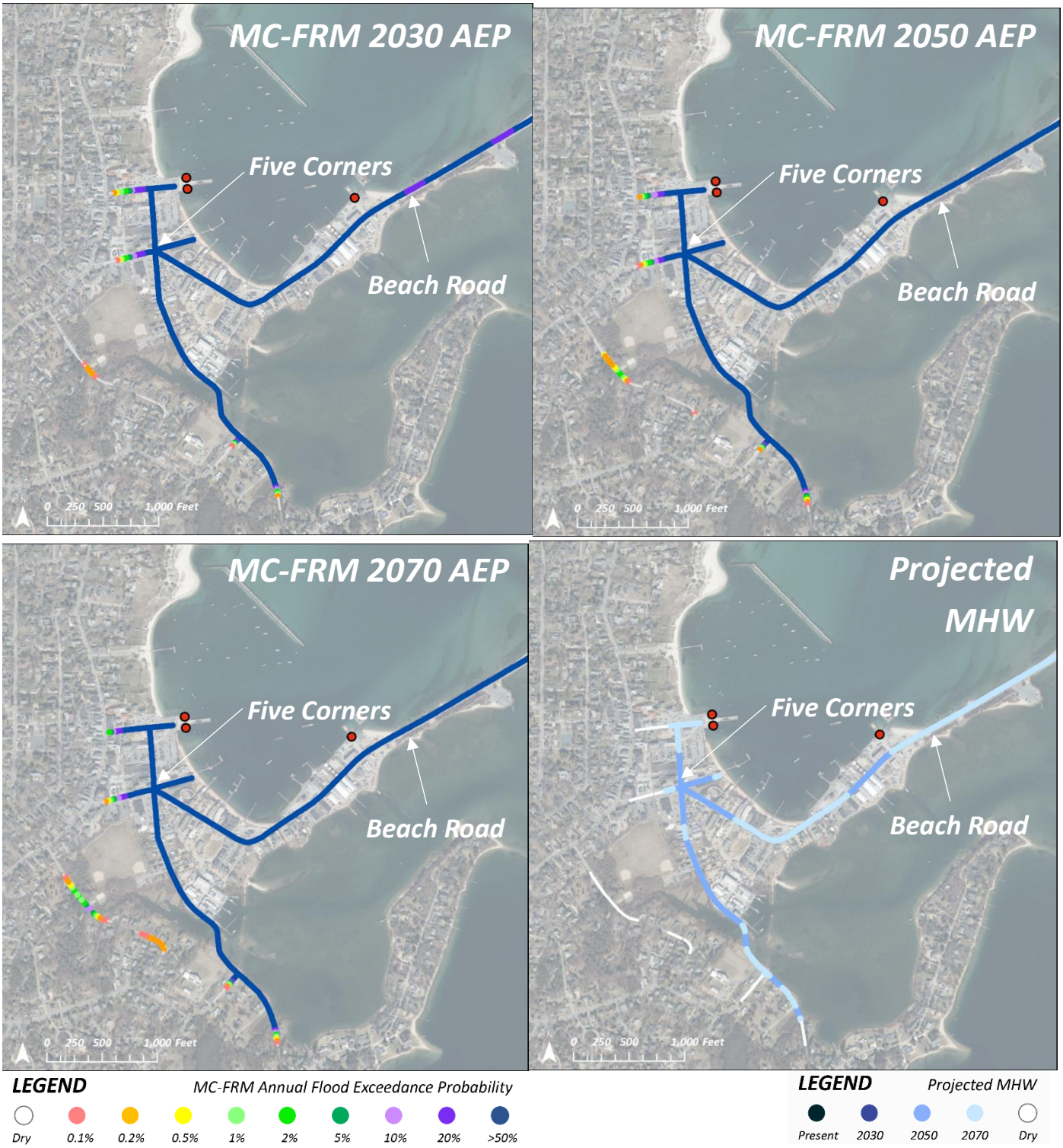


**Figure 15: Ferry approach road vulnerability in Vineyard Haven. Primary assets are indicated by red dots.**

Approach roads to both the Steamship Authority terminal and the RM Packer Co. barge landing are expected to experience daily inundation as soon as 2050. Beach Road and the Five Corners intersection currently experience inundation multiple times per year caused by compound flooding. The extreme flood vulnerability of these roadways is a key threat to Martha's Vineyard's supply chain.

**Oak Bluffs**

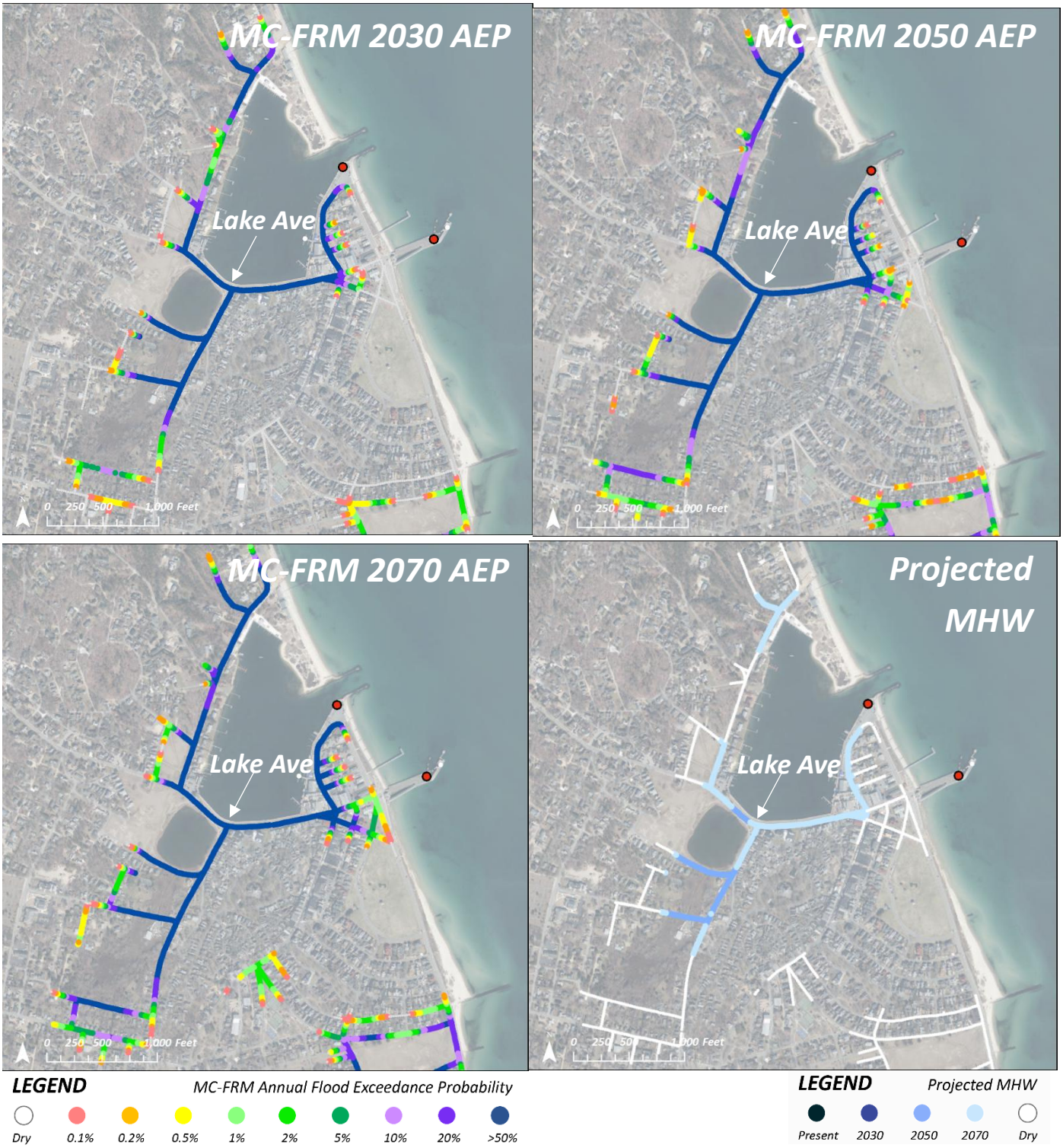


**Figure 16: Ferry approach road vulnerability in Oak Bluffs. Primary assets are indicated by red dots.**

Roads around Oak Bluffs Harbor, including Lake Avenue, are highly vulnerable to coastal flooding. However, both the SSA ferry terminal and the Patriot Shuttle docking location can be reached via Seaview Ave, which has little coastal flood vulnerability in all MC-FRM time horizons.

### Summary

Commonly reported current flooding issues on ferry approach roads are in Vineyard Haven, specifically on Beach Road and around the Five Corners intersection, in Hyannis on Ocean Street, and on Nantucket's Easy Street. Approach roads on both sides of the Chappy Ferry also flood regularly. Analysis of roadway vulnerability to daily tidal inundation helps to highlight and rank roads that may restrict access during normal ferry and barge operations.

More work would be required to refine this analysis and complete it for all facilities critical to the Islands supply chain. Ideally, this data would be available for all harbors with primary assets, and remotely sensed elevation data would be verified with an elevation survey on key low-lying roads. Data gaps exist around Nantucket, New Bedford, Edgartown, and Cuttyhunk harbors, although a slightly different type of roadway vulnerability assessment was conducted in the Town of Edgartown Vulnerability Assessment in 2021. A roadway vulnerability assessment with different methods was also conducted as part of the Nantucket Coastal Resilience Plan. Work is ongoing to address flooding issues on Easy Street and Washington Street in downtown Nantucket. In order to identify and rank vulnerable road segments critical to the supply chains of the Islands, these data gaps would need to be filled.

## *Summary and Key Findings*

### Summary of Results

Tables 13-15 below summarize results for each island by ferry line or barge infrastructure. The most vulnerable part of each ferry line or barge supply chain is identified with bold text in the tables.

### Cuttyhunk

| *Line* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| **Cuttyhunk Ferry** | **Cuttyhunk Ferry Dock New Bedford** | **10.17** | **Medium** | - | - | - | - |
| | Cuttyhunk Ferry Dock (Cuttyhunk) | 4.1 | Low | 2050 | 5%* | **MHW** | **MHW** |
| **Cuttyhunk Freight** | Cuttyhunk Fuel Dock | 4.3 | Low | 2050 | 5%* | **MHW** | **MHW** |
| | **RM Packer Co - New Bedford** | **5.87** | **Medium** | **2070** | - | - | **MHW** |
| | **Fish Island Barge Landing** | **7.15** | **Medium** | - | - | - | **5%*** |
| | **Seastreak New Bedford** | **10.12** | **Medium** | - | - | - | - |
| | **100 Herman Melville Blvd Barge Landing** | **6.96** | **Medium** | - | - | - | **5%*** |
| | **302 Herman Melville Blvd Barge Landing** | **5.71** | **Medium** | **2070** | - | **0.1%** | **MHW** |

**Table 13: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for Cuttyhunk's primary Supply Chain. Critical Elevations in ft, NAVD88. Secondary sites are highlighted in gray. The most vulnerable site for each line has bold text. Blank cells indicate no modeled vulnerability. *Likely an underestimate**

Significant data gaps exist for Cuttyhunk's ferry and barge infrastructure, including uncertainty about where barge docking occurs in New Bedford. For this reason, all barge infrastructure sites in New Bedford, including secondary sites, are included in the table above.

Cuttyhunk's greatest coastal flooding related vulnerability is the low closure threshold of the New Bedford Harbor Barrier. As discussed at the beginning of the Results section, the barrier generally closes when water surface elevations in New Bedford Harbor reach approximately 3.48' NAVD88 and begin to flood the Fairhaven waterfront. If the waterfront is adapted and the closure threshold is raised, the elevations of Cuttyhunk's docks and surrounding roads will become the "weakest link" in Cuttyhunk's supply chain.

### Martha's Vineyard

| *Line* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| **Woods Hole – Vineyard Haven (SSA)** | Woods Hole SSA Terminals | 9.0 | Medium | - | **1%** | 5% | **20%** |
| | **Vineyard Haven SSA Terminals** | **4.4** | **Low** | **2070** | **50%** | **50%** | **MHW** |
| **Woods Hole – Oak Bluffs (SSA)** | Woods Hole SSA Terminals | 9.0 | Medium | - | **1%** | 5% | **20%** |
| | **Oak Bluffs SSA Terminal** | **4** | **Very Low** | **2070** | **50%** | **50%** | **MHW** |
| **Falmouth – Oak Bluffs (Patriot)** | **Falmouth Patriot Shuttle Dock** | **3.72** | **Medium** | **2070** | **100%** | **100%** | **MHW** |
| | Oak Bluffs Patriot Shuttle Dock | 4.36 | High | 2070 | **50%** | **50%** | **MHW** |
| **New Bedford – Vineyard Haven Barge (RM Packer)** | Vineyard Haven RM Packer Co. Landing | 6.38 | Medium | - | **10%** | **50%** | **50%** |
| | **New Bedford RM Packer Co. Landing** | **5.87** | **Medium** | **2070** | - | - | **MHW** |
| **Edgartown – Chappaquiddick (Chappy Ferry)** | Chappy Ferry Landing (Edgartown) | 3.47 | High | 2050 | **50%** | **MHW** | **MHW** |
| | **Chappy Ferry Landing (Chappaquiddick)** | **2.60** | **High** | **2050** | **50%** | **MHW** | **MHW** |

**Table 14: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for Martha's Vineyard's primary Supply Chain. Critical Elevations in ft, NAVD88. The most vulnerable site for each line has bold text. Blank cells indicate no modeled vulnerability.**

Steamship Authority terminals in Vineyard Haven and Oak Bluffs are significantly more vulnerable than the terminal in Woods Hole, and represent the vulnerable points in Martha's Vineyard's car ferry service. Elevation data gaps at Martha's Vineyard's SSA terminals add uncertainty to this analysis, but it is clear that the Island terminals are lower in elevation than the renovated terminal in Woods Hole. The high vulnerability of approach roads to the Vineyard Haven terminal reinforces that site's vulnerability.

Similarly, the nearby RM Packer Co. barge landing in Vineyard Haven suffers from highly vulnerable approach roads. However, the dependence of the RM Packer Co. facility on the New Bedford Harbor Barrier being open means that it is more vulnerable to operational interruptions than the Vineyard Haven SSA terminal. New Bedford Harbor opens to the south, while Vineyard Haven Harbor opens to the north, meaning that the weak link in this portion of the supply chain may depend on the type of storm and wind direction. For example, Beach Road in Vineyard Haven may flood during a nor'easter while the New Bedford Harbor Barrier remains open, and a sou'easter might close the New Bedford Harbor Barrier without causing any flooding in Vineyard Haven.

On the Falmouth-Oak Bluffs ferry route run by Patriot Party Boats Inc., the weak point appears to be at the dock in Falmouth. However, both the docks in Falmouth and Oak Bluffs are highly vulnerable, and one or the other may flood individually depending on the type of storm event and wind direction.

Both ends of the Chappy Ferry in Edgartown and on Chappaquiddick Island are also highly vulnerable. Although both sites fall into the same vulnerability categories in this analysis, the Chappaquiddick side is lower in elevation and is therefore the first point of failure.

### Nantucket

| *Line* | *Facility* | *Critical Elevation* | *Elevation Confidence* | *Onset of Daily Inundation* | *MC-FRM AEP 2030* | *MC-FRM AEP 2050* | *MC-FRM AEP 2070* |
|---|---|---|---|---|---|---|---|
| **Hyannis – Nantucket (SSA)** | Hyannis SSA Terminals | 6.57 | Medium | - | **20%** | **20%** | **100%** |
| | **Nantucket SSA Terminals** | **6.34** | **Medium** | **-** | **20%** | **20%** | **50%** |
| **Hyannis – Nantucket (Hy-Line)** | **Hyannis Hy-Line Dock** | **4.38** | **High** | **2050** | **100%** | **MHW** | **MHW** |
| | Nantucket Hy-Line Dock | 4.46 | Medium | 2070 | **50%** | **50%** | **MHW** |
| **Nantucket Freight** | Nantucket Steamboat Wharf Barge Landing | 6.47 | Medium | - | **20%** | **20%** | **50%** |
| | **RM Packer Co - New Bedford** | **5.87** | **Medium** | **2070** | **-** | **-** | **MHW** |
| | **Fish Island Barge Landing** | **7.15** | **Medium** | **-** | **-** | **-** | **5%*** |
| | **Seastreak New Bedford** | **10.12** | **Medium** | **-** | **-** | **-** | **-** |
| | **100 Herman Melville Blvd Barge Landing** | **6.96** | **Medium** | **-** | **-** | **-** | **5%*** |
| | **302 Herman Melville Blvd Barge Landing** | **5.71** | **Medium** | **2070** | **-** | **0.1%** | **MHW** |

**Table 15: Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for Nantucket's primary Supply Chain. Critical Elevations in ft, NAVD88. Secondary sites are highlighted in gray. The most vulnerable site for each line has bold text. Blank cells indicate no modeled vulnerability. *Likely an underestimate**

Steamship Authority terminals in Hyannis Harbor and Nantucket Harbor are very similar in vulnerability level. The Nantucket SSA terminal is highlighted in bold given its slightly lower elevation and the observed (though not yet analyzed) vulnerability of its approach roads. However, both the docks in Hyannis and Nantucket are highly vulnerable, and one or the other may flood individually depending on the type of storm event and wind direction.

Hy-Line docks in Hyannis and Nantucket are similar in elevation, but differing tide elevations in the two harbors give the Hyannis site much higher vulnerability. The Hyannis Hy-Line dock is the clear highest vulnerability in fast ferry service to Nantucket, especially when the vulnerability of Ocean Street and other approach roads is considered.

Some uncertainty remains about where barge docking relevant to Nantucket occurs in New Bedford. For this reason, all barge infrastructure sites in New Bedford, including secondary sites, are included in Table 15. Regardless, the greatest coastal flood vulnerability for barge operations to and from Nantucket is the low closure threshold of the New Bedford Harbor Barrier. As discussed at the beginning of the Results section, the barrier generally closes when water surface elevations in New Bedford Harbor reach approximately 3.48'

NAVD88 and begin to flood the Fairhaven waterfront. Although closing of the Harbor Barrier appears to be more likely than flooding of Steamboat Wharf, the distance between New Bedford and Nantucket Harbors and the differing direction of their openings mean that one or the other may restrict operations individually depending on the wind direction and type of storm event.

**Summary**

The dependence of barge operations to and from the Islands on New Bedford Harbor, coupled with the Harbor Barrier's increasingly frequent closures, emerges from this analysis as the largest source of operational vulnerability to flooding in the supply chain of the Islands. Gosnold, Martha's Vineyard, and Nantucket all depend on access to landings in New Bedford Harbor, which may be disrupted by monthly fair weather closures as soon as 2030. Cuttyhunk's ferry operations suffer from the same dependence on the Harbor Barrier.

The Chappy Ferry, though lower in criticality, is not far behind the New Bedford facilities in vulnerability. It may also be disrupted by monthly fair weather flooding as soon as 2030 if adaptation measures do not go forward on both the Edgartown and Chappaquiddick sides.

The Hyannis to Nantucket Hy-Line ferry is also highly vulnerable, and can expect frequent fair weather flooding disrupting operations as soon as 2030. The Hyannis facility is more vulnerable than Nantucket's Straight Wharf, and should be prioritized for adaptation or relocation of operations.

The Patriot Shuttle can expect dock inundation on the Falmouth side to interrupt its fair (and less than fair) weather operations as soon as 2050.

The Steamship Authority's facilities in Hyannis, Nantucket, Oak Bluffs, and Vineyard Haven are all in need of adaptation. Vineyard Haven stands out as the most vulnerable in this analysis, followed closely by Hyannis and Nantucket. If the Vineyard Haven facility is not adapted, its operations are expected to be disrupted regularly by fair weather flooding as soon as 2050. SSA facilities in Hyannis and Nantucket can expect fair weather flooding disruptions as soon as 2070. Although this analysis did not include work to understand the impacts of increasing storm severity and frequency on ferry operations, the rate of ferry cancellations due to weather on both routes can also be expected to increase.

The above statements refer to flooding's impacts on the ability of the supply chain to operate during flood events only. The likelihood of ferry terminal or barge infrastructure inoperability after flood events due to damage was not assessed in this analysis. A detailed inventory, elevation survey, and vulnerability assessment of ramp controls and other electrical equipment at critical sites would be required to determine the likelihood of equipment damage and prioritize sites for adaptation.

### Data Gaps

In the course of this preliminary analysis, a series of data gaps reduced the quality of the vulnerability assessment results. Table 16 summarizes the data gaps.

| *Harbor* | *Facility* | *Elevation Data* | *High AEP Data* | *Roadway Data* |
|---|---|---|---|---|
| ***NEW BEDFORD*** | Cuttyhunk Ferry Dock New Bedford | x | **X** | **X** |
| | RM Packer Co - New Bedford | x | **X** | **X** |
| | Fish Island Barge Landing | x | **X** | **X** |
| | Seastreak New Bedford | x | X | X |
| | 100 Herman Melville Blvd Barge Landing | x | X | X |
| | 302 Herman Melville Blvd Barge Landing | x | X | X |
| ***WOODS HOLE*** | Woods Hole SSA Terminal (North) | x | ✓ | ✓ |
| | Woods Hole SSA Terminal (Middle) | x | ✓ | ✓ |
| | Woods Hole SSA Terminal (South) | x | ✓ | ✓ |
| | Woods Hole Naushon Ferry Landing | x | ✓ | ✓ |
| ***FALMOUTH*** | Falmouth Patriot Shuttle Dock | x | ✓ | ✓ |
| | Falmouth Pied Piper Ferry Dock | X | ✓ | ✓ |
| | Falmouth Island Queen Dock | x | ✓ | ✓ |
| ***HYANNIS*** | Hyannis SSA Terminal (West) | x | ✓ | ✓ |
| | Hyannis SSA Terminal (East) | x | ✓ | ✓ |
| | Hyannis Hy-Line Dock | ✓ | ✓ | ✓ |
| | Hyannis Commercial Fishing Loading/Unloading Zone | ✓ | ✓ | ✓ |
| ***CUTTYHUNK*** | Cuttyhunk Ferry Dock | **X** | **X** | **X** |
| | Cuttyhunk Fuel Dock | **X** | **X** | **X** |
| ***NAUSHON*** | Naushon Ferry Landing | X | X | X |
| ***VINEYARD HAVEN*** | Vineyard Haven SSA Terminal (North) | **X** | ✓ | ✓ |
| | Vineyard Haven SSA Terminal (South) | **X** | ✓ | ✓ |
| | Vineyard Haven RM Packer Co. Dock | x | ✓ | ✓ |
| ***OAK BLUFFS*** | Oak Bluffs SSA Terminal | **X** | ✓ | ✓ |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | ✓ | ✓ | ✓ |
| | Oak Bluffs Hy-Line Dock | ✓ | ✓ | ✓ |
| | Oak Bluffs Seastreak Dock | **X** | ✓ | ✓ |
| ***EDGARTOWN*** | Chappy Ferry Landing (Edgartown) | ✓ | ✓ | **X** |
| | Chappy Ferry Landing (Chappaquiddick) | ✓ | ✓ | **X** |
| | Edgartown Pied Piper Ferry Dock | ✓ | ✓ | **X** |
| ***NANTUCKET*** | Nantucket SSA Terminal (North) | x | ✓ | **X** |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | x | ✓ | **X** |
| | Nantucket Hy-Line Dock | x | ✓ | **X** |
| | Nantucket Steamboat Wharf Barge Landing | x | ✓ | **X** |

**Table 16: Data gaps identified during this analysis. Check marks indicate existing data, small x marks indicate low priority data gaps, and large X marks indicate high priority data gaps where existing data is very low quality or nonexistent.**

Gaps in survey-quality elevation data forced this analysis to rely on remotely sensed LiDAR, which in some cases is highly accurate but in some cases is missing, especially for docks and bridges. Ideally, survey-quality elevation data would be gathered for all sites. Gaps in "High AEP" water surface elevation data corresponding to 10% or higher probability water levels for each time horizon also limited the accuracy of the analysis. Ideally,

Mean High Water, Highest Annual Tide, 50% AEP, 20% AEP, and 10% AEP water levels would be available for each site and each time horizon. This would allow for a higher resolution understanding of the projected vulnerability of these generally low elevation waterfront sites. The column furthest to the right identifies gaps in approach road vulnerability data. Ideally, each harbor's approach roads would be analyzed using a full spectrum of AEP data, as well as Highest Annual Tide and Mean High Water datums, to provide an understanding of vulnerability.

**Next Steps**

- First, the list of primary sites should be reevaluated and finalized after this project's economic research and analysis to ensure that all sites critical to the supply chain of the Islands have been captured.
- Second, all data gaps for primary sites should be filled using existing project data that was not identified here, or by gathering new data.
    - This may include site inventories and elevation surveys of all critical equipment at ferry terminals and barge landings to expand the analysis and determine likelihood of critical equipment failure.
- Third, the vulnerability of all primary sites and approach roads should be re-assessed using accurate elevations, a full suite of critical assets, and a full spectrum of water surface elevations.
- Fourth, key vulnerabilities should be identified and addressed for each island, including issues in mainland harbors and with approach roads.
    - An economic or materials flow analysis can be cross-referenced with vulnerability assessment results to calculate which sites have the highest risk to the supply chain and prioritize action.

## Appendix A – Table of Results for All Sites

| Harbor | Facility | Critical Elevation | Elevation Confidence | Onset of Daily Inundation | MC-FRM AEP 2030 | MC-FRM AEP 2050 | MC-FRM AEP 2070 | Notes |
|---|---|---|---|---|---|---|---|---|
| NEW BEDFORD | Cuttyhunk Ferry Dock New Bedford | 10.17 | Medium | - | - | - | - | |
| | RM Packer Co - New Bedford | 5.87 | Medium | 2070 | - | - | MHW | |
| | Fish Island Barge Landing | 7.15 | Medium | - | - | - | 5%* | |
| | Seastreak New Bedford | 10.12 | Medium | - | - | - | - | Also a secondary barge loading/unloading site |
| | 100 Herman Melville Blvd Barge Landing | 6.96 | Medium | - | - | - | 5%* | Currently leased by Robert B. Our Company, no ramp |
| | 302 Herman Melville Blvd Barge Landing | 5.71 | Medium | 2070 | - | 0.1% | MHW | Currently leased by Robert B. Our Company, no ramp |
| WOODS HOLE | Woods Hole SSA Terminal (North) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole SSA Terminal (Middle) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole SSA Terminal (South) | 9 | Medium | - | 1% | 5% | 20% | |
| | Woods Hole Naushon Ferry Landing | 4.125 | Medium | 2070 | 100%* | 100%* | MHW | Private |
| | USCG Woods Hole Dock | 5.1 | Medium | 2070 | 20% | 100%* | MHW | Post-disaster operations would likely come from Newport |
| FALMOUTH | Falmouth Patriot Shuttle Dock | 3.72 | Medium | 2070 | 100%* | 100%* | MHW | |
| | Falmouth Pied Piper Ferry Dock | 3.5 | Low | 2070 | 100%* | 100%* | MHW | Seasonal/Passenger only |
| | Falmouth Island Queen Dock | 3.25 | Medium | 2070 | 100%* | 100%* | MHW | Seasonal/Passenger only |
| HYANNIS | Hyannis SSA Terminal (West) | 6.59 | Medium | - | 20% | 20% | 100%* | |
| | Hyannis SSA Terminal (East) | 6.57 | Medium | - | 20% | 20% | 100%* | |
| | Hyannis Hy-Line Dock | 4.38 | High | 2050 | 100%* | MHW | MHW | |
| | Hyannis Commercial Fishing Loading/Unloading Zone | 3.31 | High | 2050 | 100%* | MHW | MHW | Occasionally used for barges under 150' long |
| CUTTYHUNK | Cuttyhunk Ferry Dock | 4.1 | Low | 2050 | 5%* | MHW | MHW | also used by Coast Guard |
| | Cuttyhunk Fuel Dock | 4.3 | Low | 2050 | 5%* | MHW | MHW | |
| NAUSHON | Naushon Ferry Landing | 3.8 | Very Low | 2050 | 5%* | MHW | MHW | Private |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ***VINEYARD HAVEN*** | Vineyard Haven SSA Terminal (North) | 4.4 | Low | 2070 | **50%** | **50%** | **MHW** | |
| | Vineyard Haven SSA Terminal (South) | 4.4 | Low | 2070 | **50%** | **50%** | **MHW** | |
| | Vineyard Haven RM Packer Co. Dock | 6.38 | Medium | - | **10%** | **50%** | **50%** | |
| ***OAK BLUFFS*** | Oak Bluffs SSA Terminal | 4 | Very Low | 2070 | **50%** | **50%** | **MHW** | |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 4.36 | High | 2070 | **50%** | **50%** | **MHW** | |
| | Oak Bluffs Hy-Line Dock | 3.883 | High | 2070 | **50%** | **50%** | **MHW** | Seasonal/Passenger only |
| | Oak Bluffs Seastreak Dock | 4 | Very Low | 2070 | **50%** | **50%** | **MHW** | Seasonal/Passenger only |
| ***EDGARTOWN*** | Chappy Ferry Landing (Edgartown) | 3.47 | High | 2050 | **50%** | **MHW** | **MHW** | |
| | Chappy Ferry Landing (Chappaquiddick) | 2.6 | High | 2050 | **50%** | **MHW** | **MHW** | |
| | Edgartown Pied Piper Ferry Dock | 5.11 | High | 2070 | **20%** | **50%** | **MHW** | Seasonal/Passenger only |
| ***NANTUCKET*** | Nantucket SSA Terminal (North) | 6.34 | Medium | - | **20%** | **20%** | **50%** | |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | 6.93 | Medium | - | **10%** | **20%** | **50%** | |
| | Nantucket Hy-Line Dock | 4.46 | Medium | 2070 | **50%** | **50%** | **MHW** | |
| | Nantucket Steamboat Wharf Barge Landing | 6.47 | Medium | - | **20%** | **20%** | **50%** | |
| | USCG Nantucket Dock | 3.02 | Medium | 2050 | **50%** | **MHW** | **MHW** | May be used in case of storm damage to primary sites |
| ***OTHER*** | USCG Cape Cod Canal | 7.71 | Medium | 2070 | **100%*** | **100%*** | **MHW** | Post-disaster operations would likely come from Newport |
| | Chatham Fish Pier (USCG Chatham) | 6.63 | Low | 2070 | **100%*** | **100%*** | **MHW** | Post-disaster operations would likely come from Newport |
| | USCG Menemsha Dock | 5.14 | Medium | 2070 | 5%* | 5%* | **MHW** | May be used in case of storm damage to primary sites |

**Annual coastal flood exceedance probabilities as soon as 2030, 2050, and 2070 for Nantucket's primary Supply Chain. Critical Elevations in ft, NAVD88. Secondary sites are highlighted in gray. The most vulnerable site for each line has bold text. Blank cells indicate no coastal flood vulnerability within the model. *Likely an underestimate**

## Appendix B – High AEP Water Surface Elevation Data Sources

All 0.1% - 5% AEP water surface elevation data was sourced from MC-FRM, and is publicly available for download: https://www.woodsholegroup.com/innovation/massachusetts-coast-flood-risk-model/

Water surface elevation data corresponding to the 10%, 20%, and 100% AEP was produced for the Cape Cod Low Lying Roads project using MC-FRM. This data was used in existing roadway vulnerability analysis and for the new analysis in this memo for locations in Falmouth, Woods Hole, Hyannis, Chatham, and Sandwich.

Water surface elevation data corresponding to the 10%, 20%, and 50% AEP was produced for the Martha's Vineyard Hospital Access Resiliency Project using MC-FRM. This data was used in existing roadway vulnerability analysis and for the new analysis in this memo for locations in Vineyard Haven, Oak Bluffs, and Edgartown.

Water surface elevation data corresponding to the 10%, 20%, and 50% AEP was produced for the Washington Street Resilience Framework Project using MC-FRM. This data was used for the analysis in this memo for locations in Nantucket Harbor.

## Appendix C – New Bedford Harbor Barrier Closure Analysis

# Appendix C

# Task 4 Island Supply Chain Risk Assessment

AECOM

# MEMORANDUM

**DATE** May 29, 2025

**TO** Vincent Murphy, Town of Nantucket
Sakiko Isomichi, Martha's Vineyard Commission
Stewart Young, Town of Gosnold

**FROM** Ellen Douglas
Kendall Myers
Carey Barr
AECOM
3101 Wilson Blvd
Suite 900
Arlington, VA 22201

## Supply Chain Risks Assessment for the Islands Region – Preliminary Assessment

### *Introduction*

Martha's Vineyard, Nantucket, and the Elizabeth Islands (collectively the Islands) rely heavily on ferries, barges, private boats, and air transport to access critical goods, services, and workforce connections. This reliance creates a supply chain that is highly interdependent on maritime infrastructure and operational continuity.

This memo builds on the findings of the preceding coastal flood vulnerability assessment and presents a preliminary list of critical risks to the Islands' supply chain—particularly those associated with ferry service disruptions. It also identifies potential capital investments and operational changes to improve resilience and guide future analyses.

### *Background*

The Islands' transportation system serves both passenger and freight needs, with most goods transported via ferry from mainland Massachusetts ports such as Hyannis, Woods Hole, and New Bedford. Table 1 highlights critical facilities for ferries and barges on the Islands. The Steamship Authority (SSA) is a central operator, carrying over 2.9 million

passengers, 575,000 vehicles (including trucks of 20 feet or less), and nearly 99,000 freight trucks to or from the islands of Martha's Vineyard and Nantucket during 2024.[1]

[1] Woods Hole, Martha's Vineyard and Nantucket Steamship Authority 2024 Annual Report. https://www-steamship-assets.s3.amazonaws.com/versioned_downloadable_forms/path/web_res_-_2024_ssa_annual_report_-_2025-6-25.pdf

*Table 1. Sites Evaluated for Coastal Flood Vulnerability*

| Harbor | Facility | Priority | Type | Notes |
|---|---|---|---|---|
| NEW BEDFORD | Cuttyhunk Ferry Dock New Bedford | 1 | Freight/Passenger Ferry | |
| | RM Packer Co - New Bedford | 1 | Freight | |
| | Fish Island Barge Landing | 1 | Freight | |
| | Seastreak New Bedford | 2 | Passenger Ferry | Also a secondary barge loading/unloading site |
| | 100 Herman Melville Blvd Barge Landing | 2 | Freight | Currently leased by Robert B. Our Company, no ramp |
| | 302 Herman Melville Blvd Barge Landing | 2 | Freight | Currently leased by Robert B. Our Company, no ramp |
| WOODS HOLE | Woods Hole SSA Terminal (North) | 1 | Freight/Passenger Ferry | |
| | Woods Hole SSA Terminal (Middle) | 1 | Freight/Passenger Ferry | |
| | Woods Hole SSA Terminal (South) | 1 | Freight/Passenger Ferry | |
| | Woods Hole Naushon Ferry Landing | 2 | Freight/Passenger Ferry | Private |
| FALMOUTH | Falmouth Patriot Shuttle Dock | 1 | Freight/Passenger Ferry | |
| | Falmouth Pied Piper Ferry Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| | Falmouth Island Queen Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| HYANNIS | Hyannis SSA Terminal (West)/SSA Fast Ferry Ramp | 1 | Freight/Passenger Ferry | |
| | Hyannis SSA Terminal (East) | 1 | Freight/Passenger Ferry | |
| | Hyannis Hy-Line Dock | 1 | Passenger Ferry | |
| | Hyannis Commercial Fishing Loading/Unloading Zone | 2 | Freight | Occasionally used for barges under 150' long |
| CUTTYHUNK | Cuttyhunk Ferry Dock | 1 | Freight/Passenger Ferry | Also used by Coast Guard |
| | Cuttyhunk Fuel Dock | 1 | Freight | |
| NAUSHON | Naushon Ferry Landing and Barge Landing | 2 | Freight/Passenger Ferry | Private |
| VINEYARD HAVEN | Vineyard Haven SSA Terminal (North) / VH Seastreak Terminal | 1 | Freight/Passenger Ferry | Also seasonal Seastreak terminal |
| | Vineyard Haven SSA Terminal (South) | 1 | Freight/Passenger Ferry | |
| | Vineyard Haven RM Packer Co. Dock | 1 | Freight | |
| OAK BLUFFS | Oak Bluffs SSA Terminal | 1 | Freight/Passenger Ferry | |
| | Oak Bluffs Patriot/Island Queen/RI Fast Ferry Dock | 1 | Freight/Passenger Ferry | |
| | Oak Bluffs Hy-Line Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| | Oak Bluffs Seastreak Dock | 2 | Passenger Ferry | Seasonal/Passenger only |

| Harbor | Facility | Priority | Type | Notes |
|---|---|---|---|---|
| EDGARTOWN | Chappy Ferry Landing (Edgartown) | 1 | Freight/Passenger Ferry | |
| | Chappy Ferry Landing (Chappaquiddick) | 1 | Freight/Passenger Ferry | |
| | Edgartown Pied Piper Ferry Dock | 2 | Passenger Ferry | Seasonal/Passenger only |
| NANTUCKET | Nantucket SSA Terminal (North) | 1 | Freight/Passenger Ferry | |
| | Nantucket SSA Terminal (South) / Nantucket Seastreak Terminal | 1 | Freight/Passenger Ferry | |
| | Nantucket Hy-Line Dock | 1 | Passenger Ferry | |
| | Nantucket Steamboat Wharf Barge Landing | 1 | Freight | |
| | USCG Nantucket Dock | 3 | Coast Guard Facility | May be used in case of storm damage to primary sites |
| OTHER | USCG Cape Cod Canal | 3 | Coast Guard Facility | Post-disaster operations would likely come from Newport |
| | Chatham Fish Pier (USCG Chatham) | 3 | Coast Guard Facility | Post-disaster operations would likely come from Newport |
| | USCG Menemsha Dock | 3 | Coast Guard Facility | May be used in case of storm damage to primary sites |

*SSA stands for Steamship Authority*

In addition to SSA operations, private ferry providers (e.g., Hy-Line Cruises) provide passenger service, while barges and commercial vessels transport bulk freight, including fuel, construction materials, and food supplies. E-commerce deliveries typically follow a hybrid logistics pattern: goods are shipped via regional distribution centers to mainland staging areas, then transferred to ferries or barges, and finally distributed locally via truck or small-scale delivery services. This assessment primarily focuses on publicly accessible ferry systems and major freight operations, excluding most private docks, marinas, and exclusive ferry services that may provide supplemental but not system-critical capacity.

A supply chain is the chain of processes, businesses, etc. by which a commodity is produced and distributed: the companies, materials, and systems involved in manufacturing and delivering goods.[2]

Island supply chains are characterized by:

- Heavy reliance on a limited number of transportation nodes
- Seasonal demand fluctuations driven by tourism
- Limited local production capacity
- Geographic isolation that constrains redundancy

### *Elizabeth Islands*

The Elizabeth Islands constitute the town of Gosnold, which has a population of 70 people, according to the 2020 Decennial Census,[3] and limited infrastructure, relying on small ferry services and private boats for goods and mobility. Cuttyhunk Harbor in Gosnold is located at the northeastern end of Cuttyhunk Island, which lies at the southwestern end of the Elizabeth Islands. The harbor is used by a small fishing fleet, local and transient recreational boaters, and mail and freight carriers from the mainland.[4] While Cuttyhunk Harbor hosts a small amount of the supply chain relative to the Islands overall, it is a vulnerable facility subject to the New Bedford Habor Barrier, a low island dock and approach roads, and channel maintenance issues.

### *Nantucket*

Nantucket is the most geographically isolated of the Islands, located approximately 30 miles offshore. According to the U.S. Census Bureau, Nantucket County has a population

[2] Merriam-Webster. Supply Chain noun. https://www.merriam-webster.com/dictionary/supply%20chain
[3] U.S. Census Bureau. Gosnold town, Dukes County, Massachusetts. https://data.census.gov/profile/Gosnold_town,_Dukes_County,_Massachusetts?g=060XX00US2500726325
[4] US Army Corps of Engineers. Cuttyhunk Harbor Navigation Project. https://www.nae.usace.army.mil/Missions/Civil-Works/Navigation/Massachusetts/Cuttyhunk-Harbor/

of approximately 14,300 residents.[5] However, there significant seasonal fluctuations, as the population swells to 80,000 or more in July and August.[6]

### *Martha's Vineyard*

Martha's Vineyard and the Elizabeth Islands (Dukes County) have a combined year-round population of approximately 20,600.[7] Like Nantucket, there is substantial seasonal variation. August is the busiest month of the year for the Vineyard, and the 2024 peak seasonal population was estimated at nearly 95,000.[8]

## *Disruptions to Ferry Service*

Disruptions fall into two primary categories: environmental and logistical.

1. Environmental Disruptions

- Storms (hurricanes, nor'easters)
- High winds and wave conditions
- Ice events
- Coastal flooding, sea level rise, and increased frequency of "blue sky flooding" due to unusually high tides

2. Logistical Disruptions

- Mechanical failures
- Crew shortages or labor constraints
- Scheduling conflicts and congestion at terminals
- Vessel maintenance downtime

Both categories can trigger cascading supply chain impacts due to limited redundancy.

## *Supply Chain & Island Infrastructure*

Island supply chains are particularly vulnerable, relative to those that are landside, due to their reliance on maritime transport and limited alternative routes. Ports in Hyannis, Woods Hole, New Bedford, Vineyard Haven, and Nantucket are critical facilities for freight and

---

[5] U.S. Census Bureau. Nantucket County, Massachusetts. https://data.census.gov/profile/Nantucket_County,_Massachusetts?g=050XX00US25019
[6] Town & County of Nantucket Massachusetts. FAQs. https://www.nantucket-ma.gov/m/faq?cat=15#question-289
[7] U.S. Census Bureau. Dukes County, Massachusetts. https://data.census.gov/profile/Dukes_County,_Massachusetts?g=050XX00US25007
[8] Martha's Vineyard Commission. Martha's Vineyard Seasonal Population Estimate 2024. https://www.mvcommission.org/sites/default/files/docs/MVC%20Seasonal%20Population%20Estimate%208-30-24.pdf

passenger movement. Their concentration increases vulnerability, as disruption at a single port can affect the entire system.

The supply chain also depends on low-lying roadways connecting ports to distribution points. Flooding on roads such as Beach Road (Vineyard Haven) and Easy Street (Nantucket) can restrict access even when ferry service is operational. Air freight provides redundancy for high-value or time-sensitive goods but is cost-prohibitive for many commodities.

Cold storage and warehousing capacity on the Islands are limited, which reinforces reliance on just-in-time delivery systems for perishable goods. Routine ferry deliveries are essential to maintaining consistent supply levels. Under normal operating conditions, this just-in-time model is efficient because it minimizes spoilage, reduces storage costs, and accommodates seasonal demand fluctuations. However, it also introduces vulnerability: even short-term disruptions to ferry or barge service can lead to shortages of perishable goods. Unlike mainland communities, where alternate trucking routes or nearby suppliers may be available, the Islands have limited redundancy in distribution pathways.

Mainland storage facilities therefore play a critical role in supply chain resilience. These facilities effectively function as buffer nodes in the system, holding inventory that can be rapidly deployed when transportation windows reopen. Larger regional distribution centers, including refrigerated warehouses on Cape Cod and in southeastern Massachusetts, support bulk purchasing and staging of goods prior to shipment across the water. If mainland storage sites are themselves affected by flooding, power outages, or logistical bottlenecks—particularly at low-lying harbor facilities—then both upstream supply and downstream delivery to the Islands may be compromised simultaneously.

The Island's supply chain is distinctively shaped by its geographical location, seasonal population changes, and constrained infrastructure. The following sections discuss specific industries or products and their supply chain dependencies.

### *Food & Drinking Water*

The Islands are highly dependent on imported food. Less than 5% of Nantucket Island's 48 square miles is dedicated to agriculture.[9] Fishing operations rely on mainland infrastructure such as Hyannis for unloading and distribution, further connecting Island economies to mainland logistics nodes. While precise inventory levels vary by business and season, perishable food supply on the Islands is generally maintained on a short cycle—often only a few days' worth of inventory—due to limited storage capacity and

[9] Nantucket Land Bank. Staff Spotlight: Isaac Basibe. https://www.nantucketlandbank.org/staff-spotlight-isaac-basibe/

reliance on frequent ferry deliveries. Disruptions such as severe weather, ferry cancellations, or shipping delays can affect food availability from mainland sources.

Drinking water is generally sourced from groundwater systems, not transported by ship or waterline. Emergency situations or niche cases (such as construction sites) may use trucked water, but this is uncommon. Drought is a potential threat to all the Islands communities, particularly to those with public water supplies.[10] If an Island's groundwater system was contaminated or overused, then they would have to turn to imported water.

### *Medical & Emergency*

The presidents of the hospitals on both Nantucket and Martha's Vineyard have shared that many medical services can only be found on the mainland. Reduced ferry access may require overnight stays or special accommodation for island residents to access specialized care off-island. Hospitals and island residents rely on commuting workers and supply deliveries incoming regularly via ferry. Nantucket employs more than 500 workers in the medical industry, some portion of which commute each day.[11]

The Martha's Vineyard Hospital, located at One Hospital Road in Oak Bluffs, is the island's only hospital and provides acute, ambulatory, and specialized care, as well as housing the Windemere skilled nursing facility. Access to the hospital has already been affected intermittently by roadway flooding, and these challenges are expected to intensify over time.

Ferries also transport critical supplies, such as road salt in event of inclement weather. When typical transportation routes are unavailable, such as during emergency situations, Coast Guard infrastructure can be used to preserve a lifeline to the Islands, but this is a last resort.

### *Fuel*

The main source of electricity on Martha's Vineyard and Nantucket is a mainland grid delivered via undersea cables. The town of Gosnold has a solar powered microgrid.

However, fuel remains a critical resource for backup and peak power generation through generators, building heating, and transportation across Island communities. Due to geographic isolation, alternative fuel suppliers are limited, increasing reliance on a small number of providers. JP Noonan is the sole Nantucket fuel transporter; Nantucket

---

[10] Martha's Vineyard Commission. Dukes County Multi-Jurisdiction Hazard Mitigation Plan Update. Amended May 2022.

[11] UMass Amherst. The Impacts of a NOAA Vessel Speed Reduction Regulation on Nantucket. 2024. https://nantucket-current.nyc3.cdn.digitaloceanspaces.com/assets/The-Impacts-of-a-NOAA-Vessel-Speed-Reduction-Regulation-on-Nantucket.pdf

maintains about a four-day winter reserve. No alternative fuel provider exists for Gosnold. In spring 2026, a two-week fuel outage on Cuttyhunk disrupted local commerce and daily life. Fuel is typically transported to the Islands by barge or tugboats, and supply disruptions present cascading risks for all systems.

The transport of fuel and similar hazardous materials carries an associated risk of marine oil spills. New Bedford, Vineyard Haven, and Nantucket were all identified as harbors with high threats of oil spills in a recent report to the Massachusetts Department of Environmental Protection. Tugboat traffic in this region includes fuel deliveries between New Bedford and the Islands.[12]

### *Non-Essential Goods*

Non-essential goods include consumer goods such as furniture and retail items, often delivered via scheduled freight ferries. While less critical, delays can impact local businesses and tourism.

### *Passengers*

Passenger movement to and from the Islands supports a wide range of economic and social functions, but these trips vary significantly in their level of criticality and tolerance for disruption. Some trips—such as emergency services, essential workforce commuting, and access to specialized medical care—are highly time-sensitive and cannot accommodate delays. Others, including routine commuting and scheduled travel, can absorb short-term disruptions, while discretionary travel (such as tourism) can tolerate longer delays, though often with economic impacts.

Across the Islands, a substantial portion of the workforce depends on reliable, daily ferry access, including workers commuting both onto and off the islands. For example, approximately 1,255 workers commute onto Nantucket each day, nearly 22 percent of total employment.[13] Additionally, according to U.S. Census Bureau OnTheMap (LEHD) data for 2022, 32 percent of island residents work in jobs outside of Nantucket representing just over 2,000 jobs.

Access to off-island services is similarly critical for maintaining core governmental functions. Nantucket, for instance, does not currently have a resident judge, assistant district attorney, or prosecutor, requiring regular travel by ferry. Around 10 percent of Nantucket's firefighters also commute from off-island, due to a lack of affordable

---

[12] Nuka Research. Marine Oil Spill Threats to Massachusetts Coastal Communities: Updated Assessment. January 2024.

[13] UMass Amherst. The Impacts of a NOAA Vessel Speed Reduction Regulation on Nantucket. 2024. https://nantucket-current.nyc3.cdn.digitaloceanspaces.com/assets/The-Impacts-of-a-NOAA-Vessel-Speed-Reduction-Regulation-on-Nantucket.pdf

housing.[14] Comparable dependencies on off-island personnel for essential services exist across the Islands, particularly in smaller and more resource-constrained communities. Disruptions to ferry services would therefore have systemwide implications for public operations. In the past, Nantucket had to call Hyannis and other Cape towns for fire response, and the towns were only able to assist because the ferries were running.[15]

Students throughout the Islands rely on off-island travel for educational and recreational opportunities. Student-athletes regularly attend competitions across Barnstable County, Dukes County, and other parts of the state, and mainland students also travel to the Islands for events. On Nantucket alone, there were 27,353 school or youth group riders on the Hy-Line Ferry in 2023—an average of more than 2,000 per month.[16]

Economic activity on the Islands is also closely tied to passenger movement. Seasonal and off-season visitation supports local businesses, and an analysis of credit card transaction data and SSA passenger surveys indicates that day-trippers currently account for around a third of Nantucket on-island spending between November 1 and May 30.[17]

As a result, any disruption to ferry services would affect commuting flows in both directions, potentially impacting thousands of workers across the combined island economies. Passenger transportation is not simply a convenience but a critical infrastructure system supporting workforce stability, economic activity, public services, and quality of life across the Islands.

### *Other Critical Goods & Services*

While some parts of the Islands have centralized sewer systems, many still rely on septic systems. Some septic systems are treated onsite, but some septic tanks must be periodically pumped and trucked to treatment facilities or processed locally. Waste removal is also moved off the islands by ferries, and occasionally by barge for bulk shipments or when ferry capacity is constrained.

In order to address the shortage of affordable housing on the Island, builders require construction materials moved from off-island. These materials are also used for repairing damage following storms and other hazard events. Large or bulk material such as modular

---

[14] The New York Times. Nantucket's Workers Are Living on the Margins. July, 11, 2025.
[15] The New York Times. Nantucket's Workers Are Living on the Margins. July, 11, 2025.
[16] UMass Amherst. The Impacts of a NOAA Vessel Speed Reduction Regulation on Nantucket. 2024. https://nantucket-current.nyc3.cdn.digitaloceanspaces.com/assets/The-Impacts-of-a-NOAA-Vessel-Speed-Reduction-Regulation-on-Nantucket.pdf
[17] UMass Amherst. The Impacts of a NOAA Vessel Speed Reduction Regulation on Nantucket. 2024. https://nantucket-current.nyc3.cdn.digitaloceanspaces.com/assets/The-Impacts-of-a-NOAA-Vessel-Speed-Reduction-Regulation-on-Nantucket.pdf

housing or large equipment is brought onto the Islands by barge. Most other standard construction materials, such as lumber, dry wall, and small machinery, can be loaded onto trucks on the mainland, driven onto vehicle ferries (e.g., SSA), and delivered directly to job sites.

Sand for beach nourishment is also expected to be commonly transported to the Islands via barge in the near future; this could reduce capacity for other goods movement if capacity and efficiency are not expanded.

### *Critical Risks to Supply Chain*

Based on the vulnerability assessment, stakeholder feedback, and analysis, there are four critical risks to the Islands' supply chains. These critical risks include:

1. New Bedford Harbor Dependence

The New Bedford Hurricane Barrier is a flood barrier maintained and operated by the United States Army Corps of Engineers. The dependence of barge operations between the Islands and New Bedford Harbor—combined with increasing Harbor Barrier closures—was identified in the coastal flood vulnerability assessment as the largest source of operational vulnerability to flooding in the supply chain of the Islands. Gosnold, Martha's Vineyard, and Nantucket all depend on access to landings in New Bedford Harbor, which may be disrupted by monthly fair-weather closures as soon as 2030. Cuttyhunk's ferry operations suffer from the same dependence on the Harbor Barrier.

2. Ferry Terminal Vulnerability

The Steamship Authority's Hyannis, Nantucket, Oak Bluffs, and Vineyard Haven facilities face increasing flood risk. Vineyard Haven was identified in the vulnerability assessment as the most vulnerable, followed closely by Hyannis and Nantucket. If the Vineyard Haven facility is not adapted, its operations are expected to be disrupted regularly by fair weather flooding as soon as 2050. SSA facilities in Hyannis and Nantucket can expect fair weather flooding disruptions as soon as 2070. The rate of ferry cancellations due to weather on both routes can also reasonably be expected to increase.

Floodwater inundation for ferry terminals is also an issue at their approach roads. Commonly reported flooding issues on ferry approach roads are in Vineyard Haven, specifically on Beach Road and around the Five Corners intersection, in Hyannis on Ocean Street, and on Nantucket's Easy Street. Approach roads on both sides of the Chappy Ferry also flood regularly.

3. Key Route Disruptions

Ferry terminals and barge docks are generally not expected to operate during storms and can be designed to flood with little to no damage. Therefore, the goal for these types of facilities is generally to avoid fair weather and small storm inundation and preserve daily operations, in addition to minimizing damage during storms.

The Hyannis to Nantucket Hy-Line ferry is highly exposed to flooding and can expect frequent fair weather flooding disrupting operations as soon as 2030. The Hyannis facility is more vulnerable than Nantucket's Straight Wharf and should be prioritized for adaptation or relocation of operations.

The Chappaquiddick Ferry, though lower in criticality, is not far behind the New Bedford facilities in vulnerability. It may also be disrupted by monthly fair-weather flooding as soon as 2030 if adaptation measures do not move forward on both the Edgartown and Chappaquiddick sides.

The Patriot Shuttle can expect dock inundation on the Falmouth side to interrupt its fair (and less than fair) weather operations as early as 2050.

4. Staff Disruptions

Several barge and ferry captains around the Islands are nearing retirement and their replacement is predicted to be difficult, partly due to the shortage of affordable housing. Loss of staff with institutional knowledge is a risk and succession planning is difficult if staff cannot afford to live proximate to the facilities.

## *Recommendations for Future Study*

Additional opportunities to study the supply chain risks for the Islands include assessing and recommending capital investments, operational changes, and addressing other critical lifeline needs. Suggestions for further study include:

### *Capital Investments*

- Flood mitigation at ferry terminals and approach roads
  Analysis of roadway vulnerability to daily tidal inundation to highlight and rank roads that may restrict access during normal ferry and barge operations; data gaps exist around Nantucket, New Bedford, Edgartown, and Cuttyhunk harbors, as detailed in the vulnerability assessment.
- Raising bulkheads and docks (e.g., ≥6.0' NAVD88[18] standard)

[18] NAVD88 stands for North American Vertical Datum of 1988. NAVD88 is a standard elevation reference system used in the United States (and parts of North America) to measure heights above mean sea level.

As outlined in the Hyannis Harbor Municipal Vulnerability Preparedness Resilience Plan, enhanced policies and standards are needed to improve the resilience of privately owned parcels and assets throughout the Harbor District. The plan recommends adoption of a Coastal Flood Overlay Zoning District for Hyannis Harbor, incorporating new standards for bulkhead and building elevations. To maintain daily use at the water's edge through 2050, they recommend establishing a minimum elevation of 6.0 feet NAVD88 for all replaced or substantially repaired bulkheads and fixed docks.[19] It could be further studied if these guidelines are appropriate for other areas of the Islands.

- Road elevation and drainage improvements

  The Hyannis Harbor Municipal Vulnerability Preparedness Resilience Plan also recommends all roadway elevation projects within the Harbor District be required to meet or exceed 6.0 feet NAVD88 elevation. Efforts from the Town of Tisbury, Town of Oak Bluffs, Martha's Vineyard Commission, and Martha's Vineyard Hospital have also recommended raising roads and improving drainage to maintain infrastructure and asset access in the medium- to long-term. These measures would require coordination and consensus with multiple stakeholders, including MassDOT.[20]
- Expansion of local food production

  Increased production of goods on the Islands, particularly in food, may help strengthen the Island's supply chain resiliency, however it is acknowledged that production potential within the Islands is limited.
- Housing development for essential workers

  Affordable housing availability for staff on-island may ease staffing difficulties and improve emergency response.
- Detailed infrastructure vulnerability assessments

  A detailed inventory, elevation survey, and vulnerability assessment of ramp controls and other electrical equipment at critical sites would be required to determine the likelihood of equipment damage and prioritize sites for adaptation.

### *Operational Changes*

- Improved coordination among ferry operators
- Coordination and logistics planning to reduce deadheading
- Early ordering and stockpiling of critical goods
- Diversification of suppliers and ports of origin
- Enhanced communication protocols

[19] Woods Hole Group. Hyannis Harbor Municipal Vulnerability Preparedness Resilience Plan. 2024.
[20] MassDOT. Martha's Vineyard Beach Road Study Summary Report. June 2025.

Although disruptions caused by weather—and, to a lesser extent, mechanical failures—are accepted to some degree, timely and transparent communication with users remains essential.

- Greater reliance on local vendors where feasible

### *Other Critical Lifelines*

Future studies should evaluate vulnerabilities in:

- Power generation and transmission
- Water supply and wastewater systems
- Telecommunications infrastructure