Nassau County Hazard Mitigation Plan

Nassau County, New York

January 2021

HAGERTY

Nassau County Hazard Mitigation Plan Executive Summary

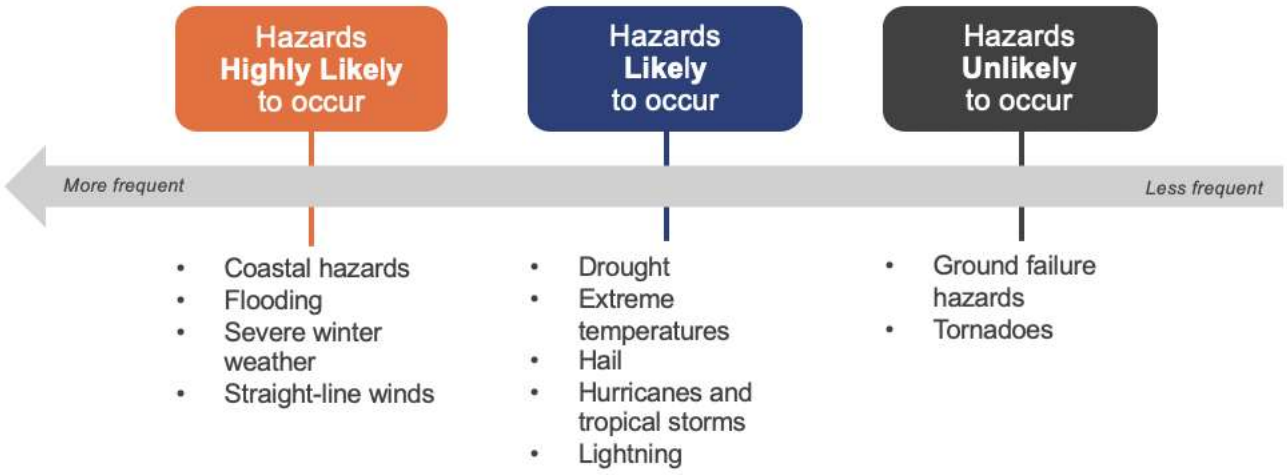
The Nassau County Hazard Mitigation Plan (Plan) is tangible evidence of Nassau County's **dedication to identifying and reducing the risks** associated with natural hazards to increase resilience of the community. Additionally, the County recognizes the importance of **maintaining a Federal Emergency Management Agency (FEMA) approved hazard mitigation plan** in order to maintain eligibility for the FEMA Hazard Mitigation Assistance (HMA) program, thereby opening the door to additional financial resources for the County.

Planning Process

Nassau County, in coordination with stakeholder groups, conducted a comprehensive, year-long planning process to update and redevelop their hazard mitigation plan to account for new risk data and cater to updated community priorities. Through this process, the County established a group of jurisdictions interested in participating (i.e., Planning Committee), identified hazards of concern, profiled these hazards, estimated risk and potential losses associated with these hazards, developed mitigation goals and actions that address the hazards that impact the area, and developed a strategy for plan implementation, to be executed upon conditional approval of the Plan from the New York State Division of Homeland Security and Emergency Services (NYS DHSES) and FEMA.

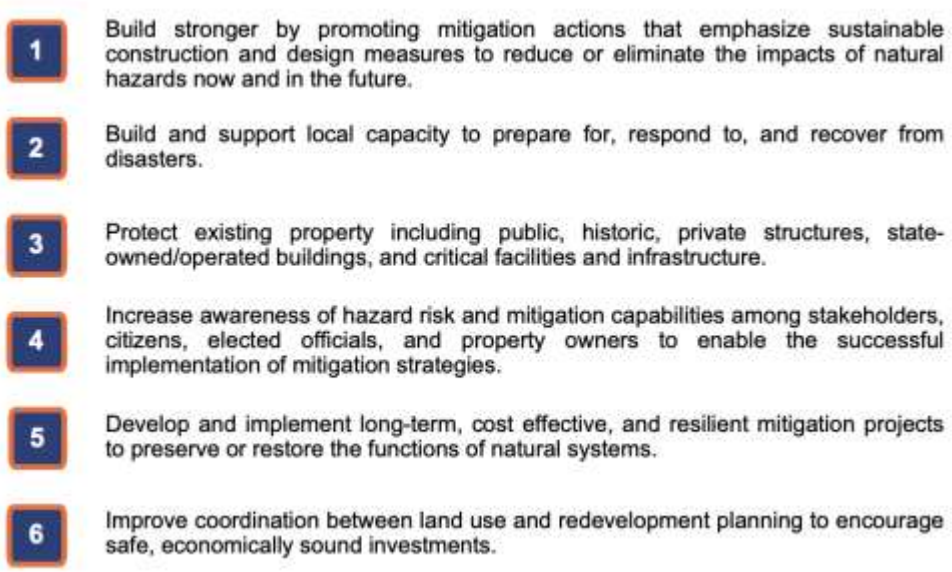
Risk Assessment

The purpose of the risk assessment is to evaluate the risks of natural hazards that are anticipated to impact the people, economy, services, housing, infrastructure, and environment of Nassau County. This assessment evaluated coastal hazards, drought, extreme temperatures, flooding, ground failure hazards, hail, hurricanes and tropical storms, lightning, severe winter weather, and straight line winds. Key considerations in this analysis were the likelihood that a hazard would occur (probability of occurrence), the anticipated severity (extent) of the hazard, and anticipated impact of the hazard on the community. The assessment found that:



Mitigation Strategy

The mitigation strategy is the heart of the Nassau County Hazard Mitigation Plan. This section defines the County's vision for mitigating risk and reaching resilience. The section details an implementation strategy that will be carried out over the next five years. The cornerstone of the County's Mitigation Strategy are these six mitigation goals that all mitigation actions align with:



Plan Organization

This Plan consists of the Base Plan, its Appendices, and the Jurisdictional Annexes. The Base Plan is comprised of the following sections:

- **Section 1 Introduction** introduces the reader to the Plan and provides context for the information included in the Plan.
- **Section 2 Planning Process** describes the planning process and records participation of various stakeholders in the planning process.
- **Section 3 County Profile** analyzes the current and future demographics, geography, and climate in the County to inform the mitigation planning process.
- **Section 4 Risk Assessment** analyzes the County and its jurisdictions' risk and vulnerabilities to natural hazards.
- **Section 5 Capability Assessment** collates the County's capabilities and assesses how these capabilities can support mitigation programs or be improved to support mitigation.
- **Section 6 Mitigation Strategy** describes the County's mitigation strategy, including the Plan's goals for a mitigation program, Countywide mitigation actions, and a road map for how the County will implement the Plan throughout the five year planning cycle.

The Base Plan Appendices include tools and data that supported the development of the Plan or will support the implementation of the plan. Lastly, each participating jurisdiction has its own Jurisdictional Annex that details a jurisdiction-specific profile, capability assessment, and mitigation strategy.

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1 Introduction

1.1 Background

Since 2007, Nassau County has maintained a hazard mitigation plan in order to reduce community vulnerability to natural disasters and meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) §201.6. The Nassau County Hazard Mitigation Plan will serve as guidance for implementation of the Mitigation Planning Program for the County and participating jurisdictions, in contrast to directing policy or having direct legal implications. The County and participating jurisdictions last updated the Nassau County Hazard Mitigation Plan in 2014. This update was largely focused on implementing lessons learned from the unprecedented impact of Superstorm Sandy in 2012. The goal for the 2021 update is to leverage current standards, regulations, guidance, and hazard information to ensure the new plan meets and exceeds New York State and FEMA hazard mitigation plan requirements. Funding for this plan update was obtained through a FEMA Pre-Disaster Mitigation Grant in 2017. This plan is tangible evidence of Nassau County's dedication to identifying and reducing the risks associated with the hazards that exist in the community.

Benefits of Mitigation Planning:

- Creates eligibility for FEMA Hazard Mitigation Assistance (HMA) funding
- Reduces impacts of natural hazards on the community
- Increases resilience of County
- Strengthens partnerships and increases awareness of hazards
- Supports prioritization of limited resources

1.2 Participating Jurisdictions

While the Nassau County Hazard Mitigation Plan applies to all communities in Nassau County, jurisdictions that fully participated in the plan update process may adopt the Plan and remain eligible as direct recipients of HMA funding.

Nassau County's two cities, three towns, and 64 incorporated villages were invited to participate in the plan update process, as required to be considered participating jurisdictions in a FEMA approved plan. During the planning process, 18 jurisdictions withdrew their participation due to a variety of reasons, including but not limited to differing planning priorities, lack of observed need for mitigation actions, and staff capacity. This planning process coincided with the COVID-19 pandemic, which posed challenges to the County and its jurisdictions as it strained the already thin resources of local communities. This may have been a significant factor for those jurisdictions that decided to withdraw participation from the plan. The County coordinated with each withdrawing jurisdiction to confirm their withdrawal and the repercussions, specifically related to federal funding eligibility, of their withdrawal.

A total of 51 participating jurisdictions are included in the 2021 Nassau County Hazard Mitigation Plan Update, as shown in ***Figure 1*** and detailed in ***Table 1***. ***Table 2*** summarizes the individuals who comprise of the Planning Committee that was responsible for this plan update.

Figure 1: Planning Area Jurisdictions

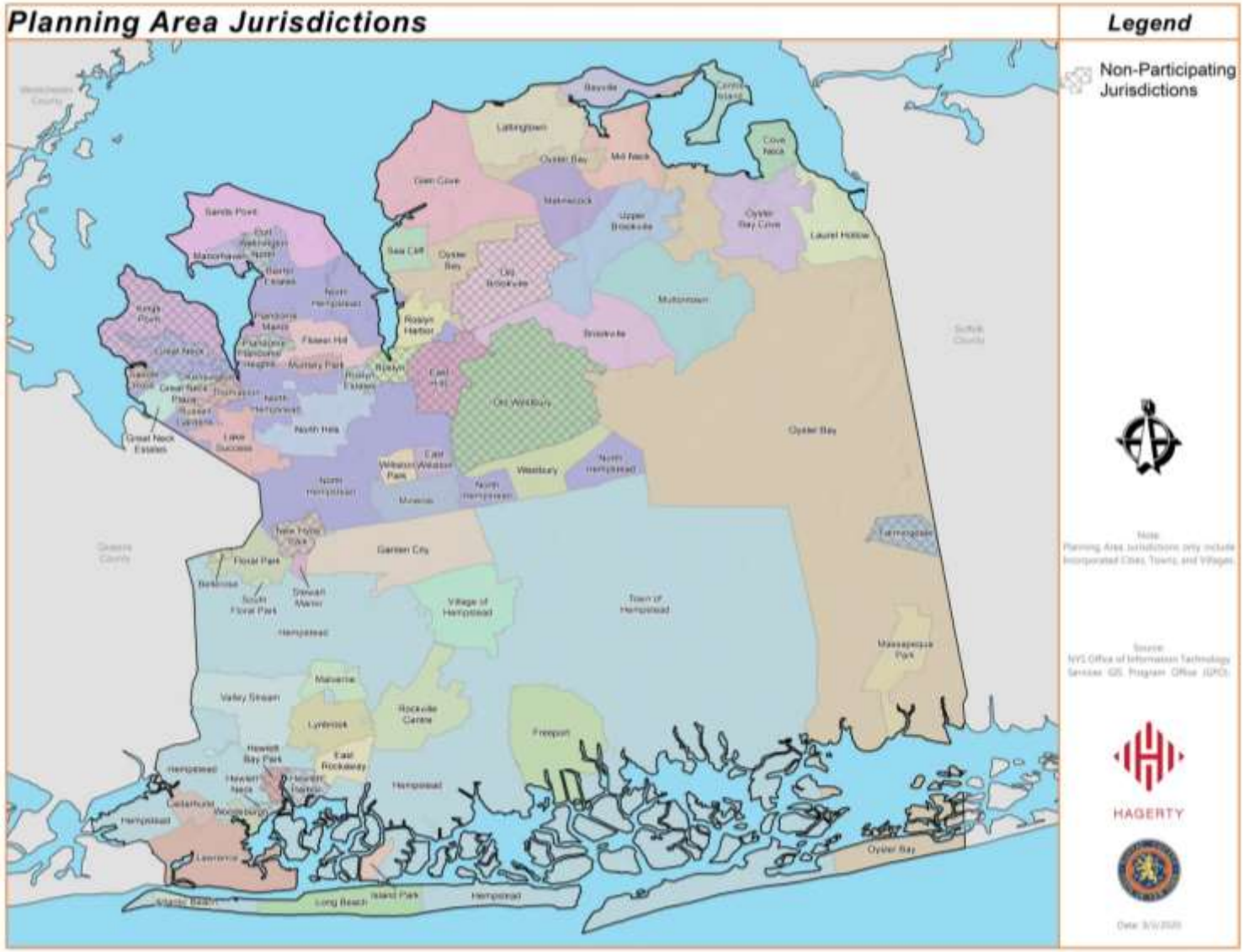

Table 1: Plan Participation Status

Name	Core Planning Group Kickoff	Planning Committee Pre-Workshop Webinar	Planning Committee Workshop	Risk Review and Mitigation Webinar	Jurisdiction Consultation Calls	Planning Committee Mitigation Strategy Webinar	Planning Committee Plan Review Webinar	Status (Adopting, Withdrawn)
Nassau County	X	X	X	X	X	X	X	Adopting
City of Glen Cove	X			X	X		X	Adopting
City of Long Beach	X	X	X		X	X	X	Adopting
Town of Hempstead	X	X	X	X	X	X	X	Adopting
Town of North Hempstead	X		X	X	X	X	X	Adopting
Town of Oyster Bay		X	X		X	X		Adopting
Village of Atlantic Beach								Adopting
Village of Baxter Estates			X	X	X	X	X	Adopting
Village of Bayville		X	X	X	X	X	X	Adopting
Village of Bellerose		X	X	X				Withdrawn
Village of Brookville		X	X	X	X	X	X	Adopting
Village of Cedarhurst			X	X	X	X	X	Adopting
Village of Centre Island			X			X	X	Adopting
Village of Cove Neck		X	X	X	X	X	X	Adopting
Village of East Hills			X					Withdrawn
Village of East Rockaway			X	X	X	X	X	Adopting
Village of East Williston		X	X		X			Adopting
Village of Farmingdale			X					Withdrawn
Village of Floral Park		X	X	X	X	X		Adopting
Village of Flower Hill			X	X	X			Adopting
Village of Freeport		X	X					Adopting
Village of Garden City			X	X	X			Adopting
Village of Great Neck		X	X	X				Withdrawn

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Village of Great Neck Estates			X		X			Adopting
Village of Great Neck Plaza				X	X	X		Adopting
Village of Hempstead		X	X				X	Adopting
Village of Hewlett Bay Park			X	X				Withdrawn
Village of Hewlett Harbor		X						Withdrawn
Village of Hewlett Neck			X	X				Withdrawn
Village of Island Park			X	X				Adopting
Village of Kensington								Withdrawn
Village of Kings Point		X	X					Withdrawn
Village of Lake Success		X	X	X	X	X	X	Adopting
Village of Lattingtown		X			X		X	Adopting
Village of Laurel Hollow			X	X	X	X		Adopting
Village of Lawrence		X		X	X			Adopting
Village of Lynbrook		X	X	X	X	X		Adopting
Village of Malverne		X	X	X	X	X		Adopting
Village of Manorhaven					X		X	Adopting
Village of Massapequa Park		X		X	X			Adopting
Village of Matinecock			X	X	X	X	X	Adopting
Village of Mill Neck		X	X	X	X			Adopting
Village of Mineola			X	X	X		X	Adopting
Village of Munsey Park					X			Adopting
Village of Muttontown		X	X	X	X			Adopting
Village of New Hyde Park			X					Withdrawn

Name	Core Planning Group Kickoff	Planning Committee Pre-Workshop Webinar	Planning Committee Workshop	Risk Review and Mitigation Webinar	Jurisdiction Consultation Calls	Planning Committee Mitigation Strategy Webinar	Planning Committee Plan Review Webinar	Status (Adopting, Withdrawn)
Village of North Hills			X	X	X	X	X	Adopting
Village of Old Brookville			X					Withdrawn
Village of Old Westbury		X	X	X				Withdrawn
Village of Oyster Bay Cove		X	X		X			Adopting
Village of Plandome								Withdrawn
Village of Plandome Heights		X			X		X	Adopting
Village of Plandome Manor		X	X	X	X		X	Adopting
Village of Port Washington North		X						Withdrawn
Village of Rockville Centre		X	X	X	X		X	Adopting
Village of Roslyn	X	X		X				Withdrawn
Village of Roslyn Estates								Withdrawn
Village of Roslyn Harbor		X	X	X	X		X	Adopting
Village of Russell Gardens		X	X	X	X		X	Adopting
Village of Saddle Rock								Withdrawn
Village of Sands Point			X	X	X		X	Adopting
Village of Sea Cliff		X			X	X	X	Adopting
Village of South Floral Park				X	X			Adopting
Village of Stewart Manor			X	X	X	X	X	Adopting
Village of Thomaston				X				Withdrawn
Village of Upper Brookville	X	X	X	X	X	X	X	Adopting
Village of Valley Stream		X	X	X	X	X	X	Adopting
Village of Westbury		X	X	X	X			Adopting
Village of Williston Park		X	X	X	X		X	Adopting

Name	Core Planning Group Kickoff	Planning Committee Pre-Workshop Webinar	Planning Committee Workshop	Risk Review and Mitigation Webinar	Jurisdiction Consultation Calls	Planning Committee Mitigation Strategy Webinar	Planning Committee Plan Review Webinar	Status (Adopting, Withdrawn)
Village of Woodsburgh			X	X	X	X	X	Adopting

Table 2: Planning Committee Members

Organization	First Name	Last Name	Job Title	Core Planning Group?
Village of Atlantic Beach	Steven	Cherson	Superintendent	No
Village of Baxter Estates	Nora	Haagenson	Mayor	No
Village of Baxter Estates	Chrissy	Kiernan	Village Clerk-Treasurer	No
Village of Baxter Estates	Alice	Peckelis	Emergency Manager	No
Village of Bayville	Maria	Alfano-Hardy	Administrator	No
Village of Bayville	Doug	Groth	Building Inspector	No
Village of Bellerose	Emil	Pape	Emergency Manager	No
Village of Brookville	Timothy	Dougherty	Village Administrator and Building Inspector	No
Village of Brookville	Angela	Mannino	Staff	No
Village of Brookville	Daniel	Serota	Mayor	No
Village of Brookville	Robert	Spina	Trustee and Director	No
Village of Cedarhurst	Frank	Parise	Superintendent	No
Village of Centre Island	Lawrence	Schmidlapp	Mayor	No
City of Glen Cove	Christopher	Ortiz	Deputy Chief	Yes
City of Long Beach	Chandra	Akins	Administrator	Yes
City of Long Beach	Richard	Corbett	Deputy Director	Yes
City of Long Beach	Joe	Febrizio	Deputy Commissioner	Yes
City of Long Beach	Scott	Kemins	Director	Yes
City of Long Beach	John	Mirando	Acting City Manager	Yes
Village of Cove Neck	Ted	Gutierrez	Trustee/Deputy Mayor	No
Village of Cove Neck	John	Hubbard	Planning Board Member	No
Village of Cove Neck	Thomas	Zoller	Mayor	No
Village of East Hills	Matt	Angst	Park Director	No
Village of East Hills	Donna	Gooch	Mayor	No
Village of East Hills	John	Salerno	Superintendent	No

Organization	First Name	Last Name	Job Title	Core Planning Group?
Village of East Hills	Charles	Summa	Emergency Manager	No
Village of East Rockaway	James	Carrigan	Emergency Manager	No
Village of East Rockaway	Juan	Garcia	Village Engineer	No
Village of East Rockaway	Thomas	Smith	Superintendent	No
Village of East Williston	Marie	Hausner	Village Clerk	No
Village of East Williston	Bonnie	Parente	Mayor	No
Village of Farmingdale	Andy	Fisch	Superintendent	No
Village of Farmingdale	Brian	Harty	Administrator	No
Federal Emergency Management Agency (FEMA)	Stephanie	Gootman	Community Planner	Yes
FEMA	Gary	Monitz	Mitigation Planner	Yes
Village of Floral Park	Kevin	Ginnane	Superintendent	No
Village of Floral Park	Renee	Marcus	Superintendent	No
Village of Flower Hill	Richard	Falcones	Superintendent	No
Village of Flower Hill	Randall	Rosenbaum	Trustee	No
Village of Flower Hill	Ronnie	Shatzkamer	Village Administrator	No
Village of Freeport	Richard	Holdener	Emergency Manager	No
Village of Freeport	Jonathan	Smith	Code Enforcement Inspector	No
Village of Freeport	Nora	Suders	Grants Technician	No
Village of Garden City	Darcia	Palmer	Deputy Treasurer	No
Village of Garden City	Domenick	Stanco	Deputy Superintendent/ Emergency Manager	No
Village of Great Neck	Louis	Massaro	Superintendent	No
Village of Great Neck	Jim	Neubert	Deputy Superintendent	No
Village of Great Neck Estates	Barbara	Dziorney	Building Inspector	No
Village of Great Neck Estates	Kathleen L	Santelli	Village Administrator	No
Village of Great Neck Estates	Christopher	Russo	Police Sergeant	No
Village of Great Neck Plaza	Jean	Celender	Mayor	No

Organization	First Name	Last Name	Job Title	Core Planning Group?
Village of Great Neck Plaza	Vincent	Ferry	Assistant to the Mayor	No
Hagerty Consulting	Michelle	Bohrson	Managing Associate	Yes
Hagerty Consulting	Jim	DeAngelo	Senior Managing Associate	Yes
Hagerty Consulting	Kris	Ledins	Senior Managing Associate	Yes
Hagerty Consulting	Michael	Levkowitz	Managing Associate	Yes
Hagerty Consulting	Sydney	McKenna	Managing Associate	Yes
Village of Hempstead	Scott	Clark	Supervisor, Water & Sewer Services	No
Village of Hempstead	Frank	Germinaro	Director	No
Village of Hempstead	Waylyn	Hobbs	Trustee	No
Village of Hempstead	Teddy	McLean	Senior Engineering Aide	No
Village of Hempstead	George	Sandas	Director	No
Village of Hewlett Bay Park	Francois	Tenenbaum	Fire Commissioner	No
Village of Hewlett Harbor	Maureen	McCarthy	Deputy Clerk	No
Village of Hewlett Harbor	Michael	Ryder	Village Clerk	No
Village of Hewlett Neck	Francois	Tenenbaum	Fire Commissioner	No
Village of Island Park	John	Isola	Deputy Village Treasurer	No
Village of Island Park	Michael	Mcginty	Mayor	No
Village of Kensington	Susan	Lopatkin	Mayor	No
Village of Kensington	Melissa	McComb	Village Clerk	No
Village of Kings Point	George	Banville	Commissioner	No
Village of Kings Point	Michael	Moorehead	Superintendent	No
Village of Kings Point	Gomie	Persaud	Head Village Clerk	No
Village of Lake Success	Patrick	Farrell	Administrator	No
Village of Lake Success	Patrick	McDermott	Superintendent	No
Village of Lattingtown	Dawn	Gresalfi	Clerk Treasurer	No
Village of Lattingtown	Enrico	Lucidi	Street Commissioner	No
Village of Laurel Hollow	Daniel	DeVita	Mayor	No

Organization	First Name	Last Name	Job Title	Core Planning Group?
Village of Laurel Hollow	Elizabeth	Kaye	Village Clerk/Treasurer	No
Village of Laurel Hollow	Jeffrey	Nemshin	Deputy Mayor	No
Village of Lawrence	Geraldo	Castro	Deputy Village Administrator	No
Long Island Regional Planning Council	Elizabeth	Cole	Deputy Director	Yes
Long Island Regional Planning Council	Richard	Guardino	Executive Director	Yes
Village of Lynbrook	Robert	Cribbin	Emergency Manager	No
Village of Lynbrook	John	Giordano	Village Administrator	No
Village of Lynbrook	Valerie	Onoroto	Deputy Administrator	No
Village of Malverne	Anthony	Marino	Director	No
Village of Manorhaven	Sharon	Abramski	Village Clerk-Treasurer	No
Village of Massapequa Park	Robert	Macri	Superintendent	No
Village of Matinecock	Roger	Cocchi	Consultant Engineer	No
Village of Matinecock	Kenneth	Goodman, M.D.	Mayor	No
Village of Matinecock	Albert	Kalimian	Deputy Mayor	No
Village of Matinecock	Peter P.	MacKinnon, Esq.	Village Attorney	No
Village of Matinecock	William	Simonds	Clerk-Treasurer	No
Village of Mill Neck	Donna	Harris	Village Clerk-Treasurer	No
Village of Mill Neck	Josh	Kugler	Emergency Manager	No
Village of Mineola	Lenny	Palumbo	Deputy Superintendent	No
Village of Mineola	Thomas	Rini	Superintendent	No
Village of Munsey Park	Tara	Gibbons	Treasurer	No
Village of Munsey Park	Maureen	McLean	Deputy Clerk	No
Village of Muttontown	Joseph	Russo	Acting Village Clerk	No
Village of Muttontown	Tony	Toscano	Emergency Manager	No
Nassau County	Paul	Broderick	Deputy Commissioner	Yes

Organization	First Name	Last Name	Job Title	Core Planning Group?
Nassau County	Ann	DeSimone	Director, Public Health Emergency Preparedness	Yes
Nassau County	Michael	Golio	Investigator Captain	Yes
Nassau County	Diana	Johnson	Coordinator of Community Mental Health Services	Yes
Nassau County	Nicole	Marks	Director of Planning	Yes
Nassau County	Steven	Morelli	Commissioner	Yes
Nassau County	Joseph	O'Connor	Emergency Management Specialist	Yes
Nassau County	Bohdan	Pilczak	Division Supervising Fire Marshal	Yes
Nassau County	Brian	Schneider	Deputy County Executive	Yes
Nassau County	Karen	Taggart	Special Counsel for Public Safety	Yes
Nassau County	Joseph	Trimarchi	Deputy Commissioner	Yes
Nassau County	Robert	Connolly	Sergeant	Yes
Nassau County	Kevin	Crean	Director	Yes
Nassau County	Timothy	Messner	Deputy Commissioner	Yes
Nassau County	Kenneth	Murray	Officer	Yes
Nassau County	Susan	Park	Director of Recovery	Yes
Nassau County	David	Viana	Planner II	Yes
Nassau County Soil and Water Conservation District	David	Ganim	District Manager	Yes
Nassau County Village Officials Association	Ralph	Kreitzman	Executive Director	Yes
Village of New Hyde Park	Richard	Coppola	Village Trustee	No
Village of New Hyde Park	Thomas	Gannon	Superintendent	No
New York City Emergency Management	Melissa	Umberger	Director	Yes
Village of North Hills	Marianne	Lobaccaro	Village Administrator	No
Village of North Hills	Dennis	Sgambati	Deputy Mayor	No

Organization	First Name	Last Name	Job Title	Core Planning Group?
New York State Department of Homeland Security and Emergency Services (NYS DHSES)	Patrick	Beckley	Regional Director	Yes
NYS DHSES	Shannon	Clarke	DHSES Mitigation Planning Manager	Yes
NYS DHSES	Jillian	Ringhauser	Regional Planner	Yes
New York State Floodplain and Stormwater Managers Association	Brian	Zitani	Region 1 (Long Island) Chapter Chairman	Yes
New York State Department of Environmental Conservation	Bill	Fonda	Public Participation Specialist	Yes
Village of Old Brookville	Bernard	Ryba	Mayor	No
Village of Old Westbury	Gregg	Bencic	Superintendent	No
Village of Old Westbury	Robert	Glaser	Chief of Police	No
Village of Old Westbury	Brian	Ridgway	Village Administrator	No
Village of Oyster Bay Cove	Joanne	Casale	Village Clerk/Treasurer	No
Village of Oyster Bay Cove	Seth	Lublin	Emergency Manager	No
Village of Oyster Bay Cove	Ted	Mergel	Police Sergeant	No
Village of Oyster Bay Cove	Edward F.	von Briesen	Road Commissioner	No
Village of Plandome	Donald	Richardson	Emergency Manager/Trustee	No
Village of Plandome Heights	Arlene	Drucker	Village Clerk	No
Village of Plandome Heights	Kenneth	Riscica	Mayor	No
Village of Plandome Manor	Barbara	Donno	Mayor	No
Village of Plandome Manor	Randi	Malman	Village Clerk	No
Village of Port Washington North	Robert	Barbach	Superintendent	No
Village of Port Washington North	Alex	Moschos	Deputy Emergency Manager	No
Village of Rockville Centre	Kevin	Reilly	Emergency Manager	No
Village of Roslyn	Sam	Daliposki	Superintendent	No
Village of Roslyn	Anita	Frangella	Village Clerk's Office	No
Village of Roslyn Estates	Henry	Krukowski	Emergency Management Officer	No

Organization	First Name	Last Name	Job Title	Core Planning Group?
Village of Roslyn Estates	Michael	Tomicich	Village Clerk/Treasurer	No
Village of Roslyn Harbor	Dina	Kussoff	Emergency Management Coordinator	No
Village of Roslyn Harbor	Marla	Wolfson	Village Clerk	No
Village of Russell Gardens	Christine	Blumberg	Village Clerk Treasurer	No
Village of Russell Gardens	Michael	Jurcsak	Supervisor	No
Village of Saddle Rock	Dan	Levy	Mayor	No
Village of Sands Point	Mike	Ertel	Sands Point Representative to Manhasset Bay Protection Committee	Yes
Village of Sands Point	Peter	Forman	Commissioner	No
Village of Sands Point	Liz	Gaynor	Village Clerk	No
Village of Sands Point	Correne	Martinez	Administrator	No
Village of Sea Cliff	Shane	Dommin	Building Inspector	No
Village of Sea Cliff	Bruce	Kennedy	Village Administrator	No
Village of South Floral Park	Jennifer	Bellamy	Emergency Manager	No
Village of South Floral Park	Mary	Long	Village Clerk	No
Village of Stewart Manor	Barbara	Arciere	Trustee	No
Village of Stewart Manor	Rosemarie	Biehayn	Village Clerk	No
Village of Stewart Manor	Richard	Clifford III	MEO-Sanitation Worker	No
Village of Stewart Manor	Michael	Onorato	Mayor	No
Suffolk County	Kenneth	Kutner	Program Examiner, Office of Emergency Management	Yes
Suffolk County	Jeanne	Lenz	Program Examiner, Office of Emergency Management	Yes
Village of Thomaston	William	Mazurkiewicz	Superintendent	No
Village of Thomaston	Steven	Weinberg	Mayor	No
Town of Hempstead	Edward	Powers	Director	Yes
Town of North Hempstead	Shawn	Brown	Commissioner	Yes
Town of North Hempstead	Tom	Devaney	Grants Manager	Yes

Organization	First Name	Last Name	Job Title	Core Planning Group?
Town of Oyster Bay	Michael	Gange	Director	Yes
Town of Oyster Bay	Robert	Mangano	Deputy Commissioner	Yes
Town of Oyster Bay	Cathie	McGarry	Public Safety Assistant	Yes
Village of Upper Brookville	Elliot	Conway	Mayor	No
Village of Upper Brookville	Tracy	Lynch	Clerk/Treasurer	No
Village of Upper Brookville	Thomas	Mullen	Deputy Clerk	No
Village of Valley Stream	Steven	Acquavella	Superintendent	No
Village of Valley Stream	Frank	Roca	Emergency Management Coordinator	No
Village of Westbury	Joseph	Brillantino	Building Inspector	No
Village of Westbury	Phil	Fulgieri	Superintendent	No
Village of Westbury	Pasquale	Iannucci	Deputy Superintendent	No
Village of Williston Park	Keith	Bunnell	Superintendent	No
Village of Williston Park	Paul	Ehrbar	Mayor	No
Village of Williston Park	Julie	Kain	Village Clerk/Treasurer	No
Villages of Woodsburgh	Francois	Tenenbaum	Fire Commissioner	No

1.3 Plan Organization

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- **Section 5 Capability Assessment** collates the County's capabilities and assesses how these capabilities can support mitigation programs or be improved to support mitigation.
- **Section 6 Mitigation Strategy** describes the County's mitigation strategy, including the Plan's goals for a mitigation program and County specific actions and provides a road map for the County of how to implement the Plan throughout the planning cycle.

The Base Plan Appendices include tools and data that supported the development of the Plan or will support the implementation of the plan. Lastly, each participating jurisdiction has a Jurisdictional Annex, which includes a jurisdiction-specific profile, capability assessment, and mitigation strategy.

2 Planning Process

The following section details the process used to update the Nassau County Hazard Mitigation Plan. Detailed documentation pertaining to this process, such as records of meeting attendance, presentations, and the outreach strategy can be found in ***Appendix A***.

2.1 Stakeholder Organization and Responsibilities

For the Nassau County Hazard Mitigation Plan update, stakeholders were organized into five different groups based on their expected responsibilities and level of participation, as detailed in ***Figure 2***. The participation of all groups was instrumental in supporting the update of this plan. Planning Committee members bore the greatest responsibility for providing information relative to the current conditions in their communities, reporting on mitigation progress, and developing new mitigation actions to address changing risk. More details on the responsibilities of each group and their participation in the planning process are included in the subsections below.

Figure 2: Stakeholder Organization and Composition

2.1.1 Steering Committee

The Steering Committee led the County's effort to update the hazard mitigation plan. This group made critical decisions about the structure of the planning process and plan update. The Steering Committee is comprised of the Nassau County Office of Emergency Management (OEM) Director of Recovery, Nassau County OEM Director of Planning, and Hagerty Consulting Project Team.

Expectations:

- Organize and carry out the planning process
- Collect information from the stakeholders to update the Plan
- Develop and finalize drafts of the Plan documents

2.1.2 Core Planning Group

The Core Planning Group (CPG) is made up of the Steering Committee, Nassau County departments, Long Island agencies, representatives from the County's cities and townships, neighboring counties, New York State agencies, and FEMA Region II. For the purposes of hazard mitigation planning, "participating jurisdictions" are the jurisdictions in the County seeking to adopt the final Plan that is approved by NYS DHSES and FEMA. A list of jurisdictions participating in the plan update, including the person's position and agency within the jurisdiction is available in the Introduction. Representatives from neighboring jurisdictions, specifically representatives from Suffolk County and New York City were invited by Nassau County Office of Emergency Management through phone and/or email to be members of the CPG.

Expectations:

- Provide information, consultation, and feedback to support the plan update.
- Consulted to make high level decisions about the purpose and goals of the base plan.
- Reviewed drafts and provided feedback to the Steering Committee.
- Contributed to the development of mitigation strategies at the county government level.

2.1.3 Planning Committee

The Planning Committee consists of the Core Planning Group and the County's 64 incorporated villages. As noted in the introduction, 18 municipalities withdrew their participation during the planning process. For the purposes of Nassau County's Mitigation Program and future Plan updates, these non-participating jurisdictions will continue to be considered part of the Planning Committee. The Planning Committee provided a critical understanding of the local community needs and in order to meet all of the State and federal requirements for hazard mitigation planning for each jurisdiction.

Expectations:

- Provide the Steering Committee with information for their respective jurisdictional annex, specifically NYS DHSES mitigation action worksheets.
- Participate in Plan update workshops and webinars.
- Review and provide comments on drafts of the Plan.

2.1.4 Stakeholder Group

The Stakeholder Group is comprised of special districts (e.g., school and fire), elected officials, nonprofits, businesses, coalitions, hospitals, utility companies, and educational institutions. As needed, the Steering Committee and Planning Committee may consult with individuals in the Stakeholder Group for subject matter expertise on specific topics.

Expectations:

- Maintain awareness of the plan update process
- Provide subject matter expertise
- Participate in public and stakeholder webinars
- Participate in public and stakeholder groups survey in June 2020. Results of this survey can be found in Appendix A.
- Review full draft plan during public review period in October 2020. Results of the public review can be found in Appendix A.

2.1.5 Public

Public engagement during the hazard mitigation planning process was a priority for Nassau County. All Nassau County residents, business owners, and other community groups were encouraged to participate in the planning process. Nassau County directly encouraged the public to participate via social media announcements, and also provided template language for the Planning Committee to use to promote these engagement opportunities locally. Nassau County will continue to make public participation a priority throughout the planning cycle as outlined in the Mitigation Strategy section.

Public Expectations:

- Participate in public and stakeholder groups survey in June 2020. Results of this survey can be found in Appendix A**.**
- Review full draft plan during public review period in October 2020. Results of the public review can be found in Appendix A.
- Participate in public and stakeholder webinars

2.2 Plan Update Process

Nassau County received a Pre-Disaster grant from FEMA to fund this update of the Nassau County Hazard Mitigation Plan. The County contracted with Hagerty Consulting to support the County in updating the Plan. Together, as the Steering Committee, the County and Hagerty Consulting worked together to lead the plan update process. There were two critical components of updating the Plan. First, the Steering Committee planned and conducted a comprehensive series of meetings and outreach to various stakeholder groups, each described in the subsequent sections of this section. The Steering Committee also reviewed and updated the content of the Plan and integrated feedback received from all stakeholder groups. The plan update spanned most of 2020 and concluded at the end of the year.

The plan update process also involved several other hazard mitigation related programs. Specifically, the plan update process was integrated with the County's participation in the National Flood Insurance Program (NFIP), FEMA's Hazard Mitigation Grant Program (HMGP), and the Community Rating System (CRS). Integration of these programs is discussed more extensively in subsequent sections.

2.2.1 Planning Meetings

The Plan Update process included a series of meetings and webinars to engage all stakeholder groups. The County originally scheduled the majority of the planning meetings to be facilitated by the Steering Committee in person. Due to the restrictions and dangers caused by the Coronavirus Disease 2019 (COVID-19) pandemic, the Steering Committee opted to conduct all planning meetings after the March 5th workshop online. ***Table 3*** provides an overview of the meetings conducted during the Plan update process and Appendix A includes documentation from these meetings including, agendas, presentations, handouts, notes, and attendance.

Table 3: Review of Planning Meetings

Name	Date	Description	Participation
Core Planning Group Kick-Off Meeting	February 3, 2020	The Nassau County Office of Emergency Management hosted the in-person CPG Kick-Off Meeting on February 3, 2020. The CPG was introduced to the Hagerty consultants working on the project and were presented with the overall goals of the HMP update. This meeting also included a session on mitigation strategies and goal setting for the updated plan, a description of the project approach, and an overview of the project meeting dates and next steps.	Core Planning Group
Planning Committee Pre-Workshop Webinar	February 19 and 20, 2020	The Steering Committee held an informational webinar as part of preparation for the first Planning Committee meeting on February 19 and February 20 of 2020. The webinar covered an introduction to hazard mitigation planning, the expected roles and responsibilities of members of the Planning Committee, and an overview of the Planning Committee workshop.	Planning Committee
Planning Committee Workshop	March 5, 2020	The Steering Committee held an in-person workshop for the Planning Committee on March 5, 2020. The workshop attendees reviewed hazard mitigation planning processes and project approaches, examined the previous plan, discussed changes to countywide hazards and mitigation goals, and reviewed jurisdictional annex documents and how to fill out online forms.	Planning Committee
Risk Review and Mitigation Strategy Webinar	June 11, 2020	The Steering Committee held a webinar for the Planning Committee on June 11, 2020. The webinar allowed for the review of the results of the Risk Assessment and highlighted key problem statements and areas to consider for mitigation projects. Additional ideas for potential mitigation projects and funding opportunities were presented along with guidelines and requirements for reporting on past mitigation projects and developing two mitigation action worksheets.	Planning Committee
Stakeholder Webinar	June 12, 2020	The Steering Committee held a webinar for stakeholders on June 12, 2020. This webinar introduced stakeholders to the HMP Update process and reviewed what had changed since the last plan update. The CPG also reviewed the results of the	Stakeholder Group

Name	Date	Description	Participation
		Risk Assessment with the stakeholders.	
Jurisdictional Consultation Calls	June 25, 2020 – July 16, 2020	Each participating jurisdiction was given the opportunity to schedule a one-hour phone consultation with a Hagerty consultant to review their jurisdictional annex contents, document past mitigation actions, and develop mitigation action worksheets.	Planning Committee
Planning Committee Mitigation Strategy Review Webinar	August 20, 2020	The Steering Committee held a webinar for the Planning Committee on August 20, 2020 to review the draft Mitigation Action Plan. This webinar also allowed the Planning Committee to provide feedback about the planning process and discuss how local jurisdictions would adopt the plan.	Planning Committee
Planning Committee Review Webinar	September 16, 2020	The Steering Committee held the final webinar for the Planning Committee on September 16, 2020 to review the draft Plan, discuss plan maintenance and adoption, and review any submitted comments.	Planning Committee,
Public Meeting/ Webinar	October 8, 2020	The Steering Committee held a public webinar on October 8, 2020 to present the final draft Plan and start the public comment process.	Planning Committee, Stakeholder Group, Public

2.2.2 Outreach

In order to promote participation in the planning process, Nassau County conducted extensive outreach to all stakeholder groups throughout the planning process. This section details some of the different aspects of this outreach. Appendix A includes documentation from this outreach process.

2.2.2.1 Outreach Strategy

At the beginning of the planning process, the Steering Committee developed an outreach strategy to define which stakeholders would be involved in the Plan update and how stakeholders would be invited to participate in the process. The Outreach Strategy is comprised of three goals and six tactics that supported thorough and comprehensive stakeholder engagement throughout the Plan update process.

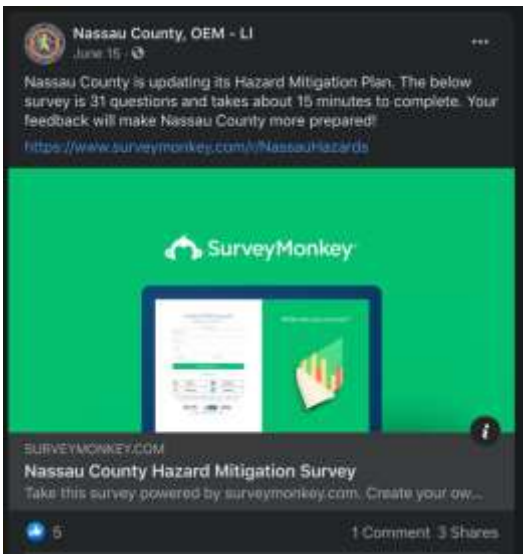
2.2.2.2 MailChimp Email Platform

The Steering Committee utilized the MailChimp Email Platform regularly to communicate with stakeholders regarding the planning progress, to distribute meeting invitations and follow up, and to send out periodic newsletters to the Planning Committee. A total of eight newsletters were sent out to the Planning Committee throughout the planning process. These newsletters aimed to continually update the committee on planning progress and remind them of current action items.

2.2.2.3 Social Media

In addition to the aforementioned methods of inviting and engaging with all levels of stakeholders, the Steering Committee utilized social media (e.g., Facebook) as a method of outreach to stakeholders, community groups, and the public. Additionally, the Steering Committee provided social media templates to members of the Planning Committee to utilize on their own social media pages to promote participation. ***Figure 3*** provides an example of a post from the Nassau County OEM's Facebook account to promote participation in the June 2020 public survey.

Figure 3: Example Social Media Engagement



2.2.2.4 Public Surveys

Two surveys were developed and distributed to Nassau County residents and business owners. The first survey was live from June 12 to July 20, 2020 and received responses from 278 individuals. This survey gathered information about the public's impressions of natural hazards and how they impact Nassau County.

The second public survey was the public comment form that was live from October 1 to October 30, 2020. This form and the draft hazard mitigation plan were posted on the Nassau County OEM website[1] for the 30-day public comment period. Survey summaries can be found in Appendix A.

2.3 Data Sources

The Planning Committee utilized a variety of existing data, new data, plans, and other documents to support the update of the Plan. The Planning Committee conducted an in-depth analysis of this data, including gathering stakeholder feedback and collecting response data to validate findings. These discoveries informed various aspects of the risk assessment and were incorporated into the development and prioritization of mitigation actions. Specific applications of data sources are included within subsequent plan sections. Data sources included, but were not limited to:[2]

Federal Data:

- NOAA NCEI Storm Events Database
- United States Geological Survey (USGS) Data
- United States Census Data

State Data:

- HAZNY Profile

Local Data:

- Nassau County GIS data
- Jurisdictional Survey responses
- Public Survey Responses

[1] Nassau County OEM website: https://www.nassaucountyny.gov/2813/Hazmit-Plan

[2] A complete listing of the references used for this HMP Update can be found in the Bibliography.

3 County Profile

The County Profile describes the characteristics of Nassau County that are relevant for consideration when developing mitigation actions to address natural hazard risk. The information presented in this section is countywide. Specifics for each jurisdiction are available in each of the Jurisdictional Annexes.

3.1 Location

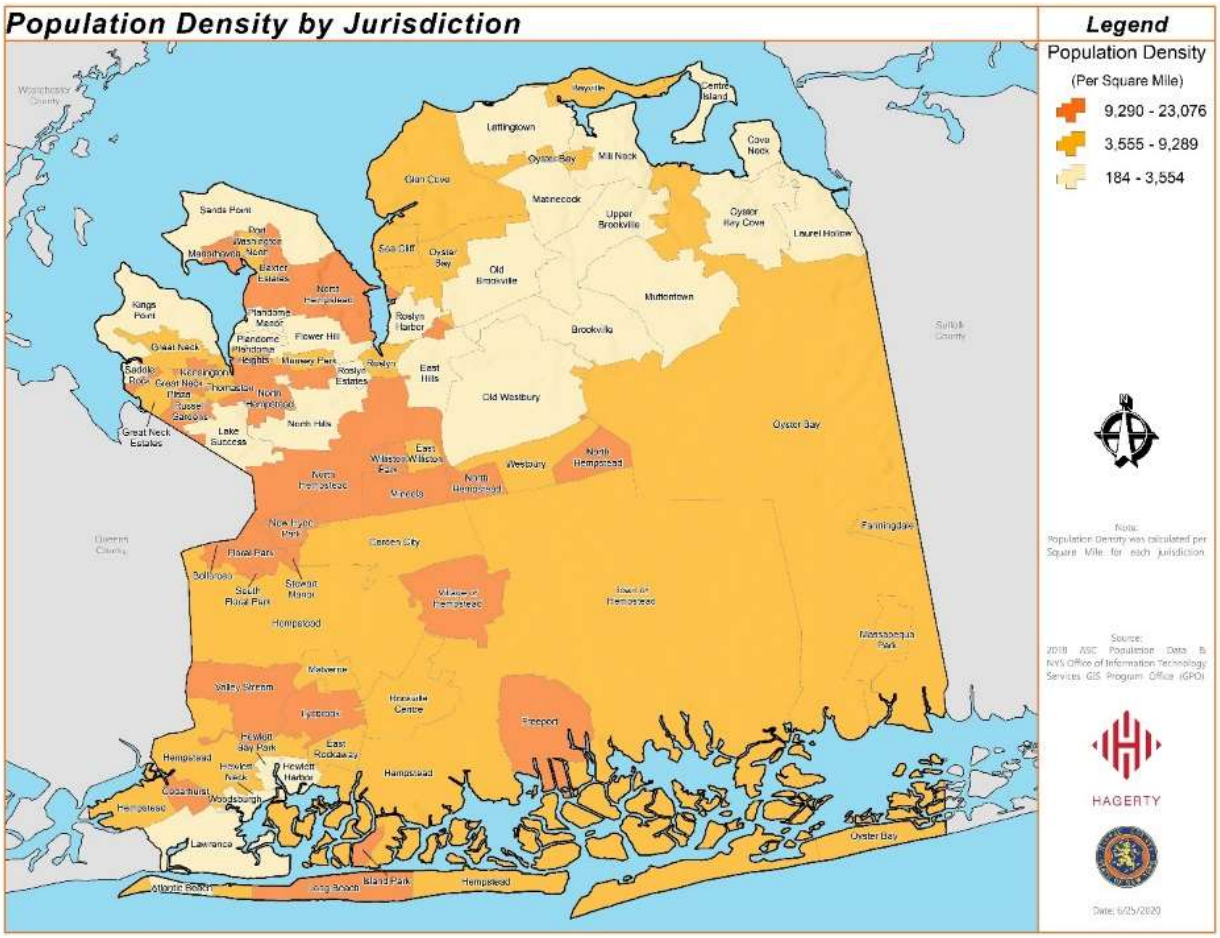
Nassau County is one of the four counties of Long Island, New York. The other three counties that make up Long Island are: Kings County, Queens County, and Suffolk County. Long Island is the longest island in the United States, extending east from New York City approximately 118 miles in length and approximately 20 miles across at its widest point. Nassau County is bounded by Queens County to the west, Suffolk County to the east, and is bordered by the Atlantic Ocean to the south and the Long Island Sound to the north.

Nassau County has a total area of 453.08 square miles, including 286.69 square miles (183,680 acres) of landmass and 166.39 square miles of water. Nassau County is comprised of two cities, three towns, and sixty-four incorporated villages.

3.2 Population Density

Nassau County has a population of 1,358,343 people (United States Census Bureau 2018) and a population density of 4,738.02 people per square mile. ***Figure 4*** provides a visual representation of the population density of the County. According to the 2018 American Community Survey 1-Year estimate, the population of Nassau County had grown approximately 1.4% since the Decennial Census was conducted in 2010, when the population was 1,339,532 (U.S. Decennial Census).

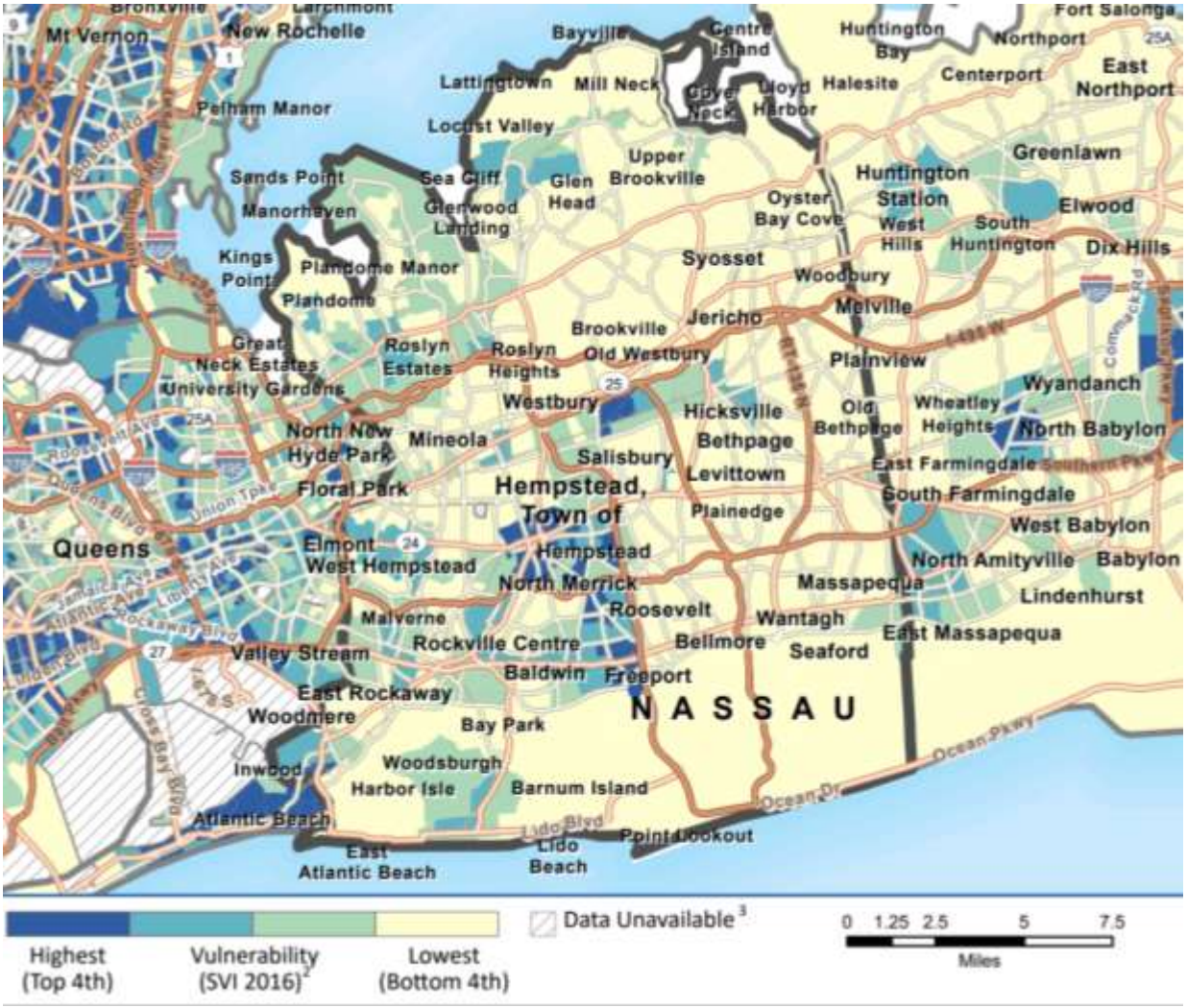
Figure 4: Population Density by Jurisdiction



3.3 Social Vulnerability

Social vulnerability provides valuable insight for the Nassau County Mitigation Program. Understanding the vulnerability of the Nassau County population allows the County to implement appropriate and effective mitigation strategies given the assets and availability of resources and considerations related to access and functional needs. ***Figure 5*** provides a visual representation of the areas of higher and lower social vulnerability in Nassau County. This map was developed by the Centers for Disease Control and Prevention, as part of the 2016 Social Vulnerability Index. The index considers factors like socioeconomic status, household composition/disability, race/ethnicity/language, and housing/transportation.

Figure 5: Social Vulnerability Index for Nassau County



3.3.1 Individual Assets and Availability of Resources

Individual assets and availability of resources is critical for mitigation planning and implementation, because it indicates the ability for individuals to invest in personal preparedness and mitigation practices, and also shows where the County may need to provide additional support.

- **The average median household income is approximately $116,304** (United States Census Bureau 2018)**.** This is higher than both the average United States' and New York's median household income, suggesting that populations in the County may be capable in investing in personal preparedness and mitigation actions.
- **An estimated 5.6% of Nassau County residents are below the federal poverty level** (United States Census Bureau 2018)**.** Preparing for disasters can often be costly for those with few resources and illustrate that there may be an increased need.
- **Nassau County has a high level of homeownership, with only 20.2% of the total population consisting of renters.** Homeowners are less mobile and often indicate increased resilience through assets and resources.

3.3.2 Disabilities, Access, and Functional Needs

Understanding and addressing social vulnerability through hazard mitigation planning also involves accounting for individuals with disabilities or access and functional needs. Access and functional needs can refer to a wide range of scenarios, but may include individuals with disabilities, older adults, younger children, individuals that have English as their second language, and individuals with limited internet access. Mitigation actions should account for the needs of everyone and include considerations that ensure accessibility of things like communication and transportation. These populations are critical to consider and integrate into planning in order to produce a plan that serves the entire community.

- **Approximately 17.8% of the population in Nassau County is over the age of 65 and approximately 5.5% of the population is under the age of 5** (United States Census Bureau 2018)**.** Both populations can be largely dependent on caregivers and can experience difficulties that makes them vulnerable in the event of a disaster.
- **An estimated 8.0% of the Nassau County population are individuals with a disability, compared to the 12.6% of the United States' population, and 11.5% of the New York State Population.** Disasters are inherently high-risk events for those with disabilities. Understanding the size and concentration of populations with disabilities can ensure that Nassau County is prepared to serve those populations before, during, and after a disaster.
- An estimated 29.3% of Nassau County that primarily speaks a language other than English at home (United States Census Bureau 2018). Individuals that have language barriers can be a major challenge when communicating with the community.
- **Approximately 11.1% Of the Nassau County population does not have access to a broadband internet subscription.** Lack of communication can be detrimental before, during, and after a disaster. It is imperative that Nassau County has methods in place to reach all its residents and visitors in the event of an emergency (United States Census Bureau 2018)

In order to better address the needs of individuals with access and functional needs related to a disaster, Nassau County has developed a *Disaster Checklist For Nassau County Residents With Access And Functional Needs Preparing At Home* available on the County's website to better support disaster preparedness.

3.4 Natural Environment

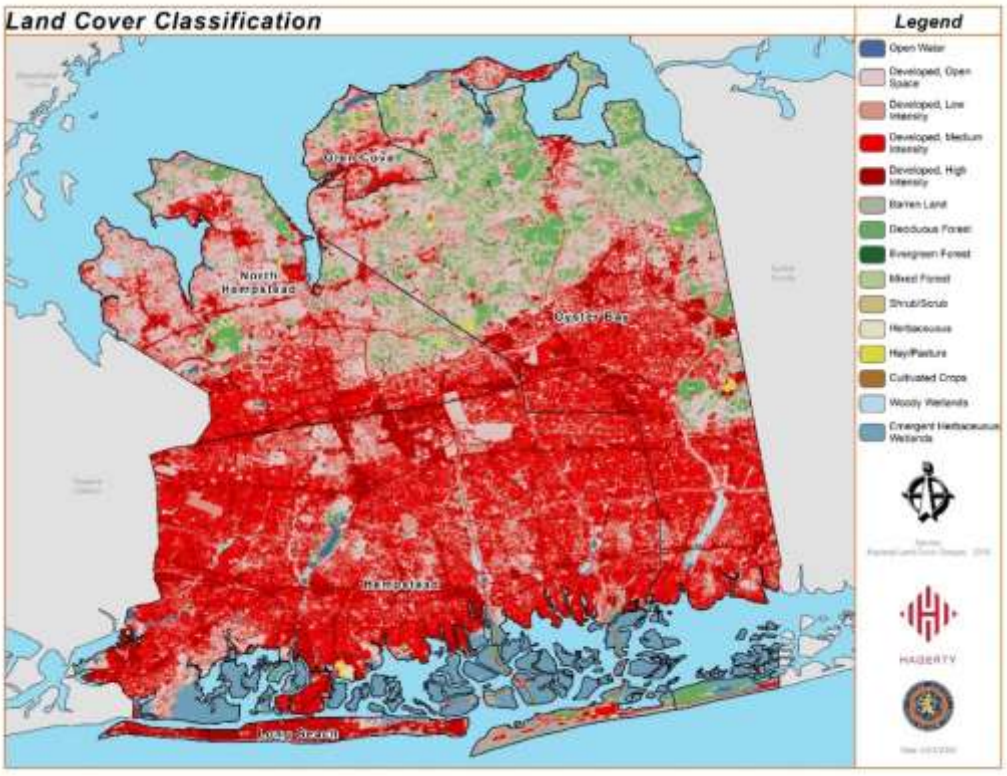
3.4.1 Climate

New York State's climate is primarily classified as 'Humid Continental,' like much of the northeastern United States. The average annual temperature is approximately 55°F in the New York City metropolitan area that Nassau County is a part of. The average precipitation totals in the Nassau County area are around 50 inches a year. Snow totals are kept below 36 inches a year in Long Island due to the warming influence of the Atlantic Ocean. The County also experiences the damaging effects of coastal storms like nor'easters and tropical cyclones (Rosenzweig, et al. 2011).

3.4.2 Land Cover

In Nassau County, medium intensity developed land covers the largest percent of land (33.62%) and developed land in totality represents 80.52% of Nassau County, as shown in ***Figure 6***. The northeastern part of Nassau County encompasses the largest portion of undeveloped land, most of it being deciduous forest. A significant portion of Nassau County's southern coastline bordering the back bays is covered with herbaceous wetlands.

Figure 6: Nassau County Landcover Classification



3.4.3 Hydrology and Hydrography

Nassau County is a coastal county. All of Nassau County is in the Atlantic Ocean/Long Island Sound Watershed, which encompasses all of Long Island, New York City, and areas north to White Plains. (New York State Department of Environmental Conservation 2020). This watershed consists of several smaller HUC 10 watersheds, four of which can be found in Nassau County as shown in ***Figure 7***.

Figure 7: Nassau County Watersheds and Rivers

3.4.4 Climate Projections

The 2014 Supplement to the New York State report on responding to climate change, ClimAID, places Nassau County in Region 4 in their division of the state. This region, compared to the baseline temperature of 54.6°F from 1971-2000, is expected to have a temperature increase between 2.0°F-2.9°F (25th to 75th Percentile) in the 2020s. The 2014 Supplement also predicts an increase in precipitation in Region 4 to be between 1 and 8% (25th to 7^{5th} Percentile). Sea level is projected to rise by four to eight inches (25th to 75th percentile). The findings of the 2014 Supplement are in line with the findings of the original report in 2011 (Horton, Bader, et al., Climate Change in New York State: Updating the 2011 ClimAID Climate Risk Information 2014).

3.5 Economy

The civilian employed population of Nassau County is estimated to be 694,792. The largest employing sectors include:

- health care and social assistance (113,444),
- educational services (86,979),
- professional, scientific, and technical services (68,257),
- retail trade (62,638), and
- finance and insurance (55,922) (ACS 1-Year, 2018).

The Long Island Regional Economic Development Council (LIREDC) supports economic development in the Long Island region. This region is inclusive of Nassau and Suffolk Counties. The top 10 employers in the region include: Broadridge Financial Solutions, Good Samaritan Hospital Medical Center, Hofstra University, Home Depot, King Kullen, Northwell Health, Prestige Employee Administrators, ProHEALTH Care, Stop & Shop Supermarkets, and Winthrop-University Hospital.

3.6 Housing

There are an estimated 473,454 housing units in Nassau County. The majority are single unit detached (76.1%); buildings with 20 or more units account for only 8.5% of the total housing units. Of the total housing stock, 69.0% were built prior to 1959 and 94.4% (447,123) are currently occupied (2018 ACS 1-Year).

3.7 Critical Facilities

> **Critical facilities** provide essential services to communities. If these facilities are damaged from a natural disaster, their services may be interrupted. As a result, a community's safety, economy, and livelihood may be temporarily disrupted.

An overview of these facilities is outlined below.

- **Police:** Nassau County has eight police precincts and one police headquarters. There are 21 village police departments.
- **Fire:** Nassau County has 71 fire departments that are broken down into nine battalions
- **Healthcare:** Twelve hospitals, 21 dialysis centers, and 35 nursing facilities located throughout the County. There are additionally six volunteer ambulance corps that have a total of 16 ambulances.
- **Roadways:** There are 23 major roadways and two major bridges that support traffic in and around communities within Nassau County. The Long Island Expressway runs through the entire County. There are five major State thoroughfares that run through Nassau County that include six bridges on three of them.
- **Rail:** Nassau County is served by the Long Island Rail Road (LIRR) with all trains from the nine branches of the railroad passing through Nassau County.

- **Bus Transit:** network of bus lines that links 96 communities through 51 routes in Nassau County, western Queens, and eastern Suffolk Counties.
- **Utilities:** Nassau County's electric and gas utility service from PSEG-Long Island and National Grid Corporation. The Villages of Freeport and Rockville Centre own and operate their own electric systems and use either their generated power or purchased power to serve their residents.

Nassau County has a variety of critical facilities potentially vulnerable to natural hazards. The vulnerability of these facilities and mitigation actions to address the risk are outlined primarily in the Risk Assessment section, where the impact of particular hazards on critical facilities was analyzed using the FEMA Hazus analysis. Additional planning efforts may consider the compilation and consolidation of local data to have a comprehensive database for critical facilities in the County.

4 Risk Assessment

The Risk Assessment profiles the natural hazards[3] that impact Nassau County most frequently and cause the greatest impacts to people, infrastructure, and property. The information presented in the Risk Assessment will inform the development of mitigation projects (or actions) that address the risks identified, as presented in the ***Mitigation Strategy***. This section of the Plan is organized into two sections. First, the ***Methodology, Data, and Tools*** section describes the data and analysis techniques used to identify and assess risk. The rest of the Risk Assessment contains profiles for each hazard that describe its characteristics, location and extent, recent occurrences, and probability of occurrence. Each profile also estimates the impact of the hazard on the County, should it occur, and discusses the vulnerability of people, property, and the environment to the hazard.

4.1 Methodology, Data, and Tools

4.1.1 Methodology

The Risk Assessment process identifies and profiles hazards that concern the community, and then assesses the vulnerability of community assets (population, structures, critical facilities, and the economy) at risk. A Risk Assessment provides the foundation for a community's decision makers to evaluate mitigation measures that reduce the impacts of a hazard (***Mitigation Strategy*** section of this Plan).

4.1.1.1 Hazard Identification

The first step of the Risk Assessment for Nassau County identified the hazards of concern. Hazards of concern are defined by the County based on State and Federal guidance and history of hazard occurrences. This update to the Nassau County Hazard Mitigation Plan identifies 11 natural hazards of concern:

- Coastal Hazards
- Drought
- Extreme Temperatures
- Flooding
- Ground Failure Hazards
- Hail
- Hurricanes and Tropical Storms
- Lightning
- Tornados
- Severe Winter Weather
- Straight-line Wind

None of the participating jurisdictions identified other natural hazards that uniquely impacted the community. Since the previous plan update, the categories of risk were modified and expanded. ***Table 4*** provides a justification for the identification of these 11 hazards and how they connect to the hazards identified in the 2014 plan.

[3] FEMA's current regulations require an evaluation of only natural hazards; however, it is possible to include additional hazards in future updates of the Nassau County Hazard Mitigation Plan.

Table 4: Hazard Identification

Hazard	Reason for Identification	Connection to 2014 Plan
Coastal Hazards	• Review of State Plan • Planning Committee and County Department of Public Works Input • Data collected as a result of DR 1899, 1957 4020, 4085	• Coastal Erosion • Wave Action
Drought	• Review of State Plan • Planning Committee and County Department of Public Works Input	Drought
Extreme Temperatures	• Review of data on the NOAA National Climatic Data Center website • Planning Committee and County Department of Public Works Input	New Hazard
Flooding	• Review of State Plan • Planning Committee and County Department of Public Works Input	New Hazard
Ground Failure Hazards	• Review of State Plan • Planning Committee and County Department of Public Works Input	• Earthquakes • Expansive Soils • Land Slides • Land Subsidence
Hail	• Review of State Plan	New Hazard
Hurricane and Tropical Storms	• Planning Committee and County Department of Public Works Input • Data from DR-4020 and 4085	Hurricane and Tropical Storm
Lightning	• Review of State Plan	New Hazard
Tornados	• Review of State Plan • Review of NOAA website • Planning Committee and County Department of Public Works Input	Tornados
Severe Winter Weather	• Review of State Plan • Review of NOAA website • Planning Committee and County Department of Public Works Input	Severe Winter Weather
Straight-line Wind	• Review of State Plan • Planning Committee and County Department of Public Works Input	Extreme Winds

The following natural hazards are not included in this Plan based on State and Federal guidance and history of hazard occurrences that indicate these hazards are unlikely to occur or cause damage:

- Avalanches
- Geomagnetism
- Ice Jams
- Tsunamis
- Volcanoes
- Wildfires

Climate change, the change in global climate patterns over a long period of time (NASA 2020), is not explicitly profiled as a hazard in this Plan. Observable local and regional impacts of climate change, including an increase in average daily temperatures and sea-level rise, influence the location, frequency, and extent of hazards in Nassau County (Horton, Bader, et al., Climate Change in New York State: Updating the 2011 ClimAid Climate Risk Information Supplement to NYSERDA Report 11-18 2014). Each hazard profile provides a discussion of the expected potential impacts of climate change for the specified hazard. In summary, by 2050 Nassau County is expected to experience:

- An increase in average temperatures between 3.1°F and 6.6°F;
- An increase in probability of precipitation between 1% and 13%;
- An increase in sea level between 8 and 30 inches; and
- An increase in days over 90°F between 14 to 39 days.

4.1.1.2 Hazard Profile Preparation

After hazard identification, the next step in the Risk Assessment process is hazard profile preparation. This profile is designed to support evaluation of hazard risk for the jurisdictions participating in this Plan update. Each hazard profile identifies the potential variation in hazard extent and location. Furthermore, each hazard profile calculates the probability of occurrence for that hazard (see ***Probability***).

The probability of occurrence is a key consideration for determining and understanding the risks associated with each hazard. In the context of the Nassau County Hazard Mitigation Plan Update, the probability is an estimate of how often a hazard event will occur and was calculated using the number of historical occurrences for a given time period. Based on this calculation, each hazard was categorized into three probability groups defined for this Plan:

- **Highly Likely**: a hazard that occurs one or more times every year
- **Likely**: a hazard that occurs at least once every five years
- **Unlikely**: a hazard that occurs less than every five years

For example, if four hazard events occurred over the course of 10 years, then it is estimated that 0.4 events occur in one year, or two events occurs every five years. This would be considered a likely event, since it occurs at least once every five years, but does not occur more than once in one year. In addition to the calculating probability based on historical occurrences, projections for future hazard events, especially due to climate change, were included in applicable hazard profiles to further contextualize apparent risk. The probabilities of each profiled hazard in the Risk Assessment are summarized in ***Table 5*** below.

Table 5: Summary of Hazard Probabilities

Probability Category	Hazards
Highly Likely	Coastal Hazards, Flooding, Severe Winter Weather, Straight-line Wind,
Likely	Drought, Extreme Temperatures, Hail, Hurricanes and Tropical Storms, Lightning
Unlikely	Ground Failure Hazards, Tornados

4.1.1.3 Understanding Risk

Understanding the risk posed by each hazard is the last step in the Risk Assessment process. Each hazard will have a different impact on each jurisdiction in Nassau County due to their unique geography, local development, population distribution, building stock, and existing mitigation measures. Data regarding population, demographics, general building stock, and critical facilities at risk informed the identification of the County's vulnerabilities. This analysis informed the development of the ***Mitigation Strategy***.

The results of the Hazards New York (HAZNY) analysis is one methodology for understanding risk. This proprietary analysis from the State of New York uses a variety of factors to assign a numerical value to each hazard's risk and impact, including scope, frequency, impact, onset, and duration. The numerical values are categorized according to the following risk scale:

- 321 to 400: High Hazard
- 241 to 320: Moderately High Hazard
- 161 to 240: Moderately Low Hazard
- 44 to 160: Low Hazard

Table 6 outlines the results of the HAZNY analysis for the hazards as they relate to the Nassau County Hazard Mitigation Plan.[4] Details from the HAZNY results specific to each hazard are provided in the ***Impacts and Vulnerability*** sections of each hazard profile.

[4] Note, the HAZNY analysis analyzes 34 hazards, not all of which are considered in the Nassau County Hazard Mitigation Plan.

Table 6: HAZNY Hazard Ranking[5]

Rank	Hazard	Hazard Rank	Rank	Hazard	Hazard Rank
1	Hurricane/ Coastal Storm	High Hazard	T-10	Tornado	Moderately Low Hazard
3	Coastal Flooding/Wave Action	Moderately High Hazard	T-18	Earthquake	Moderately Low Hazard
4	Flooding /Inland	Moderately High Hazard	T-18	Extreme Temperatures	Moderately Low Hazard
6	Severe Storm	Moderately High Hazard	29	Landslide	Low Hazard
T-7	Winter Storm (Severe)	Moderately High Hazard	32	Drought	Low Hazard

4.1.2 Data and Tools

4.1.2.1 Storm Event Database

Past occurrences data for several of the hazards profiled in this Risk Assessment was obtained from the National Oceanic and Atmospheric Administration (NOAA) Storm Events Database, as maintained by the National Centers for Environmental Information (NCEI) (NCEI 2020). The database documents the occurrence of storms and other significant weather phenomena that caused loss of life or property, injuries, and disruptions to commerce. While the database has varying years of record for the different hazards, the hazards identified in this Plan have consistent data since 1996.

4.1.2.2 Disaster Declarations

Major disaster declarations are made by the President when natural hazards cause damage that is so severe that it is beyond the capacity of the local and state governments to respond.[6] Since 2010, Nassau County has had six major disaster declarations, described in ***Table 7*** (FEMA, OpenFEMA Dataset: Disaster Declarations Summaries - V2 2019).

[5] The use of "T" indicates that two or more hazard were tied for the same ranking in the analysis.

[6] Major disaster declarations can be made by the President of the United States, as authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. §§ 5121-5207.

Table 7: Major Disaster Declarations in Nassau County

Declaration Year	Event Title	Declaration Number
2010	Severe Storms and Flooding Associated with Tropical Depression Ida and Nor'easter	DR-1869
2010	Severe Storms and Flooding	DR-1899
2011	Severe Winter Storm and Snowstorm	DR-1957
2011	Hurricane Irene	DR-4020
2012	Hurricane Sandy	DR-4085
2020	COVID-19 Pandemic	DR-4480

In addition to the major disaster declarations outlined in ***Table 7,*** some jurisdictions on the eastern border of Nassau County may have been impacted by hazard events that had major disaster declarations in Suffolk County. Events where this is known to be the case include:

- Severe Winter Storm and Snowstorm (DR-4111) in 2013
- Severe Winter Storm and Snowstorm (DR-4322) in 2017

4.1.2.3 Geographic Information Systems Database

ArcGIS is a geographic information system (GIS) software from the Environmental Systems Research Institute (Esri) that was used to visualize data, perform geospatial analysis, and develop maps for this Plan.

4.1.2.4 Hazus

FEMA's loss estimation software, Hazus-MH 4.2 (Hazus), was used to model the damages and estimate the losses associated with ***Flooding***, earthquakes (***Ground Failure Hazards***), and wind (***Hurricanes and Tropical Storms***). All estimated losses from this Hazus analysis are derived from default national databases and may contain inaccuracies. Therefore, all loss and damage estimates from this analysis should be used for planning applications only. The damaged building counts generated are susceptible to rounding errors because they are based off 2010 census block data. This error, as well as additional potential errors associated with hydrologic and hydraulic modeling within Hazus, are detailed below.

Flood Analysis

The flood analysis performed was a Level 1+. The analysis used custom depth grids that provide an estimated depth of flooding at a given location within Nassau County. The depth-damage function of Hazus then generated damage estimates, directly related to flood depth, and the estimated monetary cost of those losses. Information from this analysis can be found in the ***Flooding*** profile.

The custom depth grids used in this analysis were derived from the FEMA 100 year and 500 year floodplains and were used in place of those created by the Hazus system. These depth grids were developed by the State of New York and the Center for International Earth Science Information

Network (CIESIN), with support from the New York State Energy Research and Development Authority (NYSERDA).

One limitation of the Hazus software is that it assumes an even distribution of population and buildings over a census block. Although flooding may occur in a small section of the area where no building or people are located, the model assumes damage to the entire census block. Potential discrepancies may exist in the extent and/or depth of the generated floodplains due to the cell size of terrain used in the analysis. In addition, the only losses calculated here are those where the custom 100 year and 500 year depth grid is present, which incorrectly assumes that flood losses are not present in other areas of the County. Despite these limitations, the results from the Hazus Level 1+ flood analysis adequately describe the impacts and vulnerabilities associated with flooding hazards. However, a full Hazus Level II analyses based on local building inventory, higher resolution terrain data, and additional digital floodplain data could be used in the future to refine and improve the accuracy of the results and losses discussed in this Plan.

Earthquake Analysis (Ground Failure)

The earthquake analysis conducted was a standard Level 1 analysis to estimate the losses associated with 250 year and 1000 year earthquake events with a magnitude of 7.0. This analysis used default hazard, inventory, and damage information. Direct economic and social losses associated with the general building stock and essential facilities were computed.

Limitations related to the assumptions of the model include that one average soil condition is assumed for the entire study region, and the effects of liquefaction and landslide hazards are not incorporated. In general, uncertainty is large with these results. As described previously, these damage and loss estimates can be imprecise and inaccurate when limited to the baseline data. This type of Level 1 analysis is suitable for comparisons and preliminary estimates to help assess potential mitigation actions in Nassau County. Information from this analysis can be found in the ***Ground Failure Hazards*** profile.

Wind Analysis (Hurricane and Tropical Storms)

The wind analysis performed was a standard Level 1 to calculate losses associated with a 100 year and 500 year wind event. The analysis primarily used data provided within the software (e.g., census information and broad regional patterns of foundation distributions). The results from a Level 1 analysis are general and appropriate as initial loss estimates to determine where more detailed analyses are appropriate.

The wind analysis uses the general building stock and essential facility databases provided by the model. These databases are derived from national-level data sources for building square footage, building value, population characteristics, costs of building repair, and economic data. Similar to the earthquake and flooding analyses, the use of default data sources contributes to large levels of uncertainties with these estimates.

Information from this analysis will be used to inform the ***Hurricanes and Tropical Storms*** profile. However, it is important to note that the Hazus model separates the flooding and wind impacts of hurricanes into two separate analyses. Therefore, while the wind analysis does capture losses associated with hurricane and tropical storms, it does not fully represent flooding impacts those

events may have on Nassau County. The various impacts of these complex storm events span multiple hazard profiles.

4.2 Coastal Hazards

4.2.1 Characteristics

Coastal hazards impact Nassau County's coastline and damage buildings and infrastructure near the water. Coastal hazards include coastal erosion, strong wave action, sea level rise, rip tides, and coastal flooding.

Coastal erosion occurs when ocean waves wear down and wash away sand and rocks from the beach. The high winds and low atmospheric pressure associated with a coastal storm (e.g., tropical storms, hurricanes, and nor'easters) cause a rise in sea level, or "storm surge," as the storm approaches the shoreline. When the storm reaches land, it can cause coastal flooding, high waves, and strong currents that accelerate erosion (Miller 2019).

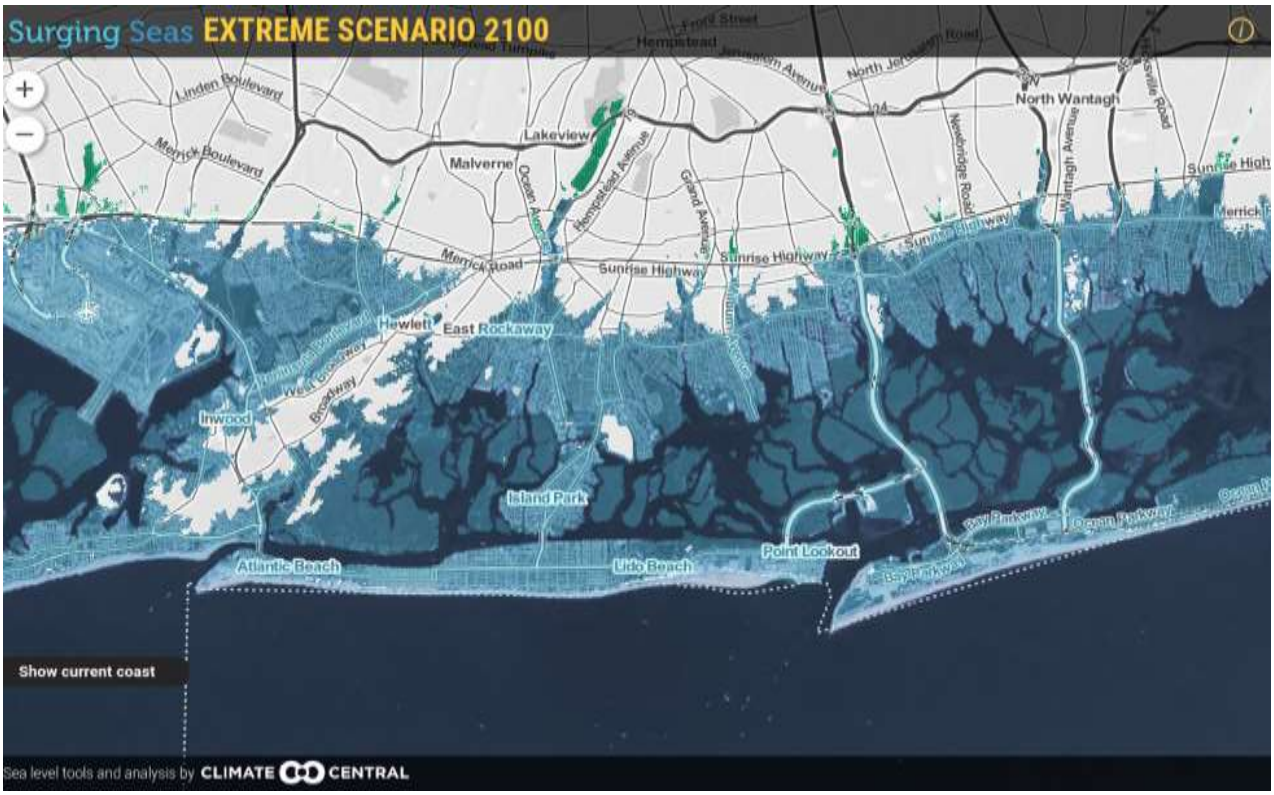
Ocean tides can also pose risks to coastal areas. Tides are caused by the gravitational pull of the sun and moon. A full moon has the greatest gravitational pull and will cause the most extreme high tides, which can contribute to coastal flooding and increased erosion rates. Rip tides, or undertow, are common along beaches and can transport significant amounts of sediment offshore, similarly contributing to altering shorelines (Miller 2019).

Finally, global sea level rise associated with climate change can interact with other coastal hazards, increasing the frequency and severity of their impacts. As a result, coastal communities may experience more frequent and extreme coastal flooding, storms, high tides, and erosion rates (Coasts 2019).

4.2.2 Location and Extent

Coastal hazards have the potential to impact any community along Nassau County's 188 miles of coastline (Fallon 2018). The County's southern shoreline is greatly exposed to the effects of coastal erosion, wave action, currents, and sea level rise from the Atlantic Ocean. Most of Nassau County's south shore is offered some degree of protection by its barrier islands and tidal wetlands in the back-bay areas; however, erosion and wave action historically have been problems on the south shore. Along the south shore, waves and wind often come from the southeast, resulting in a current that moves sand from east to west, typically at a rate of up to 500,000 cubic yards each year (Fallon 2018). Mid-to-long-term sea level rise projections show significant inundation of Nassau County's south shore, as shown in ***Figure 8***. This specific projection assumes roughly three degree Celsius of warming over the next 100 years, if carbon emission-levels remain consistent with current levels. In this scenario, sea-level globally is expected to rise by 4 feet 9 inches, with the US levels exceeding those found globally (Climate Central 2020). ***Figure 8*** below depicts localized projected sea level rise levels under this "extreme" scenario.

Figure 8: Nassau County South Shore Sea Level Rise Map



Nassau County's north shore is also exposed to coastal erosion and wave action, but from the Long Island Sound. This shoreline is irregular, with sandy beaches backed by high bluffs, in addition to many inlets, bays, and harbors. The irregularity of the north shore results in a slower rate of sediment movement of approximately 100,000 cubic yards each year (Fallon 2018).

The extent of coastal hazards cannot be measured by a single scale. Rather, the factors that combine to cause coastal hazards can be measured separately. For example, coastal erosion is measured by the rate of linear retreat (feet of recession per year) or volumetric loss (cubic yards of sediment eroded per year) (FEMA, Understanding Your Risks: Identifying Hazards and Estimating Losses 2001). NOAA has established three coastal flood thresholds based on the amount of water rise above normal tide in a particular area: minor (more disruptive than damaging), moderate (damaging), and major (destructive). These thresholds can be used to issue a flood advisory (for minor) or warning (for moderate or major) (N. O. Services 2018). The *2019 New York State Hazard Mitigation Plan* describes what the impacts of these three coastal flooding levels would look like:

- Minor flooding is nuisance coastal flooding of locations adjacent to the shore. Minor beach erosion can occur. Minor coastal flooding is not expected to close roads or do cause any major structural damage to homes and other buildings.
- Moderate flooding is more substantial coastal flooding, threatening life and property. Some roads may become impassable due to flooding. Moderate beach erosion will occur along with damage to some homes, businesses, and other facilities.
- Major flooding is a serious threat to both life and property. Numerous roads will likely become flooded. Many homes and businesses along the coast will receive major damage.

People should review safety precautions and prepare to evacuate if necessary. Major beach erosion is also expected.

4.2.3 Recent Occurrences

Over the last 10 years, Nassau County has been impacted by several coastal storms that have caused significant erosion, flooding, and degradation along its coastlines. A summary of major recent coastal storms is detailed in ***Table 19*** in the ***Hurricanes and Tropical Storms*** section.

According to the NOAA Storm Events Database, strong rip currents in southern Nassau County led to four fatalities between 2015 – 2018 (NCEI 2020). Also, between 2010 and 2020, coastal communities in Nassau County reported two incidents of storm surge. One of the incidents occurred during Hurricane Sandy. Maximum water levels were well above the National Weather Service threshold for major coastal flooding, resulting in widespread flooding along Nassau County's north and south coastlines.

In addition, there have been reports of significant storm surge associated with the following historic hurricanes and tropical storms:

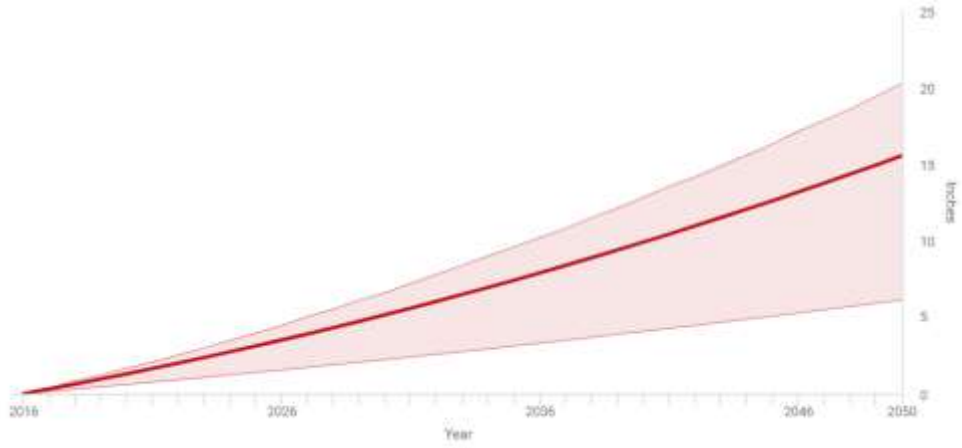
- The New England Hurricane (also known as the Long Island Express) hit Long Island on September 21, 1938 as a Category 3 (winds 111-130 mph) and devastated the coast of Long Island with storm surges of 10 to 12 feet.
- Hurricane Donna of 1960 started as a Category 4 and hit Nassau County as a Category 3 (winds 111-130 mph). Maximum tides in Nassau County were below 8.6 feet. High tides and roadway flooding were widespread.

Measurements from a tide gauge in Battery, New York show that sea levels in the area have risen by nearly nine inches since 1950. The rate of sea level rise has accelerated in recent years, with sea levels now rising by one inch in just seven-to-eight years (SeaLevelRise.org 2016).

4.2.4 Probability

The probability of occurrence for coastal hazards in Nassau County is **highly likely**, with more than one event expected on average each year based on historic occurrences of coastal floods, storm surge, and tidal events. As ***Figure 9*** shows, the sea level rise forecast for Village of Kings Point is nearly a 15-inch increase between 2016 and 2050 (SeaLevelRise.org 2016). This increase in sea level will increase the probability of coastal hazards negatively impacting Nassau County's coastal areas. Coastal flooding will become more frequent, storm surges will bring water farther inland, and coastal erosion will occur at a higher rate.

Figure 9: Sea Level Rise Forecast for Village of Kings Point, Nassau County, New York



4.2.5 Impacts and Vulnerability

According to the HAZNY risk assessment, coastal hazards, including coastal flooding and wave action, are ranked a moderately high hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Coastal Flooding/Wave Action	
Rank	Moderately High Hazard
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Highly Likely
Frequency	A Frequent Event
Onset	Several Days Warning
Hazard Duration	Two to Three Days
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Surrounded by two major water bodies to the north and south, Nassau County is particularly vulnerable to coastal hazards that can threaten the life and safety of people, damage property and the natural environment, and cause significant disruptions to economies. Southern Nassau County consists of densely developed beach and waterfront communities (e.g., City of Long Beach, Village of Atlantic Beach, Village of Island Park) that are vulnerable to coastal flooding caused by storm surge and high-tides, as well as sea level rise. Storm surge can have particularly devastating effects in this area of Nassau County, especially for communities located along the back bays that lie between the barrier islands and mainland. When storm surge from the Atlantic Ocean enters the back bays through the Village of East Rockaway, Jones, and Fire Island Inlets, water can inundate these highly developed and low-lying areas. Back bay flooding also occurs when high winds move over the back bays and cause water to “pile up”.

The northern communities of Nassau County are also susceptible to coastal flooding from storm surge and high-tides, though to a lesser degree compared to the southern part of the County. Coastal erosion causes significant impacts to the landscape of northern Nassau County, though. Many homes and businesses located along the coastline are threatened by erosion and may need to consider relocation and other mitigation measures in the future.

Coastal storms, including tropical cyclones and nor'easters, can have devastating impacts on the natural environment. For example, Hurricane Sandy catalyzed coastal dune loss and erosion in parts of Long Island that historically would have taken approximately 30 years to occur according to the United States Geological Survey (USGS) estimates (Conners 2012). This and other increasingly common and intense coastal hazards will have cascading impacts on the County's economy, infrastructure, and residents (NOAA 2020, Coasts 2019).

Efforts by local, state, and federal entities are underway to reduce the impacts of coastal hazards in Nassau County. In April 2019, the United States Army Corps of Engineers (USACE) announced that the official completion of a multi-year project designed to reduce risk to coastal storms in the City of Long Beach (Miller 2019). The federally-funded project involved constructing and rehabilitating groins, installing nearly 300,000 tons of rock, widening the beach, and reinforcing sand dunes with over 3 million cubic yards of sand (Miller 2019). The USACE is also currently conducting the Nassau County Back Bays coastal storm risk management study, in coordination with Nassau County and the New York State Department of Environmental Conservation. Hurricane Sandy's devastating storm surge inundation in Nassau County, as well as other parts of New York and New Jersey, was the impetus behind this risk management study. This study is currently examining the feasibility of different measures to mitigate the future impacts of storm surge on back bay communities. Some of the measures being examined include flood walls, bulkheads, storm surge barriers, non-structural measures, and natural and nature-based features (US Army Corps of Engineers n.d.).

The coastal regions of Nassau County are also expected to be adversely impacted by climate change. Climate change is expected to exacerbate the impacts of coastal hazards by increasing the frequency and intensity of coastal storms and raising the strength and intensity of wave action. Individual storms, strengthened by elevated sea levels and sustained by increasingly warm water temperature, will have devastating impacts.

One secondary impact of coastal hazards is saltwater intrusion, a process by which saline water moves into freshwater aquifers, contaminating drinking water. In general, saltwater intrusion can occur when too much fresh groundwater is pumped out of an aquifer, allowing the saltwater to migrate landward. Coastal hazards like sea level rise can increase the likelihood of saltwater intrusion happening. If the level of the sea is higher than the fresh groundwater level, the higher gradient water will flow towards the lower fresh groundwater. Storm surges may also push salt water inland and over the marshes on the south shore (e.g., Long Beach) and north shore (e.g., Port Washington, Kings Point, etc.) of Nassau County, contaminating drinking water wells. Continued monitoring of wells for contamination and digging deeper wells will help mitigate the future impacts of saltwater intrusion.

4.3 Drought

4.3.1 Characteristics

Droughts are typically defined as prolonged periods of dryness caused by consistently dry weather and result in deficiencies in water supply. In New York State, periods of drought are determined by comparing current precipitation levels to expected trends. Precipitation levels are calculated by monitoring precipitation depth, stream flows, and water levels in aquifers, lakes, and other water bodies (Management n.d.). There are four different kinds of droughts that communities can experience: (Planning 2019)

- **Meteorological drought** occurs when an area experiences less precipitation than expected over a certain time period, unprecedented dry conditions. The length of this period depends on the region. For example, areas characterized by year-round precipitation may identify meteorological droughts based on the number of days with precipitation below a certain threshold.
- **Hydrological drought** is the product of reduced precipitation and is characterized by changes in surface and subsurface water levels. The impacts of this type of drought can last for years beyond the initial onset of the drought. Potential impacts of this type of drought include reduced stream flow rates, decreased snowpack, and depleted aquifers.
- **Agricultural drought** is characterized by soil moisture deficits, lack of precipitation, and depleted water resources needed for irrigation, including groundwater aquifers and reservoirs. This type of drought is defined by its impact on agriculture; including crops, livestock, and forestry.
- **Socioeconomic Drought** is characterized by when the supply of goods is unable to meet the demand due to a meteorological, hydrological, or agricultural drought. An example of this type of drought is if a hydroelectric dam is unable to meet the demand of power from a community due to a drought that decreased the flow rate of its associated water source.

In New York, the Department of Environmental Conservation (DEC) monitors droughts. Management of droughts is outlined by the *New York State Comprehensive Emergency Management Plan* and its associated *Drought Management Coordination Annex*. The DEC has 13 drought regions that are roughly delineated by the state's watersheds; Nassau County is in Drought Region I. These drought regions help the DEC monitor precipitation in relation to the water levels of lakes, reservoirs, streams, and groundwater to actively assess the drought. To further drought monitoring, the USGS operates a groundwater-monitoring network on Long Island that includes Nassau County. Because groundwater is a primary source of water for Long Island's three million people, this monitoring network is critical for assessing short and long-term changes within Long Island's aquifer system (N. Y. Center 2018).

4.3.2 Location and Extent

Droughts can occur in any part of Nassau County. When droughts occur, they can impact regions and even multiple states simultaneously. The NYS DEC regularly publishes a drought monitoring report to show areas that are under a drought watch, warning, or emergency, according to the State Drought Index. The State Drought Index compares four parameters to "normal" or historic values to evaluate drought conditions: stream flows, precipitation, lake and reservoir storage

levels, and groundwater levels (N. Y. Center 2018). This index helps to assess the impact of drought on human welfare and the regional economy.

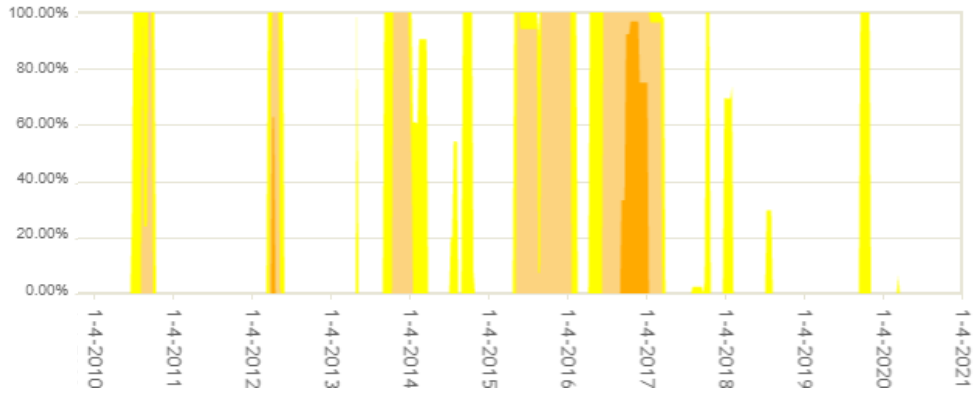
4.3.3 Recent Occurrences

Nassau County has experienced several periods of drought between 2010 and 2020, as shown in ***Figure 10*** (T. N. Center 2020). This graphic is was generated by the U.S. Drought Monitor and shows the percent area of Nassau County experiencing different categories of drought severity (D0 – D4) over time. The drought severity index is outlined in ***Table 8***. From mid-2001 to late 2002, Nassau County went through a period of severe to extreme drought. Beginning in early 2015, Nassau County was in a period of moderate drought that lasted nearly continuously through early 2017, including a period of severe drought.

Table 8: Drought Severity Index

	Category	Description
	D0	Abnormally Dry
	D1	Moderate Drought
	D2	Severe Drought
	D3	Extreme Drought
	D4	Exceptional Drought

Figure 10: U.S. Drought Monitor for Nassau County, 2000 - 2020



4.3.4 Probability

Using historical occurrence rates as a baseline, the probability of occurrence for drought in Nassau County is **likely**, meaning droughts are expected to occur on average at least once every five years. However, in the future, droughts will likely increase in frequency, severity, and length due to climate change. Increasing temperatures and more variable periods of precipitation will result in longer and more severe periods of drought. The average annual temperature in Nassau County has increased steadily since 1895, as shown in ***Figure 11***, while annual precipitation has stayed relatively flat, by comparison (***Figure 12***).

Figure 11: Average Annual Temperature in Nassau County, 1895 to 2020 (Climate at a Glance 2020)

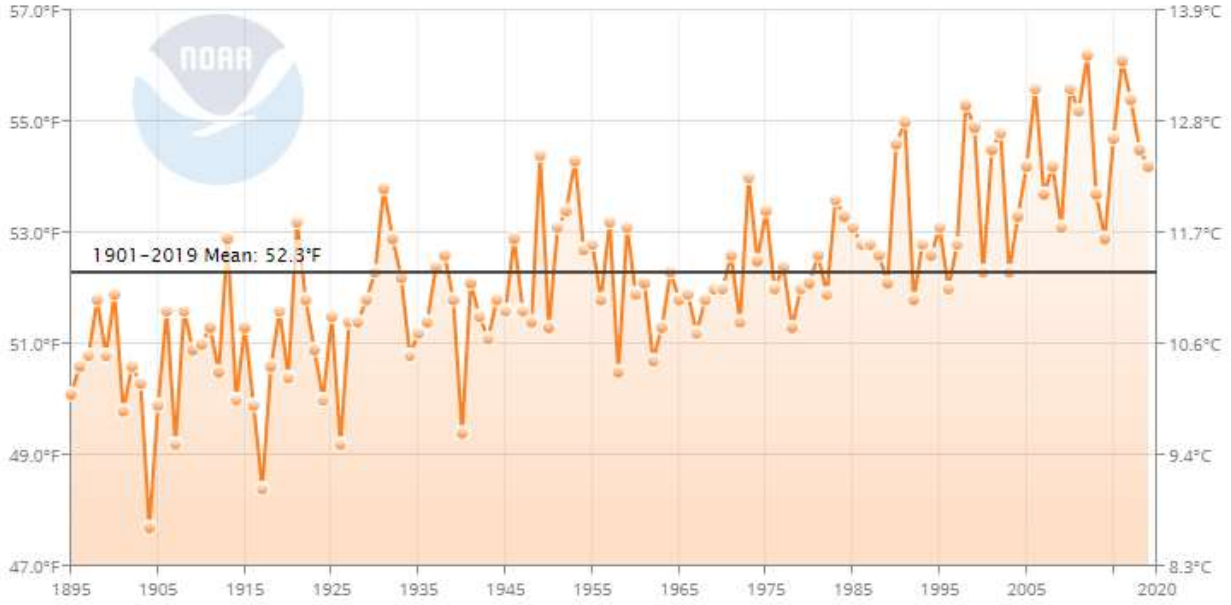
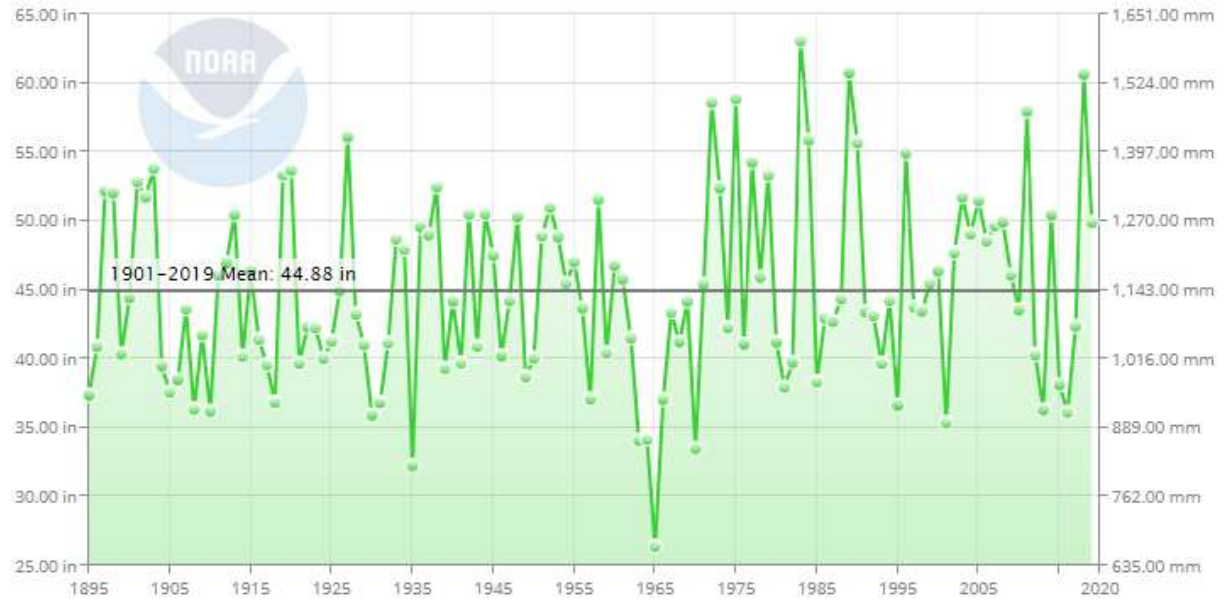


Figure 12. Average Annual Precipitation in Nassau County, 1895 to 2020 (Climate at a Glance 2020)



4.3.5 Impacts and Vulnerability

According to the HAZNY risk assessment, drought is ranked a low hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Drought	
Rank	Low
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Some Potential
Frequency	A Rare Event
Onset	A Week or More
Hazard Duration	More than One Week
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Unlikely • Little or No Damage to Private Property • Little or No Damage to Public Facilities

The National Drought Mitigation Center (NDMC) records drought impacts around the United States. NDMC defines an impact as “an observable loss or change that occurred at a specific place and time because of drought.” These impacts can include agriculture; energy; plants and wildlife; society and public health; water supply and quality; business and industry; fire, relief, response, and restrictions; and tourism and recreation (Drought Impact Reporter 2020).

Figure 13: Drought Impacts Recorded from April 2010 to April 2020

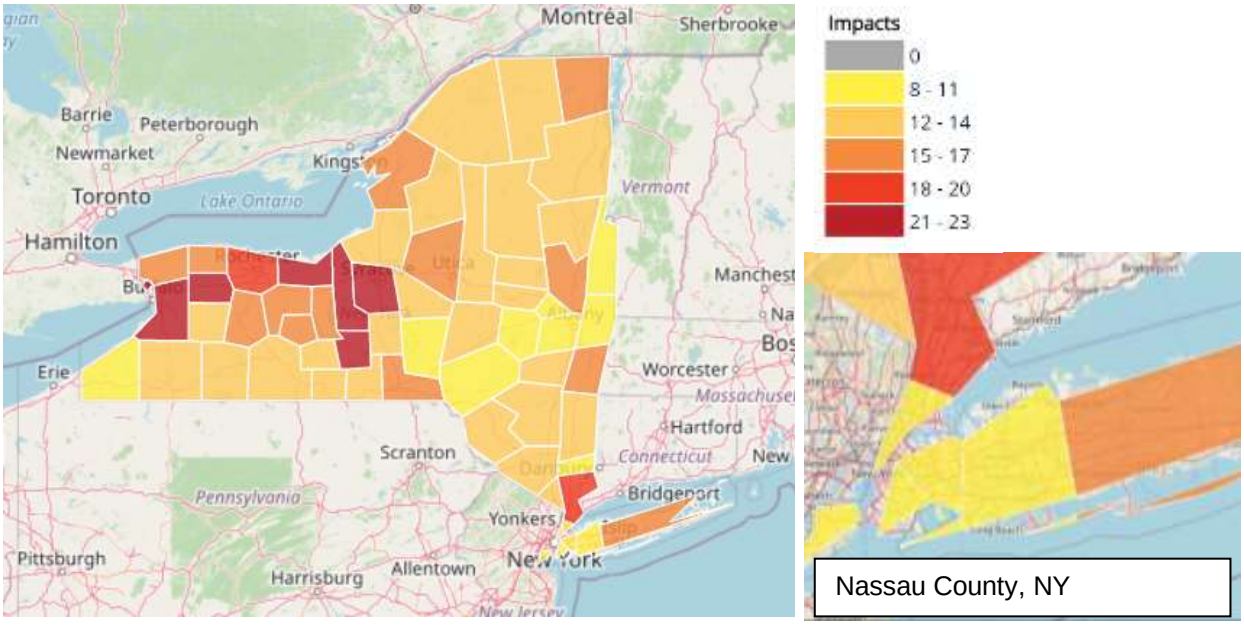


Figure 13 summarizes drought impacts in New York State from April 2010 to April 2020, according to the National Drought Mitigation Center. Nassau County has had ten recorded drought impacts during this period, many of these impacts being part of state-wide drought

watches and warnings. Some localized impacts included observations of shallow wells going dry in 2016, and shallow water in marshes affecting duck and goose hunting in the winter of 2016.

In Nassau County, droughts can negatively affect recreational resources, wildlife, and municipal water supplies, directly and indirectly impacting the local and regional economy. In general, Nassau County has a relatively low vulnerability to droughts for the following reasons:

- Crop failure is one of the main repercussions of drought. According to the 2014, Hazard Mitigation Plan, Nassau County had a very negligible 0.75 square miles of crop land usage; as of 2017, Nassau County no longer reports crop land usage, according to the 2017 Census of Agriculture, New York State and County Data report (Agriculture 2019). Therefore, drought impacts on agriculture would not directly affect Nassau County's economy.
- Water supply shortages are another effect of drought and Nassau County gets most of its water from underground aquifers that are resistant to the impacts of short-term droughts, which is the most likely type of drought to occur in Nassau County. This makes the expected likelihood of future losses associated with reductions in water supply low.
- An additional concern related to droughts is the impact they have on wildfire creation. Wildfires are not likely to occur in Nassau County; however small bushfires are possible. Even so, the expected likelihood of future losses during a drought as a result of bushfires is low across the county.

As the population and development of Nassau County expands in the future, continued monitoring of the aquifer withdrawal/recharge will be necessary during drought periods to ensure continuous supply of water the residents.

4.4 Extreme Temperatures

4.4.1 Characteristics

Extreme heat occurs when abnormally high temperatures combine with high humidity, which often happens during the summer months in Nassau County. According to the *New York State Hazard Mitigation Plan*, extreme heat is defined as an event in which the heat index reaches 105ºF for at least three hours on two consecutive days and night time air temperatures do not drop below 75ºF (N. Y. Services, Heat Wave 2019).

Extreme cold occurs when temperatures fall far below average and combine with high winds, which often happens during the autumn and winter months in Nassau County (Prevention 2012). The NOAA Storm Events Database defines extreme cold/wind chill as a period of extremely low temperatures that exceed locally defined warning criteria, often a temperature of -35ºF or colder (NCEI 2020). While wind chill temperatures of -35ºF have not been recorded in Nassau County, according to this database, the County has experienced damaging wind chills of -10 to -20ºF that are hazardous to human and animal health.

4.4.2 Location and Extent

Given the nature of the hazard, all jurisdictions in Nassau County are equally likely to experience extreme temperatures. Nassau County's location places it in the path of global weather patterns that often contribute to extremely hot or cold temperatures.

NOAA uses a Heat Index (***Figure 14***) to quantify how hot it feels when relative humidity is factored in with actual air temperature (NOAA, Heat Index 2020). The wind chill index (***Figure 15***) quantifies the cooling effect that wind has when combined with outside air temperature. Wind chill temperature represents how cold people and animals feel based on the rate of heat lost from exposed skin.

Figure 14: National Weather Service Heat Index

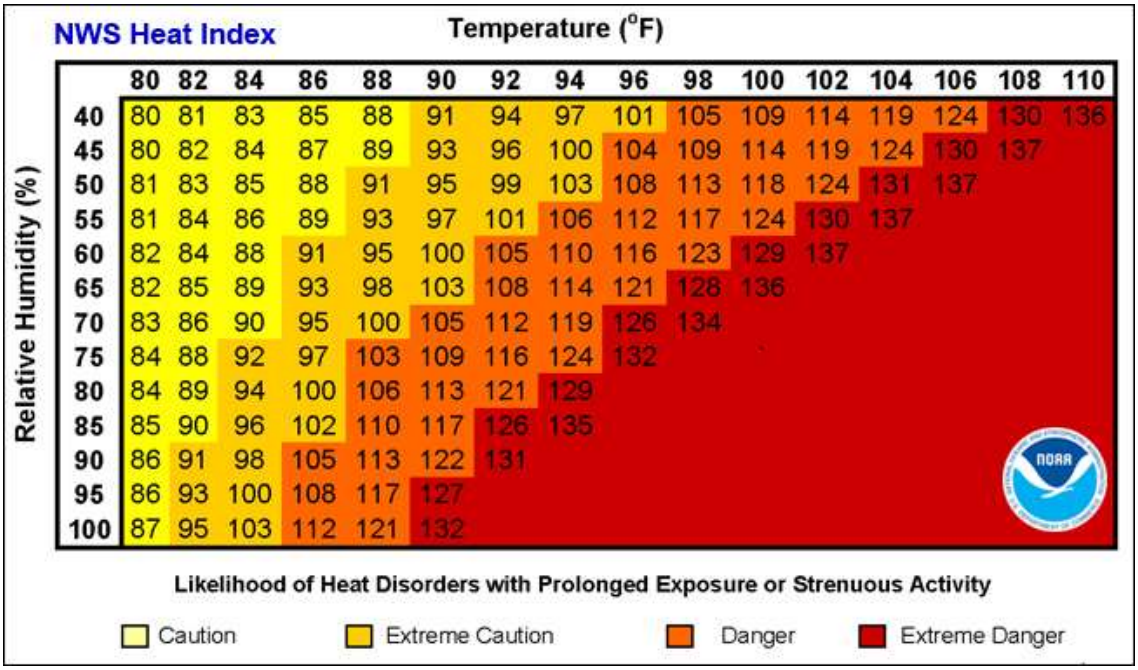
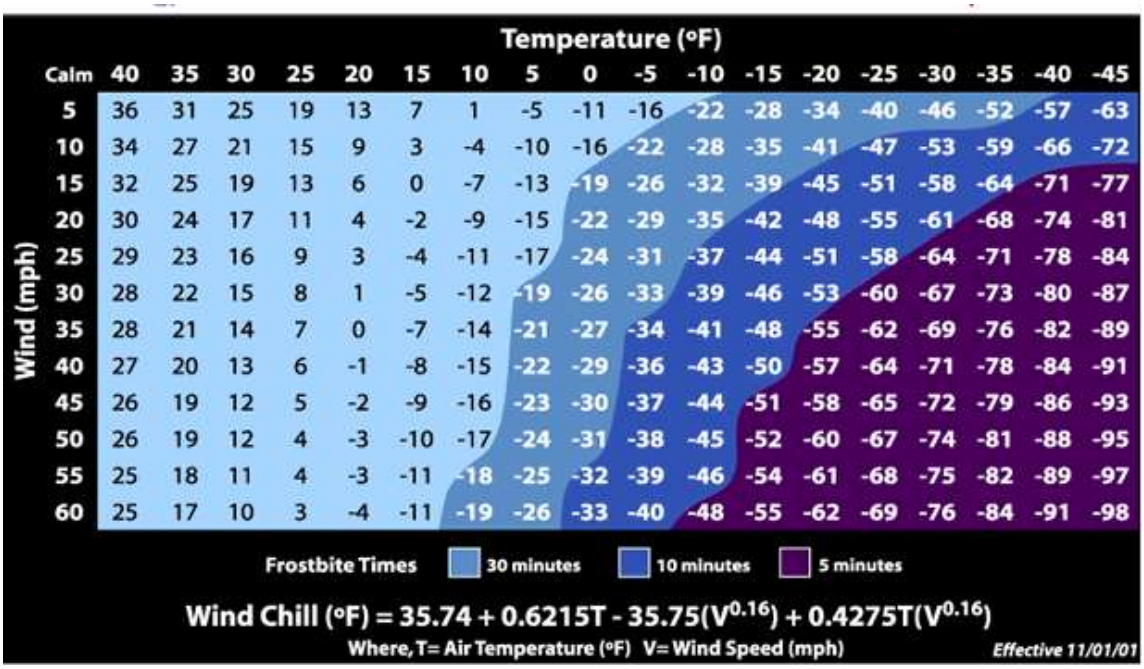


Figure 15: National Weather Service Windchill Chart



4.4.3 Recent Occurrences

According to the NOAA Storm Events Database, there were five reported days of extreme heat in Nassau County in the last 10 years (***Table 9***). There were no reports of extreme cold and wind chill events for Nassau County in the NOAA Storm Events Database.

Table 9: Extreme Temperature Events, 2010 - 2019

Date	Event Narrative
7/22/2011	Excessive heat between 95 and 105 degrees, along with heat indices more than 105 degrees occurred for a couple of days. The heat index was as high as 112 degrees at noon at Farmingdale Airport (KFRG) on July 22nd.
7/19/2013	The combination of high heat and humidity resulted in a heat index of 107 degrees at Farmingdale Airport during the afternoon hours.
8/20/2013	A 7-month-old boy died of heat exposure. He was left in a car. The outside air temperature was 85 degrees at the time at Farmingdale airport, but the car temperature was around 119 degrees.
8/12/2016	The combination of hot temperatures in the 90s, and high humidity resulted in a heat index up to 106 degrees at Republic Airport.
8/13/2016	The combination of hot temperatures in the 90s, and high humidity resulted in a heat index up to 109 degrees at Farmingdale Airport.

4.4.4 Probability

Using historical occurrence rates as a baseline, the probability of occurrence for extreme temperatures in Nassau County is **likely**, meaning extreme temperatures are expected to occur on average at least once every five years. Increased development combined with the effects of climate change may increase probability of extreme heat to highly likely, occurring at least once annually. The probability of extreme cold will remain unlikely, occurring less than once every five years.

As more development occurs, urban areas like Nassau County will grow hotter due to the “urban heat island effect.” This effect occurs because hard surfaces and pavement reflect less light and absorb more heat from the sun, warming up the surrounding area (EPA and CDC 2016). According to the New York State Department of Health “Heat and Health Profile Report” for Nassau County, temperatures during summer months (June-August) are projected to increase over the next century (Health 2019). Overall, average temperatures in Nassau County have steadily increased since 1895 (Climate at a Glance 2020). Summer temperature anomalies (a departure from a long-term average) have also been positive the last 10 years, meaning the observed temperatures were warmer than average (Health 2019).

4.4.5 Impacts and Vulnerability

According to the HAZNY risk assessment, extreme temperatures are ranked as a moderately low hazard. Additional details about the result of that assessment are summarized in the table below.

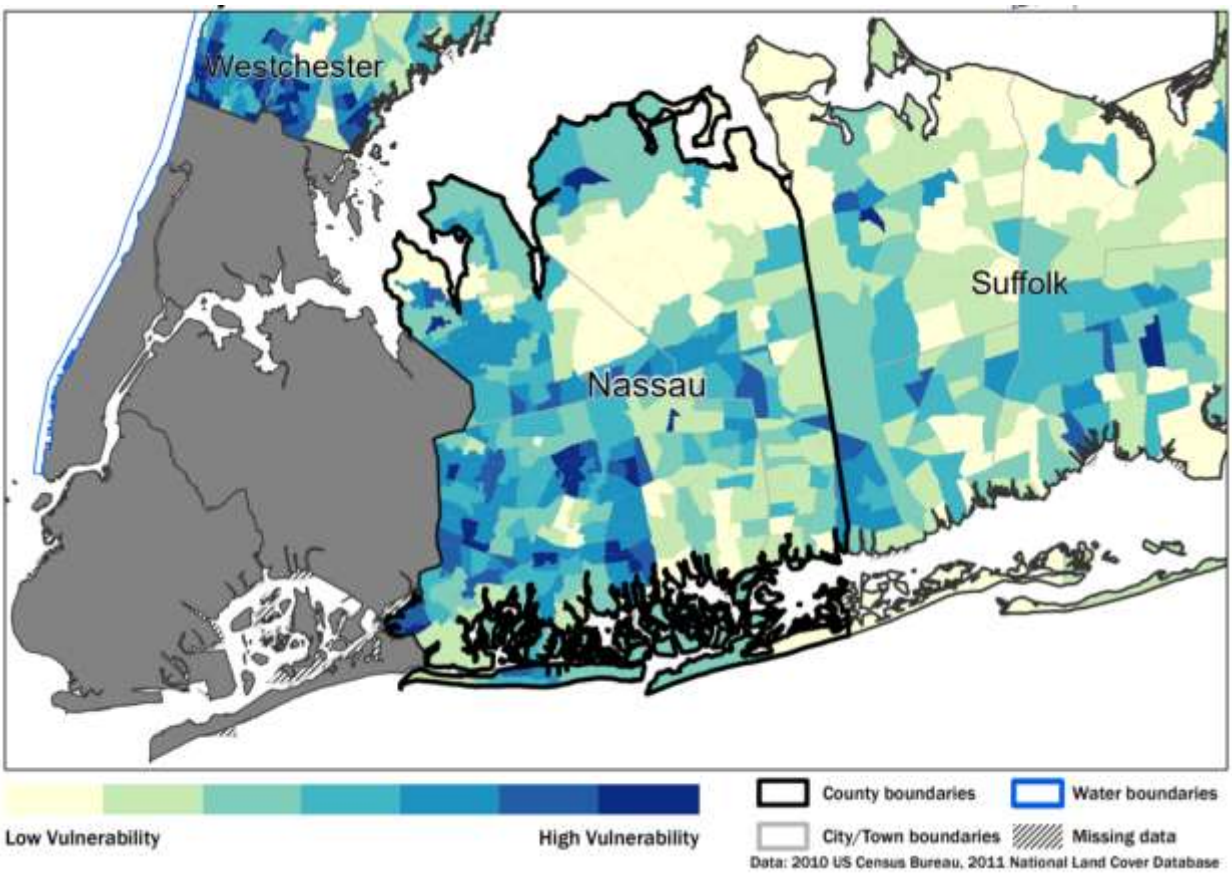
Extreme Temperatures	
Rank	Moderately Low
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Some Potential
Frequency	An Infrequent Event
Onset	Several Days Warning
Hazard Duration	Four Days to a Week
Recovery Time	Three Days to One Week
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Little or No Damage to Private Property • Moderate Damage to Public Facilities

Extreme heat might be exacerbating health outcomes including heart disease, mental illness, and sunburn. In certain cases, exposure to heat has led to death. Individuals at risk of developing health outcomes due to extreme heat include older adults, young children, and people with mental illness and chronic diseases (Prevention 2012). In Nassau County, 316,163 people are under the age of five (5.5% of the population) or older than 65 years (17.8%) (U.S. Census Bureau 2019).

NYS Department of Health (DOH) developed a Heat Vulnerability Index (HVI) that combines several indicators (e.g., underlying health conditions, socio-demographics, environment) to identify areas with populations that may be more vulnerable to the effects of heat. In Nassau County, areas with higher vulnerability tend to be in the western parts of the County (***Figure 16***). To help cool down urban areas, communities should consider greenery and vegetation. Shaded areas help diminish the impact of extreme heat (EPA and CDC 2016).

Extreme cold temperatures can lead to numerous health concerns including frostbite, hyperthermia, and other life-threatening health outcomes are possible (Prevention 2012). Cold temperatures can also cause property damage, including freezing pipes that may burst and cause water damage inside homes and businesses.

Figure 16: Heat Vulnerability Index, Nassau County



4.5 Flooding

4.5.1 Characteristics

Flooding occurs when land that is typically dry is inundated with water (Definitions n.d., CDC 2017). Different types of flooding are categorized by the cause and location of the flooding. Nassau County experiences riverine flooding, flash flooding, and coastal flooding. Riverine flooding occurs when excess runoff from a precipitation event or snowmelt causes water levels to rise in rivers or streams (USGS, What are the two types of floods? n.d.). Flash flooding most commonly occurs when runoff from an extreme rainfall event causes the rapid increase in water levels in a dry riverbed or stream (USGS, What are the two types of floods? n.d., NOAA, Flash Flooding Definition n.d.). Coastal flooding occurs when coastal processes (e.g., waves, tides, storm surge) cause flooding of coastal land (CDC 2017). In Nassau County, coastal flooding caused by hurricanes, tropical storms, and nor'easters cause the most significant damage, and flash flooding occurs most frequently with smaller and more localized impacts.

4.5.2 Location and Extent

Floodplains, or any area that can be inundated by floodwater, are used to indicate flood hazard locations and extents (Definitions n.d.). FEMA classifies floodplains by the annual percent chance of inundation to indicate the likely location and extent of flooding. These floodplains include the one percent annual chance floodplain (also known as the 100 year floodplain) and the 0.2% annual chance floodplain (or 500 year floodplain) FEMA develops Flood Insurance Rate Maps (FIRMs) to show the location of these floodplains. FIRMs display different areas of flood risk that correlate to flood insurance premiums (***Figure 17***). ***Table 10*** lists the jurisdictions in Nassau County that are in the 100 and 500 year floodplains. While flooding can occur in areas outside of the 1% and 0.2% floodplains, these hazard areas serve as the baseline for understanding flood risk in the County.

Flooding extent is defined by the impact of the flooding event on the community. In this way, flood events can be classified into minor, moderate, and major flooding, where:

- Minor flooding is when there is minimal or no public or private property damage, mild soil erosion, but possibly some public threat or inconvenience;
- Moderate flooding is when there is some inundation of structures and roads and some evacuation of people and property is necessary; and
- Major flooding is when there is extensive inundation of structures and roads, causing life threatening conditions requiring significant evacuation of people and property (NCEI 2020, NOAA, High Level Water Terminology n.d.).

This classification can be used to compare the impacts between flood events on a community but does not represent the height of flood waters during the event (flood stage).

Figure 17: FEMA 100 and 500 Year Floodplains in Nassau County

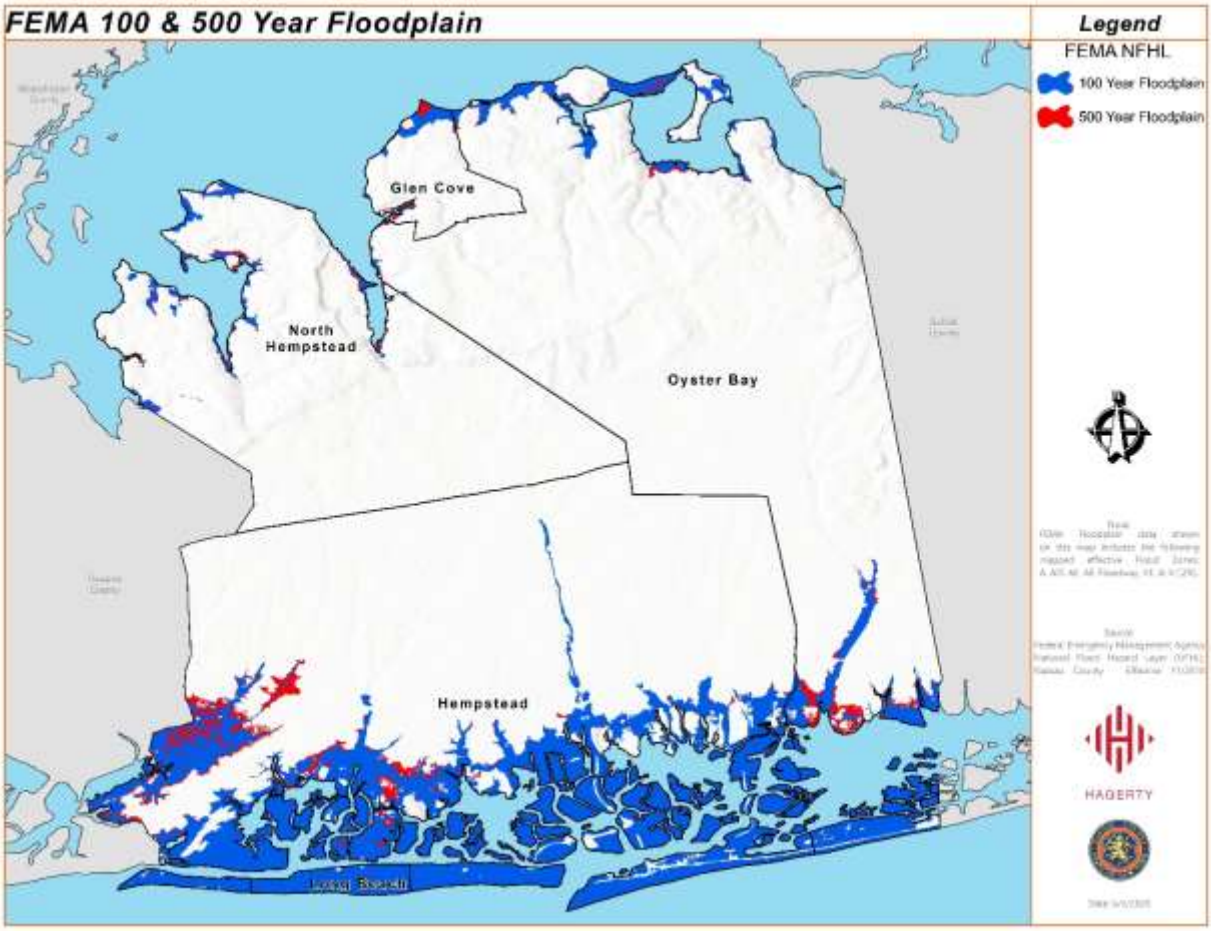


Table 10: Jurisdictions in the 100 and 500 Year Floodplains

Jurisdiction	100 Year	500 Year
Atlantic Beach, Village of	X	X
Baxter Estates, Village of	X	X
Bayville, Village of	X	X
Bellerose, Village of		
Brookville, Village of		
Cedarhurst, Village of	X	X
Centre Island, Village of	X	X
Cove Neck, Village of	X	X
East Hills, Village of		
East Rockaway, Village of	X	X
East Williston, Village of		
Farmingdale, Village of		
Floral Park, Village of		
Flower Hill, Village of	X	
Freeport, Village of	X	X
Garden City, Village of		
Glen Cove, City of	X	X
Great Neck Estates, Village of	X	X
Great Neck Plaza, Village of	X	X
Great Neck, Village of	X	X
Hempstead, Town of	X	X
Hempstead, Village of		
Hewlett Bay Park, Village of	X	X
Hewlett Harbor, Village of	X	X
Hewlett Neck, Village of	X	X
Island Park, Village of	X	X
Kensington, Village of	X	X
Kings Point, Village of	X	X
Lake Success, Village of		
Lattingtown, Village of	X	X
Laurel Hollow, Village of	X	X
Lawrence, Village of	X	X
Long Beach, City of	X	X
Lynbrook, Village of	X	X
Malverne, Village of	X	X

Jurisdiction	100 Year	500 Year
Manorhaven, Village of	X	X
Massapequa Park, Village of	X	X
Matinecock, Village of		
Mill Neck, Village of	X	X
Mineola, Village of		
Munsey Park, Village of		
Muttontown, Village of		
New Hyde Park, Village of		
North Hempstead, Town of	X	X
North Hills, Village of		
Old Brookville, Village of		
Old Westbury, Village of		
Oyster Bay Cove, Village of	X	X
Oyster Bay, Town of	X	X
Plandome Heights, Village of	X	X
Plandome Manor, Village of	X	X
Plandome, Village of	X	X
Port Washington North, Village of	X	X
Rockville Centre, Village of	X	X
Roslyn Estates, Village of	X	X
Roslyn Harbor, Village of		
Roslyn, Village of	X	X
Russell Gardens, Village of	X	X
Saddle Rock, Village of	X	X
Sands Point, Village of	X	X
Sea Cliff, Village of	X	X
South Floral Park, Village of		
Stewart Manor, Village of		
Thomaston, Village of	X	X
Upper Brookville, Village of		
Valley Stream, Village of	X	X
Westbury, Village of		
Williston Park, Village of		
Woodsburgh, Village of	X	X

4.5.3 Recent Occurrences

In the last ten years, there have been 73 total flooding events reported in the County. This includes 21 flash flooding events and 45 coastal flooding events. Information regarding specific flooding events is available in ***Appendix B.***

4.5.4 Probability

The probability of occurrence for flooding in Nassau County is **highly likely**. Based on historical data, flooding events are expected approximately eight times each year (NCEI 2020). Each type of flooding discussed in Nassau County's flood profile is individually highly likely to occur, with one riverine flooding event, five flash flooding events, and two coastal flooding events expected on an annual basis (NCEI 2020). Given current climate predictions, by 2050 the New York City region is expected to have a regional precipitation increase between four and eleven percent (Horton, Bader, et al., Climate Change in New York State: Updating the 2011 ClimAid Climate Risk Information Supplement to NYSERDA Report 11-18 2014). This will likely impact the frequency of flooding events in the County, with an expectation of an increase in heavy downpours throughout New York State (Horton, Bader, et al., Climate Change in New York State: Updating the 2011 ClimAid Climate Risk Information Supplement to NYSERDA Report 11-18 2014).

4.5.5 Impacts and Vulnerability

According to the HAZNY risk assessment, inland flooding is ranked as a moderately high hazard. Coastal flooding/wave action is addressed in the ***Coastal Hazards*** section. Additional details about the result of that assessment are summarized in the table below.

Flooding/Inland	
Rank	Moderately high
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Some Potential
Frequency	A Frequent Event
Onset	No Warning
Hazard Duration	One Day
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Moderate Damage to Private Property • Moderate Damage to Public Facilities

To estimate the potential impacts that the 100 year and 500 year flood events could have in Nassau County, different scenarios were run using the loss estimation program, Hazus. Hazus estimated the following countywide impacts from the 100 and 500 year events:

- About 1,100 buildings will be at least moderately damaged by the 100 year event, which is over 50 percent of the buildings in the Hazus database for this scenario. For the 500 year event, 1,487 buildings will be at least moderately damaged. Zero buildings will be completely damaged by either flood event.

- Between 129,027 (100 year) and 154,771 (500 year) people will be displaced and between 8,288 and 9,962 individuals will seek shelter. Refer to ***Appendix B*** for a detailed breakdown of the number of people displaced and seeking shelter, by jurisdiction, for the different flood events.
- At least moderate damage will be sustained by 28 schools, two police stations, and 12 fire stations and emergency medical services (EMS) facilities, totaling approximately $28,180,000 in losses to these essential facilities. With the 500 year flood, an additional six schools and two fire stations and EMS facilities medical services facilities will be impacted, totaling $36,102,000 in losses. ***Appendix B*** contains tables detailing the total losses sustained by each essential facility.

The total losses from the 100 and 500 year flood events are summarized in ***Table 11*** for the largest jurisdictions and the County. "Total losses" includes damage to buildings and its contents, as well as the cost of business interruptions such as relocation and wage losses. ***Appendix B*** contains tables summarizing the total losses by sector (e.g., residential, commercial, government, etc.) for each jurisdiction in Nassau County.

Table 11: Total Losses from 100 year and 500 year Flood Events

Jurisdiction	Population (Hazus)	Total Exposure	Total Losses 100 year	Total Losses 500 year
Nassau County	1,339,532	$239,082,476,000	$3,109,662,000	$3,887,914,000
City of Glen Cove	29,314	$5,042,084,000	$14,627,000	$18,709,000
Town of Hempstead	513,170	$86,016,460,000	$1,717,218,000	$2,128,041,000
City of Long Beach	33,980	$5,768,806,000	$466,391,000	$444,748,000
Town of North Hempstead	120,320	$26,354,892,000	$27,773,000	$35,066,000
Town of Oyster Bay	253,188	$49,340,000,000	$193,316,000	$288,556,000

Figure 18 shows the areas in the County most likely to experience losses due to the 100 year scenario within Nassau County. Of the nearly $3.2 billion of total estimated damages associated with the 100 year event, it is estimated that nearly $2.4 billion dollars are a direct result of business interruptions, mostly within the commercial industry.

Figure 18: Total losses due to the 100 year event

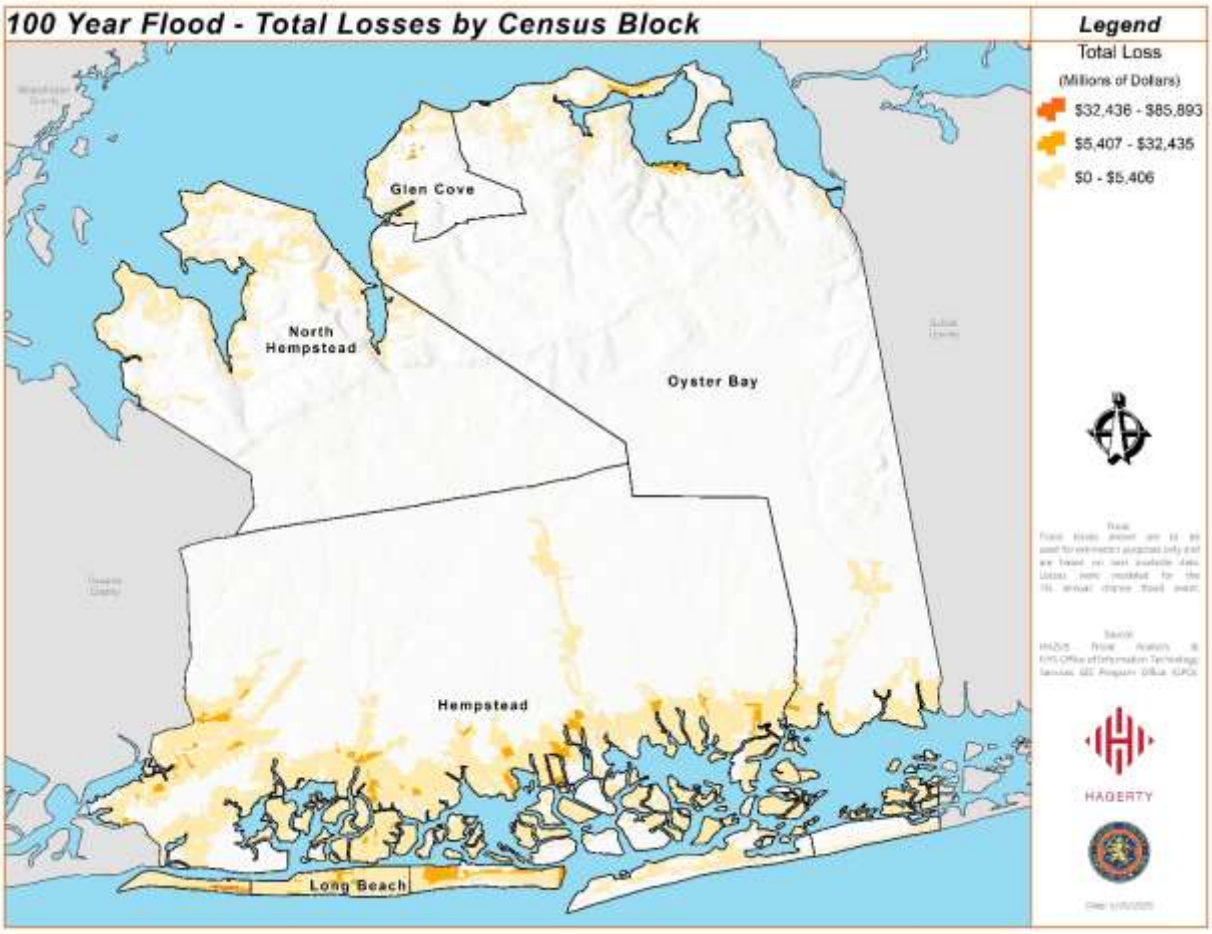
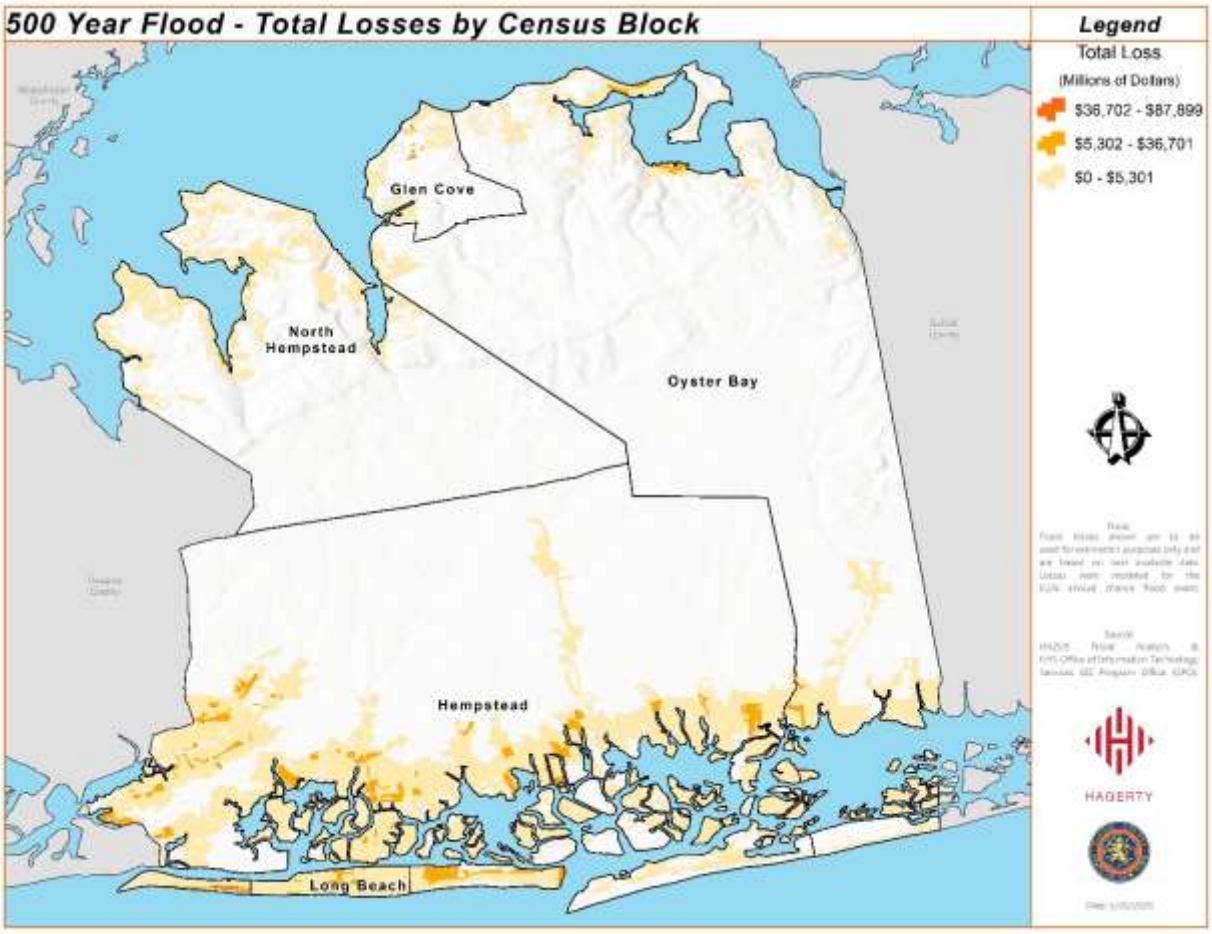


Figure 19 shows the areas in the County most likely to experience losses due to the 500 year flood event in Nassau County. Of the nearly $3.9 billion of estimated building-related damage associated with the 500 year event, it is estimated that nearly $3 billion dollars are a direct result of business interruptions, nearly half within the commercial industry.

Figure 19: Total Losses due to the 500 year event



4.5.6 National Flood Insurance Program

The National Flood Insurance Program (NFIP) was established by Congress with the passage of the National Flood Insurance Reform Act of 1968. Through this program, Federally-backed flood insurance is made available to homeowners, renters, and businesses in a community if that community adopts and enforces a floodplain management ordinance to reduce future flood damages within its floodplains. This includes not only preventative measures for new development, but also corrective measures for existing development. In addition to providing flood insurance, the NFIP also studies and maps the nation's floodplains, preparing its findings in Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs).

There are 45,499 NFIP policies in Nassau County. Since 1978, the NFIP has paid $2.2 billion to 49,224 claims. Some communities in Nassau County have high number of properties that have recurrent losses. "Repetitive loss properties" are any insurable buildings that have incurred at least two flood losses of greater than $1,000 each in any rolling ten-year period since 1978. In total, these repetitive loss properties have experienced 19,700 repetitive losses. "Severe repetitive loss properties" are single family properties insured through the NFIP that have received:

- Four or more (separate) flood-related insurance claim payments through their NFIP coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claim payments exceeding $20,000; or
- Two or more separate claim payments with the cumulative amount exceeding the reported value of the property (FEMA, Flood Insurance Terminology List 2020).

The information summarized in ***Table 12*** was obtained through NYS DHSES from FEMA Region II and represents the most specific repetitive loss information available at the time that this plan was updated. Specific information related to the types (e.g., residential, commercial, institutional, etc.) of NFIP insured structures that have been repetitively damaged by floods was requested from the towns and villages in Nassau County. The City of Glen Cove noted that there are 12 residential repetitive loss properties and no severe repetitive loss properties in their jurisdiction.

Table 12: National Flood Insurance Program Policies and Claims

Jurisdiction	Number of Policies	Total Claims Since 1978	Total Paid Since 1978	Number of Repetitive Losses[1]	Number of BCX Claims[2]
Atlantic Beach, Village Of	641	297	$11,575,264.00	N/A	N/A
Baxter Estates, Village Of	15	4	$427,227.00	0	0
Bayville, Village Of	731	1306	$22,574,058.00	654	32
Bellerose, Village of	NP	NP	NP	NP	NP

Jurisdiction	Number of Policies	Total Claims Since 1978	Total Paid Since 1978	Number of Repetitive Losses[1]	Number of BCX Claims[2]
Brookville, Village of	NP	NP	NP	NP	NP
Cedarhurst, Village Of	362	341	$16,336,210.00	72	22
Centre Island, Village Of	28	48	$1,159,291.00	11	9
Cove Neck, Village Of	11	7	$609,406.00	1	0
East Hills, Village Of	78	16	$137,869.00	2	2
East Rockaway, Village Of	941	1121	$45,894,198.00	506	100
East Williston, Village of	NP	NP	NP	NP	NP
Farmingdale, Village Of	1	0	$0.00	N/A	N/A
Flower Hill, Village Of	31	2	$6,036.00	N/A	N/A
Floral Park, Village Of	31	2	$3,923.00	0	0
Freeport, Village Of	3225	6140	$244,433,170.00	3738	174
Garden City, Village Of	56	6	$4,849.00	N/A	N/A
Glen Cove, City Of	134	164	$2,764,312.00	71	17
Great Neck Estates, Village Of	53	31	$343,956.00	8	8
Great Neck Plaza, Village Of	5	2	$333,604.00	2	2
Great Neck, Village Of	69	124	$1,158,354.00	43	26
Hempstead, Town Of	21798	21374	$964,709,056.00	7364	2040
Hempstead, Village Of	43	13	$222,195.00	N/A	N/A
Hewlett Bay Park, Village Of	60	29	$1,744,461.00	9	6
Hewlett Harbor, Village Of	264	235	$18,140,774.00	71	45
Hewlett Neck, Village Of	73	67	$5,900,637.00	9	3
Island Park, Village Of	973	1928	$110,886,894.00	1161	189
Kensington, Village of	NP	NP	NP	NP	NP

Jurisdiction	Number of Policies	Total Claims Since 1978	Total Paid Since 1978	Number of Repetitive Losses[1]	Number of BCX Claims[2]
Kings Point, Village Of	155	137	$1,512,466.00	34	9
Lake Success, Village Of	15	17	$267,532.00	3	3
Lattingtown, Village Of	45	38	$1,061,047.00	7	2
Laurel Hollow, Village Of	17	8	$21,797.00	0	0
Lawrence, Village Of	816	442	$29,273,906.00	94	65
Long Beach, City Of	7735	8440	$431,963,010.00	3006	1092
Lynbrook, Village Of	201	6	$74,225.00	5	5
Malverne, Village Of	59	3	$9,651.00	0	0
Manorhaven, Village Of	163	84	$601,005.00	3	0
Massapequa Park, Village Of	411	557	$14,562,449.00	226	67
Matinecock, Village of	NP	NP	NP	NP	NP
Mill Neck, Village Of	16	8	$7,565.00	0	0
Mineola, Village Of	18	14	$204,483.00	N/A	N/A
Munsey Park, Village Of	17	3	$12,070.00	N/A	N/A
Muttontown, Village of	NP	NP	NP	NP	NP
New Hyde Park, Village Of	17	2	$17,455.00	N/A	N/A
North Hempstead, Town Of	408	238	$2,419,800.00	54	50
North Hills, Village Of	42	12	$41,566.00	0	0
Old Brookville, Village Of	16	0	$0.00	N/A	N/A
Old Westbury, Village Of	1	0	$0.00	N/A	N/A
Oyster Bay Cove, Village Of	30	18	$345,724.00	2	0
Oyster Bay, Town Of	4431	5322	$287,872,063.00	2409	294
Plandome Heights, Village Of	13	7	$12,145.00	3	0

Jurisdiction	Number of Policies	Total Claims Since 1978	Total Paid Since 1978	Number of Repetitive Losses[1]	Number of BCX Claims[2]
Plandome Manor, Village Of	22	20	$222,286.00	7	0
Plandome, Village Of	16	15	$17,598.00	4	4
Port Washington, Village of	NP	NP	NP	NP	NP
Rockville Centre, Village of	NP	NP	NP	NP	NP
Roslyn Estates, Village Of	13	1	$14,665.00	0	0
Roslyn Harbor, Village Of	19	20	$492,405.00	0	0
Roslyn, Village Of	24	44	$228,986.00	5	0
Russell Gardens, Village Of	8	2	$1,555.00	0	0
Saddle Rock, Village Of	21	21	$313,085.00	5	5
Sands Point, Village Of	140	99	$1,230,781.00	18	5
Sea Cliff, Village Of	26	32	$208,675.00	10	0
South Floral Park, Village of	NP	NP	NP	NP	NP
Stewart Manor, Village Of	2	0	$0.00	0	0
Thomaston, Village Of	8	12	$23,730.00	1	1
Upper Brookville, Village of	NP	NP	NP	NP	NP
Valley Stream, Village Of	850	294	$3,658,238.00	70	26
Westbury, Village Of	14	1	$0.00	N/A	N/A
Willison Park, Village of	NP	NP	NP	NP	NP
Woodsburgh, Village Of	87	50	$4,631,643.00	12	9
Total:	45,499	49,224	$2,230,689,350.00	19,700	4312

[1] Nassau County worked with its jurisdictions to gather as much data as possible. However, because many jurisdictions do not have full-time, dedicated floodplain administrators, in several cases, the effort to collect this information was not successful.
[2]"BCX claims" are those made on houses located outside of the special flood hazard area, in flood zones designated as "B", "C", or "X".
NP = Not Participating (in the NFIP)

The NFIP's Community Rating System (CRS), first implemented nationwide in 1990, provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Communities participating in the CRS program receive 'points' for various activities and initiatives they undertake. As more points are accrued, the community's CRS Class increases. There are 10 CRS classes: Class 1 requires the most credit points and gives the largest premium reduction, while Class 10 requires not credit points and gives no premium reduction. CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities. A total of four communities in Nassau County participate in the CRS, summarized in ***Table 13***, achieving benefits in the form of premium discounts for their efforts to exceed the minimum requirements of the NFIP as depicted in the following table.

Table 13: Nassau County Communities Participating in the Community Rating System, effective October 1, 2019

Community Name	CRS Entry Date	Current Effective Date	Current Class	% Discount for SFHA	% Discount for non-SFHA	Status[1]
Bayville, Village of	10/1/1992	10/1/2003	8	10	5	C
East Rockaway, Village of	10/1/1992	10/1/1992	9	5	5	C
Freeport, Village of	10/1/1992	10/1/2009	7	15	5	C
Long Beach, City of	10/1/2009	5/1/2016	7	15	5	C

[1] Status: C = Current, R = Rescinded

4.6 Ground Failure Hazards

4.6.1 Characteristics

Ground failure hazards occur when there is ground instability due to seismic activity (USGS, Earthquake Glossary n.d.). For the purposes of the Nassau County Hazard Mitigation Plan, the Ground Failure Hazards Profile will discuss the earthquakes, landslides, and land subsidence, which are the three most common types of ground failure in Nassau County.

Earthquakes are caused by the shifting of tectonic plates below the earth's surface. When the plates suddenly slip on a fault line, the border between two plates, they create energy waves that ripple through the earth's crust and cause shaking on the surface (FEMA, Earthquake 2020). Landslides are categorized as the mass movement of rock, debris, or earth down a slope. This type of ground failure occurs when the force of gravity exceeds the forces holding the material in place. Landslides can be caused by earthquakes, rainfall, snowmelt, and coastal erosion (USGS, What is a landslide and what causes one? n.d.). Land subsidence is caused by excessive groundwater withdrawal, which also removes significant fine sediment and causes the rock to collapse and compact. Land subsidence can occur over large regions or in more acute areas, creating events such as sinkholes. Increased urbanization, higher water demands, and issues with water scarcity may increase the rate of land subsidence (USGS, Land Subsidence n.d.).

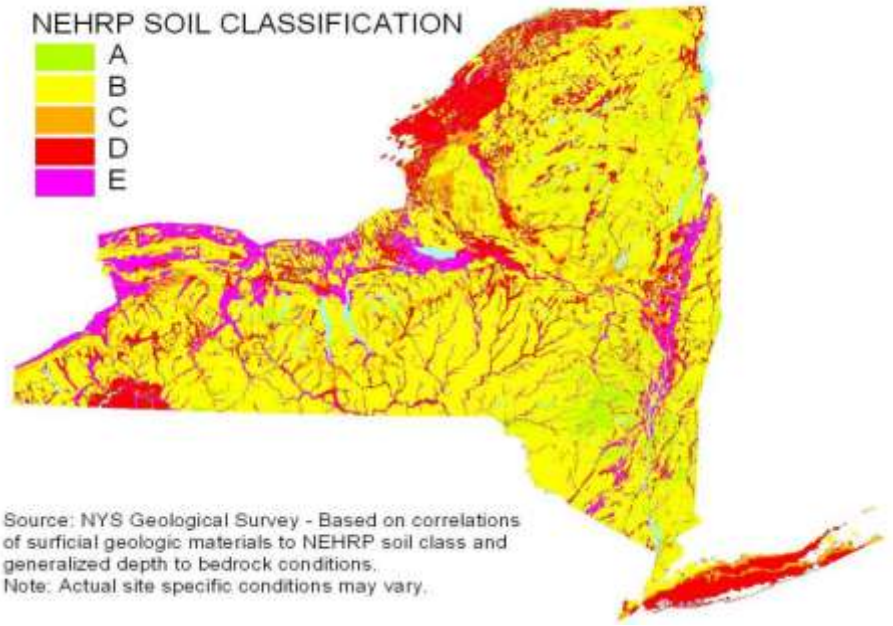
4.6.2 Location and Extent

4.6.2.1 Earthquakes

Earthquake risk exists across Nassau County. The location and extent of earthquake risk can be contextualized by understanding the fault lines in New York State, the soil classifications of the area, and the map of previous earthquake epicenters.

Figure 20 illustrates the soil classification for Nassau County (N. Y. Services 2019). Harder Class A and B soils, shown in green in, tend to reduce ground motions, while soft Class D and E soils, shown in red, tend to further amplify and magnify seismic waves. The majority of Nassau County has soil type D; therefore, the County is susceptible to experiencing an amplification of ground motion during an earthquake.

Figure 20: NEHRP Soil Classification for New York State (N. Y. Services 2019)



Earthquake magnitude is a function of amplitude of the seismic waves caused by the ground's motion. Instruments called seismographs measure the amplitude, or extent, of these waves caused by earthquakes. Charles F. Richter developed the Richter magnitude scale (or "Richter Scale") in 1935 to compare the size of earthquakes (USGS, Earthquake Glossary n.d.). The scale ranges from 1.0, an earthquake that is unfelt, to 8.0 or greater, a catastrophic earthquake. The Richter Scale is effective for comparing earthquake magnitudes, but not for expressing potential damage.

The Modified Mercalli Intensity Scale (***Table 14***), provides a subjective measurement of earthquake extent based on a person's observations of the resulting damage to people, buildings, and natural features (USGS, The Modified Mercalli Intensity Scale n.d.). While this scale does not have a mathematical basis, it provides an easily comprehensible description of earthquake intensity at the observation location.

Table 14: Modified Mercalli Intensity Scale (USGS, The Modified Mercalli Intensity Scale n.d.)

Intensity	Shaking	Total Exposure
I	Not felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeable by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.

Intensity	Shaking	Total Exposure
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

4.6.2.2 Landslides

The high cliffs on Nassau County's north shore are more susceptible to landslides in the future, though these events have a low probability of occurrence (DHSES 2008). According to the Landslide Susceptibility map included in previous iterations of the State Hazard Mitigation Plan, sourced from the USGS National Landslides Hazards Program, portions of northern Nassau County are considered highly susceptible to landslides, while southern portions of the County are in the lowest incidence category. Using the State Plan's weighted ranking system, Nassau County has the fifteenth highest landslide susceptibility ranking out of the 62 counties in the State (DHSES 2008).

4.6.2.3 Land Subsidence

There are two types of sink holes: cover-subsidence and cover-collapse. While cover-collapse is more widely discussed in news media, Nassau County is significantly more prone to cover-subsidence because of the soil classification associated with different types of sink holes. The majority of Nassau County is a barrier island comprised of sand and dunes. Cover-collapse sinkholes occur in clay-like soils, whereas cover-subsidence occurs in sandy soils, and therefore would be more prevalent in the County (N. Y. Services 2019).

4.6.3 Recent Occurrences

4.6.3.1 Earthquakes

The epicenter of an earthquake has never been recorded in Nassau County; however, several earthquakes have occurred in New York State and Connecticut that have caused ground shaking in Nassau County. Since 1884, Nassau County has been impacted by approximately 10 nearby earthquakes, with three of the 10 earthquake epicenters located on Long Island (Blasey 2019).

4.6.3.2 Landslides

On May 1, 2014, heavy rains caused multiple landslides in Nassau County. In Port Washington, a landslide buried multiple cars with mud. Another landslide occurred in the Village of Sea Cliff and washed away a home's backyard, creating a 100-foot drop to the Long Island Sound (Heavy rain causes 2 landslides in Port Washington and Sea Cliff 2014, DHSES 2008). However, according to the 2008 State Hazard Mitigation Plan, there were only approximately 11 landslide events between 1837 and 2007 (DHSES 2008).

4.6.3.3 Land Subsidence

A single database does not currently exist to capture previous occurrences of land subsidence in Nassau County, New York. However, online research of local news sources revealed that land subsidence has been reported in localized areas across Nassau County as well as the greater Long Island. For example, in Seaford, New York, at least a dozen homeowners have observed significant land subsidence occurring over the last 20 years, causing driveways to crack, backyards to sink, and garages to slide off their foundations (McLogan 2019). As of April 2019, USGS will begin collecting data from homeowners to understand the causes of this land subsidence (McLogan 2019).

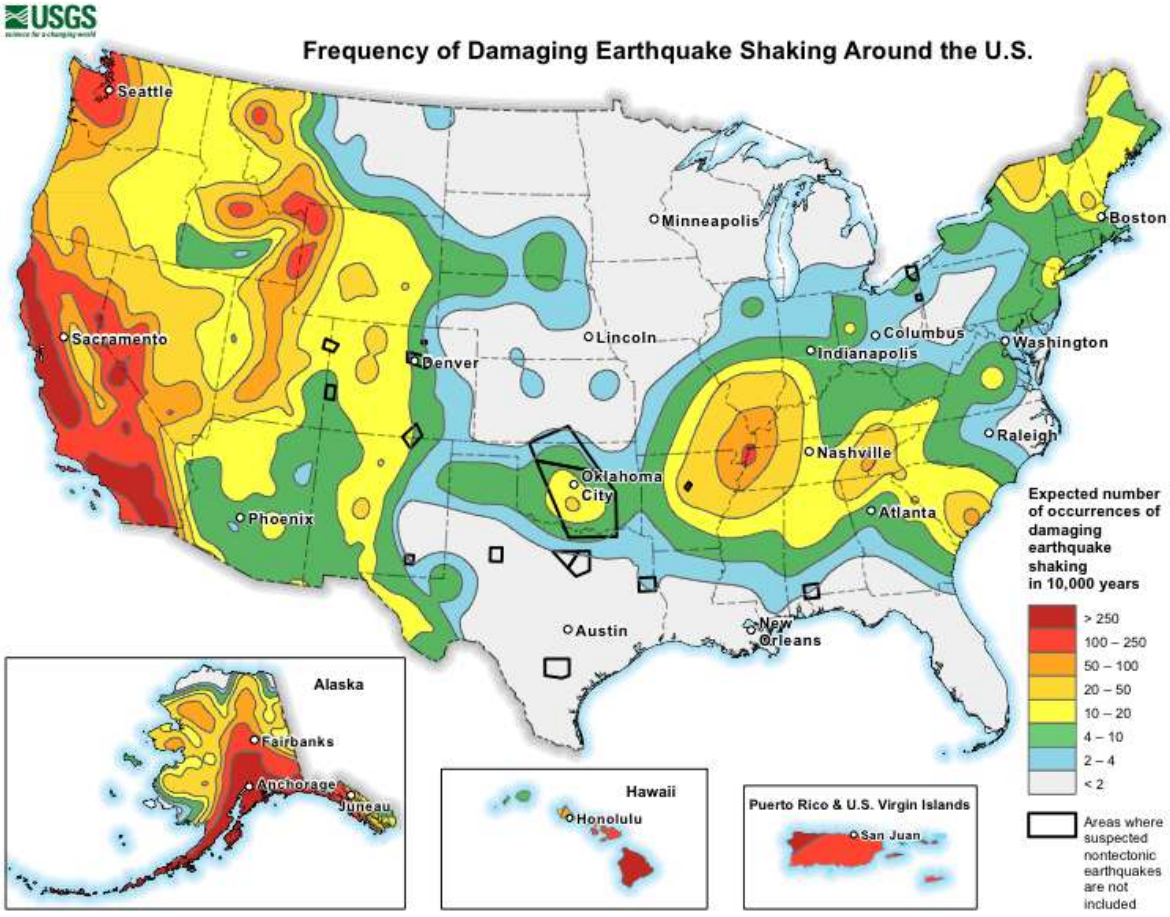
In 2011, snow and freezing temperatures lead to the formation of a 12 foot sinkhole in North Merrick that caused a partial road collapse (Long Island News 12 2011). In the Village of Rockville Centre, a sinkhole swallowed a woman in her car while she was parked in her driveway (abc7NY 2014). Neighboring Suffolk County has also had reports of sinkholes, including reports of a public transit bus swallowed by a sink hole in 2019 as it traveled through flooded roads (Kim 2019).

4.6.4 Probability

4.6.4.1 Earthquakes

The probability of occurrence for earthquakes in Nassau County is **unlikely**. As shown in ***Figure 21***, Nassau County could experience up to 10 instances of damaging earthquake shaking in the span of 10,000 years, with the western side of the county facing higher proportional risk than the eastern side.

Figure 21: Frequency of Damaging Earthquakes Shaking around the U.S.



4.6.4.2 Landslides

Looking back at estimated historic occurrences, future landslide events in Nassau County are considered **unlikely**, with events expected to occur less than once every five years.

4.6.4.3 Land subsidence

Given the iterative and ongoing land subsidence issues occurring over the last two decades, and continuing today, in Seaford, the future probability of land subsidence occurring is considered **highly likely**.

4.6.5 Impacts and Vulnerability

According to the HAZNY risk assessment, earthquake is ranked as a moderately low hazard. Additional details about the result of that assessment are summarized in the table below.

Earthquake	
Rank	Moderately Low
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Some Potential
Frequency	A Rare Event
Onset	No Warning
Hazard Duration	Less Than One Day
Recovery Time	Three Days to One Week
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Little or No Damage to Private Property • Moderate Damage to Public Facilities

According to the HAZNY risk assessment, landslide is ranked as a low hazard.

Landslide	
Rank	Low
Potential Impact	Throughout a Small Region
Cascade Effects	Yes, Some Potential
Frequency	A Rare Event
Onset	No Warning
Hazard Duration	Less Than One Day
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Little or No Damage to Private Property • Little or No Damage to Public Facilities

Ground failure hazards can heavily impact the built environment, causing damage or destruction to buildings, disrupt utilities (e.g., gas, electric, phone, water), and triggering fires. Depending on the severity of each incident these impacts could be limited and isolated or contribute to significant destruction. Landslides are more likely to cause limited damage to infrastructure and individual properties, while earthquakes may cause damage across the County.

To estimate the potential impacts that an earthquake could have on Nassau County, Hazus models were run for 250 year and 1000 year probabilistic earthquakes. Some key takeaways of this analysis include:

- Of the nearly $120 million of estimated damage associated with the 250 year event, it is estimated that more than 75% of that damage is a direct result of actual property damage, mostly to single family residential dwellings.

- The Hazus model estimated that about 1,000 buildings will be at least moderately damaged, and eight buildings will be damaged beyond repair from the 250 year event. Additionally, Hazus also estimated that the 1000 year event will at least moderately damage about 8,329 buildings and damage 116 buildings beyond repair.
- The 250 year and 1000 year earthquake events estimated no significant long-term damage to essential facilities.
- In the worst case scenario of a 1000 year event, up to 576 households may be displaced, and 370 individuals may seek shelter. For the 250 year event, 28 households may be displaced, and 31 people may seek temporary shelter.

Table 15 summarizes the total building-related losses from the 250 year and 1000 year events. "Total losses" includes damage to buildings and its contents, as well as the cost of business interruptions such as relocation and wage losses. Total economic loss estimated for the 250 year earthquake is about $123.73 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. By comparison, total economic loss for the 1000 year earthquake is about $1,968.66 (millions of dollars). ***Appendix B*** contains tables summarizing the total losses by sector (e.g., residential, commercial, government, etc.). for each jurisdiction in Nassau County.

Table 15: Total Building-Related Losses Associated with 250 Year and 1000 Year Earthquake Events

Jurisdiction	Population (Hazus)	Total Exposure	Total Losses 250-YR	Total Losses 1000-YR
Nassau County	1,339,532	$239,082,476,000	$118,990,000	$1,760,499,627
City of Glen Cove	29,314	$5,042,084,000	$2,466,629	$38,813,001
Town of Hempstead	513,170	$86,016,460,000	$71,628,706	$1,058,017,641
City of Long Beach	33,980	$5,768,806,000	$6,469,081	$90,714,182
Town of North Hempstead	120,320	$26,354,892,000	$27,335,212	$418,916,026
Town of Oyster Bay	253,188	$49,340,000,000	$31,431,561	$452,859,925

Hazus models impacts to utility systems as a result of earthquakes. The chart below summarizes the utility system pipeline damage that could result from a 250 year or 1000 year earthquake.

Table 16: Expected Utility System Pipeline Damage

System	Total Pipelines Length (Miles)	Number of Leaks (250 year)	Number of Breaks (250 year)	Number of Leaks (1000 year)	Number of Breaks (1000 year)
Potable Water	7324	6	2	42	11
Wastewater	4394	3	1	21	5
Natural Gas	64	0	0	0	0
Oil	0	0	0	0	0

Figure 22 shows the areas in the County most likely to experience building-related losses if a 250 year earthquake occurred.

Figure 22: Estimated Building Related Losses due to a 250 year Earthquake Event

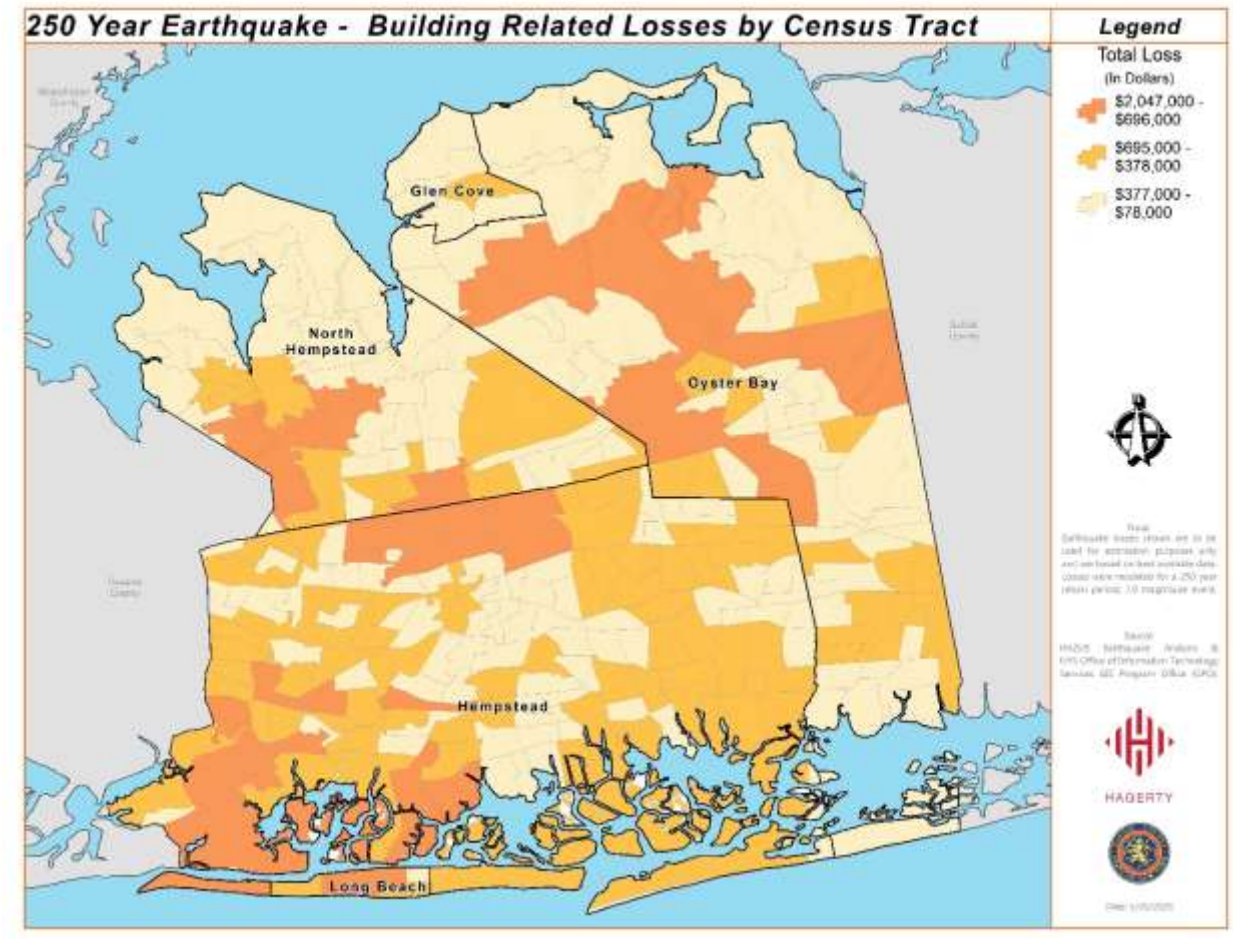
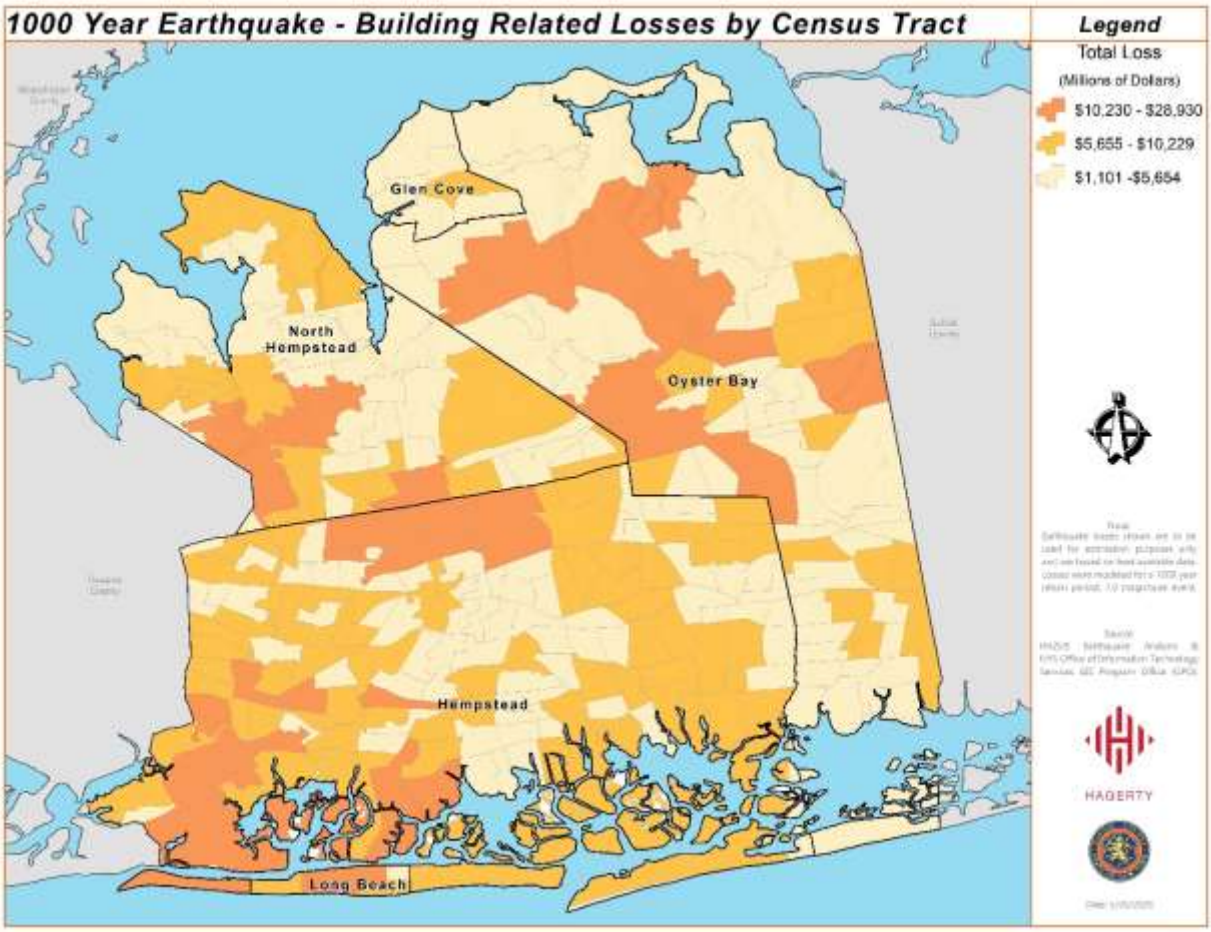


Figure 23 shows the areas in the County most likely to experience losses due to the 1000 year scenario within Nassau County.

Figure 23: Estimated Building Related Losses due to a 1000 year Earthquake Event



4.7 Hail

4.7.1 Characteristics

Hail is a form of precipitation consisting of solid ice that forms when liquid raindrops are carried by thunderstorm updrafts into extremely cold layers of the atmosphere and freeze (NOAA, Severe Weather 101: Hail Basics n.d.). Hail particles form from two processes: wet and dry growth. Wet growth is characterized by the slow freezing of water particles to the original hail piece, creating clear layers of ice. Dry growth is characterized by the rapid freezing of additional water particles (N. Y. Services 2019).

When the weight of the hail particles exceeds the force of the thunderstorm updraft, the particles fall to the ground. Additionally, larger hail typically falls closer to the updraft than smaller hail because smaller hailstones can be blown away from the updraft by horizontal winds (NOAA, Severe Weather 101: Hail Basics n.d.).

4.7.2 Location and Extent

Hail events are usually localized in nature and are equally likely to occur anywhere in Nassau County. The extent of hail is generally determined by measuring the diameter of the ice pellet. and through comparison to common objects, as outlined in ***Table 17***. Hail the size of a quarter, one inch in diameter, or larger are considered severe.

Table 17: Hail Size Extent Scale (NOAA, Severe Weather 101: Hail Basics n.d.)

Description	Diameter (in.)	Description	Diameter (in.)	Description	Diameter (in.)
Pea	0.25	Quarter	1.00	Teacup	3.00
Mothball	0.50	Golf Ball	1.75	Softball	4.00
Penny	0.75	Tennis Ball	2.50	Grapefruit	4.50
Nickel	0.88	Baseball	2.75		

4.7.3 Recent Occurrences

Between January 2010 and January 2020, Nassau County experienced nine hail events, of which five were severe. Combined, these nine occurrences resulted in $115,000 in property damage, 87 percent of which occurred during the August 2011 hail event in the Village of East Williston. Throughout the past ten years there have been no recorded losses in life or damage to crops within the County. Details about hail events between 210 and 2020 can be found in ***Appendix B***.

4.7.4 Probability

The probability of occurrence for hail in Nassau County is **likely,** with more than one event expected every five years on average, based on historic occurrences. Looking forward, climate change is expected to increase the frequency and severity of hail, causing more significant impacts to property and people (Douglas 2019). Although fewer days with hail events are expected over most areas in the future, an increase in the mean hail size is projected (NCEI 2020). Since the previous update, hail has been classified as highly likely to occur and is now a significant hazard to be addressed in this Plan.

4.7.5 Impacts and Vulnerability

According to the HAZNY risk assessment, hail was not evaluated as a separate hazard. Hail is a component of "Severe Storms" (i.e., thunderstorms), which were ranked a moderately high hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Severe Storm	
Rank	Moderately High
Potential Impact	Throughout a Small Region
Cascade Effects	Yes, Some Potential
Frequency	A Frequent Event
Onset	Several Hours Warning
Hazard Duration	Less Than One Day
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Hail hazards threaten **life, safety, and health** of the community and the **built environment**. Nassau County's built environment is vulnerable to hail events. Larger hail may damage automobiles, aircrafts, and machinery. Hail can cause notable damage to aircrafts when it enters engines, crushes the nose cone, or damages the cockpit windscreen (NOAA n.d.). Smaller and more typical hail events in Nassau County can result in property damage to automobiles and landscaping (NCEI 2020). Nassau County is expected to experience at least one hail event each year causing an average of $5,000 in damage (N. Y. Services, Hail 2019). In recent history, hail events in Nassau County have not resulted in any injuries, deaths, or crop damage (N. Y. Services, Hail 2019).

4.8 Hurricanes and Tropical Storms

4.8.1 Characteristics

Hurricanes and tropical storms bring heavy rainfall and strong winds and may cause other hazards such as floods, tornados, and coastal erosion. A tropical cyclone is an overarching term that encompasses all storm systems that are “non-frontal synoptic scale low-pressure system[s] over tropical or sub-tropical waters with organized convection (i.e. thunderstorm activity) and definite cyclonic surface wind circulation” (NOAA n.d.). There are four types of tropical cyclones, outlined below: (Machos n.d.)

- **Tropical Waves** are the most common of type of tropical disturbance with an average of 100 forming each season across the nation. They lack closed circulation, instead producing winds in all directions. Wind speeds are less than 25 mph.
- **Tropical Depressions** create sustained winds of 25 mph, presenting a disorganized system which has the presence of a closed circulation.
- **Tropical Storms** occur when shower and thunderstorm activity become organized with the closed circulation, and sustained winds reach at least 39 mph.
- **Hurricanes:** have sustained winds of at least 74 mph and the closed circulation becomes an eye, the center of the storm.

Tropical storms and hurricanes can be extremely destructive, delivering massive downpours of rain and winds that can push a wall of water, called a storm surge, in front of it. These storms can also spawn tornadoes that cause acute, localized damage.

4.8.2 Location and Extent

Given the large size of hurricanes and tropical storms, all jurisdictions in Nassau County are equally likely to experience the effects of a hurricane and tropical storm event. The coastal areas of the County are more likely to experience coastal erosion and storm surge associated while the entire County is susceptible to the high winds and heavy rains associated with hurricanes and tropical storms.

According to NOAA’s Historical Hurricane Tracks online tool, 21 tropical storms and 8 hurricanes have passed within a 50 mile radius of the County, including 11 tropical storms that have made direct landfall, as displayed in ***Figure 24***. The extent of hurricanes and tropical storms is measured based on windspeed using the Saffir-Simpson Hurricane Wind Scale, summarized in ***Table 18*** (NOAA 2012). Category 3 hurricanes and greater are considered major hurricanes capable of devastating damage.

Figure 24: Hurricane and Tropical Storm Tracks within 50 Miles of Nassau County (1861 – 2020)

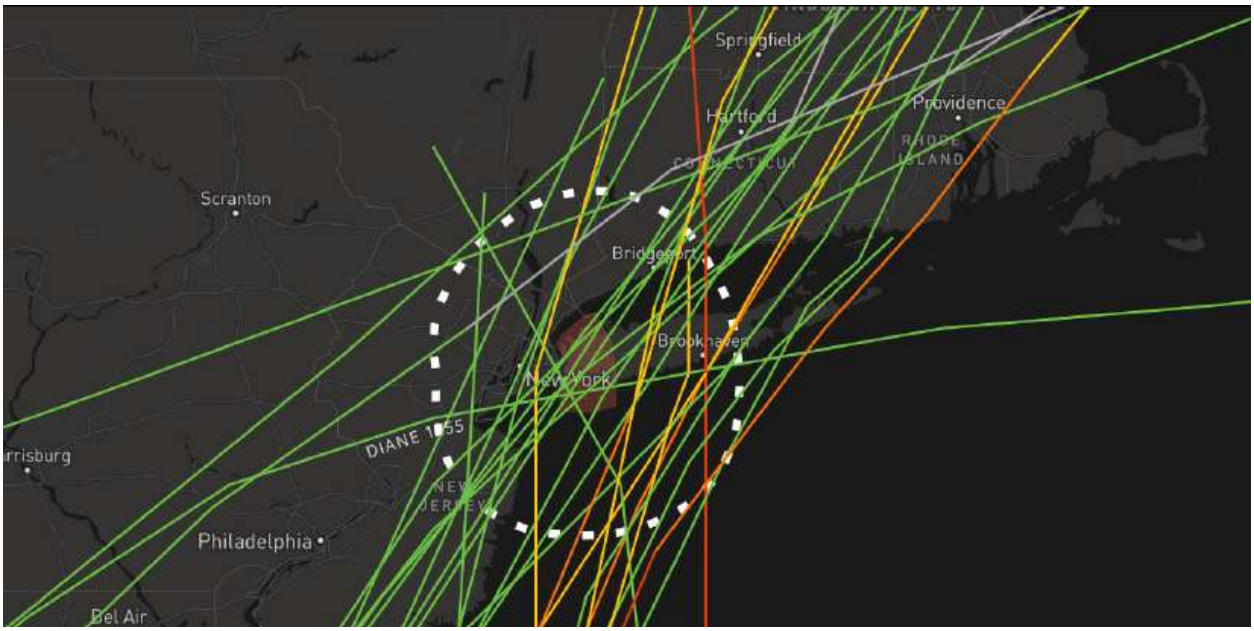


Table 18: Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3	111-129 mph	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	130-156 mph	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, and power poles downed. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 mph or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

4.8.3 Recent Occurrences

Nassau County may go years without experiencing a severe hurricane or tropical storm event, however when major storms do occur, they prove to be extremely impactful. The strongest storm to affect New York State, specifically Long Island, was the Category 3 1938 New England Hurricane. This hurricane made landfall at a speed of 47 mph, causing 700 deaths, leaving 63,000 people homeless after destroying 8,900 homes and buildings, damaging two billion trees, and costing $620 million in total damage (NOAA 2018).

In the last 20 years, Nassau County was greatly impacted by Hurricanes Isabel (2003), Frances (2004), Bill (2009), Irene (2011), Super Storm Sandy (2012), and Tropical Storm Isais (2020). ***Table 19*** summarizes details about storms that occurred most recently between 2010 and 2020 (Newsday 2017).

Table 19: Notable Hurricanes and Tropical Storms to Impact Nassau County, 2010 – 2020

Storm	Month and Year	Description
Tropical Storm Isaias	August 2020	Tropical Storm Isaias brought 50 mph winds the Nassau County, causing widespread damage and power outages to the area. Nearly one third of PSEG-Long Island 1.1 million customers in Nassau and Suffolk counties lost power during the storm.
Hurricane Jose	September 2017	While Hurricane Jose dropped to a tropical storm by the time it reached New York State, largely sparing Long Island, it still flooded Jones Beach State Park. Some minor flooding was reported in Lindenhurst, Bay Shore, Mastic Beach, and Islip. Power outages were reported. Dune erosion, dangerous riptides, and high surf occurred.
Hurricane Arthur	July 2014	The hurricane tracked east of Long Island, no direct hit, but produced larger waves, higher surf, higher rip current activity, and downpours of rain throughout the day.
Hurricane Sandy	October 2012	Hurricane Sandy evolved into a superstorm by the time it reached New York State and impacted Nassau County with life-threatening storm surges and high winds. This historic and record-setting storm destroyed 117 structures in Nassau County, with a total of 38,189 structures damaged by more than 50 percent of their value across Long Island. Multiple deaths and injuries were also reported in Nassau County as a result of the storm. Storm surge from Hurricane Sandy was so powerful it breached Fire Island in three different locations.
Hurricane Irene	August 2011	Hurricane Irene dropped to tropical storm status as it hit Long Island. However, it caused severe flooding and widespread power outages across the state of New York, suspension of Long Island Railroad, mass school closures and a statewide state of emergency declaration (Long Island Hurricane History n.d.).

4.8.4 Probability

The expansive geography of hurricanes complicates the determining their probability of impacting Nassau County. Hurricanes and tropical storms that make landfall outside of the County can still severely impact Nassau County, causing coastal flooding, erosion, wind, and other related hazards. However, these impacts that result from hurricanes and tropical storms do not register

in the NOAA Storm Events database as such, but instead are recorded as “coastal floods,” “flash floods,” “high wind,” or other interrelated event types. Therefore, other sources of historical information must be referenced to determine probability.

Looking at the historic frequency of hurricanes and tropical storms that touched Long Island, the probability of future impacts from hurricanes and tropical storms impacting Nassau County is **likely**, meaning these events should be expected at least once every five years (Newsday 2017). The historic rate of occurrence serves as a starting point for estimating future probability but does not account for anticipated changes resulting from climate change. Rising sea temperatures will increase the intensity of these storm systems and sea level rise will worsen the coastal flooding caused by storm surge.

4.8.5 Impacts and Vulnerability

According to the HAZNY risk assessment, Hurricanes/Coastal Storms are ranked as the greatest hazard to Nassau County. Additional details about the result of that assessment are summarized in the table below.

Hurricanes and Tropical Storms	
Rank	High
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Highly Likely
Frequency	A Frequent Event
Onset	Several Days Warning
Hazard Duration	Two to Three Days
Recovery Time	More Than Two Weeks
Impact	• Serious Injury or Death is Likely, in Extremely Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Nassau County is uniquely vulnerable to hurricanes and tropical storms due to its population and zoning density. Nassau County is considered to have the greatest risk within the State of New York (NYS DHSES 2019). As a coastal county, Nassau County was impacted by almost twice as much damage (in dollars) from tropical storms and hurricanes between 1996 and 2017 as the next most-damaged County (Queens). These events in Nassau County contribute to numerous associated hazards (high winds, flooding, tornadoes, etc.) that threaten the livelihood of people, damage property, and interrupt critical community lifelines. The potential impacts and county vulnerability to these other hazards are discussed in depth in their respective sections of this Plan.

Between 1996 and 2017, Nassau County reported $1.5 billion in losses due to tropical storms and hurricanes (NYS DHSES 2019). The annualized damage during that period was $64.7 million, with an average of five severe events (defined as events that caused more than $1 million in damage) occurring per year (NYS DHSES 2019).

To estimate the potential impacts that winds associated with hurricane and tropical storm events could have in Nassau County, different scenarios were run for the 100 year and 500 year wind

events using the loss estimation program, Hazus. Hazus estimated the following countywide impacts from the 100 and 500 year events:

- About 875 buildings will be at least moderately damaged and two buildings will be completely damaged as a result of the 100 year wind event. A 500 year wind event will cause considerably more building damage, with 20,838 buildings sustaining at least moderate damage and approximately five percent of the buildings in the Hazus database for this scenario (972 buildings) destroyed.
- The 100 year wind event will cause no moderate or long-term damage to essential facilities. In the 500 year wind event, four schools will sustain at least moderate damage. ***Appendix B*** contains tables detailing the total losses sustained by each essential facility.
- Approximately 145 households will be displaced and approximately 91 individuals will seek shelter as a result of a 100 year wind event. The 500 year wind event could displace 3,162 people and cause 1,988 individuals to seek shelter. Refer to ***Appendix B*** for a detailed breakdown of the number of people displaced and seeking shelter, by jurisdiction, for the different flood events.
- The model estimates 79,760 tons of debris will be generated from the 100 year wind event. This figure quadruples for a 500 year wind event, which is estimated to generate a total of 458,529 tons of debris.

After Hurricane Sandy, shelter needs were much greater due evacuation orders and the combined impacts of wind and flooding that damaged homes and displaced residents. These additional factors are considered when conducting shelter planning.

The total losses from the 100 and 500 year wind events are summarized in ***Table 20*** for the largest jurisdictions and the County. “Total losses” includes damage to buildings and its contents, as well as the cost of business interruptions such as relocation and wage losses. ***Appendix B*** contains tables summarizing the total losses by sector (e.g., residential, commercial, government, etc.) for each jurisdiction in Nassau County.

Table 20: Total Losses from 100 year and 500 year Wind (Hurricane) Events

Jurisdiction	Population (Hazus)	Total Exposure	Total Losses 100 year
Nassau County	1,339,532	$239,082,476,000	$749,532,900
City of Glen Cove	29,314	$5,042,084,000	$21,794,842
Town of Hempstead	513,170	$86,016,460,000	$419,606,026
City of Long Beach	33,980	$5,768,806,000	$46,482,904
Town of North Hempstead	120,320	$26,354,892,000	$152,875,752
Town of Oyster Bay	253,188	$49,340,000,000	$237,171,336

Figure 25 shows the areas in the County most likely to experience losses due to the 100 year scenario within Nassau County. Of the nearly $750 million of estimated damage associated with the 100 year event, it is estimated that more than 95% of the damage are a direct result of actual property damage, mostly to residential dwellings.

Figure 25: Total Economic Losses from 100 year Hurricane Event Wind

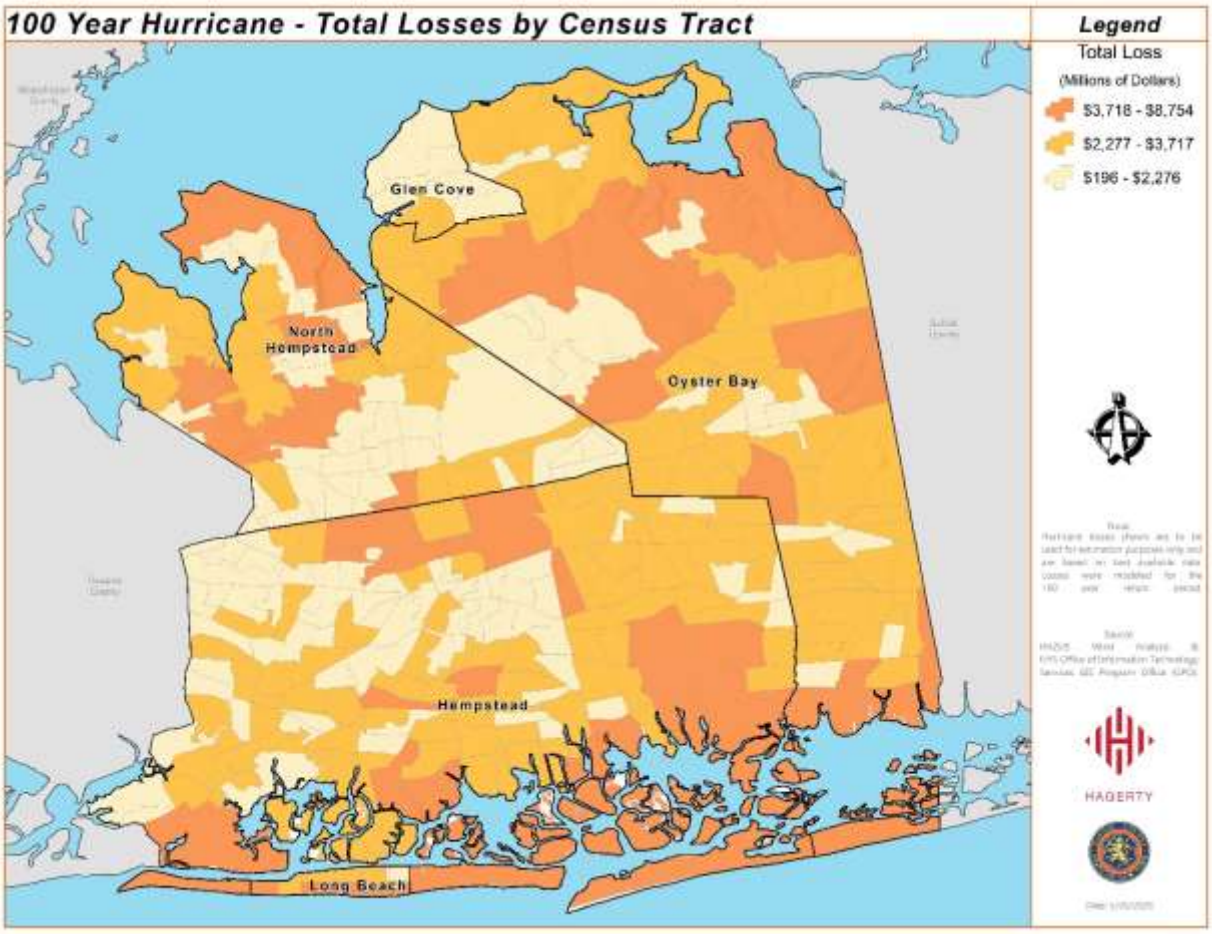
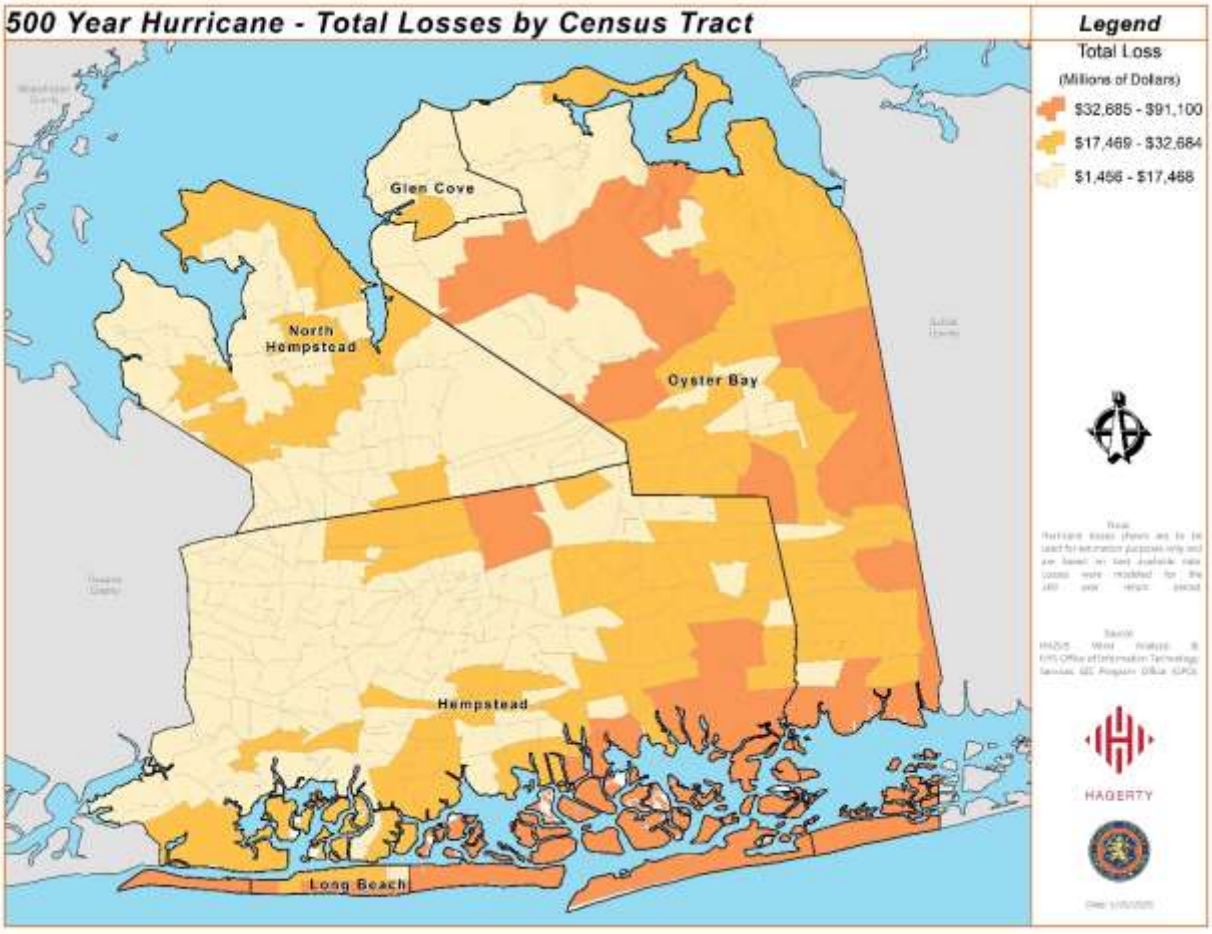


Figure 26 shows the areas in the County most likely to experience losses due to the 500 year scenario within Nassau County. Of the $5 billion in estimated damages associated with the 500 year event, it is estimated that nearly $4.7 billion dollars are a direct result of property damage, of which nearly 85% is related to residential dwellings.

Figure 26: Total Economic Losses from 500 year Hurricane Wind



4.9 Lightning

4.9.1 Characteristics

Lightning strikes occur when strong negative charges build up within a thunderstorm cloud and strong positive charges on the ground move up tall objects, such as buildings, trees, and telephone poles. A “stepped leader” (a negative charge descending from a thunderstorm cloud) then makes its way towards the ground, where it connects with the positive charge. That is when a bright flash of lightning (the “return stroke”) occurs (N. Y. Services 2019).

A lightning bolt can reach temperatures of approximately 50,000°F (NOAA n.d.). This extreme temperature causes the air surrounding the bolt to rapidly heat and expand, resulting in an explosive shockwave that we hear as thunder. Thunderstorms are dangerous storms that include lightning and can include powerful winds over 50 mph, create hail, and cause flash flooding and tornadoes (N. Y. Services 2019). There are four different types of lightning that can occur:

- **Cloud to Sky lightning** is a discharge jumping from a cloud into the surrounding sky.
- **Intra-Cloud lightning** occurs when oppositely charged centers within the same cloud ignite and cause a bright flash. This is the most common type of lightning.
- **Inter-Cloud lightning** occurs between oppositely charged areas of different clouds.
- **Cloud to Ground lightning** occurs when the negative charge of the bottom of a cloud travels to the positively charged ground below. It is the most dangerous to people and therefore the most researched.

4.9.2 Location and Extent

Given the nature of the hazards, all jurisdictions in Nassau County are equally likely to experience lightning. The extent of lightning events can be measured by the lightning activity level (LAL) outlined in ***Table 21*** (NOAA, Lightning Activity Level n.d.).

Table 21: Lightning Activity Level Extent Scale

Lightning Activity Level	Description
1	No thunderstorms
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent. One to five cloud to ground strikes in a five-minute period.
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, six to ten cloud to ground strikes in a five-minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced. Lightning is frequent. 11 to 15 cloud to ground strikes in a five-minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a five-minute period.
6	Dry lightning (LAL 3 without rain). Lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

4.9.3 Recent Occurrences

Between January 2010 and January 2020, Nassau County experienced nine significant[7] lightning events across 12 different jurisdictions in the County (NCEI 2020). These recent occurrences caused injury to five individuals and property damage totaling $73,5000 (NCEI 2020). ***Appendix B*** provides additional details on these hazard events.

4.9.4 Probability of Occurrence

The probability of occurrence for lightning in Nassau County is **likely**. Based on historic records, lightning events are expected more than once every five years (NCEI 2020). While research is inconclusive about how climate change will specifically impact lightning hazards. Research does suggest that thunderstorms will occur with greater frequency and severity which may have implications on the frequency of significant lightning.

4.9.5 Impacts and Vulnerability

According to the HAZNY risk assessment, lightning was not evaluated as a separate hazard. Lightning is a component of "Severe Storms" (i.e., thunderstorms), which were ranked a moderately high hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Severe Storm	
Rank	Moderately High
Potential Impact	Throughout a Small Region
Cascade Effects	Yes, Some Potential
Frequency	A Frequent Event
Onset	Several Hours Warning
Hazard Duration	Less Than One Day
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Nassau County is vulnerable to the impacts of lightning hazards primarily in terms of impact on **life, safety, and health** of the community and the **built environment**. The vulnerability of the community's life, safety, and health increases as population density increases (N. Y. Services, Lightning 2019). While it has been reported only an average of 10% of people who are struck by lightning are killed, the other 90% are generally left with various degrees of disability). During the ten year period of analysis, Nassau County experienced five injuries related to lightning.

[7] As defined by the NOAA Storm Events database.

The vulnerability of the built environment increases as the building density and the cost of the assets of the built environment increases. Lightning can strike and damage buildings and equipment. Lightning can therefore cause significant damage to infrastructure, critical facilities, and private property by igniting fires (N. Y. Services, Lightning 2019). Damage to the built environment can also impact communications and emergency response capabilities. During the ten year period of analysis, the County had about $7,350 in annual loss per year. However, an individual incident in the County during this period caused as much as $15,000 in damage (N. Y. Services, Lightning 2019).

4.10 Tornados

4.10.1 Characteristics

A tornado is a violently rotating column of air with winds ranging from 65 mph to more than 300 mph, usually attached to the base of a thunderstorm (NOAA, Tornado Definition n.d.). Typically, short-lived, these storms begin when high winds at ground level are slowed down by the friction of the earth's surface. A clear funnel begins to form when there is a change in wind speed or direction. As they pick up debris and dust, they acquire their grayish coloration (NOAA, Severe Weather 101: Types of Tornadoes n.d.). Due to typical weather patterns in Nassau County, most tornadoes advance west-to-east at an average speed of 30 mph (NOAA, Severe Weather 101: Tornado Basics n.d.).

4.10.2 Location and Extent

Given the nature of tornado hazards, all jurisdictions in Nassau County are equally likely to experience a tornado. The extent of a tornado is measured using the Enhanced Fujita Scale (EF Scale), shown in ***Table 22***. The EF Scale is used to evaluate damage from a suspected tornado based on a set of 28 damage indicators and estimates wind speed based on this damage assessment (NOAA, The Enhanced Fujita Scale (EF Scale) n.d.). Tornadoes are typically considered "significant" when categorized as an EF2 or EF3 on the Enhanced Fujita Scale, and "violent" when categorized as EF4 and EF5.

Table 22: Enhanced Fujita Scale

EF Rating	Wind Speed (mph)	Damage
0	65 – 85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
1	86 – 110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111 – 135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off the ground.
3	136 – 165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	166 – 200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown; small missiles generated.
5	Over 200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly in excess of 109 yards; high-rise buildings have significant structural deformation; catastrophic impacts should be expected.

4.10.3 Recent Occurrences

In the past ten years, Nassau County has not recorded a tornado occurrence. Since 1950, eight tornados have been recorded in Nassau County, all of which have been EF0 and EF1 (Bansen 2019).

4.10.4 Probability

The probability of occurrence for tornados in Nassau County is **unlikely**. Based on historic records, tornadoes are expected to occur less than once every five years in the county (NCEI 2020). Current research is inconclusive about the potential influence of climate change on the frequency and severity of tornados in New York State. However, since the 2014 risk management assessment Nassau County is no longer considered among the highest risk counties in New York State (N. Y. Services, Tornado 2019).

4.10.5 Impacts and Vulnerability

According to the HAZNY risk assessment, tornados are ranked as a moderately low hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Tornados	
Rank	Moderately Low
Potential Impact	Several Individual Locations
Cascade Effects	Yes, Some Potential
Frequency	A Regular Event
Onset	Several Hours Warning
Hazard Duration	Less Than One Day
Recovery Time	Three Days to One Week
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Nassau County is vulnerable to the impacts of tornados primarily in terms of impact on **life, safety, and health** of the community and the **built environment**. This vulnerability is highly dependent on the location of tornado incident. In areas with increased development and population damage, there is a much higher likelihood of impacts to the County. Tornados can damage public and private property, placing a financial and operational burden not only on the state at large, but also on local government and resources. Losses can extend from infrastructure damage to the interruption of services and the general economy, including critical infrastructure (N. Y. Services, Tornado 2019). Based on projections provided in the New York State Hazard Mitigation Plan based on historic occurrences, tornados are estimated to cause an annual average of $49,000 in damage to Nassau County (N. Y. Services 2019).

4.11 Severe Winter Weather

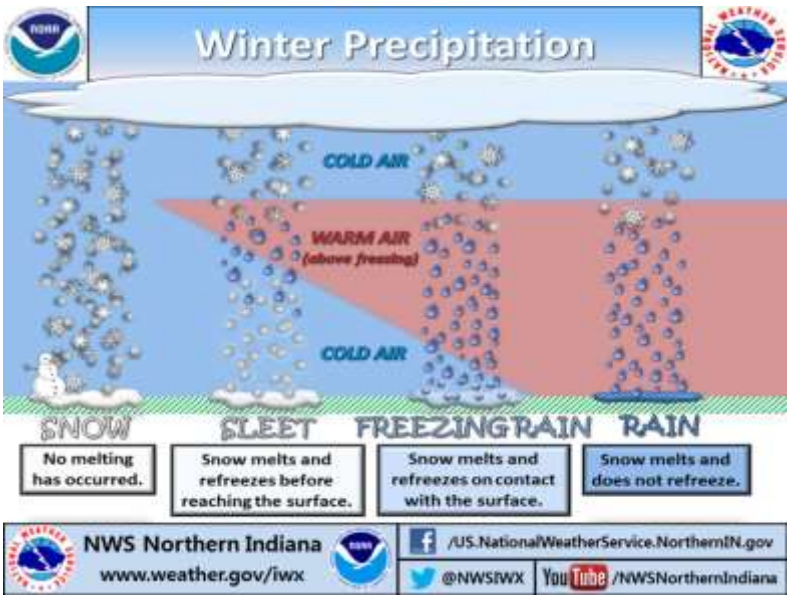
4.11.1 Characteristics

Severe winter weather is characterized by one or more of the following hazards: snow, blizzards, sleet, freezing rain, and extreme cold (NOAA, Severe Weather 101: Winter Weather n.d.). Extreme cold is discussed further in the ***Extreme Temperatures*** section. Strong low pressure systems move across the United States during winter months and bring severe winter weather to the Northeast. Nor'easters are a type of coastal winter storm that occurs along the East Coast of North America, between the months of September and April, and is known for causing damaging winds, storm surges, coastal erosion, and significant snow accumulations in Nassau County.

Different types of freezing precipitation are discussed below and in ***Figure 27.***

- **Snow**: Snow forms when precipitation freezes in cold wintertime clouds. Snowflakes are ice crystals that cling to each other as they fall to the ground. If the air temperature remains at or below 32 degrees F from the cloud base to the ground, the precipitation will continue to fall as snow.
- **Blizzards**: Blizzards are snow events with winds that exceed 35 mph, blowing snow and sometimes reducing visibility to a quarter mile or less.
- **Sleet**: When snowflakes only partially melt after falling through a shallow layer of warm air, sleet occurs. These slushy drops refreeze as they then fall through a deep layer of freezing air above the surface, and eventually reach the ground as frozen rain drops that bounce on impact.
- **Freezing Rain:** Freezing rain occurs when snowflakes descend into a warmer layer of air and melt completely. When these liquid water drops fall through another thin layer of freezing air just above the surface, they do not have enough time to refreeze completely before reaching the ground, resulting in freezing rain. When freezing rain significantly accumulates for several hours it is called an ice storm.

Figure 27: Types of Winter Precipitation



4.11.2 Location and Extent

Given the large geographic footprint of winter storms, all jurisdictions in Nassau County are equally likely to experience severe winter weather. The Northeast Snowfall Impact Scale (NESIS) is one way that the extent of severe winter weather is measured (NOAA, Regional Snowfall Index n.d.). The index, shown in ***Table 23,*** differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm.

Table 23: Northeast Snowfall Impact Scale

Category	Description	NESIS Range	Definition
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4 inch accumulations and small areas of 10 inch snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10 inches of snow while some include small areas of 20 inch snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations (greater than 30 inches)
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10 in. snows (generally between 50,000 and 150,000 square miles, roughly 1–3 times the size of New York State, with significant areas of 20 inch accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10 inch snowfalls, and each case is marked by large areas of 20 inches and greater snowfall accumulations.
5	Extreme	10+	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 inches. These are the only storms in which the 10 inch accumulations exceed 200,000 square miles and affect more than 60 million people.

The Dolan-Davis Nor'easter Intensity Scale, shown in ***Table 24***, is one method used to measure the extent of nor'easter, a common type of winter storm that impacts Nassau County (County 2010). The extent of nor'easters is challenging to measure, but the Dolan-Davis Nor'easter Intensity Scale considers storm magnitude in terms of beach and coastal deterioration.

Table 24: The Dolan-Davis Nor'easter Intensity Scale

Storm Class	Description	Beach Erosion	Dune Erosion	Overwash	Property Damage
1	Weak	Minor changes	None	No	No
2	Moderate	Modest; mostly to lower beach	Minor	No	Modest
3	Significant	Erosion extends across the beach	Can be significant	No	Loss of many structures at local level
4	Severe	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community level
5	Extreme	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional scale; millions of dollars

4.11.3 Recent Occurrences

Between January 2010 and January 2020, Nassau County experienced 32 reported winter weather events resulting in one death and 129 injuries. The worst winter storm event to impact Nassau County in terms of injuries occurred on January 10, 2014. A storm brought widespread freezing rain across Long Island causing dozens of motor-vehicle accidents and 129 injuries in Nassau County (NCEI 2020). No crop or property damage was recorded in association with these events. ***Appendix B*** provides additional details on these hazard events.

4.11.4 Probability

The probability of occurrence for severe winter weather in Nassau County is **highly likely**. Based on historic events, severe winter weather is expected multiple times annually. Research suggests that climate change is fueling an increase in the intensity winter storms because the atmosphere now holds more moisture, driving heavier than normal precipitation and snowfall accumulation (Communication 2011). Additionally, researchers attribute winter weather whiplash, a sudden shift from one set of weather conditions to another, to climate change (Harvey, How Climate Change May Affect Winter 'Weather Whiplash' 2019).

4.11.5 Impacts and Vulnerability

According to the HAZNY risk assessment, severe winter weather is ranked a moderately high hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

Severe Winter Weather	
Rank	Moderately High
Potential Impact	Throughout a Large Region
Cascade Effects	Yes, Some Potential
Frequency	A Frequent Event
Onset	Several Days Warning
Hazard Duration	Two to Three Days
Recovery Time	Three Days to One Week
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Little or No Damage to Private Property • Moderate Damage to Public Facilities

Severe winter storms can cause extensive impacts to the County, fundamentally to the **life, safety, and health** of the community and the **built environment**. Winter storms contribute to hundreds of deaths that are difficult to calculate and impossible to attribute specifically to the hazard. Examples of these types of deaths include automobile accidents caused by icy roads, heart attacks while shoveling snow, or hypothermia from prolonged exposure to the cold.

Moreover, winter storms can cause extensive damage to critical infrastructure. Utilities may be disrupted, causing life safety issues. Transportation may be interrupted causing detours, delays, and cancellation of mass transportation.

Severe winter storms can also cause property damage. High winds, heavy snow, and ice can topple over trees. The paint may chip on the siding of home after years of exposure to snow and ice. Overtime, chipping can lead to water intrusion and damage.

The County's **economy** is vulnerable to the cascading impacts of the hazard event. Severe winter weather can create the inability to commute to work, conduct business operations, purchase goods or services; in addition to the cost of snow removal and damage repairs (Directorate 2014).

4.12 Straight-Line Wind

4.12.1 Characteristics

Wind occurs when air moves from high to low pressure. Pressure differences result from the uneven heating of Earth's surface that causes differences in temperature. Straight-line winds are produced by the downward momentum in the downdraft region of a thunderstorm and distinguished from tornadic wind by the lack of rotation. Straight-line winds are commonly associated with hurricanes and nor'easters. ***Table 25*** outlines different types of straight-line winds (NOAA, Severe Weather 101: Types of Damaging Winds n.d.).

Table 25: Straight-line Wind Types

Type	Description
Downdraft	A small-scale column of air that rapidly sinks toward the ground.
Downburst	Downburst is the general term for all localized strong wind events that are caused by a strong downdraft within a thunderstorm. Downbursts can be categorized as macrobursts when they are greater than 2.5 miles across and microbursts when they are less than 2.5 miles across.
Gust front	The leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up air above them, forming a shelf cloud or detached roll cloud.
Derecho	Widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. If the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho.

4.12.2 Location and Extent

Straight-line winds can occur anywhere in Nassau County; therefore, all jurisdictions are equally likely to experience this hazard. Generally, straight-line winds are considered severe when they meet or exceed 58 mph.[8] Furthermore, the extent of straight-line wind can be measured utilizing the Beaufort Scale, shown in ***Table 26*** (Beaufort wind scale n.d.). Current research has determined that nationwide, the wind speed of significant wind events has increased since 2010 (Harvey, The World's Winds Are Speeding Up 2019).

[8] Per the National Weather Service.

Table 26: Beaufort Scale

Grade	Kind of wind	Knots	Km/h	Effects	Height of waves (meters)
0	Calm	<1	<1	Smoke rises vertical	-
1	Very light	1-3	1-5	The wind bends smoke	0.1
2	Light breeze	4-6	6-11	It can be felt on face	0.2 – 0.3
3	Gentle breeze	7-10	12-19	It shakes leaves	0.6 – 1.0
4	Moderate breeze	11-16	20-28	It lifts dust and papers	1.0 – 1.5
5	Fresh breeze	17-12	29-38	It shakes branches	2.0 – 2.5
6	Strong breeze	22-27	39-49	It shakes big branches	3.0 – 4.0
7	Near gale	28-33	50-61	It impedes walking	4.0 – 5.5
8	Gale	34-40	62-74	It shakes big trees	5.5 – 7.5
9	Strong gale	41-47	75-88	Chimney pots and slate removed	7.0 – 10.0
10	Storm	48-55	89-102	It uproots trees	9.0 – 12.5
11	Violent Storm	56-63	103-117	Serious devastation	11.5 – 16.0
12	Hurricane	> 64	>118	Very serious catastrophes	>14

4.12.3 Recent Occurrences

Between January 2010 – January 2020, Nassau County reported 75 significant[9] straight-line wind events (NCEI 2020). These recent occurrences caused injury to three individuals and property damage totaling $1,572,000 (NCEI 2020). ***Appendix B*** provides additional details on these hazard events.

4.12.4 Probability

The probability of occurrence for significant straight-line wind hazards in Nassau County is **highly likely**. High wind hazards are expected to occur in the County more than once per year.

4.12.5 Impacts and Vulnerability

According to the HAZNY risk assessment, straight-line wind was not evaluated as a separate hazard. Straight-line wind is a component of “Severe Storms” (i.e., thunderstorms), which were ranked a moderately high hazard in Nassau County. Additional details about the result of that assessment are summarized in the table below.

[9] As defined by the NOAA Storm Events database.

Severe Storm	
Rank	Moderately High
Potential Impact	Throughout a Small Region
Cascade Effects	Yes, Some Potential
Frequency	A Frequent Event
Onset	Several Hours Warning
Hazard Duration	Less Than One Day
Recovery Time	One to Two Days
Impact	• Serious Injury or Death is Likely, but Not in Large Numbers • Severe Damage to Private Property • Severe Damage to Public Facilities

Nassau County is vulnerable to the impacts of wind hazards primarily in terms of impact on the **life, safety, and health** and **built environment**. Extreme winds pose a significant threat to lives, property, and vital utilities due to flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type that can be picked up by the wind and hurled with great force.

Vulnerability increases in areas that have more structures of light construction, particularly manufactured homes, which suffer more damage from high winds. Moreover, older buildings, especially those that were built prior to when the County adopted modern building codes, are susceptible to damage from straight-line winds. These buildings are less likely to have enough design to mitigate wind damage. Even structurally sound buildings can suffer costly damage with potential for secondary impacts, such as broken windows (N. Y. Services, Wind 2019).

Extreme winds also down trees and power lines, often resulting in power outages across an affected area (N. Y. Services, Wind 2019). During the ten year period of analysis, straight-line winds have caused about $19,700 in annual losses in Nassau County. However, one event during this time period caused about $100,000 in damage (N. Y. Services, Wind 2019).

5 Capability Assessment

This section summarizes the capabilities that Nassau County has in place that can support hazard mitigation. These capabilities include plans, ordinances, staff, financial resources, and program participation. This Capability Assessment was used to help drive the identification and development of the projects presented in the Mitigation Strategy to make sure that they are appropriate in scope and achievable to implement. Capability assessments specific to the participating jurisdictions of this multi-jurisdictional Plan are available in the Jurisdictional Annexes.

5.1 Progress after Superstorm Sandy

After Superstorm Sandy, the capabilities of Nassau County and the cities, towns, and villages within Nassau County have increased related to disaster management and hazard mitigation. Superstorm Sandy devastated Nassau County, causing over $1 billion in damage to infrastructure and over 35,000 residents requesting FEMA assistance. Due to the storm, these jurisdictions have extensively utilized various funding streams, including the FEMA's Public Assistance (PA) and Hazard Mitigation Grant Program (HMGP) as well as funding from the Governor's Office of Storm Recovery (GOSR).

Specifically, Nassau County's Department of Public Works has led the way in understanding risk to the County's infrastructure that was exposed from Superstorm Sandy. Since then there has been extensive work to mitigate risk, including:

- West Shore Road and seawall repair in Bayville
- Emergency generator elevation for Bayville and Long Beach Bridges
- Purchase of portable traffic signal trailers for use throughout the County
- Purchase of portable message sign trailers for use throughout the County
- Purchase of emergency generator trailers for use throughout the County
- Purchase of traffic camera trailers for use throughout the County
- Purchase of highway advisory radios for use in the County
- Purchase of incident management response trailers for use in the County
- Traffic signal infrastructure improvements
- Signal Management System upgrades
- Restoration of Bay Park in East Rockaway
- Hardening of North Woodmere Park and Wantagh Park
- Restoration of Bay Park Wastewater Treatment Plant and Sewage Pumping Stations
- Barnes Avenue/Third Place sanitary sewer overflow mitigation in the Villages of Baldwin and Hempstead

Specific mitigation related projects implemented after Super Storm Sandy are also included in the Jurisdictional Annexes.

5.2 Legal and Regulatory Capabilities

Legal and regulatory capabilities are assessed during the mitigation planning process in order to understand the County's framework for implementing a diverse range of mitigation actions. Moreover, legal and regulatory capabilities can often in and of themselves be mitigation actions, by strategically guiding development and planning for the future.

Legal and regulatory capabilities that can support mitigating risk to a community include:

- Access and functional needs plans
- Building codes
- Capital improvement plans
- Climate action plans
- Community development plans
- Comprehensive plans
- Master plans
- Economic development plans
- Emergency response plans
- Floodplain management plans
- Growth management plans
- Flood damage prevention ordinances
- Open space plans
- Post disaster recovery ordinances
- Post disaster recovery plans
- Real estate disclosure requirements
- Resilience plans
- Site plan review requirements
- Small area development plans
- Special purpose ordinances
- Stormwater management plans
- Subdivision ordinances
- Transportation plans
- Zoning ordinances

The purpose of this piece of the assessment is not to evaluate the County based on these potential capabilities but rather to understand the capabilities the County currently has to help guide and prioritize future planning efforts. ***Table 27*** lists the existing legal and regulatory capabilities that the County has that support mitigation. Specific capabilities of individual jurisdictions are listed in the Jurisdictional Annexes.

Table 27: Nassau County's Existing Legal and Regulatory Capabilities

Regulatory Tool	Details
2017 Comprehensive Emergency Management Plan (CEMP)	Operational plan to outline how the Nassau County will manage an emergency.
2010 Nassau County Master Plan	The Master Plan is a policy framework for Nassau County that sets goals and actions for how jobs, places, and infrastructure will grow and improve to prosper on the road to 2030 and beyond.
Departmental COOP Protocols, 2020	Nassau County underwent a comprehensive continuity of operations planning effort with Nassau County government departments.
Environmental Review	Section §1611 of the County Charter charges the Nassau County Planning Commission with providing a State Environmental Quality Review Act (SEQRA) recommendation to the County Legislature or the County Executive regarding certain actions of the County. The

Regulatory Tool	Details
	Legislature or the Executive then uses that recommendation to act as Lead Agent under the State Environmental Quality Review Act (SEQRA).
Nassau Inter-County Express (NICE) Plan	Countywide plan for transportation and transit across Nassau County.
Subdivision Review	Nassau County has jurisdiction over the subdivision of land within the unincorporated portions of the Towns of Hempstead, North Hempstead and Oyster Bay. On average, the Nassau County Planning Department will review 120-140 subdivision applications over the course of a year.
2005 - 2030 Regional Transportation Plan	This plan lays out the Region's transportation needs and desires over a minimum twenty year period to provide a continuing, coordinated, comprehensive transportation planning process while assuring air quality. The Planning Department participates in NYMTC's Working Groups needed to support the RTP.
Zoning Referral	New York State General Municipal Law Section 239m requires that municipalities refer certain proposed actions to the Nassau County Planning Commission for its recommendation, including the adoption of Comprehensive Plans and Master Plans or any Plan with land use planning implications; approval of site plan; and boundary of any city, village, or town. A comprehensive list can be found on the Nassau County Planning Department's website.
U.S. Housing and Urban Development (HUD) 5-Year Consolidated Plan (2014 – 2019)	This Plan strategizes for the effective use of funding to address the revitalization needs of the 31 member Urban County Consortium.

5.3 Administrative and Technical Capabilities

Administrative and technical capabilities are assessed during the mitigation planning process in order to understand the County's capability to planning for and implement mitigation projects. This assessment also helps to highlight the additional support that may be needed to partake in certain mitigation activities. The specific capabilities of Nassau County and participating jurisdictions are listed in the Jurisdictional Annexes.

5.4 Fiscal Capabilities

Fiscal capabilities are assessed during the mitigation planning process in order to gain perspective on how projects outlined in the Mitigation Strategy can be immediately funded or funded in the future. Fiscal capabilities that can support mitigating risk to a community include:

- Ability to incur debt through general obligation bonds
- Ability to incur debt through private activity bonds
- Ability to incur dept through special tax bonds
- Authority to levy taxes for specific purposes
- Capital Improvements Project Funding
- Authority to withhold public expenditures in hazard prone areas
- Authority to utilize user fees for utility services
- Community Development Block Grants (CDBG)
- Impact fees for home buyers and/or developers
- State and federal mitigation grant programs

Table 28 lists the existing fiscal capabilities that the County has that support mitigation. Specific capabilities of individual jurisdictions are listed in the Jurisdictional Annexes.

Table 28: Nassau County's Existing Fiscal Capabilities

Fiscal Tool	Details
Community Development Block Grants (CDBG)	The Nassau Urban County Consortium is an entitlement community under the CDBG program. The CDBG program provides housing to support housing and community development in low-income and vulnerable communities.
Flood Mitigation Assistance (FMA) Program	The FMA program is a fiscal capability available to Nassau County to reduce flood risk. The County has obtained funding through the program for both riverine and coastal elevation projects.
Hazard Mitigation Grant Program (HMGP)	The HMGP program is a fiscal capability available to Nassau County. The HMGP supports communities in implementing long-term risk reduction measures post-disaster.
Pre-Disaster Mitigation (PDM) Grant Program / Building Resilient Infrastructure and Communities (BRIC)	The PDM grant program is a fiscal capability to Nassau County. The County obtained a grant through the program to fund the development of this plan update and has obtained funds previously for elevations and other infrastructure protection measures through the program. In 2020, the PDM program was replaced by FEMA's new BRIC program.

5.5 Community Classification Assessment

Community classifications are assessed during the mitigation planning process in order to gain a better understanding of what the County is already doing to promote risk reduction. Additionally, certain community classifications can influence other capabilities listed previously in this document. Community classifications that can support mitigating risk to a community include:

- Building Code Effectiveness Grading Schedule (BCEGS)
- Public Protection Classification Program
- Community Rating System (CRS)
- Climate Smart Communities Program

Table 29 lists the existing fiscal capabilities that the County has that support mitigation. These classifications generally pertain to local communities and are listed in the Jurisdictional Annexes.

Table 29: Nassau County's Community Classifications

Classification	Details
Climate Smart Communities Program	On January 2, 2020 Nassau County passed a resolution to participate in the New York State Department of Environmental Conservation's (NYSDEC's) Climate Smart Communities Program. This program aims to provide technical support to local jurisdictions to reduce greenhouse gas emissions and mitigate / adapt to the impacts of climate change. Eight municipalities in Nassau County have taken the Climate Smart Communities pledge, including: • Town of Hempstead • Town of North Hempstead • Town of Oyster Bay • Village of East Rockaway • Village of Great Neck Plaza • Village of Sea Cliff • Village of Woodsburgh • Nassau County The City of Long Beach has a Bronze Certification in the Program.
StormReady Communities	The StormReady program is run by the National Oceanic and Atmospheric Administration's (NOAA's) National Weather Service (NWS) to support community preparedness to extreme weather. Nassau County is a StormReady Community.

5.6 National Flood Insurance Program Summary

The National Flood Insurance Program (NFIP) was created in 1968 to provide an incentive to communities that enact and enforce regulations that regulate development in floodplain areas through federally backed, affordable, flood insurance to residents and business owners in those communities. The NFIP is administered by FEMA.[10] Flood insurance through the NFIP is only available to those in communities that participate in the program. In Nassau County, the NFIP is administered at the local level. Each village, town, and city that participates in the NFIP has adopted a floodplain management ordinance that stipulates how floodplain management will be enforced. Details about how each jurisdiction oversees and maintains their participation in the NFIP can be found in the Jurisdictional Annexes.

5.7 Planning for Displaced Residents

5.7.1 Intermediate Housing Needs

The New York State Mitigation Planning Guide requires that viable parcels of land be pre-identified for use if a disaster causes significant damage to residences and temporary housing is needed. Nassau County analyzed Real Property Tax Parcels throughout the County against the following list of criteria to ensure their safety and viability to accommodate temporary housing:

- Outside the 100-year floodplain, as identified on FEMA's flood insurance rate maps;
- Utilities available (e.g., water and electric);
- Ingress and egress;
- Parcel size – larger than one acre; and
- Publicly owned, ideally, though privately owned sites also considered.

Through this analysis, the County identified the ***greater Hub region of Nassau County*** as an area that could potentially be used to site temporary housing. This area is desirable because it contains several County-owned properties (e.g., Nassau County Community College) that would allow the County to more easily facilitate a temporary housing mission. Many of the large parking lots in this area are close to utilities and could provide ideal locations to place temporary housing. In addition, a shelter and disaster resource center could be opened in the greater Nassau Hub region in the event of a disaster. Co-locating temporary housing may be advantageous from a logistics and public information perspective. This area is easily accessible by car and has several mass transportation options available as well. The County will conduct a more detailed planning effort in the future to further scope out the potential needs for temporary housing and examine how sites in and/or outside of the greater Nassau Hub region could be used to address this need.

[10] FEMA,2020. Flood Insurance. Retrieved at: https://www.fema.gov/national-flood-insurance-program.

5.7.2 Long-Term Permanent Housing Needs

In the event of a severe flooding event, structures currently located in the special flood hazard area may need to be relocated and rebuilt. Nassau County is highly developed with minimal to no vacant land that is viable for construction (i.e., not in a floodplain or wetland). Therefore, the County analyzed the number of residential parcels that are not located in a 100-year floodplain, as identified by FEMA. ***Table 30*** summarizes the properties that the County would have to work with outside the high-risk area. Strategies for long-term housing relocation would need to include home buyouts and a further examination of the subdivision and rezoning of previously developed property to allow for higher density development. Exploration of this approach would consider proven current technologies that would assist in the County's focus on risk reduction in all communities.

Table 30: Summary of Residential Parcels Outside the 100-Year Floodplain

Jurisdiction	Number of residential parcels	Total acreage of residential parcels
Atlantic Beach, Village of	28	3
Baxter Estates, Village of	229	58
Bayville, Village of	1455	352
Bellerose, Village of	349	46
Brookville, Village of	641	1630
Cedarhurst, Village of	1149	183
Centre Island, Village of	155	436
Cove Neck, Village of	101	542
East Hills, Village of	2279	852
East Rockaway, Village of	1814	308
East Williston, Village of	830	202
Farmingdale, Village of	1798	330
Floral Park, Village of	4394	487
Flower Hill, Village of	1480	654
Freeport, Village of	5437	960
Garden City, Village of	6465	1421
Glen Cove, City of	6323	1902
Great Neck Estates, Village of	2540	482
Great Neck Plaza, Village of	826	306
Great Neck, Village of	143	18
Hempstead, Town of	122057	18669
Hempstead, Village of	7412	993

Jurisdiction	Number of residential parcels	Total acreage of residential parcels
Hewlett Bay Park, Village of	137	158
Hewlett Harbor, Village of	257	164
Hewlett Neck, Village of	108	65
Island Park, Village of	29	4
Kensington, Village of	321	100
Kings Point, Village of	1278	1320
Lake Success, Village of	824	300
Lattingtown, Village of	592	1440
Laurel Hollow, Village of	596	1331
Lawrence, Village of	1159	449
Long Beach, City of	67	8
Lynbrook, Village of	5024	657
Malverne, Village of	2985	408
Manorhaven, Village of	1270	138
Massapequa Park, Village of	5568	878
Matinecock, Village of	262	1025
Mill Neck, Village of	361	1122
Mineola, Village of	4542	524
Munsey Park, Village of	836	212
Muttontown, Village of	1080	2043
New Hyde Park, Village of	2819	301
North Hempstead, Town of	27575	4586
North Hills, Village of	801	276
Old Brookville, Village of	757	1872
Old Westbury, Village of	1078	2822
Oyster Bay Cove, Village of	723	1873
Oyster Bay, Town of	68119	14418
Plandome Heights, Village of	407	186
Plandome Manor, Village of	314	78
Plandome, Village of	245	146
Port Washington North, Village of	712	115
Rockville Centre, Village of	5915	1056
Roslyn Estates, Village of	434	136

Jurisdiction	Number of residential parcels	Total acreage of residential parcels
Roslyn Harbor, Village of	404	192
Roslyn, Village of	355	355
Russell Gardens, Village of	242	63
Saddle Rock, Village of	266	91
Sands Point, Village of	846	1502
Sea Cliff, Village of	1633	384
South Floral Park, Village of	402	46
Stewart Manor, Village of	658	78
Thomaston, Village of	644	144
Upper Brookville, Village of	559	1784
Valley Stream, Village of	9196	1092
Westbury, Village of	3747	684
Williston Park, Village of	2153	234
Woodsburgh, Village of	192	101
Total:	**326397**	**77796**

5.8 Planning for Evacuation and Sheltering

Nassau County's *Coastal Storm Plan* outlines the viable evacuation routes in the event of a coastal storm. The County also maintains a Hurricane Preparedness Section on the Nassau County OEM website that includes a link to the evacuation routes.

- Hurricane Evacuation Routes: https://www.nassaucountyny.gov/2931/Hurricane-Evacuation-Routes

Information about the types of shelters and accommodations available to Nassau County residents during the time of an emergency can be found here on the Nassau County OEM website:

- Shelter Information: https://www.nassaucountyny.gov/1627/Emergency-Preparedness

The County has taken steps to analyze that all Coastal Storm shelters are located outside of the flood zones. A list of these shelters is included as part of a redacted appendix to this Plan. The County does not publicly post the full list of shelter locations because these locations are only opened based on the event. The County does not want people to assume that all the shelters will always be opened. In the event of an emergency, the County will publicly post information about shelter locations as they are opened at the following link:

- Hurricane Evacuation Shelters: https://www.nassaucountyny.gov/1633/Hurricane-Evacuation-Shelters

6 Mitigation Strategy

This section presents the Mitigation Strategy for the Nassau Hazard Mitigation Plan. ***Figure 28*** below summarizes the different components of the Mitigation Strategy: the goals of the County's Mitigation Program, the review and development of mitigation action plans, and the implementation strategy. Nassau County's mitigation actions are presented in this section of the plan. Actions for each of the participating jurisdictions can be found in their respective Jurisdictional Annex. It is through these actions that Nassau County and its jurisdictions aim to reduce long-term exposure and losses to the natural hazards reviewed in the Risk Assessment.

Figure 28: Summary of Mitigation Strategy

6.1 Mitigation Strategy Goals

The Mitigation Strategy Goals are the mitigation targets that the Planning Committee defined for the 2021 Nassau County Hazard Mitigation Plan Update. These goals outline the mitigation priorities that the County and its jurisdictions will address over the next five years. The Planning Committee, in coordination with the Steering Committee, reviewed and adjusted the 2014 Mitigation Goals to better align with the current priorities of the County and its jurisdictions. Changes in development and increased hazard risk informed many of the adjustments made.

- **Goal 1:** Build stronger by promoting mitigation actions that emphasize sustainable construction and design measures to reduce or eliminate the impacts of natural hazards now and in the future.
- **Goal 2:** Build and support local capacity to prepare for, respond to, and recover from disasters.
- **Goal 3:** Protect existing property including public, historic, private structures, state-owned/operated buildings, and critical facilities and infrastructure.
- **Goal 4:** Increase awareness of hazard risk and mitigation capabilities among stakeholders, citizens, elected officials, and property owners to enable the successful implementation of mitigation strategies.
- **Goal 5:** Develop and implement long-term, cost effective, and resilient mitigation projects to preserve or restore the functions of natural systems.
- **Goal 6:** Improve coordination between land use and redevelopment planning to encourage safe, economically sound investments.

6.2 Mitigation Strategy Development

This section discusses the approach taken to develop the Plan's Mitigation Strategy, including the Planning Committee's process of reviewing the previous plans actions and developing new actions to address changes in risk. Nassau County's mitigation actions are discussed and summarized in this section of the plan. The actions for each of the participating jurisdictions can be found in their corresponding Jurisdictional Annex.

6.2.1 Updates to the 2014 Mitigation Action Plan

As a part of the hazard mitigation planning process, the Planning Committee members who participated in the 2014 plan reviewed the 2014 Mitigation Action Plan to report on the status of each action and evaluate these actions in light of current and emerging priorities. As detailed in the ***Planning Process***, the structure of the Planning Committee has changed significantly compared to the 2014 plan.

For this plan update, Nassau County's municipal governments (i.e., 2 cities, 3 towns, and 64 villages) were invited to participate as adopting jurisdictions. As much as possible, actions from the 2014 plan that were provided by special-purpose local governments (e.g., school districts, special districts) or non-profit entities were assigned to a municipal government based on their geographic location, or to the County. The County and its municipalities are not responsible for the projects from these entities or for pursuing grants for these projects. Nassau County and its municipalities contacted these entities to try to obtain a status update for these actions. A status update is provided where responses were received. This approach was taken to leverage local ties to more effectively update the previous plan's actions.

The County's updates to the 2014 mitigation actions can be found in the Nassau County Jurisdictional Annex. The 2014 mitigation actions were used as a foundation for the development of the 2020 Nassau County Mitigation Action Plan. Assessing and evaluating previous elements of the mitigation strategy helps keeps this Plan up-to-date, supports creativity in mitigation practice, and supports the development of an appropriate and effective mitigation strategy.

6.2.2 Identification of Mitigation Actions

In order to develop the 2020 Mitigation Action Plan, Planning Committee members reviewed their 2014 actions (if applicable), developed their 2020 Mitigation Action Plan, and completed at least two NYS DHSES mitigation action worksheets. Once these materials were completed, Nassau County and each participating jurisdiction had a one-on-one consultation call with Hagerty Consulting to discuss their mitigation strategy, the appropriateness of actions, and the completeness of the submitted documentation for the Plan. On these calls, jurisdictions voiced challenges with securing funding for mitigation and having limited staff capacity to manage a mitigation program alongside the ongoing disaster response to COVID-19. The Planning Committee will continue mitigation-focused discussions as they convene throughout the coming years, including considerations for undeveloped land and open space. As the Planning Committee moves forward with implementing their mitigation actions, they will continue to share ideas and resources with each other to support the identification of funding and building capacity.

6.3 2020 Nassau County Mitigation Action Plan

This section presents an explanation of the Nassau County's 2020 Mitigation Action Plan in **the County Annex**. The action plan contains the following information as specifically as possible to support project implementation:

Project Name and Number:	The project name and number are unique for each project (action). The mitigation actions in the 2014 plan were not numbered; a new numbering system has been implemented for this Plan update.
Goal being met:	Each action must be consistent with one or more of the goals identified in the Plan.
Hazard to be mitigated:	The hazard(s) to be mitigated by this action.
Description of the Problem:	A brief description of hazard's impact to the community, including damages and/or potential damages.
Description of the Solution:	A brief description of the proposed project, including location and scope of work of mitigation action (including studies/assessments required or already performed).
Critical Facility:	Is this project related to a critical facility?
EHP Issues:	Will this project require an Environmental and Historic Preservation (EHP) related review and/or permitting?
Estimated Timeline:	The time required for completion of the project upon implementation.
Lead Agency:	The lead agency or department responsible for implementation.
Estimated Costs:	The estimated cost for implementation. Rough dollar figures are included where possible.
Estimated Benefits:	A description of the estimated benefits, either quantitative and/or qualitative.
Potential Funding Sources:	The funding sources that will be used to implement this project.

For some of the actions, Nassau County completed a "Mitigation Action Worksheet" that provides additional information about the project and its implementation. Refer to ***Mitigation Strategy*** in the County's Jurisdictional Annex. The County and each adopting jurisdiction must complete at least two of these worksheets to meet one of the New York State hazard mitigation planning requirements. Mitigation action worksheets for each participating jurisdiction are contained in their corresponding annex to the hazard mitigation plan.

6.4 Implementing the Mitigation Strategy

The Nassau County Mitigation Program consists of implementing the hazard mitigation projects outlined in this plan, building hazard mitigation capabilities over time, and updating the hazard mitigation plan every five years. The Planning Committee will implement the Mitigation Program by completing mitigation projects and meeting regularly to maintain the Plan according to the five-year cycle outlined in ***Figure 29***.

Figure 29: Nassau County Mitigation Program

6.4.1 Plan Adoption

Participating jurisdictions adopt the Plan to demonstrate their intent to implement the Plan, in accordance with regulations outlined in the Stafford Act and Title 44 Code of Federal Regulations (CFR) § 201.6. Each participating jurisdiction provides documentation to FEMA (e.g., a resolution) demonstrating that the Plan was formally adopted by its governing body.

Responsibility: Planning Committee Members

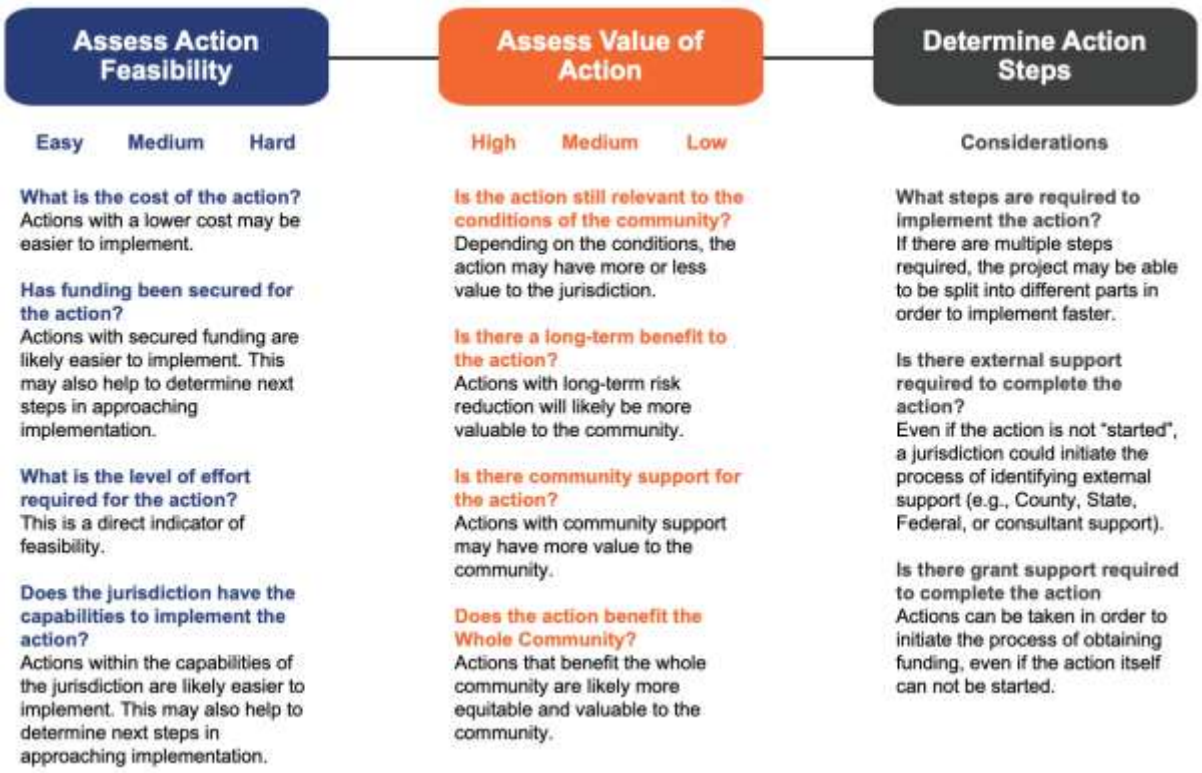
Frequency: Year 1, One-Time

Support Tools: Appendix C

6.4.2 Action Prioritization

Members of the Planning Committee will meet annually to prioritize projects. The Committee will use the action prioritization methodology presented in ***Figure 30*** to determine the priority of their jurisdiction's actions and update their action plans for the year. Factors like the feasibility of the action, its value, and considerations for next steps will help determine these priorities. Jurisdictions may include additional factors to help further refine the prioritization.

Figure 30: Action Prioritization Methodology



6.4.3 Plan Maintenance

The Planning Committee will meet at least twice a year to maintain the Nassau County Hazard Mitigation Plan and keep it up to date. Plan maintenance will consist of:

- **Monitoring** – tracking and reporting on mitigation project completion over the five-year Nassau County Mitigation Program cycle.
- **Evaluating** – assessing how effectively the Plan has been at supporting the Nassau County Mitigation Program.
- **Updating** – reviewing and revising the Plan's content to reflect changes in development, progress in local mitigation efforts, changes in priorities, and new hazard risks.

	Monitoring	Evaluating	Updating
Responsibility:	Planning Committee	Planning Committee	Planning Committee
Frequency:	Twice a year	Twice a year	At least once every five years and after major events
Support Tools:	Appendix C	Appendix C	

6.4.4 Project Implementation

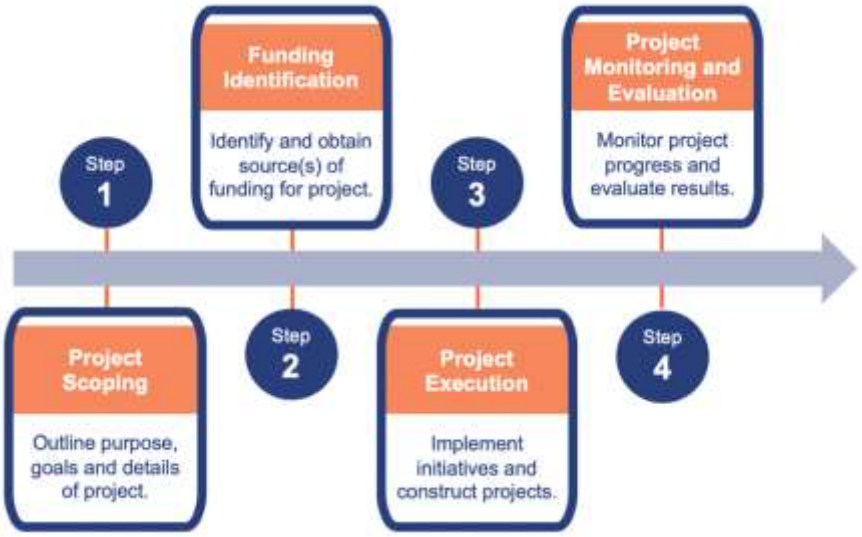
Planning Committee members will implement the mitigation actions contained in this Plan to reduce Nassau County's long-term risk to natural hazards. As shown in ***Figure 31***, project implementation consists of four main steps: project scoping, funding identification, project execution, and project monitoring and evaluation

Responsibility: Planning Committee Members

Frequency: Ongoing

Support Tools: Appendix C

Figure 31: Project Implementation Process



6.4.5 Public Engagement

Public engagement will be conducted regularly to support the Nassau County Mitigation Program. This engagement will ensure the Plan is consistently addressing the needs of stakeholders and community members who are experiencing the impacts of natural hazards. The public will be engaged annually by the Planning Committee through a variety of potential engagement methods, including:

- Public surveys
- Public meetings
- Document publication

Responsibility: Planning Committee Members

Frequency: Annually

Support Tools: Nassau County OEM website and social media, jurisdiction websites and social media

6.4.6 Plan Integration

Nassau County and its municipal governments will use scheduled voluntary and required updates to planning documents as opportunities to integrate relevant information from this Hazard Mitigation Plan into other local planning mechanisms. For example, comprehensive plans guide future development and address community values related to land use, transportation, infrastructure, housing, economic development, and natural resources. The goals and actions in this hazard mitigation plan can inform the goals and strategies in future comprehensive plan updates. Nassau County and the participating municipal governments will refer to FEMA's guide "Plan Integration: Linking Local Planning Efforts" and similar resources to help inform this process of plan integration.

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