

## Section 5 - Assess The Impacts

### 5.A Introduction

The possible hazards affecting the Village of Mamaroneck were identified, profiled and ranked in Section 4 above. The rating and ranking of the hazards used the HAZNY method with input from the local experience of the Village of Mamaroneck's All Hazard Committee. The primary purpose of the current section is to identify and assess the Village of Mamaroneck's assets and evaluate the impacts from these hazards.

This section is based largely on the recommended organization and methods outlined in the FEMA "How-to Guides" and the State and Local Mitigation Planning guidance manual called "Understanding Your Risks". These documents provide an approach to identifying hazards and estimating the losses produced by these hazards. This section was also guided by the FEMA Activity Worksheet: "510 Floodplain Management Planning" under Section 511, Credit Points, and follows the outline given in the guides under Section 5, "Assess the Problem".

The hazard assessment began with the identification and ranking of all hazards that affect the Village of Mamaroneck (See Section 4.B above). The Hazards New York (HAZNY) method was used to identify and rank hazards based on input from the community with the experience of emergency services professionals. The results of these analyses are shown in Table 5-1A and are discussed above in Section 4.C. The HAZNY ranking analysis includes the probability or frequency of occurrence of a given hazard and refers to how often a hazard will occur in the future. The HAZNY analysis distinguishes between the following frequencies of occurrences:

- Rare Event              Occurs less than once every 50 years.
- Infrequent Event      Occurs between once every 8 years to once in 50 years.
- Regular Event        Occurs between once a year to once every 7 years.
- Frequent Event        Occurs more than once a year.

**Table 5-1A. Summary of Hazards Scores Based on HAZNY Analysis.**

<b>High Hazards</b>	<b>HAZNY Score Village of Mamaroneck</b>
None	<b>321-400</b>
<b><u>Moderately High Hazard</u></b>	<b>241-320</b>
Flood	302
Coastal Storm*	253
Severe Storm & Thunderstorm**	246
<b><u>Moderately Low Hazard</u></b>	<b>161-240</b>
Fire	240
Winter Storm (Severe)	230
Wind Storm	230
Transportation Accident	230
Dam Failure	224
Utility Failure	221
Terrorism	219
Ice Storm	217
Storm Surge/Wave Action	216
Hurricane	212
Hazardous Materials (in Transport)	210
Earthquake	202
Oil Spill	201
Landslide (Rockslide)	199
Extreme Temperatures (Hot)	196
Explosion	192
Water Supply Contamination	182
Hazardous Materials (Fixed Site)	168
Structural Collapse	164
<b><u>Low Hazard</u></b>	<b>44-160</b>
Epidemic	160
Hailstorm	159
Tornado	155
Fuel Shortage	142
Radiological (Fixed Site)	140
Air Contamination	132
Blight	128
Ice Jam	123
Food Shortage	119
Fuel Oil Spill	114
Drought	101
Civil Unrest	96
Wildfire	94

\* Including tropical storms, nor'easters.

\*\* Including severe and gale force winds as well as other non-winter storms listed. Hurricanes and coastal storms not included

No quantitative assessment was prepared for the hazards showing a low impact or risk. Where quantitative data were available, the future likelihood of the hazard was based on the information available. For several hazards, where the probability of future events was not quantified, a qualitative assessment of the likelihood is based on the HAZNY criteria and an evaluation of the current extent of the problem.

An impact and damage analysis is provided in Section 5.E for major hazards impacting the Village of Mamaroneck. This analysis is not given for hazards evaluated in Section 5.C below that were judged to be not significant enough, or found to have a very low probability of occurring in a given year.

## **5.B Inventory of Assets**

The Village of Mamaroneck is a largely built-out residential suburban community, and there is a limited amount of vacant land with room approved for new development. The commercial districts comprise approximately 10% of the village. The central business district is located on Mamaroneck Avenue and runs between the Boston Post Road and the I-95 Overpass. The other major business area runs along the Boston Post Road. There are also much smaller neighborhood commercial areas on Old White Plains Road, Halstead Avenue, and North Barry Avenue. Two general commercial marine districts are situated in the Village. One located on Rushmore Avenue, Southeast of Harbor Island Park, and the other along the harbor, just east of the Mamaroneck Avenue and the Boston Post Road intersection. The industrial area in the Village of Mamaroneck consists of approximately 70 acres. The major industrial areas run along Fenimore Road, Hoyt Avenue, and Waverly Avenue.

The following studies were prepared for the Village of Mamaroneck:

- Comprehensive Master Plan, adopted 1986
- Gateway Study, 1988
- Mamaroneck Village Industrial Area Study, 1997
- Waverly Avenue Design Study, 2004
- Fenimore Road Improvement Report, 2004
- Harbor Island Park Master Plan, 2004

- Comprehensive Master Plan Update, DRAFT, 2011

The general assets of the village are evaluated according to the property use code or the category of the building occupied. This breakdown however does not consider the importance of impacts on certain facilities. In addition, there are groups of assets that are evaluated in this section including:

- Critical Facilities
- Key Assets
- Infrastructures
- Resident Populations

#### ***5.B.1 Inventory of Buildings According to Property Use***

Table 5-1 provides an estimate of residential, commercial, education, recreation, government, religious and other buildings in the Village based on the Village of Mamaroneck tax assessments. The number of structures by property use code is listed in Table 5-1. For the most current year 2011, the predominant buildings in the Village are 2,818 single residential properties out of total 4,984 structures. There are 818 multi-residential structures.

Commercial buildings are located in use class codes 400-486. Recent tax assessment records show a total of 1,270 commercial buildings. Commercial apartment buildings are also included in this class. The major concentration of commercial activity is located along Mamaroneck Avenue and along the Boston Post Road.

The industrial areas run along Fenimore Road, Hoyt Avenue, and Waverly Avenue, comprising approximately 70 acres in the Village of Mamaroneck. Although there is industry in the Village, all buildings are coded as Commercial (400-486) rather than Industrial (700-749). Therefore, commercial and industrial properties are combined for the hazard and vulnerability assessment.

**Table 5-1. Residential, Commercial, Industrial and other Buildings in the Village of Mamaroneck.**

<b>Property Class Code</b>	<b>Building Type by Property Class</b>	<b>Number of Buildings*</b>
210	Single Residential	2,818
220-283	Multi-residential	818
400-486	Commercial	1,270
546-570	Sports facilities	15
600-649	Community Services & Education	26
620	Religious	21
650-662	Government & Protection	16
	Total	4,984

**\* Data provided by Village of Mamaroneck Manager's Office.**

“Community Services” include education, government, health services and religious properties. The Mamaroneck Library and the Emelin Theatre are included in this category. These are not broken out on Map 5 and will be combined for the hazard and vulnerability assessment.

“Sports facilities” include building stock from indoor sports facilities, country clubs, and marinas.

### **5.B.2 Critical Facilities**

The principal critical facilities identified in the Village of Mamaroneck are given in Table 5-2. The location of these facilities is shown in Figure 5-1. They include the Village Offices, Village Hall, fire and emergency response facilities, Town Hall, schools and other buildings to be used as emergency shelters, Metro-North Railroad. A full-service hospital is not located in the Village of Mamaroneck. The closest hospitals are located in New Rochelle, White Plains, and Greenwich, CT.

**Table 5-2. Critical Facilities in The Village of Mamaroneck.**

<b><u>Facility Name</u></b>	<b><u>Facility Function</u></b>	<b><u>Address</u></b>	<b><u>Facility Vulnerability to Hazards</u></b>
Village of Mamaroneck Offices	Village Administrative Services, Emergency Response	123 Mamaroneck Avenue	Loss of village records. Interruption of services & communication. Loss of emergency & rescue services. Emergency Shelter
Town of Mamaroneck Offices	Town Administrative Services, Emergency Response	740 West Post Road	Loss of town records. Interruption of services & communication. Loss of emergency & rescue services. Emergency Shelter
Village Hall, Court, Police, Bldg Dept	Village Administrative Services, Emergency Response	169 Mt. Pleasant Avenue	Loss of village records. Interruption of police services. Interruption of communication. Loss of emergency & rescue services. Emergency Shelter
VMFD HQ & Fire Station	Emergency Response , Storage of Emergency Response Vehicles & Equipment	146 Palmer Avenue	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter
Columbia Fire Station	Emergency Response , Storage of Emergency Response Vehicles & Equipment	605 North Barry Avenue	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter
Volunteer Firehouse	Emergency Response , Storage of Emergency Response Vehicles & Equipment	643 Mamaroneck Avenue	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter
Halstead Manor Firehouse	Emergency Response , Storage of Emergency Response Vehicles & Equipment	1400 Halstead Avenue	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter
EMS Rescue Squad Bldg	Emergency Response , Storage of Emergency Response Vehicles & Equipment	200 North Barry Avenue Ext	Interruption of emergency & rescue services. Emergency Shelter
Dept of Public Works Garage	Emergency Response, Storage of Village Vehicles & Equipment	313 Fayette Street	Interruption of emergency services.

Westchester Joint Waterworks	Water Delivery System	1625 Mamaroneck Avenue	Interruption of municipal water supply.
Wastewater Treatment Plant	County Facility	199 West Boston Post Road	Interruption of water pollution control services
U.S. Post Office	Post Office	309 Mount Pleasant Avenue	Interruption of communications. Emergency Shelter.
FE Bellows Elementary School	Grade School 3-5	200 Carroll Avenue	Emergency Shelter
Daniel Warren Elementary School	Grade School K-2	1310 Harrison Avenue	Emergency Shelter
Rye Neck Middle School	Grade School 6-8	300 Hornridge Road	Emergency Shelter
Rye Neck High School	Grade School 9-12	310 Hornridge Road	Emergency Shelter
French-American School	Private School 6-12	145 New Street	Emergency Shelter
Mamaroneck Avenue School	Grade School K-6	850 Mamaroneck Avenue	Emergency Shelter
Mamaroneck High School	Grade School 9-12	1000 West Boston Post Road	Emergency Shelter
Westchester Day School	Religious Yeshiva	856 Orienta Avenue	Emergency Shelter
Mamaroneck School Garage	School Transportation Facility	119 Gertrude Avenue	Loss of school transportation services.
Metro North Railroad Station	Metro North Commuter RR, Amtrak, CRX, Metro-North	Station Plaza	Loss of major transportation thoroughfare.



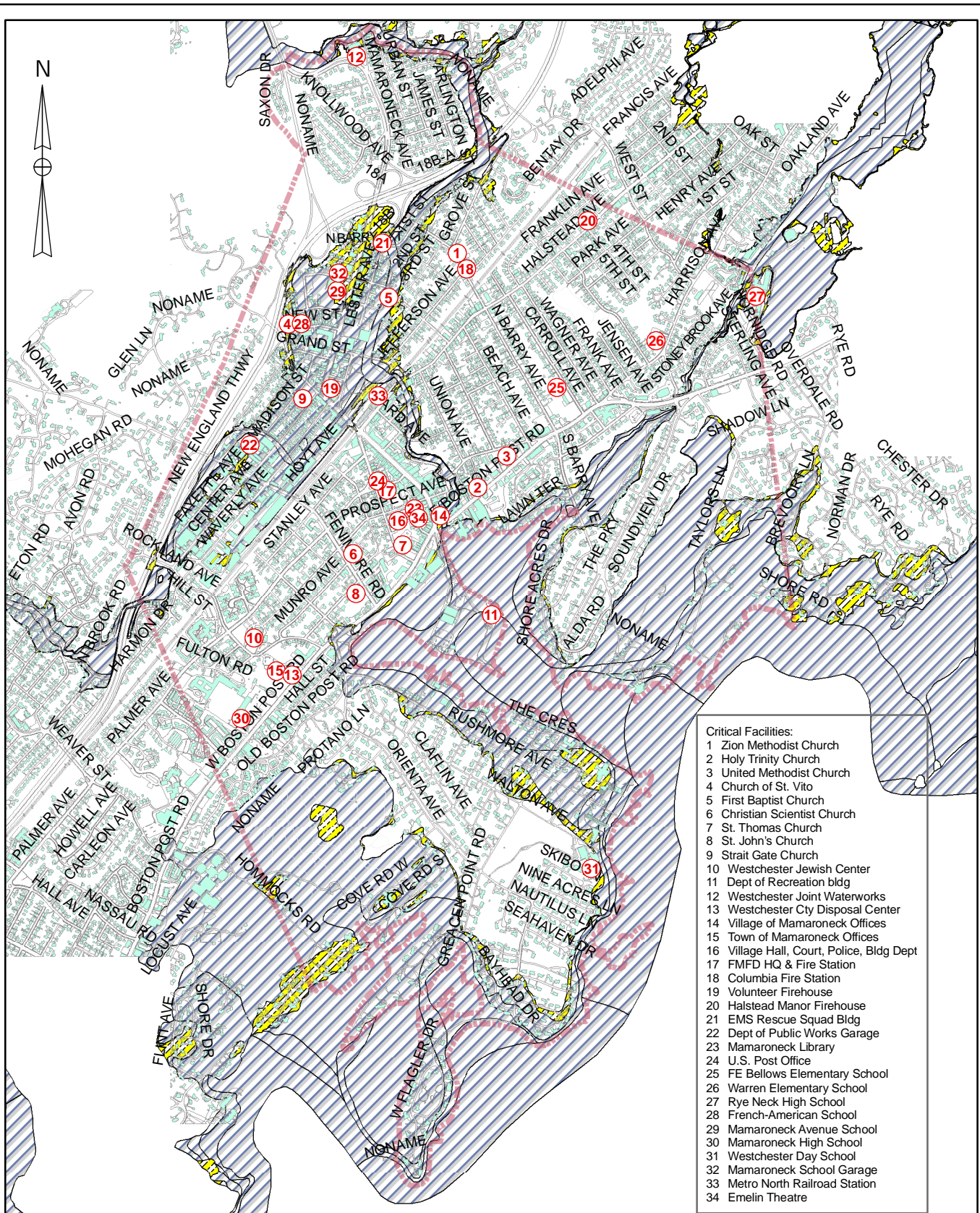


Figure 5-1  
Location Of Critical Facilities  
Incorporated Village of Mamaroneck  
Multi-Hazard Mitigation Plan

**Legend**

- Municipal Boundaries
- FEMA Flood Mapping
- 100 Year Flood Line
- 500 Year Flood Line

DWN BY: YS  
CHK BY: JB  
SCALE: AS SHOWN  
DATE: 03/21/12



300 WHEELER ROAD, SUITE 307, HAUPPAUGE, NEW YORK 11788

0 1,250 2,500 3,750 5,000 Feet

Basemap information by Westchester County GIS



### 5.B.3 Key Assets

The Village of Mamaroneck has several economic, cultural and recreational facilities of concern. Key assets in the Village of Mamaroneck are listed in Table 5-3. These include buildings that, if damaged or destroyed, would have significant cultural, economic or social impact on the village.

**Table 5-3. Key Assets in the Village of Mamaroneck**

Type of Asset	Key Asset	Location	Priority Need
Economic/Key Employers	Mamaroneck Union Free School District	Village of Mamaroneck	Major employer
	Rye Neck Union Free School District	Village of Mamaroneck	Major Employer
	Town of Mamaroneck	Town of Mamaroneck	Major Employer
	Village of Mamaroneck	Village of Mamaroneck	Major Employer
	Sarah Neuman Center for Healthcare	845 Palmer Avenue	Major Employer
	Commercial Business District	Mamaroneck Avenue. Boston Post Road	Commercial Retail Centers
	Industrial Areas	Fenimore Road. Hoyt Avenue. Waverly Avenue	Industrial & Manufacturing Centers
Cultural, Historical and Natural Areas	Emelin Theatre	153 Library Lane	Arts & Entertainment Cultural Center
	Mamaroneck Library	136 Prospect Avenue	Historical building Cultural Center
	U.S. Post Office	309 Mt. Pleasant Avenue	Historical building
	Zion Methodist Church	645 North Barry Avenue	Historical building House of Worship
	Holy Trinity Church	320 East Post Road	Historical building House of Worship
	United Methodist Church	546 East Post Road	Historical building House of Worship
	Church of St. Vito	816 Underhill Avenue	Historical building House of Worship
	First Baptist Church	817 Howard Avenue	Historical building House of Worship
	Christian Scientist Church	155 Fenimore Road	Historical building House of Worship
	St. Thomas Church	168 West Boston Post Road	Historical building House of Worship
	St. John's Church	122 Fenimore Road	Historical building House of Worship
	Strait Gate Church	120 Madison Street	Historical building House of Worship
	Westchester Jewish Center	175 Rockland Avenue	Historical building House of Worship
	Dept of Recreation bldg..	Beach Pavilion, Harbor Island Park	Recreation

	Harbor Island Park	Mamaroneck Ave & Boston Post Road	Recreation
	Florence Park	Florence Street	Recreation
	Columbus Park	Van Rans Place	Recreation
	Hampshire Country Club	1025 Cove Road	Recreation
	Mamaroneck Beach & Yacht Club	555 South Barry Avenue	Recreation
	Oriente Beach Club	1054 Walton Avenue	Recreation
	Beach Point Club	900 Rushmore Avenue	Recreation
Education * (Noncritical facility)	Mamaroneck Community Nursery	501 Tompkins Avenue	Preschool
	Little Flower Nursery School	310 East Boston Post Road	Preschool

\* See Table 5-2 for other education facilities.

#### 5.B.4 Infrastructure

Infrastructure needs for the Village of Mamaroneck are provided and maintained by State, County, Town, Village and several private organizations (See Table 5-4). For example, Con Edison Company of New York is responsible for supplying electrical power, maintaining the power grid and electrical substations, and providing emergency services for downed power lines, damaged transformers and controlling brownouts. Verizon provides telecommunication infrastructure. The Metro-North Railroad, which maintains the rail and Mamaroneck Station provides public rail transportation services. The Westchester County Bee Line Bus system provides intercommunity bus transportation.

**Table 5-4. Village of Mamaroneck Key Infrastructures.**

Service Provider	Facility Type	Key Locations of Concern	Importance/Function
NY State	Highway/Roads/ Streets	I-95, NE Thruway	Evacuation Route
NY State	Highway/Roads/ Streets	US-1, The Boston Post Road	Evacuation Route
County/Town/Village	Roads/Streets	Palmer Avenue	Evacuation Route
County/Town/Village	Roads/Streets	Mamaroneck Avenue	Evacuation Route
County/Town/Village	Roads/Streets	Fenimore Road	Evacuation Route
County/Town/Village	Roads/Streets	Harrison Avenue	Evacuation Route
County/Town/Village	Roads/Streets	Old White Plains Road	Evacuation Route

Westchester County	Bus Service	Intercounty & local bus routes	Public Transportation
Metro-North Railroad	Rail Service	Station Plaza	Commuter & Public Transport
Verizon	Telecommunication Service	Village wide	Telecommunications Infrastructure
Con Edison Company of NY	Power Service	Village wide	Electric Power

#### ***5.B.5 Vulnerability of Critical Facilities and Key Infrastructures***

Critical facilities and vulnerabilities in the Village of Mamaroneck are given in Table 5-2 and include government buildings, fire and emergency response facilities, and emergency shelters. The loss of any of these from a catastrophic event would be a major setback for the Village. Critical facilities should be designed to withstand the flood plain elevation caused by a 500-Year storm. Table 5-5a gives the vulnerabilities for the Village critical facilities and the geographical extent of the hazard. Table 5-5b gives the vulnerabilities for the key infrastructure facilities and the geographical extent of the hazard.

**Table 5-5a Vulnerability of Critical Facilities to Selected Hazards**

Critical Facility	Vulnerability	Moderately High Hazard						Moderately Low Hazard												Low Hazard							
		Hurricane	Flood	Utility Failure	Dam Failure	Fire	Coastal Storm *	Wind Storm	Terrorism	Thunderstorm	Fuel Oil Spill	Severe Storm **	Winter Storm	Tornado	Extreme Temps	Ice Storm	Haz. Materials (transport)	Explosion	Landslide	Hailstorm	Haz. Materials (fixed)	Epidemic	Radiological (fixed)	Drought	Earthquake	Air Contamination	Water Supply Contam.
Village of Mamaroneck Offices	Loss of village records. Interruption of services & communication. Loss of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Town of Mamaroneck Offices	Loss of town records. Interruption of services & communication. Loss of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Village Hall, Court, Police, Bldg Dept	Loss of village records. Interruption of police services. Interruption of communication. Loss of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
VMFD HQ & Fire Station	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Columbia Fire Station	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Volunteer Firehouse	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Halstead Manor Firehouse	Interruption of fire emergency services. Interruption of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U

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**Table 5-5a Vulnerability of Critical Facilities to Selected Hazards (Continued)**

Critical Facility	Vulnerability	Moderately High Hazard						Moderately Low Hazard												Low Hazard							
		Hurricane	Flood	Utility Failure	Dam Failure	Fire	Coastal Storm *	Wind Storm	Terrorism	Thunderstorm	Fuel Oil Spill	Severe Storm **	Winter Storm	Tornado	Extreme Temps	Ice Storm	Haz. Materials (transport)	Explosion	Landslide	Hailstorm	Haz. Materials (fixed)	Epidemic	Radiological (fixed)	Drought	Earthquake	Air Contamination	Water Supply Contam.
EMS Rescue Squad Bldg	Interruption of emergency & rescue services. Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Dept of Public Works Garage	Interruption of emergency services.	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Westchester Joint Waterworks	Interruption of municipal water supply.	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Wastewater Treatment Plant	Interruption of water pollution control services	V	V	V	C	H	V	V	C	V	H	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
U.S. Post Office	Interruption of communications. Emergency Shelter.	V	V	V	C	H	V	V	C	V	H	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
FE Bellows Elementary School	Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Warren Elementary School	Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Rye Neck Middle School	Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Rye Neck High School	Emergency Shelter	V	V	V	C	H	V	V	C	V	H	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
French-American School	Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Mamaroneck Avenue School	Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U

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**Table 5-5a Vulnerability of Critical Facilities to Selected Hazards (Continued)**

Critical Facility	Vulnerability	Moderately High Hazard						Moderately Low Hazard												Low Hazard								
		Hurricane	Flood	Utility Failure	Dam Failure	Fire	Coastal Storm *	Wind Storm	Terrorism	Thunderstorm	Fuel Oil Spill	Severe Storm **	Winter Storm	Tornado	Extreme Temps	Ice Storm	Haz. Materials (transport)	Explosion	Landslide	Hailstorm	Haz. Materials (fixed)	Epidemic	Radiological (fixed)	Drought	Earthquake	Air Contamination	Water Supply Contam.	Civil Unrest
Mamaroneck High School	Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Westchester Day School	Emergency Shelter	V	V	V	C	H	V	V	C	V	U	V	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Mamaroneck School Garage	Loss of school transportation services.	V	V	V	C	H	V	V	C	V	H	V	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U
Metro North Railroad Station	Loss of major transportation thoroughfare.	V	V	V	C	H	V	V	C	V	H	V	V	V	V	V	H	U	U	V	H	C	U	V	V	U	U	U

\* Including tropical storms and nor'easters.

\*\* Including severe and gale force winds as well as other non-winter storms listed.  
Hurricanes and coastal storms not included.

Key: V = Village Wide  
C = County Wide  
U = Highly Unlikely  
H = Hazard Localized

**Table 5-5b Vulnerability of Key Infrastructure to Selected Hazards**

Key Infrastructure	Vulnerability	Moderately High Hazard						Moderately Low Hazard														Low Hazard						
		Hurricane	Flood	Utility Failure	Dam Failure	Fire	Coastal Storm *	Wind Storm	Terrorism	Thunderstorm	Fuel Oil Spill	Severe Storm **	Winter Storm	Tornado	Extreme Temps	Ice Storm	Haz. Materials (transport)	Explosion	Landslide	Hailstorm	Haz. Materials (fixed)	Epidemic	Radiological (fixed)	Drought	Earthquake	Air Contamination	Water Supply Contam.	Civil Unrest
Metro-North Railroad. Commuter & Public Transport	Loss of major transportation thoroughfare	V	V	V	C	U	V	V	C	V	H	V	V	V	V	V	H	U	U	V	U	C	U	V	V	U	U	U
Verizon. Telecommunications Infrastructure	Interruption of telecommunications system	V	V	V	C	U	V	V	C	V	U	V	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Consolidated Edison. Electric Power service	Interruption of electric power service	V	V	V	C	U	V	V	C	V	U	V	V	V	V	V	U	U	U	V	U	C	U	V	V	U	U	U
Westchester County Bus Service (Bee Line) Commuter & Public Transport	Loss of major transportation service	V	V	V	C	U	V	V	C	V	H	V	V	V	V	V	H	U	U	V	U	C	U	V	V	U	U	U
I-95 - NE Thruway, US1 – Boston Post Road	Loss of NYS evacuation routes	V	V	V	C	U	V	V	C	V	H	V	V	V	V	V	H	H	U	V	U	C	U	V	V	U	U	U
Palmer Avenue, Mamaroneck Avenue, Fenimore Road, Harrison Avenue, Old White Plains Road	Loss of County/Town/Village evacuation routes	V	V	V	C	U	V	V	C	V	H	V	V	V	V	V	H	H	U	V	U	C	U	V	V	U	U	U

\* Including tropical storms and nor'easters.

\*\* Including severe and gale force winds as well as other non-winter storms listed. Hurricanes and coastal storms not included.

Key: V = Village Wide  
C = County Wide  
U = Highly Unlikely  
H = Hazard Localized



Other key facilities shown in Table 5-3 such as schools, religious institutions, major employers and commercial businesses are important to the village since damage to any of these would result in loss of important services to the community. Important infrastructures shown in Table 5-4 provide needed transportation, energy and communication services.

The loss of the Village Hall would result in the following impacts:

- Interruption of services.
- The loss of critical plans and management tools.
- The loss of critical records.
- The loss of an emergency shelter.

The loss of any of the schools listed in Table 5-2 would result in loss of shelter space during an emergency evacuation. The loss of any fire and emergency response facilities would reduce the ability of these services to respond and help the areas of the village that are impacted.

The loss of the electrical and telecommunications infrastructure would result in the following problems:

- The whole or partial loss of the community telephone system.
- The whole or partial loss of the electrical service.
- The loss of transportation signals.
- Cascade impacts on other needed services, infrastructure and facilities.

#### ***5.B.6 Vulnerable Populations***

According to the 2010 Federal Census, the population of the Village of Mamaroneck was 18,929 with a median age of 40. According to the U.S. Census Bureau, the area of the village is approximately 6.7 square miles, with 3.5 square miles underwater, leaving approximately 3.2 square miles of land area. There were 1,169 residents under the age of 5 and 2,262 over the age of 65. The percentage of minority populations consists of 24.3% Hispanic, 4.8% Asian, and 3.7% African American. The Village of Mamaroneck is considered to be an upper-middle income community. The median household income was reported to be \$105,139 and the per capita income was \$56,807.

Much of the village lies in the 100-year flood plain. Vulnerable populations to storms and flooding (Figure 5-2 and 4-2) include those residences and businesses located in the following areas:

- A portion of the Harbor Heights section of the Village of Mamaroneck bordering the Mamaroneck River, including:
  - Chestnut Avenue
  - North James Street
  - Urban Street
  - Winfield Street
- Washingtonville, aka “The Flats” section of the Village, including:
  - Elliott Avenue
  - Madison Avenue
  - New Street
  - Ralph Avenue
  - Howard Avenue
  - Lester Avenue
  - Nostrand Avenue
  - Sheldrake Place
  - Depot Plaza
  - Station Plaza
  - Van Ranst Place
  - Jefferson Avenue (east of Mamaroneck Ave, bordering the Sheldrake River)
- West of Mamaroneck Avenue bordering Sheldrake River
  - Center Avenue
  - Grand Street
  - Waverly Avenue
  - Plaza Avenue
  - Fayette Avenue
  - Fenimore Road
- Along the lower section of the Mamaroneck River
  - Ward Avenue
  - Spencer Place
  - Valley Place
  - First Street
  - Second Street
  - North Barry Extension
  - Stoneybrook Avenue
- The neighborhoods of Orienta and Shore Acres

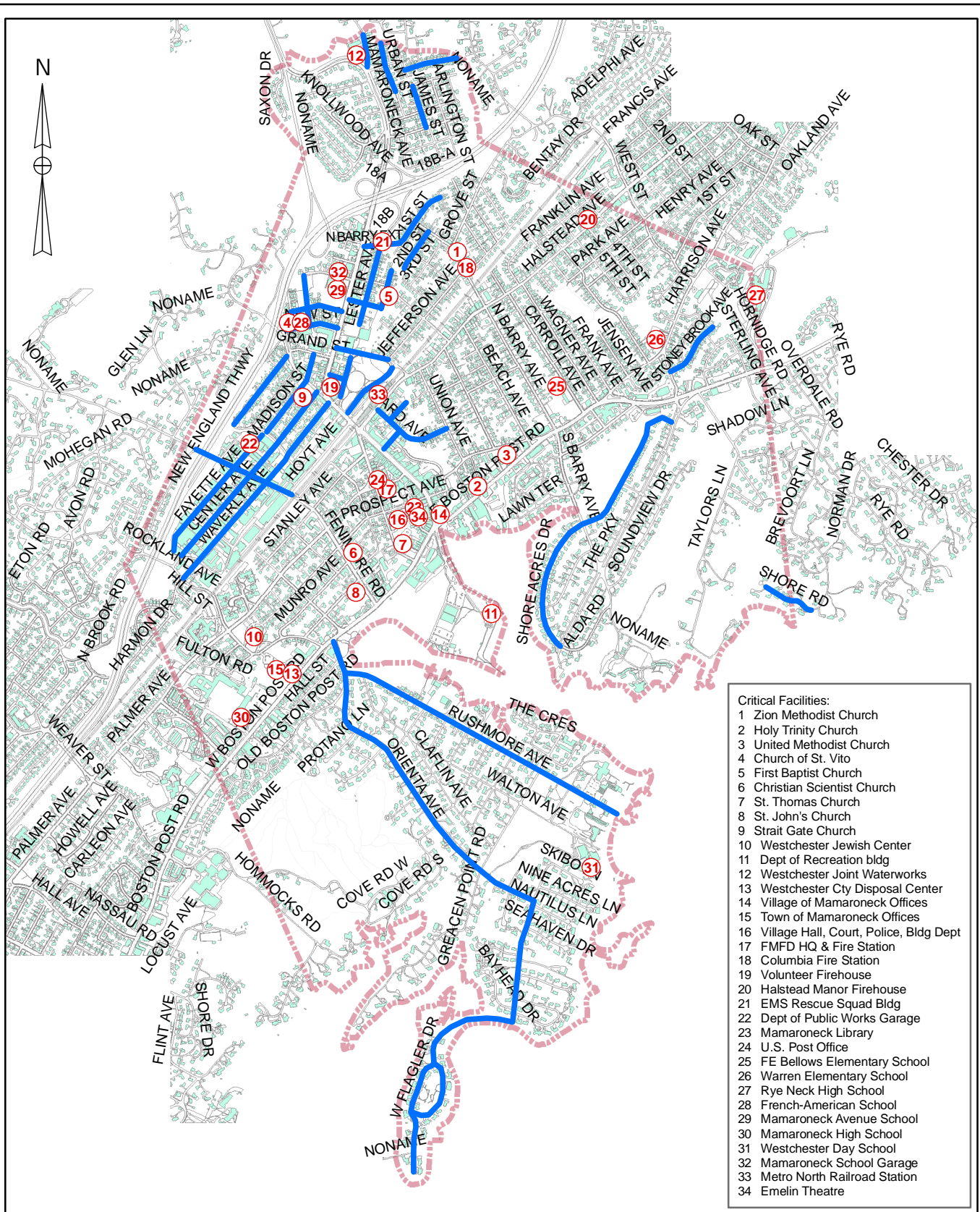


Figure 5-2  
Frequently Flooded Streets  
Incorporated Village of Mamaroneck  
Multi-Hazard Mitigation Plan

**Legend**

- Municipal Boundaries
- Frequently Flooded Streets

DWN BY: YS  
CHK BY: JB  
SCALE: AS SHOWN  
DATE: 04/23/12

**ETG** Environmental  
Technology  
Group, Inc.  
300 WHEELER ROAD, SUITE 307, HAUPPAUGE, NEW YORK 11788

0 1,250 2,500 3,750 5,000  
Feet

Basemap information by Westchester County GIS

Senior citizens are also at higher risk. The chronically ill are vulnerable since they lack mobility. With the growing numbers of senior citizens this vulnerability to hazards may increase in the Village of Mamaroneck in the future.

The impact of hazards to the life, safety and health of people in the Village of Mamaroneck depend on several vulnerability factors. These include:

- Location of the population relative to the hazard (persons in flood prone areas or shoreline areas are at greater risk).
- Age of the population (very young and elderly tend to be more vulnerable).
- Current health of the population (persons with chronic illnesses are more vulnerable)
- Mobility of individuals (persons who can't walk or drive have special needs for evacuation and are at higher risk).

Of all the hazards discussed in Section 4 and assessed below in Section 5.C, the population of the Village of Mamaroneck in general and vulnerable populations specifically, are most at risk to severe storm hazards such as flooding and wind damage.

### **5.C Assessment of Primary Hazards**

The following is an assessment of probable hazards identified in Section 4 above and vulnerability to these hazards. Based on this assessment, primary hazards are screened for a more detailed impact assessment on community property and structures. Only some of the hazards evaluated in Section 4 are considered a primary concern to the community. In screening the primary hazards of concern, several criteria were used including:

- HAZNY rating and rank
- Likelihood of a damaging event
- Potential extent of the hazard in the village
- Likelihood of significant damage
- Severity of damage
- Vulnerable populations
- Impact on safety of people

Hazards considered to have a low impact rating or probable occurrence by these criteria were not considered further for quantitative assessment of damages or for developing objectives and mitigation measures. Therefore the focus of this plan is to assess damages only for those hazards likely to cause significant impacts and to propose remediation measures that will provide the greatest benefit to the community.

### ***5.C.1 Flood Related Hazards***

Flooding was rated moderately high with a HAZNY score of 302 and rank of one. Most flooding is due to storms, heavy or extended rainfall and snow melt. The geographical extent of the 100-Year flood, the 500-Year flood and hurricane inundation is shown in Figure 4-2 and Map 2. These events may be compounded from the concurrence of the moon coupled with high tide events with heavy rains and high winds.

The probability of future flood events is high for a 100-Year flood. It has a 1% probability of occurring in any given year. A 500-Year flood is infrequent, and has a likelihood of occurrence of 0.2% in any given year. Based on past events, the probability for local flooding in the Village of Mamaroneck for any given year is very high. Maps 2 and 3 show the extent of flooding from major events that may span the neighborhoods of Orienta, Shore Acres, Columbus Park, Washingtonville, the industrial area, some sections of Harbor Heights, and the Northern part of the central business district. (See Figure 5-3.) Due to the extent and potential depth of flooding there is a high likelihood of significant damage. Severity of damage along the Mamaroneck and Sheldrake rivers could be significant. Impact on safety of people could be significant if advance warning is insufficient and evacuation routes are blocked.





Photograph by Grannel Knox, via Larchmont Gazette



Photo by Westchester County Legislator Judy Myers, via Larchmont Gazette

**Figure 5-3. Photos of Local Flooding in the Village of Mamaroneck.** Top taken at North James Street in Harbor Heights, adjacent to the Mamaroneck River. Bottom taken of flooded parked cars near Columbus Park. These routes can be cut off for use by emergency vehicles and persons needing to escape to high ground.

Figure 4-2 and Map 2 show the expected extent of flooding for a 100-Year and 500-Year flood. Vulnerable populations include those residences and businesses in the neighborhoods of Orienta, Shore Acres, Columbus Park, Washingtonville, the Industrial area, some sections of Harbor Heights, and the northern part of the central business district.

The impacts on health and safety from floods include injuries and deaths caused by:

- Street flooding which would cut off critical emergency access and escape routes from the Village of Mamaroneck.
- Collapsing buildings from water-weakened foundations.
- Falling trees caused by reduced strength of water-saturated soil.
- Infiltration and inflow to storm and sanitary sewers causing backup and overflow of infectious sanitary waste.
- Drowning in low-lying flooded areas.
- Exposure to waves and strong currents in rivers and shoreline areas subject to storm surges.

The following flood impacts have been identified for the Village of Mamaroneck:

- Storm water could exceed the drainage capacity of the natural and manmade drainage systems causing flooding of basements and roads.
- Groundwater levels would rise, causing flooded basements.
- High groundwater levels would cause significant seepage into storm and sanitary sewers.
- Clogged or ineffective storm and sanitary sewers would fail to drain floodwaters.
- Surges could flood and erode natural barriers along the Sheldrake and Mamaroneck Rivers
- Surges could flood and erode natural barriers along the Long Island Sound.
- Damage to buried fuel tanks, building foundations and swimming pools.
- Isolation of critical facilities and village infrastructure; The Village of Mamaroneck's operations center and emergency centers could be impacted or isolated.
- Repetitive damage to structures in the floodplain and significant flood insurance claims.
- Weaken structural strength of soil resulting in susceptibility to falling trees.



Flooding therefore is one of the major natural hazards facing the Village of Mamaroneck. Based on this evaluation, a damage assessment for flood hazards is provided below in Section 5.D.

### **5.C.2 Hurricane Hazards**

Hurricanes ranked number thirteen and were rated moderately low with a HAZNY score of 212. Although hurricanes can produce extensive and devastating damage, the hazard was given a moderately low HAZNY score due to the rarity of occurrence, as most hurricanes have been downgraded to highly damaging tropical storms by the time they have reached Westchester County. They are a regular event on Long Island, yet are usually downgraded to Tropical Storm or Tropical Depression status by the time they near Westchester County. Most damage from hurricanes is from high winds, and heavy rains. The extent of the flooding depends on the hurricane category and inundation of the river from storm surges. The potential extent of flooding is shown in Map 3 folder at the end of Part I.

The high winds and heavy rains in Westchester County in recent years have resulted in floods, downed trees and power lines. According to the NOAA, based on current weather patterns, the National Weather Service predicts that the upcoming years will show increased hurricane activity, yet the odds of a category 4 or higher hurricane hitting the New York City and vicinity area is one every 500 years.

According to the United States Landfalling Hurricane Probability Project, prepared by the Tropical Meteorology Project at Colorado State University, the probabilities of a hurricane hitting landfall in Westchester County have increased in the last five years. Based on 2011 data, the probability of a named Tropical Storm hitting landfall in Westchester County in 50 years is 18.6% (from 11.3% in 2006). The 50 year probability of a hurricane with sustained winds of 75-114 mph is 11.2% (from 3.2% in 2006), and an intense hurricane with sustained winds over 115 mph is 5.4% (from 0.7% in 2006). (<http://typhoon.atmos.colostate.edu>).

Should a hurricane strike the Village of Mamaroneck, the severity of flood damage throughout the village would be extensive. The impact on safety of people could be significant if advance warning is insufficient and evacuation routes are blocked.

The following damage impacts from hurricanes are likely to affect the Village of Mamaroneck:

- Wind-driven storm surges could raise the level of the Mamaroneck and Sheldrake Rivers, causing flood damage.
- Water may go overtop land barriers and be driven through storm sewers.
- The shorelines of the Village on the Long Island Sound may be inundated by wind-driven storm surges.
- Substantial wind damage to homes and businesses are likely.
- Substantial wind damage to boats in the Marinas is likely.
- Downed power lines would cause power outages and a safety hazard.
- Downed trees would damage homes and vehicles.
- High velocity winds would damage or destroy homes and businesses.

Safety hazards from hurricanes are considered significant. Major hurricanes that strike low-lying areas with limited egress, such as the 1938 Hurricane, can cause drowning. High velocity winds of 74 miles per hour or more will cause significant damage to buildings and property over the entire community and injuries and loss of life by flying debris, wind-propelled glass shards, falling trees and tree limbs, falling poles and downed power lines.

The Village of Mamaroneck Community consists of a population of 18,929 people (2000 US Census). Vulnerable populations include those residents and businesses along and below the Mamaroneck and Sheldrake Rivers, and bordering the Long Island Sound. People in more than 1/3 of the village would be at risk of being exposed to storm surges from hurricanes.

Probable causes of injury and mortality include:

- Downed trees could be the cause of a few deaths and injuries in a major hurricane.
- Downed power lines can cause electrocution.
- Persons near the rivers and sound are at high risk of drowning from a storm surge.
- Strong winds can blow people to the ground or into flooded areas.
- An increase in motor vehicle accidents is likely to occur.
- Death and injury would result from wind damage to buildings and homes from broken glass and other flying debris.

Hurricanes are one of the most damaging natural hazards facing the Village of Mamaroneck. Storm surges along the Mamaroneck River, the Sheldrake River, and the Long Island Sound along with high intensity winds can cause extensive wide spread damage and fatalities. Based on this evaluation a detailed damage assessment for hurricanes is provided below in Section 5.D.

### ***5.C.3 Severe Storm and Wind Related Hazards***

Coastal storm hazard was given a score of 253 in the HAZNY analysis and ranked number 2 in importance. Severe storm events other than hurricanes also cause flooding which was discussed previously in Section 5.C.1. These storm hazards include tropical storms, severe storms, thunderstorms and nor'easter coastal storms. The Severe storm and thunderstorm hazard was given a score of 246 in the HAZNY and ranked number 3 in importance.

Thunderstorms are frequently accompanied by lightning, heavy rains, and heavy winds. Flooding could occur, which would affect the residences and businesses along the flood prone areas (in the neighborhoods of Orienta, Shore Acres, Columbus Park, Washingtonville, the Industrial area, some sections of Harbor Heights, and the northern part of the central business district). Floods could also affect the Village's Key Infrastructures, such as Evacuation Routes (Interstate 95, The Boston Post Road, etc.). Another key infrastructure that could be affected is Con Edison; severe storms could knock out power. It is difficult to determine the extent of the vulnerability.

Severe storm events also generate high velocity wind hazards that can approach hurricane or tornado force. It is this wind hazard that is a primary concern in this section. Tornadoes were ranked 25<sup>th</sup> with a HAZNY score of 155 and are also included in this storm category. They are relatively uncommon events and will not be analyzed separately. When they do strike, they can cause extensive local damage across a narrow path. Although they periodically occur in Westchester County, no records were found for a tornado strike in or near the Village of Mamaroneck. The probability of significant yearly damage from severe storms is very high. The following severe wind concerns include:

- High winds can cause structural damage to commercial buildings and homes.
- Wind and waves cause erosion of the riverbanks.
- Wind and waves can cause structural damage to boats in the Marinas

- Falling trees damage homes and cars, break overhead power, telephone and cable lines.
- Fallen trees, utility poles and lines can block escape routes.

Individual severe storms tend to cause local and isolated damages and impacts are over a short period of time. New structures are required to meet criteria for withstanding severe winds as shown in Figure 4-7. Unless wind speeds approach those of a category 1 hurricane or a class F1 tornado, damage is expected to be light. Tropical storms, severe thunderstorms, nor'easters, coastal storms and tornados will not be analyzed separately. A quantitative damage assessment will be made, where applicable, with assessment for windstorm damage provided below in Section 5.D.3.

#### ***5.C.4 Winter Storms, Snow and Ice***

The HAZNY score for winter snowstorms and ice storms, which ranked 5th and 11th, were moderately low hazards and had final scores of 230 and 217 respectively. While major snowstorms may not occur every year, those that do occur can cause considerable local damage. The most significant of these storms are winter nor'easters.

Also notable are ice storms that occur occasionally which can be more damaging than snowstorms. Damaging winter storms have a high probability of occurring every year or two with a high likelihood of damage. They can be regarded as frequent events since they may occur more than once a year.

The impacts associated with these winter storm events include:

- Problems of heavy snow accumulation causing interruptions in private and public transportation, schools and businesses.
- Snow and ice damage to public roads and walkways.
- Roofs collapsing under the weight of snow.
- Damage to trees in parks and on streets stemming from falling branches and blow down of trees.
- A utilities failure from breaks in overhead lines caused by weight of snow/ice and by falling trees and limbs.
- Damage to trees caused by the build-up of ice during ice storms.

- Limited access to escape and rescue routes.

Health and safety impacts from winter storms, ice and snow result in breakdowns in communication, transportation, emergency services, motor vehicle accidents, falling limbs and power lines. Risks to people from winter storms can be significant. The key safety impacts include:

- Downed trees can cause deaths and injuries.
- Downed power lines can cause electrocution.
- An increase in motor vehicle accidents due to slippery roads.
- Back injury and cardiac problems in residents due to shoveling snow.
- Limited visibility conditions while driving.
- Frost bite.

A quantitative damage assessment for winter storms will not be made. Property damage compared with other major storm events is limited and localized. Interruption of services and business is mostly limited to a few days or less. The primary hazards include structurally inadequate roofs, fallen trees and limbs, downed power lines and traffic accidents. Data and analysis are not readily available to conduct a separate analysis for snow and ice damage. Economically these impacts fall most heavily on the Village public works and Con Edison repair crews. Wind impacts are considered more significant than snow and ice and will be considered in Section 5.D.3.

#### **5.C.5 Utility Failure Problems**

The hazard level associated with utility failure was ranked 9th and was classified as Moderately Low with a HAZNY Score of 221. Utility failures are both local in the Village of Mamaroneck and regional (from county wide to the entire northeast). Power failures may be caused by downed power lines from wind storms, snowstorms, ice storms, fallen trees, heat waves, power grid system failures, substation failures, fires, or terrorism. The local concerns include downed power lines and poles caused by high winds, ice, snow and fallen limbs and trees. The regional utility problems due to far-ranging power grid, regional control and distribution problems are beyond the control of the local community. Regional and local problems are also often related to heat waves. Whatever the cause, the impacts on the community are the same. The probability of

local power failures in a given year is high. The probability of a major grid failure or brownout is high over the next several years. The problems associated with utility failures include:

- Loss of life sustaining equipment.
- Loss of refrigeration and spoilage of food.
- Loss of air conditioning in the summer during a heat wave.
- Loss of heating in winter and freezing of water pipes.
- Loss of rail service for the village.
- Traffic problems from loss of signal lights.
- Economic losses for local businesses.

The summer of 2006 showed record setting peak electricity demand. On September 14, 2006, Con Edison representatives met with several Westchester Municipal Officials to discuss Con Edison's less than optimal response to previous power outages, and to discuss solutions and future plans. Con Edison agreed to work with the municipalities on improving their response to power outages. Con Edison also announced that it would invest 1.2 Billion dollars beginning in 2007 to upgrade and reinforce its electric delivery system in New York City and Westchester County. ([www.coned.com/publicissues](http://www.coned.com/publicissues), Con Edison).

For several years Con Edison brought its Tree Maintenance Program to Westchester, including the Village of Mamaroneck. Their objective was to create safer distances between electric lines and surrounding trees. They performed systematic tree trimming in order to prevent damages and outages during heavy winds and storms.

Since Con Edison is already in the process of upgrading their system, as well as coordinating their efforts with local municipal officials, further health and safety assessments and a damage analysis from utility failure will not be performed nor will mitigation measures be proposed or evaluated.

### **5.C.6 Dam Failure**

Dam Failure was ranked 8<sup>th</sup> in the moderately low range with a HAZNY score of 224. Located in Valhalla, failure of the Kensico Dam could occur for several reasons; including overtopping, structural failure, cracking, poor maintenance, poor piping, and terrorism.

Failure of the Kensico Dam would be devastating, with little or no warning, resulting in catastrophic damages and fatalities. Approximately nine million people would lose their water supply. A tidal wave would ensue which would affect hundreds of thousands of people. Countless lives would be lost, as well as structures and critical facilities in the tidal wave's path, which would span from White Plains through the Bronx.

There are two other Dams in the area that would affect the Village of Mamaroneck, should either of the Dams fail. The Larchmont Dam is located on the Sheldrake River, and the Mamaroneck River Dam is located behind the Westchester Joint Waterworks. Failure of the Mamaroneck River Dam would result in the flooding of neighborhoods along the Upper Mamaroneck River.

The Kensico Reservoir is protected by the New York City Department of Environmental Protection (NYCDEP). After September 11, 2001, the Department of Public Safety created Westchester County's Office of Intelligence, Security and Counter-Terrorism (ISCT). The ISCT is working with the NYCDEP and has made significant security improvements at the Kensico Dam. Further health and safety assessments and a damage analysis from dam failure will not be performed, nor will mitigation measures be proposed or evaluated.

#### **5.C.7 Fire**

Fire hazard was ranked 4<sup>th</sup> in the moderately low range with a HAZNY Score of 240. According to incident reports from the Village of Mamaroneck Fire Department, the following fires have occurred in the Village from 2006 to 2010:

<b>Type of Situation</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Building Fires:	80	54	99	30	30
Vehicle Fires:	9	15	16	15	13
Other Fires:	21	22	9	14	35
Total Fires:	110	91	124	59	78

There are approximately 1270 commercial/industrial facilities and 3,636 residential buildings in the Village of Mamaroneck (See Table 5-5). Vulnerable fire prone locations include gas stations, restaurants and schools. Densely developed residential areas likely to be fire risks,



including single family and multi-residential buildings, and has the likelihood to affect more than one building. There are approximately 2,818 single family homes and 818 multi-residential buildings in the Village of Mamaroneck. There have been minimal occurrences of wildfire in the Village. Identified fire risks and concerns in the Village that need attention include:

- Single-Family residences
- Multi-family residences
- Light Industry and commercial

Risks to human health and safety, although a major concern, appear to be controlled. Based upon this assumption, further health and safety assessments and a damage analysis due to local fires will not be performed.

#### ***5.C.8 Extreme Temperatures***

This hazard was ranked 18th in the moderately low range with a HAZNY Score of 196. Summer temperatures have become gradually higher in recent years and may continue to increase in the near term. A heat event between July 4 and 6, 1999 in the New York metropolitan area had temperatures ranging from 100 to 105 degrees F with peak at 110 degrees. This resulted in 33 fatalities in the New York metropolitan area. Rolling electrical blackouts occurred across the region (National Climate Data Center, [ncdc.noaa.gov](http://ncdc.noaa.gov)).

In 2001, New York was hit with another heat wave, along with the rest of the east coast, resulting in 4 deaths. Temperatures in New York City reached 103 degrees F. In 2006, the North American Heat wave spread throughout most of the United States, killing more than 225 people. At least 32 deaths were reported in New York City. Massive blackouts occurred in the Tri-state area and Westchester County.

In July of 2010, a hot air mass developed and settled over the New York City area. Temperatures were in the mid to upper 90s and low 100s. The NYSDEC issued an ozone advisory for the New York metropolitan area. The Westchester County Health Department issued a heat advisory on July 6<sup>th</sup> due to 101 degree temperature. More than 1300 were without power during this heat wave.

In July of 2011, the New York City area was hit with another heat wave which lasted for 8 days. Temperatures in New York City reached 104 degrees, and 11 deaths were reported.

Since, most homes are air-conditioned there is a growing tendency for power failures and brownouts to occur during the warmest weeks of the year. The primary impact of high temperatures is the increased electrical demand and its stress on electrical utilities (see Utility Failure Section 5.C.5 above). Additional concerns are related to health and safety of people sensitive to heat stress and air pollution (see Section 5.C.12). Heat-related problems have a high probability of occurring in the future. Specific structure or facility damage related to high temperatures is limited. In extremely hot weather roads and bridges can buckle. An increase in safety risks to pedestrians and car passengers is probable.

The July 4-6, 1999 heat event resulted in 33 fatalities in the New York metropolitan area. Four deaths in the region were attributed to an August 2001 excessive heat event. 32 deaths in New York City resulted from the heat event in 2006. 11 deaths in New York City resulted from the heat event in 2011. Health impacts from elevated temperatures depend on the population of people sensitive to heat stress. For example, senior citizens are at-risk for heat stroke. The chronically ill are vulnerable to sudden high temperature heat waves. With the growing populations of the senior citizens in Westchester County, this is the sort of problem that could increase in the Village of Mamaroneck in the future. Although limited, there is a moderate to low likelihood that the elderly and chronically ill would be impacted.

There is no significant property damage from heat waves. Interruption of services and businesses is limited and primarily due to electrical utility failures. Health and safety of vulnerable populations is a concern. Based on this assessment, further health and safety assessment and a damage analysis from extreme temperatures will not be performed nor will mitigation measures be proposed or evaluated for this hazard.

#### ***5.C.9 Hazardous Material Releases***

This hazard covers materials, which, if released or if not used in a safe manner, could pose a threat to people, property and the environment. This hazard was evaluated from two perspectives. The release of hazardous materials during transit ranked 14<sup>th</sup> and was rated a

moderately low score of 210. Released from fixed locations, hazardous materials were rated moderately low with a HAZNY Score of 168 and a rank of 21.

Trucks carrying hazardous materials are likely most at risk at one of the established transportation routes that traverse the Village of Mamaroneck. These routes include I-95 on the western border, The Boston Post Road, which runs parallel to the Long Island Sound; and Mamaroneck Avenue, which runs through the middle of the village. Metro-North commuter tracks run through the Village of Mamaroneck and are also used by CRX to transport hazardous materials through the village.

Based on the probable sources and quantities of hazardous materials stored and used in village, the likelihood of significant damage or injury is low from the release of hazardous materials from a fixed site. The potential releases from small businesses would likely be small quantities and would have a limited local impact. Local fire and emergency response teams and local police can manage this hazard with current resources. In fact, there have only been 3 reported releases from a fixed site since 2005. According to the Village of Mamaroneck Fire Department Incident Reports, all incidents were controlled and confined.

Releases may occur from activities such as dry cleaning, auto repair and repainting, marina activities, gasoline and home fuel distributors, home building and maintenance services, compressed gas distributors, painting and cleaning and small quantity home use. The following problems from release of hazardous materials include:

- Releases from accidents during handling of chemicals.
- Spill of materials during use.
- Accidental air emission
- Release of toxic chemicals during a fire or explosion.
- Release from improper storage or disposal.
- Release from a truck in an accident.
- Rail car accident.

The frequency of hazardous materials distributed in the Village of Mamaroneck is an important community concern. However, the quantities involved would not result in significant property damage or result in significant injury, illness or mortality to the public.

Based on this assessment, further health and safety assessment and a damage analysis from hazardous material releases (fixed or in transit) will not be performed and mitigation measures will not be proposed or evaluated.

#### ***5.C.10 Explosion***

Explosion hazard was ranked in the moderately low range with a HAZNY Score of 192 and a rank of 19. Fueling activities at gasoline stations and Marinas and natural gas use in homes are risks. Handling and refilling gas cylinders at a local compressed gas distributor requires adherence to strict safety procedures. Accidents from use of flammable solvents in paint shops can cause explosions. Accidents from use of natural gas or propane at commercial and industrial facilities are a concern.

The problem is sporadic and the likelihood and magnitude is considered low. However, explosions though low in occurrence can cause major damage to a facility and surrounding properties and can injure or kill people. At present the Mamaroneck Fire and Police Departments oversee the protection of the community from these hazards and provide emergency fire response for sites with potentially explosive hazards.

Based on this assessment, further health and safety assessment and a damage analysis from explosion hazards will not be performed and mitigation measures will not be proposed or evaluated.

#### ***5.C.11 Oil Spills***

Oil spills were ranked 16<sup>th</sup> in the moderately low range with a HAZNY score of 201. Fuel oil spills were ranked 32 in the low range with a HAZNY Score of 114. Fuel oil spills during transport within or through the Village or during filling operations, can impact the health and safety of Village residents. Trucks carrying fuels are likely most at risk on the commercial roads, such as I-95. No significant releases that have affected the public and required evacuation

have been occurred in the Village. The primary concern would be fire and explosion incidents. There are no major fuel storage or processing facilities in the Village. Therefore, the magnitude and severity of the hazard is expected to be limited to local areas in the Village.

Oil spills can also occur as a result of failed underground storage tanks at gas stations and home-heating oil businesses. Other than fuel/oil services at local gas stations, marinas, and heating oil businesses, there are no significant commercial or industrial oil storage or transfer facilities in the Village of Mamaroneck. Fuel oil spills can also occur as a result of fuel transportation and delivery. Flooding can cause fuel tanks to become buoyant causing oil spills. Fuel oil spills can cause contamination of groundwater and surface water resources. Incidences of oil spills have been sporadic in the village. Spills within the village are most likely to be local and their impacts small.

Although these are important environmental contamination issues that could result in local property damage, this hazard would result in limited damage to buildings and limited injury, illness or mortality. Based on this assessment, further health and safety assessment and damage analysis from oil spills will not be performed nor will mitigation measures be proposed or evaluated.

#### **5.C.12 Air Contamination**

This hazard was ranked in the low range ranking 28<sup>th</sup> with a HAZNY Score of 132. No major industrial sources of air pollution were identified within the Village of Mamaroneck. Mamaroneck is within the USEPA Non Attainment area that has been designated for ozone. This means that the regional baseline air quality does not meet USEPA requirements and that certain activities with the potential for causing air pollution are not permitted. Therefore, there is a very high probability for the occurrence of air contamination problems. These problems include:

- Air contamination resulting from commercial/light manufacturing businesses.
- Air contamination resulting from local homes or sources such as wood burning fireplaces and stoves in winter.
- Local contamination resulting from outside regional sources.
- Local automobile emissions in the Village of Mamaroneck.

- Local diesel emissions in the Village of Mamaroneck from trucks, busses, and diesel/electric hybrid trains.
- Regional truck transport and commuter travel through the area and its perimeter and surrounding areas.

Air contamination events in the Village of Mamaroneck due to local sources are small and isolated and do not represent a major increase in health and safety risks to local residents. The primary health and safety concern is among the elderly, infirmed and sensitive individuals with respiratory problems. These risks are related regional problems rather than local sources.

These problems, though important air pollution issues, would not result in significant property damage or result in significant injury, illness or mortality. Based on this assessment, further safety assessment and a damage analysis from extreme temperatures will not be performed nor will mitigation measures be proposed or evaluated.

#### **5.C.13 Earthquakes**

This hazard was ranked 15th in the moderately low hazard range and has a HAZNY Score of 202. Chances of an earthquake occurring in the Village of Mamaroneck are low. None of the 4,984 structures in the Village are particularly at risk. Earthquakes in excess of 5.0 on the Richter Scale are extremely rare in the Northeast while events of lower magnitude occur periodically and minor damage may occur. According to the USGS, the peak ground acceleration (PGA) rating for Mamaroneck is 3.757%g. (<http://gldims.cr.usgs.gov>). This rating places the Village in a low risk category for earthquakes. According to the Lamont-Doherty Cooperative Seismographic Network (LCSN) of Columbia University, no earthquakes have been reported with a magnitude greater than 5 since 1884 in the Greater New York City area. However, in October 1985, an earthquake occurred in Westchester County which was centered in Ardsley and measured 4.0 on the Richter Scale. There have been other minor earthquakes reported in the White Plains and Dobbs Ferry areas. In addition, tremors were felt in Westchester County from an earthquake that occurred on August 23, 2011 and measured 5.8 on the Richter Scale. The epicenter was Northwest of Richmond, Virginia. There is no particular elevated safety risk linked to earthquakes of Richter Scale 5.0 or less.

In 2008 the USGS updated their National Seismic Hazard Maps. The peak ground acceleration (PGA) rating for the Westchester County ranges between 3– 4%g, and represents a moderately low risk category for earthquakes (See Figure 4-8). All reported events in Westchester County have been minor with no significant damage or injuries. Based on this information, there is a low probability that a damaging earthquake would occur in the Village of Mamaroneck.

However, a study published in the Bulletin of the Seismological Society of America analyzed 383 earthquakes from 1677 to 2007 in a 15,000 square mile area around New York City, along with new data. The study suggests a pattern of subtle, yet active faults, which increases the risk of earthquake to the New York City area.

Although earthquakes are an infrequent occurrence in the New York City area, the risk is greater due to the extremely high concentration of people and infrastructure. The population is denser than in more earthquake-prone areas. In the event a damaging earthquake did occur in the area, the losses would be far more catastrophic.

Based upon research in this study, an earthquake with a Magnitude-5 is predicted to occur every 100 years. In addition, it is estimated that a Magnitude-6 will occur every 670 years, and a Magnitude-7 will occur every 3,400 years (The corresponding probabilities of occurrence in any 50-year period would be 7% and 1.5%, respectively).

In addition, the study has uncovered new seismic zones that have not previously been identified, thereby increasing the risk of a damaging earthquake in the area. For example, a newly discovered seismic zone was identified which runs from Stamford, CT, to Peekskill, NY. This zone runs less than one mile north of the Indian Point Nuclear Power Plant. In addition, the Ramapo Seismic Zone, that runs from Eastern Pennsylvania to the Mid-Hudson Valley, passes within two miles northwest of Indian Point, placing the power plant in a very precarious position.

Indian Point sits on the banks of the Hudson River in Buchanan, New York. It is situated 23.65 miles from the Mamaroneck, and was built to withstand a Magnitude-7 on the Mercalli Scale, or 6.1 on the Richter Scale.



The higher-level events could cause substantial damage to structures that are not specifically designed to withstand earthquakes. Beyond damage to structures there would also be damage to underground utilities.

FEMA has run vulnerability assessment studies using HAZUS-MH software. Damage analysis from earthquakes will be discussed in section 5.D.4.

#### **5.C.14 Terrorism**

Terrorism was ranked in the moderately low range with a HAZNY score of 219 and a rank of 10. As discussed in Section 4.D.7, this human caused hazard would be low risk in the Village of Mamaroneck since there are no major terrorist targets of interest identified in the Village of Mamaroneck. Key target populations, high profile historical landmarks, airports, significant regional infrastructures, important manufacturing facilities, critical industries or key government institutions and structures are not present in the Village. The commuter rail station in the Village of Mamaroneck was identified as a possible target but it is only one of several commuter lines feeding into the greater metropolitan area. Another potential target is the Kensico Dam located in Valhalla. Because of the absence of important target facilities and key vulnerable populations, this hazard will not be considered for further evaluation or analysis.

#### **5.C.15 Other Hazards**

The following hazards were rated as low hazards and were ranked the lowest. They are not expected to cause significant damage or have substantial health or safety impacts. They are either rare events - occurring less than once every 50 years or infrequent events occurring between once every 8 years to once in 50 years. They have a low likelihood of causing a significant damaging event and the extent of the hazard in the Village of Mamaroneck is limited. They are unlikely to have any significant impact on the critical facilities, infrastructure, local economics, or key cultural or historical resources. These hazards judged to have a low impact or risk include:

- Civil Unrest
- Epidemic
- Radiological releases

Civil unrest has a low HAZNY ranking of 96 although it is a potential risk (Section 4.D.7.1). The community has a very stable and upwardly mobile profile and has no history of significant civil strife or unrest that would cause significant damage to the community. Therefore the likelihood for civil unrest that would cause damage to property or injury to numbers of people is low.

Epidemics are a very low risk in the Village of Mamaroneck. Epidemic hazard was ranked in the low range with a HAZNY score of 160. Based on the hazard profile given in Section 4.D.5.3, epidemics are a real concern but rare or infrequent. Epidemics are more likely to be a regional problem than a local one.

Should an epidemic, such as west Nile virus occur, none of the 4,984 structures would be affected. There are no hospitals located in the Village. The schools may need to be used as emergency shelters. There would be heavy demand on the Village of Mamaroneck's rescue services.

However, there are several concerns over potential outbreaks of disease. When an epidemic occurs, the health impacts can be severe. Some concerns include the occurrence of the mosquito borne West Nile Virus Disease, events stemming from failures in the wastewater treatment systems with resulting backups into homes, events stemming from drinking water quality failures, food poisoning, and from failures of marine water to meet swimming, clamming and fishing standards. Although epidemics are rare, the impact on the community can be large. Should an epidemic occur, it would most likely affect the region and not just the Village of Mamaroneck. Epidemics are not likely to be a common problem in the Village of Mamaroneck. Public health concerns related to epidemics in the Village of Mamaroneck include:

- Problems deriving from food poisoning.
- Insect and tick-borne diseases such as West Nile virus, Rocky Mountain spotted fever and Lyme disease, among others.
- Diseases caused by exposure to untreated sewage.
- Diseases caused by drinking contaminated drinking water.
- Biohazards resulting from terrorist missions.
- Epidemics caused by new contagious diseases such as SARS.

- Epidemics can overwhelm healthcare facilities and cannot treat all who are affected.

No special mitigation measures beyond current state or county public health activities are called for. These issues are currently handled by the Westchester County Department of Health. Based on this assessment, further health and safety assessment and a damage analysis from these hazards will not be performed and potential mitigation measures will not be evaluated.

## **5.D Impact and Damage Analysis of Major Hazards on Village Facilities**

### ***5.D.1 Vulnerability and Value of Buildings Subject to Hazards***

The Village of Mamaroneck is essentially a residential community and about 73 percent of the total buildings are single-family and multi-family residences (Table 5-6). Commercial properties, including apartment buildings, represent about 25% of the buildings in the Village.

**Table 5-6. Residential, Commercial, Industrial and other Buildings Potentially Exposed to Hazards in the Village of Mamaroneck.**

<b>Property Class Code</b>	<b>Building Type by Property Class</b>	<b>Total Number of Buildings *</b>	<b>% of Total Buildings</b>
210	Single Residential	2818	56.5%
220-283	Multi-Residential	818	16.4%
400-486	Commercial	1270	25.5%
546-570	Sports Facilities	15	0.3%
600-649	Community Services & Education	26	0.5%
620	Religious	21	0.4%
650-662	Government & Protection	16	0.3%
	Total	4984	100.0%

**\* Data provided by Village of Mamaroneck Manager's Office.**

The valuation of the buildings at risk is based on the Village of Mamaroneck's tax assessments. The Village tax assessment information is given in Table 5-7A. The Residential Assessment Ratio (RAR) to determine the value of residential properties for the Village of Mamaroneck is 1.72 for 2011. The Equalization Rate for the Village of Mamaroneck is 1.82. The total valuation of all occupied properties in the Village of Mamaroneck is approximately \$83.4 million (\$4,753 million, adjusted by RAR and Equalization Rate). For the purpose of this assessment, residential and multi-residential were combined. Since the total number of

properties was small, community services, education, religious and government services were combined. Apartment buildings are assigned to a commercial code. Entertainment and Sports facilities were combined with commercial properties since these activities have similar commercial functions in the community.

Table 5-7A shows the percent of building number exposure to hazards by occupancy type. Property values were based on the assessed value of the property and the tax assessment rate. About 64% of the value is residential and multi-residential property. About 21% of the exposed value is from commercial properties. About 10% of the exposed value is from community services and education. These three property types represent a total of 95% percent of the number of the Village of Mamaroneck buildings.

Table 5-8A shows the replacement value of buildings exposed to hazards by occupancy type. Property values were based on the assessed value of the property and the tax assessment rate in Table 5-7A.

**Table 5-7A. Village of Mamaroneck Property Tax Assessments and Property Values. \***

<b>Property Occupancy Class</b>	<b>Total Number Buildings</b>	<b>Total Assessed Value \$</b>	<b>Average Property Value \$</b>	<b>Percent Total Value</b>
Single Residential	2818	43,795,626	15,541	52.5%
Multi-Residential	818	9,616,525	11,756	11.5%
Commercial	1270	17,570,656	13,835	21.1%
Sports Facilities	15	1,456,871	97,125	1.7%
Community Services & Education	26	8,156,570	313,714	9.8%
Religious	21	1,945,500	92,643	2.3%
Government & Protection	16	869,000	54,313	1.0%
	4984	83,410,748	598,927	100.0%

**\* Data provided by Village of Mamaroneck Manager's Office.**

Residential values were adjusted using the Residential Assessment Rate (RAR) of 1.72. Other building types were adjusted using the Equalization Rate of 1.82. Adjusted values are represented below in Table 5-7B.

**Table 5-7B. Property Values adjusted by RAR and Equalization Rate.**

<b>Property Occupancy Class</b>	<b>Total Number Buildings</b>	<b>Total Assessed Value \$</b>	<b>Average Property Value \$</b>	<b>Percent Total Value</b>
Single Residential	2818	2,546,257,326	903,569	52.5%
Multi-Residential	818	559,100,291	683,497	11.5%
Commercial	1270	965,420,659	760,174	21.1%
Sports Facilities	15	80,047,857	5,336,524	1.7%
Community Services & Education	26	448,163,187	17,237,046	9.8%
Religious	21	106,895,604	5,090,267	2.3%
Government & Protection	16	47,747,253	2,984,203	1.0%
	4984	4,753,632,177	32,995,279	100.0%

**Table 5-8A. Building Exposure by Occupancy type. \***

<b>Property Class Code</b>	<b>Occupancy Class</b>	<b>Total Value Properties *</b>	<b>Replacement Value</b>
210	Single Residential	43,795,626	32,053,076
220-283	Multi-Residential	9,616,525	7,374,125
400-486	Commercial	17,570,656	11,400,779
546-570	Sports Facilities	1,456,871	612,030
600-649	Community Services & Education	8,156,570	6,541,350
620	Religious	1,945,500	1,472,600
650=662	Government & Protection	869,000	639,300
	Total	83,410,748	60,093,260

\* Based on data provided by Village of Mamaroneck Manager's Office.

**Table 5-8B. Adjusted Building Exposure by Occupancy type. \***

<b>Property Class Code</b>	<b>Occupancy Class</b>	<b>Total Value Properties *</b>	<b>Replacement Value</b>
210	Single Residential	2,546,257,326	1,863,550,930
220-283	Multi-Residential	559,100,291	428,728,198
400-486	Commercial	965,420,659	626,416,429
546-570	Sports Facilities	80,047,857	33,628,022
600-649	Community Services & Education	448,163,187	359,414,835
620	Religious	106,895,604	80,912,088
650=662	Government & Protection	47,747,253	35,126,374
	Total	4,753,632,177	3,427,776,875

\* Values adjusted by RAR and Equalization Rate.

#### **5.D.2.1 Flood Insurance Claims**

There was limited information available on insurance claims data for the Village of Mamaroneck. According to the NFIP, as of 9/30/2011, there are currently 1052 flood insurance policies for the Village. The total insurance coverage is \$279,140,100 and since 1978 there were 1429 claims made for \$16,751,541.57. However, these flood insurance claims are likely underreported and actual flood damages are probably higher. (<http://bsa.nfipstat.com>).

Please see the Appendix for a complete list of the Village of Mamaroneck's Repetitive Loss properties, along with the number of losses and total paid. There are currently 23 properties designated as Severely Repetitive Loss Properties. FEMA defines a severe repetitive loss (SRL) Property as a residential property that is covered under an NFIP flood insurance policy and:

- a) That has at least four NFIP claim payments (including building and contents) over \$5,000 each, and the cumulative amount of such claims payments exceeds \$20,000; or
- b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

#### **5.D.2.2 100-Year and 500-Year Flood Hazards**

The 100-Year flood is defined as the base flood standard and the 500-Year flood is a probable worst-case. Flood levels for these events are summarized in the Flood Insurances Study (FIS) for the Village of Mamaroneck, Westchester County, NY (All jurisdictions), by the Federal Emergency Management Agency (FEMA), September 28, 2007. Inundation floods from hurricanes, which may cause more severe wave surges, are evaluated in Section 5.D.2.3.

Flooding in the Village of Mamaroneck has been associated with high stream states and with high tidal stages during all seasons. The most severe riverine floods have been associated with the heavy rains from storms or landfalling hurricanes originating in the Caribbean Sea. Wind-driven storm surges particularly from hurricanes and Nor'easters cause severe flooding and backup of storm water (See Map 3 at end of Part I).

The Village of Mamaroneck was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

<b>Flood Insurance Zone</b>	<b>Description</b>
Zone AE	Corresponds to the 1-percent annual chance floodplains that are determined by detailed methods. Base flood elevations determined.
Zone VE	Corresponds to the 1-percent annual chance coastal floodplains that have additional hazards associated with storm waves. Coastal flood zone with velocity hazard (wave action); Base flood elevations determined.
Zone X	Corresponds to areas outside the 0.2-percent annual chance floodplain, areas within the 0.2-percent annual chance floodplain, and to areas of 1-percent annual chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent annual chance flood by levees. No base flood elevations or depths are shown within this zone.

**Source: Flood Insurance Rate Map 36119C0361F, Village of Mamaroneck, New York, Westchester County. FEMA. September 28, 2007.**

According to the FIS, wave heights in Zone VE were computed along transects that were located along the coastal areas of the Village of Mamaroneck. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in the locality. The transects were taken perpendicular to the shoreline and extended inland to a point where the wave action ceased. Stillwater starting elevations and wave crest elevations for the village of Mamaroneck on the FIRM are detailed as follows:

<b>TRANSECT Zone VE</b>	<b>LOCATION</b>	<b>ELEVATION (FEET NAVD) STILLWATER</b>	<b>ELEVATION (FEET NAVD) WAVE CREST</b>
13	Western corporate limits to approximately 1500 ft east of western corporate limits	11.6	18.0
14	Approximately 1500 ft east of western corporate limits to Seven Oaks Lane, extended	11.6	18.0
15	Seven Oaks Lane, extended, to Orienta Point	11.5	17.0
16	Orienta Point to mouth of Otter Creek	11.5	17.0
17	Mouth of Otter Creek to approximately 1400 feet east of mouth of Otter Creek	11.5	17.0
18	Approximately 1400 feet east of mouth of Otter Creek to eastern corporate limits	11.5	15.0

**Source: FEMA Letter of Map Revision Determination Document, Effective April 6, 2010, corresponding to Flood Insurance Rate Map 36119C0361F, Village of Mamaroneck, New York, Westchester County. FEMA. September 28, 2007.**

Because of the expanse of the area, there are several base flood elevations for the 100-year flood for FIRM Map Zone AE. Elevation reference marks were measured, resulting in several different base flood elevations along each flooding source. Base flood elevations are shown for several cross sections of the 100-year flood spanning the Village of Mamaroneck.

Base flood elevations are shown below for several cross sections of the 100- year flood spanning throughout the Village of Mamaroneck along the Beaver Swamp Brook and the Mamaroneck and Sheldrake Rivers:

<b>Flooding Source Cross Section: Beaver Swamp Brook</b>	<b>Base Flood Water Surface Elevation</b>
A	11.5
B	22.8
C	23.2
D	27.2
E	28.4
F	31.3
G	32.3
H	32.5
I	32.8

<b>Flooding Source Cross Section: Mamaroneck River Lower Reach</b>	<b>Base Flood Water Surface Elevation</b>
A	11.5
B	11.5
C	11.5
D	16.7
E	16.9
F	20.3
G	20.5
H	22.2
I	22.3
J	33.1
K	34.8
L	38.1
M	38.7
N	38.7
O	40.8

**Source: (Flood Insurance Study, Village of Mamaroneck. September 28, 2007).**



Base flood elevations are shown below for 4 cross sections of the Sheldrake River, spanning from the confluence with the Mamaroneck River to the New England Thruway.

<b>Flooding Source Cross Section: Sheldrake River</b>	<b>Base Flood Water Surface Elevation</b>
A	25.8
B	25.8
C	28.5
D	28.6

**Source: (Flood Insurance Study, Village of Mamaroneck, September 28, 2007).**

For purposes of this assessment, the referenced base flood elevations were averaged to determine the mean base flood elevation for each zone. Therefore, the mean base flood elevation in the 100-year flood plains is 21 feet.

The impacts of flooding from 100-Year and 500-Year events were assessed counting buildings on properties for the various categories of property use (Maps 1 and 5) (i.e. residential, commercial, industrial and community services). Counts made using overlays for each of the two flood zones from Map 2, and information supplied from the Village Manager's office are summarized on Table 5-9. Based on the average assessed value for each property type the total assessed value for each category was estimated and is given in Table 5-10. The total dollar value can be viewed as the amount of the total property and buildings at risk. This value does not represent the actual damages or losses of the property since in most cases only a portion of the building is damaged from a flood.

Table 5-9 shows that about 13.4% and 6.1% of the properties in the Village of Mamaroneck would be at risk from a 100-Year and a 500-Year flood event, respectively. The major impacts would be from flooding of single residential homes. For the 100-Year flood, the total value of properties at risk from damage in the Village is about \$579 million (Table 5-10). The 500-Year flood resulted in a risk of about \$266 million (Table 5-10). This compares to a total adjusted property value of \$4,753.6 million.

The largest potential loss values for these two classes of floods are single residential homes at nearly \$459 million and \$238 million respectively. Commercial capital risks are also substantial at nearly \$117 million and \$25 million for 100 and 500-Year events. Community services face a smaller risk with about \$3.2 million and 3.6 million for 100 and 500-year flood year events.

**Table 5-9. Number of Buildings in the Village of Mamaroneck Subject to Flood Hazards**

Category	Single & Multi Residential	Commercial/Industrial	Community Services*	Total Properties at Risk	% Properties at Risk
100-Year flood	508	154	8	670	13.4
500-Year flood**	263	33	9	305	6.1
Total Village Properties	3636	1285	63	4984	

\* Includes Education, Government, other community services and Religious facilities.

\*\* Total properties in the 100-Year and 500-Year floodplain.

**Table 5-10. Value of Buildings and Properties in the Village of Mamaroneck Subject To Flood Hazards**

Flood Zone	Property Classes	Number of Structures Impacted*	Average Property Value** (\$1,000)	Total Value at Risk (\$1,000)
100 Year	Residential	508	903.5	458,978
	Commercial/Industrial	54	760	117,040
	Community Services**	8	402	3,216
	<b>Totals</b>	<b>670</b>		<b>579,234</b>
500 Year***	Residential	263	903.5	237,621
	Commercial/Industrial	33	760	25,080
	Community Services**	9	402	3,618
	<b>Totals</b>	<b>305</b>		<b>266,319</b>

\* Estimates based on manual counts from Westchester County Base Maps and Land Use Designation Map (See Maps 2, 3 & 5). Single-Residential and Multi-Residential structures combined.

\*\* Based on assessed rates given in Table 5-7. Includes the market value of the property and structure.

\*\* Includes education, government, healthcare, other community services and religious properties.

\*\*\* Number of structures is inclusive of 100-Year flood.

An estimate of building damages and losses due to flooding is presented in Table 5-11 and 5-12 using the methodology from FEMA's Mitigation Planning Guide 386.2. These capital and economic loss estimates assume an average depth of flooding for a given event, the percentage of the structure damaged, a percentage of building contents damaged and an estimate of downtime costs for businesses. The average depth of flooding was calculated by subtracting the estimated low floor elevation from the 100-Year flood and 500-Year flood elevations from the FIRM map and the Village of Mamaroneck FIS, 2007.

The total structural damage to buildings for a 100-Year flood event was about \$133.2 million and nearly \$88 million for a 500-Year event (Table 5-11). However, when contents losses and economic losses such as downtime (Table 5-12) are considered, the impacts increase to nearly \$255 million and nearly \$161 million, respectively.

Table 5-12 provides an estimate of downtime losses for commercial/industrial properties. Commercial downtime from flood damages was approximately \$1,012,115 in the 100-year flood zone and \$275,220 in the 500-year flood zone. These losses are likely low since FEMA national averages were used for sales estimates. Westchester County sales per sq. foot are likely higher than the national average.

**Table 5-11 Summary of Floodplain Related Damages in the Village of Mamaroneck**

Event	Flood Depth* (Feet)	Total Value of Structure (Million \$)	% of Structure Inundated**	Structure Damage (Million \$)	Contents Value*** (Million \$)	% Contents Damage**	Contents Damage (Million \$)	Downtime Costs**** (Million \$)	Total Damage (Million \$)
<b>100-Year Flood Zone</b>									
Residential	3	458.9	23	105.5	229.5	34.5	79.2		184.7
Commercial/Industrial	3	117	23	26.9	117	34.5	40.4	1	68.3
Community Services	3	3.2	23	.74	3.2	34.5	1.1		1.84
<b>Total</b>				<b>133.2</b>			<b>120.7</b>		<b>254.84</b>
<b>500-Year Flood *****</b>									
Residential	5	237.6	33	78.4	118.8	49.5	58.8		137.2
Commercial/Industrial	5	25	33	8.3	25	49.5	12.4	0.28	20.9
Community Services	5	3.6	33	1.2	3.6	49.5	1.8		3.0
<b>Total</b>				<b>87.9</b>			<b>87.3</b>		<b>161.2</b>

\* Base Flood Elevations less the Low Floor Depths. Based on figures from Village of Mamaroneck FIS, 2007.

\*\* FEMA 386.2 Page 4-13.

\*\*\* Contents Value estimated using FEMA 386.2 Page 3-11.

\*\*\*\* See Table 5-12. for estimates. Downtime values were not estimated for residential buildings or Community Services.

**Table 5-12. Summary of Flood Related Downtime Damages in the Village of Mamaroneck.**

Event	Flood Depth (Feet)	Number of Structures Inundated	Average Estimated Area* (Sq. Feet)	Total Structure Area (Sq. Feet)	Annual Sales** (\$/Sq. Ft.)	Total Daily Sales Loss (\$)	Function Downtime *** (Days)	Total Downtime Costs (\$)
<b>100-Year Flood</b> Commercial/Industrial	3	54	535,400	535,400	30.0	44,005	23	1,012,115
<b>500-Year Flood</b> Commercial/Industrial	5	33	111,623	111,623	30.0	9,174	30	275,220

\* Derived from HAZUS model.

\*\* Value estimated using FEMA 386.2 Page 3-12.

\*\*\* FEMA 386.2 Pages 4-14

### **5.D.3 Wind Storm Damage Assessment**

The Village of Mamaroneck is highly vulnerable to wind damage from hurricanes, nor'easters, thunderstorms and other significant wind events. In severe storms, the village is subject to damaged roofs, siding, windows, utility poles, and trees as well as total building losses. The most significant storm events that cause the greatest damage to the region are remnants of hurricanes. Tornados, because of their low frequency are unlikely to strike the Village of Mamaroneck although their potential for destruction is high. The following section provides a detailed damage and economic assessment of hurricane wind damages and economic impacts in the Village of Mamaroneck.

#### **5.D.3.1 HAZUS Hurricane Model**

Hurricane impacts from wind were assessed using FEMA's HAZUS ®*MH MR2* model. HAZUS is a regional multi-hazard loss estimation computer model that was developed by FEMA and the National Institute of Building Sciences. The HAZUS Hurricane Model provides estimates of the economic losses from hurricane force winds. The damage and loss estimates can be used to plan and propose efforts to mitigate or reduce risks from wind damage, reduce disaster payments and to prepare for emergency response and recovery in the event of a damaging event.

Two runs of the model were used in this assessment: a user-defined historical model and a probabilistic analysis of impacts for different strength hurricanes. The historical model was given worse-case storm parameters as an example of a hurricane that could strike Mamaroneck directly. The model parameters used were those defined in Section 9.3 of the HAZUS Users Manual for Hurricanes. The HAZUS probabilistic model evaluates risks of future impacts from hurricanes for several hurricane wind speeds and return periods (i.e. probability of an occurrence in a year).

Since the HAZUS model uses data derived from several databases with varying assumptions, the results in Tables 5-16 through 5-20 and in the Attachments included in Part 2 may differ from the data provided by the Village of Mamaroneck in Tables 5-6 through 5-8. For example the number of residential houses and commercial buildings differ in part due to different sources of the data, use of regional model estimates for local village parameters, and dates the data were

collected. Considering these variables, the Village total building counts in Table 5-6 are reasonably close to the model estimates in Table 5-16. Since the Village provided counts are current and based on the Mamaroneck Tax Assessors Office, the HAZUS model estimates of damages were adjusted using the Village of Mamaroneck data. Although the Village replacement costs are substantially higher than the model's "Dollar Exposure" replacement costs, the Village estimates are more in line with the current real estate market values.

**Table 5-16 Basic parameter estimates**

Property Use Class	Village Building Counts	HAZUS Building Counts	Count Adjustment Factor	Village Replacement Value x1,000	HAZUS Replacement Value x1,000	Value Adjustment Factor *
Commercial/Industrial	1,285	83	13.5	660,044	236,386	2.79
Government	16	4	4.0	235,126	5,164	7.94
Education/Community Services	26	7	3.7	359,415	47,781	
Religious	21	2	10.5	80,912	6,915	
Residential	3,636	4,061	0.9	2,292,279	1,175,153	1.95
Total	4,984	4156		3,427,776	1,471,399	

\* Values combined for Commercial/Industrial and Government/Education/Religion/Community Services

The HAZUS historical model represents a probable worse-case Category 3 hurricane that could strike the village and would be similar to those storms listed in Table 4-4 and Figure 4-6 except it would track through Mamaroneck (Figure 5-4). Although the storms may begin as Category 3 or 4 hurricanes, they historically deteriorate quickly to Category 1 when they hit land or track closer to the coast, thus avoiding major inland damage for the Westchester County region. Since a Category 4 storm would be a rare event and Category 5 storms are unlikely to reach as far north as New York, a Category 3 Hurricane with maximum 1 minute sustained winds ranging of 102 mph is considered as the most probable worst case scenario.

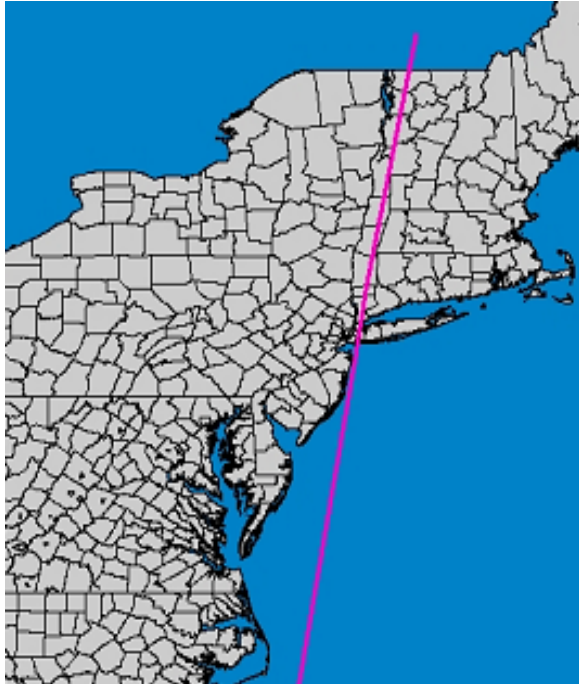


Figure 5-4. HAZUS Historical Model projected track for a hypothetical hurricane through Mamaroneck NY with 120 mph winds.

The model results in Table 5-16 show what could have happened if this model hurricane track struck Mamaroneck with full force sustained winds of 120 mph with peak 3-second gusts of 141 mph. The model's assumptions and detailed output from the HAZUS historical model is given as an Attachment in Part 2. A hurricane of this size could destroy over 549 homes and severely damage 758 more. About 6.5% or 235 of the homes would escape some damage. A similar type of considerable wind damage could be caused by a tornado rated as F2 but the damages would be over a narrow band of the village rather than covering the entire area.

The HAZUS probabilistic model was run to evaluate possible future impacts of hurricanes on Mamaroneck. Using the HAZUS program, probabilities of damage, expected building losses, expected contents losses, and expected loss-of-use are computed for different classes of building use for several probable hurricanes and peak wind gusts. Results of these analyses are given in Tables 5-17 and 5-18.



**Table 5-17. Potential Damage to Mamaroneck Buildings From a Category 3 Hurricane.  
(120 MPH Sustained Winds)**

Occupancy Class	Village Count *	No Damage		Minor Damage		Moderate Damage		Severe Damage		Destruction	
		Count	(%)**	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Commercial/Industrial	1285	103	8.0	175	13.6	397	31.0	590	45.9	20	1.53
Education/Community Services	26	2	7.2	3	11.0	7	28.2	14	53.0	0	.66
Government	16	1	7.4	2	9.9	4	27.1	9	55.2	0	.38
Religious	21	2	7.8	4	18.5	7	34.9	8	37.9	0	.84
Residential	3,636	236	6.5	829	22.8	1262	34.7	760	20.9	549	15.1
Total	4,984	344		1013		1,677		1,381		569	

\* Village-provided building counts were substituted for estimated model counts. See Text and Table 5-16.

\*\* % Damaged buildings were estimated using the HAZUS Historical Model.

Table 5-18 shows the probabilistic model results for building damages associated with four hurricane “return periods” and peak wind gusts (maximum 3-second wind speed). A return period of 100 years for example, corresponds to a 1% chance per year in Mamaroneck of exceeding the computed total direct loss shown for the 100-Year event. These periods and winds are specific to the Village of Mamaroneck. Areas closer or more distant from the coastline will have different values. A 200-year return event would be in the mid range of a Category 2 storm. A 500-Year return event with peak wind gusts of 127 mph would be in the lower range of a Category 3 storm having maximum 1-minute sustained winds of 111 mph. This storm would have a probability of 0.2% striking the area in a year. A return period of 1000 years is a rare storm event and is not presented in Tables 5-18 and 5-19. Also the 10 and 20-year events with peak wind gusts of 39 and 58 mph are not summarized since the model results show either no or minor damages from these more frequent storms. The peak wind gust speeds are estimated by HAZUS for each of the return periods. These wind speeds are the estimated maximum 3-second gusts in open terrain at 10m above ground at the center of each census tract used in the model. The wind gust speeds and return periods are within the ranges of a Category 1, 2 and 3 storms. Detailed output from the HAZUS probabilistic model for all return periods is given in the Attachments in Part 2.

The data used in the model were from the Village of Mamaroneck US Census tracts that are part of the model’s database. The default conditions were applied to the model, which included information describing the building use inventory, essential facilities, tree coverage, and surface

roughness. For the purposes of this hazard mitigation plan, this simplified approach was judged to be sufficient.

In Tables 5-17 and 5-18, the count of damaged buildings was estimated by multiplying the total count in a property class by the % impact (/100). To correct for differences between the default census tract data in the model for building use categories and the current assessment data provided by the Village Administration, the model output results were adjusted using the ratio of the property value provided by the Village to model's building use class value. For example, the total residential building replacement value derived from the HAZUS model was \$1,175,153,000 and the Village's property estimate based on assessed value for residential and multi-residential (Table 5-8 and 5-16) was \$2,292,279,000. This resulted in an adjustment factor of 1.95, which was applied to the HAZUS model result for residential loss to obtain the result of \$11,524,890 in Table 5-19. The adjustment factor for combined commercial/industrial use was 2.79 and for other community services (education, government, and religious services) the factor was 7.94. Thus capital damage losses in Table 5-19 can be compared to current property values in Mamaroneck.

Using formulas programmed in HAZUS, damage probabilities, expected building losses, expected contents losses, and expected loss-of-use were estimated for different class uses of buildings. The hurricane loss estimates provided in this report are based on regional census and economic parameters. The area of Mamaroneck Village is 3.14 square miles. There are over six thousand households in the village, which has a total population of 18,464 people in 4 census tracts (2000 Census Bureau data). There are an estimated 5,000 buildings in the Village with a total building and property value, excluding contents, of 3.4 billion dollars (Table 5-7). Approximately 75% of the buildings (and 64% of the building value) are associated with residential housing.

**Table 5- 18. Probabilistic Building Damage Risks from Hurricanes that Could Strike the Village of Mamaroneck.**

Return Period (Yrs.)*	Peak Wind Gusts (mph)*	Property Class**	Total Building Count***	Degree of Wind Damage									
				None		Minor		Moderate		Severe		Destruction	
				(%) Impact	Damage Count	(%) Impact	Damage Count	(%) Impact	Damage Count	(%) Impact	Damage Count	(%) Impact	Damage Count
50	82	Commercial/Industrial	1285	97.1	1,248	2.6	34	0.3	3	0.0	0	0.0	0
		Education/Community	26	96.7	25	3.1	1	0.2	0	0.0	0	0.0	0
		Government	16	96.7	15	3.1	1	0.2	0	0.0	0	0.0	0
		Religious	21	97.6	21	2.3	0	0.1	0	0.0	0	0.0	0
		Residential	3636	96.3	3,500	3.3	120	0.4	16	0.0	1	0.0	0
		Total	4,984		4,809		155		19		1		0
100	98	Commercial/Industrial	1285	82.0	1,053	13.4	172	4.2	53	0.5	6	0.0	0
		Education/Community	26	79.5	21	14.9	4	5.1	1	0.5	0	0.0	0
		Government	16	79.5	13	14.7	2	5.3	1	0.5	0	0.0	0
		Religious	21	84.2	18	13.4	3	2.4	0	0.1	0	0.0	0
		Residential	3636	79.7	2,899	16.4	596	3.7	133	0.2	6	0.1	3
		Total	4,984		4,003		777		189		12		3
200	111	Commercial/Industrial	1285	50.8	652	25.2	324	18.4	236	5.6	72	0.1	1
		Education/Community	26	49.3	13	24.8	6	19.4	5	6.5	2	0.0	0
		Government	16	49.3	8	23.8	4	20.0	3	6.9	1	0.0	0
		Religious	21	52.1	11	28.9	6	15.7	3	3.3	1	0.0	0
		Residential	3636	49.2	1,787	33.7	1,224	14.4	523	1.8	64	1.1	39
		Total	4,984		2,471		1,564		771		139		39
500	127	Commercial/Industrial	1285	19.0	244	22.4	288	31.5	405	26.6	342	0.4	6
		Education/Community	26	16.9	4	19.7	5	31.3	8	32.1	8	0.1	0
		Government	16	17.0	3	18.1	3	31.1	5	33.7	5	0.1	0
		Religious	21	18.6	4	28.8	6	31.5	7	21.0	4	0.1	0
		Residential	3636	18.7	681	34.7	1,260	30.3	1,101	10.0	364	6.3	231
		Total	4,984		936		1,562		1,526		724		236

**Table 5-18 Notes:**

- \* Return period, peak wind and % impacts are from HAZUS probabilistic model for hurricane damage for the Village of Mamaroneck
- \*\* Residential includes single and multifamily.
- \*\*\* Building counts provided by Village of Mamaroneck Manager's Office were substituted for model estimates. (See text.)

**5.D.3.2 Hurricane Damage Analysis**

Table 5-18 summarizes the expected building damage by hurricane event and general property class in the Village. Based on HAZUS percentage estimates, about 1,564 buildings will suffer from minor damage to destruction from a 200-year event. This is about 31% of the total number of buildings in the village. There are an estimated 236 buildings that will be completely destroyed in a 500-year event. In contrast, a 50-year event showed 4,809 or 96% of the buildings would have no significant wind damage compared to only 936 or 18.8% unharmed from a 500-year event.

The hardest hit would be residential buildings. The greatest amount of damage is to wooden structures and the HAZUS model estimated that 79% of the buildings in the Village are constructed of wood. The strong winds of a 500-year return storm would impact about 80% of these wooden structures and 5.5% of the wooden structures would be destroyed. The model estimated that 1459 households would be displaced from their homes as a result of a 500-year hurricane and about 335 people in the village population will likely need temporary public shelters. (See Attachments in Part 2.)

Building losses are divided into two categories: direct property damage losses and business interruption losses. The direct property damage or capital losses include the estimated costs to repair or replace the damage to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

**Table 5-19 HAZUS Hurricane Probabilistic Model – Property Damage Capital Losses (X \$1,000)\***

Return Year	Wind Gusts mph	Losses	Residential **	Commercial /Industrial	Community Services	Total Interruption Losses
50	82	Building	11,525	492	358	12,375
		Contents	2,417	74	12	2,498
		Inventory	0	3	1	4
			<b>13,492</b>	<b>569</b>	<b>371</b>	<b>5,978</b>
100	98	Building	42,470	3,749	3,099	49,588
		Contents	9,404	1,241	1,108	11,753
		Inventory	0	53	14	67
		<b>Subtotal</b>	<b>52,144</b>	<b>5,043</b>	<b>4,221</b>	<b>61,408</b>
200	111	Building	145,477	21,192	17,164	183,833
		Contents	45,351	11,044	8,819	65,214
		Inventory	0	468	78	546
		<b>Subtotal</b>	<b>190,828</b>	<b>32,704</b>	<b>26,061</b>	<b>249,593</b>
500	127	Building	478,632	87,235	73,807	639,674
		Contents	193,306	56,137	45,709	295,152
		Inventory	0	2,210	267	2,477
		<b>Subtotal</b>	<b>671,938</b>	<b>145,582</b>	<b>119,783</b>	<b>937,303</b>

\*HAZUS Model results adjusted for Mamaroneck Village replacement values (See text and Table 5-16).

\*\* Total Residential, Commercial includes Industrial, and Community Services include Educational, Governmental, and Religious Facilities.

**Table 5-20 HAZUS Hurricane Probabilistic Model - Business Interruption Losses (X \$1,000)\***

Return Year	Wind Gusts mph	Losses	Residential	Commercial /Industrial	Community Services	Total Interruption Losses
50	82	Income	0	307	0	307
		Relocation	203	201	4	408
		Rental	221	116	0	337
		Wage	0	109	0	109
		<b>Subtotal</b>	<b>424</b>	<b>733</b>	<b>4</b>	<b>1,161</b>
100	98	Income	0	2,509	184	2,693
		Relocation	1,050	3,174	336	4,560
		Rental	916	1,598	20	2,579
		Wage	0	2,492	737	3,229
		<b>Subtotal</b>	<b>2011</b>	<b>9,773</b>	<b>1,277</b>	<b>13,061</b>
200	111	Income	1	5,709	255	5,965
		Relocation	6,022	17,943	1,886	25,851
		Rental	3,468	9,260	116	12,844
		Wage	2	5,954	995	6,951
		<b>Subtotal</b>	<b>9493</b>	<b>38,866</b>	<b>3,252</b>	<b>51,611</b>
500	127	Income	14	71,489	328	71,831
		Relocation	19,054	62,413	7,122	88,589
		Rental	9,931	36,854	496	47,281
		Wage	33	74,259	1,108	75,400
		<b>Subtotal</b>	<b>29,032</b>	<b>245,015</b>	<b>9,054</b>	<b>283,101</b>

\* Corrected for Building counts provided by the Village. (See text)

\*\* Total Residential, Commercial includes industrial and Community services include education, government, and religious facilities.

**Table 5-21 HAZUS Hurricane Probabilistic Model – Summary of Economic Losses (X \$1,000)**

Return Year	Wind Gusts mph	Total Interruption Losses	Total Capital Losses	Total Village Losses
50	82	1,161	14,877	16,038
100	98	13,061	61,408	74,469
200	111	51,611	249,593	301,204
500	127	283,101	937,303	1,220,404

Tables 5-19, 5-20 and 5-21 summarize the losses associated with the building damage for the hurricane events with return periods of 50 years through 500 years. The losses were adjusted to building counts and replacement values provided by the Village Administration. (See Section 5.D.3.1 above.) The total economic loss estimated for a 500-year return hurricane is about \$1,220.4 million dollars, which represents nearly 36% of the \$3.4 billion in total property value for the total Village. The total capital property damage costs were about \$937 million dollars with 23% or \$283 million of the estimated losses due to the interruption of business in the Village. The largest capital loss, \$672 million, was to residential buildings, which accounted for 71% of the total capital losses. The HAZUS model showed \$16,038 million in damages for a 50-year event with peak gusts of 82 mph. Thus a Category 1 storm could produce significant dollar losses with only minor and moderate damage to buildings.

HAZUS estimates the amount of debris generated by a hurricane. Three general types of debris are evaluated by the model: brick/wood, reinforced concrete/steel, and trees. A total of 16,175 tons of debris will be generated from wind damage during a 200-year event. Brick and wood comprises 81% of the total debris, reinforced concrete and steel comprise of 1% and the remaining debris consists of trees. The building debris alone (brick, wood, concrete and steel) generated by the hurricane will require 530 truckloads (@25 tons/truck) to remove the debris.

There are several critical facilities of concern (see Section 5.B.2). There are several schools, 4 fire stations, a Village Hall containing police facilities, Village administration offices which could be used as the Village Emergency Operations Center (EOC), etc. There are no hospitals in the Village. A 500-year event would likely have a 50% probability of causing at least moderate damage to these facilities. Loss-of-use time for these facilities is expected to be less than one day.

Although HAZUS can provide comprehensive loss estimates, uncertainties are inherent in any model methodology. The next hurricane that may strike Mamaroneck could be quite different from any model hurricane included in this hurricane analysis. The results of this model analysis for Mamaroneck should not be considered a *prediction or forecast* of future hurricanes but viewed as an indication of what possible hurricanes in the future may do. This probabilistic

hurricane analyses can be used to develop estimates of long-term “annualized losses” as well as the expected distribution of losses based on “return period losses”. These damage estimates reflect the expected hurricane tracks and intensities that may likely occur in Mamaroneck. There are significant uncertainties in the results due to the limited history of hurricane observations, limited knowledge of actual local building characteristics, use of simplified modeling assumptions, and other local socio-economic factors. A probabilistic analysis has statistical uncertainties that need to be considered when interpreting the model results.

#### ***5.D.4 Valuation Assessment of Earthquakes***

An earthquake is a rare event in Mamaroneck but can cause impacts and losses to the Village’s structures and facilities. The overall hazard ranking determined by the Hazard Mitigation Planning Committee for this hazard is moderately low. The following vulnerability assessment emphasizes that earthquakes are a hazard of concern. Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. Possible mitigation actions would include public awareness/ education and reviewing State and local building codes with respect to earthquakes.

In 2000, FEMA reported a study using the model “HAZUS99 Estimated Annualized Earthquake Losses for the United States”. The study showed that New York State ranked 4<sup>th</sup> in annualized earthquake losses, and 20<sup>th</sup> in annualized earthquake loss ratio (annualized loss as a fraction of replacement value of building stock). Annualized Earthquake Loss was determined to be \$83,987,000, while Annualized Earthquake Loss Ratio was \$90 per million.

In addition, FEMA ran a vulnerability assessment study using HAZUS-MH software which indicated counties most vulnerable to earthquake hazards. The study factored in regional variations in earthquake hazards, as well as the extent of the built-up areas between counties. Estimated losses for several return periods were used, based on values from the USGS seismic probabilistic curves. The estimated cost of earthquakes to each county is based on annualizing the aggregates of the loss and exceedance probabilities. Total Exposure represents the dollar value of all general building stock and calculated potential total losses (Capital Stock and Income Losses) for four return periods.



Westchester County's results are as follows:

Total Exposure	2500-year	1000-year	500-year	250-year
69,147,392	4,579,368,000	1,218,843,000	343,001,000	69,121,000

The four approaches used in the study were Annualized Total Loss-Rank, Annualized Total Loss per Capita-Rank, Exposure Ratio, and Exposure Ratio-Rank. Table 5-22 below provides the ranking results for Westchester County. The New York City Area Consortium for Earthquake Loss Mitigation estimates the cost of a large earthquake in the New York Metropolitan Area to be between \$39 and \$197 billion dollars.

**TABLE 5-22. HAZUS-MH Earthquake Annualized Loss Estimation and Ranking Results**

Total Exposure ( x \$1,000) (\$)	69,147,392
Annualized Capital Stock Losses (\$)	4,393
Annualized Income Losses (\$)	579
Annualized Total Losses (\$)	4,972
Annualized Loss Ratio (\$/\$1 million of exposure)	72
Annualized Loss per Capita (\$)	5.38
Exposure Rank	6
Exposure Ratio-Rank	9
Annualized Loss Rank	5
Annualized Loss per Capita-Rank	6

Source: New York State Standard Multi-Hazard Mitigation Plan, Section 3. SEMO.

[www.semo.state.ny.us/programs/planning/hazmitplansection3.cfm](http://www.semo.state.ny.us/programs/planning/hazmitplansection3.cfm)

Additional HAZUS studies were run which factored in the different classifications in soils. The following maps depict the annualized earthquake losses by county, factoring in soil classifications from the NEHRP (National Earthquake Hazard Reduction Program).

Figure 5-5 shows the annualized earthquake loss for New York State to be \$24,234,822, and the annualized earthquake loss for Westchester County to be \$1,498,958. Figure 5-6 shows the Per

Capita Annual Earthquake Loss for Westchester County to be estimated at \$1.01 - \$2.00. Figure 5-7 shows the Annualized earthquake loss per square mile to be estimated at \$500.01 - \$10,000

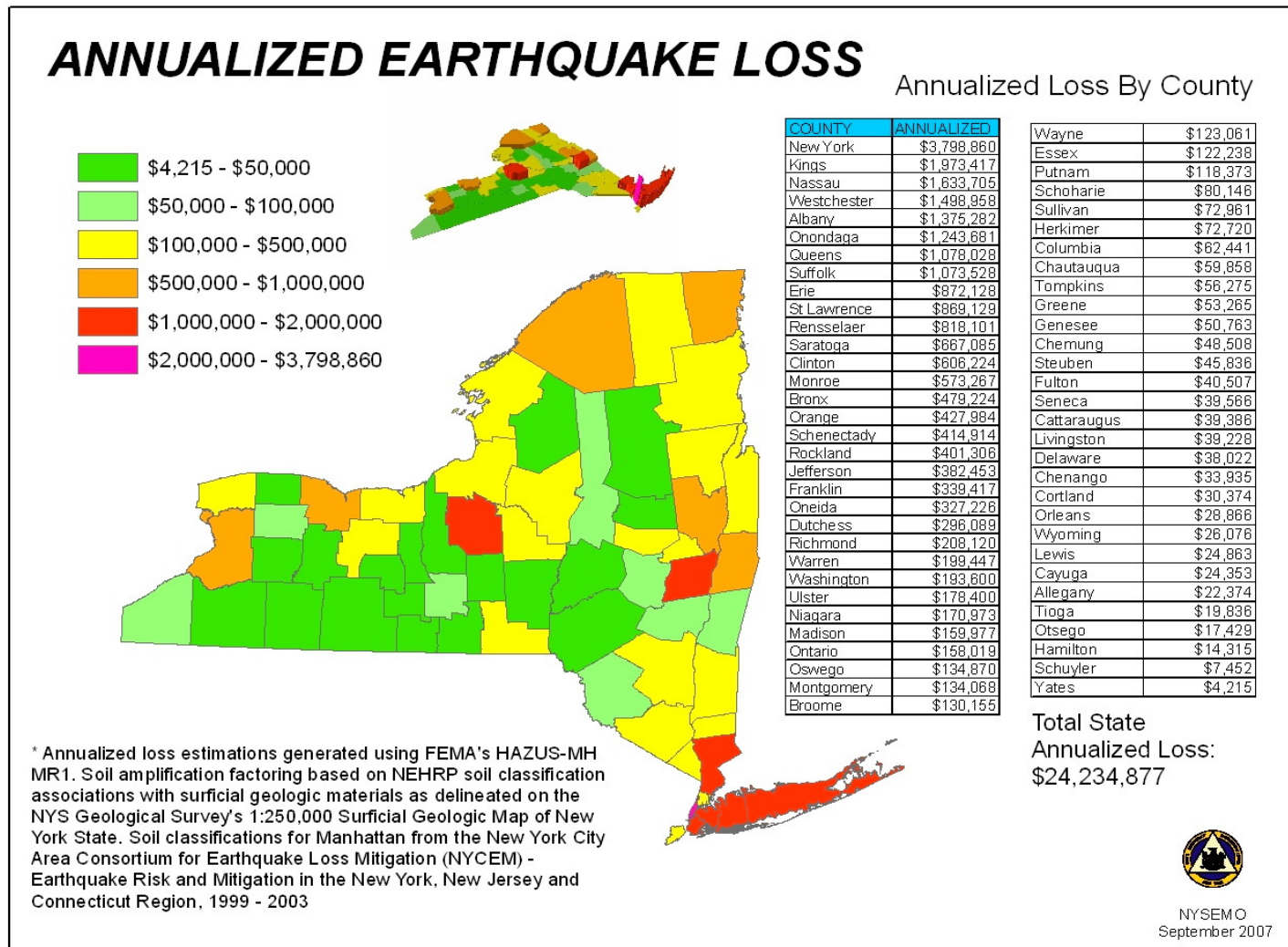
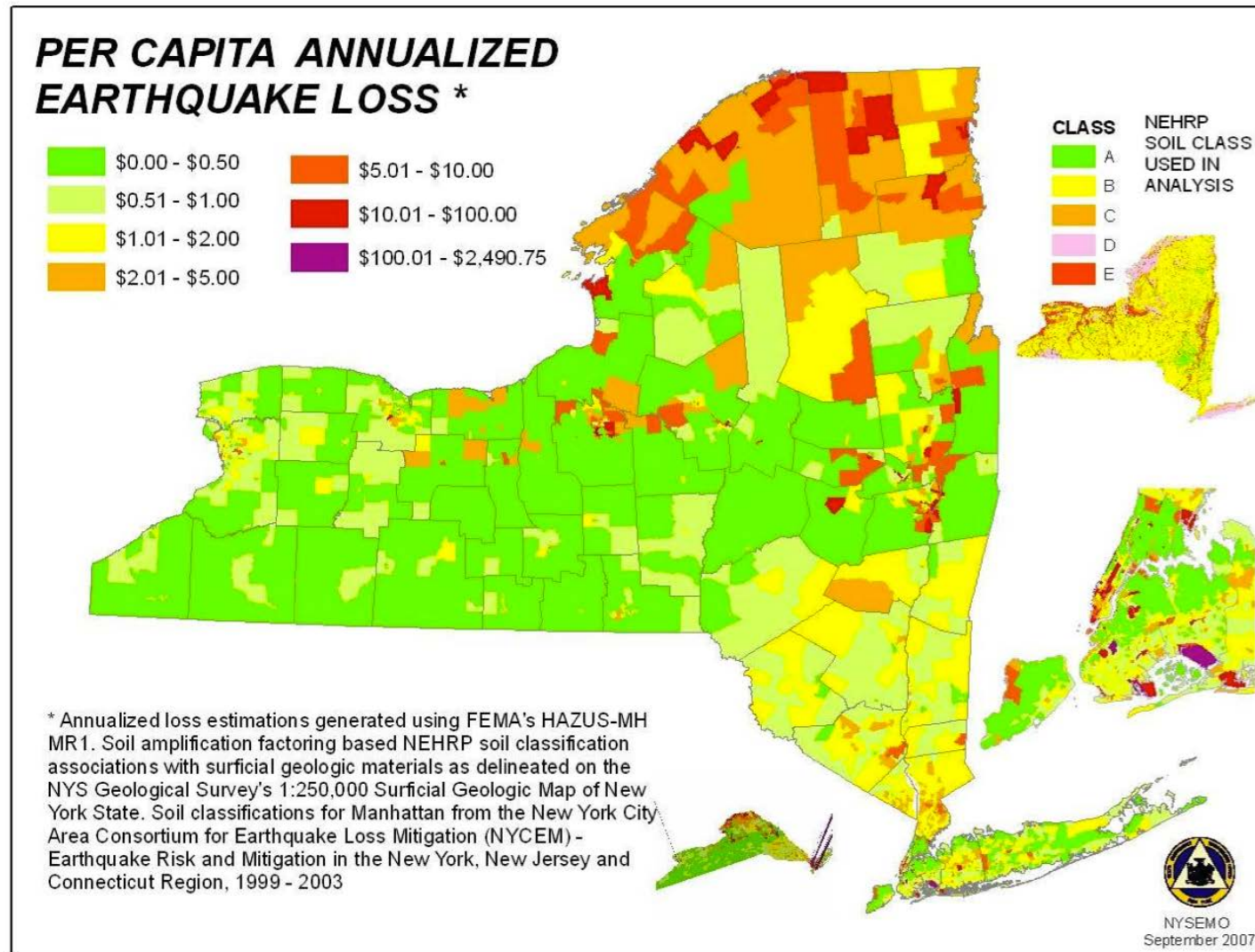
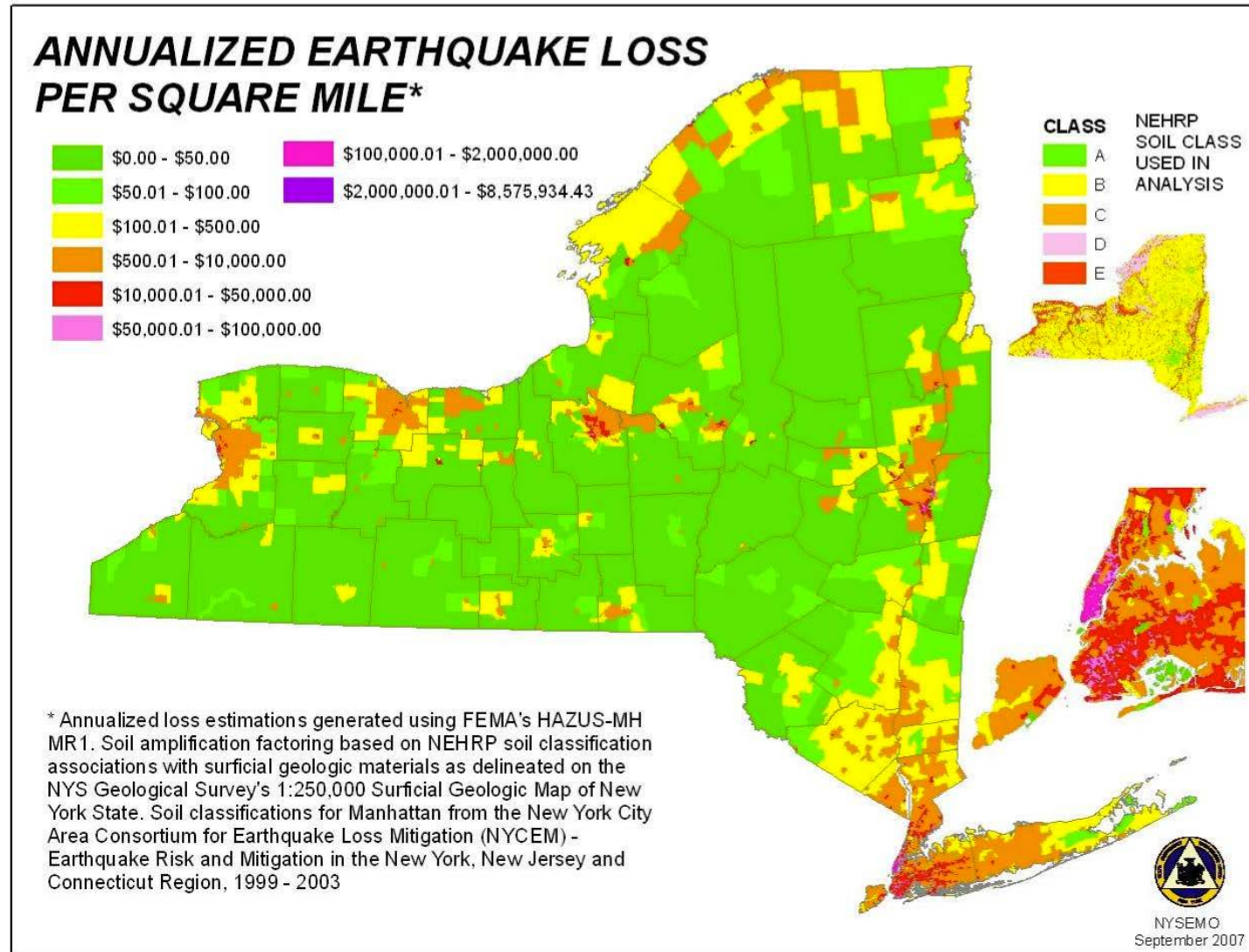


Figure 5-5. Annualized Earthquake Loss



**Figure 5-6. Per Capita Annualized Earthquake Loss.**



**Figure 5-7. Annualized Earthquake Loss**



## **5.E Valuation Assessment of Other Hazards**

The damage to structures for the other hazards was not quantitatively evaluated. Damage was judged to be small for these hazards compared to flooding and wind damage. Also, these hazards were judged to be rare, improbable or not significant to the Village of Mamaroneck. Further data needs to be collected on these hazards to review and evaluate probable extent of impacts if they are judged to be significant. This additional information would be used to develop future mitigation strategies if needed.

The following hazards were discussed above in Section 5.C and are not expected to have a major impact on properties, people, critical facilities or other key facilities in The Village of Mamaroneck. These include:

- Air Contamination
- Civil Unrest
- Extreme Temperatures
- Explosion
- Fire
- Epidemics
- Hazardous Material Release
- Oil Spills

## **5.F Natural and Beneficial Functions**

Wind, water, ice and snow are part of natural storm events affecting the Village. They are significant events and affect the near-shore shifting of channels, shoreline erosion and redistribution and shifting of beaches. There are a number of areas for natural habitats, wetlands and marsh plants and grasses along the Long Island Sound, Sheldrake River, the Mamaroneck River, Otter Creek, Guion Creek, and Beaver Swamp. These are areas that are affected by natural storm events, and other hazards such as coastal and riverine erosion and flooding, and

would impact the village. The village's terrain is low-lying and slopes downward toward the east and the Long Island Sound.

## **5.G Land Use Development, Redevelopment and Population Trends**

The current population in the Village of Mamaroneck is around 18,930 according to the 2010 US Census. It is seen as a mature suburban community with an established land use pattern. The population has increased by .9% over the last 10 years, yet changes are planned for the Village. Proposed changes to the Zoning Codes are presently under consideration and review by the Village of Mamaroneck. One focus is for the Village to provide additional affordable housing to the community. New residential developments and accessory buildings are currently in the planning stages. The Village of Mamaroneck is also in the process of improving the downtown area, easing congestion in the industrial area

## **5.H Summary of the Impacts on the Community**

Of all of the probable hazards that are likely to cause damage to the Village of Mamaroneck, the ones that cause flooding and high winds are most significant. These hazards include hurricanes, nor'easters, coastal storms, severe thunderstorms and winter storms. These are the events that have the potential to impact the entire community to the highest possible degree.

Sections of the Village of Mamaroneck have limited access to natural escape routes, especially in the coastal neighborhoods of Orienta and Shore Acres. Other neighborhoods, such as Columbus Park, Washingtonville, Harbor Heights, the Industrial area, and the Northern section of the central business district, suffer from riverine flooding, which can be just as devastating. This causes a high risk with regard to citizens' safety.

The next major flooding hazard in terms of probable consequences and costliness is the flooding from an inadequate storm drainage infrastructure. The road, street and basement flooding resulting from these problems are costly.

Flooding damages can be substantial but they do not have the same damaging impact as high wind events due to hurricanes. All of the other hazards listed in Section 5.E and discussed in

Section 5.B have been addressed in this plan and are of concern. They have the potential for serious impact. However, none of these hazards, under the most probable circumstances would cause the same level of damage or would result in the loss of life to the same degree as floods and wind damage.

All of these other hazards are likely to impact the community to some degree and should be addressed. However, the issues deriving from wind and water hazards should be addressed as the first priority. With primarily the issues connected with wind and water hazards, there are many safety and economic benefits that would result from planning mitigation activities that focus on these issues. These are discussed in Section 7 of this plan.