Section 4 Assessing the Hazard

4.A Introduction and Background

The Incorporated Village of Mamaroneck is a community located in south eastern Westchester County with a population of about 18,930 people recorded in the 2010 U.S. Census. The area is bounded on the north by the City of Rye and the Town/Village of Harrison, NY, to the west and south by the Township of Mamaroneck and to the East by Long Island Sound. (See Figures 0-2 and 1-1.) For additional background information see the Preface and Summary Statement at the beginning of this Plan. The topography of the Village slopes toward the Long Island Sound. (See Figure 4-1.)

The Village is subject to a variety of events that may lead to damage from water, wind and man-made hazards. From the perspective of FEMA's Community Rating System (CRS) objectives discussed in the Preface, this water-related hazard is a major concern to the Village. In addition to water-related events, there are severe wind storms, other natural events and man-made hazards to which the community is potentially exposed. This all-hazard mitigation plan evaluates flooding events, storm hazards, other natural hazards and several human-caused hazards as required under the Disaster Mitigation Act 2000 and FEMA 44 CFR Parts 201 and 206, 2002.

Process

The hazard identification and assessment process included four steps:

1. Identify all potential hazards based on the input from the hazard mitigation committee and the public, a review of documents and website searches. A list of potential hazards was developed.
2. Profiles of the hazards of concern were prepared and primary hazards of concern were evaluated for potential risk assessment. Each hazard was then summarized, evaluated and characterized in a hazard profile. (See Section 4D.)
3. Assets were then identified and inventoried for impacts of concern. (See Section 5)
4. Potential losses were estimated and the hazards were evaluated for human health and safety risks and for property damage and losses. (See Section 5.)

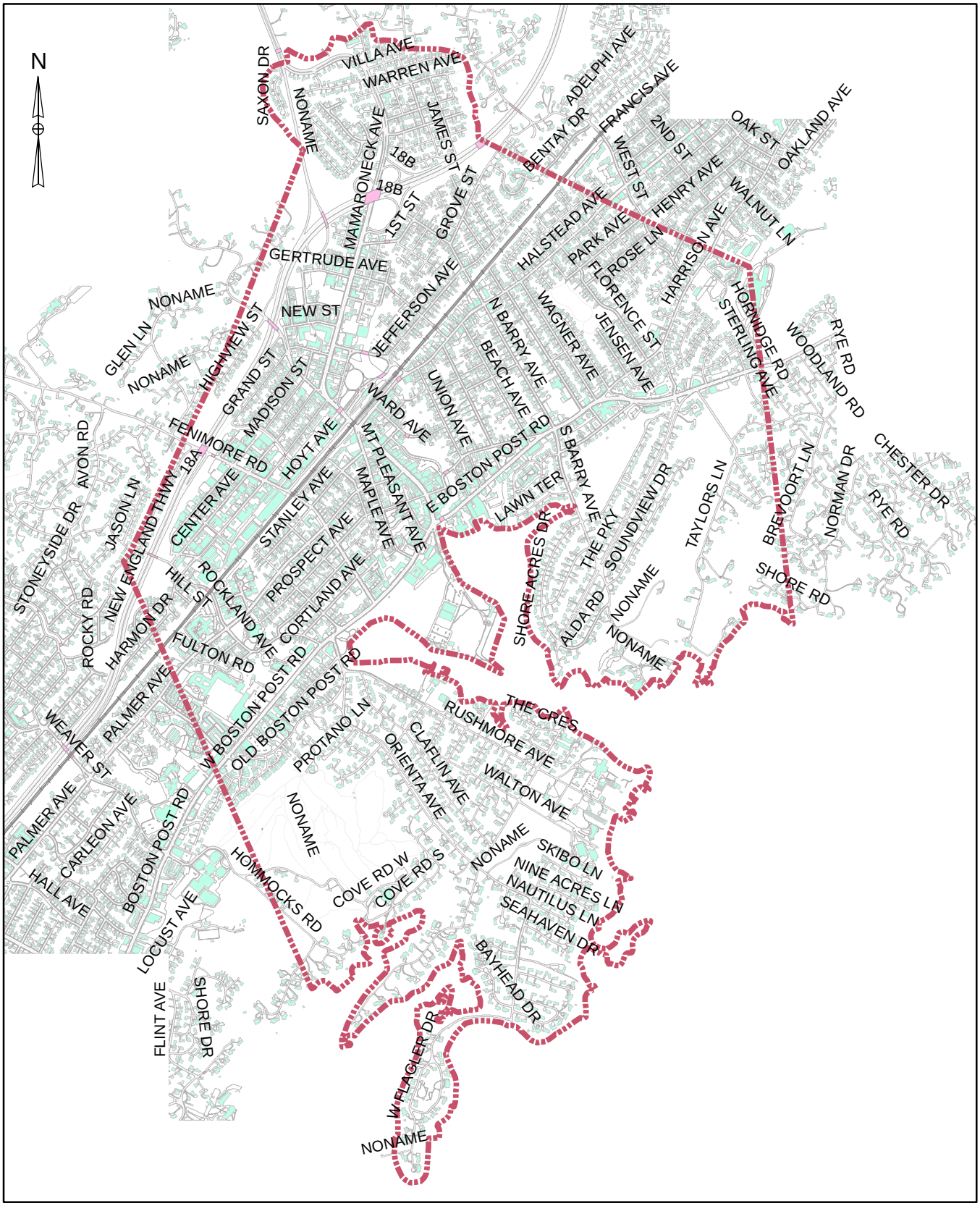

Figure 1-1
Village of Mamaroneck Boundary

Legend

Municipal Boundaries

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

Incorporated Village of Mamaroneck
Multi-Hazard Mitigation Plan

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

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

Basemap information by Westchester County GIS

A list of potential hazards was prepared and reviewed. Those that were not applicable, prevalent or would not cause significant damage or personal harm were screened out and not evaluated further. (See Tables 4-1b, 4-2, 4-3 and Section 4.E Elimination of Hazards.) The list of potential hazards was then evaluated and rated using New York State's HAZNY program (See Section 4.C below). The HAZNY process helps to evaluate the relative degree of hazard posed by each prevalent hazard or significant risk. The New York State Office of Emergency Management (NYS OEM) recommends that the HAZNY analysis program be used to review and assess the hazards. The American Red Cross together with NYS OEM developed this program. It is an interactive program where members of the Planning Committee and the consultants provided input to the process.

Background information, frequency of occurrence, impacts, severity, extent, location and other data were then summarized for each hazard profile. (See Section 4.D below).

Sources of Information:

In addition to the plans, studies and reports noted in Section 3C, several sources of information were used to identify and characterize the hazards of concern. For additional sources and detailed citations see Section 11, References Cited. These sources include:

Letters from residents
Public meeting with residents
Village of Mamaroneck Officials
Local newspaper articles
Village of Mamaroneck Website http://www.village.mamaroneck.ny.us/Pages/index
Documents, plans and Engineering reports supplied by the Village
Several NOAA websites http://noaa.gov/
National Climate Data Center (2006), www.ncdc.noaa.gov
National Weather Service (2007), Hurricane Page, www.nhc.noaa.gov
FEMA website www.fema.gov/
Westchester County Flood Insurance Study (2007)
USGS website http://earthquake.usgs.gov/
Seismic Zoning Maps for NYS Seismic Bldg Code
Lamont-Doherty Earth Observatory, Columbia University Website
Consolidated Edison website, press releases, and studies, www.coned.com/
Westchester County GIS website http://giswww.westchestergov.com/westchester/emap/wc
EPA Enviromapper website http://www.epa.gov/emefdata/em4ef.home

4.B Hazard Identification

The hazards screened include those given in FEMA 386-2 guidance, FEMA (2003b) examples and Disaster Mitigation Act 2000 guidance (FEMA, 2000), HAZNY guidance and input from the Village Planning Committee. The Hazard Mitigation Planning Committee with the aid of the consultant screened all potential hazards listed and the committee concluded that these hazards are possible in the Village of Mamaroneck and surrounding area. Historic FEMA disaster declarations for New York State are listed below in Table 4-1a. Tables 4-1b and 4-2 summarize the hazards evaluated and the results of their initial screening.

Those hazards in the region that were judged to be prevalent, pose a significant human safety risk or have a potential to cause significant damage were selected for further analysis. This assessment was based on available documents, information from databases, and websites. (See sources above and Section 11 References Cited.) The sources used to determine the probability of future events for each natural hazard are given in Table 4-1c. Knowledge and experience of local officials and the Planning Committee aided the analyses and assessments made by the consultant. The consultant guided the Committee through the hazard assessment process during June and July 2011.

The hazards evaluated include

- natural hazards (floods, hurricanes, other severe storms, winter snow and ice storms and other natural non-storm hazards),
- technological hazards (environmental releases, fires, explosions and utility failures) and
- human-caused hazards (such as civil unrest and terrorism).

These hazards are individually profiled below in Section 4.D. The prevalent hazards and other hazards judged to be important were then evaluated using the HAZNY hazard ranking system discussed in Step 4.C below.

Table 4-1a. Major Historical Disaster Declarations for New York State.

Year	Date	Disaster Types	Active	Disaster Number
2011	09/13	Remnants of Tropical Storm Lee	Yes	4031
2011	08/31	Hurricane Irene	Yes	4020
2011	06/10	Severe Storms, Flooding, Tornadoes, Straight-line winds	Yes	1993
2011	02/18	Severe Winter Storm and Snowstorm	No	1957
2010	10/14	Severe Storms, Tornadoes, Straight-line winds	No	1943
2010	04/16	Severe Storms and Flooding	No	1899
2009	12/31	Severe Storms and Flooding, Tropical Depression Ida and Nor'easter	No	1869
2009	09/01	Severe Storms and Flooding	No	1857
2009	03/04	Severe Winter Storm	No	1827
2007	08/31	Severe Storms, Flooding, and Tornado	No	1724
2007	07/02	Severe Storms and Flooding	No	1710
2007	04/24	Severe Storms and Inland and Coastal Flooding	No	1692
2006	12/12	Severe Storms and Flooding	No	1670
2006	10/24	Severe Storms and Flooding	No	1665
2006	07/01	Severe Storms and Flooding	No	1650
2005	04/19	Severe Storms and Flooding	No	1589
2004	10/01	Tropical Depression Ivan	No	1565
2004	10/01	Severe Storms and Flooding	No	1564
2004	08/03	Severe Storms and Flooding	No	1534
2003	08/29	Severe Storms, Tornadoes and Flooding	No	1486
2003	05/12	Ice Storm	No	1467
2002	05/16	Earthquake	No	1415
2002	03/01	Snowstorm	No	1404
2001	09/11	Terrorist Attack	No	1391
2000	07/21	Severe Storms	No	1335
1999	09/19	Hurricane Floyd	No	1296
1998	09/11	Severe Storms	No	1244
1998	07/07	Severe Storms and Flooding	No	1233
1998	06/16	Severe Thunderstorms and Tornadoes	No	1222
1998	01/10	Severe Winter Storms	No	1196
1996	12/09	Severe Storms/Flooding	No	1148
1996	11/19	Severe Storms/Flooding	No	1146
1996	01/24	Severe Storms/Flooding	No	1095
1996	01/12	Blizzard	No	1083
1993	04/02	World Trade Center Explosion	No	984

Table 4-1a. Major Historical Disaster Declarations for New York State (Contd.).

Year	Date	Disaster Types	Active	Disaster Number
1992	12/21	Coastal Storm, High Tides, Heavy Rain, Flooding	No	974
1991	09/16	Hurricane Bob	No	918
1991	03/21	Severe Storm, Winter Storm	No	898
1987	05/15	Flooding	No	792
1985	10/18	Hurricane Gloria	No	750
1985	03/22	Snow Melt, Ice Jams	No	734
1985	03/20	Flooding	No	733
1984	09/25	Severe Storms, Flooding	No	725
1984	04/17	Coastal Storms, Flooding	No	702
1977	02/05	Snowstorms	No	527
1976	09/03	Hurricane Belle	No	520
1976	07/21	Severe Storms, Flooding	No	515
1976	06/29	Flash Flooding	No	512
1976	03/19	Ice Storm, Severe Storms, Flooding	No	494
1975	10/02	Severe Storms, Heavy Rain, Landslides, Flooding	No	487
1974	07/23	Severe Storms, Flooding	No	447
1973	07/20	Severe Storms, Flooding	No	401
1973	03/21	High Winds, Wave Action, Flooding	No	367
1972	06/23	Tropical Storm Agnes	No	338
1971	09/13	Severe Storms, Flooding	No	311
1970	07/22	Heavy Rains, Flooding	No	290
1969	08/26	Heavy Rains, Flooding	No	275
1967	10/30	Severe Storms, Flooding	No	233
1965	08/18	Water Shortage	No	204
1963	08/23	Heavy Rains, Flooding	No	158
1962	03/16	Severe Storm, High Tides, Flooding	No	129
1956	03/29	Flood	No	52
1955	08/22	Hurricane, Floods	No	45
1954	10/07	Hurricanes	No	26

Source: www.FEMA.gov

Table 4-1b. Initial Screening of Potential Hazards.

Potential Hazards	**Possible Hazards**	**Prevalent Hazards***	**Potential Hazards**	**Possible Hazards**	**Prevalent Hazards***
Natural Hazards			Extreme Temperature	X	
Flood	X	X	Land Subsidence		
Severe Storm Hazards			Land (Rock) Slide	X	
Hailstorm	X		Mudflow		
Hurricane	X	X	Tsunami		
Coastal Storm	X	X	Volcano		
Thunder Storm	X	X	Wildfire		
Tornado	X				
Windstorm	X	X	**Technological Hazards**		
Winter Storm Hazards			Air Contamination	X	
Avalanche			Building Fire	X	
Ice Jam	X		Transportation Hazardous Material Spills	X	
Ice Storm	X	X	Oil Spill	X	
Severe Snow Storm	X	X	Hazardous Materials Releases (Fixed Site	X	
Other Natural Hazards			Explosion		
Erosion			Radioactive Release	X	
Dam Failure	X		Utility Failure	X	X
Drought	X		Water Supply Failure	X	
Earthquake	X		**Human-Caused Hazards**		
Epidemic	X		Civil Unrest	X	
Expansive Soils			Terrorism	X	

* A frequent or regular event. May occur more than once in 7 years to several times a year.

Table 4-1c. Sources Used to Determine Probability of Future Events for Natural Hazards.

Hurricane & Storm Hazards	Historical weather data NOAA/National Climatic Data Center US Landfall Hurricane Probability Project, Colorado State University National Weather Service
Flood Hazards	Historical flood data Village Flood Insurance Study Engineering Reports supplied by the Village FEMA Flood Mapping Village FIRM
Earthquake	FEMA NYS OEM USGS NYCEM Lamont-Doherty Cooperative Seismographic Network of Columbia University
Winter Storms	Historical weather data NOAA/NCDC National Weather Service
Tornado and Wind Hazards	Historical data NOAA/NCDC Tornado Project Website SEMO wind zones
Extreme Temperature & Drought	Historical Data NOAA/NCDC National Weather Service
Epidemic	Historical data Center for Disease Control Westchester County Health Department

Table 4-2. Summary of Significant Safety Risks and Damage Potential.

Possible Hazards	Health and Safety Risks	Potential for Damage
Natural Hazards		
Flood	X	X
Severe Storm Hazards		
Hailstorm		X
Hurricane	X	X
Coastal Storm	X	X
Thunder Storm	X	X
Tornado	X	X
Windstorm	X	X
Winter Storm Hazards		
Ice Storm	X	X
Severe Snow Storm	X	X
Other Natural Hazards		
Drought		
Earthquake		X
Epidemic	X	
Extreme Temperature	X	
Technological Hazards		
Air Contamination	X	
Explosion	X	X
Fire	X	X
Fuel Oil Spill		
Hazardous Material Spills (Transport)	X	X
Hazardous Material Spills (Fixed)	X	X
Radioactive Release (Fixed Site)	X	
Water Supply Failure	X	
Utility Failure	X	
Human-Caused Hazards		
Civil Unrest	X	X
Terrorism	X	X

Of the 35 listed hazards, 26 were considered as possible for the region and only 8 were considered to be prevalent hazards to the community. A significant health and safety risk was associated with 20 possible hazards and 16 hazards were linked to significant damages to property, buildings and other structures.

Preliminary Hazard Elimination

Based on the above screening, several Hazards were eliminated from further consideration and include:

Avalanches: There are no mountains in or near the village that could produce avalanches.

Erosion of soils: There are no significant areas subject to severe erosion.

Land Subsidence: There are no significant areas subject to subsidence.

Expansive soil hazards: There are no expansive soils hazards in the area.

Land (Rock) Slide: There are no significant areas subject to landslides.

Tsunamis: Do not occur in this region of the country

Volcanoes: Do not occur in this region of the country.

4.C Hazard Ranking by The HAZNY System

Identification and ranking of all hazards that affect the Village of Mamaroneck is a primary system assessing significant hazards (See Section 4.B above). The Hazards New York (HAZNY) method further identifies and ranks hazards based on a rigorous method, which combines input from the community with the experience of emergency services professionals. The Hazard Mitigation Committee was guided through the HAZNY process to resolved questions concerning the risk level and priority of consideration for several of the risk factors.

This section discusses the process for selecting and ranking the hazards based on the HAZNY process. The results of these analyses are shown in Table 4-3 and are discussed below. The analysis was done under the guidelines of the HAZNY program, which is a New York State organized process for identifying and prioritizing the risks of hazards that might be experienced in Mamaroneck. The formation of the list, and the determination of their relative values, is based in part on the actual experience of the Committee members. Additional details are given in the appendix.

4.C.1 HAZNY Process

The HAZNY process involves a logical ordering by priority, and perception of the hazards that affect a community like Mamaroneck. It analyzes and ranks hazards on the basis of five factors which include:

- Scope covers the aerial extent of the impact and the likelihood that the event itself would trigger another hazard (i.e. Cascade Effect).
- Frequency of the event.

- Impact from the standpoint of the likelihood of injury or death, and damage to private property and public facilities.
- Onset, or how much warning time will be received.
- Duration, or the length of the event and its recovery time.

The detailed summary of Ground Rules is found in the NYS OEM Ground Rules for HAZNY, which is found in attachments in the Appendix of this Plan. We have ranked FEMA-recognized "generic" hazards including hazards that have been identified in the Village of Mamaroneck from the standpoint of likelihood of occurrence and prevalence. Using the HAZNY Ground Rules the committee scored the major risk factors for the group of Mamaroneck hazards that are possible and prevalent. These factors can be used to examine and quantify other risk factors that may be identified in the future.

Some potential hazards such as avalanches, mudflows, and volcanoes were excluded since they were considered of low probability and judged insignificant for further evaluation. (See Table 4-2.) Several hazards such as civil unrest, epidemics, drought and ice jams were considered to be not prevalent but were included in the HAZNY analysis because they were considered to have potentially significant impacts, although uncommon. The results of the HAZNY analysis are given in Table 4-3.

Table 4-3. Summary of Hazards Scores Based on HAZNY Analysis.

High Hazards	HAZNY Score Village of Mamaroneck
None	**321-400**
Moderately High Hazard	**241-320**
Flood	302
Coastal Storm*	253
Severe Storm & Thunderstorm**	246
Moderately Low Hazard	**161-240**
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
Low Hazard	**44-160**
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

4.C.2 Hazard Ratings

The HAZNY rating scores were used to further screen hazards. The information from the HAZNY analysis contributed to the preparation of the Hazard Profiles in Section 4.D. The Committee concurred in general with the selection of the moderately high and moderately low hazards in Table 4-3. The detailed results of scoring for each hazard are given in the Appendix.

The most significant hazard in Table 4-5 is flooding. (See Section 4.D below.) The storm of greatest concern for this area is the coastal storm which includes several types of storms as well as hurricanes which by itself was rated as a moderately low hazard. This may reflect the fact that few high category hurricanes hit Mamaroneck. By the time a hurricane makes land fall it is often relegated to a tropical storm. Floods were considered the most severe hazard which is caused by several types of storms such as coastal storms and thunder storms which were rated as number two and three in the HAZNY analysis. Coastal storms scored 253 and were rated the 2nd highest hazard (Table 4-3). Although not as severe as hurricanes, these storms cause severe flooding and wind damage. Such storms often last longer and flood more often than hurricanes. Frequent local flooding is the major community concern expressed in public meetings.

Both localized and regional utility power failures are a concern which can be the result of cascade effects from other hazards discussed in Section 4.D below. Utility failures can also impact critical facilities, rail transportation systems as well as residences, industrial and commercial facilities. Dam failure with a score of 224 was rate as a moderately low hazard in the Table 4-5.

Winter storms ranked 5th had a score 230. These storms include blizzards that can damage buildings, power lines, critical facilities and transportation systems. Although damage can be significant for ice storms, they are less frequent than winter snowstorms and ranked 11 in importance.

4.C.3 Hazard Rating Criteria

A summary of the hazard rating criteria based on the HAZNY process is attached in the Appendix. We have ranked FEMA-recognized “generic” hazards including hazards that have been identified in Mamaroneck from the standpoint of likelihood of occurrence and prevalence.

Using the HAZNY Ground Rules we scored the major risk factors for the group of Mamaroneck hazards that are possible and prevalent. These factors can be used to examine and quantify other risk factors that may be identified in the future.

The HAZNY criteria also provide a basis to specify the relative scope or location of the hazard. For example: if the hazard occurs at a single location, several individual locations, throughout a small region or throughout a large region the score will reflect this scope. Of the prevalent hazards like coastal storms and floods, information on the location/size of the hazard is provided.

The HAZNY scores also incorporate the probability or likelihood of future occurrences. This is one of the specific quantified elements of input in the HAZNY process. The probability or likelihood of future occurrence has been specified for each of the hazards included in this analysis.

The extent or magnitude of each hazard can be expressed and quantified. Such factors as the extent of the area affected, the likelihood of a cascade effect, the frequency of the event and the impact of the hazard on the health and safety of people, the impacts on property and the impacts on infrastructure are all covered in this analysis.

4.D Hazard Profiles

We have assembled a comprehensive summary of past hazard events, which provides accounts that describe the potential impact of these events on the Village of Mamaroneck. These data together with firsthand accounts by members of the committee, historical meteorological reports of hurricanes, nor'easters and other storms completes the picture that the Village of Mamaroneck Planning Committee and the consultants will use as an important tool of the planning process.

Detailed hazard profiles are presented below for the three moderately high hazards and for seven moderately low natural hazards listed in Table 4-3 above. The hazard ratings were based on the New York State HAZNY analysis discussed in Section 4.D above. These hazards were considered to have a higher magnitude or severity of impact to the Village and include:

- Floods (Section 4.D.1)
- Coastal Storms (Section 4.D.3.2)
- Severe Storm and Thunderstorms (Section 4.D.3.3)
- Hurricanes (Section 4.D.2)
- Fire (Section 4.D.6.7)
- Severe Winter Storms (Section 4.D.4.1)
- Wind Storms (Section 4.D.3.5)
- Transportation Accidents (Section 4.D.6.6)
- Dam Failure (Section 4.D.5.1)
- Utility Failures (Section 4.D.6)

Other hazards considered less severe or low magnitude are describe in less detail but may be reevaluated in later updates to this Plan. These hazard profiles include summarize information and details on the following hazard features:

- Overall summary
- Definition
- Location
- Extent (magnitude/severity0
- Previous instances
- Future events
- Impact

4.D.1 Floods

Hazard Summary: A flood is a general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation of runoff or surface waters from any source or (3) from intense and severe rainfall. Flooding is a frequent occurrence in the Village of Mamaroneck at several locations shown on Figures 4-2, 4-3 and 5-2. Floods may cover large areas of several streets, the river flood plains around the Mamaroneck River and Sheldrake River, and shore line of the harbor. Floods of several feet deep occur regularly following rain events. A major flood occurred on April 15, 2007. (See Figures 4-4 and 4-5.) The most recent major flood was caused by Tropical Storm Irene August 28, 2011 followed by remnants of Tropical Storm Lee on September 4, 2011. Future flooding problems are expected to continue unless mitigation actions are implemented. A future 100-Year flood is a likely event for the areas identified. Floods are

costly from the damage they cause. Numerous homes and families have been impacted with flooded basements and impassible streets and highways. Details of the flood hazards in the Village are given below.

Sources of information on floods are included in Section 11, References Cited: Public meeting with residents; Local paper articles; The Loop, The Daily Mamaroneck, Larchmont-Mamaroneck Patch, Sound and Town, The Journal News, NY Times; Documents and Engineering reports supplied by the Village, NOAA websites, FEMA website, Westchester County Flood Insurance Study; Village of Mamaroneck Local Waterfront Revitalization Plan.

Profile Details: Flooding is a serious problem for the Village of Mamaroneck and ranked 1st with a HAZNY score of 302. It is a low lying shoreline community that is criss-crossed by a number of rivers and streams, thus making it susceptible to flooding from a variety of sources. Floods in the Village have been caused by hurricanes, coastal storms, windstorms, thunderstorms and melting snow and ice. Notable events that caused major damage were from Tropical Storms Floyd and Ernesto, the Nor'Easter of 2007, and most recently, Tropical Storm Irene in August 2011. Based on the past frequency of flooding, the probability of future floods is very high. The Mamaroneck and Sheldrake rivers flow through the Village. The neighborhoods of Orienta, Shore Acres, and Washingtonville (The Flats), and the industrial section lie directly within the 100 year floodplain and coastal flood zones. Even larger area is in the 500 year floodplain. Critical flooding occurs in these areas (See Figure 4-2). The Village lies at the bottom of the Mamaroneck River, the Sheldrake River, and Beaver Swamp Brook, thus these areas are often subject to flooding. These areas are also at high risk for personal safety, personal property damage, and severe damage to infrastructures such as utilities, storm and sanitary sewer lines and roads.

Floods are costly and cause extensive damage. According to FEMA, approximately $16,227,400.28 was paid out in insurance claims for flood damage in the Village of Mamaroneck between January 1, 1978 and May 31, 2011. However, these flood insurance claims are likely underreported and actual flood damages are probably higher. This amount only covers 1197 losses, and only covers insured damages. (http://bsa.nfipstat.com/reports/1040.htm#36)

4.D.1.1 Flood Extent

The Flood Insurance Rate Map (FIRM) indicating flood zones effective September 28, 2007 (National Flood Insurance Program) for the Village of Mamaroneck is shown in Figure 4-2. This map illustrates the hazard areas related to flooding in the Village. This map shows the floodplain area that would be inundated by the 100-Year flood or Base Flood. Also shown are the areas that would be impacted by the 500-Year flood. Areas impacted by surges caused by hurricanes of categories 1, 2, 3 and 4 are shown on Figure 4-3. This map illustrates the inundation or SLOSH zones that would result under the various hurricane categories.

According to the FIRM, the most critical areas for flooding in the Village of Mamaroneck are along the neighborhoods of neighborhoods of Orienta, Shore Acres, Washingtonville (The Flats), and the industrial section. Flooding from hurricanes (Figure 4-3) is discussed in Section 4.D.2 below. The topography in these flood risk areas is relatively flat, with poor drainage and high chance for flooding (Figures 4-1 and 4-3).

4.D.1.2 Impact on Storm Sewer Backups

There have been many reports of storm drain and sanitary sewer manhole overflows. These backups have been a particular problem along First Street in the Village of Mamaroneck.

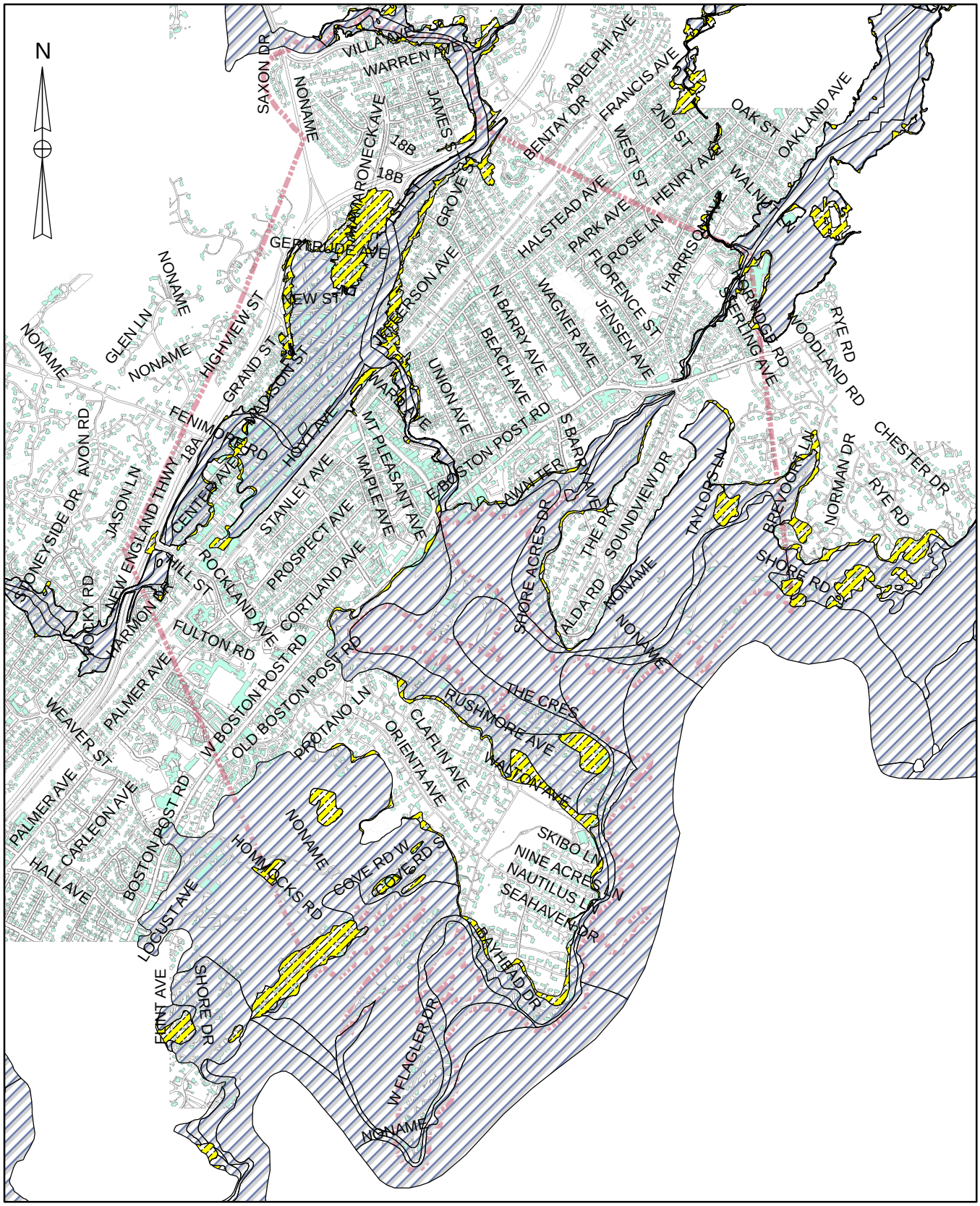

Figure 4-2
100 and 500-Year Floodplain

Incorporated Village of Mamaroneck
Multi-Hazard Mitigation Plan

Legend

FEMA Flood Mapping

100 Year Flood Line

500 Year Flood Line

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

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

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

Basemap information by Westchester County GIS

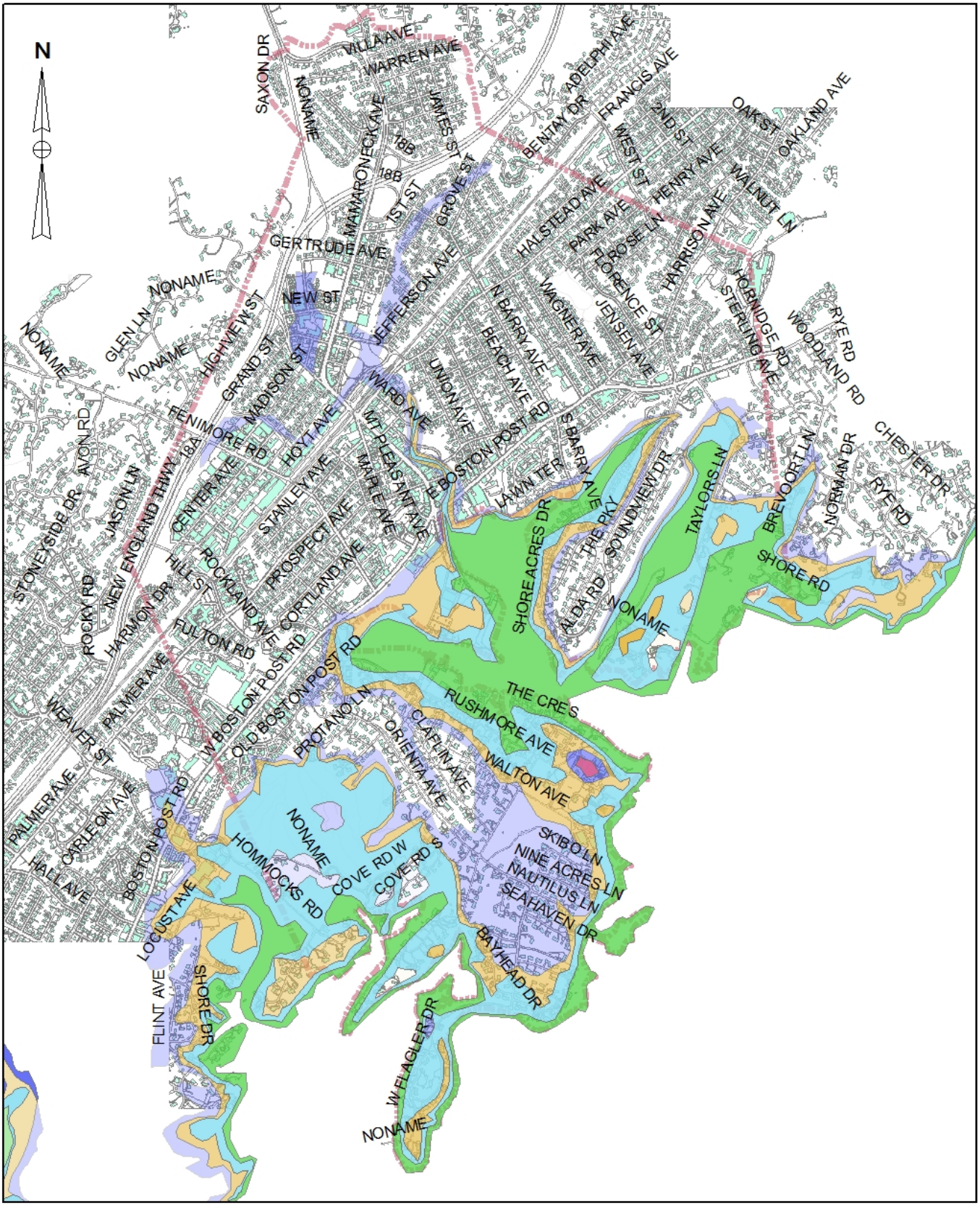

Figure 4-3
Hurricane Inundation Zones

Incorporated Village of Mamaroneck
Multi-Hazard Mitigation Plan

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Legend

Hurricane Inundation Zones
- 0
- 1
- 2
- 3
- 4

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

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

Basemap information by Westchester County GIS

4.D.1.3 Frequent Local Flooding

Areas that have experienced the most damage from flooding (See Figures 4-2, 4-3, and 5-2) occur in:

- 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 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
  - Fayette Avenue
  - Fenimore Road
  - Grand Street
  - Waverly Avenue
  - Plaza Avenue
  - East Plaza Avenue (Paper Street)
- Along the lower section of the Mamaroneck River
  - Ward Avenue
  - Spencer Place
  - Valley Place

  - North Barry Extension
  - First Street
  - Second Street
- Beaver Swamp Brook
  - Stoneybrook Avenue
- The neighborhoods of Orienta and Shore Acres

Flooding has been a major issue in the Village of Mamaroneck, with documentation dating back to 1942, When the U.S. Department of War, New York District Engineer's Office began a Flood Control Study.

In 1945, the Westchester County Harding Report studied alternate approaches on the Mamaroneck and Sheldrake Rivers.

The United States Army Corps of Engineers (USACE) started the Mamaroneck and Sheldrake Rivers' mitigation studies in 1977. In 1987, they created a preliminary design for a flood control project to widen and deepen the Mamaroneck River, and reroute the Sheldrake River under Fenimore Road. This project was not completed due to high costs.

Most recently, in February 2010, a Federal, State, and County agreement was signed which authorizes the USACE to reexamine opportunities to curtail flooding from the Mamaroneck and Sheldrake Rivers drainage basin, thus reducing flood risks to the Village of Mamaroneck. The parties will reevaluate the flood mitigation project that was abandoned. Changes to the rivers' flows will require another study prior to forging ahead with the project. This project is a partnership between USACE, New York State Department of Conservation (NYSDEC), and Westchester County. The first draft of the USACE's report is expected to be completed by August 2013. This is halfway through the five year process.

Figure 4-4. Village of Mamaroneck Street Flooding During The Nor'easter April 15, 2007.

New Street, Village of Mamaroneck. Photo by Sharon Keck, via Larchmont Gazette.

Mamaroneck Avenue School parking lot. Photograph by Sharon Keck via Larchmont Gazette

Figure 4-5. Village of Mamaroneck Street Flooding During Tropical Storm Irene August 29, 2011.

Fenimore Road and Waverly Avenue. Photo by L. Garcia via Larchmont-Mamaroneck Patch

Rising water at entrance of Harbor Island Park. Stemming from the Mamaroneck Reservoir at the northern most point of the village. Photo by Sarah Caldwell via Larchmont-Mamaroneck Patch

4.D.1.4 The Base Flood

The Base Flood is the 100-Year flood. This is not a flood that occurs once in 100 years but is a large flood elevation that has a one-percent chance of being equaled or exceeded in any given year. Therefore, the 100-Year flood could occur more than once in a relatively short period of time. The "100-Year" flood is a measure of the size of the flood, not how often it occurs. The 100-Year flood is the standard used by most federal and state agencies such as the National Flood Insurance Program (NFIP).

The FEMA 100-Year flood line for the Village of Mamaroneck along and affects the neighborhoods of Orienta, Shore Acres, Washingtonville, and the industrial section.
Properties along shorelines are vulnerable to storm damage during severe northeasters and hurricane conditions. Flooding can come with little warning. Even though they appear to move slowly (three feet per second) a flood two feet deep can knock a man off his feet and float a car. Properties that are susceptible border the banks of the Mamaroneck and Sheldrake Rivers, and the Long Island Sound, which are affected by tides and surges.

4.D.1.5 The 500-Year Flood

A 500-Year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any one year. While extensive portions of Mamaroneck – including the neighborhoods of Orienta, Shore Acres, and Washingtonville as well as the industrial area – lie directly within the 100-year floodplain and coastal flood zones, an even larger area is within the 500-year floodplain.

Numerous structures could potentially be impacted. The 500-Year flood is an infrequent event meaning that it can occur between once in eight years to once in fifty years. As with the 100-Year Flood, it does not mean a flood occurs once in 500 years.

4.D.2 Hurricanes

Hazard Summary: Hurricanes are major tropical cyclonic wind and rain storms with winds ranging from 75 to over 155 mph. The last major hurricane to cross Westchester County was the “Great Hurricane of 1938”. Since then, there have been no official hurricanes. Damage is not only from strong wind but also major flooding can occur from storm surges (see Figure 4-3). Hurricanes are among the most threatening and highest ranked natural disasters in the northeast.

The Village of Mamaroneck's close proximity to the coast line gives it greater exposure to the risk of hurricanes. Heavy rainfall would result in flooded areas shown in Figure 4-2. The extent of wind damage from hurricanes varies but this hazard would impact the entire village and the surrounding region. Wind and water damage from hurricanes include: serious flooding of streets and homes; utility failures; damage to buildings, roofs, windows and personal property; interruption of traffic and emergency, fire, police services; automobile accidents; food shortages; sewage impacts and economic loss business loss, loss of employment, downtime, loss of inventory. A major hurricane though infrequent could strike the Village of Mamaroneck.

Sources of information on Hurricanes are given in Section 11, References Cited and include: National Weather Service Hurricane website; US Landfalling Hurricane Project website; NOAA Hurricane Research Division website; NOAA National Climatic Data Center website and event record details; Accuweather website; Local papers: Journal News, NY Times, Daily Mirror. (September 23, 1938, pg. 3 &17)

Profile Details: The flood-producing hurricane has a moderately low risk 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 tropical storms by the time they have reached Westchester County. Based on historical records, the last hurricane to cross Westchester County was the "Great Hurricane of 1938". Since then, there have been no official hurricanes. There have been numerous storms that began as hurricanes, such as Hanna in 2008, Ernesto in 2006, and Floyd in 1999, which were downgraded to tropical storms by the time they reached Westchester County. The most recent hurricane that downgraded to tropical storm by the time it reached Westchester County is Irene, which occurred on August 27, 2011. These tropical storms will be discussed in detail in Section 4.D3.1. Damage is not only from strong wind but also major flooding can occur from storm surges (Figure 4-3). Figure 4-6 shows the paths of the hurricanes listed in Table 4-4 that have been tracked within 50 miles of the Village of Mamaroneck from 1861 to 2008. This map was generated from http://maps.csc.noaa.gov/hurricanes/ on the NOAA (2011) web site.

Hurricanes are among the most threatening and highest ranked natural disasters in the northeast. Expected geographical extent of flooding of the river from a hurricane surge is indicated on

Figure 4-3. Heavy rainfall would result in flooded areas shown in Figure 4-2. The extent of wind damage from hurricanes varies but this hazard would impact the entire village and the surrounding region. Wind and water damage from hurricanes include:

- Serious flooding problems (streets and homes)
- Utility failures (electricity and telephone)
- Natural resource damage (trees, wetlands)
- Property damage (buildings, roofs, windows, personal property)
- Oil spills (floating and damaged underground tanks)
- Boat damage (destruction and capsizing)
- Serious traffic problems (interruption in emergency, fire, police services)
- Beach and shoreline erosion
- Public health and safety (automobile accidents, food shortages, sewage impacts)
- Economic loss (business loss, loss of employment, downtime, loss of inventory)

Hurricanes are rated according to the Saffir-Simpson Hurricane Scale based on the present intensity of the sustained wind speed. The scale ranges from 1 to 5 as follows:

CATEGORY		
Category 1 (Weak)	74 to 95 mph	4-5 feet
Category 2 (Moderate)	96 to 110 mph	6-8 feet
Category 3 (Strong)	111 to 130 mph	9-12 feet
Category 4 (Severe)	131 to 155 mph	13-18 feet
Category 5 (Devastating)	Over 155 mph	Over 18 feet

Because the Village of Mamaroneck is in the northeastern U.S., Category 5 hurricanes are considered unlikely. Although possible, no category 4 hurricanes have directly hit Westchester County. The Village of Mamaroneck is located in Wind Zone 2, with wind speeds ranging up to 160 mph. It is also mapped in the Hurricane Susceptible region, which extends along the east coastline.

The Hurricane of 1938 for example, was one of the most damaging events on record. It was a Category 3 storm, but Mamaroneck did not suffer the brunt of the storm. According to news

archives, Mamaroneck suffered from flooded cellars, downed telephone and telegraph poles, downed trees along back roads, and power outages for only one half hour. (Daily Mirror, Friday September 23, 1938)

Climate models project increased rainfall rates, which can lead to stronger hurricanes and rising sea levels. This topic is discussed in Section 4.D.5.7, The Effect of Climate Change on Natural Hazards.

Summary of Search:

Location: 10543, postal code, Mamaroneck, New York, United States
Buffer: 92600 Meters (50 Nautical Miles)
Search was not refined

Summary of Storms

Category	Count
Category 5 (H5)	2
Category 4 (H4)	1
Category 3 (H3)	5
Category 2 (H2)	1
Category 1 (H1)	9
Trop./Sub. Storm (TS/SS)	7
Trop./Sub. Depression (TD/SD)	0
Extratropical (ET)	1
Unknown (N/A)	0

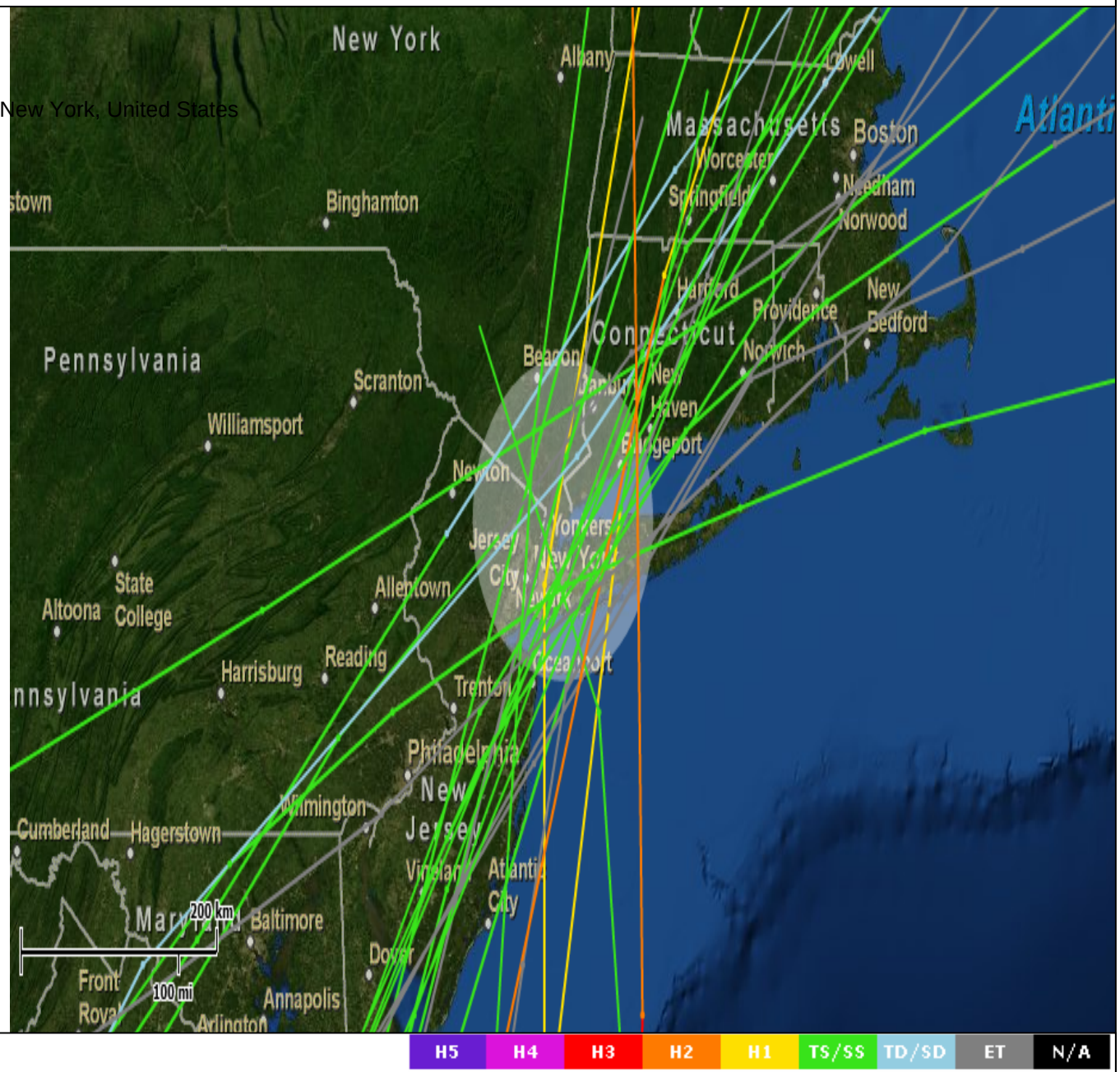


Figure 4-6 Major Regional Hurricane Tracks

Table 4-4. Historical Hurricanes Storm tracks from 1861 - 2008 within 50 Miles of Mamaroneck NY.

Storm Name	Max Saffir-Simpson	Date
NOT NAMED 1861	H1	Sep. 27,1861 to Sep. 28, 1861
NOT NAMED 1863	TS	Sep. 16, 1863 to Sep. 19, 1863
NOT NAMED 1866	H1	Oct. 28, 1866 to Oct. 30, 1866
NOT NAMED 1872	H1	Oct. 22, 1872 to Oct. 28, 1872
NOT NAMED 1874	H1	Sep. 25, 1874 to Oct. 1, 1874
NOT NAMED 1888	H3	Aug. 14, 1888 to Aug. 24, 1888
NOT NAMED 1888	TS	Sep. 6, 1888 to Sep. 13, 1888
NOT NAMED 1893	H3	Aug. 15, 1893 to Aug. 26, 1893
NOT NAMED 1900	TS	Oct. 10, 1900 to Oct. 15, 1900
NOT NAMED 1915	H1	Jul. 31, 1915 to Aug. 5, 1915
NOT NAMED 1924	ET	Sep. 27, 1924 to Oct. 1, 1924
NOT NAMED 1934	H1	Jun. 4, 1934 to Jun. 21, 1934
NOT NAMED 1938	H5	Sep. 10, 1938 to Sep. 22, 1938
ABLE 1952	H2	Aug. 18, 1952 to Sep. 2, 1952
DIANE 1955	H3	Aug. 7, 1955 to Aug. 21, 1955
BRENDA 1960	TS	Jul. 28, 1960 to Aug. 1, 1960
UNNAMED 1961	TS	Sep. 12, 1961 to Sep. 15, 1961
DORIA 1971	TS	Aug. 20, 1971 to Aug. 29, 1971
AGNES 1972	H1	Jun. 14, 1972 to Jun. 23, 1972
BELLE 1976	H3	Aug. 6, 1976 to Aug. 10, 1976
GLORIA 1985	H4	Sep. 16, 1985 to Oct. 2, 1985
CHRIS 1988	TS	Aug. 21, 1988 to Aug. 30, 1988
BERTHA 1996	H3	Jul. 5, 1996 to Jul. 17, 1996
FLOYD 1999	H5	Sep. 7, 1999 to Sep. 19, 1999
GORDON 2000	H1	Sep. 14, 2000 to Sep. 21, 2000
HANNA 2008	H1	Aug. 28, 2008 to Sep. 8, 2008

Source: http://maps.csc.noaa.gov/hurricanes

Note: Hurricane Irene formed on August 20, 2011 and dissipated on August 29, 2011. Its highest rank on the Saffir-Simpson Scale was a Category 3 Hurricane (H3). Irene was downgraded to a Tropical Storm before it reached Westchester County.

4.D.2.1 Notable Northeastern Hurricanes

All of the hurricanes listed below in Table 4-5 struck the northeast portion of the United States. Their total cost, death toll, and relative ranking are based on their overall impact along the Atlantic coast. The 1938 Hurricane (The Long Island Express) was a Category 3 storm when it hit landfall in the Northeast. The Category 4 hurricane such as Donna is a rare event largely because hurricanes generally lose force and intensity as they move into northern areas with colder ocean water.

Table 4-5. Major Northeast Hurricanes and Damage Costs.

National Ranking by Damage	Hurricane Name	Year	Hurricane Category	Total Damage Million Dollars*
9	Agnes	1972	1	11,760
14	Floyd	1999	2	9,225
17	Diane	1955	1	7,408
19	L.I. Express	1938	3	6,325
23	Great Atlantic	1944	3	5,706
26	Carol	1954	3	4,175
29	Donna	1960	4	3,215
30	Bob	1991	2	2,703

***Damage costs for east coast U.S. based on Year 2010 deflator.**

Source: NOAA Technical Memorandum NWS NHC-6. "The Deadliest, Costliest and Most Intense U.S. Tropical Cyclones From 1851-2010 (And Other Frequently Requested Hurricane Facts)". National Weather Service, National Hurricane Center, August 2011. www.nhc.noaa.gov/pdf/nws-nhc-6.pdf

4.D.3 Other Severe Storm Hazards

There are other severe storm hazards that produce damaging winds and flooding. This section discusses warmer season storms. Winter storm hazards are addressed in Section 4.D.4 below. The impact locations and extent of damage and flooding from other severe storms can be similar to hurricanes, and result in 100-Year and 500-Year floods that were discussed above in Section 4.D.1. The geographical extent of wind damage from severe storms may cover large areas and this hazard would likely impact the entire village. The damage to the Village of Mamaroneck from severe storms and coastal storms has been very significant.

Utility failures occur during severe storms such as nor'easters, tropical storms, wind and snowstorms. This is usually due to the breakage of utility poles or power lines causing electrical failures in local areas. This damage may be localized in several areas or impact the entire

village. Con Edison reports that during storm events several hundred thousand customers have been without power for several days. Storm related damage has sometimes required help from other utilities outside our region in order to restore power. Utility failure will be discussed in detail in Section 4.D.6.1. Structural damage for each of these storm hazards has not been quantified but can be assumed to be similar to less severe hurricanes.

4.D.3.1 Tropical Storms

Hazard Summary: Tropical storms are tropical cyclones with sustained winds between 39-73 mph. Hurricanes have sustained winds of 74 and up and are often downgraded to tropical storm status by the time they reach Westchester County. It is an organized rotating weather system that develops in the tropics and which has a warm center (or core) of low barometric pressure. The Village of Mamaroneck has felt the effects of many tropical storms. Because of their less severe wind speeds, wind damage is less that a hurricane. However, rainfall, wind, and storm surge from these storms has caused serious flooding in the Village. Areas flooded are shown in Figure 4-2, 4-4, 4-5 and 5-2. Damages are the same as those described for flooding discussed above. Future flooding from tropical storms can be expected.

Sources of information on tropical storms are given in see Section 11, References Cited and include: Public meeting with residents; Local papers and websites, including: Sound and Town, The Loop, The Daily Mamaroneck, Larchmont-Mamaroneck Patch, Journal News, and NY Times; Village Documents and Engineering reports; NOAA websites; FEMA website; Village of Mamaroneck Flood Insurance Study; NYS Office of the Governor Press releases; FEMA Press releases.

Profile Details: Tropical Storm Floyd wreaked havoc on Westchester County on September 16, 1999. Sustained 60 mph winds accompanied torrential rainfalls. Maximum rainfall rates ranges from 1 to 2 inches per hour for at least 3 consecutive hours across parts of Westchester. Total rainfall at the Westchester County Airport was measured at 6.26 inches. Damage in Westchester County was reported at $6.6 million. (DR-1296).

Tropical Storm Ernesto brought strong winds and heavy rain to Westchester County on September 2, 2006. The hardest hit areas were the Southern Westchester towns, including

Greenburgh, Larchmont, Mamaroneck, Mount Vernon, New Rochelle, North Castle, Ossining, Port Chester, Rye, Scarsdale, Tarrytown, White Plains, and Yonkers. The storm caused power outages to approximately 80,000 customers in Westchester County, most located in Southern Westchester. According to Con Edison, approximately 100 trees were downed, and 900 wires fell. Residents of the Village of Mamaroneck experienced high winds, which downed power lines and trees, and caused power outages.

Tropical Storm Hanna hit Westchester County on September 6, 2008. Wind gusts ranges from 35 to 45 miles per hour, and rainfall totaled 4.41 inches of rain at Westchester County Airport.

Tropical Storm Irene hit Westchester County on August 27, 2011. The President declared an Emergency for the State of New York, Including Westchester County (DR-4020). This storm brought severe damage to the County. Over 7 inches of rainfall fell on the Village of Mamaroneck and flooded approximately 40 percent of the village, affecting approximately 3,300 homes. Hardest hit were Washingtonville, First Street, Second Street, and a section of Harbor Heights. River flooding impacted Washingtonville. A storm surge of over 3 feet occurred off the Long Island Sound, and tidal flooding impacted the Shore Acres and Orienta Neighborhoods. Between 400 and 500 homes in the Village of Mamaroneck's low lying areas and coastal and river flood zones were affected by an evacuation order. Trees and power lines were also downed. Wind gusts of 75–80 MPH knocked out power. Con Edison reported that the storm knocked out power to approximately 4,000 customers in the Village. An estimate of 280 people utilized the emergency shelter located in the gym at Mamaroneck High School. (DR-4020).

4.D.3.2 Coastal Storms

Hazard Summary: A coastal storm is a non-tropical storm that produces gale-force winds and precipitation in the form of heavy rain or snow. An intense extra-tropical coastal storm for the region is called the nor'easter. The Village of Mamaroneck has felt the effects of many coastal storms. Because of their less severe wind speeds, wind damage is less that a hurricane. However, rainfall and storm surge from these storms has caused serious flooding in the Village. In the winter these storms can cause blizzards. Flooding impacts several streets scattered over the Village. Areas flooded by these storms are the same as for other storms and are shown in

Figure 4-2, 4-4, 4-5 and 5-2. Damages are the same as those described for flooding and tropical storms discussed above.

The March 13, 2010 storm was the most recent storm to cause widespread flooding. (See Figure 4-4.) Future storms of this type are commonly expected. Future flooding from these storms can be expected.

Sources of information on coastal nor'easter storms are given in Section 11, References Cited and include: Public meetings with residents; Local papers and websites including: The Loop, The Daily Mamaroneck, Larchmont-Mamaroneck Patch, Sound & Town, Journal News, and NY Times; Documents and Engineering reports supplied by the Village; NOAA websites; FEMA website; Village of Mamaroneck Flood Insurance Study; NYS Office of the Governor Press releases; Consolidated Edison Press releases; Village of Mamaroneck Press releases.

Profile Details: Nor'easter storms move north along the east coast and have strong winds with heavy precipitation blowing off the Atlantic Ocean from the northeast. If a nor'easter moving up the coast follows a track westerly of New York City, rain is typically the result. However, if the storm maintains a track just off the eastern coast of the city, then snow or mixed precipitation is likely to occur. In the Mamaroneck area these storms have resulted in serious flooding of streets and homes, very high gale force winds, destruction of trees, utility poles, and damage to homes and other buildings. These storms are frequent and cover a large region including Westchester County, Long Island, and New England.

The presence of fronts and a drop in temperature at higher levels of the troposphere keep the storm from being classified as tropical. The most notable nor'easters that affect New York City and Westchester County have occurred as snowstorms during the winter weather months. Winter nor'easters are discussed below in Section 4.D.4. They may occur as heavy rainstorms or snowstorms. Severe storms have occurred in the Mamaroneck area that resulted in heavy precipitation, serious flooding of streets and homes, very high gale force winds, destruction of trees, utility poles, and damage to homes and other buildings.

These storms are frequent events and cover a large region including Westchester County, Long Island, and New England. Wind speeds can approach those of a Category 2 hurricane. These storms may last from one to a few days. There is a potential for serious injury and some deaths. Property damage may be moderate to severe. Damage to infrastructures such as electrical power lines may be moderate to severe. There is a high probability for a major future coastal storm.

The Nor'easter of December 10-13, 1992 caused torrential rains, gusting winds, massive flooding, power outages, and property damage. Basements were flooded, trees and utility poles were down, and traffic was seriously snarled. This storm caused about $1-$2 million in damages and costs and 19 deaths in the northeastern U.S. (NCDC/NOAA (1998), Billion Dollar Weather Disasters). (FEMA DR-974).

The Nor'easter of October 19-20, 1996 brought widespread flooding to the area. Approximately 5 inches of rain fell in Southern Westchester County, and there were 30-40mph winds with gusts up to 60 mph. This storm caused more than $3.5 million in damages to Westchester and Suffolk Counties. (DR-1146). (NOAA, NESDIS, NCDC, Event Record, 19 Oct. 1996).

The Nor'easter of April 15, 2007 brought high wind gusts and approximately 8.05 inches of rain fell on Southern Westchester County within a 24 hour period, leaving scores of homes and businesses underwater. This resulted in what some people call the "worst flooding in half a century". The Village of Mamaroneck was one of the sections affected hardest. Con Edison turned off the power to scores of residents and businesses in the Village of Mamaroneck to protect against rising water coming into contact with equipment in basements and resulting in hazardous conditions. In Harbor Heights, the Mamaroneck River overflowed its banks. Over 220 Washingtonville residents had to be evacuated to the High School gym. (DR-1692).

The Nor'easter of March 13, 2010 brought rain and high wind gusts of up to 62 mph. Northeast winds brought coastal water from the Mamaroneck Harbor crashing onto the land, flooding the Orienta and Harbor Heights sections of the Village of Mamaroneck. Trees and power lines were downed, closed local roads, and basements flooded. Reports of downed trees came from Florence Street and Walton Avenue, where trees landed on homes; Bleeker Avenue; the Parway; South Barry Avenue; Madison Street; Center Avenue, where a tree fell on a vehicle; and

Mamaroneck Avenue. Power outages occurred to 650 customers in the Village of Mamaroneck (Con Edison). (DR-1899).

4.D.3.3 Severe Storms and Thunderstorms

Hazard Summary: Severe storms are atmospheric disturbances usually characterized by strong winds, frequently combined with rain, snow, sleet, hail, ice, thunder and lightning. A thunderstorm is an event that produces lightning strikes, thunder, high winds, heavy rains, flooding and hail. Other associated dangers of thunderstorms include tornadoes, and flash flooding. Flash flooding is responsible for more fatalities, more than 140 annually, than any other thunderstorm-associated hazard.

Because their winds can be strong and gusty, wind damage can be severe. Trees, roofs and utility lines are particularly vulnerable from wind and lightning throughout the entire village. Rainfall from these storms has caused serious flooding in the Village. Areas flooded by these storms are shown in Figure 4-2, and 5-2. Damages are the same as those described for flooding and tropical storms discussed above. Future storms of this type are commonly expected. Future flooding from these storms can be expected.

Sources of information on thunderstorms are given in see Section 11, References Cited and include: Public meeting with residents; Local papers and websites including: The Loop, The Daily Mamaroneck, Larchmont-Mamaroneck Patch, Sound & Town, Journal News, and NY Times; Documents and Engineering reports supplied by the Village; NOAA websites; FEMA website; Consolidated Edison Press releases.

Profile Details: A severe storm and thunderstorm can produce lightning strikes, high winds, heavy rains, flooding, hail, and cause damage to trees, utility poles, power lines, commercial structures and residential homes. Although damage from one these storms is localized, the damage could be anywhere in the Village. Such thunderstorms have a high probability of occurrence in the region.

Deaths from lightning strikes and other accidents occur in Westchester County. Such thunderstorms have a high probability of occurrence in the region. These storms are commonly

associated with frontal systems and may result in concentrated heavy down pours of rain. Rapid local flooding may occur without warning.

Hailstorms, which can accompany thunderstorms, occur in Westchester but they are not prevalent. Thunderstorms may also be associated with hurricanes discussed above and with tornados discussed below. This severe storm hazard is prevalent in Westchester County during the warmer months of the year.

Between January, 1, 1950 and April 30, 2011, 173 major thunderstorms were listed in the NCDC database for Westchester County. This is not a complete listing of all storms as thunderstorms are more frequent than indicated. These storms are very frequent events and may cover large area across Westchester County. Wind gusts of 50 to 75 mph are not uncommon. A storm may last from less than an hour to several hours. There is a potential for serious injury and limited deaths. Property damage may be moderate to severe. Damage to infrastructures such as electrical power lines is prevalent with downed power lines or damaged transformers or substations.

Westchester County was hit hard by a multitude of weather events, all of which were accompanied by severe thunderstorms. Most notable storms include one that occurred in August 1999, and a series of storms, which occurred during the summer of 2006, as described below.

A severe storm wreaked havoc on Southern Westchester County on August 26, 1999. Severe thunderstorms produced torrential rain that caused serious urban flooding in the area. Road closures occurred in the area. The storm dropped 3-5 inches of heavy rain in the Village of Mamaroneck in the time frame of just 90 minutes, and flooded streets and basements. Metro-North service was suspended. No injuries were reported.

Westchester County was hit hard in 2006 by a series of storms that occurred in the summer. They occurred closely together and were all accompanied by severe thunderstorms. Most notable thunderstorms include the ones that accompanied the microburst on July 18, 2006, which affected areas in Westchester County, South of I-287. Heavy rains, and wind gusts up to 60-70 mph knocked out power to 35,000 households. This storm damaged many trees in the County.

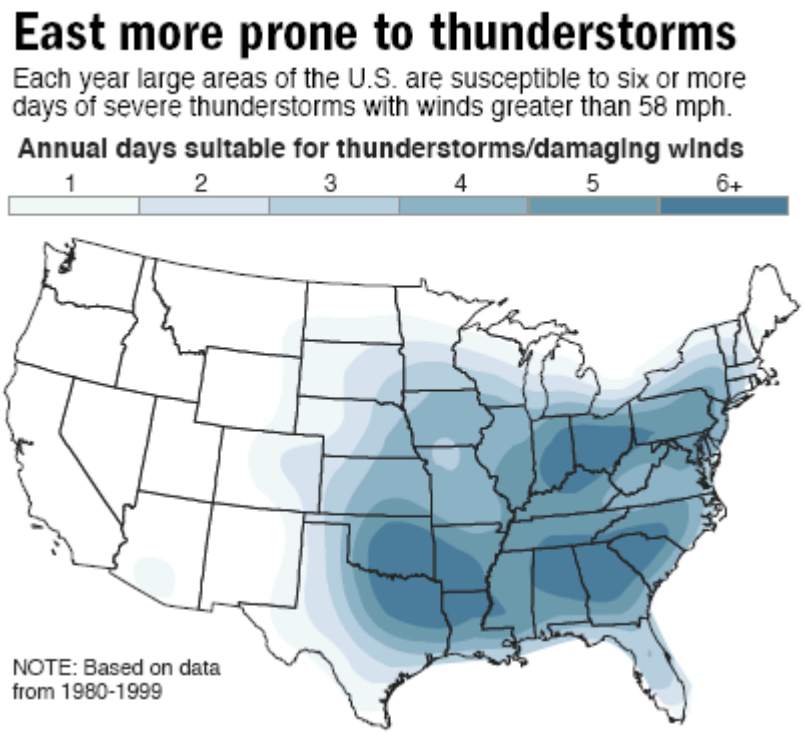
Another thunderstorm accompanied a microburst electrical storm which occurred just days later on July 21, 2006, which also affected areas south of I-287. The next day, another storm knocked out power to an additional 6,000 households.

A severe storm dropped approximately 4 inches of rain in the Village of Mamaroneck on March 2, 2007. More than 85 homes were evacuated near the Mamaroneck River, as water flooded the streets and basements and garages in the area. Con Edison reported approximately 188 households had their power shut off in the Village of Mamaroneck.
Downed trees and power lines closed Weaver Street between Palmer and Howell Avenues due to winds from a severe thunderstorm on October 10, 2010. A downed tree also closed Halstead Avenue and Jefferson Street, near the Mamaroneck train station.

A severe thunderstorm caused a tree to fall on Shore Acres Drive, starting a small electrical fire on June 10, 2011. Power outages were reported to 20 households on Shore Acres Drive and 1 household on Fenimore Road.

There is a high probability for future damaging thunderstorms. NOAA scientists predict that more severe thunderstorms with lightning, hail and the potential for tornadoes will occur in the future due to climate change. Prepared by the National Weather Service, figure 4,7 below identifies the states most prone to these severe storms, including New York State.

Figure 4-7. States Most Prone to Thunderstorms.



Source: msnbc.com, NWS

4.D.3.4 <u>Tornados</u>

Hazard Summary: A tornado is a local atmospheric storm, generally of short duration, formed by winds rotating at very high speeds, in a funnel-shaped cloud striking the ground with whirling winds of up to 318 miles per hour or more. The vortex, up to several hundred yards wide, is visible to the observer as a whirlpool-like column of winds rotating about a hollow cavity or funnel. Winds may reach 300 miles per hour or higher.

They are infrequent and are scattered geographically over the County and cover a relatively narrow path that can produce severe damages. Wood frame building and other weakly constructed building, trees, and utility lines are particularly vulnerable from wind damage. There is no history of a tornado in the Village of Mamaroneck. There were 7 documented tornadoes in Westchester County between 1958-2004. Four scored an F1 on the Fujita Tornado Scale and 3 scored an F0. There was an 8th tornado on 7/12/2006 which was sighted over the Hudson River

and went through Sleepy Hollow, Mt. Pleasant, and the hamlet of Hawthorne. This was an F2 tornado. However, their unpredictable impact could strike any area in village. These storms are rare event in the County and future storms of this type are unlikely but possible. Hilly terrain such as that surrounding Mamaroneck has a lower risk and frequency of tornadoes. They are also associated with other severe storm hazards, so they are not evaluated further in the plan as a separate hazard.

Sources of information on tornadoes are given in see Section 11, References Cited and include: Tornado History Project website; Bergen SkyWarn website; Accuweather.com; Journal News; NOAA websites; FEMA website.

Profile Details: Although there have been several tornados reported in Westchester County, they are considered infrequent. There is no history of a tornado striking the Village of Mamaroneck. Figure 4-7 shows that significant tornado occurrences are scattered over the State. The database for storm events lists eight tornado events for Westchester County between 1950 and April, 2011 (NCDD/NOAA, 2011) with one death reported. None of the eight reported events have been in or near Mamaroneck. On July 12, 2006, the eighth tornado occurred in Westchester County. A tornado was sighted over the Hudson River near the Tappan Zee Bridge. It quickly moved east over the Village of Sleepy Hollow, then into the town of Mount Pleasant, where it did the most damage in the hamlet of Hawthorne. Winds exceeded 150 MPH along the path. A state trooper's patrol car was picked up in the air and spun around. A two-story brick building was critically damaged; seven large trees toppled onto the Metro-North railroad tracks; and 4,000 Westchester residents lost power due to the severe thunderstorms that accompanied the tornado. There were 6 injuries reported. The reported path width of the tornado was estimated at 200 to 300 yards based on the damage survey across Westchester County. (National Weather Service, Upton, NY, July 14, 2006).

The severity of a tornado is rated using the Fujita Tornado Scale. All reported tornados in the county were less than a magnitude of F3. The last tornado reached an F2 magnitude, four of the tornadoes were an F1 Magnitude, and three reached an F0 Magnitude.

Fujita Tornado Scale

F0 = 40 to 72 mph – light damage

F1 = 73 to 112 mph – moderate damage

F2 = 113 to 157 mph – considerable damage

F3 = 158 to 206 mph – severe damage

F4 = 207 to 260 mph – devastating damage

F5 = 261 to 318 mph – incredible damage

Although infrequent, these tornadoes can produce considerable damage in localized areas anywhere in the Village or County. The reported width of tornados in Westchester County ranged from 13 yards to 300 yards. However, the geographical occurrence could be anywhere in the Village or the county. Tornados are also associated with severe thunderstorms and with hurricanes for which hazards were discussed in Section 4.C.1. NOAA scientists predict that more severe thunderstorms with lightning, hail, and the potential for tornadoes will occur in the future due to climate change.

Because tornadoes are not a frequent hazard, are scattered geographically and are also associated with other severe storm hazards, they are not evaluated further in this plan as a separate hazard.

4.D.3.5 Wind Storms

Hazard Summary: Wind storms are accompanied by strong gale force or stronger winds that may or may not include precipitation. These winds may be associated with tornadoes, thunderstorms, Nor'easters, tropical storms, and hurricanes. They are violent winds of high velocity and are commonly associated with frontal weather systems. They cover a relatively wide path in the region and they affect the entire geographical area of the Village. Wind storms can produce gale force gusts of wind and can cause severe damage to wood frame buildings, roofs, trees, utility lines and unsecured materials and items. Con Edison reported that severe windstorms occurred between January 18-22, 2006, which uprooted trees and caused scattered power outages across Southern Westchester. 61,486 households in Westchester lost power from those storms. NOAA reported a severe wind storm occurred on September 30th and October 1, 2010, with wind gusts ranging from 40 – 55 mph in Southern Westchester. Con Edison reported 1200 households in Southern Westchester lost power during that storm. Wind events are

common in the Village of Mamaroneck and they can strike any area in village. Future storms of this type are highly likely.

Sources of information on wind storms are given in see Section 11, References Cited and include: Bergen SkyWarn website; Accuweather.com; Journal News; NOAA websites; FEMA website; Wind zones of NY, NYSOEM website; NYS Multi-Hazard Mitigation Plan.

Profile Details: Windstorms can cause destruction of trees, toppling of power and telephone lines, and serious widespread damage to humans and property. Wind zones for New York State, which are used for construction standards, are shown in Figure 4-7. This hazard cannot be geographically determined but can affect the entire Village planning area. These storms have caused power failures, damage to property including window and roof breakage, human injuries from falling objects, and damage and capsizing of boats, beach erosion, and financial losses. Windstorms are similar to and commonly associated with the advance of other storm events such as thunderstorms and tornados.

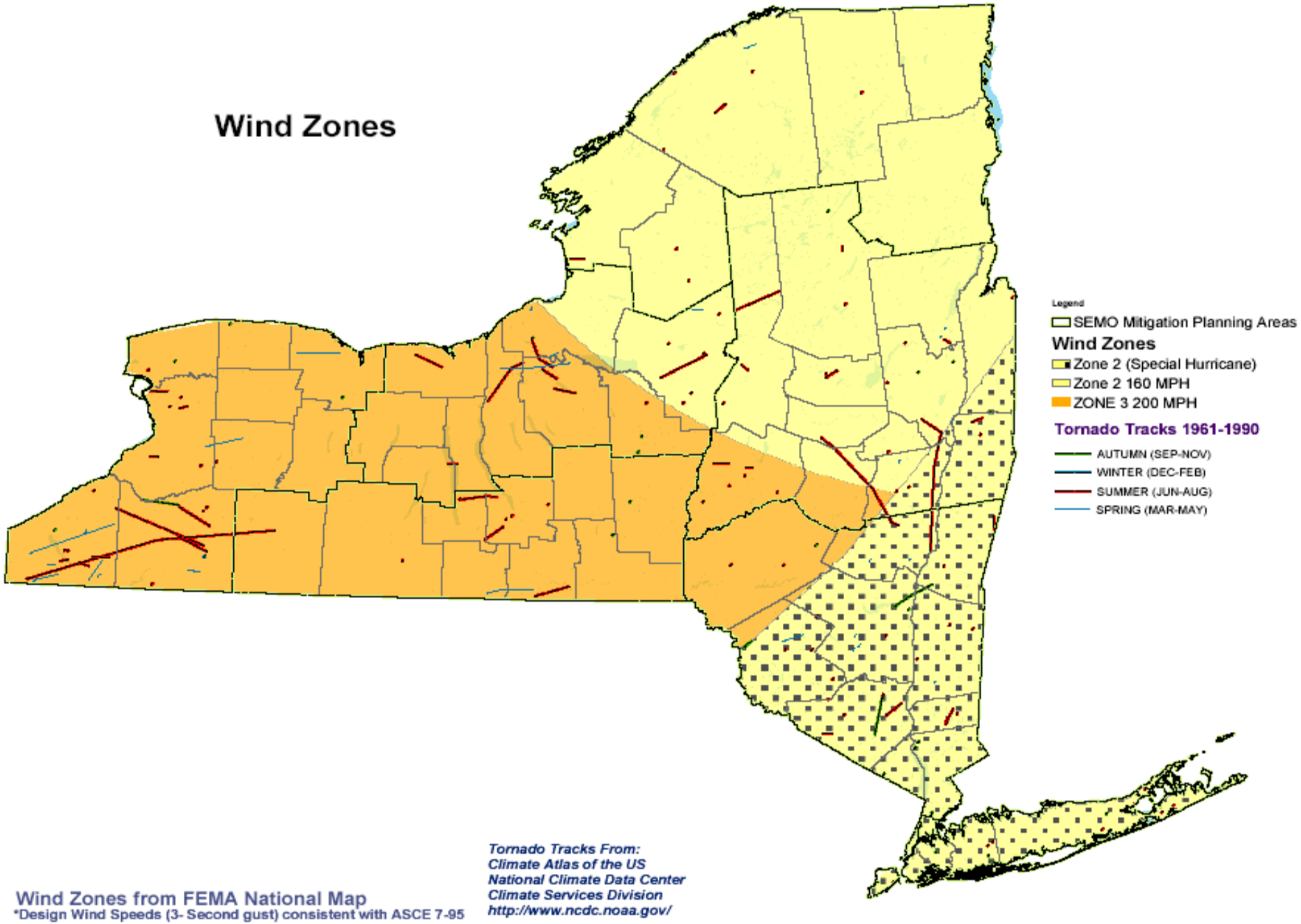


Figure 4 - 8

Wind Zones of New York State

4.D.4 Winter Storm Hazards

Winter weather for the Village of Mamaroneck is highly variable. Storm systems in winter may deposit snow, sleet or freezing rain, with a significant impact on transportation systems and public safety. These hazards also include severe snow storms and blizzards. Although there are several winter storm hazards, ice storms and snowstorms are the most prevalent. There are no mountains in the area that could produce avalanches. Although ice jams in the Village's rivers can occur in severely cold winters, they are not a hazard causing severe damage or significant loss of life, but some have caused localized flooding. Ice jams have occurred around the Jefferson Avenue Bridge, the Ward Avenue Bridge, and the Waverly Avenue Bridge in the past, causing localized flooding to nearby homes and businesses, and forcing the closure to roadways, and causing minor structural damage to the bridge.

The damage to the Village of Mamaroneck from severe winter storms, coastal storms, nor'easters, ice storms, and snowstorms has been very significant. Winter storms cover a relatively wide path in the region and they affect the entire geographical area of the Village. Average minimum winter temperatures for the area are approximately 28.6 degrees Fahrenheit. The lowest recorded temperature for New York City was -15 in 1934. (NYSCE 2006, Climate Summary)

4.D.4.1 <u>Snow Storms</u>

Hazard Summary: A severe snowstorm deposits heavy snow amounting to 12 inches in 12 hours or less. Snowstorms are common winter events for the region. The average annual snowfall for New York City region is 22.3 inches. Snow storms deposit several inches of snow over the entire Village and are often accompanied by strong gale force winds. Snow storms with high winds are referred to as blizzards. They blanket a relatively wide area locally and can produce severe damage to buildings, trees, and utility lines. Heavy snowfalls and blizzards affect the entire planning area since access to roads and highways is necessary for residents. In addition they disrupt train service, bus service and traffic as well as school, business and employment activities. The greatest daily snowfall since 1949 was 26.9 inches in February 2006 when a snowstorm occurred in the area. The blizzard of February 12, 2006 was the biggest snowstorm in the New York City region's history. Snow events are common in the Village of

Mamaroneck and they generally strike the entire village. Future storms of this type are highly likely.

Sources of information on snow storms are given in see Section 11, References Cited and include: Accuweather.com; Local newspapers papers and websites: Sound and Town, Larchmont-Mamaroneck Patch, The Loop, Journal News; NY Times; NOAA websites; FEMA website; NYSCE 2006, Climate Summary, NWS Forecast Office, Significant Weather Events Archive.

Profile Details: Heavy snowfalls and blizzards affect the entire planning area since access to roads and highways is necessary for residents to travel to work and school, obtain necessary foodstuffs for their families, and allow fire, public safety, and ambulances to reach their destinations when emergencies arise. These storms also cause dangerous situations from fallen electrical lines and trees falling on roofs. Coastal winter snowstorms or nor'easters can be particularly severe and hazardous. They can deposit large amounts of snow and produce strong winds that result in blizzard conditions.

A nor'easter in December 1992 was a blizzard that covered the eastern U.S. This storm cost $1-$2 billion and resulted in 19 deaths over the area impacted. $1.6 - $3.2 billion were reported in damages. These dollar amounts were adjusted to 2011 dollars by using the Consumer Price Index (CPI). (NCDC /NOAA, billion dollar U.S. Weather Disasters, 1980-August 29, 2011). www.ncdc.noaa.gov/oa/reports/billionz.html (DR-974).

A nor'easter on March 12-14 1993 was a blizzard that covered the eastern U.S. and was called the storm of the century. It affected 26 states and resulted in 270 fatalities. This storm cost $7.8-$9.4 billion adjusted 2011 dollars (NOAA/NCDC, 1993, Storm/Blizzard March 1993), In New York State the death toll was 23. Hundreds of roof collapses occurred in the northeast due to the weight of the heavy wet snow. Over 3 million customers were without electrical power in the region at one time due to fallen trees and high winds. At least 18 homes fell into the sea on Long Island due to the pounding surf. Winds of 71 mph were reported at La Guardia Airport, NY (NCDC/NOAA, 2006). Westchester County suffered approximately $8.4 million dollars in damages, and received between 10 and 20 inches of snow. The National Weather Service

reported 16.5 inches of snow in Croton Falls with some wind gusts above 50 mph. Approximately 1,200 customers lost power in Mamaroneck and New Rochelle (NY Times, "The Blizzard of '93", March 14, 1993). (EM-3107).

The blizzard of January 6-8, 1996 was the biggest snowstorm in the New York City region in 48 years. Over 27 inches of snow fell on some areas of the region. LaGuardia Airport reported 24 inches of snow. Seven deaths in New York State were associated with the storm. The impacts of the storm were compounded by a thaw and heavy rains on January 19. Ten flood fatalities resulted for New York State. According to the National Climate Data Center, "Billion Dollar U.S. Weather Disasters (NCDC/NOAA, 2011), the total impact from this event on the northeast was 187 fatalities and about $4.3 billion in total damages and adjusted 2011 costs including snow removal. (DR-1083).

The blizzard of February 12, 2006 was the biggest snowstorm in the New York City region's history. A classic Northeaster, the storm was 1,200 miles long and 500 miles wide on satellite images, and it had winds that gusted up to 60 miles per hour. It spanned across the Northeast from Virginia to Maine. According to the National Weather Service, a record 26.9 inches fell in Central Park, the most since record keeping began in 1869. The previous record was 26.4 inches set during the great snowstorm of 1947 (Dec 26-27) when 77 people were killed. Another record 25.4 inches fell at LaGuardia Airport. Areas in the Bronx had 24.5 inches of snowfall. NOAA reported accumulation of 16 to 25 inches of snowfall in Westchester County; 21.5 inches fell at Westchester Airport, and 24.5 inches fell in New Rochelle. Although no power failures were reported in Westchester County, winds downed many trees and power lines. The total impact from this event on the northeast was only 3 fatalities and about $3 billion in total damages and costs.

Approximately 12 inches of snow fell on the Village of Mamaroneck during the February 25-26, 2010 snowstorm. The storm brought wind gusts as high as 45 mph to the Village.

The Blizzard of December 26-27, 2010 dropped 22 inches of snowfall on the Village of Mamaroneck. Extremely high winds knocked a high voltage wire loose from the transformer on Palmer Avenue, knocking out power to the block. (DR-1957).

During the heavy snow storm of January 26-27, 2011, 13 inches of snow fell on the Village of Mamaroneck, with wind gusts up to 43 mph.

4.D.5 Other Natural Hazards

Although other natural hazards occur in the Village of Mamaroneck only a few are of concern while most others may not be severe or prevalent events. The following three hazards were eliminated from further consideration. There are no expansive soils hazards in or near the Village. Tsunamis (tidal waves) and volcanoes do not occur in this region of the country. The following potential hazards are discussed below: Dam failure, Earthquakes, Epidemics, Extreme temperature, Drought and Landslides.

4.D.5.1 Dam Failure

Hazard Summary: A dam failure is the collapse or failure of an impoundment that causes downstream flooding. This failure could be caused by weakened dam structure or terrorist act, and would result in large volumes of water to rush downstream. The Kensico Dam, located near Valhalla in northern Westchester Co., (See Figure 0-2.) holds 30.6 billion gallons of water in a reservoir covering approximately 2000 acres. The Dam sits at the head of the narrow canyon of the Bronx River, stretching south from the dam and running throughout Westchester and 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 these dams could cause significant flooding to the Village.

Should the Kensico Dam fail, countless people would lose their lives, as well as structures in the floods path spanning from White Plains through the Bronx. The destruction would be extensive and impacts would be County wide, running from White Plains through the Bronx. Impacts to the Village of Mamaroneck would be less severe since it is not directly in the Bronx River valley. Approximately nine million people, including 85% of Westchester County would lose their water supply. It could impact the Village and surrounding areas by running down the Mamaroneck River, resulting damage to buildings and utility lines. In addition it would disrupt

train service, and traffic. Future event of this type is considered unlikely but with a potential for large impacts.

Since New York City and Westchester County are responsible for the dam safety and security, no further health and safety assessments and damage analysis will be performed in Section 5, and no mitigation measures will be proposed or evaluated.

Sources of information on dam failures are given in see Section 11, References Cited and include: Village officials, Planning Committee, Association of State Dam Safety Officials, Collins' Assessment of New York City's reservoirs, dams, and aqueducts.

Profile Details: Located in Valhalla, the Kensico Dam is 3,300 feet long, 307 feet high, and holds back 30.6 billion gallons of water in a reservoir covering approximately 2000 acres. 90% of New York City's drinking water is funneled through the Kensico Dam, along with 27 Westchester communities. (See Figure 0-2.)

According to the Association of State Dam Safety Officials, Dam failures are most likely to happen for the following reasons:

- Overtopping, caused by water spilling over the top of the dam
- Structural failure of materials used in dam construction
- Cracking, caused by movements such as the natural settling of the dam
- Poor maintenance and upkeep
- Poor piping, if seepage is not properly filtered, sink holes can form in the dam.

Since September 11, 2001, in today's society, another potential reason for dam failure is the possibility of terrorism.

The first comprehensive risk assessment of New York's network of reservoirs, dams, and aqueducts was done by Michael Collins, former head of the NYCDEP's Watershed Police Department, in conjunction with the Federal Bureau of Investigation in 1997. According to the analysis, if the Kensico Dam were to fail, the City of White Plains could encounter water depths of an estimated 70 feet within one hour of dam failure, which would dwindle to 3.5 feet four

hours after failure. This surge would be deadly. Table 4-6 shows the 9 worst dam failures in U.S. history.

Over 200,000 people live downstream of the Kensico Dam. Countless lives would be lost, as well as structures in the tidal wave's path spanning from White Plains through the Bronx. In addition, approximately nine million people, including 85% of Westchester County, would lose their water supply. A failure of the dam would be devastating.

Table 4-6. The Worst Dam Failures in U.S. History*

South Fork Dam Johnstown, PA	May 31, 1889	Located 9 miles upstream, City was devastated, 2,209 deaths
St. Francis Dam San Franciscquito Canyon, CA	March 12, 1928	450 deaths, 1,200+ homes destroyed, 10 bridges destroyed
Canyon Lake Dam Rapid City, SD	June 9, 1972	Dam failed during severe storm, widespread flooding, 237 deaths, 3,000+ injured, 1,300+ homes destroyed, $60+ million in damages
Mill River Dam Williamsburg, MA	May 16, 1874	139 deaths, destroyed factories, Destroyed 740 homes in Leeds, Williamsburg, Skinnerville, & Haydenville
Buffalo Creek Dam Logan County, WV	February 26, 1972	125 deaths, 500+ homes destroyed, $400+ million in damages
Laurel Run Dam Johnstown, PA	July 19-20, 1977	40 deaths, $5.3 million in damages
Kelly Barnes Dam Toccoa Falls, GA	November 5, 1977	39 deaths, $2.5 million in damages
Teton Dam Southeast Idaho	June 5, 1976	11 deaths due to adequate warning, $1+ billion in damages
Baldwin Hills Dam Los Angeles, CA	December 14, 1963	5 deaths, 1000+ homes and apartment buildings destroyed.

***Association of State Dam Safety Officials,** http://new.damsafety.org

The New York City Department of Environmental Protection (NYCDEP) protects the Kensico Reservoir in northern Westchester County at Valhalla (see Figure 0-2). After September 11, 2001, the Dept. of Public Safety created Westchester County's Office of Intelligence, Security, and Counter-Terrorism (ISCT). The ICST is working with the NYCDEP and has made significant security improvements at the Kensico Dam. Since this hazard is the responsibility of

NYCDEP and the County, no further health and safety assessments and damage analysis will be performed in Section 5, and no mitigation measures will be proposed or evaluated.

4.D.5.2 Earthquake

Hazard Summary: An earthquake is a shaking or trembling of the crust of the earth caused by underground breaking and shifting of rock faults beneath the land surface. This can be caused by surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, tsunamis, and seiches. They are infrequent in this region and are scattered. Wood frame buildings and other weakly constructed building are particularly vulnerable to earthquakes. If an earthquake should occur it would impact the entire area of the village as well as the surrounding region. A measure of earthquake hazard is the peak ground acceleration (PGA) which for the Village of Mamaroneck is 3.757%. (See Figure 4-8) This rating places the entire area of the Village in a low risk category for earthquakes. There have been no reported earthquakes in the Village of Mamaroneck. No earthquakes have been reported with a magnitude greater than 5 on the Richter Scale in Westchester County since 1884. All reported incidents in Westchester Co. have been minor with no significant damage or injuries.

Sources of information on earthquakes are given in see Section 11, References Cited and include: New York Times; NOAA websites; FEMA website; NYS Multi-Hazard Mitigation Plan; USGS website; USGS Seismic Zoning Maps for NYS Seismic Bldg. Code; Lamont-Doherty Earth Observatory, Columbia University website, Bulletin of the Seismological Society of America.

Profile Details: Although earthquake tremors have been felt and recorded in the area, they are not considered a very big event in Westchester County. According to the United States Geological Survey (USGS), danger is generally from earthquakes that are rated 4.5 or higher on the Richter Scale. In addition, earthquakes are an infrequent event in Westchester County.
On August 23, 2011, tremors were felt in Westchester County from an earthquake that whose epicenter was northwest of Richmond, Virginia. The earthquake registered 5.8 on the Richter Scale.

The largest quake in the New York area occurred on August 10, 1884. According to the Lamont-Doherty Cooperative Seismographic Network (LCSN) of Columbia University, it registered a 5.2 on the Richter Scale. Only minor tremors occurred from that time until October 19, 2005, when an earthquake and foreshock struck about two minutes apart and were centered in Ardsley, New York. The quake measured 4.0 on the Richter Scale, and the shock measured 2.0. An aftershock occurred on October 22, 1985 measuring 3.0 on the Richter Scale. Six minor aftershocks then followed. On April 23, a small quake measuring 2.7 occurred in the same area. On January 11, 2003 a quake occurred that measured 1.2, and on January 15, 2003 another occurred measuring 1.4. The fault line that runs southeast from Dobbs Ferry into Greenburgh was responsible for these earthquakes. Based on this information earthquake hazards causing significant damage, personal injury or death in the Village of Mamaroneck are not prevalent, significant or likely. However, if a large quake should strike, significant damage could result.

In 2008, the U.S. Geological Survey updated its National Seismic Hazard Maps. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps, which supersedes the 1996 and 2002 versions. The USGS has determined that the 2008 map represents the best available date. The Peak Ground Acceleration (PGA) is a standard measure of potential earthquake hazard used by FEMA and the U.S. Geological Survey. This is a measure of the ground surface acceleration from an earthquake relative to gravity, which is recorded as %g. For the Village of Mamaroneck (Latitude: 40.948N, Longitude: -73.733W), the %g value is 3.757% (See Figure 4-8). According to the current USGS Seismic Hazard Map for the region Mamaroneck would be included in that PGA zone. This indicates a low hazard due to earthquakes. There is a 10% chance in 50 years that the PGA would exceed 4%.

Based on historical evidence, the risk of a damaging earthquake event was thought to be highly unlikely. However, new studies suggest that the probability of such an event may be more prevalent than previously thought. A study published in the Bulletin of the Seismological Society of America analyzed past earthquakes, 383 earthquakes from 1677 to 2007 in a 15,000 square mile area around New York City. New data was also analyzed. The study suggests a

pattern of subtle, yet active faults, which increases the risk of earthquake to the New York City area.

The study suggests that 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 in the New York area is denser than in earthquake-prone areas. In the event a damaging earthquake did occur in the area, the losses would be far more catastrophic.
Based on their research, an earthquake with a Magnitude of 5 is estimated to occur every 100 years. In addition, it is estimated that a Magnitude 6 earthquake will occur every 670 years, and a Magnitude 7 earthquake will occur every 3,400 years (The corresponding probabilities of occurrence in any 50-year period would be 7% and 1.5%).

In addition, the study revealed that the Indian Point Nuclear Power reactor is situated in a very precarious position. A newly discovered seismic zone, that runs from Stamford, Connecticut, to Peekskill, New York, runs less than one mile north of Indian Point. In addition, the Ramapo Seismic Zone, that runs from Eastern Pennsylvania to the Mid-Hudson Valley, passes within two miles northwest of Indian Point. The Indian Point Nuclear Reactor sits on the banks of the Hudson River in Buchanan, New York. It was built to withstand a Magnitude 7 on the Mercalli Scale, or 6.1 on the Richter Scale.

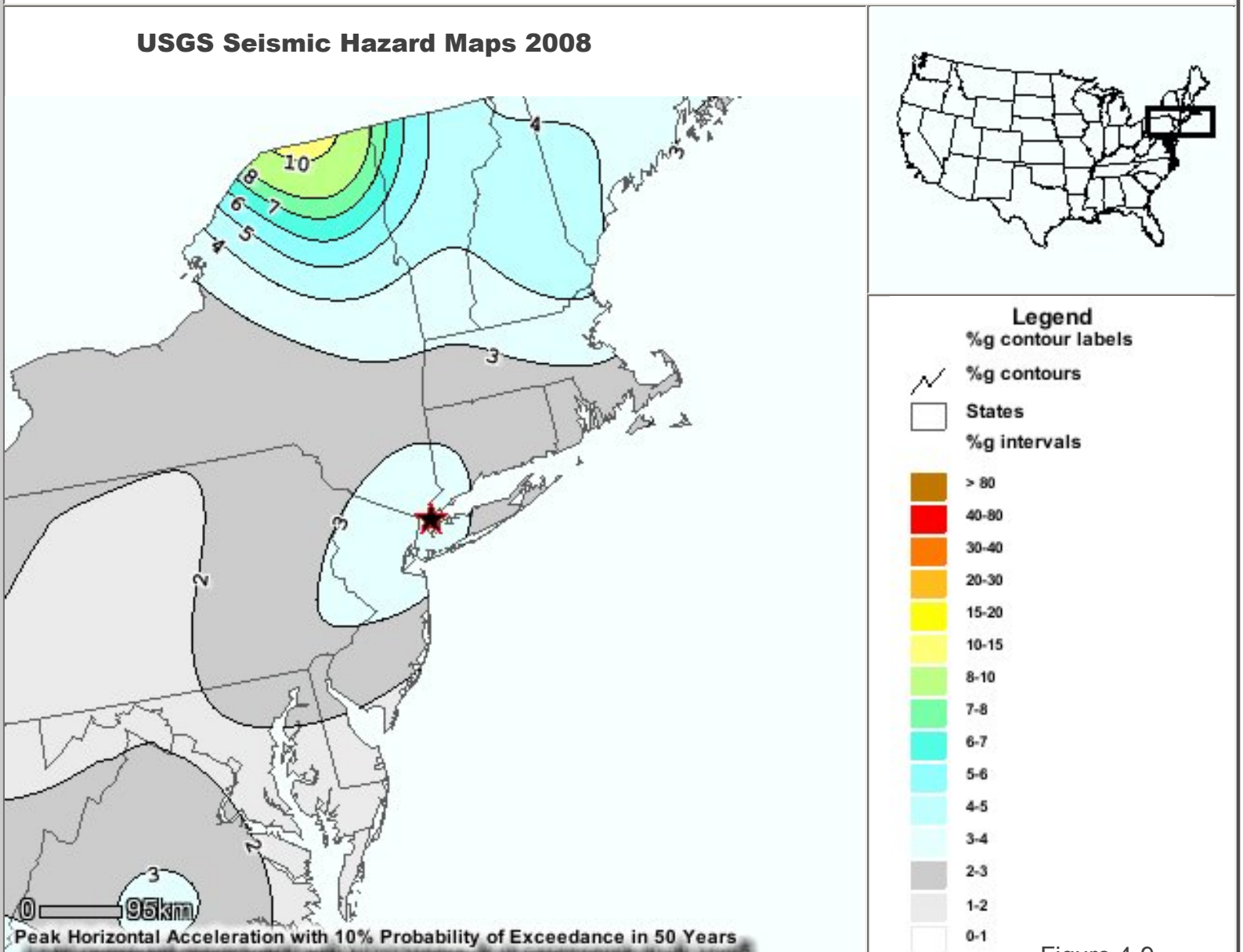


Figure 4-9
Seismic Hazard Zones
in New York State

Table 4-7. Largest Earthquakes Near New York City.

DATE yr/mo/day	TIME hh:mm: sec	LAT. (°N)	LONG. (°W)	LOCATION	MAGNITUDE Richter (ML)	Max. Intensity (MM)	Remarks
1884 Aug 10	19:07	40.45	73.90	Greater N.Y. City area	5.2	VII	Threw down chimneys - felt from Virginia to Maine;
1737 Dec 19	03:45	40.80	74.00	Greater N.Y. City area*	5.2	VII	Threw down chimneys
1783 Nov 30	03:50	41.00	74.00	N. Central N.J.*	4.9	VI	Threw down chimneys
1847				Greater N.Y. City area*	4.5	V	Probably Offshore
1848 Sep 09		41.11	73.85	Greater N.Y. City area*	4.4	V	Many people in the NY City area felt the earthquake
1895 Sep 01	11:09	40.55	74.30	N. Central N.J.	4.3	VI	Location determined by fire and aftershock
1985 Oct 19	10:07	40.98	73.83	Ardsley, N.Y.	4.0	IV	Many people in the NY City area felt this earthquake
1927 Jun 01	12:23	40.30	74.00	Near Asbury Park, N.J.	3.9	VI-VII	Very high intensity in Asbury Park, NJ - perhaps shallow event
1845 Oct 26	23:15	41.22	73.67	Greater N.Y. City area*	3.8	VI	
1938 Aug 23	05:04:53	40.10	74.50	Central N.J.	3.8	VI	
1951 Sep 03	21:26:24	41.25	74.00	Rockland Co., N.Y.	3.6	V	
1937 Jul 19	03:51	40.60	73.76	Western Long Is., N.Y.	3.5	IV	One or few earthquakes beneath Long Island
1957 Mar 23	19:02	40.60	74.80	Central N.J.	3.5	VI	
1874 Dec 11	03:25	41.05	73.85	Near Nyack and Tarry-town, N.Y.	3.4	VI	
1885 Jan 04	11:06	41.15	73.85	Hudson Valley	3.4	VI	
1979 Mar 10	04:49:39	40.72	74.50	Central N.J.	3.2	V-VI	Felt by some in Manhattan [it is called Chesequake earthquake]
2001 Oct 17	01:42:21	40.79	73.97	Manhattan, New York City	2.6	IV	Felt in Upper West Side of Manhattan, Astoria and Queens, NYC

(*) Location very poorly determined; may be uncertain by 50 miles., ML=Richter local magnitude
Source: Lamont-Doherty Earth Observatory of Columbia University, 1999
www.ldeo.columbia.edu/lcsn/big-ny-eq.html

4.D.5.3 Epidemic

Hazard Summary: An epidemic is the occurrence or outbreak of disease in a large number of individuals or proportion of human or animal populations. An epidemic affects many people at the same time in an area and spreads from person to person in a locality where the disease is not permanently prevalent. An epidemic would impact the entire Village of Mamaroneck. West Nile Virus is a current threat to the NY area through exposure by mosquito bites. Another epidemic concern is Flu epidemic spread by human contact. Lyme disease is borne by the deer tick, but is seldom fatal, is easily treated through antibiotics and is not an issue in the Village. The probability of future epidemic event in the County and in the Village is low. The expected magnitude and severity of an epidemic is expected to be low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information for epidemic hazards are given in Section 11, References Cited and include: Westchester County Health Department; USGS Disease Maps and website; Local Papers; NY Times; Journal News.

Profile Details: A current epidemic threat is the possibility of being exposed to the West Nile virus contracted from mosquitoes. This has been a concern in the Westchester area since the mosquito vector breeds in wet areas, flooded areas, streams and shoreline areas in the region. Potential epidemics also relate to the failure of the sewage treatment plant and pumping stations that could cause sewage backups in homes and streets. This would place the residents at risk of contracting disease from the untreated raw sewage. Another major epidemic concern is a Flu epidemic which can spread quickly worldwide. Lyme disease, which is borne by the deer tick, is a concern in the County but is seldom fatal, is easily treated with antibiotics and deer as vectors are not common in the Village.

Table 4-8 lists the number of cases of West Nile Virus contracted in humans for the last three years. The number of cases in Westchester County is minimal.

Table 4-8. Cumulative Human Disease West Nile Virus Cases by County.

County	2008	2009	2010
Bronx County	**1**	**1**	7
Kings County	**3**	**1**	**6**
Nassau County	**20**	**1**	57
New York County	**1**	**1**	**6**
Queens County	**5**	**1**	**14**
Richmond County	**5**	**1**	**9**
Suffolk County	**9**	**1**	**24**
Westchester County	**2**	**1**	**4**
Total:	**46**	**8**	**127**

Source: U.S. Geological Survey

http://diseasemaps.usgs.gov

As of August 30, 2011, there were only 2 reported cases of West Nile Virus in humans in 2011. One case reported in Yonkers, Westchester County, and one case in Suffolk County.

Epidemics, although a concern for the entire planning area, are not considered to be a prevalent or severe hazard and are most likely to result from damage to treatment facilities, sewers or other infrastructure that are caused by other flooding hazard discussed above. Such health hazards are handled through our current Westchester County Heath Department and the Federal health advisory system.

If an epidemic should occur, it would likely cover a wide regional area and not be restricted to the Village geographical. However, an epidemic has a potential for serious illness and a large number of deaths. There is a low probability for a future epidemic event in the Village of Mamaroneck. No unique epidemic hazards were identified as significant or prevalent.

No special mitigation measures beyond current state or county public health activities are called for. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.5.4 Extreme Temperature

Hazard Summary: Extreme temperatures include extended periods of excessive cold or hot weather with a serious impact on human populations, particularly the elderly and/or persons with respiratory ailments. Heat waves are the primary hazard of concern. The NWS defines a "heat wave" as three consecutive days of temperatures exceeding 90ºF. Temperature hazards are region wide and include the entire Village area. The magnitude and severity of cold stress hazard would be low. The magnitude and severity of heat stress would be high when temperatures exceed 100 degrees, particularly when humidity is high. A previous occurrence in 1999 brought a series of heat waves to the NY metropolitan region. The summer of 1999 brought 27 days of 90+ degree days, causing rolling blackouts to the area. The North American heat wave of 2001 brought 32 reported heat related deaths to NYC. Heat hazards can cause heat stroke and death particularly to the chronically ill and elderly. The probability of future events is high. A warning system is handled through the National Weather Service. No further health and safety assessments and damage analysis for extreme temperatures will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information for temperature hazards are given in see Section 11, References Cited and include: Local Papers: Larchmont-Mamaroneck Patch, Journal News, NY Times; Climate change documents; National Climate Data Center website; Accuweather website; Westchester County Health Department.

Profile Details: Although extreme cold temperature is a concern, heat waves are the primary hazard of concern. Extreme heat hazard is associated with summer weather and is typified by a combination of high temperatures and humid conditions. Extreme heat can be a life-threatening condition, affecting senior residents and those with health problems.

In 1999, New York was hit with a series of heat waves that imposed heat stress and extra energy demands on the New York metropolitan region. High temperatures were widespread throughout most of the eastern portion of the United States in July. During the summer, New York City experienced 27 days of 90 degree temperature or higher. Rolling blackouts occurred in area-wide system failures. More than 80,000 households and businesses in northern Manhattan and the Bronx experienced a blackout for 19 hours. 33 people died from heat-related causes.

In 2001, New York was hit with another heat wave, along with the rest of the east coast. Temperatures in New York City reached a peak of 103 degrees, and Newark, New Jersey reached a record 105 degrees.

In 2006, the North American heat wave spread throughout most of the United States killing at least 225 people. 14 people died in Queens, 10 in Brooklyn, 6 in Manhattan, and 2 in the Bronx; totaling at least 32 reported heat-related deaths in New York City. Blackouts occurred throughout the entire tri-state area, most notably in Astoria Queens, and Westchester County.

In July, 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 6th due to 101 degree temperature. More than 1300 were without power during this heat wave.

In July 2011, the New York metropolitan area was hit with another heat wave. Temperatures in New York City reached 104 degrees. There were 11 reported deaths in New York City from this heat wave.

The National Weather Service (NWS) defines a "heat wave" as three consecutive days of temperatures exceeding 90ºF. In addition, there is little wind, and abundant sunshine during the entire day and heat is retained during the humid nights. Heat waves occur when an area of high atmospheric pressure stalls over a region. Westchester County with its warm summer seasons is susceptible to heat waves of this type.

High temperature hazard has occurred frequently in recent years for the entire planning area during the hot summer months, and affects senior residents and those with health problems. The highest recorded temperature since 1869 was 106.5° in 1936 for New York City. The summer of 1999 was one of the hottest periods on record for the New York City area, when they experienced 27 days of 90 degree weather or higher.

Extreme high temperatures also result in power failures due to the high demand for air conditioning during heat waves (See Section 4.D.6.1 below). Power outages during heat waves have become a common occurrence in New York City and Westchester County. Although blackouts and brownouts may be frequent, their direct effect on health, safety and structures is not severe. During extended power failures, the lack of refrigeration results in food spoilage in homes and markets, transportation problems, closing of schools and businesses, as well as great financial losses. Power failures can put the sick or infirmed at risk. Extended power failures associated with brownouts and blackouts have resulted in significant property damage in New York City and Westchester County. The probability of power failures due to heat or storms is high for the Village.

Although heat hazards may be frequent, its direct effects on health, safety is limited. It often has impacts on infrastructures such as utilities. Heat waves cover a wide regional area and are not restricted to the Village. However extreme temperatures have a potential to cause illness and death for sensitive populations such as the chronically ill and elderly. There is a high probability for future heat events in Westchester County. A warning system for this hazard is handled through the National Weather Service.

No significant property damage has been reported from past heat waves. Interruption of services and businesses is limited and primarily due to electrical utility failures. No further health and safety assessments and damage analysis for extreme temperatures will be performed, and no mitigation measures will be proposed or evaluated.

4.D.5.5 Drought

Hazard Summary: A drought occurs when a long period of time passes without any substantial precipitation. Droughts can occur at any time of the year. A prolonged drought can have serious economic impacts on an area. Agricultural production can be damaged or destroyed by loss of crops or livestock, resulting in food shortages. Increased demand for water and electricity can result in shortages of these resources particularly those serving the Village area. Lack of precipitation, accompanied by extreme heat can increase the risk of wildfires and heat stress. Health impacts are worse on the elderly, small children, and immune deficient. A drought is a regional hazard and would impact the entire Village area. A severe drought during the summer

of 1999 affected most of the northeast. Damage of over 1 billion in agricultural losses and 502 deaths occurred in the eastern US. There is a high probability of a future drought. The magnitude and severity on the Village area would be low if water conservation measures are enforced.

Sources of information related to drought are given in see Section 11, References Cited and include: Local Papers; Journal News, NY Times; Climate change documents; National Climate Data Center website; Accuweather website.

Profile Details: Drought impacts are regional and Village wide. The heat wave during the summer of 1999 (see above) led to a major drought, which affected most of the Northeast. It was reportedly the worst drought in the United States since the Dust Bowl of the late 1930s. In New York City, combined rainfall amounts were almost 8 inches below normal for the summer months, and reservoir levels were 15% below normal.

Homeowners were requested not to water their lawns, wash cars, or refill their swimming pools in the New York area. Widespread ground fires broke out in the Hudson Highlands. This drought was blamed for over $1 billion in agricultural losses and an estimated 502 deaths in the eastern United States. (NOAA/NCDC, 2006) a drought is an emergency that can lead to untamed fires. The intense summer drought and responses to it may also have contributed to the outbreak of the West Nile Virus, by affecting the habitat of mosquitoes and crows carrying the virus.
There is a high probability of future drought event: A warning system is handled through the National Weather Service. No significant property damage in the Village of Mamaroneck was reported from drought. Interruption of services and businesses is regional and primarily due to electrical utility failures and water shortage. Due to its low hazard rating, no further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.5.6 Landslides

Hazard Summary: A landslide is a downward and outward movement of loosened rocks or earth down a hillside or slope. According to the NYS Hazard Mitigation Plan, the landslide is identified as a hazard of concern for New York State. However, most of Westchester County is

located in a low landslide incidence area. 11 landslides occurred from 1837 to 2007 in the County. According to the USGS, the Village of Mamaroneck has a low landslide incidence.

This hazard was ranked as a moderately low hazard. No further health and safety assessments and damage analysis will be performed in Section 5, and no mitigation measures will be proposed or evaluated.

Sources of information on landslide hazards are given in see Section 11, References Cited and include: Village Officials; NY State Hazard Mitigation Plan; USGS Landslide Hazards Program.

4.D.5.7 The Effect of Climate Change on Natural Hazards

Heavier rainfall events have occurred in the United States over the last few decades with increasing incidence of devastating floods. Although no single storm can be attributed directly to global warming, changing climate conditions have affected weather trends. Warmer air can hold more moisture so that the atmosphere will have more water available for rain. Therefore heavier and more precipitation is expected in the future. Climate models project increased rainfall rates in hurricanes. This increased rainfall can lead to stronger hurricanes and rising sea levels for the U.S. Gulf and Atlantic Coasts. In addition, snowfall pattern shifts and river ice melting changes may exacerbate flooding risks.

Although there are conflicting reports on the extent of the impact of climate change, models suggest heavier rainfall, stronger hurricanes, rising sea levels, more extreme heatwaves, and an increase in droughts and wildfires.

Sources of information on the effects of climate change are given in Section 11. References Cited and include: U.S. Environmental Protection Agency, "Climate Change Indicators in the United States" EPA 430-R-10-007, April 2010. www.epa.gov/climatechange/indicators.html ; NY State Climate Action Council, "New York State Climate Action Plan Interim Report", November 9, 2010. http://www.nyclimatechange.us/InterimReport.cfm

4.D.6 Technological Hazards

Technological hazards such as regional utility blackouts, hazardous material releases, oil spills, air contamination, explosions, fires, civil unrest and terrorism are a community concern.

4.D.6.1 Utility Failures

Hazard Summary: Utility Failure refers to periodic cessation of electrical or communication services due to adverse weather conditions, human error or mechanical failure. These failures can cover an entire region such as northeastern United States, the Village or just a few blocks of the Village. The most frequent causes of outages are severe storms that damage power lines or heat waves that overload power equipment. In 2006 a multitude of utility failures occurred in Westchester County. The summer of 1999 brought 27 days of 90+ degree days, causing rolling blackouts to the area. Impacts from power outages are severe and affect businesses, emergency services, health and safety of the elderly and the ill, rail transportation, communication, food preservation and numerous other impacts. The probability of future events is high. The magnitude and severity of utility failures can be high depending on the area covered by a blackout, the population affected and its duration. Con Edison is in the process of upgrading their distribution system, and has been coordinating their efforts with local municipal officials.

Sources of information are given in Section 11, References Cited and include: Con Edison website, press releases and studies; Larchmont-Mamaroneck Patch, Sound and Town, NY Times, Journal News.

Profile Details: Consolidated Edison is the primary supplier of electricity to the Village. Con Edison has significant problems related to electricity supply and demand. Utility failures have occurred during severe storms such as hurricanes, northeasters, electrical storms, windstorms, tornados, heat waves, and snowstorms (See Sections 4.D.3 and 4.D.5 above). Power outages due to heat waves are a common occurrence in NYC and Westchester County. The breakage of utility poles or power lines is a major cause of electrical failures in local areas during storms. Storm related damage has sometimes required help from other utilities outside our region in order to restore power.

Con Edison serves approximately 349,000 residential and commercial electric customers, and 232,000 residential and commercial gas customers in Westchester County. It is estimated that there are approximately 8,000 electrical customers in the Village of Mamaroneck. Their service area encompasses 310 square miles, 15,089 miles of overhead wires, 6452 miles of underground cable, and 91,593 utility poles. Most notable outages are listed below.

On August 14, 2003, there was a mass power outage that swept across the entire Northeastern United States. FEMA declared an emergency declaration for New York State allotting $5 million for public assistance relief. (EM-3186).

In 2006 alone, a multitude of utility failures occurred in Westchester County:

- January 18-22, 2006: Thunderstorm, wind and rain storms occurred in Westchester County which uprooted trees and 61,486 Con Edison customers lost power. (Con Edison: January 18-22, 2006 Westchester County Severe Wind and Rain Storm. www.dps.state.ny.us/conediso-january2006stormreport.pdf)
- July 12, 2006: Severe thunderstorms that accompanied a tornado caused approximately 4,000 households in Westchester County to lose power.
- July 17, 2006: Heat wave caused 10,000 households in Westchester County to lose power. High-energy consumption and an overloaded transformer were blamed for this power outage.
- July 18, 2006: Severe storm caused an additional 35,000 households in Westchester County to lose power.
- July 21, 2006: Storm caused an additional 9,500 households in Westchester to lost power.
- July 22, 2006: An additional 6,000 Westchester households lost power.
- September 2, 2006: The remnants of Tropical Storm Ernesto caused approximately 80,000 households in Westchester County to lose power.

On September 14, 2006, Con Edison representatives met with several Westchester municipal officials to discuss Con Edison's response to the 2006 power outages, and to discuss solutions and future plans. Con Edison agreed to work with the municipal officials on improving response to power outages.

Regarding structural improvements, Con Edison was asked about the feasibility of moving the power lines underground. Con Edison replied that this can be accomplished by a) burying the existing system underground at an estimated cost of $5 billion; or b) Installing a new underground system costing $50 billion, plus the additional cost of burying the telephone and cable lines. Every street in Westchester County would have to be excavated, which would create major construction disruptions, environmental, and safety issues. Con Edison stated that neither method is being considered.

On June 27, 2007 a series of violent storms occurred in the area. Heavy rain and wind toppled trees and power lines causing severe damage to the electrical system, resulting in power outages throughout New York City and Westchester County. Con Edison reported that Mamaroneck, New Rochelle, White Plains, Rye, Rye Brook, Scarsdale, Greenburg, and Harrison were among the hardest hit communities of Westchester County, estimating up to 10,000 households lost power in those areas. Several homes were reported to be struck by lightning in Mamaroneck, New Rochelle, and Rye.

The Nor'easter of March 2010 knocked out power to approximately 173,000 households in Westchester County and New York City. Con Edison reported 650 households without power in the Village of Mamaroneck.

Tropical Storm Irene, which occurred on August 23, 2011, knocked out power to approximately 183,000 households in Westchester County and New York City. Con Edison reported approximately 4,100 households without power in Mamaroneck.

The Village of Mamaroneck has auxiliary power supplied by generators at the police, fire, EMS, and DPW facilities. Their fuel pumps also have auxiliary generators to allow vehicles to function during an emergency.

Con Edison is reported to be upgrading their distribution system, and is coordinating their efforts with local municipal officials. No further health and safety assessments and damage analysis will be performed related to utility failures, and no mitigation measures will be proposed or evaluated.

4.D.6.2 Hazardous Materials Fixed Site Releases

Hazard Summary: This hazard is the release of any substance or material that when involved in an accident and released in sufficient quantities, poses a risk to people's health, safety, and/or property. These substances and materials include explosives, radioactive materials, flammable liquids or solids, combustible liquids or solids, poisons, oxidizers, toxins, and corrosive materials. Release of these materials from a business or industrial operation can impact the health and safety of workers and people near the facility. There are a few commercial enterprises that require the storage of chemicals and generate hazardous wastes in the Village of Mamaroneck (See Figure 4-10). Most of the reported materials and wastes are small quantities and are not likely to result in major loss of property and life. Therefore, the magnitude and severity of the hazard would be restricted to local sites in the Village. The location of these sites is mostly in the industrial and manufacturing sections of the Village. These areas likely have the highest risk of a hazardous materials incident. Relatively few significant releases that would affect the pubic and require evacuation have been reported in the Village. The risk is considered to be moderately low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information are given in Section 11, References Cited include: Conversations with Village Officials; Incident Reports from Village of Mamaroneck Fire Department; Westchester County GIS website; EPA Enviromapper website.

Profile Details: The Federal Community Right-to-Know law is enforced by New York State and requires businesses and industries to maintain inventories of hazardous materials. The USEPA and NYS Department of Environmental Conservation closely regulate hazardous wastes and require the reporting of these wastes that are stored on-site. Should there be any dangerous releases of these materials; the Village of Mamaroneck's Police Department is the first notification for all emergencies. The Fire Department, Ambulance, and Village Administration are also integrated with the Village's Police Department's Major Incident Response Plan.

Hazardous materials can be explosive, inflammable and combustible, toxic, and radioactive. Hazardous materials are manufactured, used or stored at an estimated 4.5 million facilities in the United States, and the "hazardous materials label" can be applied to more than 500,000 products.

Hazardous material release from fixed facilities is a hazard of concern. There are a number of commercial enterprises that require the storage of chemicals and generate hazardous wastes in the Village of Mamaroneck (See Figure 4-9).

The Village of Mamaroneck has seen relatively few occurrences of the release of hazardous materials from a fixed site. According to the Village of Mamaroneck Fire Department, there were only three occurrences in the past several years. All releases were controlled and confined, with no major injuries.

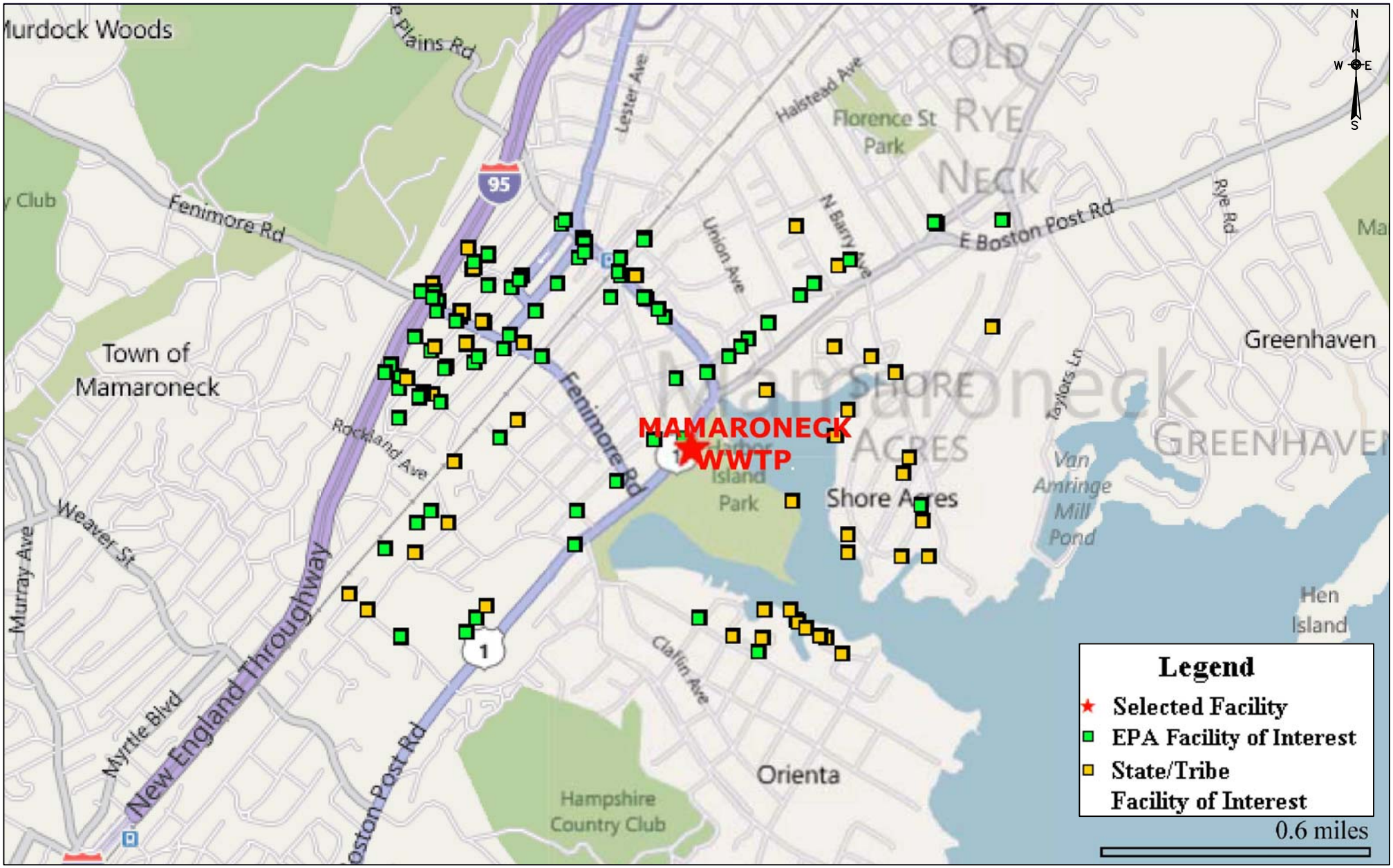
On August 24, 2005 there was a small chemical spill at Mamaroneck High School, located at 950 Mamaroneck Avenue. Nitric acid, turpentine, and sodium bicarbonate were spilled when a cart was knocked over.

On August 3, 2006 there was a small fire in the chemical cabinet of National Photocolor Corporation, located at 428 Waverly Ave. A small release of toxic byproducts occurred.

On April 16, 2009 there was a chemical leak at Arctic Glacier Ice, located at 500 Fenimore Road. An ammonal leak occurred from a storage tank on the premises.

Most of the reported materials and wastes are small quantities and are not likely to result in major loss of property and life. The location of these sites is mostly in the industrial and manufacturing area of the Village. These areas likely have the highest risk of a hazardous materials incident.

Hazardous material releases in the Village of Mamaroneck can occur from activities such as dry cleaning, auto repair and repainting, home building and maintenance, and small quantity home use of chemicals. There is no major manufacturing of hazardous materials in the Village. There could be a problem if materials used in commercial facilities and homes are spilled, a tank or pipe breaks or leaks, a fire occurs in a facility containing hazardous substances, or if an accident occurs during transportation and delivery of fuels. This transportation issue is discussed below with oil spills.



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Project Name
Incorporated Village of Mamaroneck
Multi-Hazard Mitigation Plan

Figure Title
Hazardous Materials Locations
Village of Mamaroneck, NY

Figure 4-10
DWN BY: AJZ
CHK BY: JB
SCALE: AS SHOWN
DATE: 4/27/12

The frequency of hazardous materials distributed in the Village 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. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.6.3 Hazardous Materials Transport Releases

Hazard Summary: Hazardous materials can be explosive, flammable and combustible, toxic, and radioactive. Release of these materials during transport within or through the Village can impact the health and safety of Village residents. 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, 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. Hazardous materials spills or accidents could also occur at one of the many fixed sites located throughout the village where hazardous materials are used or stored, such as in the marinas and boat yards. No significant releases that would affect the pubic and require evacuation have been reported in the Village of Mamaroneck. Therefore, the magnitude and severity of the hazard is expected to be limited to local areas.

Sources of information are given in Section 11, References Cited include: Westchester County GIS website; Incident Reports from Village of Mamaroneck Fire Department; Metro-North Website; Conrail website; Village of Mamaroneck Emergency Preparedness Plan.

Profile Details: There are nearly 7,000 hazardous material incidents ever year in the United States on average, most of which are on the highway. U.S. Department of Transportation regulates the transport of hazardous materials and has procedures in place to mitigate hazardous spills. These procedures involve the local fire and public safety departments.

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, 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. Hazardous materials spills or accidents could also occur at one of the many fixed sites located throughout the village where hazardous materials are used or stored, such as in the marinas and boat yards. No significant releases that would affect the pubic and require evacuation have been reported in the Village of Mamaroneck. Therefore, the magnitude and severity of the hazard is expected to be limited to local areas.

The Village of Mamaroneck would rely on the Westchester County Hazardous Materials Response Team as its primary agency to respond to and coordinate the control and cleanup of any hazardous materials event.

The risk is considered to be moderately low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.6.4 Fuel Oil Spills

Hazard Summary: Fuel oil spills are defined as the uncontrolled or accidental discharge of petroleum into water and/or onto land or sea. 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 pubic 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.

The risk is considered to be moderately low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information are given in see Section 11, References Cited and include: EPA Enviromapper website; Westchester County GIS website; USDOT website;

Profile Details: Local oil spill problems have typically only occurred during deliveries to residences or in one of the marinas. The U.S. Department of Transportation regulates the transport of hazardous materials and has procedures in place to mitigate hazardous spills. These procedures involve the local Police, fire and public safety departments.

Fuel oil spills would result in limited damage to property, buildings and limited injury, illness, and mortality. The primary concern would be fire and explosion incidents. The risk is considered to be moderately low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.6.5 Air Contamination

Hazard Summary: Air contamination is the result of emissions chemicals from industry, transportation into the air. Air contamination events in the Village, 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 risks are related to regional problems, rather than local sources. Air contamination in the Village is considered to be a low risk hazard. Region wide ozone alerts are generated by the National Weather service. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information are given in Section 11, References Cited and include: EPA Enviromapper website; Westchester County GIS website; Accuweather website.

Profile Details: The small commercial and light manufacturing establishments in the Village of Mamaroneck would not cause an air pollution problem of significant concern. Regional air episodes such as ozone alerts occur over the New York City Metropolitan area that does affect Mamaroneck. These alerts are often associated with hot weather. These episodes would have the greatest impact on senior residents and those that have respiratory, heart or other problems.

Events in the Village, due to local sources, are small and isolated and do not represent a major increase in health and safety risks to local residents. These risks are related to regional problems, rather than local sources. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

4.D.6.6 Transportation Accidents – Highway

Hazard Summary: A transportation accident is defined as a mishap involving one or more conveyances on land, sea, and/or in the air that results in mass casualties and/or substantial loss of property. Transportation accidents happen on a regular basis on most highways. However, an abundance of accidents have occurred on Interstate I-95 between mile marker 9.5 and mile marker 10, both Northbound and Southbound. This area is a stretch of curving roadway from Mamaroneck Avenue down to Old White Plains Road. Mile marker 9.8 is in the middle of the curve, and has been particularly dangerous. There are identical curves on the northbound and southbound sides of I-95.

Sources of information are given in Section 11, References Cited and include: Conversations with Village Officials; local newspapers and websites: Larchmont-Mamaroneck Patch, The Loop, Sound and Town, NY Times, Journal News; NYS Thruway Authority via NYS Freedom of Information Law (FOIL)

Profile details: There have been an abundance of transportation accidents on I-95 between Mile Markers 9.5 and 10.0, particularly at the curve of Mile Marker 9.8. When it rains or snows, these sections of I-95 become extremely slippery, causing many accidents. The stretch of roadway is difficult to navigate even when the road conditions are dry.

According to statistics obtained through the New York State Freedom of Information Law (FOIL) from the NYS Thruway Authority, 13 accidents took place between mile markers 9.5 and 10.0 on the Northbound side of I-95, and 25 accidents took place on the Southbound side of I-95 in 2010. 4 of the 13 accidents on the Northbound side occurred when the road was wet; 6 of the 25 accidents on the Southbound side occurred when the road was wet. From January 1st to June 30, 2011, 8 accidents took place between mile markers 9.5 and 10.0 on the Northbound side of I-95, and 12 accidents took place on the Southbound side. 5 of the 8 accidents on the Northbound side occurred when the road was wet; 1 of the 12 accidents on the Southbound side occurred when the road was wet.

It is reported that the surface of the curved roadway was resurfaced some years ago using concrete instead of blacktop. The road got noisier and instead of resurfacing with blacktop, they

used diamond grinding, which cut grooves into the road that was supposed to quiet things down. When the diamond grinding wore down, it created a smooth surface which would become extremely slick when wet.

The NYS Thruway Authority laid down a coating of pavement at the 9.8 mile marker on the Southbound side of I-95. The Northbound side, however, has not been repaved. The roadway is owned by the NYS Thruway Authority.

4.D.6.7 Fires

Hazard Summary: Fire hazards result from uncontrolled combustion of materials, buildings or other structures that threaten human life and property. Fires have occurred in residences and commercial establishments in the Village. Based on the frequency of calls and alarms and the likelihood that a fire would affect more than one building and that there is a strong chance that serious injury or death could occur, the hazard was ranked moderately low. Since the incidents are localized to individual buildings the magnitude and severity of large village area fire is considered to be low. Although most fires that have occurred are structural fires, there have been incidences of wildfire hazard, in the form of a brush fire at Saxon Woods Park. No further health and safety assessments and damage analysis will be performed, and no mitigation measures specific to fire hazards will be proposed or evaluated.

Sources of information: Village officials, Planning Committee; Incident Reports from Village of Mamaroneck Fire Department; NYS Division of Homeland Security and Emergency Services, Office of Fire Prevention and Control Summary of All Calls by Type of Situation Found for Mamaroneck Village.

Profile Details: Fire can always occur in residences and commercial establishments. This hazard was rated 240 with a rank of 4 in the HAZNY analysis. Most fires occurring in the Village of Mamaroneck are structural fires. There are limited incidences of fires occurring in natural areas in the village, which could be a concern as a wildfire hazard. A brush fire occurred in Saxon Woods Park on April 21, 2011. A small brushfire broke out behind the track area of Mamaroneck High School. Village fires are random occurrences that are routinely handled by the Fire Department. Fire was ranked high in the HAZNY because of the likelihood that a fire

would affect more than one building and that there is a strong chance that serious injury or death could occur. In addition, fire would cause severe property damage.

According to the Village of Mamaroneck Fire Department, the following fires have occurred in the Village in the last five years:

Type of Situation	2006	2007	2008	2009	2010
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

No further health and safety assessments and damage analysis will be performed, and no mitigation measures specific to fire hazards will be proposed or evaluated.

4.D.7 Human-Caused Hazards

4.D.7.1 Civil Unrest

Hazard Summary: Civil unrest may include unruly or violent crowds during public events, and political protests. Civil unrest could include racial, ethnic or political group protests or demonstrations. Although such events can occur any place, the likelihood of civil unrest occurring in the Village of Mamaroneck is low, given the suburban demographics. Historically, civil unrest has not been an issue for the Village. The local Police, Fire and Public Safety Departments can handle the potential for civilians causing local damage. Random events can be a potential concern. There have been limited incidences of very minor civil unrest, relating to the issue of the pickup site for illegal immigrant workers. The Village Police Department controlled the situation. There is no history of significant civil unrest that would cause damage to property and injury to numbers of people is low. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Sources of information: Conversations with Village Officials; Village of Mamaroneck Hazard Mitigation Plan, February 2008

4.D.7.2 Terrorism

Hazard Summary: Although acts of terrorism are possible anywhere in Westchester County, this hazard would be less likely in the Village of Mamaroneck. There are no major terrorist targets of interest identified in the Village such as key target populations, high profile historical landmarks, airports, significant infrastructures, important facilities, critical industries or major government institutions and structures. Possible targets for terrorism located in the Village include the Westchester County Department of Environmental Facilities Wastewater Treatment Plant, four Thruway bridges, and six Metro North bridges. The rail station in the Village of Mamaroneck is a possible target. Railroad facilities have been targets in recent years in European cities. Another target is the Kensico Dam located further north near Valhalla. The effects of failure of the Dam are discussed in section 4.D.5.1 of this report. Because of the absence of important target facilities and key populations, this hazard was not considered significant enough for further evaluation or analysis.

Sources of information: Discussions with Village officials; NY Times; Journal News.

4.E Elimination of Hazards

Several Hazards were eliminated from a detailed risk and damage assessment and evaluation of mitigation measures after an initial profile assessment and discussions with the Committee. These include:

Tornadoes: Tornadoes are not a frequent hazard. Only 8 tornadoes documented since 1958, and they are scattered geographically. None of the 8 occurred in Mamaroneck. Tornadoes have a moderately low hazard rating and are also associated with other severe storm hazards, so they were not evaluated separately from other wind hazards in this plan.

Dam Failure: The New York City Dept. of Environmental Protection (NYCDEP) protects the Kensico Reservoir. After September 11, 2001, the Dept of Public Safety created Westchester County's Office of Intelligence, Security, and Counter-Terrorism (ISCT). The ICST is working with the NYCDEP and has made significant security improvements at the Kensico Dam. The Larchmont Dam is located on the Sheldrake River, and the Mamaroneck River Dam is located behind the Westchester Joint Waterworks. Should either of these dams fail, flooding would

occur to the Village. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated. Updates to this plan will evaluate mitigation measures for this hazard as necessary.

Earthquakes: Based on information given in the hazard profile, an earthquake event in Westchester would cause only minor damage and would be a relatively rare event. An event is unlikely to have any impact on the critical facilities, local economics, or key cultural or historical resources. This hazard has a low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated. Updates to this plan will evaluate mitigation measures for this hazard as necessary.

Epidemic: Should an epidemic occur, it would most likely be affect the region and not just the Village. No special mitigation measures beyond current state or county public health activities are called for. This hazard has a low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Extreme Temperatures: No significant property damage was reported from heat waves. Interruption of services and businesses is limited and primarily due to electrical utility failures. This hazard has a moderately low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Drought: No significant property damage in the Village of Mamaroneck was reported from drought. Interruption of services and businesses is regional and primarily due to electrical utility failures and water shortage. Due to its low hazard rating, no further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Hazardous Material Releases (Fixed and In transit): The frequency of hazardous materials distributed in the Village 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. These hazards have moderately low hazard ratings. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be

proposed. Mitigation measures will be evaluated in Section 7 since they are needed as part of the Village emergency planning requirements.

Fuel Oil Spills: These spills would result in limited damage to buildings and limited injury, illness, and mortality. Hazard issues are the same as those for hazardous material releases. This hazard has a moderately low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Air contamination: Events in the Village due to local sources are small and isolated and do not represent a major increase in health and safety risks to local residents. These risks are related to regional problems, rather than local sources. This hazard has a low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Explosions: Information provided indicate explosion hazards are primarily related to handling and transport of fuels and are discussed under fuel spills and hazardous material hazards. Explosion hazards were ranked moderately low. Therefore, no further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Fire: Building fire hazards are not considered significantly different from neighboring communities. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Civil Unrest: Random events can be a potential concern. There is no history of significant civil unrest that would cause damage to property and injury to numbers of people is low. This hazard has a low hazard rating. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.

Terrorism: There is an absence of important target facilities and key vulnerable populations in the Village. No further health and safety assessments and damage analysis will be performed, and no mitigation measures will be proposed or evaluated.