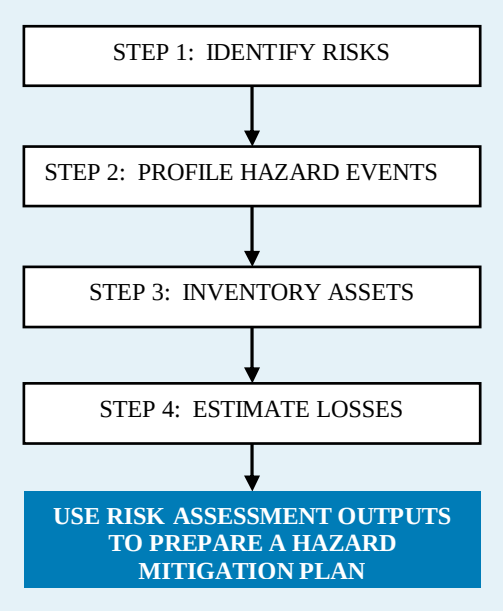
SECTION 4 - RISK ASSESSMENT

This section addresses the risk assessment portion for natural hazards of the mitigation plan. The risk assessment process used for this pilot project is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, *Understanding Your Risks – Identifying Hazards and Estimating Losses* (FEMA 2001). Figure 4-1 shows the steps that comprise the risk assessment process. The risk assessment process considers the assets that are at risk in the community and what assets could be damaged or lost should a hazard event occur. This analysis allows the community to make informed decisions to compare hazards and guide its mitigation strategy (Section 5 of this plan).

This section describes the identification of hazards, presents profiles of hazards of concern, summarizes the inventory of assets, and presents the loss estimates for the Town of Clay's Risk Assessment. The risk assessment was developed to evaluate natural hazards of primary concern to local decision-makers and to estimate potential damages and losses. This risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs. To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, the Town of Clay used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Two standardized tools used to support the risk assessment are introduced below.

Figure 4-1-1. Risk Assessment Process



Hazards NY (HAZNY)

HAZNY is an automated interactive spreadsheet designed to support communities in evaluating hazards that could be a concern. This tool was developed by NY NYSEMO and the American Red Cross to support consistent identification and ranking of hazards across the state. HAZNY as a key input includes historical and expert data on selected hazards. HAZNY is designed specifically for group, rather than individual, use and was prepared for use at a municipal, rather than county level. Therefore, the Planning Group applied the software and then average values were evaluated by the group. The program interface asks specific questions about potential hazards in a community and records and evaluates the responses to these questions to prepare a preliminary score for each hazard. This score helps the community to develop an initial ranking of the priority of each hazard. This plan used HAZNY as a key input to identify and profile hazards; this process included a consideration of background and local conditions, historic frequency and probability of occurrence, severity, historic losses and impacts, and designated hazard areas. It also identified the potential impact, onset, frequency, hazard duration, cascading effects and recovery time for each hazard. Additional information on the methodology and results associated with HAZNY are discussed in Section 4.2.

Hazards U.S. – Multi-Hazard (HAZUS-MH)

HAZUS-MH is a nationally applicable, standardized methodology and software program for estimating potential losses from earthquake, flood, and hurricane hazards. HAZUS-MH was developed by FEMA in partnership with the National Institute of Building Sciences. Loss estimates produced with HAZUS-MH

are based on current scientific and engineering knowledge. HAZUS-MH is designed to generate an estimate of the consequences to a city or a region of a "hazard event" (i.e., an earthquake, flood or a hurricane of a given severity and location) or for probabilistic events (i.e., a flood that has an annual probability of occurrence of 0.01 percent). The resulting "loss estimate" describes the scale and extent of damage and disruption that may result from different hazards. To generate this information, the software uses HAZUS-MH provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. The guidance *Using HAZUS-MH for Risk Assessment: How-to Guide* (FEMA 433) was used to support application of HAZUS-MH for this risk assessment and plan.

Two methodologies were used to assess potential exposure and losses associated with natural hazards of concern to the Town of Clay. These both used HAZUS-MH to some extent and are summarized below:

- **HAZUS-MH** was applied using HAZUS-MH software and associated tools to estimate losses associated with the flood and hurricane hazards. (Note: Hurricanes are considered unlikely to impact the Town of Clay at full force so the risks associated with the hurricane hazard are primarily considered to include wind and are integrated for presentation with the severe storm hazard, which also includes severe windstorms, thunderstorms, hailstorms, and tornadoes.)

- **HAZUS-MH support** was used to evaluate other hazards, as feasible. For some of the hazards evaluated in this risk assessment, historic data was not considered adequate to model future losses at this time. However, HAZUS-MH can map hazard areas and calculate exposures if geographic information on the locations of the hazards and inventory data are available. For some of the other hazards of concern, areas and inventory susceptible to specific hazards were mapped and exposure was evaluated to help guide mitigation efforts discussed in Section 5. For still other hazards, a qualitative analysis was conducted using the best available data and professional judgment. This approach was applied to six (6) hazards of concern, including the following:

  - Severe Storm (wind)
  - Severe Winter Storm (snow)
  - Ice Storm
  - Extreme Temperatures
  - Fire (urban and wild)
  - Infestation (primarily disease-carrying mosquitoes)

In addition, this approach was applied to the non-hurricane components of the severe storm hazard. For this risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

1) Approximations and simplifications necessary to conduct such a study
2) Incomplete or dated inventory, demographic, or economic parameter data
3) The unique nature, geographic extent, and severity of each hazard
4) Mitigation measures already employed by the Town of Clay and the amount of advance notice residents have to prepare for a specific hazard event

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and are used to understand relative risk. Over the long term, the Town of Clay will collect

additional data to assist in estimating and refining loss estimates associated with hazards of concern (see Section 6.0, "Plan Maintenance Procedures").

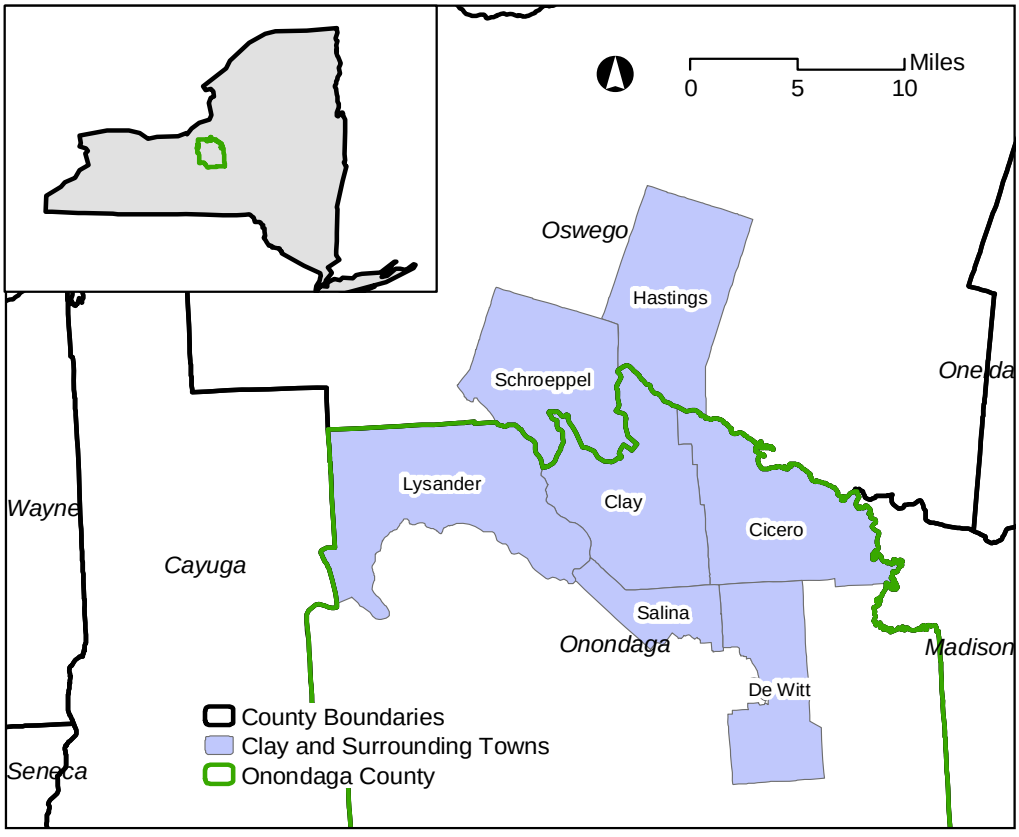
4.1 Identification of Hazards

The natural hazard identification process included identifying an initial list of hazards and then selecting the hazards of concern for the area. Natural (e.g., flood, ice storms) hazards were selected for further profiling and assessment. This section 1) presents background information for the Town of Clay, and 2) identifies hazards of concern identified for the study area.

4.1.1 Background of the Town of Clay

The Town of Clay is located in northern Onondaga County in central New York, approximately 250 miles northwest of New York City. It is bordered by the Town of Cicero to the east; the Town of Salina to the south; the Town of Lysander to the west; the Towns of Schroeppel and Hastings to the north; and the Village of North Syracuse to the south (see Figure 4-1-2) The town boundary contains a portion of the Village of North Syracuse. The Town of Clay occupies approximately 48.8 square miles and includes a population of approximately 60,000 (2003 Town of Clay est.; 58,805 per 2000 U.S. Census), making it the 17th largest town in New York State.

Figure 4-1-2 Regional Municipal and County Boundaries



Approximately 1.1 % of the total area of the Town of Clay is covered by water, while 5.8% is covered by wetlands. The town is delimited in the west by the Seneca River and in the north by the Oneida River. As described in the March, 1992 FEMA Flood Insurance Study for the Town of Clay, the major stream

within the Town of Clay is Mud Creek (see Figure 4-1-3). Together with its tributaries, Mud Creek drains the central and southern portions of the town north to the Oneida River. The northeast and southwest corners of the town are directly tributary to the Oneida and Seneca Rivers, respectively. The northwest corner of the town (Horseshoe Island area) is directly tributary to both the Seneca and Oneida Rivers as they join at the Three Rivers area to form the Oswego River.

Elevations within the Town of Clay vary from 365 to 490 feet. Topography of the town varies from the hills of the Appalachian Upland in the southern portion of the town, to the level areas of the Erie-Ontario Lowland in the northern portion of the town. The topography of the town is gently rolling with a slight slope towards the northern boundary of the town. Throughout the town, the predominant soil group is, as the name implies, clay. Other areas within the community have silty soils, while swampy areas contain peat and muck.

The Town of Clay contains a mixture of rural and suburban landscapes. The northern portion of town and the areas surrounding the Clay Marsh (aka Hamlin Marsh, Peat Swamp) are primarily rural, while the southern portion of town is primarily developed with a mixture of residential and commercial development, as well as two major industrial/business parks.

Repetitive flooding, severe winter storms, and severe non-winter storms (including severe windstorms, hurricanes, and thunderstorms) are major persistent hazards that affect the area and result in repetitive losses and rehabilitation costs. Onondaga County has received numerous Presidential Disaster Declarations for flooding and other severe events, as summarized in Table 4-1-1 for the years 1972 to 2003.

Table 4-1-1. Presidential Disaster Declarations for Onondaga County (1972 to 2003)

Type of Event	Date	Declaration Number	Cost of Losses (approx.)
Tropical Storm	June 1972	DR 338	$82,099.88
Heavy Rain	October 1975	FDAA 487 DR	$1,581.60
Blizzard	March 1993	FEMA 3107 EM NY	$72,510.35
Storm	September 1998	FEMA 1244 DR NY	$579,253.38
Storm / Flooding	May 2000	FEMA 1335 DR NY	$19,748.91
Ice Storm	April 2003	FEMA 1467 DR NY	$155,659.62
Total Cost			$910,853.74

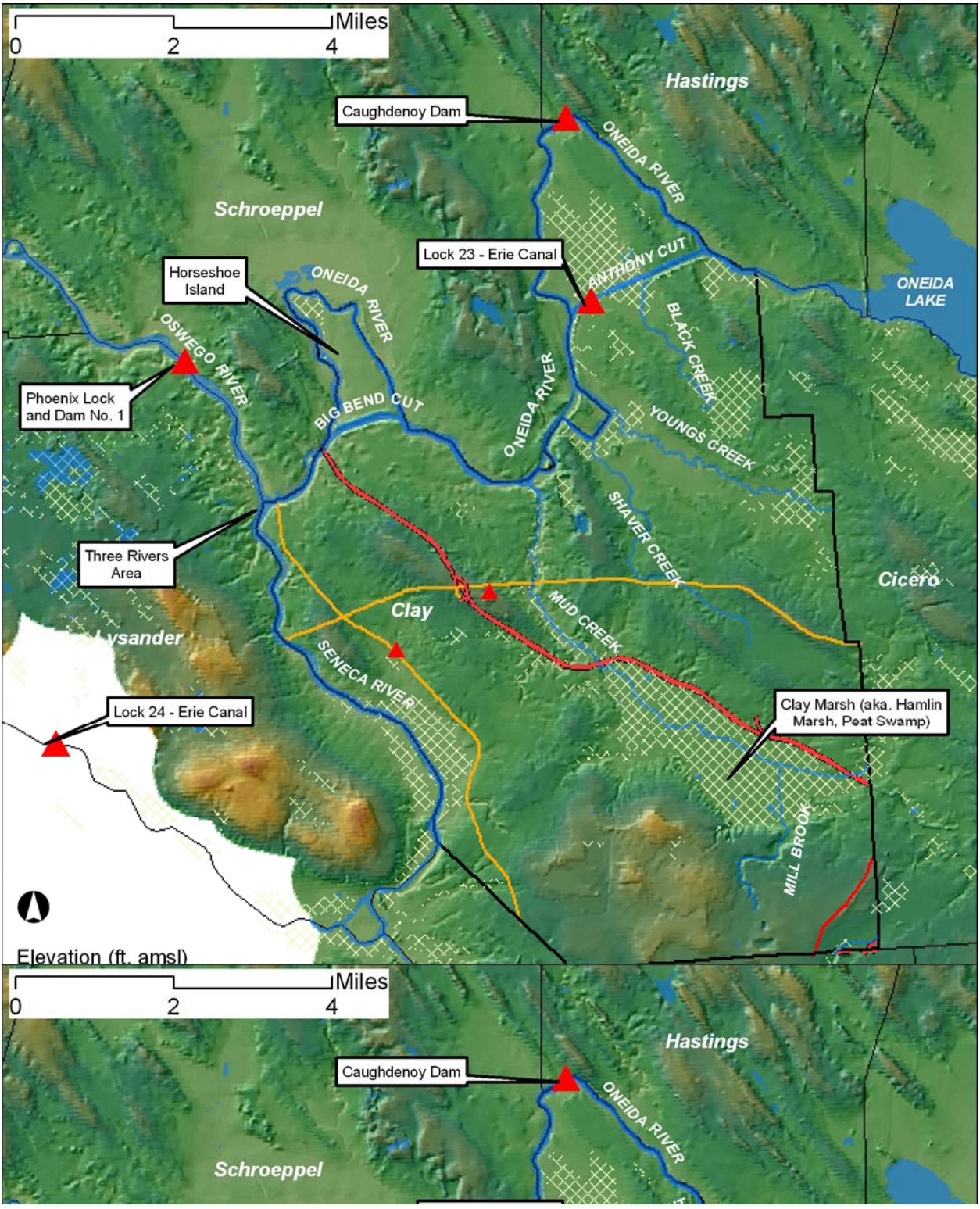
Notes: Recorded losses indicate the dollar value of loss made available through public records reviewed for this risk assessment. Source: FEMA website (http://www.fema.gov/library/drcys.shtm)

A *Major Disaster Declaration* is a post-disaster status requested by a state's governor when local and state resources are not sufficient to meet disaster needs. It is based on the damage assessment and an agreement to commit state funds and resources to the long-term recovery. The event must clearly exceed the capacity of the state or local government to manage the event alone.

A *Presidential Disaster Declaration* puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities in the areas of human services, public assistance (infrastructure support), and hazard mitigation. If declared, funding comes from the President's Disaster Relief Fund and disaster aid programs of other participating federal agencies.

Extreme weather events can have cascading effects; for example, severe weather can cause technological hazard events like utility failures in the town. During the late autumn and winter, when cold arctic air sweeps across the Great Lakes of North America, snow squalls may form along the lee shores of the Lakes. These squalls can bring locally heavy snowfalls with reduced visibility to a relatively small area. The large cities of Buffalo, Syracuse, and Rochester, New York, Cleveland, Ohio, Erie, Pennsylvania and London, Ontario are all located in major lake-effect snowbelts. Onondaga County's susceptibility to lake effect weather systems increases extreme weather occurrences and the associated impacts. Lake-effect snowstorms account for countless lost work and school days. They necessitate high expenditures for snow removal, create frequent hazardous driving conditions.

Figure 4-1-3. Regional Hydrography, Topography and Major Features



The low permeability, high clay content soils that are ubiquitous throughout the town result in significant volumes of run-off during extreme weather events. Town of Clay residents living along the Seneca and Oneida Rivers are particularly vulnerable to repetitive flooding due to the lack of flood control measures and structures. In addition, the Town of Clay includes over 830 manufactured homes (trailer and similar homes), nearly 500 clustered near the Seneca River, which have an increased vulnerability to extreme weather events. Further, residents in these communities are often less capable of recovering from a hazard event.

4.1.2 Identification of Hazards for the Town of Clay Study Area

Hazards of Interest are those hazards that are considered most likely to impact a community. These are identified using available data and local knowledge.

To provide a strong foundation for mitigation strategies considered in Section 5, the Town of Clay planning group considered a full range of natural hazards that could impact the area, and then identified and ranked those hazards that present the greatest concern to the town. The Town of Clay employed a two-stage hazard identification process, relying on readily available tools, supplemented by local considerations, additional research, and expert input. This process incorporated input from the local decision-makers; hazard screening using an automated hazard scoring model (HAZNY); additional research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural hazards and the perceived vulnerability of the study area's assets to them.

The Town of Clay Planning Group assembled a group of local officials and members of emergency services-related agencies, organizations and homeowner's groups to support the hazard identification process. The process began with significant discussion and input and the application of HAZNY, the statewide hazard screening tool that considers a range of factors that can impact a hazard's importance within a given community. The HAZNY process initially identifies a list of 35 hazards of interest from which the group selects those that are relevant to their study area. The initial HAZNY screening process, conducted on September 29, 2004 with assistance of NYSEMO, discussed the following 25 potential hazards: dam failure, drought, earthquake, explosion, extreme temperatures, fire, flood, hazardous materials (fixed site), hazardous materials (in transit), hurricane, ice jam, ice storm, infestation, oil spill, radiological (fixed site), radiological (in transit), severe storm, structural collapse, terrorism, tornado, transportation accident, utility failure, water supply contamination, wildfire and winter storm (severe).

All relevant hazards for this geographic area were considered. However, some natural hazards (for example, tsunami, avalanche, coastal erosion, and volcanoes) were not considered geographically relevant and therefore, were not considered further as part of this risk assessment. Also, some hazards that could occur in the area were screened out during the initial phase, based on low frequency or impact estimated for this area. Landslide, drought, and earthquake hazards were initially screened out, based on historically low frequency and/or low potential losses for these hazards in the Town of Clay. The basis for screening out these three hazards is presented below.

The Town of Clay lies within an area with low incidence of landslides. Though landslides have been observed sporadically in the region, especially in areas with steeper topography, the events are highly localized and are not considered likely to result in losses or response costs comparable to other hazards in the area.

Drought was not retained as a hazard of concern for further study in this area because of the low probability that a drought would be of a duration long enough to cause significant water supply or other impacts at the municipal level. On average, the study area receives sufficiently large amounts of precipitation annually to avoid long-term droughts. As well, lake effect precipitation associated with study area's proximity to the Great Lakes is expected to provide sufficient moisture to avoid long-term droughts. In addition, sufficient reserves of surface water are available in the region to address the irrigation of crops and livestock, which would be required if a longer-term drought did occur.

The earthquake hazard is not considered a major hazard of concern for this study area. No major faults lie in the study area and, according to earthquake data provided by NYSEMO, peak ground acceleration values (a critical parameter in the prediction of areas subject to major losses associated with earthquakes) for the Onondaga County are in the lowest category on the scale. While the Town has felt earthquake tremors in the past, there are no recorded historic losses of resources or assets in the town and earthquakes are not expected to present a major risk in the future. While earthquakes are possible anywhere, concerns associated with them represent a far lower priority to the Town of Clay than the hazards selected for further evaluation.

The remaining list of 18 hazards identified using the HAZNY model as moderately low to high hazards are presented in Table 4-1-2, in order of their initial HAZNY hazard "score."

Table 4-1-2. Summary of HAZNY Qualitative Hazard Ranking

Ranking	Hazard in this Category	Initial Average Ranking Score
High Hazard	None Identified	N/A
Moderately High Hazard	Severe Storm	312
	Winter Storm (severe)	273
	Ice Storm	261
	Flood	252
Moderately Low Hazard	Tornado	234
	Transportation accident	230
	Extreme Temperatures	218
	Haz-Mat (In Transit)	216
	Utility Failure	209
	Fire (urban and wild)	200
	Terrorism	184
	Infestation	173
	Explosion	172
	Oil Spill	172
Low Hazard	Haz-Mat (Fixed Site)	152
	Drought	144
	Earthquake	144
	Dam Failure	114

Source: Town of Clay HAZNY 2004

After initial hazard identification and HAZNY ranking, the Town of Clay Planning Group and their mitigation consultant discussed the results of the scoring, and applied local knowledge, additional research, and further input to group similar hazards for further evaluation and refine the qualitative ranking of the hazards of concern. Factors considered to support this effort included the potential cascading effects of hazards, hazard groupings that made sense for this study area, additional data, and input regarding the costs associated with previous events.

For the purposes of this analysis, the Planning Group chose to group some hazards based on the similarity of hazard events, their typical concurrance or their impacts. For example, the tornado hazard and high-wind hazard were included in the severe storm hazard. The Planning Group felt that tornados, while exhibiting dramatic and highly localized impacts, occur rather infrequently in the Town of Clay and during severe storm events and that there was no advantage to having it as a separate, distinct hazard within the context of this Plan. Further, the hurricane hazard was grouped within the severe storm hazard as hurricanes historically manifest themselves in this region at sub-hurricane strength, and are experienced as severe storm events. This grouping is not believed to significantly change the definition of these hazards as defined within HAZNY and/or FEMA guidance documents, and consequently for the hazard analysis conducted through the use of HAZUS-MH, either directly or as a risk assessment support tool.

Due to the limited availability of budget resources, this mitigation planning effort has, at least initially, limited consideration to natural hazards and the Hazardous Materials - Fixed Facility hazard. The Town of Clay may attempt to expand the scope of this Plan to include technological and man-made hazards as resources permit.

Based on this hazard identification and ranking process, limited as permitted by DMA 2000, the following list of eight hazards of concern, in order of significance for the study area as a whole, was prepared for further evaluation during the risk assessment:

1) Severe Storm (wind, including hurricane and tornado)
2) Severe Winter Storm (snow)
3) Ice Storm
4) Flood
5) Extreme Temperatures
6) Fire (urban and wild)
7) Infestation (primarily disease-carrying mosquitoes)
8) Hazardous Materials – Fixed Facility

Table 4-1-3 summarizes the 8 hazards selected for further analysis and summarizes historical event data and information sources identified for each hazard. Section 4.2 provides detailed profiles of each of these hazards, grouped in the order presented in Table 4-1-3.

Table 4-1-3. Summary of Hazards of Greatest Concern in the Town of Clay and Onondaga County Area

Hazard	Years	# of Events	Impacts	Available Data Sources and Maps
Severe storm (wind, including hurricane and tornado)	12	76	$98,000,000	NOAA NCDC, NWS
Severe winter storm (snow)	11	66	$73,000 (Clay, 1993)	NOAA NCDC, NWS
Ice Storm	12	5	$155,700 (Clay, 2003)	NOAA NCDC
Flood	8	18	$10,000,000	NOAA NCDC, NWS, FEMA
Extreme Temperatures	55	13	$400,000 (County, 2004)	NOAA NCDC
Fire (urban and wild)	11	957	TBD	Clay and Moyers Corners Fire Department, NFIRS records
Infestation (primarily disease-carrying mosquitoes)	5	6 (Human)	6 human cases of WNV, no deaths	NYDOH, OCHD
Hazardous Materials (fixed facility)	TBD	1	TBD (no significant events or impacts identified by Planning Group)	NYSDEC, USEPA

Notes: Statistics are County-wide unless noted otherwise.

FEMA – Federal Emergency Management Agency
NCDC – National Climate Data Center
NFIRS – National Fire Incident Reporting System
NOAA – National Oceanic and Atmospheric Administration
NWS – National Weather Service
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York Department of Health
OCHD – Onondaga County Health Department
TBD – To Be Determined
USEPA – United States Environmental Protection Agency
WNV – West Nile Virus