ULSTER COUNTY
MULTI-JURISDICTIONAL
NATURAL HAZARD MITIGATION PLAN

DRAFT PLAN UPDATE
2015

Prepared by:
URS

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Multi-Jurisdictional
Natural Hazard Mitigation Plan
Ulster County, New York

Prepared for

Ulster County Department of Emergency Communications/Emergency Management
238 Golden Hill Lane
Kingston, NY 12401

Prepared by

1255 Broad Street, Suite 201
Clifton, New Jersey 07013-3398

DRAFT PLAN UPDATE

2015

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PLAN ADOPTION RESOLUTIONS

In accordance with Part 201.6 of the Disaster Mitigation Act of 2000 (DMA 2000), Ulster County, New York, has developed this Multi-Jurisdictional Hazard Mitigation Plan to identify hazards that threaten the County and ways to reduce future damages associated with these hazards.

Following this page are the signed adoption resolutions of the County and all participating jurisdictions that have adopted this Plan Update, authorizing municipal government staff to carry out the actions detailed herein.

Signed resolutions of adoption by all participating jurisdictions shall be inserted following this page after FEMA has reviewed and determined that the plan update is Approvable Pending Adoption.

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INSERT COPIES OF EACH ADOPTION RESOLUTION HERE

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EXECUTIVE SUMMARY

Across the United States and around the world, natural disasters occur each day, as they have for thousands of years. As the world's population and development have increased, so have the effects of these natural disasters. The time and money required to recover from these events often strain or exhaust local resources. The purpose of hazard mitigation planning is to identify policies, actions, and tools for implementation that will, over time, work to reduce risk and the potential for future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together an in effort to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damages.

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act ("the Stafford Act"), enacted by Section 104 of the Disaster Mitigation Act of 2000 ("DMA 2000"), provides new and revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance, and established a new requirement for local mitigation plans. Except under extraordinary circumstances as determined by FEMA, an approved hazard mitigation plan is required to receive hazard mitigation assistance grants.

While Ulster County has always sought ways to reduce their vulnerability to hazards, the passage of DMA 2000 helped County officials to recognize the benefits of pursuing a long-term, coordinated approach to hazard mitigation through hazard mitigation planning. The County has received grant funds from the Federal Emergency Management Agency (FEMA) for developing both this hazard mitigation plan update, and its initial version in 2009. This **Ulster County Multi-Jurisdictional Natural Hazard Mitigation Plan** represents the collective efforts of Ulster County and each of its participating jurisdictions, the general public, and other stakeholders. Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementations of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

The Ulster County Multi-Jurisdictional Hazard Mitigation Plan has been developed by the Ulster County Hazard Mitigation Planning Committee (the "Planning Committee"), with support from outside consultants. The efforts of the Planning Committee were headed by the Director of the Ulster County Department of Emergency Communications/Emergency Management (UCECEM). The overall Planning Committee was divided into a Core Planning Group (CPG) and Jurisdictional Assessment Teams (JATs), with one JAT for each of the County's participating jurisdictions. The JATs consisted of a wide range of position titles for each community, from key individuals involved in emergency management, planning, engineering, floodplain management, and local administrators.

Ulster County's first hazard mitigation plan was approved by FEMA in February 2009; it was subsequently adopted by each participating jurisdiction[1]. FEMA requires hazard mitigation plans to be monitored and evaluated regularly, and updated at least once every five years. This document represents the first Plan Update. The plan update process was initiated in 2013 with a Project Initiation Meeting between the County and its consultant held on August 16, 2013. A Kickoff Meeting of the full Core Planning Group was conducted on October 3, 2013. Thereafter, Core Planning Group members met on: November 21, 2014 (for a both morning progress meeting and an afternoon working session); July 21, 2015; and August 4, 2015. JATs in each municipality met individually throughout the plan development process as they deemed necessary.

[1] With the County's adoption on March 11, 2009.

Community support is vital to the success of any hazard mitigation plan. **The County and each participating community were responsible for conducting outreach within their respective jurisdictions. Since the plan update process began in the fall of 2013, more than 140 outreach activities have been undertaken by the planning team members, including more than one dozen opportunities for public and stakeholder involvement from the County alone.** These efforts provided the general public and other stakeholders with opportunities to take part in the decisions that will affect their future.

County-Led Outreach Activities. The County-led outreach actions during the plan update were similar to those undertaken during the development of the initial plan. The County performed ongoing maintenance of its online hazard mitigation planning web presence at http://ulstercountyny.gov/emergency-services/hazard-mitigation/general-information with information on the planning process and where to go for additional information or comments. The initial press releases were issued on November 7, 2013. Press releases were posted on the County web site. Project fact sheets were widely distributed by UCECEM at various meetings throughout the process. They were also made available at the County Office Building and various libraries. Additionally, fact sheets were posted on the Ulster County Emergency Management webpage from September 13, 2013 through December 31, 2015. The County update to the Plan was reported in articles in *The Daily Freeman* on November 11, 2013 and September 14, 2015. **Furthermore, the public and other stakeholders were invited to respond to a survey that was posted on the UCECEM mitigation planning web site.**

The County's JAT met throughout the plan update process to discuss progress and work on development of the County's mitigation strategy. Meetings were held on April 24, 2015; August 6, 2015; August 17, 2015; and August 18, 2015. The County JAT included direct membership and participation from the following groups or individuals who attended various meetings throughout the process and provided input on action items being considered for the County's mitigation strategy:

Art Snyder, Director, Ulster County Emergency Communications/Emergency Management[2]
Steve Peterson, Director, Ulster County Emergency Communications/Emergency Management[3]
Dennis Doyle, Director of Planning, Ulster County Planning Department
Brendan Masterson, Stormwater Management Specialist II, Ulster County Department of Public Works
Diane Beitl, Safety Officer, Ulster County Safety Office
Burton Gulnick, Jr., Commissioner of Finance, Ulster County Department of Finance
Robert Sudlow, Deputy County Executive, Ulster County
Dean Fabiano, Ulster County Legislator, Ulster County Public Safety Committee
T.J. Briggs, Ulster County Legislator, Chairman, Ulster County Public Safety Committee
Amanda Lavalle, Coordinator, Ulster County Department of Environment
Aaron Bennett, Environmental Planner, Ulster County Department of Environment
Thomas Hynes, GIS Technology Engineer, Ulster County Department of Information Services

Furthermore, at the outset of the plan update process, UCECEM sent a letter of invitation to 34 stakeholder entities to invite them to participate. Stakeholders were advised that they would have opportunities to contribute to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, and reviewing draft updates of the document. Those interested in participating on the planning committee were asked to respond to UCECEM in writing. All letter recipients were also invited to the plan update Kickoff Meeting on October 3, 2013. Those not interested in participating directly on the committee were suggested to check back on the County's web

[2] Mr. Snyder retired on August 21, 2014 and did not participate in the process thereafter.

[3] Prior to Mr. Snyder's retirement, Mr. Peterson served as Deputy Director. For a short time after Mr. Snyder's retirement, Mr. Peterson served as Acting Director. He became Director on August 21, 2014]

site periodically for updates on how the planning process is progressing. Input, questions, and feedback were welcomed at any time. Four stakeholder groups returned a Statement of Authority to Participate:

American Red Cross
New York Thruway Authority
SUNY New Paltz
SUNY Ulster

The following stakeholder entities participated by attending one or more planning team meetings:

Central Hudson Gas & Electric
Health Alliance of the Hudson Valley
New York City DEP
New York State Police
New York State OEM – Region 2
Orange County OEM
SUNY New Paltz

Municipal JAT Outreach Activities. Participating communities supplemented the above range of County-led efforts with outreach targeted toward members of the general public and other stakeholders within their respective municipalities to get the word out even further and to supplement the County's larger outreach activities. JATs employed a wide range of techniques for providing opportunities for feedback and participation from the public and other stakeholders. Many distributed copies of the project fact sheet, posted information on their web sites, discussed the plan update at open public meetings in their communities, reached out to key stakeholder groups, and collectively undertook more than 140 activities throughout the plan update process to ensure that the public and other stakeholders were made aware of the process and their opportunity to participate and provide feedback and input.

The initial hazard mitigation planning process consisted of the following key steps:

- Researching a full range of natural hazards to identify which hazards could affect the County;
- Identifying the location and extent of hazard areas;
- Identifying assets located within these hazard areas;
- Characterizing existing and potential future assets at risk;
- Assessing vulnerabilities to the most prevalent hazards; and
- Formulation and prioritization of goals, objectives, and mitigation actions to reduce or avoid long-term vulnerabilities to the identified hazards.

For this Plan Update, the CPG:

- Assessed current development patterns and development pressures
- Evaluated new hazard or risk information
- Described progress in local plan maintenance and plan integration efforts
- Assessed previous goals and actions
- Summarized progress in implementing actions
- Adjusted actions to address current realities
- Explained changes in priorities
- Addressed changes in Federal/State requirements
- Reviewed the 2009 Natural Hazard Mitigation Plan to determine the changes that occurred since the Plan was prepared.

Natural hazards that can affect Ulster County that are included in the Plan are as follows:

- ***Atmospheric hazards***, including: extreme temperatures, extreme wind, hurricanes and tropical storms, lightning, nor'easters, tornadoes, and winter storms;
- ***Hydrologic hazards***, including: dam failure, drought, flooding, ice jams, and storm surge;
- ***Geologic hazards***, including: earthquakes and landslides; and
- ***Other hazards***, including: wildfires.

After evaluating these hazards and assets within the County to which they are vulnerable, each participating jurisdiction developed an updated hazard mitigation strategy to increase the disaster resistance of the County, along with procedures for monitoring, evaluating and updating the Plan to ensure that it remains a "living document." Nearly 200 mitigation actions are included in this plan update to reduce the impacts of natural hazards throughout the County, including 35 projects totaling upwards of $31 million submitted by the County alone. Most jurisdictions intend to apply for various types of grant funding for at least some portion of their activities to offset the local cost burden. The robust mitigation strategies developed by each participating jurisdiction as part of this plan update are a significant expansion of many of the strategies that were proposed in the 2009 plan, and represent a substantial improvement in addressing each jurisdiction's highest hazards and key risks.

This 2015 Draft Plan Update is currently under review by NYSOEM, FEMA, and the public and other stakeholders. If you have any questions or comments on the Multi-Jurisdictional Natural Hazard Mitigation Plan for Ulster County, New York, please contact:

Steven Peterson, Director
Ulster County Department of Emergency Communications/Emergency Management
238 Golden Hill Lane
Kingston, New York 12401-6440
Phone: 845-331-7000
Fax: 845-331-1738
E-Mail: spet@co.ulster.ny.us

For jurisdiction specific information, individuals identified as representatives of the jurisdictions should be contacted (see **Appendix 1.2** for membership lists and contact information).

After the review cycle is complete, comments will be evaluated and incorporated as needed, and the County and all participating jurisdictions will each formally adopt the Final 2015 Plan Update. The Final Plan Update will include copies of each jurisdiction's adoption resolution following Page i.

ACKNOWLEDGEMENTS

The following jurisdictions (Ulster County and 21+ of its constituent municipalities) participated in the development of this plan:

County of Ulster

Denning, Town of	*Lloyd, Town of*	*Saugerties, Town of*
Ellenville, Village of	*Marlborough, Town of*	*Saugerties, Village of*
Gardiner, Town of	*New Paltz, Town of*	*Shandaken, Town of*
Hardenburgh, Town of	*New Paltz, Village of*	*Shawangunk, Town of*
Hurley, Town of	*Olive, Town of*	*Ulster, Town of*
Kingston, City of	*Plattekill, Town of*	*Wawarsing, Town of*
Kingston, Town of	*Rosendale, Town of*	*Woodstock, Town of*

The records show that the following 10 stakeholder entities participated in meetings and provided valuable input for the plan update:

American Red Cross
Central Hudson Gas & Electric
Heath Alliance of the Hudson Valley
New York City Department of Environmental Protection
New York State Police
New York State Office of Emergency Management (Region 2)
New York Thruway Authority
Orange County Office of Emergency Management
SUNY New Paltz
SUNY Ulster

The following County Departments were instrumental in the plan update process and are hereby acknowledged for their dedication and contributions:

Ulster County Emergency Communications/Emergency Management
Ulster County Department of Environment
Ulster County Department of Information Services
Ulster County Planning Department
Ulster County Department of Public Works
Ulster County Executive's Office
Ulster County Legislature

URS Corporation (Clifton, NJ) acted as the plan development consultant providing hazard mitigation plan update services.

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SECTION 1 - INTRODUCTION

Purpose

Ulster County is susceptible to a number of different natural hazards. Each hazard event has the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. The time and money required to recover from these events often strain or exhaust local resources. While an important aspect of emergency management deals with disaster recovery (those actions that a community must take to repair damages and make itself whole in the wake of a disaster), an equally important aspect of emergency management involves **hazard mitigation** - sustained actions taken to reduce long-term risk to life and property. They are things you do today to be more protected in the future. Hazard mitigation actions are essential to breaking the typical disaster cycle of damage, reconstruction, and repeated damage. With careful selection, they can be long-term, cost-effective means of reducing risk and helping to create a more sustainable and disaster-resilient community. Hazard mitigation actions are most effective when they are based on a comprehensive, long-term plan that is developed before a disaster occurs. When community leaders, businesses, citizens, and other stakeholders undertake a joint process of evaluating the hazards that can affect their area, and use this knowledge to develop a strategy for reducing risk and the potential for future losses, this process is known as hazard mitigation planning. A **hazard mitigation plan**[1] describes an area's vulnerability to the various natural hazards that are typically present, along with an array of actions and projects for reducing key risks. This list of actions and projects is known as a **mitigation strategy**. While natural disasters cannot be prevented from occurring, the continued implementation of mitigation strategies identified in the plan will gradually, but steadily, increase community sustainability and disaster-resilience.

The **Multi-Jurisdictional Natural Hazard Mitigation Plan for Ulster County** was initially prepared between 2007 and 2009 to meet the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), which requires all states and local governments to have a hazard mitigation plan in place in order to be eligible to apply for certain types of federal hazard mitigation project grants. FEMA grant monies were received to cover the costs of the 2009 plan's development. Ulster County used a 'multi-jurisdictional' approach, inviting all of the municipalities within the County to participate in the plan. At that time, 12 of the County's 24 jurisdictions opted to participate. This opened the door for the County its 12 participating jurisdictions to apply to FEMA for hazard mitigation project funding, including monies that became available under the recent Federal disaster declarations for Hurricane Irene, the remnants of Tropical Storm Lee, and Superstorm Sandy. Participating jurisdictions have been working since the plan was initially approved by FEMA in 2009 to implement the actions listed in their mitigation strategies.

Hazard mitigation plans must be: (a) implemented on an ongoing basis, and (b) updated every five years to ensure that they remain applicable representations of local risk and locally-preferred risk reduction strategies. Ulster County and its jurisdictions initiated the first required plan update in 2013. This **2015 Plan Update** is expected to be reapproved by FEMA and adopted by all participating communities. The County has once again obtained FEMA grant funding to cover cost associated with the update, and has continued its 'multi-jurisdictional' approach. This time, 21 municipalities in the County successfully participated. Each jurisdiction attended meetings, provided feedback in a wide range of topic areas, reached out to the public and other key stakeholders in their community, and developed an updated mitigation strategy. Successful participation of each jurisdiction in the update process and the plans ongoing maintenance and implementation is required to maintain eligibility to apply for mitigation project grants. The initial plan of 2009, and the 2015 Plan Update, are maintained on the County web site at: http://ulstercountyny.gov/emergency-services/hazard-mitigation.

[1]Hazard mitigation plans are not intended to serve as a reference for immediate disaster response. They focus on actions that can be implemented prior to disaster events in order to reduce potential loss of life and property damage; however, they are referred to in the recovery process.

For questions or other feedback, or to find out how you can become involved, contact your community's local elected officials or Emergency Management Coordinator. At the County level, please feel free to reach out to Mr. Steven Peterson, Director, Ulster County Emergency Communications and Emergency Management (UCECEM) at 845-331-7000 or via e-mail to spet@co.ulster.ny.us. More information about the plan is maintained on the County web site at: http://ulstercountyny.gov/emergency-services/hazard-mitigation.

Document Organization

This Multi-Jurisdictional Hazard Mitigation Plan is organized into the following major sections.

- **Section 1 - Introduction**. Plan purpose, overview of the County, summary of plan development process, document organization, and key terms.
- **Section 2 - Identification of Potential Hazards.** Documentation of the Planning Committee's evaluation of a full range of natural hazards, and indication of which hazards were identified for inclusion in this plan (and why) versus those that were not identified (and why not).
- **Section 3 - Risk Assessment.** Hazard profiles, identification and characterization of assets in hazard areas, damage estimates, summary of land uses and development trends in hazard areas, and key risk findings.
- **Section 4 - Capabilities and Resources.** Overview of local, state, and federal resources for hazard mitigation.
- **Section 5 -Mitigation Goals.** Summary of hazard mitigation goals for the State Hazard Mitigation Plan and also for this county-wide multi-jurisdictional hazard mitigation plan.
- **Section 6 – Mitigation Strategies.** Information about the hazard mitigation actions identified by each jurisdiction to address their key risk findings.
- **Section 7 – Plan Maintenance and Integration.** Procedures selected for monitoring, evaluating, and updating this mitigation plan; including participation of the public and other stakeholders in plan maintenance, and plan integration.
- **Section 8 – For More Information.** Contact information for questions, comments, or how to become involved in the plan's ongoing maintenance and implementation, and future updates.

Key Terms

For the purpose of clarity throughout this document, the following definitions are briefly outlined:

- A **natural hazard** is any hazard that occurs or results from acts of nature such as floods, earthquakes, hurricanes, tornadoes and coastal storms, to name a few. *This plan addresses natural hazards only. It does not assess man-made / technological hazards or terrorism, but may address technological issues caused by a natural hazard.*
- A **disaster** is any catastrophic event that causes loss of life, injuries and widespread destruction to property. For the purpose of this document, a disaster is the result of a natural hazard, whether anticipated (such as flash flood warnings) or fortuitous (such as earthquakes).
- **Hazard mitigation** is the method by which measures are taken to reduce, eliminate, avoid or redirect natural hazards in order to diminish or eradicate the long-term risks to human life and property.
- A **hazard mitigation plan** is a well-organized and well-documented evaluation of the natural hazards and the extent that the events will occur. In addition, the plan identifies the vulnerability to the effects of the natural hazards typically present in a certain area, as well as the goals, objectives and actions required for minimizing future loss of life and property damage as a result of natural hazards.

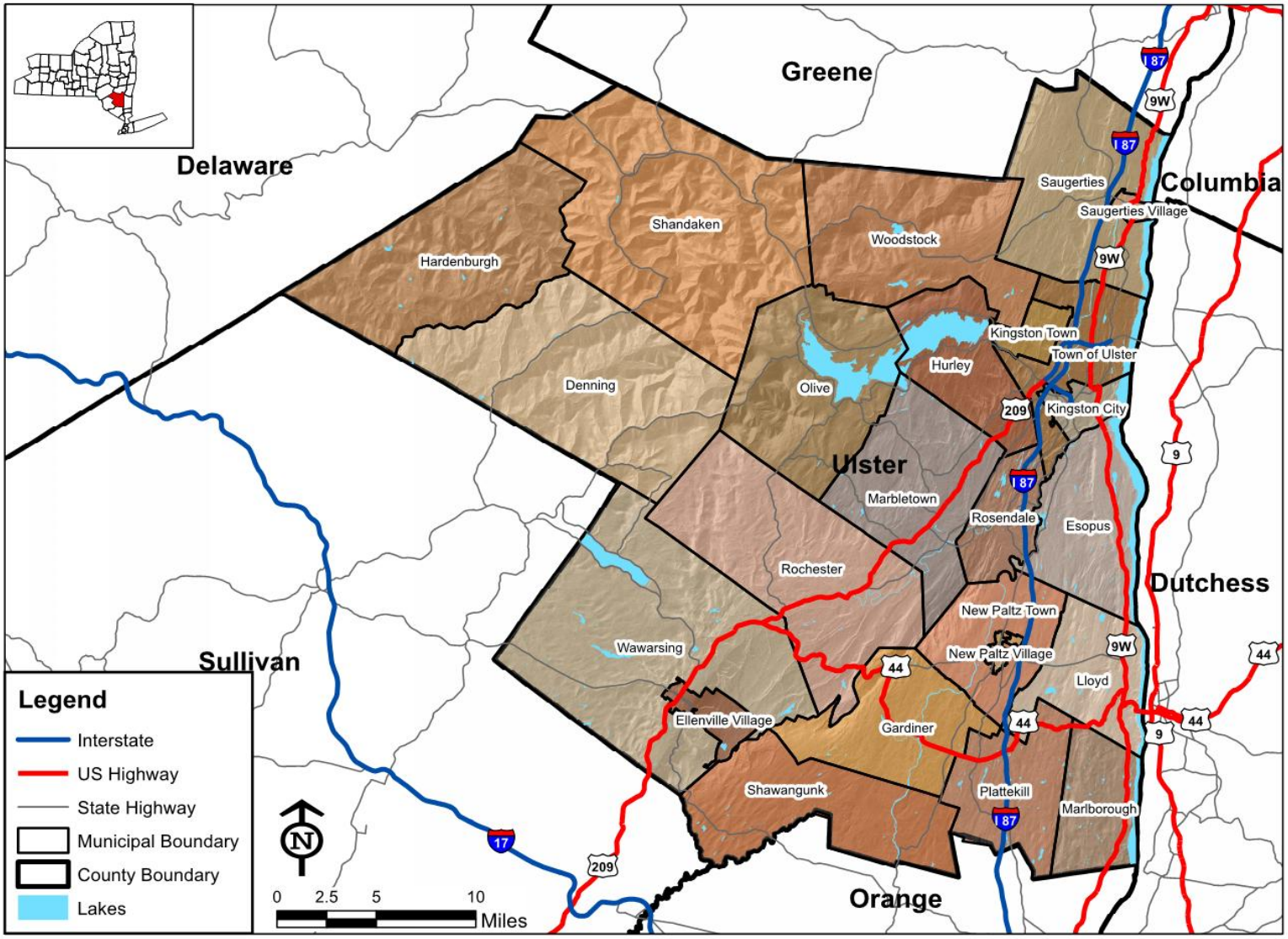
- **Hazard mitigation planning** is the process of managing actions taken by individual citizens and professional organizations involved in mitigation activities. The process involves carrying out plans to reduce loss of life, injuries and damage to property, as well as reducing the costs associated with losses from natural hazards. It is a long-term process with benefits best realized over time.

About the Planning Area

The planning area for this plan encompasses the whole of Ulster County, New York. Ulster County is located in the southeast part of New York State in the Mid-Hudson Region of the Hudson Valley approximately 70 miles north of New York City and 45 miles south of Albany. Ulster County is the northernmost county and largest county (by land area) in the New York Metropolitan Area, with a total area of 1,161 square miles, of which roughly three percent is water. Ulster County is comparable in size to the State of Rhode Island. Ulster County is bounded by Orange, Sullivan, Delaware, Greene, Columbia, and Dutchess Counties (from Orange County in the south and moving in a clockwise direction). The Hudson River provides the boundary of eastern sections of Ulster County. The County is home to 20 towns, three villages and one city. The county seat and only city is Kingston – the first capital of New York State. Other communities include the Villages of Ellenville, New Paltz and Saugerties; and Towns of Denning, Esopus, Gardiner, Hardenburgh, Hurley, Kingston, Lloyd, Marbletown, Marlborough, New Paltz, Olive, Plattekill, Rochester, Rosendale, Saugerties, Shandaken, Shawangunk, Ulster, Wawarsing and Woodstock (**Figure 1.1**).The County and 12 municipalities successfully participated in the development of the initial 2009 Plan; the County and 21of the 24 municipalities successfully participated in the 2015 Plan Update.

Ulster County has a wide variety of natural resources and landscapes including mountains, valleys, rivers, lakes, streams, forests and farmlands. The county is known for its many mountains and parks, pick-your-own farms and farmers' markets, local wineries and breweries, spas and spiritual retreats, artisans, museums, performing arts centers, pottery shops, fairs and festivals, luxury resorts. Ulster County is truly a unique place to visit. It is a year-round vacation center alive with entertainment, adventure, culture and history. In warmer seasons residents and visitors enjoy boating or sailing on the majestic Hudson River; biking, hiking, camping, or rock climbing in the world famous Shawangunk and Catskill Mountains; fishing in the regions many trout streams and lakes; or golfing on some magnificent courses. The county's rich agricultural market abounds farm stands and orchards. As the weather cools, the county's abundance of open space provides glorious fall foliage. During the winter months, opportunities abound for outdoor sports such as snowboarding, ice skating, and ice climbing. Ulster County is also home to the oldest street in America: Historic Huguenot Street, a National Historic Landmark District which includes seven original stone houses dating to 1705, a burial ground, a reconstructed 1717 French church, and a museum shop. From its agrarian beginnings, to the dawn of the industrial revolution, and then on to its emergence as a regional economic powerhouse in Hudson Valley, Ulster County has been an integral part of the economy of upstate New York. During the 1990s, a dramatic change in economic climate was experienced with the closure of a major industrial plant and the dislocation of hundreds—if not thousands—of businesses. This had a long-lasting, adverse impact on local workers and families. In the period since, Ulster County has struggled to revitalize its manufacturing base, maintain its legacy in production agriculture, and encourage a vibrant tourism-visitor industry without compromising its unique natural resource endowment. Ulster County is currently implementing economic development strategies to better coordinate the collective activities of the system, and provide focus to the strategic economic development efforts across the County.

Figure 1.1 – Ulster County Base Map



Source: NYS GIS Program Office.

In Ulster County:

- The NYC Metropolitan Area connection offers Ulster County access to global markets, intellectual capital, and is relied on by tourism and arts and culture businesses.
- Ulster County has a higher percentage of small businesses than any other county in the region.
- Ulster County has adequate critical infrastructure (water/sewer/transportation) to support growth in many of its central places.

Ulster County's unique location makes it a place that residents from New York City can go to escape the costs, pressures and densities of life in a major metropolis. It also makes the County a place where businesses want to be located that serve the State of New York's two most important cities. At the same time, Ulster County's location between the Hudson River and the Catskill Mountains ensures that development cannot get too intense, especially since the County, the State, the local jurisdictions and private organizations have done an excellent job of ensuring that much of the County will remain in pubic open space.

Ulster County is balancing the objectives of preserving natural, cultural and historic resources; facing the reality of an economy which is undergoing a big change as the nation moves into the post-industrial era; and, seeing development that is driven by agricultural and natural resources as well as the occurrences of the nation's largest urban area only 70 miles away. The County is involved in economic development, housing, open space and stormwater and transportation planning. Communities are working to ensure that they are safe, thriving and appealing places to live, work and play. The following recent development trends are expected to continue in the future:

- The County and its jurisdictions will continue to focus on preserving open space throughout the area.
- Most new development will continue to occur in the Hudson River Valley, especially along Interstate Highway 87 corridor.
- Additional development will take place along transportation corridors in the County, particularly in and around existing hamlets that have developed throughout the County.;
- Redevelopment will take place throughout the County, as sites that were vacated due to changes in the economy are reused, modified or replaced.
- Agriculture and natural resources will continue to be a focus of the Ulster County economy.
- Ulster County will continue to be both a recreational destination and driver of the commercial and industrial development in the region.
- Ulster County will continue to be a location where individuals that seek to leave the bustle of the New York City urban area choose to relocate.

Population. As of the year 2010 Census, the population of Ulster County was 182,493. According to the US Census, the population of Ulster County in 1990 was 165,304; whereas, in 2000 it increased to 177,749 – an increase of approximately 7.5 percent over ten years. Between 2000 and 2010, the County's population increased by only 2.7 percent. County-wide, a general upward trend in population is expected to continue between now and the year 2020. **Table 1.1** shows key County population changes and projections (county-wide and for each municipality) as reported in the Ulster County Transportation Plan.

Table 1.1
Ulster County Population Changes and Projections

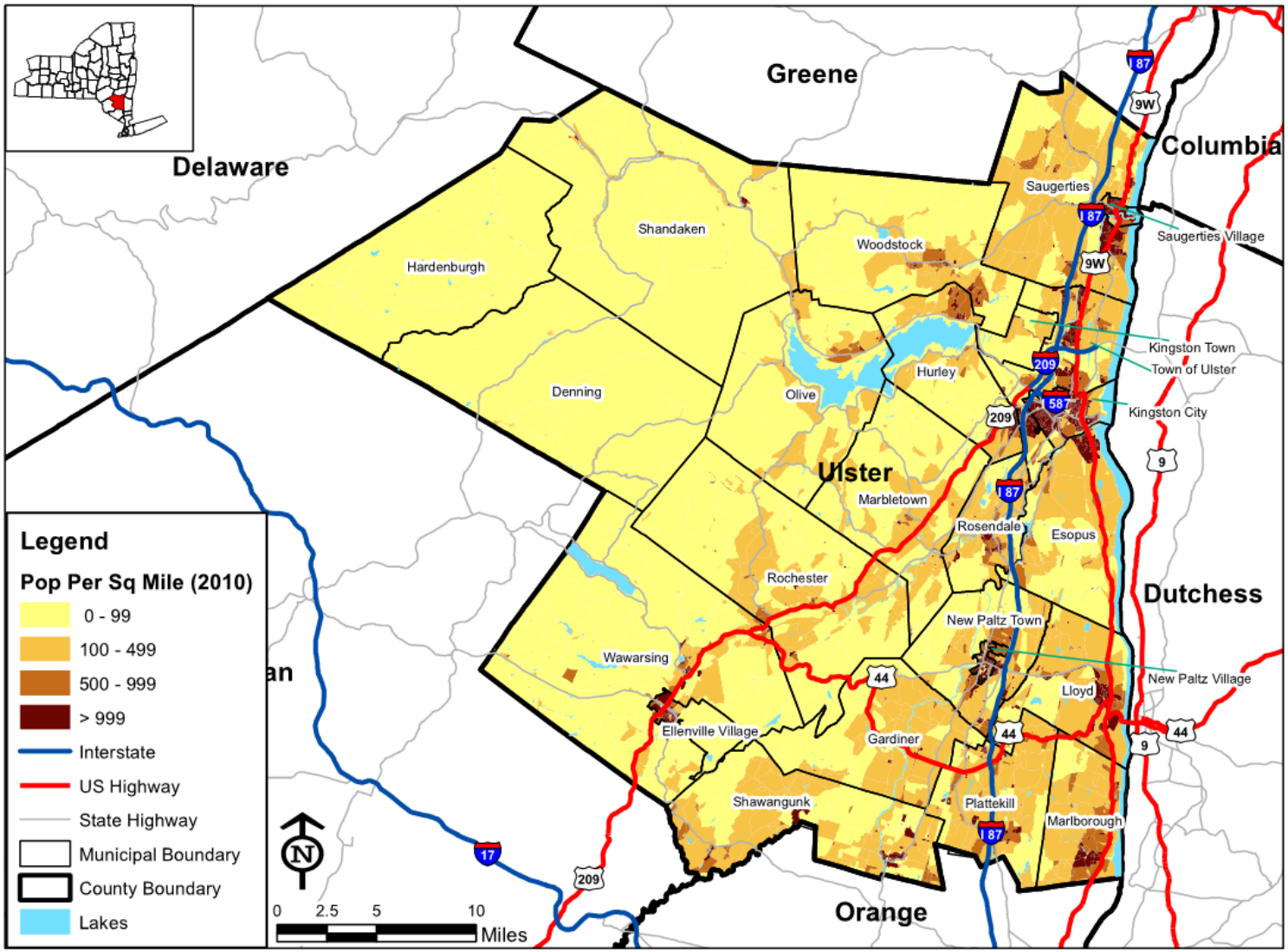
Municipality	Census Population 1990	Census Population 2000	Census Population 2010	Population Estimate 2013	Population Projection 2020	Absolute Change Projected 2000-2020	Percent Change Projected 2000-2020
Ulster, County of	**165,304**	**177,749**	**182,493**	**180,998**	**214,999**	**37,250**	**20.96%**
Denning, Town of	524	516	551	Not reported	716	200	38.76%
Ellenville, Village of	4,243	4,130	4,135	4,118	Not reported	Unknown	Unknown
Esopus, Town of	8,860	9,331	9,041	Not reported	11,531	2,200	23.58%
Gardiner, Town of	4,278	5,238	5,713	Not reported	8,338	3,100	59.18%
Hardenburgh, Town of	204	208	238	Not reported	358	150	72.12%
Hurley, Town of	6,741	6,564	6,314	Not reported	7,764	1,200	18.28%
Kingston, City of	23,095	23,456	23,893	23,731	24,656	1,200	5.12%
Kingston, Town of	864	908	889	Not reported	1,308	400	44.05%
Lloyd, Town of	9,231	9,941	10,863	Not reported	12,841	2,900	29.17%
Marbletown, Town of	5,285	5,854	5,607	Not reported	7,654	1,800	30.75%
Marlborough, Town of	7,430	8,263	8,808	Not reported	10,863	2,600	31.47%
New Paltz, Town of	11,388	12,830	7,185	Not reported	15,930	3,100	24.16%
New Paltz, Village of	5,463	6,034	6,818	6,924	Not reported	Unknown	Unknown
Olive, Town of	4,086	4,579	4,419	Not reported	5,479	900	19.65%
Plattekill, Town of	8,891	9,892	10,499	Not reported	13,092	3,200	32.35%
Rochester, Town of	5,679	7,018	7,313	Not reported	9,418	2,400	34.20%
Rosendale, Town of	6,220	6,352	6,075	Not reported	7,452	1,100	17.32%
Saugerties, Town of	18,467	19,868	15,511	Not reported	22,768	2,900	14.60%
Saugerties, Village of	3,915	4,995	3,971	3,905	Not reported	Unknown	Unknown
Shandaken, Town of	3,013	3,235	3,085	Not reported	3,835	600	18.55%
Shawangunk, Town of	10,081	12,022	14,332	Not reported	15,322	3,300	27.45%
Ulster, Town of	12,329	12,544	12,327	Not reported	13,844	1,300	10.36%
Wawarsing, Town of	12,348	12,889	9,022	Not reported	14,589	1,700	13.19%
Woodstock, Town of	6,290	6,241	5,884	Not reported	7,241	1,000	16.02%

The average percent change between 2000 and 2020 for Ulster County municipalities is roughly a 21 percent increase in population. However, this varies a great deal across municipalities, from a minimum of five percent to a maximum of 72 percent. The three highest projected percent increases are in Hardenburgh with a projected increase of 72 percent; Gardiner at 59 percent; and the Town of Kingston at 44 percent. The lowest projected percent increases are in the City of Kingston with a projected increase of five percent; the Town of Ulster at ten percent; and Wawarsing at 13 percent.

Ulster County's population is also aging. The population is aging faster than state and national averages, as population growth has slowed, with roughly 30 percent of the population potentially retiring by 2026. The overall median age in 2010 has been estimated by the U.S. Census Bureau to be 42.0, up from 38.2 in 2000. The percentage of the population over 65 years of age appears to be increasing (from 13.3 percent in 2000 to 14.8 percent in 2010).

The U.S. Census Bureau reports that Ulster County has a total area of 1,161 square miles, of which 1,124 square miles is land and 37 square miles is water. The 1990 U.S. Census population density per square mile of land in Ulster County was 147 persons per square mile; whereas, in the 2000 U.S. Census, there were 158 persons per square mile – an increase of 7.5 percent in ten years. The 2010 Census estimated about 162 persons per square mile. By 2020, the population density is projected to be 191 persons per square mile – an increase of 17.3 percent over the year 2000 values. The population of Ulster County is concentrated in its eastern areas, and decreases significantly moving in a westward direction (see **Figure 1.2).** The City of Kingston and Town of Saugerties are the two largest population centers; both are located in the County's northeast corner.

Figure 1.2 – Ulster County Population Density



Source: NYS GIS Program Office. US Census Bureau (2010).

Income and Employment. Between 2000 and 2012 both the median household and median family incomes in Ulster County exhibited a greater rise than the national equivalents, according to the U.S. Census Bureau, as shown in **Table 1.2.** Also, according to the same source, between 2000 and 2012 levels of unemployment and poverty both rose in Ulster County and national levels also rose in both categories over the same time period.

Table 1.2
Income and Employment in Ulster County

Economic Characteristic	2000[2]		2012[3]	
	Ulster Co.	USA	Ulster Co.	USA
Median Household Income	$42,551	$41,994	$58,934	$53,046
Median Family Income	$51,708	$50,046	$72,734	$64,585
Families Below Poverty Level	7.2%	9.2%	7.7%	10.9%
Individuals Below Poverty Level	11.4%	12.4%	12.9%	14.9%
Unemployed*	4.0%	3.7%	5.8%	6.0%

*As a percentage of the population aged 16 years or more

Transportation Links. Ulster County is linked to the surrounding area by road, notably the New York State Thruway (I-187) which traverses the full extent of the County from north to south in its eastern portion, parallel with the Hudson River. There are currently no passenger railroad services, although there are hopes that some may be reinstated in the future, particularly to link the County by rail to the New York metropolitan area. The County is well served by bus links, including services operated by Trailways, Ulster County Area Transit, and the CiTiBus (City of Kingston Bus Service). While there are three airfields in Ulster County with runways capable of operating substantial fixed-wing aircraft, none currently offer regular scheduled passenger services.

FEMA Disaster Declarations. Disaster declarations, for the county or counties affected by a disaster, are declared by the President of the United States under the authority of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the "Stafford Act"). FEMA then manages the entire process, including making federally-funded assistance available in declared areas; coordinates emergency rescue and response efforts; provides emergency resources; and provides other related activities/funding in the process of aiding citizens and local governments in a nationally-declared disaster. NYS OEM routinely assists local governments, voluntary organizations, and private industry through a variety of emergency management programs including hazard identification, loss prevention, planning, training, operational response to emergencies, technical support, and disaster recovery assistance. **Tables 1.3**, **1.4, and 1.5** provide a summary of disaster, emergency, and fire management assistance declarations for the State of New York (based on review of the FEMA web site and the New York State Hazard Mitigation Plan, and still current as of queries on December 14, 2015), with an indication as to whether Ulster County was part of the declared area.

Table 1.3
New York State Major Disaster Declarations

Year	Date	Disaster Type	Disaster Number	Was Ulster County Designated?
2014	22-Dec	Severe Winter Storm, Snowstorm and Flooding	4204	no
2014	8-Jul	Severe Storms and Flooding	4180	no
2013	12-Jul	Severe Storms and Flooding	4129	no
2013	23-Apr	Severe Winter Storm and Snowstorm	4111	no
2012	30-Oct	Hurricane Sandy	4085	yes
2011	13-Sep	Remnants of Tropical Storm Lee	4031	yes
2011	26-Aug	Hurricane Irene	4020	yes
2011	10-Jun	Severe Storms, Flooding, Tornadoes, and Straight-line Winds	1993	yes

[2] Census 2000
[3] 2008-20012 American Community Survey, 5-year Estimates

Table 1.3
New York State Major Disaster Declarations

Year	Date	Disaster Type	Disaster Number	Was Ulster County Designated?
2011	18-Feb	Winter Storm and Snowstorm	1957	no
2010	14-Oct	Severe Storms, Tornadoes, and Straight-line Winds	1943	no
2010	16-Apr	Severe Storms and Flooding	1899	no
2009	31-Dec	Severe Storms and Flooding - Ida and Nor'easter	1869	no
2009	1-Sep	Severe Storms and Flooding	1857	no
2009	4-Mar	Severe Winter Storms	1827	no
2007	31-Aug	Severe Storms, Flooding, and Tornado	1724	no
2007	2-Jul	Severe Storms and Flooding	1710	yes
2007	24-Apr	Severe Storms and Inland and Coastal Flooding	1692	yes
2006	12-Dec	Severe Storms and Flooding	1670	no
2006	24-Oct	Severe Storms and Flooding	1665	no
2006	1-Jul	Severe Storms and Flooding	1650	yes
2005	19-Apr	Severe Storms and Flooding	1589	yes
2004	1-Oct	Tropical Depression Ivan	1565	yes
2004	1-Oct	Severe Storms and Flooding	1564	yes
2004	3-Aug	Severe Storms and Flooding	1534	yes
2003	29-Aug	Severe Storms, Tornadoes and Flooding	1486	no
2003	12-May	Ice Storm	1467	no
2002	16-May	Earthquake	1415	no
2002	1-Mar	Snowstorm	1404	no
2001	11-Sep	World Trade Center Terrorist Attack	1391	yes
2000	21-Jul	Severe Storms	1335	yes
1999	19-Sep	Hurricane Floyd	1296	yes
1998	11-Sep	Severe Storms	1244	no
1998	7-Jul	Severe Storms and Flooding	1233	no
1998	16-Jun	New York Severe Thunderstorms and Tornadoes	1222	no
1998	10-Jan	Severe Winter Storms	1196	no
1996	9-Dec	Severe Storms/Flooding	1148	no
1996	19-Nov	Severe Storms/Flooding	1146	no
1996	24-Jan	Severe Storms/Flooding	1095	yes
1996	12-Jan	Blizzard	1083	yes
1993	2-Apr	World Trade Center Explosion	984	no
1992	21-Dec	Coastal Storm, High Tides, Heavy Rain, Flooding	974	no
1991	16-Sep	Hurricane Bob	918	no
1991	21-Mar	Severe Storm, Winter Storm	898	no
1987	10-Nov	Severe Winter Storms	801	no
1987	15-May	Flooding	792	yes
1985	18-Oct	Hurricane Gloria	750	no
1985	22-Mar	Snow Melt, Ice Jams	734	no
1985	20-Mar	Flooding	733	no
1984	25-Sep	Severe Storms/Flooding	725	no
1984	17-Apr	Coastal Storms/Flooding	702	yes
1977	5-Feb	Snowstorms	527	no
1976	3-Sep	Hurricane Belle	520	no
1976	21-Jul	Severe Storms/Flooding	515	no
1976	29-Jun	Flash Flooding	512	no
1976	19-Mar	Ice Storm, Severe Storms, Flooding	494	no
1975	2-Oct	Severe Storms, Heavy Rain, Landslides, Flooding	487	no
1974	23-Jul	Severe Storms/Flooding	447	no
1973	20-Jul	Severe Storms/Flooding	401	yes
1972	23-Jun	Tropical Storm Agnes	338	yes
1971	13-Sep	Severe Storms/Flooding	311	yes
1970	22-Jul	Heavy Rains, Flooding	290	no
1969	26-Aug	Heavy Rains, Flooding	275	no
1967	30-Oct	Severe Storms/Flooding	233	no
1965	18-Aug	Water Shortage	204	yes
1963	23-Aug	Heavy Rains, Flooding	158	no
1962	16-Mar	Severe Storm, High Tides, Flooding	129	no

Table 1.3 New York State Major Disaster Declarations				
Year	**Date**	**Disaster Type**	**Disaster Number**	**Was Ulster County Designated?**
1956	29-Mar	Flood	52	no
1955	22-Aug	Hurricane, Flood	45	no
1954	7-Oct	Hurricane	26	no

Table 1.4 New York State Emergency Declarations				
Year	**Date**	**Emergency Type**	**Declaration Number**	**Was Ulster County Designated?**
2012	28-Oct	Hurricane Sandy	3351	yes
2011	8-Sep	Remnants of Tropical Storm Lee	3341	no
2011	26-Aug	Hurricane Irene	3328	yes
2008	18-Dec	Severe Winter Storm	3299	no
2007	23-Feb	Snow	3273	no
2006	15-Oct	Snowstorm	3268	no
2005	30-Sep	Hurricane Katrina Evacuation	3262	yes
2004	3-Mar	Snow	3195	no
2003	23-Aug	Power Outage	3186	yes
2003	27-Mar	Snowstorm	3184	yes
2003	26-Feb	Snowstorm	3173	yes
2002	1-Jan	Snowstorm	3170	no
2000	4-Dec	Snow Storm	3157	no
2000	11-Oct	Virus Threat	3155	yes
1999	18-Sep	Hurricane Floyd	3149	no
1999	10-Mar	Winter Storm	3138	no
1999	15-Jan	Winter Storm	3136	no
1993	17-Mar	Severe Blizzard	3107	not available
1980	21-May	Chemical Waste, Love Canal	3080	no
1978	7-Aug	Chemical Waste, Love Canal	3066	no
1977	29-Jan	Snowstorms	3027	no
1974	2-Nov	Flooding (NYS Barge Canal)	3004	no

Table 1.5 New York State Fire Management Assistance Declarations				
Year	**Date**	**Disaster Type**	**Disaster Number**	**Was Ulster County Designated?**
1999	9-Aug	West Point Fire Complex	2269	no
1995	21-Aug	Sunrise Complex	2115	no

Participating Jurisdictions

Ulster County took a multi-jurisdictional approach to preparing its initial hazard mitigation plan and this 2015 Plan Update, inviting all 24 of its municipalities to participate. County and local levels of government bring unique resources to the table. The County has personnel, funding, data, and capabilities that many local jurisdictions lack, while municipalities have the legal authority to enforce compliance with land use planning and development issues.

For the initial 2009 Plan, the County and 12 of its municipalities opted to participate in, and were covered by, the Plan: Ulster County, Gardiner, Hurley, Kingston City, Kingston Town, Lloyd, Marbletown, Marlborough, Rosendale, Saugerties Town, Shandaken, Shawangunk, and Ulster Town. The following

municipalities did not participate in 2009: Denning, Ellenville, Esopus, Hardenburgh, New Paltz Town, New Paltz Village, Olive, Plattekill, Rochester, Saugerties Village, Wawarsing, and Woodstock.

For the 2015 Plan Update, Ulster County and 21 of its constituent municipalities participated in, and are covered by, this plan update. They are:

County of Ulster

Denning, Town of	*Lloyd, Town of*	*Saugerties, Town of*
Ellenville, Village of	*Marlborough, Town of*	*Saugerties, Village of*
Gardiner, Town of	*New Paltz, Town of*	*Shandaken, Town of*
Hardenburgh, Town of	*New Paltz, Village of*	*Shawangunk, Town of*
Hurley, Town of	*Olive, Town of*	*Ulster, Town of*
Kingston, City of	*Plattekill, Town of*	*Wawarsing, Town of*
Kingston, Town of	*Rosendale, Town of*	*Woodstock, Town of*

At the outset of the plan update process, participation commitments were demonstrated through each jurisdiction submitting a fully executed Statement of Authority to Participate to UCECEM. **Figure 1.2** shows a blank version of this letter of commitment. Completed statements are included in **Appendix 1.1 – Statements of Authority to Participate.**

The County's remaining three municipalities (Esopus, Marbletown, and Rochester) initially provided a Statement of Authority to Participate, but later opted out of the process.

Statement of Authority - Participating

Ulster County Multi-Jurisdictional Hazard Mitigation Plan Update - 2013

Lead Agency: Ulster County
Emergency Communications / Emergency Management
238 Golden Hill Lane
Kingston, NY 12401-6440
Arthur R. Snyder, Director; Steven Peterson, Deputy Director

This document is prepared as a statement of the authority advising Ulster County Emergency Communications / Emergency Management that the _____ of _____ **has opted to participate** in the first update of the Ulster County Multi-Jurisdictional Hazard Mitigation Plan. Our municipality has committed to participating in the development of an updated county-wide, multi-jurisdictional hazard mitigation plan. We have authorized the following two individuals: _____ and _____ ("Representative" and "Alternate", respectively) as local members serving on the Multi-Jurisdictional Core Planning Group and to actively participate as requested throughout the planning process.

We understand that our municipality will be required to name its own local hazard mitigation planning committee ("Jurisdictional Assessment Team") if it has not already done so. The Local Emergency Planning Committee may be able to serve in this capacity.

At the end of the project, when FEMA deems the plan approvable, it is understood that our municipality will need to pass a resolution formally adopting the final plan if we are in agreement with said plan and wish to be deemed eligible by FEMA to apply for future funding for hazard mitigation projects. This resolution will be provided immediately to Ulster County Emergency Communications / Emergency Management for submittal to FEMA, who requires the resolution on file.

Name of Municipality _____

Name & Title of Authorizing Individual _____

Authorizing Signature and Date _____

Representative's Name & Title _____

Representative's Address _____

Representative's Phone, Fax and Email _____

Alternate's Name & Title _____

Alternate's Address _____

Alternate's Phone, Fax and Email _____

Figure 1.2 – Statement of Authority

Hazard Mitigation Planning Team Organizational Structure

The Ulster County Multi-Jurisdictional Hazard Mitigation Plan has been developed by the Ulster County Hazard Mitigation Planning Committee (the "**Planning Committee**"), with support from outside consultants (URS Corporation – Clifton, NJ, "URS") who guided all jurisdictions through the planning process and ultimately authored both the initial plan in 2009, and this 2015 Plan Update.

As was the case with the initial plan's development, the overall Planning Committee for this plan update consisted of representatives for Ulster County, each participating jurisdiction, and the public and other stakeholders. The Planning Committee did not meet together in one place during the planning process; instead, a team concept was used to more evenly distribute responsibilities and to make best of use of every participant's unique capabilities. The overall Planning Committee was divided into a Core Planning Group (CPG) and a series of Jurisdictional Assessment Teams (JATs), with one JAT for each participating jurisdiction (see **Figure 1.3**). The Core Planning Group includes representation of the participating jurisdictions.

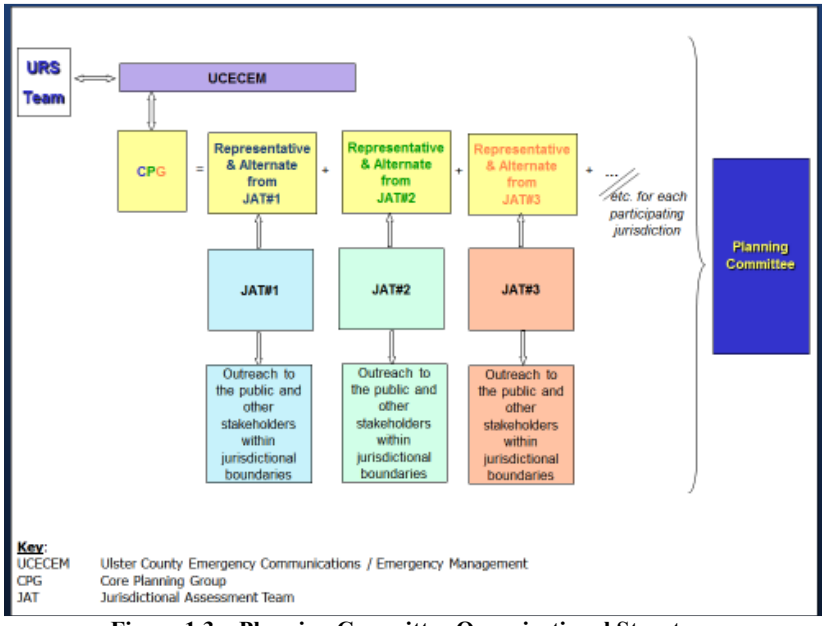


Figure 1.3 – Planning Committee Organizational Structure

The **County JAT** was responsible for managing overall plan formulation activities under the direction of UCECEM's Director Steve Peterson. UCECEM was responsible for setting CPG meeting dates and times, securing a meeting facility, and notifying all team members of upcoming meetings. They also played the primary role in reminding CPG members of various project deadlines. The Consultant prepared meeting agendas, handouts, and PowerPoint presentations. UCECEM ensured that all meeting materials and report deliverables were posted on the County web site.

Local JATs were identified for each participating jurisdiction, and included a range of expertise - from elected officials and administrators to staff in planning, public works, and engineering, for example. Each JAT was responsible for coordinating and facilitating local planning efforts; providing information and feedback to the contractor regarding a wide range of topic areas from land uses and development trends, to local capabilities and floodplain management initiatives through completing various worksheets; involving the public and local community stakeholders in the planning process; assessing mitigation alternatives; selecting a course of action to be followed for their community; adopting the plan; reviewing draft documents; and participating in plan monitoring and implementation. JATs fulfilled these

responsibilities under the leadership of their CPG members (the "representative" and "alternate" designated on the Statement of Authority to Participate).

The **CPG** as a whole - made up of lead members of each JAT – was the day-to-day planning team for the overall multi-jurisdictional planning process. CPG members were the primary local points of contact for both the County JAT and the consultant and were the go-betweens between the local JATs and the larger CPG. CPG members were responsible for fulfilling their jurisdiction's plan update process obligations, with assistance and direct support from the members of their JAT. CPG members attended planning meetings; conveyed meeting information back to their JAT members; solicited information and feedback needed from JAT members for incorporation into the plan (typically, on an as-needed basis depending upon the nature of the information request as compared to JAT member areas of specialty), and had primary responsibility for providing opportunities for the public and other stakeholders within their jurisdiction to be involved in the planning process. Readers are invited to review the jurisdictional annexes of **Appendix 1.2** for a list of JAT members for each jurisdiction. CPG Representatives and Alternates are identified on the Statements of Authority of **Appendix 1.1.**

At the end of the plan update process, each jurisdiction will formally adopt the Final Plan, documenting their commitment to strive to implement the actions and projects identified in the mitigation strategy to reduce or eliminate long-term risk from natural hazards and disasters in their community.

Planning Team Meetings

The initial version of this plan was prepared between 2007 and 2008. It was approved by FEMA and adopted by local communities in 2009. Participating jurisdictions have been working since that time to implement the actions that were listed in their respective mitigation strategies. FEMA requires ongoing plan implementation, regular monitoring of progress, and formal updates every five years thereafter. The 2009 Plan provided the details of the initial plan development process, which will not be reiterated here. Instead, this subsection will focus strictly on the process undertaken during the first plan update.

Ulster County and its jurisdictions initiated the process for this first required plan update by submitting a planning grant application to FEMA on May 1, 2012 under the HMGP program; notification of grant award was received on September 19, 2012 (HMGP-4020 Planning Grants). URS was selected to facilitate the update process. A contract was subsequently negotiated, with URS receipt of a notice to proceed on August 13, 2013. Key planning team meetings held during the plan update process are summarized in **Table 1.5.**[4] Meeting materials such as agendas, sign in sheets, and presentations are provided in **Appendix 1.3**.

Table 1.5
Key Planning Team Meetings

Date	Title	Details
December 11, 2012	County JAT Meeting	JAT meeting, which included the County executive's office, to initially discuss Plan development, timeline, stakeholders, and hiring of a consultant to guide the County in this update process.
January 7, 2013	County JAT Meeting	County staff convened to further discuss a timeline for Plan development and prepare language for a resolution authorizing the contract with NYS OEM.
April 3, 2013	County JAT Meeting	JAT members, including Ulster County Department of Information Services met to discuss current hazard mitigation GIS data availability and how to best incorporate into the Plan update.
August 16, 2013	Project Initiation Meeting (UCECEM, URS)	Project Initiation Meeting Teleconference – UCECEM met with URS on a conference call to refine the scope of work and project schedule. They discussed the overall readiness of the CPG to begin the update process; CPG activities/progress since 2009 in plan maintenance and integration; project schedule; scope of work; approach for future meetings (particularly the Kickoff Meeting); exchanged GIS staff points of contact, and outreach to the public and other stakeholders.
October 3, 2013	CPG Kickoff Meeting	Topics discussed included: the importance of the plan update, overview of the 2009 plan, benefits of continued participation in the plan update, key steps of the plan update process, participation requirements for the update, project timeline, near term actions items for participating jurisdictions, outreach to the public and other stakeholders, long term action items for participating jurisdictions,

[4] Local JAT meetings are not presented in this table. Individual JATs met on a fairly ad-hoc basis throughout the plan update process as they deemed necessary.

Table 1.5
Key Planning Team Meetings

Date	Title	Details
		expanded mitigation strategies. The importance of their ongoing and future activities to reach out to the public and key stakeholders in their communities was stressed (using Guidance Memo 1 as a guide, and documenting their activities in the provided Outreach Log). Feedback would be provided on various worksheets, and blank copies of Worksheet 1 were distributed.
November 12,2014 *Morning*	CPG Progress Meeting	This meeting began with a quick recap of the plan, the plan update, and the benefits of participating as well as the importance of active participation. The County provided a year in review summary of plan update activities in 2013 and 2014. URS followed with a summary of contractor activities to-date. Then, an open discussion occurred where municipal representatives discussed their respective activities in 2013 and 2014 The meeting concluded with an overview of activities that would be undertaken during the remainder of the project timeline.
November 12, 2014 *Afternoon*	CPG Working Session	This working session allowed a subset of interested CPG members to receive direct assistance from URS staff in providing the information and feedback for the plan update regarding: JAT membership, land uses and development trends updates, capabilities updates, continued compliance with the NFIP, status of past projects, and plan integration activities, mitigation actions, and outreach to the general public and other stakeholders. These inputs were initially targeted for submittal to the contract in early 2014 but as of November, most communities had still not provided their inputs. The working session focused on the feedback each jurisdiction would need to provide to URS and the activities each jurisdiction should undertake to conduct outreach to the general public and other stakeholders. Detailed explanations were provided to attendees on Worksheet 1 (documenting local JAT members); Worksheet 2 (National Flood Insurance Program information); Worksheet 3 (land uses and development trends update); Worksheet 4 (capability assessment); Worksheet 5 (status of past projects); Worksheet 6 (status of plan integration activities over the first plan maintenance cycle, and planned integration activities over the next plan maintenance cycle); Worksheet 7 (action worksheets, one per project in each local mitigation strategy); along with the importance of a robust local approach for outreach to the public and key local stakeholder groups and suggestions for doing so.
April 7, 2015	Project Progress Meeting (UECEM, UCDE and URS)	A project progress meeting was held on April 7, 2015, with UCECEM, Ulster County Department of Environment (UCDE), and URS. The purpose of the meeting was to discuss project progress to-date, and information still needed from the participating jurisdictions in order for the contractor to complete the plan. A revised project timeline was established, given the limited municipal inputs received at that point. A plan was set for one-on-one assistance with communities to be provided over the summer to facilitate, prior to the revised deadline for municipal inputs which was extended to August 18th.
April 24, 2015	County JAT Meeting	Meeting to update members on Plan progress and further discuss which mitigation actions should be included in the Plan update – primarily disaster-prone County-owned infrastructure.
July 21, 2015	One-on-One Working Sessions With Local JATs	Local municipalities attended various back to back, one hour time slots throughout the day. URS provided one-on-one assistance to JAT members from eight communities at UCECEM regarding how to develop a robust mitigation strategy that addresses each community's highest hazards and key risks to achieve safer, more disaster-resistant and resilient communities. Attendees were counseled on the mitigation strategy being the heart of the hazard mitigation plan, and the community's roadmap for reducing its risks from natural hazards. Stress was placed on the need for the strategy to be developed by the full JAT, with input from the public and key stakeholders. Jurisdictions were educated on the need for their updated mitigation strategies to do a much better job of making better connections between problems and solutions, with more appropriate, better-developed, and robust mitigation actions that focus on highest hazards and key risks. Additional support was provided for those with questions on documenting their local feedback for the plan update regarding: JAT membership, land uses and development trends updates, capabilities updates, continued compliance with the NFIP, status of past projects, and plan integration activities, and outreach to the general public and other stakeholders.
August 4, 2015	One-on-One Working Sessions With Local JATs	After the initial One-on-One meetings held in July, additional communities expressed interest to the County in this level of support, and a second day of One-on-One Working Sessions was conducted in August. Local municipalities attended various back to back, one hour time slots throughout the day. URS provided one-on-one assistance to JAT members from eight additional communities at UCECEM regarding how to develop a robust mitigation strategy that addresses each community's highest hazards and key risks to achieve safer, more disaster-resistant and resilient communities. Attendees were counseled on the mitigation strategy being the heart of the hazard mitigation plan, and the community's roadmap for reducing its risks from natural hazards. Stress was placed on the need for the strategy to be developed by the full JAT, with input from the public and key stakeholders. Jurisdictions were educated on the need for their updated mitigation strategies to do a much better job of making better connections between problems and solutions, with more appropriate, better-developed, and robust mitigation actions that focus on highest hazards and key risks. Additional support was provided for those with questions on documenting their local feedback for the plan update regarding: JAT membership, land uses and development trends updates, capabilities updates, continued compliance with the NFIP, status of past projects, and plan integration activities, and outreach to the general public and other stakeholders.
August 6, 2015	County JAT Meeting	Meeting to update members on Plan progress and finalize which mitigation actions should be included in the Plan update, including, but not limited to County-owned infrastructure.
August 17, 2015	County JAT Meeting	Meeting to discuss the status of past projects, including whether or not they were deemed complete, incomplete and whether or not to move them forward to the updated Plan. Additionally, members worked on completing worksheets #4,-#6.)
August 18, 2015	County JAT Meeting	Meeting to continue to discuss the status of past projects, including whether or not they were deemed complete, incomplete and finalized whether or not to move them forward. Additionally, members

Table 1.5 Key Planning Team Meetings		
Date	**Title**	**Details**
		completed worksheets #4,-#6.)
August 20, 2015	Project Progress Meeting Telecon, *(UCECEM and URS)*	Required municipal inputs were still outstanding from more than half of the communities as of August 18, 2015. With an aim for the plan update to capture as many local municipalities as possible, the County opted to offer an additional extension for local submittals; this time to September 18, 2015.
September 21, 2015	Project Progress Meeting Telecon, *(UCECEM and URS)*	Required municipal inputs were still outstanding from about 30 percent of the communities as of September 18, 2015 and continuing as outstanding through October 26, 2015 when this plan section was last updated. The most recent target date for the Draft Plan Submittal to NYSOEM of October 28, 2015 is delayed as these inputs are awaited.
Various dates, 2013, 2014 and 2015	UCDE and Local Communities	Ulster County Department of Environment played a major role in facilitating local participation, particularly for the County's NY Rising Communities. They provided as-needed support to NY Rising communities via phone, email, and in person throughout the plan update process and were a critical player in this plan update.
2016	*TBD*	*Placeholder for any future meetings held in 2016, to be inserted for the Final Plan Update.*

Roles and Responsibilities – County, Municipalities, and Contractor

County. In addition to acting as a participating jurisdiction in its own right, Ulster County took on the role of lead agency and facilitator in the plan development and update processes. UCECEM secured the grant funding for the 2009 Plan and its 2015 Plan Update, and solicited the participation of all 24 jurisdictions. They selected the consultant and administered the contract; managed communications between the consultant and the CPG (principally through email); distributed deliverables and outreach materials to jurisdictions, the public, other stakeholders, and reviewing agencies; facilitated meetings; procured meeting venues and presentation equipment; distributed meeting invitations; and conducted an extensive outreach strategy for the public and other stakeholders. They continue to maintain a central hazard mitigation planning website to solicit feedback.

A County JAT was assembled to provide feedback on the plan and on mitigation actions. As shown in Tables 1.5, County JAT met throughout the plan update process. A list of specific member names and position titles is included on Worksheet 1 in the County's jurisdictional annex of **Appendix 1.2.** The County JAT consisted of representation from the following entities:

Ulster County Emergency Communications/Emergency Management
Ulster County Department of Environment
Ulster County Department of Information Services
Ulster County Planning Department
Ulster County Department of Public Works
Ulster County Executive's Office
Ulster County Legislature

Municipalities. Each participating jurisdiction contributed throughout the overall plan development and update processes under the support and guidance of UCECEM and URS. Municipal JATs conducted outreach to the public and other stakeholders within their respective jurisdictions, assessed risk and hazard mitigation alternatives, and ultimately developed a mitigation action plan for their community. Each JAT was responsible for providing staff to participate in the CPG, attending CPG meetings, and holding their own JAT meetings as they deemed necessary. JATs were responsible for reviewing information, data and documents; submitting feedback to the consultant; completing questionnaires/forms; reaching out to the public and other stakeholders in their respective jurisdictions; developing a unique updated mitigation strategy for their jurisdiction; and reviewing and commenting on draft documents. CPG members documented activities undertaken by their municipal JAT for URS

incorporation into the document, and prepared the following written documentation at key junctures in the plan update process:

- Each municipality formally advised UCECEM of their desire to participate in the multi-jurisdictional hazard mitigation plan update process. Statements of "Authority to Participate" from participating jurisdictions are included in **Appendix 1.1**.
- Each CPG member was responsible for developing a local JAT for their community. "Worksheet 1 – JAT Membership" documents, for a range of position titles, who was approached by the CPG member and when, and whether or not that person agreed to participate in the plan update (along with their contact information). Copies of Worksheet 1 submittals are included in jurisdictional annexes of **Appendix 1.2.**
- At the project kickoff meeting on October 3, 2013, CPG members learned about the plan update process and their role in it. They also were asked to provide feedback on whether they felt any hazards should be added to – or omitted from – the list of hazards that were previously included in the 2009 plan. Meeting materials from this kickoff meeting and others throughout the plan update process are provided in **Appendix 1.3**.
- All of Ulster County's municipalities participate in FEMA's NFIP. Each CPG member coordinated with their local floodplain manager to describe their community's participation in the NFIP and describe their floodplain management program for continued compliance with NFIP requirements. "Worksheet 2 – NFIP Participation" documents this information, and copies of each response are included in jurisdictional annexes of **Appendix 1.2.**
- Each CPG member coordinated with their JAT to document changes in land uses and development trends since the last plan was prepared. "Worksheet 3 - Land Uses and Development Trends Worksheet" documents this step. Copies of each JAT's response are included in jurisdictional annexes of **Appendix 1.2.**
- Each CPG member coordinated with their JAT to document changes in local capabilities since the last plan was prepared. "Worksheet 4 – Capability Assessment" documents this step, elaborating on each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs. Copies of each JAT's response are included in jurisdictional annexes of **Appendix 1.2.**
- Each CPG member coordinated with their JAT to evaluate and demonstrate progress made in the past five years in achieving goals and implementing actions outlined in their 2009 mitigation strategy, including an explanation of if and how any priorities may have changed since the plan was previously approved. "Worksheet 5 – Status of Past Projects" documents this step, and copies of each JAT's response are included in jurisdictional annexes of **Appendix 1.2.**
- Each CPG member coordinated with their JAT to document the status of plan integration activities over the first plan maintenance cycle, and jurisdiction-specific activities projected for the next plan maintenance cycle. "Worksheet 6 – Plan Integration" documents this step, and copies of each JAT's response are included in jurisdictional annexes of **Appendix 1.2.**
- Each CPG member coordinated with their JAT to develop an updated mitigation strategy. "Worksheet 7 – Action Worksheets" document this step (with one worksheet for each action). Each JAT's action plan describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction. Copies of the action worksheets for projects comprising each jurisdiction's local mitigation strategy are included in jurisdictional annexes of **Appendix 1.2.**
- Each JAT provided opportunities for the general public and other stakeholders to be made aware of the plan update process, and the opportunity for them to participate and provide feedback. Outreach Logs were completed by each JAT as activities were undertaken. Copies of each JAT's Outreach Logs are included in jurisdictional annexes of **Appendix 1.2.**

A detailed summary of the participation demonstrated by each jurisdiction, including attendance at meetings and submission of requested deliverables, is presented in **Table 1.6** on the next page.

Contractor. URS was contracted by the County to guide participating jurisdictions through the process and author the plan in a manner consistent with applicable regulations, criteria, and guidance. URS was the lead firm for this assignment for both the 2009 Plan and the 2015 Plan Update. URS was the direct County point of contact, and assisted in all aspects of the plan update, guided local municipalities through their participation in key aspects of the update in a manner that would meet current requirements, led the hazard mitigation planning efforts, was the primary presenter at CPG meetings, authored the plan document, and provided overall contract administration. URS conducted the analyses necessary to provide team members with the information they needed to make sound decisions, and helped guide them through the necessary steps of the plan development and update processes. URS also prepared a project fact sheet; sample generic press release about the plan update for use by municipalities, at their option (in full or in part); and a sample generic PowerPoint presentation about the plan update process, also for use by municipalities, at their option (in full or in part) - both to facilitate consistent messaging across participating municipalities and for the sake of efficiency by ensuring that different municipalities didn't have to each spend time generating separate presentation materials. These were emailed to participating jurisdictions via UCECEM at various points in the project timeline between 2013 and 2014, and provided again en-masse to CPG members on CD at the project Progress Meeting on November 12, 2014 for their use throughout the project.

Table 1.6
Ulster County Jurisdictions Plan Participation

Entity	Returned Statement of Authority to Participate	Planning Team Meetings Attended *(listed in chronological order from left to right)*														Worksheets Submitted[5]							Submitted Documentation of Outreach to the Public and Other Stake-holders
		County JAT Meeting 12/11/12	County JAT Meeting 01/07/13	County JAT Meeting 04/03/13	Project Initiation Meeting 08/16/13	CPG Kickoff Meeting 10/03/13	CPG Progress Meeting 11/12/14	CPG Working Session 11/12/14	Project Progress Meeting 04/07/15	County JAT Meeting 04/24/15	One-on-One Working Sessions with Local JATs 07/21/15	One-on-One Working Sessions with Local JATs 08/04/15	County JAT Meeting 08/06/15	County JAT Meeting 08/17/15	County JAT Meeting 08/18/15	1	2	3	4	5	6	7	
Ulster, County of		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Emergency Communications/Emergency Management		■	■	■	■	■	■	■	■	■	■	■	■	■	■	County JAT members provided feedback for various worksheets and assisted with outreach.							
Department of Environment						■	■	■	■	■	■	■	■	■	■								
Planning		■	■			■				■													
Engineering/Public Works						■				■			■										
Information Services				■																			
Manager/Administrator		■	■	■																			
Elected Officials		■	■																				
Communities																							
Denning, Town of	■					■	■	■								■	■	■	■	■	■	■	■
Ellenville, Village of	■					■					■					■	■	■	■	■	■	■	■
Esopus, Town of	■															■							
Gardiner, Town of	■										■					■	■	■	■	■	■	■	■
Hardenburgh, Town of	■					■										■	■	■	■	■	■	■	■
Hurley, Town of	■						■	■								■	■	■	■	■	■	■	■
Kingston, City of	■					■	■									■	■	■	■	■	■		
Kingston, Town of	■						■	■			■					■	■	■	■	■	■	■	■
Lloyd, Town of	■										■					■	■	■	■	■	■		
Marbletown, Town of	■					■						■											
Marlborough, Town of	■					■	■	■								■	■	■	■	■	■		
New Paltz, Town of	■					■	■	■			■					■	■	■	■	■	■	■	■
New Paltz, Village of	■										■	■				■	■	■	■	■	■	■	
Olive, Town of	■					■	■				■					■	■	■	■	■	■	■	■
Plattekill, Town of	■					■	■	■				■				■	■	■	■	■	■		■
Rochester, Town of	■											■				■							
Rosendale, Town of	■						■	■								■	■	■	■	■	■		
Saugerties, Town of	■					■	■									■	■	■	■	■	■	■	
Saugerties, Village of	■						■	■				■				■	■	■	■	■	■	■	■
Shandaken, Town of	■						■	■								■	■	■	■	■	■	■	■
Shawangunk, Town of	■					■	■									■	■	■	■	■	■		
Ulster, Town of	■					■	■	■			■					■	■	■	■	■	■	■	■
Wawarsing, Town of	■						■	■				■				■	■	■	■	■	■	■	■
Woodstock, Town of	■					■										■	■	■	■	■	■	■	■
Stakeholders																							
American Red Cross	■																						
Central Hudson Gas & Electric						■																	
Health Alliance of the Hudson Valley						■																	
New York City DEP						■																	
New York State Police						■																	
New York State OEM – Region 2						■																	
New York Thruway Authority	■																						
Orange County OEM						■																	
SUNY New Paltz	■					■																	
SUNY Ulster	■																						
Consultant																							
URS					■	■	■	■	■		■	■											

KEY:

	= Not invited/Not applicable	■	= Invited and attended/submitted	[blank cell] = Invited but did not attend/submit

[5] Worksheet 1 = JAT Membership; Worksheet 2 = NFIP; Worksheet 3 = Land Uses and Development Trends Update; Worksheet 4 = Capability Assessment Update; worksheet 5 = Status of Past Projects; Worksheet 6 = Plan Integration; Worksheet 7 = Action Worksheets. Worksheet 2 is not applicable for the County because the county level of government is not eligible to participate in the NFIP. This table includes all documentation received by URS as of October 26, 2015.

Outreach to the Public and Other Stakeholders

A key element in the mitigation planning process is the discussion it promotes among community members about creating safer, more disaster-resilient communities. To meet Federal requirements, opportunities must be provided for the general public and other stakeholders[6] to be involved throughout hazard mitigation planning and plan update processes.

Outreach to the public and other stakeholders was undertaken concurrently by both the County and each participating jurisdiction. County outreach activities were broader efforts aimed at a larger, county-wide scale; while each participating jurisdiction's JAT was responsible for providing outreach opportunities for the general public and other stakeholders within their municipal borders. County activities alone totaled nearly two dozen opportunities for the public and other stakeholders to participate in the plan update – not including stakeholder attendance at County JAT, CPG, or other planning team meetings. Additionally, municipal JATs provided hundreds of additional opportunities at a more local level. **While this subsection of the plan presents a general overview of County-led activities for outreach to the public and other stakeholders, details of the specific activities undertaken by the County and each participating jurisdiction are provided in each jurisdictional annex of Appendix 1.2.**

- Invited Stakeholders. On August 21, 2013, at the outset of the plan update process, UCECEM sent a letter of invitation to 34 stakeholder entities to invite them to participate (**Table 1.7**). Stakeholders were advised that they would have opportunities to contribute to the plan update in an advisory role by providing relevant hazard information, assessing potential mitigation actions, and reviewing draft updates of the document. Those interested in participating on the planning committee were asked to respond to UCECEM in writing. All letter recipients were also invited to the plan update Kickoff Meeting on October 3, 2013. Those not interested in participating directly on the committee were suggested to check back on the County's web site periodically for updates on how the planning process is progressing. Input, questions, and feedback were welcomed at any time.

Table 1.7
Other Stakeholders Invited by the County to Participate in the Plan Update

Chief Mark Brown **Kingston Fire Department** 19 E O'Reilly Street Kingston, NY 12401	Mr. Richard Parrish EMS Coordinator **Health Alliance of the Hudson Valley** 396 Broadway Kingston, NY 12401	Mr. Wayne V. Ferguson Mgr of Bridge Operations **NYS Bridge Authority** PO Box 1010 Highland, NY 12528
Mr. Mark P. Komdat Dean of Administration **SUNY Ulster** PO Box 557 Stone Ridge, NY 12484	Dr. Carol M. Smith, MD, MPH Commissioner of Health **UC Health Department** 300 Flatbush Avenue Kingston, NY 12401	Mr. Brendan Masterson Stormwater Management Specialist II **UC Public Works Department** 317 Shamrock Lane Kingston, NY 12401
Director Dennis Doyle **UC Planning Department** PO Box 1800 Kingston, NY 12402-1800	Chief Joseph A. Sinagra Saugerties Police Department **UC Chiefs Association** 4 High Street Saugerties, NY 12477	Sheriff Paul Van Blarcum **UC Sheriff's Office** 380 Boulevard Kingston, NY 12401
Supervisor Carl Chipman **UC Town Supervisors Association** PO Box 65 Accord, NY 12404	Chief P.O. Christopher Sheppard **US Coast Guard** 152 Lighthouse Drive Saugerties, NY 12477	Mr. Paul Bennett **NYC DEP** 71 Smith Avenue Kingston, NY 12401

[6] A stakeholder is any person, group, or institution that can affect or be affected by a course of action, such as neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, businesses, academia, and other private and nonprofit interests.

Table 1.7 Other Stakeholders Invited by the County to Participate in the Plan Update		
Mr. Robert Sudlow Deputy County Executive **UC Executive's Office** PO Box 1800 Kingston, NY 12402-1800	Chief David Dugatkin University Police **SUNY New Paltz** 1 Hawk Drive New Paltz, NY 12561	Mr. Charles Mutz **UC Fire Coordinator** 24 Brooks Drive Kerhonkson, NY 12446
Mr. Richard Muellerleile **EMS Council** 61 Van Dale Road Woodstock, NY 12498	Captain Robert Nuzzo **New York State Police** 1971 Rt 209 Kingston, NY 12401	Mr. Paul LaForce **NYS Thruway Authority** Albany Division 200 Southern Blvd Albany, NY 12201
Mr. Michael O'Rourke, PhD **Ulster BOCES** 175 Rt 32 North New Paltz, NY 12561	Ms. Kathie Cayton **American Red Cross** 103 Hooker Avenue Poughkeepsie, NY 12601	Mr. Bill Cotting **Central Hudson Gas & Electric** 284 South Avenue Poughkeepsie, NY 12601
Mr. Ken Davidson **Duthess County Emergency Response** 392 Creek Road Poughkeepsie, NY 12601	Mr. Gary Tuthill **NYS Emergency Management Office Region 2** 10 Ross Circle, Suite 1 South Poughkeepsie, NY 12601	Mr. John Farrell **Greene County Emergency Services** 25 Volunteer Drive Cairo, NY 12413
Coordinator Amanda LaValle **UC Department of Environment** PO Box 1800 Kingston, NY 12402-1800	Mr. Richard Bell **Delaware County Emergency Services** 280 Phoebe Lane, Suite 3 Delhi, NY 13753	Mr. Richard Martinkovic **Sullivan County Emergency Services** PO Box 5012 Monticello, NY 12701
Mr. Seamus Leary **Orange County Emergency Management** 22 Wells Farm Road Goshen, NY 10924	Mr. Gene Lucchese **NYS Emergency Management Office Region 2** 10 Ross Circle ,Suite 1 South Poughkeepsie, NY 12601	Mr. Gary Capella **Ulster County Soil & Water Conservation District** 652 Route 299, Suite 103 Highland, NY 12528
Richard Parete, Chairman **Law Enforcement and Public Safety** Committee PO Box 1800 Kingston, NY 12402-1800	Dean Fabiano, Chairman **Public Works & Capital Projects Committee** PO Box 1800 Kingston, NY 12402-1800	
Lieutenant Chris Flocatoulas **New York State Police - OEM**	Sergeant Jeffrey Radliff **New York State Police**	

- Stakeholders Expressing an Interest in Participating. In response to the County's letter of invitation to stakeholders of August 21, 2013, responses were received from four stakeholder entities indicating a desire to participate in an advisory role in the process (see **Table 1.6**):

American Red Cross
NYS Thruway Authority
SUNY New Paltz
SUNY Ulster

- Other Stakeholders Attending Key Planning Team Meetings. In response to the County's letter of invitation to stakeholders of August 21, 2013, the following additional stakeholders also participated by attending one or more planning team meetings (see **Table 1.6**):

Central Hudson Gas & Electric
Health Alliance of the Hudson Valley
New York City DEP
New York State Police
New York State OEM – Region 2
Orange County OEM
SUNY New Paltz

- Press. Information regarding the plan update appeared in various news outlets over the course of the project to provide opportunities for the public and other stakeholders to be informed and to participate in the process. An executive press release was issued by the County on November 7, 2013, discussing the plan update process. The County also used the mitigation plan web site to publicize information about the process. A sampling of local media[7] articles is provided in **Appendix 1.4**.

- Public Meetings. The plan update was included as an agenda item at open public meetings of the Ulster County Legislature on January 22, 2013 when it passed Resolution #13 "Authorizing The Chairman Of The Ulster County Legislature To Execute An Agreement With The New York State Office Of Emergency Management To Develop A Multi-Jurisdictional Multi-Hazard Mitigation Plan That Complies With Federal Emergency Management Agency Requirements, And Amending The 2013Ulster County Budget – Emergency Communications / Emergency Management." The plan update was also discussed by County staff at the following open public meetings: Town of Olive Flood Advisory meetings of October 30, 2014 and March 12, 2015; Claryville Local Flood Analysis meeting of November 3, 2014; Shandaken Area Flood Assessment and Remediation Initiative meetings of November 12, 2014 and February 25, 2015 and July 10, 2015; and the Ashokan Watershed Stream Management Program Stakeholder's Council meeting of March 19, 2015.

- Website. A hazard mitigation planning page was initiated by UCECEM in 2007 at the onset of development of the initial plan. The County maintained this web presence (http://ulstercountyny.gov/emergency-services/hazard-mitigation), and updated its content to reflect the plan update on September 13, 2013. The purpose of the web content is to inform the public and other stakeholders about the purpose and need for the plan and the update and solicit their feedback and participation. Content includes general information about the process, participating jurisdictions, planning group and meeting information, contact information, a link for the plan, and more. **Figure 1.4** shows a screen capture of the main page for the plan update. **Figure 1.5** shows a screen capture of the General Information page. All participating jurisdictions have supplemented this by posting links on their jurisdiction web sites to the overall county mitigation planning pages. Screen captures for each jurisdiction are included in **Appendix 1.5**.

- Document Repository. A document repository was established at the Ulster County Emergency Management Offices at: 238 Golden Hill Lane Kingston, NY 12401. The repository is updated periodically with hard copies of meeting minutes, handouts, etc. as well as draft and final copies of the Plan. The repository is advertised on the County's hazard mitigation planning web site at http://ulstercountyny.gov/emergency-services/hazard-mitigation/document-repository.

[7] News articles in **Appendix 1.4** do not represent comprehensive coverage of the plan update by local news media. Other articles may have been published that do not appear in the appendix. The appendix is intended to give a flavor for the type of articles that appeared throughout the update.

Figure 1.4 – Plan Update Web Content
http://ulstercountyny.gov/emergency-services/hazard-mitigation/general-information

Figure 1.5 – Plan Update Web Content
http://ulstercountyny.gov/emergency-services/hazard-mitigation/planning-group-organizational-structure

- Fact Sheet. Participating jurisdictions found the use of the plan update fact sheet to be of great use for getting the word out regarding the initial plan's development, and the CPG opted to use this as one component of its outreach strategy for the plan update process as well. **Figure 1.6** on the next page shows the fact sheet used for the plan update. In addition to describing the purpose and need for the plan, and information about the plan update, the fact sheet also gave UCECEM contact information for interested parties to reach out to for questions or other feedback, or to learn more about how they could become involved in the plan update process. CPG members distributed this fact sheet on notice boards and at various meetings with the public and other stakeholders. Some examples of ways the County, in particular, used the fact sheet for its outreach strategy include but are not limited to: distribution of the fact sheet to interested parties at its various outreach meetings; and placement of the fact sheet on the UCECEM notice board and notice board in the lobby of the County Office Building. The fact sheet was also distributed on a more ad-hoc basis throughout the process by County staff and participating jurisdictions, and was posted on the plan update web site at:

  http://ulstercountyny.gov/sites/default/files/Ulster%20County%20Fact%20Sheet%20August%202013.pdf

- Municipal OEM Coordinators Meetings. On October 17, 2014, December 12, 2014, February 13, 2015, June 12, 2015, August 14, 2015; UCECEM hosted meetings of the Municipal OEM Coordinators. At each meeting, coordinators were made aware of the plan update and invited to participate in the process.

- Disaster Response and Recovery Committee Meetings. UCECEM discussed the hazard mitigation plan update with Emergency Response Team on December 16, 2014; January 20, 2015; February 17, 2015; and April 21, 2015; and encouraged participants to visit the mitigation planning web site at http://ulstercountyny.gov/emergency-services/hazard-mitigation/ for additional information.

Ulster County
Multi-Jurisdictional Hazard Mitigation Plan Update

Adopted Plan Cover, 2009

Planning Timeline

- *First plan adopted in 2009; updates are required every five years*
- *Update process began in August 2013 and is ongoing*
- *FEMA approval and jurisdictional adoptions of the updated plan are anticipated in 2015*

Background

Natural hazards are a part of life throughout Ulster County. All of our hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. An important part of emergency management involves **hazard mitigation** – which is, essentially, actions and projects undertaken to *protect* things *before* they get damaged. A **hazard mitigation plan** describes the hazards that can occur in a community, and then presents actions and projects that will be done to reduce key risks.

Natural disasters cannot be prevented from occurring but, if we tackle some of the biggest risks with hazard mitigation projects, eventually, our hazards won't become disasters.

Purpose and Need

The **Multi-Jurisdictional Natural Hazard Mitigation Plan for Ulster County** was adopted in 2009 to meet the requirements of the Disaster Mitigation Act of 2000 (or "DMA 2000"). Its development was led by the County under a FEMA planning grant that covered the costs of its preparation. Though it wasn't required, Ulster County opted to use what FEMA calls a 'multi-jurisdictional' approach – meaning that instead of it just being a plan for the County government, every municipality was invited to participate as an equal partner with the County. Adopting a FEMA approved hazard mitigation plan opened the door for all participating municipalities to be in compliance with DMA 2000, and eligible to apply for hazard mitigation project grants. To stay in compliance with DMA 2000, the plan must be updated every five years. The update ensures that the plan remains current in its discussion of local risks and risk reduction strategies. The County has once again obtained FEMA grant funding to cover the cost of this first plan update, and has opted to continue its 'multi-jurisdictional' approach. Each jurisdiction in the County is attending meetings, providing feedback in a series of topic areas, reaching out to the public and other key stakeholders, and updating their local mitigation strategy.

Here, a flood prone home was acquired and the property was converted to parkland. During the next storm, the residents were safe in their new home on higher ground, and no damages were incurred on this parcel.

For More Information

For questions or other feedback, or to find out how you can become involved, please contact your local elected official or Emergency Management Coordinator; the Ulster County Office of Emergency Communications / Emergency Management at 845-331-7000; or visit our web site at www.co.ulster.ny.us.

Ulster County Multi-Jurisdictional Hazard Mitigation Plan Update • "PlanFacts "• August 2013 •

Figure 1.6 – Fact Sheet for the 2015 Plan Update

Feedback from the Public and Other Stakeholders

As discussed in the preceding subsection and detailed in the Outreach Logs for each jurisdiction (as provided in municipal annexes of **Appendix 1.2**) the County and participating jurisdictions collectively undertook more than 140 actions to raise awareness of the plan update process and provide the public and other stakeholders with a forum for participating in - and providing feedback throughout - the plan update. These activities ranged from web site and social media postings to use of print media, public meetings, and targeted outreach to key stakeholder groups.

Overview of Stakeholder Feedback

Stakeholders provided feedback and input throughout the plan update process in informal settings. SUNY New Paltz, Orange County OEM, NYS Police, NYS OEM Region 2, NYC DEP, Health Alliance of the Hudson Valley, and Central Hudson Gas & Electric participated by attending at least one Core Planning Group meeting. One example of stakeholder input into the Plan was from the NYCDEP, which indicated a new protocol for reducing the risk of downstream flooding below the Ashokan and Rondout reservoirs in anticipation of an approaching storm. At the Ashokan, managers can utilize a release channel to quickly reduce water levels, thus creating a void for water storage, in the reservoir's west basin. Watershed wide, including the Rondout reservoir, NYCDEP uses what is called the Operational Support Tool (OST), which allows managers to make operational decisions (such as drawdowns) based upon the most current data and long-range weather forecasts to predict future reservoir levels. Central Hudson Gas & Electric representatives discussed related storm impacts on their systems and the community. Additionally, they talked about their outage map information that is available to the public which consists of an interactive website which includes maps and a place where the public can report and view outages in their area.

The County considered feedback from all stakeholders during the updating of the mitigation strategy.

Overview of Feedback Provided by the General Public

The feedback provided by the general public during the course of the first plan update resulted from outreach sessions conducted at various meetings/events throughout the County. General comments and questions by the public regarding the plan included a basic description of the plan and its purpose. Some suggestions and comments from the public included: questions/discussions on home elevations and relocations, streambank stabilization improvements, generators for shelters and critical community facilities, improved communications during power outages, improved training for municipal code enforcement officials, and the consideration of the effects from climate change. Comments on the Draft 2015 Plan Update are included in **Appendix 1.6**.

Considering the range of opportunities that were provided to the general public and other stakeholders, the feedback received is disproportionate to the volume of opportunities that were provided. CPG members will consider more targeted outreach to the public and other stakeholders during the next plan maintenance phase to elicit feedback. The purpose of these events would be to distribute literature and educate the public and other stakeholders on natural hazards and hazard mitigation, and to obtain comments and feedback regarding the mitigation action items that can be pursued. Types of activities could include: (1) increased use of social media, which is becoming more widely-used with each passing year; (2) more frequent outreach to local media outlets (television, radio, and print media partners) to prepare stories to help promote widespread public involvement and awareness, and to elicit feedback and comments; (3) more formal presentations to governing bodies regarding the hazard mitigation plan (in an open public forum setting); (4) targeted public/stakeholder events such as roundtables and public forums specifically regarding the plan, and natural hazard mitigation; and (5) small, area-specific meetings on a semi-annual basis at public libraries or other public venues.

Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

In the process of preparing this hazard mitigation plan update, many other existing plans, studies, reports, and technical information were evaluated. These sources are noted throughout this report as various topics are discussed. As shown in **Table 1.8**, the development of this hazard mitigation plan included the review and incorporation of data from existing plans, studies, reports, and technical information. Relevant information was referenced or included, as applicable, to form the content of this mitigation plan.

Table 1.8
Review and Incorporation of Data from Outside Sources

Data Source	How Incorporated	Where Incorporated
Readily available on-line information from federal and state agency web sites including: FEMA, NYSEMO, NY State Department of Environmental Conservation, US Forest Service National Avalanche Center, US Geological Survey, National Oceanic and Atmospheric Administration (including National Weather Service and National Climatic Data Center, and the National Severe Storms Laboratory), U.S. Department of Agriculture Natural Resources Conservation Service, U.S. Army Cold Regions Research and Engineering Laboratory, National Drought Mitigation Center Drought Impact Reporter, USGS National Earthquake Information Center, and the US Department of Transportation Federal Highway Authority.	Referenced throughout this report as various topics are discussed. Primarily, these sources were consulted to develop lists of historic occurrences of various hazards as well as areas at risk, probability of future occurrences, and impact information.	Throughout the document, but primarily in Sections 2 and 3.
New York State Hazard Mitigation Plan (2014)	Hazard information including historic occurrences, areas at risk, probability of future occurrences, and impact information. Also: State capabilities that can support local hazard mitigation efforts, State goals and actions (to compare against local goals and actions to ensure that the two go hand-in-hand), etc.	Throughout the document, but primarily in Section 2 and Section 3 for hazard information. Information regarding capabilities is incorporated in Section 4 and State goals are incorporated in Section 5.
FEMA Flood Map Data and Municipal Flood Insurance Studies	Areas susceptible to flooding. Also, FISs included information about local flood protection features. DFIRMs were combined with parcel data in GIS to evaluate the area of the floodplain in each municipality, the value of improvements in each area.	Throughout the document, but primarily in Sections 2 and 3.
NY Rising Community Reconstruction Plan (2014)	Historic event information for Irene, Lee, and Sandy was incorporated into the hazard profiles. Municipal actions from the NY Rising Plan were rolled up into mitigation strategies of this hazard mitigation plan update. The NYRCR Ulster Communities are: the Villages of Ellenville, New Paltz, and Saugerties; and the Towns of New Paltz, Olive, Rochester, Rosendale, Saugerties, Wawarsing, and Woodstock, the Town of Shandaken, and the Town of Hardenburgh.	Incorporated event information into Section 3, but the report is primarily used by NYCR communities developing their mitigation strategies (Section 6, with specifics in municipal annexes of Appendix 1.2)
County GIS data	County GIS data included parcel data such as the type of property, its ownership, and the value of land/improvements. This was used to quantify the land area and value of improved	Throughout the document, but primarily in Sections 2 and 3.

Table 1.8
Review and Incorporation of Data from Outside Sources

Data Source	How Incorporated	Where Incorporated
	property at risk in various hazard areas. In addition, the County provided data sets for: fire stations, police stations, hospitals, potable water treatment facilities, airports, public works facilities, waste transfer stations, schools, and senior care facilities. These data sets were used to evaluate assets located in hazard areas.	
USGS Earthquake History of New York State	Historic earthquake event occurrences	Throughout the document, but primarily in Sections 2 and 3.
NY State Geological Survey NEHRP Soil Class Mapping	The severity of impact of an earthquake can be exacerbated by certain soil types, and soils mapping was used in the earthquake hazard profile to inform the degree to which soil type might exacerbate earthquake impacts in Erie County.	Throughout the document, but primarily in Sections 2 and 3.
NY State Landslide Inventory Mapping	Historic landslide event occurrences. Landslides are more likely to occur in areas where they have happened in the past.	Throughout the document, but primarily in Sections 2 and 3.
USGS National Landslides Program Landslide Mapping	Historic landslide event occurrences. Landslides are more likely to occur in areas where they have happened in the past.	Throughout the document, but primarily in Sections 2 and 3.
USGS Fact Sheet 165-00, Land Subsidence in the United States	Land subsidence hazard maps were evaluated to determine whether land subsidence is a significant hazard in Erie County.	Throughout the document, but primarily in Sections 2 and 3.
National Agricultural Statistics Service, Ulster County Profile, 2012	Information regarding agricultural uses in Ulster County to characterize how widespread the potential impacts of some hazards might be (drought and hail, for example).	Throughout the document, but primarily in Sections 2 and 3.
HAZUS-MH database for emergency facilities and utilities	The database of assets from HAZUS was imported on a GIS platform to determine assets at risk from delineable hazards	Throughout the document, but primarily in Sections 2 and 3.
NYSDEC Inventory of Dams	Dam inventory data was used to quantify the number, type, and hazard ranking of dams in Erie County. (as applicable for the flood hazard)	Throughout the document, but primarily in Sections 2 and 3.
Stanford University National Performance of Dams Program web site	Dam inventory data was used to quantify the number, type, and hazard ranking of dams in Erie County. (as applicable for the flood hazard)	Throughout the document, but primarily in Sections 2 and 3.
U.S. Army Corps of Engineers National Inventory of Dams	Dam inventory data was used to quantify the number, type, and hazard ranking of dams in Erie County. (as applicable for the flood hazard)	Throughout the document, but primarily in Sections 2 and 3.
New York State Historic Preservation Office GIS shape files for state and federally listed historic and cultural resources	These GIS shape files were used to quantify historic and cultural resources in delineable hazard areas.	Throughout the document, but primarily in Sections 2 and 3.
The American Society of Civil Engineers Standard 7-02, Minimum Design Loads for Buildings and Other Structures and "Wind Zones in the United States" map	Map used to determine which wind region the County is in; this informed the wind hazard profile.	Throughout the document, but primarily in Sections 2 and 3.
New York City Area Consortium for Earthquake Loss Mitigation website	Historic event information	Throughout the document, but primarily in Sections 2 and 3.
FEMA Publication 320 - Taking Shelter from the Storm: Building a Safe Room for your Home or Small Business	Typical damage for each Enhanced Fujita scale tornado and hurricane category, as well as wind zones and tornado activity maps	Throughout the document, but primarily in Sections 2 and 3.
FEMA NFIP Community Status Book	NFIP participating communities, numbers of policies, historic numbers and values of paid claims, etc.	Throughout the document, but primarily in Sections 2 and 3.

Table 1.8
Review and Incorporation of Data from Outside Sources

Data Source	How Incorporated	Where Incorporated
FEMA data for NFIP Repetitive Loss Properties and Community Rating System communities	Repetitive Loss Data includes numbers of losses, value of paid claims, communities with repetitive loss properties, communities participating in the CRS (and CRS class), etc.	Throughout the document, but primarily in Sections 2 and 3.
FEMA's "NFIP Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials (FEMA-480)"	Types of mitigation measures, definitions of the different categories of flooding for the hazard profile, and a table showing the odds of being flooded (for various time periods and flood events)	Throughout the document, but primarily in Sections 2 and 3.
USGS Landslide Overview Map of the Conterminous United States, prepared in hard copy format in 1982 by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes (Geologic Survey Professional Paper 1183), compiled digitally by Jonathan W. Godt (USGS Open File Report 97-289), as viewed on NationalAtlas.gov	Landslide incidence and susceptibility	Throughout the document, but primarily in Sections 2 and 3.
American Society of Civil Engineers (ASCE) Standard 7-98: Minimum Design Loads for Buildings and Other Structures	Minimum design loads for wind	Throughout the document, but primarily in Sections 2 and 3.
FEMA's "Multi-Hazard Identification and Risk Assessment" (1997)	Several hazard definitions and information to support the hazard profile, as well as ideas for types of mitigation approaches	Throughout the document, but primarily in Sections 2 and 3.
American Meteorological Society "Glossary of Meteorology"	Definitions of meteorological hazards	Throughout the document, but primarily in Sections 2 and 3.
In addition, to conduct their Capability Assessments, local jurisdictions considered relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, comprehensive plans, capital improvements plans, economic development plans, emergency response plans, post-disaster recovery plans, post-disaster recovery ordinances, local waterfront revitalization plans (in seven of Erie County's communities), and real estate disclosure ordinances. For additional information, please see the "Capabilities and Resources" section of this plan.	Responses were recorded in the Capability Assessment of Section 4. At the Mitigation Strategy Working Session, jurisdictions were asked to review local plans and ordinances and consider all local capabilities when developing their mitigation strategies as the enhancement of existing capabilities, or bridging identified gaps in capabilities, can further mitigation goals and objectives.	Throughout the document, but primarily in Sections 2 and 3.

Regulatory Compliance

This Hazard Mitigation Plan was prepared in a manner consistent with applicable regulations, criteria, and guidance. The Plan's components address the local hazard mitigation planning requirements of the DMA 2000. The planning team used FEMA's Local Mitigation Planning Handbook (March 2013) and its "Regulation Checklist" as a guide. Each element of the Regulation Checklist must be addressed satisfactorily for a plan to be approved by FEMA. **Table 1.9** summarizes the FEMA regulations, and where the regulation is addressed in this plan.

Table 1.9
FEMA Plan Review Criteria

Regulation	Location in Plan[8]
Element A - Planning Process	
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction (Requirement 201.6(c)(1))	Section 1
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interest to be involved in the planning process? (Requirement 201.6(b)(2))	Section 1
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement 201.6(b)(1))	Section 1
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement 201.6(b)(3)	Section 1
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (requirement 2016(c)(4)(iii))	Section 7
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement 201.6(c)(4)(i))	Section 7
Element B – Hazard Identification and Risk Assessment	
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? (Requirement 201.6 (c)(2)(i))	Sections 2 and 3a
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement 201.6(c)(2)(i))	Section 3a
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement 2016(c)(2)(ii))	Sections 3b,3c, 3d, and 3e
B4. Does the Plan address NFIP insured structure within the jurisdiction that have been repetitively damaged by floods? (Requirement 201.6(c)(2)(ii)	Section 3a
Element C – Mitigation Strategy	
C1. Does the plan document each jurisdiction's existing authorities, policies, programs, and resources and its ability to expand on and improve these existing policies and programs? (Requirement 201.6(c)(3))	Section 4
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement 201.6(c)(3)(ii))	Section 3a
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement 201.6(c)(3)(i))	Section 5
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement 201.6(c)(3)(ii))	Section 6
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement 201.6(c)(3)(iii))	Section 6
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement 201.6(c)(4)(ii))	Section 7
Element D – Plan Review, Evaluation, and Implementation (applicable to plan updates only)	
D1. Was the plan revised to reflect changes in development? (Requirement 201.6(d)(3))	Section 3d
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement 201.6(d)(3))	Section 6
D3. Was the plan revised to reflect changes in priorities? (Requirement 201.6(d)(3))	Section 6
Element E – Plan Adoption	
E1. Does the Plan include documentation that the Plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement 201.6(c)(5))	Page i[9]
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement 201.6(c)(5))	Page i[20]
Element F – Additional State Requirements	
Add here	

[8] "Location in the Plan" is referring to the primary plan Section where the requirement is met, and any appendices referenced in that section.

[9] Participating jurisdictions will each be responsible for passing their resolutions after agency reviews are completed and FEMA indicates that the plan is "Approvable Pending Adoption". Each jurisdiction is responsible for providing a copy of their adoption resolution to UCECEM. UCECEM is responsible for providing a copy of all resolutions to FEMA, and inserting hard copies into the bound document following Page i.

General Overview of Modifications to the 2009 Plan as part of the 2015 Plan Update

This section documents how the planning team reviewed and analyzed each section of the prior version of the plan (2009) and whether each section was revised as part of the 2015 Plan Update. As part of this update, every section of the earlier plan has been reviewed and comprehensively updated as needed to achieve compliance with FEMA mitigation planning requirements outlined in the Local Mitigation Plan Review Guide in October 2011 and the Local Mitigation Planning Handbook in March 2013.

The document has been streamlined, with a good deal of supporting documentation moved into appendices reproduced only on CD but not in hard copy in order to make the hard copy version of the plan more portable and user-friendly for those benefiting from its contents. Printed hard copies of all data and appendices reproduced on CD will be kept on file by UCECEM for inspection upon request. Applicable and relevant information from the last version of the plan has been carried through to the updated text on a case by case basis.

Highlights of some key additional information appearing in this updated document include:

- A description of the planning process and associated outreach activities (to the public and other stakeholders) that was undertaken as part of this update.
- A listing of historical occurrences of the identified hazards since the last version of the plan was prepared in 2009 (including but not limited to major disaster and emergency declarations).
- Current information regarding changes in development, progress on local mitigation efforts, and any changes in priorities.
- The status of past projects and plan maintenance activities, as well as identification of new mitigation strategies, for the County and each of the municipalities who opted to participate in the plan update.
- A full summary of updated local capabilities with local assessments of how their capabilities could be improved to foster mitigation goals.
- Incorporation of recently published information not available at the time of the 2009 Plan (such as the New York State Hazard Mitigation Plan of 2014).

Table 1.10 documents how each section of the plan was reviewed and analyzed, and whether each section was revised as part of the update process.

Table 1.10
Overall Summary of Plan Transition – 2009 to 2015

2009 Plan Section (s)	2015 Plan Update Section(s)	Comments
Plan Adoption Resolutions Placeholder	Plan Adoption Resolutions Placeholder	Reviewed and updated to refer to the 2015 Plan Update, but presentation remains largely unchanged.
Acknowledgements	Acknowledgements	Reviewed and updated to present details for the 2015 Plan Update, but presentation remains largely unchanged.
Executive Summary	Executive Summary	Reviewed and updated to reflect current conditions. More specific discussions of outreach activities have been added. County agencies and stakeholder entities who participated on the Steering Committee are now highlighted specifically. A paragraph has been added regarding the improvements each JAT has made to its mitigation strategy, and some broad brush descriptions of types of projects in the mitigation strategies.
Section 1 – Introduction	Section 1 – Introduction	Reviewed and updated to present details of the 2015 Plan Update process. General information about the County has been updated to current conditions. Subsections regarding the planning process and planning team organizational structure have been reorganized and updated to streamline discussions and improve readability. Discussions of outreach have also been reorganized and streamlined to improve readability, and updated to present the **substantially more comprehensive and robust outreach activities undertaken during the**

Table 1.10 Overall Summary of Plan Transition – 2009 to 2015		
2009 Plan Section (s)	**2015 Plan Update Section(s)**	**Comments**
		first update. Text has been added to more explicitly define the incorporation of existing plans, studies, reports, and technical information. The regulatory compliance section was revised from the old Crosswalk references to the new Regulation Checklist. And a section was added to provide an overview of modifications to the previous version of the document.
Section 2 – Identification of Potential Hazards	Section 2 – Identification of Potential Hazards	Reviewed and updated to present details for the 2015 Plan Update, but data presentation remains largely unchanged. Hazard descriptions have been moved to an appendix.
Section 3a – Hazard Profiles	Section 3a - Hazard Profiles	Updated to reflect new data (such as newer flood maps) and recent hazard event occurrences. Some restructuring of data presentation to streamline content. Priority Risk Indices appear in a new Section 3e. **Updated information has been incorporated such as new flood maps, current repetitive flood loss property data, local assessments of NFIP administration in each jurisdiction, newer coastal surge mapping (for Hudson River tidal communities), etc.**
Section 3b – Identification and Characterization of Assets in Hazard Areas	Section 3b – Identification and Characterization of Assets in Hazard Areas	Reviewed and updated to reflect current conditions, but presentation remains largely unchanged. **Updated to include more recent County parcel data and critical facilities layers; more recent HAZUS stock data, and updated lists of historic and cultural resources.**
Section 3c – Damage Estimates	Section 3c – Damage Estimates	**Damage estimates updated. Incorporated more recent GIS data, latest hazard area maps, latest critical facilities data, County parcel data, etc. as well as new information on sea level rise.** Restructuring to eliminate some information, and move others to appendices.
Section 3d – Land Uses and Development Trends in Hazard Areas	Section 3d – Land Uses and Development Trends in Hazard Areas	Reviewed and **updated to reflect jurisdictional reassessments of current conditions, and revised to reflect changes in development since the last plan was prepared**. New subsections added regarding development trends in hazard areas, and policies being implemented in the next plan maintenance cycle that can provide some level of risk reduction.
Not in the earlier draft	**New** Section 3e – Conclusions on Hazard Risk	**New section added to present overall conclusions on hazard risk, including Priority Risk Indices and Key Risk Findings.**
Section 4 – Capabilities and Resources	Section 4 – Capabilities and Resources	This section was updated to reflect **jurisdictional reassessment of capabilities**. Restructuring of the section moved some information into appendices to streamline presentation.
Section 5 – Mitigation Goals	Section 5 – Mitigation Goals	Updated to reflect current state plan goals; presentation remains largely unchanged.
Section 6 – Range of Possible Mitigation Actions Considered Section 7 – Action Item Evaluation and prioritization Section 8 – Implementation Strategies	Combined into a new Section 6 – Mitigation Actions	Sections were combined to streamline presentation of content and ease readability. Some restructuring of information presentation. **Update provides status of projects in jurisdictional action plans in 2010, along with information on relevance and whether the action would be carried forward to the 2015 action plans. Updated strategies include hundreds of actions and are robust approaches to mitigation**. The most notable difference in this plan section will be observed with regard to mitigation strategies for each jurisdiction. The entire planning team spent a great deal of effort reconsidering risks and developing substantially more robust mitigation strategies that address highest hazards and key risk findings. Many more projects are included in jurisdictional action plans. Actions are documented much more thoroughly, and they now represent jurisdictional mitigation visions with a significantly more focused aim at disaster resilience and risk reduction.
Section 9 – Plan Maintenance and Integration	Section 7 – Plan Maintenance and Integration	Reviewed and updated to reflect current conditions and jurisdictional preferences. **Substantial expansion in the level of detail of plan integration activities for the next plan maintenance cycle identified by each JAT, along with a detailed jurisdictional assessment of integration activities that were undertaken during the first 5-year cycle.**
Section 10 – For More Information	Section 8 – For More Information	Presentation remains unchanged

SECTION 2 - IDENTIFICATION OF POTENTIAL HAZARDS

Ulster County is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. FEMA's current regulations and interim guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism, etc.) is encouraged, though not required, for plan approval. Ulster County has focused solely on natural hazards at this time. Incorporation of human-caused hazards may be evaluated in future versions of the plan, as it is a "living document" which will be monitored, evaluated and updated regularly. Upon a review of the full range of natural hazards, Ulster County has identified a number of hazards that are to be addressed in its Multi-Jurisdictional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from three key sources: Planning Committee members, research of past disaster declarations in the County, and the New York State Hazard Mitigation Plan. Readily available online information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources. The most prominent online sources of data used in this assessment to identify the occurrence of various hazards were records of declared disasters and emergencies maintained by FEMA and NYSOEM, the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) Storm Event Database, and the Spatial Hazard Events and Losses Database for the United States (SHELDUS) maintained by the Hazards and Vulnerability Research Institute (HVRI) at the University of South Carolina.

The hazards of the 2009 Plan were reviewed, and the need for adding or removing hazards was considered. All earlier assessments were determined to still be applicable for the plan update; however, storm surge was added during the update process based on Hudson River surges observed during Superstorm Sandy. CPG members in attendance indicated their concurrence with these findings by a show of hands; all who were present at the meeting were in support of the updated assessment. **Table 2.1** provides a summary of the hazard identification and evaluation process noting which of the 23 initially identified hazards are considered significant enough for further evaluation through Ulster County's multi-jurisdictional hazard risk assessment (marked with a "☑").

Table 2.1 - Summary Results of the Hazard Identification and Evaluation Process

ATMOSPHERIC

- ☐ Avalanche
- ☑ Extreme Temperatures
- ☑ Extreme Wind
- ☐ Hailstorm
- ☑ Hurricane and Tropical Storm
- ☑ Lightning
- ☑ Nor'easter
- ☑ Tornado
- ☑ Winter Storm

HYDROLOGIC

- ☐ Coastal Erosion
- ☑ Dam Failure
- ☑ Drought
- ☑ Flood
- ☑ Ice Jams
- ☑ Storm Surge
- ☐ Wave Action

GEOLOGIC

- ☑ Earthquake
- ☐ Expansive Soils
- ☑ Landslide
- ☐ Land Subsidence
- ☐ Tsunami
- ☐ Volcano

OTHER

- ☑ Wildfire

☑ = Hazard considered significant enough for further evaluation through Ulster County's multi-jurisdictional hazard risk assessment.

Table 2.2 provides a summary of the County's 2014 HAZNY analysis for reference and comparison. The updated risk assessment includes all natural hazards ranked above "low" in the HAZNY.

Table 2.2 – Ulster County's HAZNY Analysis Results (2014)

Natural Hazard	Identified for Inclusion in the Plan Update?	HAZNY Analysis Rating	Classification
Flood	Yes	324	High
Severe Storms	Yes	310	Moderately High
Ice Storm	Yes	304	Moderately High
Wildfire	Yes	286	Moderately High
Hurricane	Yes	274	Moderately High
Extreme Temperatures	Yes	262	Moderately High
Landslide	Yes	246	Moderately High
Drought	Yes	234	Moderately Low
Ice Jam	Yes	232	Moderately Low
Dam Failure	Yes	224	Moderately Low
Tornado	Yes	222	Moderately Low
Earthquake	Yes	212	Moderately Low
Climate Change	Yes	196	Moderately Low
Avalanche	No	107	Low
Tsunami	No	107	Low

Note: HAZNY Analysis Rating is out of a possible maximum of 400. Only natural hazards are included in the table.

Table 2.3[1] documents the evaluation process used for determining which of the initially identified hazards are considered significant enough for further evaluation through Ulster County's multi-jurisdictional hazard risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Planning Committee during the plan update process. Table 2.3 also documents the planning team's reassessment of hazard significance during the first plan update as part of its ongoing maintenance of the plan to ensure that it reflects current conditions.

Appendix 2.1 lists the full range of natural hazards initially identified for consideration for inclusion in the plan and provides a brief description for each. This table includes 23 individual hazards. Some of these hazards are considered to be interrelated or cascading (i.e., hurricanes can cause flooding, storm surge and tornadoes), but for preliminary hazard identification purposes these individual hazards are broken out separately. It should also be noted that some hazards, such as earthquakes or winter storms may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage.

[1] Table 2.3 was updated to include events captured by readily-available data sources (particularly NCDC records) as of Fall 2013. The sources themselves are not updated to the same end date across all hazards; hence, Table 2.3 will show event records through different end dates and this variability is reflected in the table. Information gleaned from the New York State Hazard Mitigation Plan is from the latest version available (2011) at the time this section was drafted.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
ATMOSPHERIC HAZARDS				
Avalanche	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of US Forest Service National Avalanche Center web site • Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Avalanches are not included in the NY State Hazard Mitigation Plan, and are not discussed for NY on the US Forest Service Avalanche Center web site. • While avalanches are not unknown in northern New York State, the topography and climate in Ulster County do not typically support conditions that would be required for the occurrence of significant avalanches. • Avalanches are listed as a low hazard in the Ulster County HAZNY; rare events where serious injury or death is unlikely, little or no damage is expected to private property, and little or no structural damage would be expected to public facilities.
Extreme Temperatures	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA National Climatic Data Center (NCDC) Database • Ulster County HAZNY • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Input from Planning Group	• Extreme temperature events are included in the NY State plan as a discrete hazard. The State plan records 108 extreme temperature events affecting New York State between 1993 and 2010 resulting in 99 deaths, 51 injuries, $533,000 in property damage. It also shows that the percentage of the population most susceptible to extreme temperatures (under 5 years and over 65 years) is 19 percent, which is somewhat lower than in most other counties in the state (the statewide percentages range from a low of 14.2 percent to a high of 25.8 percent). • NCDC reports 46 significant extreme temperature events for areas including Ulster County between January 1996 and June 2013 (including 34 extreme summer heat events and 12 extreme winter cold events). For these events there are no recorded property damages, deaths or injuries; however, in $16.7 million in crop losses occurred (from a single extreme cold event in May 2008). • Extreme temperatures were ranked 6th out of 15 ("Moderately High Hazard") natural hazards included in the Ulster County HAZNY study.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Extreme Wind	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of American Society of Civil Engineers (ASCE) Standard 7-02 (Minimum Design Loads for Buildings and Other Structures) • Ulster County HAZNY • Input from Planning Group	• Extreme wind events are included in the NY State plan and the Ulster County HAZNY in the context of hurricane and tornado events. • The state plan ranks Ulster County as 13th out of 62 counties in the state for the threat of extreme wind and vulnerability to extreme wind loss. • Ulster County is located in a climate region that is highly susceptible to numerous types of extreme wind events including severe thunderstorms, hurricanes, tropical storms, nor'easters and severe winter storms. • According to FEMA, Ulster County is located in a wind zone where extreme wind speeds of 160mph are possible. • NCDC reports 111 high wind events (wind speed > 50 knots/58 mph) in Ulster County between January 1996 and June 2013. These events have caused $2,987,000 in property damage and two deaths. The 3 second wind gust for Ulster County for building design purposes as per ASCE 7-02 is 90 mph. The standard also shows south eastern Ulster County is located in a Special Wind Region (i.e., an area where wind anomalies are known to occur and in which wind speeds may be substantially higher than specified).

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Hailstorm	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database and NOAA National Severe Storms Laboratory NSSL website • Ulster County HAZNY • Input from Planning Group	• The State plan includes hailstorms as a discrete hazard and estimates that hail storms in New York State have caused approximately $3.2 million in property damage and $60.1 million in crop damage since 1993; and roughly 89 injuries statewide since 1987; with annualized hail losses in Ulster County of just under $83,000 per year. • NCDC reports 40 severe hailstorm events (3/4 inch diameter hail or greater) for Ulster County between January 1996 and June 2013, causing $33,500 in property damages and $17.1 million in crop damages, but no recorded deaths or injuries. Reported crop damages are associated with only two events (May 18, 2000 and June 16, 2008). • NCDC reports only one event in which "damaging" hail (at least 2 inches in diameter) fell in Ulster County (Kingston – August 13, 2003). However, no deaths, injuries, property or crop damages were recorded for this event. According to NSSL data Ulster County is located in a part of the country with the lowest annual number of hail days (less than 3), and where the annual average number of damaging hail events is less than 0.25. • Hailstorms are not included in the Ulster County HAZNY. • There are minimal hazard mitigation techniques available to reduce hailstorm impacts outside of the emergency preparedness procedures and severe weather warning systems already in place (i.e. mass public notifications that recommend immediate protective actions). Agriculture is the most affected by hailstorms, but there are no measures that can be implemented to protect crops from hail. Therefore, hail – while a hazard in Ulster County – has not been identified as a hazard to be addressed in the plan at this time. The only municipality in Ulster County to report that it considers hailstorms to be a significant hazard is the Town of Marlborough, which has both the highest proportion and total acreage of agricultural land use in the County. In the absence of hail mitigation measures for crops, there is not sufficient overall concern to warrant further investigation in this hazard mitigation plan at this time, although future plan updates may revisit the hail hazard at a later date.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Hurricane and Tropical Storm	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks • Review of NOAA National Hurricane Center website • Review of NOAA NCDC Storm Events Database • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Hurricane and tropical storms are discussed in the State plan, which includes FEMA mapping showing Ulster County located in a hurricane-prone area where extreme wind speeds of 160 mph are possible. • Ulster County has been included in the area covered by major disaster declarations due to hurricanes or tropical storms on six occasions since 1985. • NOAA historical records indicate 3 hurricanes (all Category 1), 8 tropical storms, and 4 tropical depressions passing within 50 miles of the Ulster County seat in Kingston since 1863. • The most recent of these events was Irene which passed along the eastern border of the county in 2011 as a tropical storm. • According to the NHC the estimated return period for a Category 1 hurricane in the New York City area is 17 years, rising to 370 years for a Category 5 event • Hurricanes were ranked 5th out of 15 ("Moderately High Hazard") natural hazards included in the Ulster County HAZNY study. • Sandy was a Category 3 storm at its peak intensity when it made landfall in Cuba; however, on making landfall it New Jersey, it was classified as as a post-tropical cyclone with hurricane-force winds "Superstorm Sandy". Whatever the name, Sandy's impacts were those of a hurricane, and impacted Ulster County, primarily due to storm surge propagating up the Hudson River and flooding riverfront communities. Ulster County was declared a Federal Disaster Area as a result of Sandy.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Lightning	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database, NOAA lightning statistics, and NSSL web site • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Lightning is not considered as a discrete hazard in the NY State Hazard Mitigation Plan or the Ulster County HAZNY. • According to NOAA and FEMA data, Ulster County is located in an area of the country that experiences an average of less than 40 thunder events and 1 - 4 lightning flashes per square kilometer per year. For comparison, large areas of the country experience more than 100 events per year and more than 10 flashes per square kilometer. • NOAA records that New York State has experienced the fifth most deaths from lightning in the USA from 1959 to 1994. • NCDC reports 18 lightning events for Ulster County between January 1996 and June 2013. These events have resulted in 1 death, 6 injuries, and $613,000 in property damage.
Nor'easter	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Nor'easters are discussed in the state plan as a common cause of flooding and snowstorms, particularly in the south eastern part of the state. • Although not specifically included in the Ulster County HAZNY, the county has been affected by numerous nor'easters, with the principal impacts being heavy snowfall and flooding, and the HAZNY ranks "Severe Storms" 2nd out of 15 ("Moderately High Hazard") natural hazards included in the Ulster County HAZNY.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Tornado	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database and National Severe Storms Laboratory (NSSL) • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• The state plan acknowledges that New York State has a definite vulnerability to tornadoes, with an average annual occurrence of about 6 tornadoes per year since 1950. NCDC reports 2 tornado events in Ulster County between January 1996 and June 2013. These events have resulted in no recorded deaths or injuries but have caused an estimated $200,000 in property damage. The most severe being an F2 tornado that struck the county in May 2000. • NSSL tornado probability data indicate that while Ulster County is in an area that experiences less than 1 tornado event per year, life-threatening and damaging tornado events remain a possibility. • Tornadoes were ranked 11th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Winter Storm	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • New York State Climate Office web site • Ulster County HAZNY • Input from Planning Group	• Winter storms including heavy snow and ice storms are discussed in the state plan, which notes that Ulster County averages approximately 60 inches of snowfall per year. The statewide average is 65 inches, with 60% of the state experiencing at least 70 inches annually. The website of the New York State Climate Office records that some areas of higher ground in western Ulster County experience annual average snowfalls of 100 inches and more. • The NY State plan ranks Ulster County 26th out of 62 counties in the state for most threatened by snow and vulnerable to snow losses. The plan also ranks Ulster County 36th out of 62 counties in the state for most vulnerable to ice storms and ice storm losses. • NCDC reports that Ulster County has been affected by 109 significant snow and ice related events between January 1996 and June 2013 resulting in $2.8 million in property damage • FEMA records show that Ulster County has been included in one snow-related disaster declaration in the last 30 years and two snow-related emergency declarations. • There has been one presidential disaster declaration due to ice storms in Ulster County since 1953. • Ice Storms were ranked 9th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY study.
HYDROLOGIC HAZARDS				
Coastal Erosion	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Input from Planning Group	• While coastal erosion is identified as a hazard and discussed in the NY State plan, it does not apply to Ulster County. Coastal erosion is a coastal phenomenon, and since Ulster County is located more than 50 miles from the nearest coastline, it is not regarded as a hazard for the purposes of this plan.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Dam Failure	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of New York State Department of Environmental Conservation (NYSDEC) Bureau of Flood Protection and Dam Safety web site • Review of U.S. Army Corps of Engineers National Inventory of Dams database • Review of Stanford University's National Performance of Dams Program web site • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Dam Failure is briefly discussed in the state plan as a potential cause of flooding. • The USACE NID lists 54 dams of all types in Ulster County. The NID consists of dams meeting at least one of the following criteria: (1) high hazard classification - loss of one human life is likely if the dam fails; (2) significant hazard classification - possible loss of human life and likely significant property or environmental destruction; (3) equal or exceed 25 feet in height and exceed 15 acre-feet in storage; and/or (4) equal or exceed 50 acre-feet storage and exceed 6 feet in height. • The Stanford University NPDP also lists 54 dams in Ulster County; 10 are listed as high hazard; 26 are listed as significant hazard; 17 are listed as low hazard, and one is unclassified. • Dam Failure was ranked 10th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY study.
Drought	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Database • Review of National Drought Mitigation Center /NOAA web sites • Ulster County HAZNY • Input from Planning Group	• Drought is discussed in the state plan, which records two significant local droughts and one statewide drought event that affected Ulster County since 1993. • NCDC reports that Ulster County has been affected by four drought events of varying severity since 1996. • According to the Palmer Drought Severity Index data released by NOAA, Ulster County experienced moderate drought during 41 weeks and severe drought in one week between January 1998 and December 2007. • Drought was ranked 8th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY study.

Table 2.3 - Documentation of the Hazard Evaluation Process

Natural Hazards Considered	2009 Plan Assessment	First Update Assessment	How was this determination made?	Why was this determination made?
Flood	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of FEMA's NFIP Community Status Book and Community Rating System (CRS) • Review of FEMA flood maps and Flood Insurance Study for Ulster County and the County Flood Insurance Study • Ulster County HAZNY • Input from Planning Group	• Flooding is described in the state plan as the primary natural hazard in the State of New York and is discussed in comprehensive detail. • About 85 percent of all Federal disaster declarations covering Ulster County have involved flooding. Ulster County has been affected by 19 flood-related Presidential disaster declarations since 1953 (6 of which were related to hurricane or tropical storm events). Of these, 11 have occurred within the last ten years (2003-2013). • NCDC records more than 100 flood events affecting Ulster County since March 1993. One fatality, one injury, and almost $25 million in property damage was attributed to these events. • According to the New York State Plan 100-year Floodplain Property Exposure Analysis, 1,854 residential properties (valued at about $395 million) lie within the identified 100-year floodplain. Ulster County ranks as the 9th most threatened and vulnerable to flood loss out of the 62 counties in the state on this basis. • All jurisdictions in Ulster County participate in the NFIP but none participate in the CRS. Ulster County ranks 13th out of 62 for the total number of NFIP policies and 12th for the total dollar amount of NFIP coverage. Ulster county ranks 15th in the state for the total number of NFIP claims since 1978, but 11th for the total dollar amount of claims paid. • Flooding was ranked number 1 out of 15 ("High Hazard") natural hazards included in the Ulster County HAZNY study.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Ice Jams	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • USACE Cold Regions Research & Engineering Laboratory Ice Jams Database • Ulster County HAZNY • Input from Planning Group	• Ice jams are mentioned as a significant cause of flooding in the state plan – New York State has experienced more ice jam events than any other U.S. state except Montana in the period 1867 through 2010. • USACE CRREL Ice Jams mapping indicates ice jam incidents at 12 locations on rivers in Ulster County from 1875 to 2007. • Ice jams were ranked 9th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY study.
Storm Surge	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and based on new data from Superstorm Sandy, the hazard is identified as a significant hazard to be addressed in the plan update.	• Review of NY State Hazard Mitigation Plan • Review of U.S. Army Corps of Engineers SLOSH model data • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of NCDC records • Input from Planning Group	• NOAA NCDC records for Superstorm Sandy in October 2012 indicate that this powerful storm caused a storm surge of water that moved up the Hudson River from the New York City area. Record flooding occurred on the Hudson River at Poughkeepsie as the river reached 9.54 feet. This surge of water moved all the way up to Albany. Flooding occurred along the Hudson River in Dutchess, Ulster, Greene, Columbia, Rensselaer and Albany counties causing damage to homes and businesses located near the river. Ulster County was declared a Federal Disaster Area as a result of Superstorm Sandy.
Wave Action	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Input from Planning Group	• While waves are discussed in the state plan under flood hazard, damage-causing waves are considered a coastal phenomenon, and since Ulster County is located more than 50 miles from the nearest coastline, they are not regarded as a hazard for the purposes of this plan.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
GEOLOGIC HAZARDS				
Earthquake	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of USGS Earthquake Hazards Program web site • Review of New York City Area Consortium For Earthquake Loss Mitigation website • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Earthquakes have occurred in and around the State of New York in the past, and are discussed in the State Plan. • The State Plan ranks Ulster County 23rd out of 62 counties for potential annualized earthquake losses and 31st out of 62 for potential annualized earthquake loss per capita. • According to the 2008 USGS seismic hazard maps in the State Plan, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for Ulster County is largely between 2%g and 3%g, with the exception of a small region in the southeast corner of the county that is mapped between 3%g and 4%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more. • USGS records do not show the historic occurrence of any earthquakes of magnitude 3 or greater in Ulster County. Earthquakes of lesser magnitude are generally too small be to be felt and are not considered to be the cause of damage. • Earthquakes were ranked 12th out of 15 ("Moderately Low Hazard") natural hazards included in the Ulster County HAZNY study.
Expansive Soils	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of USDA Natural Resources Conservation Service (NRCS) Soil Websites • Input from Planning Group • Ulster County HAZNY	• Expansive soils are not identified as a significant hazard in the NY State plan or the Ulster County HAZNY. • According to FEMA and USDA sources, Ulster County is located in an area that has a "slight to moderate" clay swelling potential. • According to USDOT FHA Report No. FHWA-RD-76-82, Ulster County lies in an area mapped as non-expansive, except for a small area in the northeastern part of the county, which is potentially of low expansive character and/or low frequency of occurrence. • New York State 2010 building codes are based on the International Building Code (2006), in which Chapter 18 includes provisions for building on expansive soils (through design, removal or stabilization) so that new construction will be protected.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Landslide	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of New York State Geological Survey GIS database of historic landslides in New York • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Landslides are discussed in the NY state plan, which gives Ulster County a weighted rank of 9th out of 62 counties in the state for susceptibility to landslides, and 19th out of 62 for vulnerability to losses from landslides. • Mapping based on the NYSGS landslide inventory presented in the state plan appears to show five landslide events occurring in Ulster County up to 1989. Tables in the state plan record only a single historic landslide incident in Ulster County since 1837, an event which caused two fatalities in 1921. • USGS landslide hazard maps indicate "High landslide incidence" (more than 15% of the area is involved in landsliding) for a narrow area immediately adjacent to the Hudson River in Ulster County. A portion of the southern part of the county is identified as "Moderate incidence", and the northwestern part of the county is identified as "High susceptibility but moderate incidence". The remainder of the county (approximately 70%) is identified as "Low incidence". • Landslides were ranked 7th out of 15 ("Moderately High") natural hazards included in the Ulster County HAZNY study.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Land Subsidence	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Review of USGS Fact Sheet 165-00 Land Subsidence in the U.S. • Ulster County HAZNY • Input from Planning Group	• The state plan delineates certain areas that are susceptible to land subsidence hazards in New York. While mapping in the plan depicts a narrow band of carbonate karst rock (in which there can be the potential for subsidence caused by sinkholes) crossing the southern portion of Ulster County, collapses that have resulted in structural damage are not reported. • While there is a history of mining in Ulster County (principally to extract lime for the production of cement), due to the robust nature of the geological strata in which these activities were carried out, it is assumed that there is no significant risk of land subsidence due to mine collapse. • According to the NYSGS (regarding the likelihood of subsidence): "…new sinkhole formation in the karst areas is rare, the last being 1989 … in a farmer's field…., and —…subsidence occurring in areas that are already subsiding (expanding existing sink holes) are relatively common, occurring every few years…." • Although our research indicates a certain possibility of land subsidence hazard in Ulster County, it also indicates very low risk to population and property. Additionally, the extremely localized and virtually unpredictable nature of land subsidence makes it nearly impossible to estimate potential loss. This said, with the exception of continuing to document land subsidence occurrence, this Plan will not include the land subsidence hazard in further analysis or mitigation strategy development. • Land subsidence is not included in the Ulster County HAZNY. Mine collapse, however, is included but was determined to be a Low hazard. Mine collapse was estimated to be a rare event, causing little to no damage to private property or public facilities, though serious injury/death was possible depending on location (though not in large numbers).

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
Tsunami	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• Tsunamis were ranked 15th out of 15 ("Low") natural hazards included in the Ulster County HAZNY study. They were estimated to be rare events where serious injury or death is unlikely and little or no damage to private property or public facilities would be expected. • Tsunamis appear in the 2014 State Draft Mitigation Plan Update, for coastal areas. • Since the southernmost border of Ulster County is located approximately 70 miles from open ocean, and no record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States, FEMA mitigation planning guidance suggests that locations on the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment. If tsunami inundation maps should one day become available for Ulster County, this hazard will be revisited in future plan updates.
Volcano	Not identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program web site • Ulster County HAZNY • Input from Planning Group	• No volcanoes are located within approximately 2,000 miles of Ulster County. • Volcanos are not included in the State Plan or County HAZNY.

Table 2.3 - Documentation of the Hazard Evaluation Process				
Natural Hazards Considered	**2009 Plan Assessment**	**First Update Assessment**	**How was this determination made?**	**Why was this determination made?**
OTHER HAZARDS				
Wildfire	Identified as a significant hazard to be addressed in the plan at that time.	Considered again and the earlier assessment was determined to still be applicable for the plan update.	• Review of NY State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of NYSEMO and NYSDEC web sites • Review of FEMA's Multi-Hazard Identification and Risk Assessment • Ulster County HAZNY • Input from Planning Group	• NYSEMO and NCDC records show one wildfire event in Ulster County since 1903 - in 2008, a 2,800 acre wildfire occurred in Minnewaska State Park killing approximately 50% of the old growth forest cover in this very popular and scenic park. • Five wildfires of more than 100 acres have burned in Ulster County between 1988 and 2012; this represents 6.3% of the statewide total for that time period. • Wildfires were ranked 4th out of 15 ("Moderately High Hazard") natural hazards included in the Ulster County HAZNY study. • According to available GIS data, approximately 70% of the county area is forested, and wildfire hazard risks are expected to increase as development along the urban/wildland interface increases.

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SECTION 3a- RISK ASSESSMENT: HAZARD PROFILES

Overview

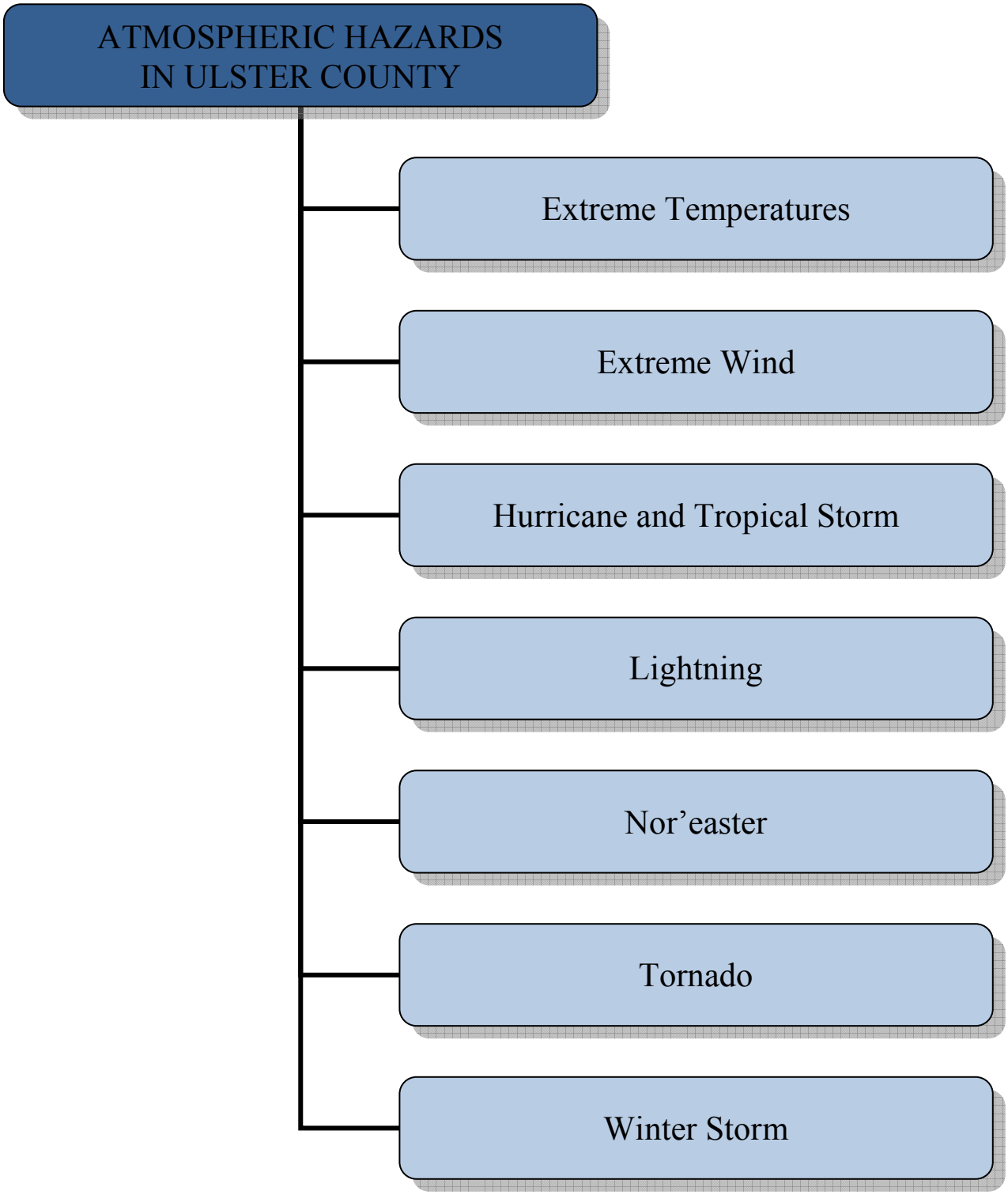
This section includes detailed profiles for each of the hazards identified in the previous section and described in **Appendix 2.1**. Each hazard profile includes a general description of the location of each hazard, its extent (magnitude or severity), notable historical occurrences and the probability of future occurrences. Profiles also include specific items noted by members of the Planning Committee as it relates to unique historical or anecdotal hazard information for Ulster County or a particular municipal jurisdiction. Please note that information is included for the Towns of Esopus, Marbletown and Rochester which opted not to participate.

Table 3a.1 lists each significant hazard for Ulster County and identifies whether or not it has been determined to be a specific hazard of concern for each of the County's 24 municipal jurisdictions based on best available data and local information provided by the Planning Committee (■ = hazard of concern).

Table 3a.1
Summary of Profiled Hazards by Jurisdiction

Jurisdiction	Atmospheric							Hydrologic					Geologic		Other
	Extreme Temperatures	Extreme Wind	Hurricane / Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Dam Failure	Drought	Flood	Ice Jam	Storm Surge	Earthquake	Landslide	Wildfire
Ulster, County of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Denning, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Ellenville, Village of [1]	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Esopus, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Gardiner, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Hardenburgh, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Hurley, Town of	■	■	■	■	■	■	■	■	■	■	■		■		■
Kingston, City of	■	■	■	■	■	■	■		■	■	■	■	■		■
Kingston, Town of	■	■	■	■	■	■	■		■	■	■		■	■	■
Lloyd, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Marbletown, Town of	■	■	■	■	■	■	■	■	■	■	■		■		■
Marlborough, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
New Paltz, Town of	■	■	■	■	■	■	■	■	■	■	■		■		■
New Paltz, Village of	■	■	■	■	■	■	■		■	■	■		■		■
Olive, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Plattekill, Town of	■	■	■	■	■	■	■	■	■	■	■		■		■
Rochester, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Rosendale, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Saugerties, Town of	■	■	■	■	■	■	■		■	■	■	■	■	■	■
Saugerties, Village of	■	■	■	■	■	■	■		■	■	■	■	■	■	■
Shandaken, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Shawangunk, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Ulster, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wawarsing, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■
Woodstock, Town of	■	■	■	■	■	■	■	■	■	■	■		■	■	■

ATMOSPHERIC HAZARDS



Extreme Temperatures

Extreme temperatures principally affect the health and safety of the human population, although they can also impact livestock, agricultural crops, and may also cause damage to infrastructure and property. This section provides detailed profiles of both extreme high and extreme low temperatures.

Location – Extreme Temperatures

Ulster County is located in a region of the country that is susceptible to both extreme heat and extreme cold. During periods of extreme temperature conditions, the effects are felt over a widespread geographic area, and it is generally assumed that the entire planning area (Ulster County and all of its municipalities) is uniformly exposed to extreme heat and extreme cold.

Extent – Extreme Temperatures

The speed of onset of extreme temperature events typically offers 24 hours of warning time. The duration of historic events in Ulster County is typically less than one week. The extent of extremely cold temperatures is typically measured through the Wind Chill Temperature (WCT) Index. The WCT Index provides a formula for calculating the dangers from winter winds and freezing temperatures. It is, essentially, a calculation of the temperature that is felt when the effects of wind speed are added to the base air temperature. **Figure 3a.1** shows the NOAA NWS Wind Chill Chart.

Figure 3a.1
NWS Wind Chill Index

Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

The extent of the extremely hot temperatures is typically measured through the Heat Index, which calculates the dangers from high relative humidity and extremely hot temperatures. It is, essentially, a calculation of the temperature that is felt when the effects of relative humidity are added to the base air temperature. **Figure 3a.2**shows the NOAA NWS Heat Index.

Figure 3a.2
NWS Heat Index

NOAA national weather service: heat index

Relative Humidity (%)	temperature (°F)															
	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Caution
Extreme Caution
Danger
Extreme Danger

Historical Occurrence – Extreme Temperatures

Extreme Cold

According to NOAA's National Climatic Data Center (NCDC), there were a total of 45 extreme cold[1] events in Ulster County between January 1996 and July 2015[2] (or an average of about two extreme cold event days per year). No deaths, injuries, or property damage was recorded for these events. However, $16.7 million in crop damage was recorded. Twenty-three events occurred since the last version of the plan was finalized in February 2009. All but two of these events occurred between the months of October and May, the time of year when extreme cold events are most common in the area. New York State has received no Federal Disaster or Emergency Declarations due solely to extreme temperatures. Some recent *notable* extreme cold events as reported by the NCDC include:

> **April 27, 2002.** A cold high pressure system settled into the Mid-Hudson Valley during the overnight hours of April 26-27. Under a mostly clear sky, and light wind, temperatures fell to or below 32 degrees across

[1] NCDC search results for the event types of cold/windchill, extreme cold/windchill, and frost/freeze.
[2] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.

portions of Ulster and Dutchess Counties where the growing season had already started. No damage was reported to the National Weather Service with this freeze.

January 25-26, 2007. An arctic air mass moved into east central New York State late Thursday night on January 25th, and remained in place into Friday, January 26th. Early morning low temperatures on Friday ranged between zero and ten degrees below zero, with some temperatures as low as 15 degrees below zero across higher elevations of the Adirondacks. In addition, northwest winds of 10 to 15 miles per hour produced wind chills as low as 25 to 30 degrees below zero early Friday morning, especially across higher elevations.

May 1, 2008. Widespread freezing temperatures, along with frost, affected areas across the mid-Hudson Valley, Capital District, the Lake George and Saratoga region, and Mohawk Valley of eastern New York during the early morning hours of Thursday May 1st. The freeze and frost was particularly damaging to fruit trees, as a previous warm spell in mid to late April led to unusually advanced stages of bloom. Crop damages were most extensive in Ulster County, where $16.7 million in crop losses were estimated, mainly for apple and peach orchards.

January 16, 2009. A bitterly cold air mass spread across much of east central New York and adjacent western New England during Friday January 16th. Widespread subzero temperatures were recorded across the region. Across portions of the southern Adirondacks and eastern Catskills, wind chills of 20 to 25 degrees below zero were recorded. Property and crop damages are not reported in the NCDC database for this event.

February 13, 2015. Behind an Arctic cold front, a frigid air mass moved into upstate New York, accompanied by gusty northwest winds of up to 35 miles per hour. Temperatures dropped as low as 18 degrees below zero, with wind chill values as low 35 degrees below zero at times. Some schools were delayed on the morning of Friday, February 13th. Several communities opened warming shelters. There were also some reports of frozen pipes and burst water mains, especially in the areas that contained older infrastructure. Property and crop damages are not reported in the NCDC database for this event record.

Extreme Heat

According to NOAA's National Climatic Data Center (NCDC), there were a total of 18 extreme heat[3] event days in Ulster County between March 1998 and July 2015[4] - or an average of about one extreme heat event day per year. No deaths, injuries, property, or crop damages are recorded in the database for these events. Eleven events occurred since the last version of this plan was approved in 2009, the most recent of which was in September 2013. Some *more notable* extreme heat events as reported by the NCDC include:

June 7, 1999. On June 7th, the season's second Bermuda High brought the first 90 degree temperature of 1999 to much of eastern New York. At the Albany International Airport it was the first official 90 degree temperature since August 16, 1997. The temperature did not stop there, but soared all the way to 95 degrees. This value tied the daily record for the date last set in 1925. The combination of heat and humidity produced a heat index between 100 and 105 degrees during the hottest portion of the day. There were no unusual problems or power outages reported due to the excessive heat.

July 4-6, 1999. Temperatures soared to 90 or higher most everywhere while dewpoints climbed well into the 70s. At the Albany International airport, the temperature peaked at 94 on July 5th and 95 on July 6th. However, after combining humidity values, the heat index reached as high as 105 on both days. At the Dutchess County airport near Poughkeepsie, the temperature crested at 99 degrees both days. On July 5th, the dewpoint reached 79 to produce a heat index of 119 degrees. The heat index peaked around 110 degrees on July 6th. The sultry air mass set the stage for a large severe thunderstorm outbreak during the afternoon of July 6th across eastern New York.

[3] NCDC search results for the event types of excessive heat and heat.

[4] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.

August 8-9, 2001. Officially, at the Albany International Airport, there were four consecutive days of 90 degrees or higher, the longest such stretch in over 6 years. The heat wave reached its peak on August 8th and 9th. During those days, the high reached 100 and 102 at Poughkeepsie respectively. On those same days the Albany International Airport reached 93 and 96. The 96 was a new daily maximum record for August 9th, eclipsing the old record of 94 set in 1949. Humidity levels were also high, which produced heat indices between 105 and 110 near Albany, and 110 to 115 closer to Poughkeepsie. The high heat indices did cause some heat related health problems in Schenectady. While no other heat related problems were reported to the National Weather Service, the heat led to record state electricity consumption, three days in a row. Governor Pataki closed down the State government at 2:00 PM on August 9th to conserve power. Hot weather also caused a railroad bridge to malfunction between the cities of Albany and Rensselaer, resulting in delays for four of Amtrak's passenger trains on August 9th.

June 9, 2008. Unseasonably hot and humid conditions persisted from June 9th until June 10th. Temperatures reached the mid to upper 90s across much of the mid-Hudson Valley and Capital Region during each afternoon. The combination of high temperatures and humidity levels produced heat indices of 100 to 104 degrees. Many schools across the region either cancelled classes, or had early dismissals due to the extreme heat.

July 21-22, 2011. Temperatures across much of east central New York warmed well into the 90s with some locations reaching the century mark in the mid-Hudson Valley. The most oppressive day was Thursday, July 21st, due to very high dew points in the 70s. The high humidity, combined with temperatures in the 90s, resulted in heat indices of 105 to 110 degrees up the Hudson River Valley. The New York Independent System Operator (NYISO) reported that New York State's peak power consumption on the 21st was the third highest peak on record. On Saturday July 23rd, heat indices of 100 to 104 degrees were recorded across the Capital District, mid-Hudson Valley, southern Taconics and southeastern Catskills.

July 15-19, 2013. High temperatures each day exceeded 90 degrees. When combined with the humidity, heat index values exceeded 100 degrees at times, mainly for the mid-Hudson Valley. The hottest days were July 18th and 19th, when high temperatures reached the mid to upper 90s in many locations. On the 19th, heat index values were between 105 and 110 degrees across portions of Ulster and Dutchess Counties, with heat index values over 100 degrees across much of eastern New York. The New York State Independent System Operator (NYSISO) reported that power consumption reached a record high on Friday, July 19th, exceeding a record set in 2006.

September 11, 2013. Temperatures warmed into the lower to middle 90s throughout the entire Hudson Valley, along with dewpoint values in the lower to middle 70s. This allowed heat index values to reach between 100 and 105 degrees.

Probability of Occurrence – Extreme Temperatures

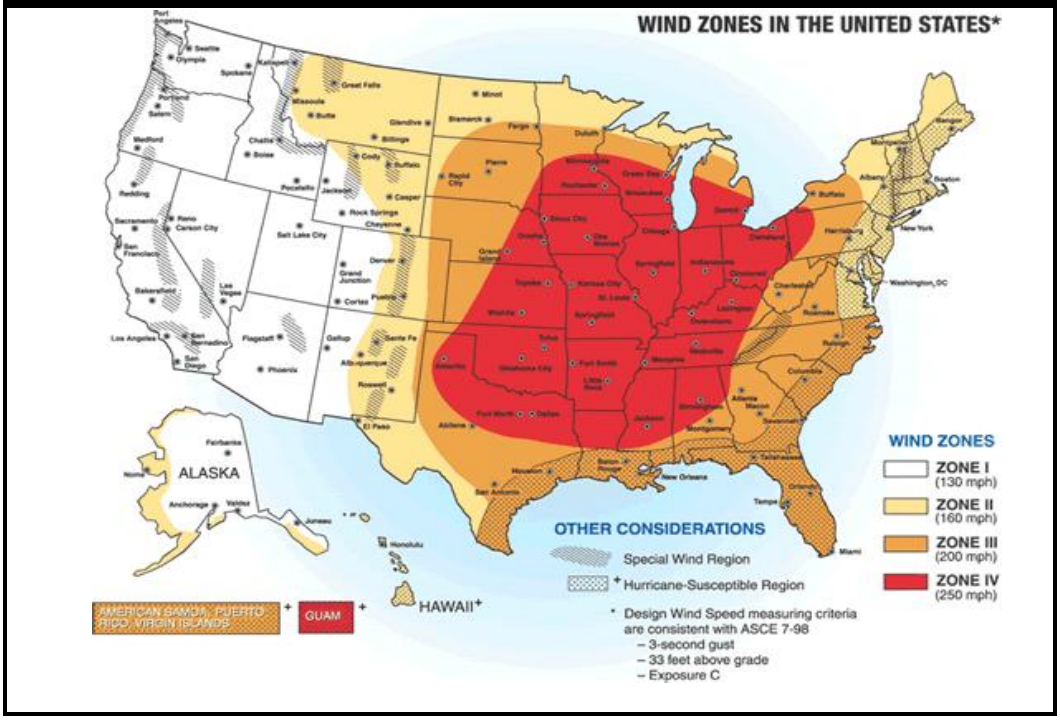
Extreme temperature events will continue to have a high probability of occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain (higher for extreme cold than extreme heat). While the impact of such occurrences on people and property is typically minimal, it is anticipated that the threat to human lives and safety is increasing due to growing elderly populations in many of Ulster County's municipal jurisdictions. Furthermore, temperatures in the Northeast United States have risen by about 1.5 degrees Fahrenheit (°F) on average since 1900. With climate change, it is anticipated that extreme temperature events will be more common occurrences in the years ahead.

Extreme Wind

Location – Extreme Wind

Extreme wind events are experienced in every region of the United States. The extreme wind hazard area covers the whole of Ulster County and the entire planning area is uniformly susceptible to the extreme wind hazard. **Figure 3a.3** illustrates various wind zones throughout the country based on design wind speeds established by the American Society of Civil Engineers. It divides the country into four wind zones, geographically representing the frequency and magnitude of potential extreme wind events including severe thunderstorms, tornadoes and hurricanes. The figure shows that all areas of Ulster County are located within Zone II and are susceptible to hurricanes, with a design wind speed for shelters of 160 mph (3-second gust).

Figure 3a.3
Wind Zones in the United States



Source: Federal Emergency Management Agency

Extent – Extreme Wind

Extreme wind can occur alone, such as during straight-line wind events and derechos, or it can accompany other natural hazards, including hurricanes and severe thunderstorms. Severe wind poses a threat to lives, property, and vital utilities primarily due to the effects of flying debris or downed trees and power lines. Severe wind will typically cause the greatest damage to structures of light construction, particularly manufactured homes. **Table 3a.2** illustrates the severity and typical effects of various sustained wind speeds. These would be reflective of high winds associated with thunderstorms, hurricanes, tropical storms and nor'easters. Typical effects of wind are very different for tornados. **Table 3a.3** illustrates the severity and typical effects of wind during tornados, as measured by various 3 second gusts. Note that tornados are addressed separately later in this plan section.

Table 3a.2
Severity and Typical Effects of Various Sustained Wind Speeds

Sustained Wind Speed* (mph)	Equivalent Saffir-Simpson Scale** (Hurricanes)	Severity of Damage	Typical Effects
0-73 *(V_{3S}=0 to 88)*	N/A	Isolated	Isolated damage for winds below 50 mph. Above 50 mph, expect some minor damage to buildings of light material. Small branches blown from trees.
74-95 *(V_{3S} =89 to 115)*	1	Minor	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, and vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
96-110 *(V_{3S}=116 to 130)*	2	Extensive	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
111-129 *(V_{3S}=131 to 149)*	3	Devastating	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
130-156 *(V_{3S}=150 to 176*	4	Catastrophic	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
157 or higher *(V_{3S}>177)*	5	Catastrophic	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Oceanic and Atmospheric Administration

** The 2003 International Building Code Table 1609.3.1 was used to convert Saffir-Simpson sustained wind speeds to 3- second gusts (V_{3S}) for the purposes of comparison between hurricane and tornado winds.*

TABLE 1609.3.1
EQUIVALENT BASIC WIND SPEEDS[a,b,c]

V_{3S}	85	90	100	105	110	120	125	130	140	145	150	160	170
V_{fm}	70	75	80	85	90	100	105	110	120	125	130	140	150

For SI: 1 mile per hour = 0.44 m/s.
a. Linear interpolation is permitted.
b. V_{3S} is the 3-second gust wind speed (mph).
c. V_{fm} is the fastest mile wind speed (mph).

*** The Saffir-Simpson Scale is described further in this section under Hurricanes.*

Table 3a.3
Severity and Typical Effects of Various Tornado Wind Speeds (3 second gust)

Maximum Wind Speeds 3 Second Gust (mph)	Equivalent Enhanced Fujita Scale* (Tornadoes)	Severity	Typical Effects
65-85	EF0	Light	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
86-110	EF1	Moderate	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
111-135	EF2	Significant	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; high-rise windows broken and blown in; light-object missiles generated.

136-165	EF3	Severe	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
166-200	EF4	Devastating	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
Over 200	EF5	Incredible	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; steel reinforced concrete structures badly damaged.

Source: National Oceanic and Atmospheric Administration
** The Enhanced Fujita Scale is described further in this section under Tornados.*

Historical Occurrences – Extreme Wind

Ulster County has experienced numerous types of damaging extreme wind events in the past including severe thunderstorms, tornadoes, hurricanes, tropical storms and nor'easters. According to the NCDC[5], 199 extreme wind[6] event days have affected Ulster County from July 1963 to July 2015 (data excludes tornado events which are addressed separately within this section). These incidents resulted in a reported total of three deaths, one injury, and roughly $3.1 million in property damages. Forty-two high wind days have been recorded since the last version of this plan was approved in February 2009, for which one death and $19,000 in damages were recorded. Extreme wind events occur regularly in Ulster County. Most events are associated with thunderstorms occurring during the summer months, with relatively low reported property damages per event (in the thousands of dollars). However, stronger weather systems have produced much more extreme and widespread wind-related impacts. A sampling of more *notable extreme, damage-causing events* includes the following:

November 6, 1994. High winds downed trees and power lines. Especially hard hit was Kingston, where trees fell on homes and vehicles. One death and $0.5 million in property damages were reported during this event.

December 24, 1994. A coastal storm which moved over extreme southeast New York on the morning of December 24th brought high winds to parts of eastern New York, downing trees, tree limbs and power lines. Especially hard hit were Olive, Woodstock and Hurley where large trees were uprooted and several homes sustained significant damage as trees fell on them (with an estimated $0.5 million in property damage).

March 19, 1996. A strong low pressure system produced damaging winds. In Ulster County trees were blown down in Kingston, Woodstock and Wawarsing resulting in an estimated $89,000 in property damages.

May 29, 1998. Thunderstorm winds downed trees and power lines. An elderly man was instantly killed at Ellenville in Ulster County, when a large tree limb fell on him.

July 1, 2001. In Ulster County, microbrust damage was surveyed by National Weather Service personnel on the east side of Gardiner. Winds were estimated to be around 100 mph and the damage was generally contained within a semi-circle to the west of Ireland Corners. Large trees were snapped or taken down in an area bounded by Route 44-55, Route 208 and Marabac Road. One tree fell on an automobile, crushing it. Meanwhile to the south of the Route 208 intersection, another tree fell onto the roof of a house. At the same location, a chimney toppled onto another vehicle. At the same time, thunderstorm winds blew down numerous trees in the City of New Paltz. Total estimated property damages in Ulster County totaled $65,000.

[5] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.
[6] NCDC query for events categorized as high wind, strong wind, and thunderstorm wind.

November 13-14, 2003. A steep pressure gradient between a low pressure area in the east and a high pressure system building across the Ohio Valley, brought the second major wind event of the fall season to eastern New York. Since the storm was slow moving, this turned out to be a two day high wind event. A roof over gas pumps at a Stewarts in Rosendale in Ulster County was badly damaged. A large tree fell onto a house near Kingston, damaging the roof. Downed live power lines caused a brush fire outside of New Paltz. One injury and $275,000 in property damages were attributed to this storm in Ulster County.

July 22, 2006. A thunderstorm over the lower Catskills shortly before daybreak became severe. It produced a wet-microburst wind gust estimated at 70 to 80 miles an hour in Ellenville. The strong wind blew down about 30 trees, destroyed a car, and damaged 2 homes. The estimated cost of the damage was 35 thousand dollars.

December 1, 2006. A tree was blown onto an apartment building, crashing through the roof and killing an individual inside in Wawarsing. This occurred from strong winds, well ahead of any thunderstorms.

October 29-30, 2012. Superstorm Sandy. As the storm made landfall in southern New Jersey during the evening of October 29th, bands of rain moved across eastern New York. Strong and gusty winds in association with the storm caused damage to trees and power lines across the region. Although not quite as widespread as areas across southeastern New York and New Jersey, power outages occurred throughout the region, mainly across the higher terrain. Local media reported that up to 63,000 customers lost power in Dutchess and Ulster Counties. It was also reported that utility National Grid had 8,000 customers without power in eastern New York at the height of the storm. Wind gusts of 40 to 60 mph were common, and reached 60 mph at Stone Ridge in Ulster County. One direct death was caused by these winds as flying debris was thrown through a windshield and killed a 69 year old woman driving in Kerhonkson in Ulster County.

Probability of Occurrence – Extreme Wind

Extreme wind events will continue to have a high probability of occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain. The entire planning area is susceptible to a wide variety of recurring events that cause extreme wind conditions including severe thunderstorms (most frequent), tornadoes, hurricanes, tropical storms and nor'easters. Based on historic occurrence data, Ulster County can expect about four and six extreme wind days per year[7].

Hurricanes and Tropical Storms

Location– Hurricane and Tropical Storm

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States, and while coastal areas are most directly exposed to the brunt of landfalling storms their impact is often felt hundreds of miles inland. Ulster County is located in a region of the country that is susceptible to all of the hazards wrought by hurricanes and tropical storms. In the strictest sense, hurricanes and tropical storms are not hazards in their own right but, rather, events where the primary damaging hazards are high-level sustained winds, heavy precipitation that causes inland flooding and tornadoes (coastal areas are also susceptible to the additional forces of storm surge, wind-driven waves and tidal flooding, which can be more destructive than cyclonic wind). The entire planning area is located within a geographic area that is affected by hurricanes and tropical storms. The hazard areas for the accompanying extreme wind, storm surge, coastal erosion, riverine flooding, tornadoes, and wave action hazards do, however, vary across the county. While mentioned

[7] About four extreme wind days per year is based on NOAA NCDC period of record of 52 years and 199 event days. However, the database is not particularly robust for its initial years of coverage between 1956 and 1986 during which only 15 event days are recorded. When the same calculation of extreme wind days per year is done using only the 29 years of robust record keeping and 184 event days during that period, the estimate of extreme wind days per year goes up to 6.3.

here, each of these individual forces are more thoroughly addressed as separate hazards within this section (i.e., extreme wind, coastal erosion, flood, tornado, storm surge, and wave action).

Extent – Hurricane and Tropical Storm

As a hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 mph, the system is designated a tropical storm, given a name and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach 74 mph the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 3a.4**), which rates hurricane intensity in categories on a scale of 1 to 5, with Category 5 being the most intense. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure and storm surge potential, which are combined to estimate potential damage. Categories 3, 4 and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. Even tropical storms and hurricanes that parallel the New York and New Jersey coastline many dozens of miles away from Ulster County without ever making direct landfall can still cause significant damage.

Table 3a.4
Saffir-Simpson Scale for Hurricanes

Category	Maximum Sustained Wind Speed (mph)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74–95	Greater than 980	3–5
2	96–110	979–965	6–8
3	111–129	964–945	9–12
4	130–156	944–920	13–18
5	157 +	Less than 920	19+

Source: National Oceanic and Atmospheric Administration

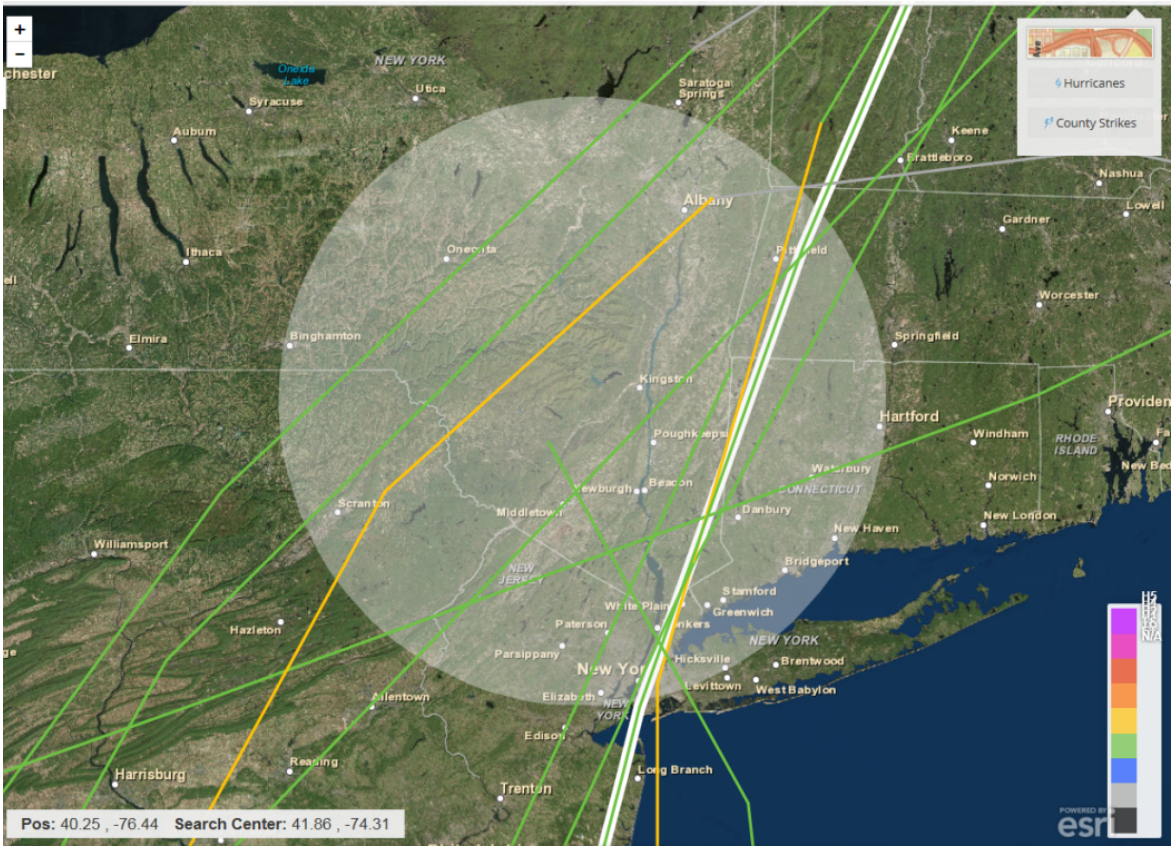
Historical Occurrences – Hurricane and Tropical Storm

Hurricanes and tropical storms have impacted Ulster County and its participating jurisdictions in the past, and will continue to do so in the future.

Ulster County has an active history of hurricanes and tropical storms. According to NOAA historical records, ten hurricane or tropical storm tracks[8] have passed within 75 nautical miles of Ulster County since 1863. This includes two Category 1 hurricanes; and eight tropical storms. Of these ten events, two tracks traversed directly through Ulster County (a Category 1 hurricane in 1878 and a tropical storm in 1893). **Figure 3a.4** shows the track of each recorded historical storm in relation to the Ulster County search area. As can be seen in the figure, almost all hurricane and tropical storm tracks traverse in a northeasterly direction through the area. For each event, **Table 3a.5** provides the date of occurrence, storm name (if applicable), maximum wind speed and category of the storm based on the Saffir-Simpson Scale (as recorded within 75 miles of Ulster County).

[8] Not including tropical depressions or extratropical systems.

Figure 3a.4
Historical Hurricane and Tropical Storm Tracks within 75 Nautical Miles of Ulster County[9], 1863-2014*



** NOAA 2014 (latest date available from data source, http://coast.noaa.gov/hurricanes/). Note that Irene's track is highlighted in white.*

Table 3a.5
Historical Hurricane and Tropical Storm Tracks within 75 Nautical Miles of Ulster County (1856-2014)

Date of Occurrence	Storm Name	Maximum Wind Speed (knots)	Storm Category
September 19, 1863	Unnamed	40	Tropical Storm
October 23, 1878	Unnamed	70	Category 1
August 22, 1888	Unnamed	40	Tropical Storm
August 24, 1893	Unnamed	75	Category 1
August 29, 1893	Unnamed	55	Tropical Storm
August 29, 1949	Unnamed	50	Tropical Storm
August 28, 1971	Doria	45	Tropical Storm
June 23, 1972	Agnes	45	Tropical Storm
September 6, 1979	David	40	Tropical Storm
August 28, 2011	Irene	55	Tropical Storm

[9] Out of five recent key damaging events for Ulster County (Ivan, Floyd, Irene, Lee, and Sandy), it is notable that only Irene meets the query criteria of hurricane or tropical storm strength within 75 nautical miles of Ulster County. The remnants of Hurricane Floyd and Hurricane Ivan were both tropical depressions by the time they reached Ulster County. Tropical Storm Lee made landfall in Louisiana and was no longer a tropical system when its remnants reached New York, and Superstorm Sandy was extratropical when its center passed several hundred miles to the south of Ulster County.

Ulster County has, most recently, been impacted by the remnants of both Hurricane Floyd in September 1999 and Hurricane Ivan in September 2004, both of which were Tropical Depressions by the time they reached Ulster County. Since the last version of the plan was prepared, Hurricane Irene (August 2011), the remnants of Tropical Storm Lee (September 2011), and Superstorm Sandy (October 2012) all hit Ulster County with full force. Brief descriptions of these *most notable, recent* tropical events include the following:

September 1999 – Floyd. Remnants of Hurricane Floyd impacted the western portions of Ulster County with high winds, heavy rains, and some flooding. Information received from local sources reports that this event caused significant property damage in the Town of Saugerties and left some residents without power for almost a week.

September 2004 - Ivan. Remnants of Hurricane Ivan impacted the County with high winds, heavy rains, and some flooding.

Hurricane Irene (August 28, 2011), Tropical Storm Lee (September 7, 2011), and Superstorm Sandy (October 29, 2012) hit Ulster County with full force. The torrential downpour caused water levels in the Rondout Creek, Wallkill River, and Lower and Upper Esopus Creek to reach record heights causing widespread flash flooding. Homes, businesses and infrastructure were destroyed, particularly in low-lying areas. Countless roads were closed due to flood waters overtopping culverts; bridges were closed isolating residents; and the force of the stormwater caused substantial infrastructure damage to water mains, sewage treatment facilities, and water delivery systems throughout the region. Stream banks were overtopped and severely eroded, flooding dozens of homes and depositing natural and man-made debris throughout the stream corridors. Businesses were severely flooded, leaving residents without access to basic necessities for weeks. Residents were forced to evacuate their homes, moving to shelters established in local emergency service buildings, schools, and community centers. County-wide shelters were set up at the Belleayre Mountain Ski Center and the SUNY New Paltz Health and Wellness Center, which, given their remote locations were difficult to access. The physical damage to roads, bridges, homes, and other essential infrastructure resulted in short and long term economic impacts that rippled throughout the County and the region. Irreparable losses to commodity farms, power failures, and, in some cases, isolation from economic centers complicated and delayed recovery efforts. Tourism, a major industry in this region, suffered greatly through both an overall loss of revenue and lost wages due to postponed business activity. A sampling of key critical issues facing the Ulster County[10] include:

Town of Olive - Watson Hollow Rd. Bushkill Creek
(Photo courtesy of Ed Kahill, NYRCR Ulster Plan)

Emergency Service Providers, Rosendale
(Photo courtesy of Jeanne Walsh, NYRCR Ulster Plan)

Flooded Residence, Lawrenceville
(Photo courtesy of Dr. David Rosenbaum, NYRCR Ulster Plan)

Debris and Road Collapse in the Village of Ellenville
(Photo courtesy of NYCRCR Ulster Plan)

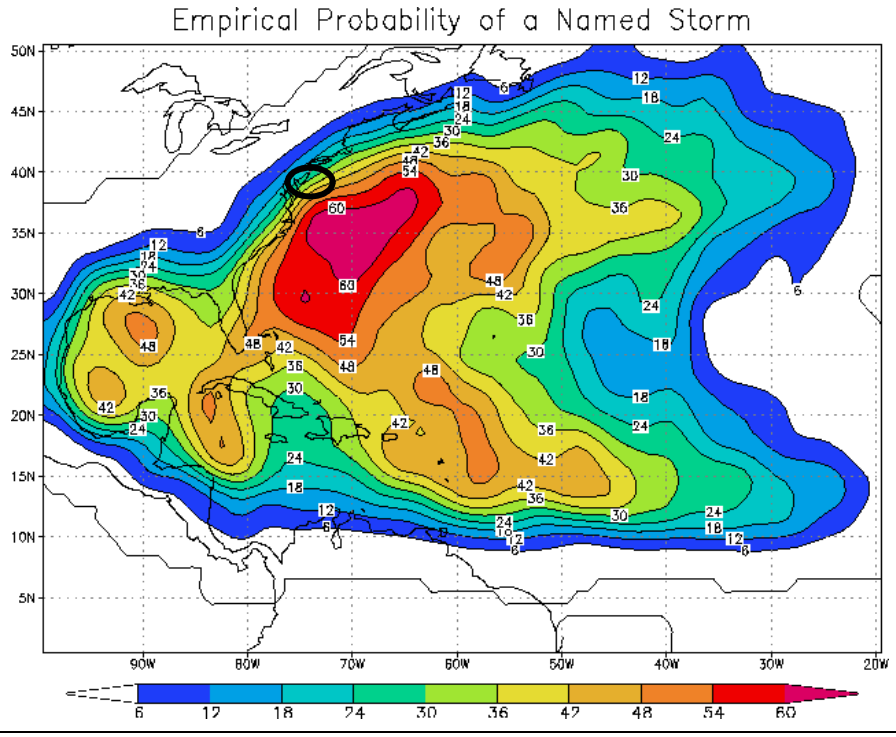
[10] Source: Ulster NY Rising Community Reconstruction Plan

widespread flooding of the Rondout, Wallkill and Esopus; natural and man-made debris blocking culverts, lodging against bridge abutments, and inhibiting the flow of water, and compromising infrastructure; direct economic impact to agricultural operations from commodity loss and secondary economic impacts to the region from loss of tourism revenue; massive stream bank erosion throughout the watershed areas, and on the Hudson River shoreline; lack of emergency preparedness, regional command centers and effective inter-municipal communication among emergency service providers; damage to residential neighborhoods built in flood prone areas, exacerbated by the lack of resilient design and construction; lack of regional sheltering, with protected access routes; vulnerability of and damage to critical assets including key municipal and emergency service buildings, commercial and healthcare facilities; vulnerability of and damage to bridges, culverts, roadways, water supply, wastewater treatment plans and system infrastructure; widespread and prolonged roadway closures isolating neighborhoods, healthcare facilities and senior centers, regional shelters, businesses, regional economic generators, and preventing access by emergency service providers; lack of designated route detours and signage; prolonged and widespread electrical power interruption including to communication towers.

Probability of Occurrence – Hurricane and Tropical Storm

The probability of future hurricane and tropical storm events for Ulster County is high. According to NOAA statistical data, Ulster County is located in an area with an annual probability of a named storm between 6 and 12 percent (**Figure 3a.5**). This empirical probability is fairly consistent with other scientific studies and observed historical data made available through various federal, state and local sources. Occurrences are most likely during the official Atlantic hurricane season (the months of June through November). The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is six. The probability of storm occurrences will vary significantly based on the return interval for different categories of magnitude. The probability of less intense storms (lower return periods) is higher than more intense storms (higher return periods).

Figure 3a.5
Empirical Probability of a Named Storm*



Source: NOAA

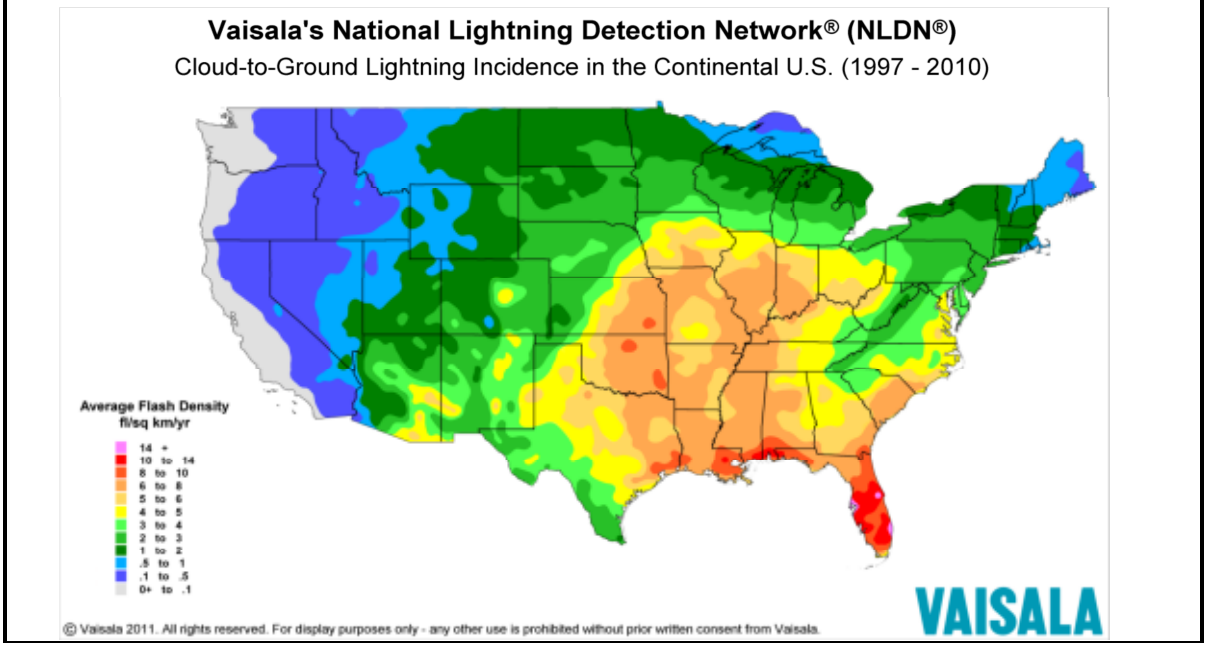
The frequency and intensity of coastal storms and severe weather events is expected to increase in the future due to climate change. In the years to come, it is anticipated that Ulster County will observe fairly drastic changes in storm character, intensity, frequency, and storm tracking. Hurricanes are likely to become more intense with rising sea water temperatures. Storm effects are expected to be more extensive in the future. The following types of impacts could be anticipated in Ulster County's future as a result of climate change: inundation of low-lying areas; increased frequency and extent of storm-related flooding; impacts to human populations (property losses, more frequent flood damage, more frequent flooding of roadways and urban centers, risks to people as the population of flood-prone areas increases); more buildings and infrastructure exposed; currently exposed buildings and infrastructure could be subject to potentially greater losses as water levels increase; impacts on gravity flow stormwater systems; impacts on non-coastal areas. Impacts of climate change can affect all parts of a community, including: transportation infrastructure (ports, marinas, airports, roads, bridges, railways); public infrastructure (stormwater and wastewater management systems, drinking water supply and distribution systems, power utility systems, communications systems); public facilities (i.e., police, fire, ambulance, hospitals, schools, daycare centers, adult living facilities, historic landmarks, government buildings, libraries, parks, etc.); economic viability of a community – particularly for communities where tourism tends to drive local economies, as is the case in some of Ulster County's communities. Climate change also could lead to a potential loss of assets that support tourism.

Lightning

Location and Extent – Lightning

Ulster County is located in a region of the country that is susceptible to lightning strikes, though not as susceptible as southeastern states. **Figure 3a.6** shows a lightning flash density map for the years 1997 to 2010 based upon data provided by Vaisala's National Lightning Detection Network® (NLDN®)[11].

Figure 3a.6
Lightning Flash Density in the United States



[11] Source: http://www.vaisala.com/Vaisala%20Documents/Scientific%20papers/2014%20ILDC%20ILMC/ILMC-Thursday/Roeder%20et%20al-Mapping%20Lightning%20Fatality%20Risk-2014-ILDC-ILMC.pdf

All areas of Ulster County are equally susceptible to lightning strike. While lightning occurs randomly anywhere and anytime, the most common location for lightning fatalities and injuries to people is in open areas such as parks, beaches, golf courses and other recreational areas. Ulster County remains susceptible to lightning deaths and injuries due to the large number of people who engage in outdoor activities.

Historical Occurrences – Lightning

According to NCDC[12], 16 lightning event days were recorded in Ulster County between July 1996 and July 2015. These incidents resulted in a reported total of one death, six injuries, and caused approximately $654,000 in property damages (representing an average of about 0.85 event days per year). Three events (with an associated $6,000 in property damages and one death) were added to the database since the last version of this plan was finalized in February 2009. Some *more notable events* include the following:

July 15, 1997. At Highland in the Town of Lloyd, a 180 foot by 120 foot storage facility was burned to the ground following a lightning strike causing an estimated $250,000 in damages.

July 4, 1999. Lightning resulted in as many as 3,500 residents without power in the Mid-Hudson Valley. **In addition, the l**ightning from the thunderstorm struck two different houses, one in Kingston and another in Ulster.. The first strike, at 119 Dewitt Street in Kingston ignited a fire that was contained to a storage room. The second lightning strike hit a tree, destroying it. The flames from the tree damaged a roof at 98 Katrine Lane, in the Town of Ulster.
August 10, 2003. Lightning from a thunderstorm struck a pole next to a house on Hardenburg Road in Rifton, in the Town of Esopus. The lightning was conducted through electrical wires and traveled into a nearby home striking a man in his basement. The man was not seriously injured. Another lightning strike from the same storm struck a house on Glasco Turnpike in Saugerties. The house was set ablaze, destroying the home and killing two dogs. Approximately $100,000 in damages and one injury were associated with this event.

June 14, 2008. Three hikers and a baby were slightly injured by a nearby lightning strike while sitting on a bench at the Mohonk Mountain House near New Paltz during a thunderstorm. The group was walking on a trail when the thunderstorm started. They then took cover and sat on a bench when lightning struck nearby. Their feet were in water, exacerbating the impact of the nearby lightning strike.

July 27, 2008. Lightning struck a home near the Hamlet of Accord (Town of Rochester) during a thunderstorm. Significant damage was limited to the den and study areas, with smoke damage throughout the house. Approximately $50,000 in property damage was recorded.

July 3, 2009. Thunderstorms developed across the region in the afternoon and evening hours. One death was reported of a 35 year old male in the Hamlet of Highland (Town of Lloyd), who was in the backyard of his home wrapping up an extension cord when lightning either struck the ground near him or the cord.

July 29, 2009. Numerous showers and thunderstorms developed across eastern New York and western New England during Wednesday afternoon and evening on July 29th. Some of the thunderstorms were severe, producing isolated damaging winds. In addition, several clusters of thunderstorms moved slowly, across the same areas for several hours, producing torrential rainfall and resulting in significant flash flooding. Trees and wires were reported down approximately one mile north of Woodstock due to lightning, and approximately $5,000 in property damage was recorded.

June 3, 2014. Slow moving showers and thunderstorms produced very heavy rain in a short period of time. This led to some flash flooding, especially in urban and poor drainage areas. In addition, a few of the thunderstorms also produced strong wind gusts, which caused damage to trees and power lines. By the late evening, the threat for thunderstorms ended, as the frontal boundary pushed through and less humid air moved into the region. Lightning downed wires on Fishcreek Road and Highwoods Road in Saugerties. Approximately $1,000 in property damage was reported for this event.

[12] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.

Probability of Future Occurrences – Lightning

The probability of occurrence for future lightning events in Ulster County is certain. Using the NLDN® data from **Figure 3a.6**, Ulster County is located in an area of the country that experiences two to three lightning flashes per square kilometer per year. Given this regular frequency of occurrence, it can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the County.

Nor'easters

Location – Nor'easter

Nor'easters threaten the entire Atlantic Coast of the United States, and while coastal areas are most directly exposed to the damaging forces of such storm systems their impact is often felt far inland. Ulster County is located in an area that is extremely susceptible to nor'easters. All areas throughout the County are susceptible to the hazards that can be associated with nor'easters: extreme wind, flooding and heavy snowfall. Ulster County's Hudson River shoreline jurisdictions are also susceptible to the added effects of storm surge.[13]

Extent – Nor'easter

While there are a variety of indicators for nor'easter intensity, **Table 3a.6** describes the Dolan-Davis Nor'easter Intensity Scale which is based on coastal storm erosion, degradation and property damage.

Table 3a.6
Dolan-Davis Nor'easter Intensity Scale

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

Historical Occurrences – Nor'easter

Ulster County has a lengthy history of devastating impacts wrought by nor'easters. This includes damages caused by the effects of extreme wind, heavy snowfall and flooding. Some more notable *examples* include:

> **Blizzard of 1993.** The Storm of the Century, also known as the '93 Superstorm, No-Name Hurricane, the White Hurricane, or the (Great) Blizzard of 1993, was a large cyclonic storm that occurred on March 12–March 15, 1993, on the East Coast of North America. It is unique for its intensity, massive size and wide-reaching effect. At its height the storm stretched from Canada to Central America, but its main impact was on the Eastern United States and Cuba. States of emergency were declared by local towns in Ulster County.

[13] Distinct hazard area locations for surge are discussed elsewhere in this section.

February 23-25, 1998. This nor'easter resulted in heavy snowfall across Ulster County, including a recorded 25 inches at Slide Mountain in western Ulster County.

December 30, 2000. Many areas received the most snow to fall in a single storm since January 1996, and one local death was blamed on the weather when a man blowing snow had a heart attack. Area police, utilities and public works crews reported few storm-related problems. During the mid-afternoon, snow was piling up at a rate of two inches per hour in Kingston, where a snow emergency was declared.

December 26-27, 2010. A major nor'easter brought significant snows and blizzard conditions to much of the northeastern United States Sunday, December 26th into Monday, December 27th. Bands of heavy snow with snowfall rates of one to three inches an hour occurred across the region. Snowfall totals of one to two feet occurred mainly east of the Hudson River and across adjacent western New England. Snowfall amounts dropped off dramatically to the northwest of the Capital District. Strong and gusty winds caused significant blowing and drifting of the snow. Winds gusts across the local area were 35 to 45 mph with gusts of 50 to 70 mph reported across southeastern New York, Connecticut and eastern Massachusetts.

October 29-30, 2011. An early season Nor'easter dumped heavy wet snow mainly to the south and east of the Capital District with snowfall amounts dropping off rapidly to the north and west. Snowfall rates were as high as two to four inches an hour. Snowfall amounts ranged from as little one to four inches across the northern portion of the Capital District, to five to 10 inches in the Hudson Valley including the southern portion of the Capital District, with 10 to 16 inches in the eastern Catskills, and 12 inches to almost two feet across the Taconics. Power outages occurred as trees and wires came down due to the heavy snow. The outages were the most widespread and prolonged in areas where leaves were still on the trees. Governor Andrew Cuomo declared a state of emergency for 13 New York counties including Albany, Columbia, Dutchess, Greene, Rensselaer and Ulster. Central Hudson Gas and Electric reported more than 115,000 homes and business lost power in Dutchess and Ulster counties. They reported 13 transmission lines, 31 distribution circuits and four sub-stations were out of service due to damage. Utility workers from outside the area were brought in to help with the restoration of power. Warming centers and overnight shelters were opened.

November 26, 2014. An early season winter storm impacted all of eastern New York during the busy Thanksgiving travel period on November 26th-27th, 2014. The storm began during the morning of Wednesday, November 26th. Snow began shortly after sunrise across southern areas and gradually began further north by the late morning or early afternoon hours. Once snow began, it increased in intensity, falling at rates at or greater than one inch per hour. This snowfall caused slow and difficult travel, which was particularly noteworthy as this was the day before Thanksgiving. By the early morning on Thanksgiving, most of eastern upstate New York saw snowfall of six to 12 inches, with locally up to 15 inches in the southeastern Adirondacks. Most of Ulster County received six to 10 inches of snow during this event. The snow was rather wet across southern areas, which allowed it to easily coat trees and power lines. Due to the weight of the snow, some tree limbs fell and caused power outages, especially across the mid-Hudson Valley. Up to 32,000 power customers in Dutchess and Ulster Counties were without power at one point during the storm. With power outages lasting up to several days, the Red Cross opened shelters and the local power company distributed dry ice and bottled water to area residents.

Probability of Occurrence – Nor'easters

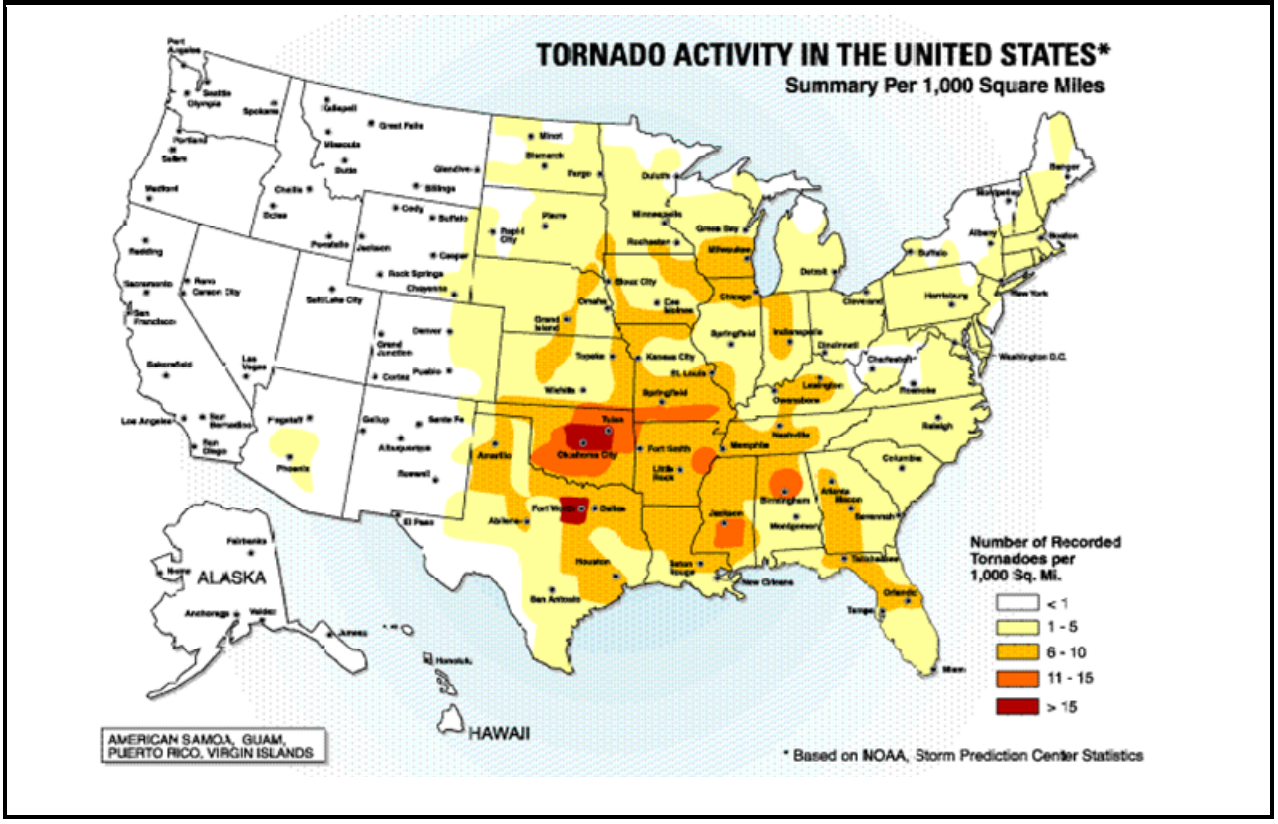
Nor'easters will continue to have a high frequency of occurrence for Ulster County, and the probability of future occurrences affecting all of Ulster County's jurisdictions is certain. The frequency and intensity of coastal storms and severe weather events is expected to increase in the future due to climate change. In the years to come, it is anticipated that Ulster County will observe drastic changes in storm character, intensity, frequency, and storm tracking. Nor'easters are likely to become more intense with rising sea water temperatures. Storm effects are expected to be more extensive in the future.

Tornado

Location – Tornado

Ulster County is located in an area that is susceptible to tornados, though their occurrence is not nearly as frequent or intense as it is in other regions of the country. Of the roughly four tornadoes that touch down in New York State each year, approximately 80 percent tend to be of low magnitude (from EF0 to EF2) and typically impact only relatively small areas. **Figure 3a.7** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles. Tornadoes are completely random and it is not possible to predict specific tornado hazard areas. Tornadoes can occur anywhere, and no one location is more susceptible than another. All of Ulster County is uniformly exposed.

Figure 3a.7
Tornado Activity in the United States



Source: Federal Emergency Management Agency

Extent – Tornado

Table 3a.7 shows the Enhanced Fujita Scale for Tornadoes which was developed to measure tornado strength and associated damages. The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Table 3a.7 Enhanced Fujita Scale for Tornadoes				
Storm Category	**Damage Level**	**3 Second Gust (mph)**	**Description of Damages**	**Photo Example**
EF0	LIGHT	65–85	Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.	
EF1	MODERATE	86–110	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.	
EF2	SIGNIFICANT	111–135	Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; highrise windows broken and blown in; light-object missiles generated.	
EF3	SEVERE	136–165	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.	
EF4	DEVASTATING	166–200	Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.	
EF5	INCREDIBLE	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 m (109 yd); trees debarked; steel reinforced concrete structures badly damaged.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Historical Occurrences – Tornado

According to NCDC[14], there have been eleven recorded tornado days in Ulster County between September 1975 and July 2015. Intensities ranged from F0 to F2, as shown in **Table 3a.8**. These events resulted in three injuries and $3.13 million in reported property damages. No new tornados have been recorded since the last event occurred in May 2000.

Table 3a.8 Historical Tornadoes in Ulster County					
Location	**Date**	**NCDC Reported Magnitude**	**Deaths**	**Injuries**	**Property Damage**
Ulster (Town)	09/20/75	F1	0	1	$25,000
Warwarsing	03/21/76	F2	0	0	$0
Warwarsing	03/21/76	F1	0	0	$25,000
Marbletown	06/30/76	F1	0	0	$25,000
Denning	07/21/83	F0	0	0	$25,000
Rochester	5/12/84	F0	0	0	$25,000
Ulster (Town)	10/5/85	F1	0	0	$250,000
Warwarsing/Shawangunk	7/26/86	F2	0	2	$2,500,000*
Saugerties (Town)	9/10/93	F1	0	0	$50,000
Hardenburgh	6/26/98	F1	0	0	$150,000
Esopus	5/18/00	F2	0	0	$50,000
		Total	**0**	**3**	**$3,125,000**

** May include damages outside of Ulster County*

[14] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.

Since the initial version of the plan was prepared in 2009, it is now customary to categorize tornados using an Enhanced Fujita Scale (EF-scale). The Enhanced F-scale is still a set of wind estimates (no measurements) based on damage. NCDC database records for historic occurrences, however – such as those shown for historic events in Ulster County in Table 3a.8 – are still provided in the old Fujita Scale (F-scale). **Table 3a.9** shows how the two scales compare to one another[15].

Table 3a.9
Comparison, Fujita Scale (F) versus Enhanced Fujita Scale (EF)

Fujita Scale		Enhanced Fujita Scale	
F-Number	**3 Second Gust (mph)**	**EF-Number**	**3 Second Gust (mph)**
0	45-78	0	65-85
1	79-117	1	86-110
2	118-161	2	111-135
3	162-209	3	136-165
4	210-261	4	166-200
5	262-317	5	Over 200

Descriptions of the *most recent events* in Ulster County include the following:

> **September 9, 1993**. A small F1 tornado touched down in Saugerties tearing half the roof off a house and uprooting some trees.
>
> **June 26, 1998**. One thunderstorm in Ulster County spawned an F1 tornado in the vicinity of Mongaup Mountain, in the Town of Hardenburgh. This tornado had a non-continuous damage path that included massive tree damage.
>
> **May 18, 2000**. A strong cold front crossed eastern New York late on May 18. At the same time, very strong winds aloft moved over the area. The combination of the instability, and lift ahead of the front, spawned a line of thunderstorms. A series of microbursts began in Ulster County about a mile northwest of the center of Esopus. They knocked down several clusters of trees as they neared State Highway Route 9W, while moving in an easterly direction. Embedded within the microburst, an F1 tornado, touched down briefly to the east of Black Creek and 9W, less than a tenth of a mile south of the center of Esopus. The track of the tornado was about a quarter mile long and 25 to 50 yards wide with numerous trees pushed about 70 degrees to the left of the storm track. There was little property damage due to the tornado, but it was sighted by nearby residents.

Probability of Occurrence – Tornado

It is likely that Ulster County will continue to experience weak to moderate tornado events, though their frequency of occurrence will be fairly low. Probability data made available through NOAA's National Severe Storms Laboratory (NSSL) indicate that Ulster County is in an area that experiences less than one tornado event per year. Historical storm data made available through NCDC confirm this data (eleven confirmed events in 40 years, resulting in an estimated annual number of 0.275 events per year). In New York, tornadoes are more likely to occur during the months of March through August and tend to form in the late afternoon and early evening.

[15] As per www.spc.noaa.gov/faq/tornado/ef-scale.html

Winter Storm

Location – Winter Storm

Nearly the entire continental United States is susceptible to winter storms, but the degree of exposure typically depends on the normal expected severity of local winter weather. Ulster County is accustomed to severe winter weather conditions and is prepared for the potential disruptions they might cause, though intense winter storms might still overwhelm local capabilities. The State Plan reports that, on average, New York State receives more snowfall than other states in the US, with average annual snowfall of about 65 inches. For the years 1960 to 2012, Ulster County's average annual snowfall ranged from as high as 60 to 95 inches per year in northwestern areas, to less than 60 inches in southeastern areas. All areas throughout the County are susceptible to the hazard effects of snow and/or ice accumulations during winter storms.[16]

Extent – Winter Storm

The magnitude or severity of a severe winter storm depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (i.e., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from one to five. It is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms that have occurred since 1900 (NOAA-NCDC 2011). **Table 3a.10** presents the five RSI ranking categories.

Table 3a.10
Regional Snowfall Index Ranking Categories

Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18.0+

Historical Occurrences – Winter Storm

In Ulster County, severe winter snow and ice storms are normal and expected. According to the NCDC[17], 122 recorded winter storms[18] have affected Ulster County between January 1996 and July 2015 with approximately $1.4 million in property damages[19]. Thirty-eight of the 122 recorded events have occurred

[16] Nor'easters and their hazard effects are discussed separately within this section.
[17] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.
[18] NCDC query for event types classified as blizzard, heavy snow, ice storm, winter storm, winter weather.
[19] It is likely that there are limitations in the database for this event type with regard to property/crop damages resulting in a significant underestimation of winter storm related damages incurred from historic events. Of the $1.4 million in property damage for all events from 1996 to 2015, approximately $1 million is tied to the storm of March 31, 1997. By far, the majority of events recorded in the database have $0 damages; and no damages at all are identified for any events after the year 2002.

since the last version of this plan was finalized in February 2009. A sampling of some of the more *notable recent events* includes the following:

January 28, 2009. A low pressure system developed over the lower Mississippi Valley during Tuesday January 27th. The low then strengthened, and tracked northeast from the lower Ohio Valley Wednesday morning on January 28th, into Pennsylvania during Wednesday afternoon, and into northern New England by Thursday morning January 29th. This storm spread a significant wintry mix of precipitation across eastern New York State, with heavy snow and sleet across much of the southern Adirondacks into the Lake George Saratoga region, with a significant mix of snow, sleet and freezing rain occurring elsewhere. Snow and sleet amounts ranged from eight to 12 inches across the southern Adirondacks and the Lake George Saratoga region, with four to eight inches occurring further south across the Mohawk River Valley, the Greater Capital District, the eastern Catskills, the Schoharie Valley, the mid-Hudson Valley and into the central and southern Taconics. In addition, ice accretion from freezing rain of between one and three tenths of an inch occurred across areas near and south of the Mohawk River Valley, with locally higher amounts of up to one half of an inch occurring across portions of the mid-Hudson Valley. This wintry mix resulted in the closure of numerous schools and businesses across east central New York for both Wednesday and Thursday mornings, and also created treacherous travel conditions.

December 9, 2009. A low pressure system originating over Texas moved northeast and across the central and eastern Great Lakes Wednesday, December 9th. A secondary low formed over the mid-Atlantic region early Wednesday morning and strengthened as it moved northeast across Long Island and southern New England during the day. Snow overspread east central New York between 3 AM and 5 AM LST Wednesday morning. The snow was heavy at times with snowfall rates of one to two inches an hour in some locations. Some warmer air worked in aloft causing sleet to mix with the snow during the day Wednesday. The precipitation became light and tapered off by early Wednesday afternoon as it changed to rain below 1000 feet, and freezing rain above 1000 feet in elevation. Snowfall totals ranged from around five inches up to 12 inches.

February 23-27, 2010. Two significant snow events occurred within just days of each other in late February 2010. The first system brought heavy, wet snow to the area beginning on February 23rd, resulting in treacherous travel conditions, widespread power outages and even some building collapses. Generally, one to two feet of snow accumulated across much of east central New York with the highest amounts above 1500 feet. The heavy wet snow resulted in widespread power outages across east central New York including impacts to six of Central Hudson Gas and Electric major transmission lines. Numerous trains were delayed and or canceled on Amtrak between Albany-Rensselaer and Poughkeepsie due to power outages. At times crossing gates had to be manually activated due to the power outages. In addition, eight of Amtrak's 26 weekday trains between Albany-Rensselaer and New York City's Penn Station had to be canceled Thursday, February 25th, to conduct repair work to tracks and systems that were damaged from the storm. There were a number of flights canceled at the Albany International Airport. Many cities declared snow emergencies. Days later, a second powerful storm brought additional heavy rainfall and a heavy wet snow to the area. The heavy wet snow resulted in additional and continued widespread power outages across east central New York, downed trees and power lines, treacherous travel, road closures, train delays, building collapses and snow emergencies. In addition to the heavy precipitation, strong and gusty winds developed along the east-facing slopes of the Taconics, with gusts up to 50 miles per hour. The rain snow line set up just to the west of the Hudson River Valley with heavy wet snow occurring across the eastern Catskills, Mohawk Valley and portions of the southern Adirondacks with snowfall rates of two to three inches an hour. By the time the snow came to an end, snowfall totals of one to four feet were reported across the eastern Catskills, Mohawk Valley and portions of the southern Adirondacks on top of the one to two feet from February 23rd and 24th. The greatest totals occurred across the higher terrain, generally above 1000 feet. Lighter snow accumulations with as little as two to four inches occurred across portions of Washington County into the Capital District. The liquid equivalent totals from the storm where generally one to two inches, with higher values of four to six inches in portions of the eastern Catskills.

December 26-29, 2012. Snow fell across much of eastern New York from the late afternoon and evening of the 26th into the day on the 27th. Warmer air moving in aloft allowed for the precipitation to mix with or change over to sleet and freezing rain across the mid-Hudson Valley and Taconic Region, with up to a quarter of an inch of ice occurring in Hyde Park. Total storm snowfall amounts ranged for just a few inches in the

Greater Poughkeepsie area to around 17 inches across the Helderbergs. Most areas in the Capital District reported between six inches and 11 inches of snow. This storm resulted in very slow travel during the holiday season, especially on the evening of the 26th and morning on the 27th. On the heels of this bigger snowstorm, a light to moderate snowfall occurred across the region on Saturday, December 29, 2012. An area of low pressure developed along the coast of North Carolina and moved northeastward off the Eastern Seaboard. Although the storm passed well to the south, an upper level disturbance associated with the storm allowed for light snow to occur throughout the day. With temperatures cold across the entire area, the precipitation remained entirely in the form of snow. Most areas across east central New York reported between three and six inches of snow. However, portions of the Schoharie and Mohawk Valleys reported between four and eight inches with the southeastern Adirondacks reporting between six and 10 inches. This snow resulted in slow travel, especially considering it was during the holiday season.

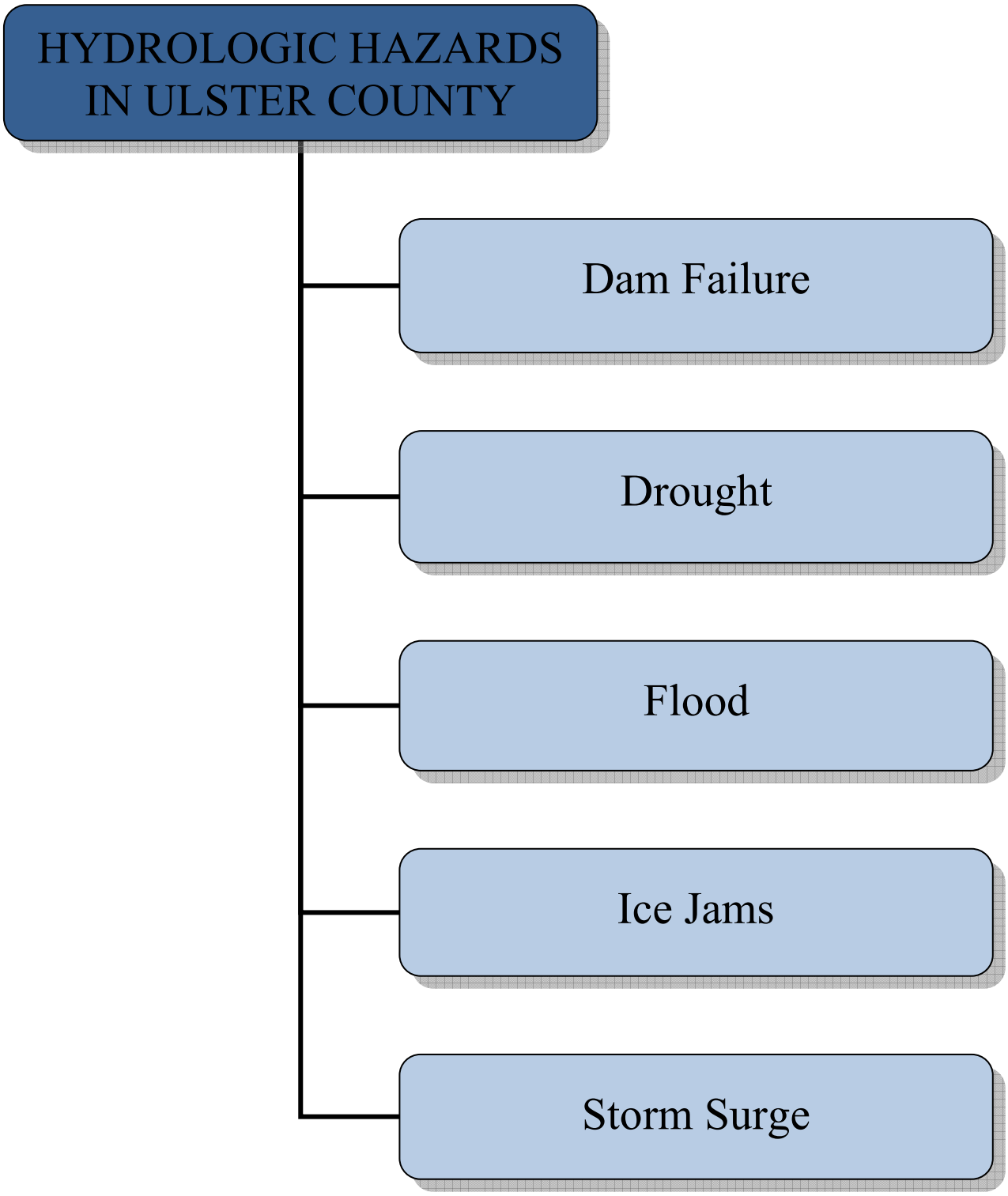
January 1, 2014. A long lasting snowstorm occurred across all of eastern upstate New York between the evening of New Year's Day and the morning of January 3rd, 2014. A slow moving frontal boundary situated over the mid-Atlantic Region was in place on Wednesday, January 1st. An area of high pressure situated over southern Quebec allowed Arctic air to move down into the region. As a weak wave of low pressure developed along the front, moisture moved up and over the frontal boundary into the region. As a result, light snow broke out and gradually spread from south to north between the evening on Wednesday, January 1st and the early morning hours on Thursday, January 2nd. The snow evolved into a moderate snow over portions of the Mohawk Valley, Schoharie Valley and Capital Region during the morning hours on January 2nd and continued through much of the day. Further south, there was a brief break in the steady snowfall during the daytime on January 2nd, but it remained quite cold, with temperatures only in the single digits over much of the region. On the evening of Thursday, January 2nd, a new area of low pressure began to form of the mid-Atlantic coast. This brought some moisture from the Atlantic Ocean into the region, and a moderate snowfall developed over the entire area. The snow gradually tapered off to light snow and snow showers from west to east overnight as the low pressure area tracked east northeast away from the region. By the morning hours of Friday, January 3rd, a general six to 12 inches of snow fell over much of the region, with lighter amounts across the far western Adirondacks and the mid-Hudson valley region. A few spots in the high terrain of the northern Catskills and Helderbergs saw close to 15 inches. In addition, temperatures remained very cold and with a cold northwest wind, wind chill values were zero to minus 20 degrees.

January 18, 2015. A storm system moved up the eastern seaboard on Sunday, January 18th. Although the precipitation fell in the form of rain, the ground remained very cold due to recent bitter cold, Arctic air. With surface air temperatures around the freezing mark, the rain froze on contact with the ground, producing a thin layer of slippery, black ice. Most areas only see a tenth of an inch of ice accretion, but this ice was very hazardous to travelers. According to local newspapers, at least 80 auto accidents were reported in the mid-Hudson Valley, 16 of which caused injuries. Local media also reported around 100 accidents in the Lake George-Saratoga Region, seven of which caused injuries. With the ground extremely cold, freezing rain was even occurring when surface air temperatures were above freezing. It took most of the day for the cold air at the surface to finally warm up enough. Precipitation also was tapering off by late in the day, ending the threat of freezing rain.

Probability of Occurrence – Winter Storm

Winter storm events will continue to have a high probability of occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain. While the impact of snow and ice storms will cause major disruptions to transportation, commerce and electrical power as well as significant overtime work for government employees, large scale property damages and/or threats to human life and safety are not expected. Nor'easters occur less frequently but represent a much greater hazard of concern as it relates to the impacts of winter storm events (addressed separately within this section). Winter storms typically occur in New York from late November through mid-April, with peak months being December through March. Nor'easters are one type of severe winter storm that typically bring high winds, coastal surge (up the Hudson River) and flooding along with heavy precipitation, which are addressed separately within this section.

HYDROLOGIC HAZARDS



Dam Failure

Location and Extent - Dam Failure

*State and Federal dam inventories exist to plot the **location** of dams in Ulster County. The **extent** or magnitude of a dam failure event can be measured in terms of the classification of the dam, based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests that would result from failure or misoperation of the dam. It is important to note that dam hazard classifications are based on the consequences of dam failure—not the condition, probability or risk of failure itself. More information about the location and extent of the dam failure hazard in Ulster County is provided below.*

The National Inventory of Dams (NID) maintained by the U.S. Army Corps of Engineers (USACE) records 54 dams in Ulster County[20]. The NID consists of dams meeting at least one of the following criteria:

1) High hazard classification - loss of one human life is likely if the dam fails,
2) Significant hazard classification - possible loss of human life and likely significant property or environmental destruction,
3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4) Equal or exceed 50 acre-feet storage and exceed six feet in height.

The New York State Department of Environmental Conservation maintains an inventory of 176[21] dams in Ulster County. New York State uses a dam downstream hazard classification system similar to that of many states and federal agencies. The following classification levels are used in New York. They are listed in order of increasingly adverse consequences from a dam failure. These classification levels build on each other, with the higher levels adding to the consequences of the lower levels.

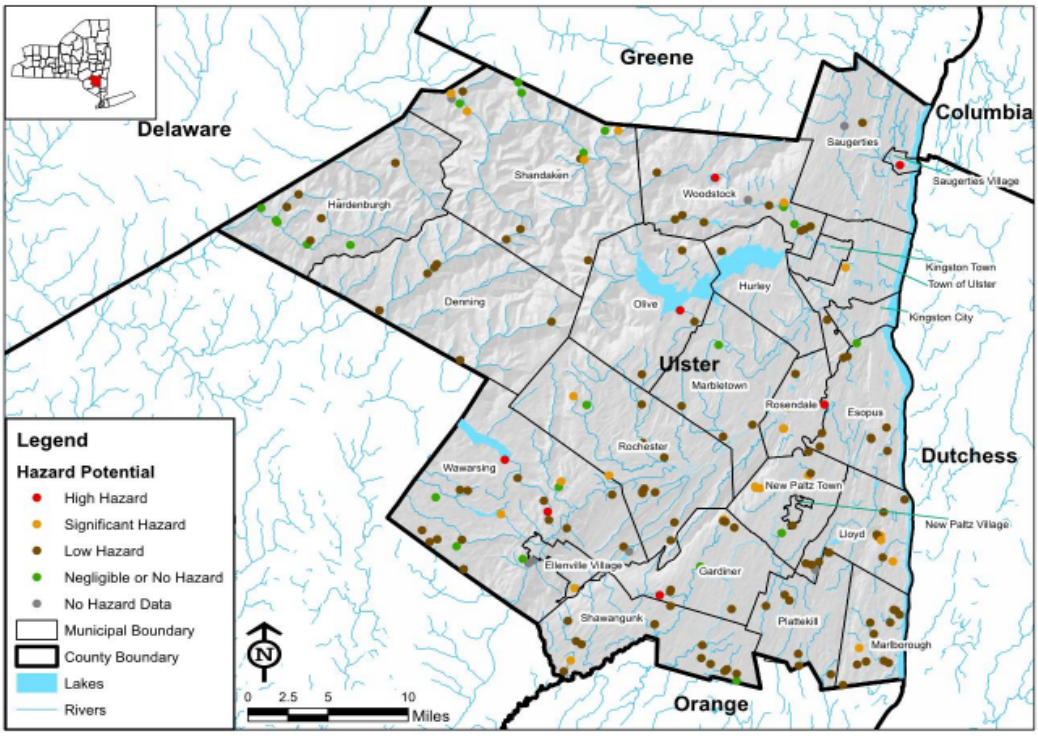
1) Class "A" or "Low Hazard" dam: A dam failure is unlikely to result in damage to anything more than isolated or unoccupied buildings, undeveloped lands, minor roads such as town or county roads; is unlikely to result in the interruption of important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; and/or is otherwise unlikely to pose the threat of personal injury, substantial economic loss or substantial environmental damage.
2) Class "B" or "Intermediate Hazard" dam: A dam failure may result in damage to isolated homes, main highways, and minor railroads; may result in the interruption of important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; and/or is otherwise likely to pose the threat of personal injury and/or substantial economic loss or substantial environmental damage. Loss of human life is not expected.
3) Class "C" or "High Hazard" dam: A dam failure may result in widespread or serious damage to home(s); damage to main highways, industrial or commercial buildings, railroads, and/or important utilities, including water supply, sewage treatment, fuel, power, cable or telephone infrastructure; or substantial environmental damage; such that the loss of human life or widespread substantial economic loss is likely.
4) Class "D" or "Negligible or No Hazard" dam: A dam that has been breached or removed, or has failed or otherwise no longer materially impounds waters, or a dam that was planned but never constructed. Class "D" dams are considered to be defunct dams posing negligible or no hazard. The department may retain pertinent records regarding such dams.

For this plan update, the two databases were merged to ensure all dams were captured, for a total of 176 dams in Ulster County. Specific locations for all dams that have been geo-referenced for mapping

[20] http://nid.usace.army.mil/cm_apex/f?p=838:12:14026652215444, as queried in May 2015.
[21] http://www.dec.ny.gov/pubs/42978.html with, last updated in 2009.

purposes[22] are illustrated in **Figure 3a.8**. Of the 176 dams in the combined database, seven are classified as having "high hazard potential"; another 21 dams have been classified as having "significant hazard potential"; 117 dams are classified as having "low hazard potential". Information on the hazard classification was not provided in the dam inventory for the remaining eight dams.

Figure 3a.8
Ulster County Dams



Source: Dam data downloaded from NYSGIS Clearinghouse (Origin: New York State Department of Environmental Conservation, 2009), and National Inventory of Dams maintained by USACE.

Table 3a.11 lists information for all state-regulated dams in Ulster County reported as having high (H) hazard potential or significant (S) hazard potential. **Of the 28 "high" or "significant" hazard dams in Ulster County, three have been classified by USGS as "major" dams representing the most significant hazard risk based on the potential consequences of a dam failure.** Major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more. In Ulster County, these include the Ashokan Reservoir Dam in Olive (water supply); the Rondout Reservoir Dam (Merriman Dam) in Wawarsing (water supply); and the Sturgeon Pool Dam in Esopus (hydroelectric).

[22] No hazard data was included in the NYS Dam Inventory for eight dams.

Table 3a.11
State-Regulated Dams with High or Significant Hazard Potential

Dam Name	Jurisdiction	River/Stream	Owner(s)	Storage (acre-feet)	Hazard Potential
Ashokan Dam *	**Town of Olive**	**Esopus Creek**	**NYSDEP Dams West Of The Hudson River**	**512,500**	**High**
Binnewater Reservoir Dam & Dike	Town of Ulster	Tr-Esopus Creek	City Of Kingston	50	Significant
Binnewater Road Dam	Town of Rosendale	Tr-Rondout Creek	Town Of Rosendale	8	Significant
Bridgeview Plaza Dam	Town of Lloyd	None	Bridgeview Sp Corp	75	Significant
Cape Pond Dam	Town of Wawarsing	Beer Kill	Cape Pond Inc.	3,605	Significant
Chichester Dam	Town of Shandaken	Tr-Stony Clove	Paul & Heidi Nute	0	Significant
Cooper Lake Dam And West Dike	Town of Woodstock	Saw Kill	City Of Kingston	3,683	High
Diamond Mills Paper Company Dam	Village of Saugerties	Esopus Creek	Leading Edge Developers, LLC	830	High
Highland Lower Reservoir Dam	Town of Lloyd	Tr-Hudson River	Town Of Lloyd Highland Water District	27	Significant
Highland Water Dist Res Dam & Dike	Town of Lloyd	Tr-Hudson River	Town Of Lloyd Highland Water District	92	Significant
Honk Falls Dam	Town of Wawarsing	Rondout Creek	Karen And Robert Berger, David Cook	1,504	High
Horsenden Lake Dam	Town of New Paltz	Tr-Wallkill River	James E Rappa	22	Significant
Kingston Reservoir #2 Dam	Town of Woodstock	Saw Kill	City Of Kingston	125	Significant
Lake Maratanza Dam	Town of Wawarsing	Tr-Verkeerder Kill	Open Space Institute	323	Significant
Lyon Lodge Dam	Town of Wawarsing	Lyon Creek	Lyons Lodge, LLC	224	Significant
Marlborough Water District Dam & Dike	Town of Marlborough	Tr-Hudson River	Marlborough Water District	53	Significant
Merriman Dam (Rondout Reservoir Dam)*	**Town of Wawarsing**	**Roundout Creek**	**NYCDEP Dams West Of The Hudson River**	**202,800**	**High**
New Paltz Lower Reservoir Dam	Village of New Paltz	Tr-Kleine Kill	Village Of New Paltz	2	Significant
New Paltz Middle Reservoir Dam	Town of New Paltz	Tr-Kleine Kill	Village Of New Paltz	2	Significant
New Paltz Reservoir Dam	Village of New Paltz	Tr-Kleine Kill	Village Of New Paltz	3	Significant
New Paltz Upper Reservoir Dam	Village of New Paltz	Tr-Kleine Kill	Village Of New Paltz	8	Significant
Pecks Dam	Town of Gardiner	Tr-Mara Kill	Bruce Consiglio	96	Significant
Pine Hill Lake Dam	Town of Shandaken	Birch Creek	NYS Olympic Development Agency	116	Significant
Pinebush Lake Dam	Town of Shawangunk	Tomy Kill	Jennifer Ferraro, Mark Glusak	38	Significant
Sturgeon Pool Dam*	**Town of Esopus**	**Wallkill River**	**CH Energy Group, Inc.**	**10,894**	**High**
Tillson Lake Dam	Town of Gardiner	Palmaghatt Kill	NYSOPRHP - Palisades Interstate Park Commission	394	High
Vincent Dunn Pond Dam	Town of Rochester	Tr-Rondout Creek	Valerie Friedlander	15	Significant
Vrasidas Dam	Town of Rochester	Mombaccus Creek	MPV Lazy Acres Inc.	4	Significant

* Dam also listed as a "major" dam in the USGS National Inventory of Dams (NID). Major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more.

Tr = Tributary

Dam failure inundation studies are often prepared by the owners of dam facilities as part of their own emergency action plans to show areas potentially vulnerable to inundation if the dam were to fail. Emergency action plans with dam failure inundation studies have previously been completed for the three major high hazard dams in Ulster County (Ashokan Reservoir Dam, Rondout Reservoir Dam, and Sturgeon Pool Dam), and the corresponding inundation mapping is presented in **Figures 3a.9 though 3a.11.** These maps were developed by digitizing the inundation envelope resulting from dam failures under wet weather conditions from scanned hard copies of the original mapping, supplied by New York State Department of Environmental Conservation, who were unable to provide the original source GIS files. The areas shown as vulnerable to inundation **in Figures 3a.0 through 3a.11** should be regarded as approximate areas subject to a great deal of hydrologic uncertainty.

Figure 3a.9
Potential Area Affected by Failure of the Ashokan Reservoir Dam

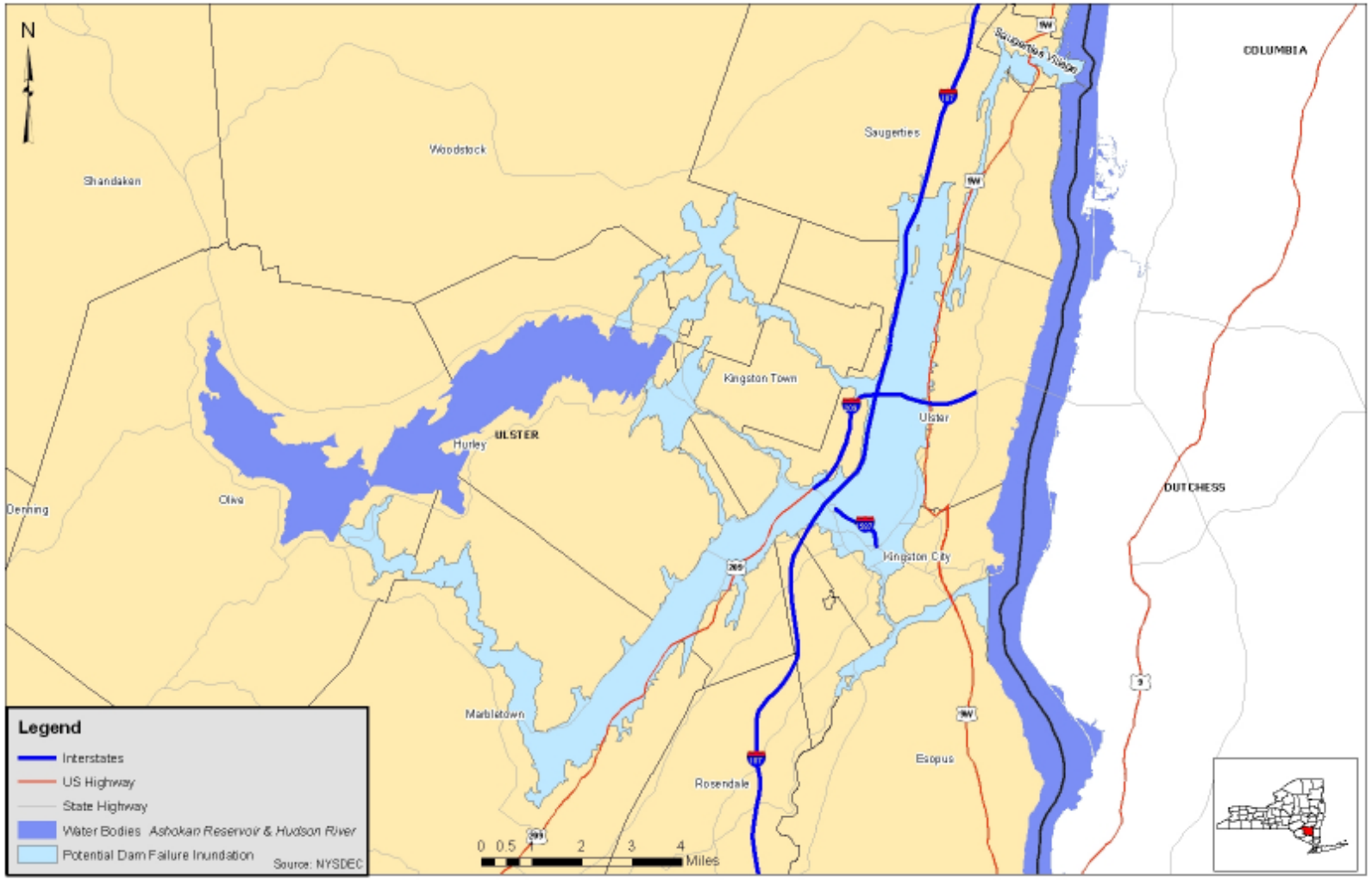


Figure 3a.10
Potential Area Affected by Failure of the Rondout Reservoir Dam

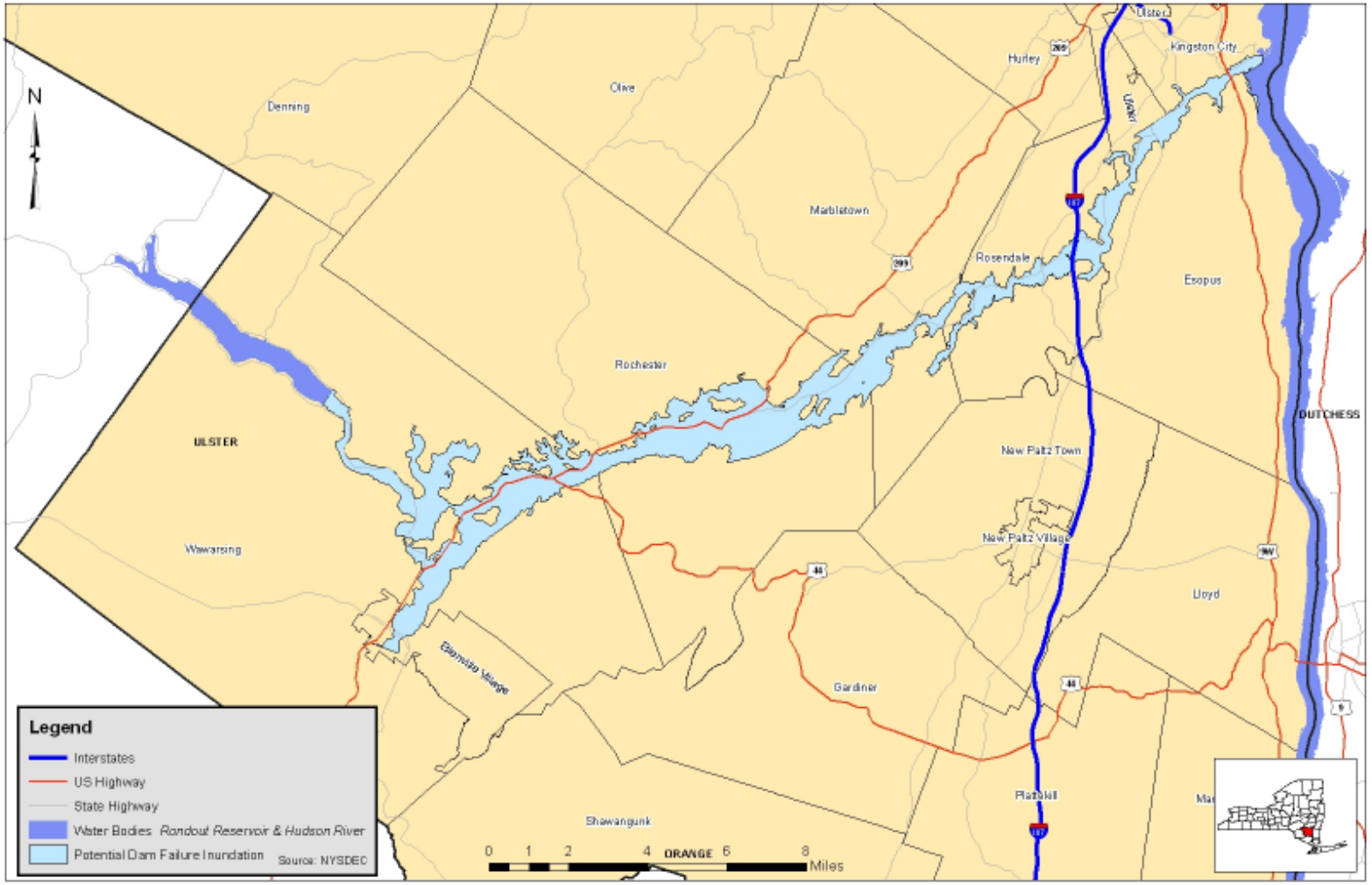
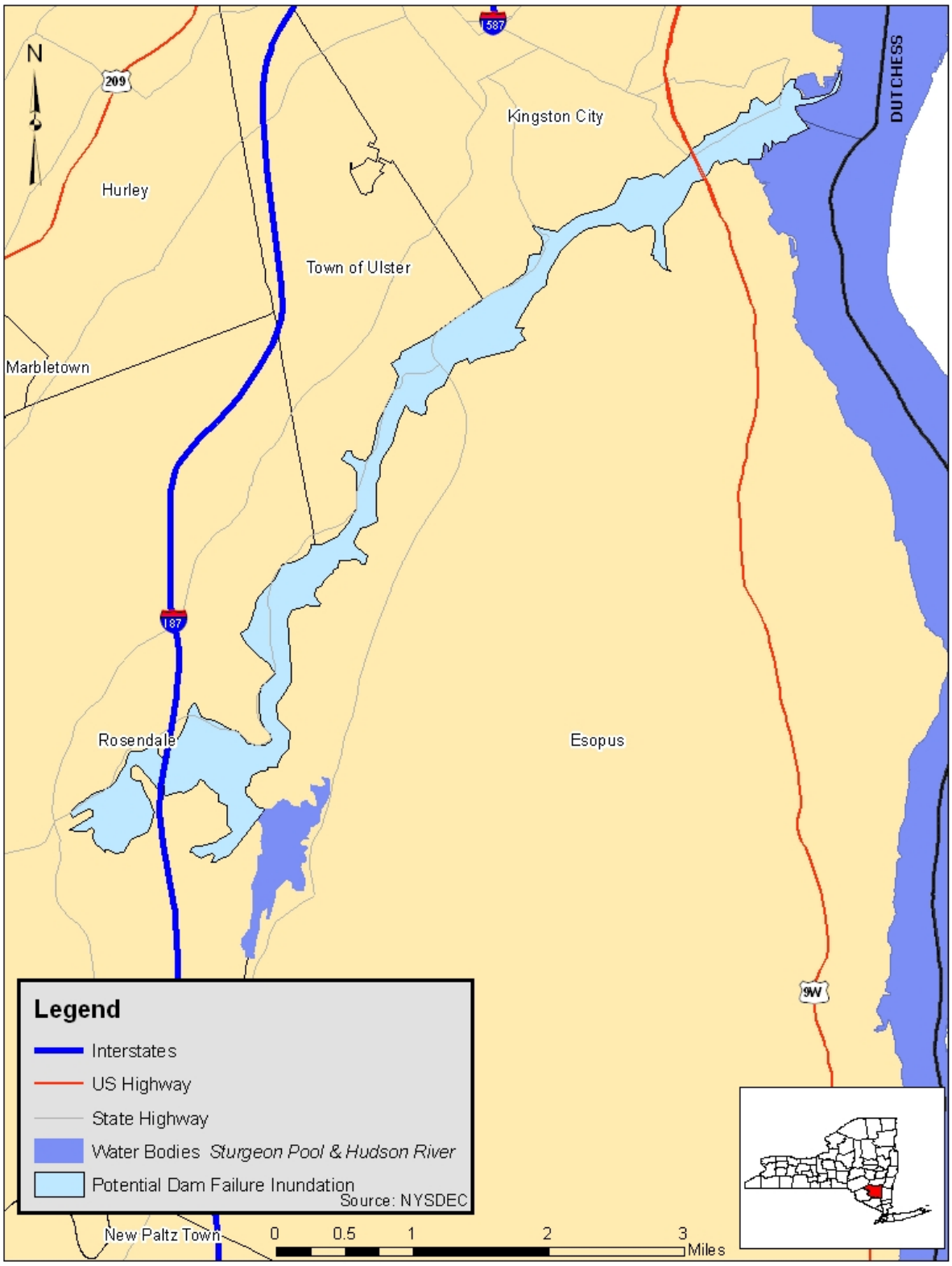


Figure 3a.11
Potential Area Affected by Failure of the Sturgeon Pool Dam



Historical Occurrences – Dam Failure

According to the Stanford National Performance of Dams Program (NPDP) records[23], there have been 74 dam incidents[24] in New York State since 1868. No new incidents have occurred since the last version of this plan was prepared; the date of the most recent record in the database is January 1, 2003. Only 17 of the 74 historic state-wide incidents are recorded as events involving an uncontrolled release of the reservoir. Only one incident is recorded in Ulster County. The NPDP records indicate that the Diamond Mills Paper Company Dam in the Village of Saugerties experienced a failure in 1978. Although detailed information related to the consequences of the recorded failure was not readily available, the NPDP event report mentions deterioration of spillways, inoperable outlets, and a general lack of maintenance as contributory causes. In the early 2000's, concerns were raised by both the NYSDEC and the USACE regarding issues including lack of maintenance and lack of an emergency action plan. However, since the last version of this plan was prepared, current NYSDEC records show an EAP on file as of July 1, 2013, with the most recent inspection in February 2012.

Local sources also report that the Tillson Lake Dam in the Town of Gardiner suffered a failure in the 1930s, although there are no definitive records regarding subsequent injuries or loss of life. Despite reports that the dam was drained for repairs in the 1990s, the safety of this dam remains a concern to the local community.

Probability of Occurrence – Dam Failure

The probability of a dam failure occurrence in Ulster County is relatively low due to routine inspection, repair and maintenance programs, though the possibility of a future failure event is likely increasing due to aging dam structures that may be in need of repair or reconstruction. The NYSDEC's Dam Safety program serves to ensure the safety and integrity of dams in New York State and, thereby, protect people and property from the consequences of dam failures.

Drought

Location – Drought

Droughts occur in all parts of the country and at any time of year, depending on temperature and precipitation over time. Similarly, droughts can occur in all parts of Ulster County at any time of year, depending on temperature and precipitation over time. While arid regions of the United States are more susceptible to long-term or extreme drought conditions, other areas such as Ulster County tend to be more susceptible to short-term, less severe droughts. It is impossible to delineate a drought hazard area for the County, per se, but it is generally assumed that drought is a county-wide hazard, with drought conditions being possible in all geographic areas.

[23] http://npdp.stanford.edu/dam_incidents

[24] The NPDP defines dam "incidents" as "events of engineering and safety interest that provide insight into the structural and functional integrity of dam systems and their operation. Included in this definition are events associated with a dam system that are anticipated or unanticipated, and satisfactory as well as unsatisfactory. Collecting information on success stories is as important as events involving failures or other episodes of unsatisfactory performance. Examples of dam incidents that are "successes" include: a group of dams located near a fault, experience and survive without ground motion associated with a magnitude 8.2 earthquake; a dam successfully passes a flood equivalent to 90 percent of the estimated PMF; an emergency action plan is successfully implemented with the population-at-risk evacuated in a timely manner; dam operators are able to successfully open dam gates and low-level outlets to lower the reservoir after a dam has been damaged as a result of an earthquake. Use of the term 'incident' is traditional, but is somewhat unfortunate because the word generally has a negative connotation. The implication is that something "bad or unsatisfactory" has occurred. In fact, incidents in the NPDP database also include positive events that allow for a better understanding of the performance and operation of dam systems.

Extent – Drought

The extent (i.e., magnitude or severity) of drought can depend on the duration, intensity, geographic extent, and the regional water supply demands made by human activities and vegetation. The intensity of the impact from drought could be minor to extreme damage in a localized area or regional damage affecting human health and the economy. Generally, impacts of drought evolve gradually, and regions of maximum intensity change with time. The severity of a drought is determined by areal extent as well as intensity and duration. The frequency of a drought is determined by analyzing the intensity for a given duration, which allows determination of the probability or percent chance of a more severe event occurring in a given mean return period.

The Palmer Drought Severity Index (PDSI) is one of many available drought indices used to assess the extent of a drought event. It was developed by Wayne Palmer in 1965 and indicates prolonged and abnormal moisture deficiency or excess. The PDSI tends to be used more commonly than other available indices, and is an important tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. PDSI drought classifications are based on observed drought conditions and will range from -0.5 (incipient dry spell) to -4.0 (extreme drought). The PDSI also reflects excess precipitation using positive numbers. The PDSI is the most effective in determining long-term droughts; but has limitations in terms of use for short-term forecasts.

Historical Occurrences – Drought

According to NCDC[25], two recorded instances of drought conditions have affected Ulster County between April 1999 and July 2015. They occurred in April 1999 and August 1999. No deaths, injuries, property, or crop damages are recorded in the NCDC database. Neither of these events occurred since the last version of the plan was prepared in 2009. The 2014 NYSHMP includes an overview of drought occurrences in New York State between August 1993 and October 2007; four events are noted impacting Ulster County. The 2014 NYSHMP also reports a SHELDUS total of three drought events in Ulster County from 1960 to 2012 (recurrence interval of 17 years), and a total of $16,667 in property damage and $2,685,185 in crop damage. A sampling of *more notable* historical events as per these sources includes:

> **1960's and 1980's**. In the 1960s and then again in the 1980s New York State was impacted by two major drought occurrences. During the 1960s, an extended period of droughts affected the entire state. The worst stint lasted from 1964 to 1965 placing a severe impact on agriculture, water quality, and forest and human health. As a result, there were widespread impacts, including forest fires, crop failure, fish kills, water shortages, harmful algal blooms, and heat related deaths. A Federal disaster declaration was issued for areas including Ulster County on August 18, 1965 (DR-204). The drought of the 1960s ended in 1967 only for the State to experience another drought in 1980 that has had a continuing affect into the present.
>
> **August to December 1993.** A prolonged period of drought during the summer of 1993 decimated much of the agriculture in southeast New York. A drought alert advisory was issued on August 5, 1993 by the New York State Drought Management Task Force for Delaware, Dutchess, Sullivan and Ulster Counties. Other counties hit hard by drought included Albany, Rensselaer, Columbia and Greene. The August 1993 drought alert advisory was upgraded to a drought warning by the New York State Drought Management Task Force for Delaware, Dutchess, Greene, Otsego, Schoharie, Sullivan, and Ulster Counties. Further, the Delaware River Basin Commission continued the drought warning for the basin which includes small sections of Broome, Chenango, Greene, Schoharie and Ulster Counties and much of Delaware and Sullivan Counties. The damage primarily affected the agriculture sector's feed grain. Estimates of feed grain losses in these counties were well over 40 percent and in some cases nearly 100 percent. There were significant losses in hay, corn, and other fruit and vegetable crops. The NYSHMP reports total dollar damages for all impacted counties as approximately $50 million.

[25] Data current as of October 2015.

June to September 1995. The New York State Drought Management Task Force declared a "Drought Watch" for the Catskills (Delaware, Greene, Otsego, Schoharie, Sullivan and Ulster counties), and the Hudson-Mohawk Region (Albany, Columbia, Dutchess, Fulton, Oneida, Herkimer, Montgomery, Rensselaer, Saratoga, Schenectady, and Washington Counties). The Hudson and Mohawk Valleys including the Catskills experienced extreme drought conditions while areas north of the Mohawk Valley and north of Saratoga County in the Hudson Valley saw severe drought conditions. At the end of August precipitation deficits of six to 12 inches were common in the extreme drought area. The drought produced a reduction in corn yield due to the shorter and slender ears. Hay yields were also down as many areas saw a very small second cutting or none at all. Wells ran dry in many communities and a Water Emergency was declared in Herkimer County and the Town of Deerfield in Oneida County.

April 1999. April 1999 was officially the second driest April on record in Albany and the driest of this century. Only 0.60 inches of rain fell at the Albany International Airport and only 0.56 inches at the N.W.S. office located on the University at Albany (SUNY) Campus. Rainfall amounts were a little bit higher to the south of Albany, but still fell well short of normal. The combination of low rainfall, along with frequent gusty winds, turned the underbrush into very dry tinder. This scenario led to numerous brush fires during the month across the Berkshires.

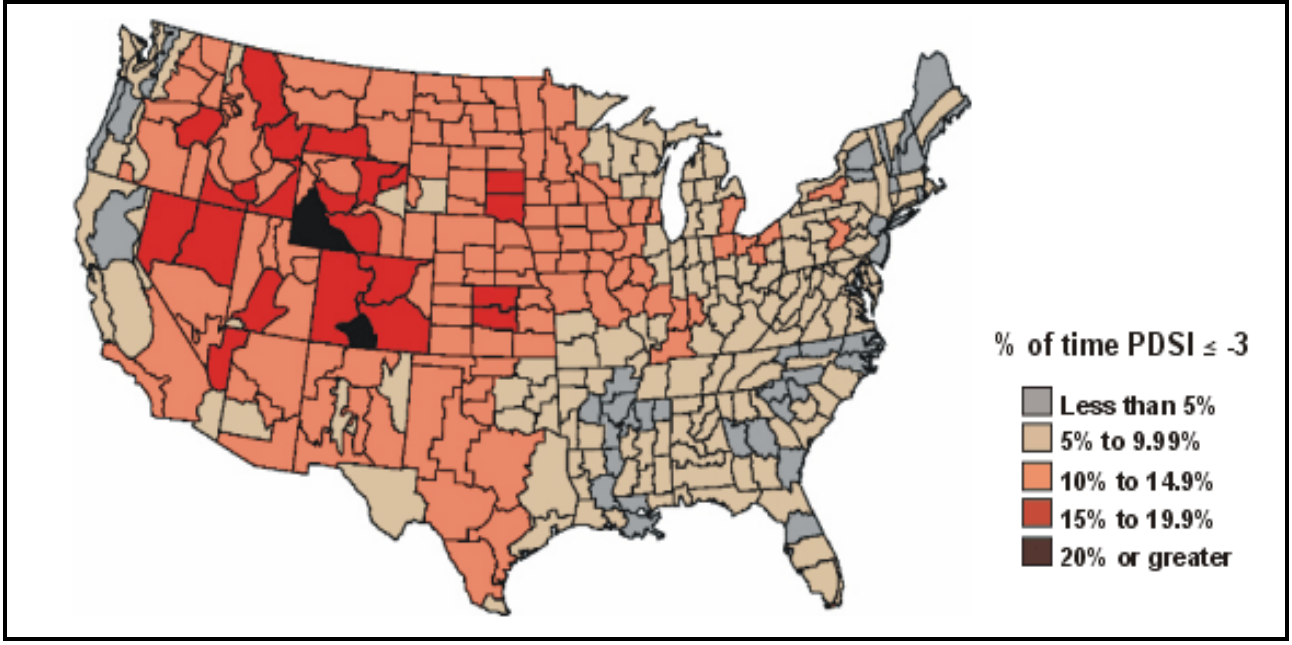
August 1999. August 1999 was the peak of the long term drought across Eastern New York that began in July of 1998. The fourteen month stretch, ending in August, saw rainfall and melted snowfall throughout the region only tallying up to about 80 percent of normal. At the Albany International Airport 35.41 inches of water equivalent was recorded from July 1998 through August 1999, compared to the thirty year normal of 42.82 inches. The long term drought combined with the heat of the summer, resulted in a drought warning across much of the region as well as a declaration of agricultural disaster. The Mohawk Valley and Western Adirondacks were especially hard hit. The drought resulted in record low levels of the Mohawk River, numerous forest fires across the Adirondacks, and many wells going completely dry. Most communities implemented voluntary or mandatory water restrictions.

Probability of Occurrence – Drought

According to the USGS Division of Water Resources, Ulster County and its jurisdictions fall within what is described as a "humid region" and is more likely to experience a short-term drought. Ulster County faces a low to moderate probability of severe drought conditions, though short-term instances of drought will be a more frequent occurrence. **Figure 3a.12** shows the PDSI Summary Map for the United States from 1895 to 1995. According to the map, Ulster County is in a zone that experienced severe drought conditions between five and ten percent of the time between 1895 and 1995, but short-term, less severe drought conditions are more common and may occur several times in a decade.

The 2014 NYSHMP reports that typical variations in weather patterns can lead to dry periods and, based on historical occurrences, New York State's overall annual future drought probability is three percent. From data gathered by the SHELDUS database, Delaware, Oneida, and Otsego Counties are most probable to experience a drought event with Ulster County noted as having a six percent annual future drought probability. While it is unknown how climate change will impact regional water supplies, the State Plan reports that water resources are stressed and any added stress from climate change will only increase the competition for water resources. Warmer climates increase potential drought frequency, severity, and create longer-lasting events. The State projects at least one short-term drought occurrence to happen every summer if greenhouse emission levels continue to increase, specifically in the Catskill and Adirondack Mountains.

Figure 3a.12
Palmer Drought Severity Index Summary Map for the United States



Source: National Drought Mitigation Center, 1895-1995

Flood

Location – Flood

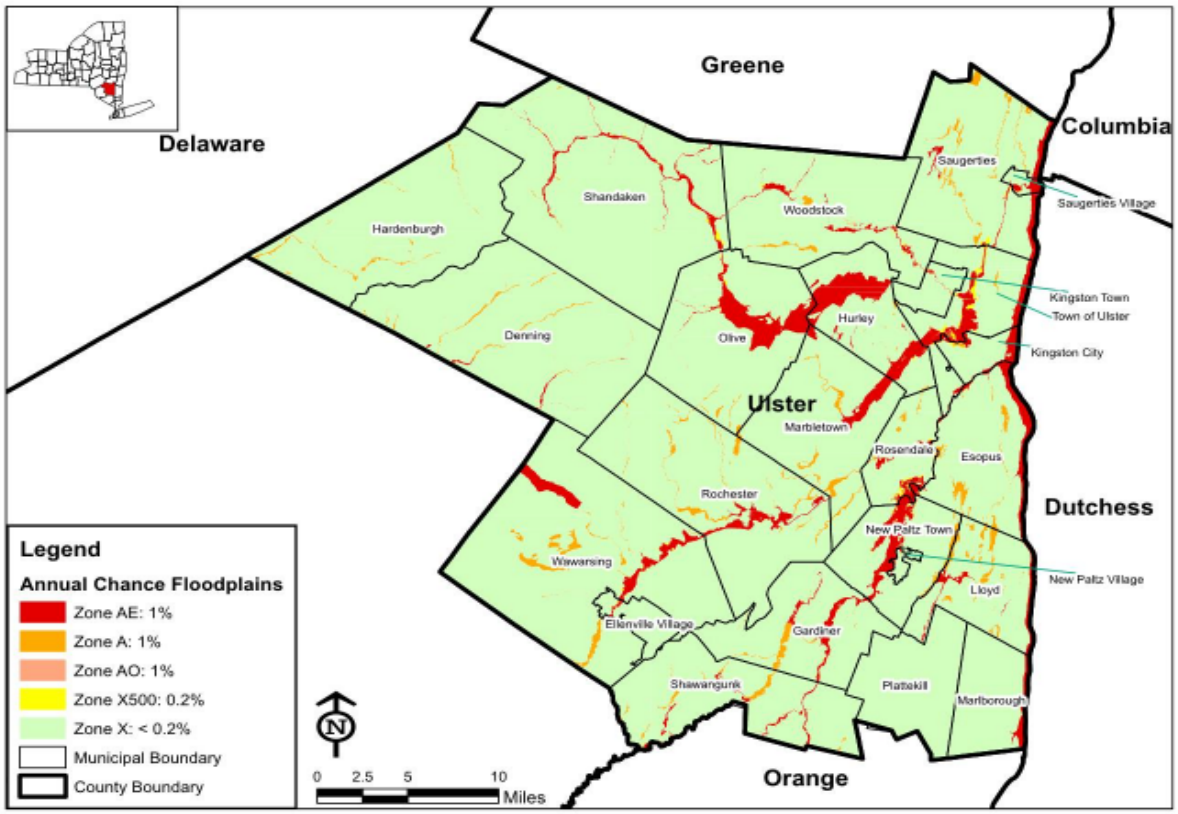
Despite being located many miles inland with no Atlantic Ocean coastal frontage, Ulster County is subject to both riverine and coastal flooding. **Riverine flooding** occurs along inland channels such as rivers, creeks, streams. When a channel receives too much water, the excess water flows over its banks and inundates low-lying areas. **Coastal flooding**, on the other hand, is a result of storm surge where sea levels rise to inundate areas along not only the coasts of oceans, bays, and estuaries; but also, tidal rivers and lakes. Hurricanes and tropical storms, severe storms, and nor'easters cause most of the coastal flooding in New York State overall. Ulster County has recently been impacted by coastal flooding due to storm surge[26] traveling up the Hudson River during Superstorm Sandy. Many areas of Ulster County are also susceptible to urban (stormwater) flooding.

It is estimated that approximately five percent of lands within Ulster County are located in the 100-year floodplain. **Figure 3a.13** illustrates the location and extent of currently mapped special flood hazard areas for Ulster County based on FEMA's 2013 Preliminary Digital Flood Insurance Rate Maps (DFIRMs). This includes Zones A/AE/AO (100-year floodplain), Zone X500 (500-year floodplain), and Zone X (areas higher than the elevation of the 500-year flood). There are no mapped areas of Zone V (100-year floodplain with wave action). It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood

[26] Storm surge is addressed as a separate hazard within this section.

risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas – particularly in areas that were not included in detailed study areas.

Figure 3a.13
Special Flood Hazard Areas in Ulster County



Source: FEMA Preliminary Digital Flood Insurance Rate Maps(DFIRM) data issued on May 24, 2013.

The flooding portion of this hazard mitigation plan has been revised as part of this first update to reflect changes between the old Q3 mapping used previously and the new 2013 Preliminary DFIRMs. As part of the 2015 update, the Revised Preliminary Flood Insurance Study for Ulster County dated December 20, 2013, notes:

- Revised hydrologic and hydraulic analyses were prepared for all approximate studies and for detailed studies on the Saw Kill, Twaalfskill Brook, and Rondout Creek. The hydrologic and hydraulic analyses were revised for Alton Creek, Alton Creek Tributary, Beaver Kill, Birch Creek, Broadstreet Hollow, Bush Kill, Bushnellsville Creek, Cross Mountain Hollow, Dry Brook, East Branch Neversink River, Esopus Creek Reach 2, Fox Hollow, Little Beaver Kill, Maltby Hollow Brook, Mink Hollow, Muddy Brook, Rondout Creek Reach 2, Stony Clove Creek, Sundown Creek, Wagner Creek, Warner Creek, Woodland Creek, and Woodland Creek Tributary.

- The digital base map information shown on the FIRMs was provided by NYSDEC. The projection used for the preparation of the DFIRMs was UTM Zone 18. The horizontal datum was the North American Datum of 1983, GRS1980 spheroid.

Extent – Flooding

In the case of riverine flood hazard, once a river reaches flood stage, the flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations. (NWS 2011)

The extent of flooding associated with a one percent annual probability of occurrence (the base flood or 100-year flood, **Figure 3a.13** for Ulster County) is used as the regulatory boundary by many agencies. Also referred to as the SFHA, this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the water elevation resulting from a given discharge level, which is one of the most important factors used in estimating flood damage.

Historical Occurrences – Floods

Flooding is the most common major natural hazard in New York State. Floods have occurred in Ulster County's communities in the past, and will continue to do so in the future. Ulster County and its component municipalities have generally been impacted by riverine flooding and shallow flooding, as well as some coastal flooding along its Hudson River shoreline during extreme events such as Superstorm Sandy. The Ulster County FIS notes that flooding can occur in Ulster County during any season of the year, but is most likely to occur in the late winter-early spring months when severe or long-duration precipitation events combine with melting snow. Late summer flooding is also a possibility due to thunderstorms and tropical storms/hurricanes carrying abundant amounts of rain as they travel up the eastern seaboard.

According to the NCDC, 81 recorded flood[27] days have occurred in Ulster County between January 1996 and July 2015[28]. These events have resulted in more than $24 million in property damages. A sampling of *more recent, notable events* includes the following:

> **January 19-27, 1996**. An intense area of low pressure which was located over the Mid-Atlantic region on Friday morning January 19th produced unseasonably warm temperatures, high dewpoints and strong winds. This resulted in rapid melting of one to three feet of snow. In addition to the rapid snowmelt one to three inches of rain fell as the system moved northeast along the coast. This resulted in widespread flooding across Ulster County. Federal Disaster Assistance was made available by presidential declaration. Small streams flooded across the entire county which resulted in many roads being washed out. Extensive flooding also occurred along the Hudson River and Esopus Creek. In the mountainous terrain of Ulster County road washouts were more numerous. In the Town of Shandaken five town roads were destroyed and several homes were damaged. In the Town of Hardenburgh three quarters of the roads were washed out. In New Paltz homes were flooded near the wetlands along route 299 due to the Wallkill Creek.

[27] NCDC was queried for the event types of Coastal Flood, Flash Flood, Flood, Lakeshore Flood, Storm Surge/Tide. No event days were recorded as coastal flood or lakeshore flood events.
[28] NCDC records were queried on October 27, 2015, and are current for event dates through July 31, 2015.

Flooding also occurred in the Towns of Denning, Olive, Woodstock, Saugerties and Kingston. Evacuations occurred in the Phoenicia-Shandaken area and in the Town of Kingston. Ten million dollars in property damage was recorded in Ulster County for this event. On January 24th, a low pressure system tracked across the northern Great Lakes and produced additional rain across the already ground-soaked region. Additional runoff along with high tides along the Hudson River created flooding over two days (January 24-25) along the Rondout Creek between Eddyville and the Hudson River and along the Hudson River in Kingston, with an additional $60,000 in property damage. Days later, on January 27th, a low pressure system over the upper Great Lakes produced a general rainfall of one to two inches across eastern New York with up to three inches of rain across parts of the Catskills. This amount of rainfall on already saturated soil brought many small streams out of their banks across Ulster County. The Wallkill River, Rondout Creek and Esopus Creek also flooded in Ulster County. Evacuations occurred along the Esopus Creek and Route 28 was closed between Phoenicia and Mount Tremper. Along the Rondout Creek at Eddyville flooding was widespread and severe. Numerous roads were washed out across the county and the Towns of Shandaken and Hardenburgh declared a local state of emergency. An additional $400,000 in property damage occurred, bringing the total property damage for this multi-day event up to nearly $10.5 million in Ulster County.

September 16, 1999- Floyd. The remnants of Hurricane Floyd moved up the eastern seaboard on September 16th and during the early hours on September 17th. The storm brought both high winds and exceptionally heavy rainfall to eastern New York, which included a large swath of three to six inch amounts. The heaviest rain fell just to the west of the Hudson Valley in the eastern Catskills and Helderbergs, with locally higher amounts in excess of one foot in some areas. Specific rainfall amounts included 6.12 inches at Albany International Airport, the highest ever officially recorded at that site from any given storm. Even higher amounts of rainfall occurred at Delmar and Knox including 8.15 inches in Delmar and 9.00 inches at Knox, both located in Albany County. The storm's peak rainfall of 12.21 inches was recorded in Cairo, Greene County. The rain produced widespread flooding across the region. Significant flooding was noted on many smaller tributaries, including the Esopus, Catskill and Schoharie Creeks. Many communities and counties declared a State of Emergency. The rains, combined with left-over rain from Tropical Storm Dennis one week earlier, alleviated the fourteen month drought across most of the region. The combination of high winds and very saturated ground produced widespread downing of trees and power lines across much of eastern New York. The rain and wind produced massive power outages across the region. As many as 80,000 people lost power in the Mid-Hudson Valley region; 54,000 in the Greater Capital District; and another 25,000 in the Lake George Saratoga region. Some individuals had to wait over a week for power to be restored. The storm resulted in lost wages, closed schools throughout the region, and cancelled flights. Floyd resulted in the counties of Albany, Dutchess, Greene and Rensselaer being declared "major disaster areas". Nearly $1.1 million in property damage was recorded in Ulster County.

July 14-15, 2000. On the afternoon of July 14th, a very moist air mass moved over the Mohawk Valley and Southern Catskills. A cold front stalled to the west of the region. This scenario allowed for a cluster of thunderstorms to develop. The thunderstorms produced torrential rains as they became stationary over the area. Five to seven inches of rain fell at West Shokan in Olive. A mudslide occurred on High Point Mountain Road, with debris blocking nearby roads. Denning was especially hard hit. Doppler radar estimated between eight and 10 inches of rain fell in a few hours during the late afternoon and evening hours as thunderstorms became virtually stationary over the area. Massive flooding caused almost every road in Denning to be washed out, including County Route 46 (Greenville Road). Five families were evacuated. Small bridges were also washed out. The Hamlet of Sundown suffered the most damage with all but one road devastated. A trailer was destroyed while other houses had damage to their foundations. Other portions of homes were torn away. The next day, on July 15th, a slow-moving low pressure area pumped a deep layer of tropical air into the region and resulted in widespread heavy rain. The heaviest rain fell across the Mohawk Valley and Catskills. Exceptional 24-hour rainfall totals included 9.85 inches at Boiceville and 11.97 inches at West Shokan, both located in Ulster County. However, these totals included the heavy rain which fell the previous night. The excessive rains resulted in flooding and flash flooding across Albany, Ulster, Rensselaer and, especially, Columbia Counties. Areas of Ulster County, not fully recovered from

Friday's flood, had additional flooding Saturday. County Route 101 was made impassable due to water in Olivebridge. Recorded property damages for these totaled $6,056,000.

March 28 to April 3, 2005. Severe storms and flooding resulted in a Federal Disaster Declaration for Ulster County and 11 other New York Counties. Many roads were closed throughout the County. The Esopus Creek exceeded the 20.0-foot flood stage at the Mount Marion gage in the Town of Saugerties, cresting at 20.54 feet at 8:00AM on the 29th. Springtown Road flooded. In the Hamlet of High Falls (portions of which are located in both Marbletown and Rosendale), the intersection of Stone Ridge Road and Route 213 was under water. Springtown Road was closed between Kleinkill Road and Dug Road in New Paltz due to flooding. Heavy rainfall pushed water over roads near Blue Mountain Reservoir in Saugerties. Bushnellsville Creek flowed out of its banks and Route 42 was flooded in the Town of Shandaken. Pancake Hollow Road to South Chodikee Lake Road closed due to flooding in New Paltz. Plains Road from Main Street to Locust Lane flooded in New Paltz. A tractor trailer tanker floated into a bridge on Rondout Creek in Kerhonkson (a Hamlet in the Town of Rochester). For all declared counties, more than $8 million was approved under FEMA's Individual Assistance Program, and more than $51 million was obligated under the Public Assistance Program. NOAA's NCDC records $2.2 million in property damages in Ulster County during this event.

Various events – Flooding in the Town of Ulster 2005, 2006, 2007. Local sources on the CPG when the 2009 Plan was prepared provided further information about significant flooding experienced by the Town of Ulster in 2005, 2006, and 2007. Together, these events damaged approximately 150 residential structures in the town, most of which were mobile homes in parks adjacent to Rondout and Esopus Creeks, and caused several significant sewer breaks. In total, the Town reported that they received more than $870,000 in Public Assistance funds from FEMA for these events. The areas in the Town of Ulster most affected by these events were in the vicinity of Orlando Street, Buckley Street, Sandy Road, Brabant Road, Creek Locks Road, Farm to Market Road, Parish Lane, and County Route 28. Local sources report that flooding along the Twaalfskill Creek near Highland in the Town of Lloyd in April 2007 and March 2008 caused serious damage to local roads, and estimate that flooding has caused nearly $2 million in damages that three-year period alone.

Flood Damage in Boice's Mobile Home Park, Farm to Market Road, Town of Ulster, April 2005.

Flooding on Orlando Street, Town of Ulster, April 2007.

January 25, 2010. The combination of strong low pressure, a slow moving cold front, warm temperatures and deep moisture produced a period of heavy rainfall Monday, January 25th across east central New York. In addition, the warm temperatures caused some melting of the snow pack, adding to the runoff. Widespread flash flooding and river flooding occurred as the heavy rain fell on frozen ground. In addition, some ice jam flooding was reported as well as some mud and rock slides. The rain was heaviest in the Catskill Mountains where three to five inches fell. Elsewhere, across east central New York, one to around two inches of rainfall was reported. Widespread flooding was reported and significant runoff continued across Ulster County. The river gauge at Allaben on the Esopus Creek exceeded its seven foot flood stage. Plank Road from Phoenicia to Route 212 and Route 212 from Plank Road to Route 28 were reported closed due to flooding. Sawkill Road was reported closed due to flooding between Hill Road and Melissa Road in Kingston. Springtown Road in New Paltz was reported reduced to one lane between Kleinekill Drive and Dug Road due to flooding in the southbound lane.

October 1, 2010. Remnants of Tropical Storm Nicole moved across the region, bringing abundant tropical moisture and very heavy rains. Storm total rainfall of three to nine inches occurred, resulting in widespread river and small stream and urban flooding, including water in basements. Major flooding occurred on the Esopus Creek at Cold Brook. Cold Brook crested at 18.86 feet at 0600 LST on October 1st. Flood stage is 11 feet. State Route 214, Main Street, High Street, Station Road and Plank Road, all near the Esopus Creek,

were reported closed due flooding in Phoenicia (a Hamlet in the Town of Shandaken). The Bridge Street bridge in Phoenicia suffered structural damage and was closed. Fifteen to 20 homes were evacuated in Phoenicia due to the flooding. In addition, Onteora School District canceled classes for the day. States of Emergency were declared in the Towns of Shandaken and Hardenburgh due to the flooding. Route 32 was reported closed in both directions due to flooding just north of Creek Locks Road in Rosendale. A few homes were evacuated along Riseley Road in Mount Tremper (a Hamlet in the Town of Shandaken) due to the heavy rains. Part of Route 209 along the Rondout Creek in Accord (a Hamlet in the Town of Rochester) was closed due to flooding.

Cragswood & Springtown Roads in Hurricane Irene (Julia Robbins)

August 28, 2011-Tropical Storm Irene. Irene tracked north-northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding, and damaging winds. The greatest impact was heavy to extreme rainfall, which resulted in catastrophic flooding. Rainfall amounts generally averaged four to eight inches across the region, although amounts of eight to 12 inches were common across higher elevations within the eastern Catskills and Schoharie Valley, with isolated amounts as high as 18 inches reported. This heavy to extreme rainfall resulted in widespread flash flooding and river flooding. In Ulster County, extensive damage to roads, bridges, and electrical infrastructure was reported, with the majority of roads impassable across the Catskills. Five rescues were performed by the Ulster County Sheriff's Department swift water team for people driving into the water, with numerous mandatory evacuations also occurring. Record flooding occurred on the Esopus Creek at Cold Brook, the Rondout Creek at Rosendale, and the Hudson River at Poughkeepsie, with major flooding occurring on the Esopus Creek at Mount Marion. Record flooding occurred on the Esopus Creek upstream of the Ashokan Reservoir. The Mount Temper/Cold Brook river gage exceeded its 11 foot flood stage at 4:07 am EST August 28th; its 15 foot moderate flood stage at 6:53 am; its 18 foot major flood stage at 8:17 am; and crested at a record 23.34 feet at 12 pm; then dropped below flood stage at 12:26 am August 29th. At a level of 18 feet, roads and bridges are flooded in Phoenica; at 21 feet, water reaches Route 28; and at 22 feet, the Boiceville business district is underwater. Water flowed over Zena Road in Woodstock. Record flooding occurred on the Rondout Creek. The Rosendale river gage exceeded its 18 foot flood stage at 7:11 am EST August 28th; its 21 foot moderate stage at 8:33 am; its 23 foot major flood stage at 9:52 am; crested at a record 29.96 feet at 5 pm; and dropped below flood stage at 1:32 am August 29th. At a level of 26 feet, severe flooding occurs in the Rondout Valley. Major flooding occurred on the Espous downstream from the Ashokan Reservoir. The Mount Marion river gage exceeded its 20 foot flood stage at 7:36 am EST August 28th; its 22 foot moderate flood stage at 9:30 am; its 24 foot major flood stage at 12:17 pm; crested at 25.39 feet at 4:15 pm August 28th; and dropped below flood stage at 8 pm on August 31st. At a level of 24 feet, flooding occurs to homes in the Towns of Hurley and Saugerties. The Ashokan Reservoir East gage exceeded its 589 foot flood stage at 5:22 am August 28th, its 590 foot moderate flood stage at 8:49 pm, it crested at 590.58 feet at 11:10 pm, and dropped below flood stage at 11:57 pm August 29th. The Twaalfskill Creek overflowed its banks into the town of Highland, with water washing over Vineyard Avenue. Route 214 was reported closed due to flooding from the Ulster-Greene County border, near Moggre Road, to Route 23A in Greene County. The Stony Clove Creek runs along much of the Route 214. The New York State Thruway was closed due to numerous reports of flooding from Exit 24 (Milepost 145) to Exit 8 (Milepost 11). Route 42 was closed due to flooding between Route 23A in the Town of Lexington and Route 28 in Shandaken.


Satellite image of Tropical Storm Irene.

NY 416 flooded by Wallkill River after Lee. (Photo courtesy of Daniel Case)

September 7, 2011-Tropical Storm Lee. A slow moving frontal boundary moved eastward across New York State between Monday September 5th, and Tuesday September 6th. The front then moved south and east of the state by late Tuesday, as waves of low pressure continued to travel northeast along the boundary. In addition, copious amounts of moisture from the remnants of Tropical Storm Lee, which made landfall along the Gulf coast, interacted with the frontal system from Wednesday into Thursday September 8th, producing additional heavy rainfall. Total rainfall amounts across eastern New York for the period from Monday into Thursday ranged from four to eight inches, with the greatest amounts occurring across portions of the eastern Catskills. This heavy rainfall, combined with saturated soil from the excessive rains which fell in late August associated with the passage of Irene in late August, led to widespread minor to moderate flooding on rivers, as well as small streams and creeks across eastern New York. Minor flooding occurred on the Esopus Creek upstream of the Ashokan Reservoir. Moderate flooding occurred on the Espous downstream from the Ashokan Reservoir. Numerous roads were reported closed county-wide due to flooding as small streams overflowed their banks. The Pine Bush schools were closed due to the flooding. Moderate flooding occurred on the Wallkill River at Gardiner.

October 29, 2012-Superstorm Sandy. Hurricane Sandy moved northward off the eastern seaboard of the United States during the last week of October 2012. Due to a very strong blocking ridge of high pressure situated over the Atlantic Ocean, the storm turned back to the northwest and rapidly strengthened as it moved toward the mid-Atlantic coast. Although the storm began transitioning into non-tropical nor'easter storm, it remained an extremely powerful cyclone. As the storm made landfall in southern New Jersey during the evening of October 29th, bands of rain moved across eastern New York. The rainfall was not excessively heavy and did not cause any flooding, thanks to dry antecedent conditions. While less than an inch of rain fell in valley areas, higher terrain areas of the northern and eastern Catskills received over an inch of rain. Strong and gusty winds in association with the storm caused damage to trees and power lines across the region. Although not quite as widespread as areas across southeastern New York and New Jersey, power outages occurred throughout the region, mainly across the higher terrain. Local media reported that up to 63,000 customers lost power in Dutchess and Ulster Counties. It was also reported that utility National Grid had 8,000 customers without power in eastern New York at the height of the storm. One direct death was caused by these winds as flying debris was thrown through a windshield and killed a 69 year old woman driving in Kerhonkson in Ulster County. Two indirect deaths also occurred due to carbon monoxide poisoning from using a generator in the wake of the storm in the Town of Olive. In addition, the powerful storm caused a storm surge of water that moved up the Hudson River from the New York City area. Record flooding occurred on the Hudson River at Poughkeepsie as the river reached 9.54 feet. This surge of water moved all the way up to Albany. Flooding occurred along the Hudson River in Dutchess, Ulster, Greene, Columbia, Rensselaer and Albany counties causing damage to homes and businesses located near the river. Route 213 was reportedly closed between the Kingston City line and Creeks Lock Road due to tidal flooding along the Roundout Creek. Tidal flooding along the Esopus Creek and Hudson River caused an estimated six foot storm surge at Lighthouse Drive in Saugerties. About a dozen homes were stranded as water from a bay on the Hudson River met water from the Esopus Creek. Also, flooding also occurred on Maple Street in Smith Landing. Tidal flooding along the Rondout Creek in Kingston flooded East Strand Road and much of the Kingston Waterfront on the Hudson River. Two city employees working at a waste water treatment plant were stranded. An NWS Post-Storm Hydrologic Survey found water marks on The New Central Baptist Church of three to four feet high. Water also flooded rest rooms near Mariners Harbor Restaurant. The T.R. Gallo Park had significant flooding. Rosita's Cantina was flooded with three to four feet of water. Also, the Steelhouse Restaurant and Bar was flooded as well.

July 1, 2013. Showers and thunderstorms developed along a very slow moving surface boundary, and a persistent southerly flow caused a lot of these showers and thunderstorms to develop and pass over the same areas. Due to heavy rainfall over the last month, the ground was rather saturated and it didn't take much additional rain to cause issues. As a result, flash flooding occurred throughout the day on Monday, July 1st and again during the evening on Tuesday, July 2nd. Roads were damaged and closed and some evacuations took place as homes were impacted by the flood waters. The hardest hit areas were across part of the Mohawk Valley, where significant flash flooding had occurred just a few days prior. Springtown Road near New Paltz was closed due to flash flooding from heavy rainfall. The intersection of Route 32 and Washington Avenue in Rosendale was closed as a result of flash flooding.

July 2, 2014. Thunderstorms developed during the afternoon hours of July 2nd. Many of these storms became severe, producing wind damage to trees and power lines. A few storms also contained large hail. In addition, the very humid air mass in place gave the storms the capability of producing very heavy rainfall in a short period of time which led to flash flooding in some urban areas. In addition, these storms produced a significant amount of cloud to ground lightning. Heavy rainfall from thunderstorms led to flash flooding in Rosendale. A portion of State Route 32 was closed between Kallop Road and Washington Avenue in Rosendale due to high water. Flash flooding also occurred in Marlboro. A vehicle became stuck at the intersection of Route 9W and Old Post Road due to high water.

July 1, 2015. An area of showers and thunderstorms moved slowly across the region. Heavy bursts of rainfall repeated over the same portions of the eastern Catskills, with radar estimating up to three inches of rain falling in a short period of time. As a result, flash flooding occurred and several small streams overflowed their banks, which caused several roadways to be temporarily closed. Flash flooding in Ellenville led to the closure of Route 209 between Oak Ridge Road and Hang Glider Road. Heavy rainfall led to flash flooding in the Town of Rochester along the Kripplebush Creek, a tributary of the Roundout Creek. Kyserike Road was closed between Old Kings Highway and Lucas Turnpike as a result of the flooding.

Historical Summary of Insured Flood Losses

Floods have occurred in Ulster County's communities in the past, and will continue to do so in the future Ulster County and its component municipalities have generally been impacted by riverine flooding and shallow flooding. A picture of the flooding history of Ulster County in terms of damage to private property over the last three decades or so can be derived from the recorded flood losses and payments data from the NFIP.

According to the latest FEMA flood insurance records[29], there are a total of 1,345 active flood insurance policies in Ulster County and there have been 1,279 flood losses reported in Ulster County through the National Flood Insurance Program (NFIP) since 1972[30], totaling $29,100,559 in claims payments. Every municipal jurisdiction in Ulster County is listed by FEMA as being an active participant in the NFIP[31]. The name of the Floodplain Administrator (the person responsible for ensuring that development activities comply with floodplain management ordinances and NFIP regulations) for each jurisdiction is included on **Worksheet 2 in jurisdictional annexes of Appendix 1.2**. No Ulster County communities are listed by FEMA as Community Rating System (CRS) eligible communities[32]. Under the CRS, communities which implement floodplain management actions that go beyond the minimum requirements of the NFIP are eligible for discounts on flood insurance premiums for properties within that community. This data is presented **in Table 3a.12**, along with the total number of current policies, the total coverage

[29] Policy data current as of August 31, 2015 (still representing the latest information online as of November 3, 2015).
[30] Loss data current as of August 31, 2015 (still representing the latest information online as of November 3, 2015)
[31] As per FEMA's Community Status Book of participating communities (October 12, 2015).
[32] As per the FEMA's list of Community Rating System Eligible Communities effective October 1, 2015.

values, and key dates associated with the municipalities' participation in the NFIP. All data in **Table 3a.12** is current as of November 3, 2015.

The table shows that Ulster County NFIP insured flood losses have totaled more than $29 million since 1978, or more than $786,500 per year. Actual flood losses are likely to be higher, since this value only includes NFIP payouts and does not include losses incurred by non-policy holders, losses for which a claim was not submitted, or losses for which payment on a claim was denied.

Table 3a.12
FEMA NFIP Policy and Claim Information for Ulster County Jurisdictions
Source: www.fema.gov / www.bsa.nfipstat.com

NFIP Participating Communities in Ulster County, NY	Community Number	Date Entered NFIP	Current Effective FIRM Date	NFIP Policies In Force	Insurance in Force ($)	Total Number of Losses	Total Payments ($)
Denning	361439	5/25/1984	5/25/1984	23	$4,623,600	16	$235,717
Ellenville	360975	7/5/1983	9/25/2009	35	$8,110,000	34	$752,086
Esopus	360855	7/5/1984	9/25/2009	33	$7,767,200	13	$86,548
Gardiner	360856	9/30/1982	9/25/2009	41	$11,630,900	27	$878,975
Hardenburgh	361578	7/20/1984	3/16/1989	6	$1,825,000	1	$36,550
Hurley	360857	7/3/1985	8/18/1992	37	$7,246,400	34	$1,010,673
Kingston City	360858	5/1/1985	9/25/2009	76	$19,886,900	89	$1,477,683
Kingston Town	361218	8/27/1982	9/25/2009	34	$5,675,300	24	$598,995
Lloyd	361012	9/17/1982	9/25/2009	47	$10,903,900	43	$1,592,196
Marbletown	361219	10/22/1982	9/25/2009	32	$ 9,718,100	18	$343,450
Marlborough	361220	12/5/1984	9/25/2009	8	$1,854,200	14	$244,058
New Paltz Town	360859	9/30/1982	9/25/2009	52	$11,105,400	59	$1,100,363
New Paltz Village	361544	4/15/1982	9/25/2009	45	$7,575,000	13	$1,042,096
Olive	360860	11/1/1984	11/1/1984	53	$14,202,900	39	$1,836,938
Plattekill	361221	9/29/1978	NSFHA*	8	$ 1,520,600	5	$132,798
Rochester	360861	3/16/1983	9/25/2009	45	$12,239,300	51	$623,401
Rosendale	360862	11/1/1985	9/25/2009	62	$13,980,000	41	$771,124
Saugerties Town	360863	8/19/1985	9/25/2009	102	$21,695,700	49	$1,263,982
Saugerties Village	361504	9/10/1982	9/25/2009	33	$6,860,300	48	$1,564,434
Shandaken	360864	1/17/1985	2/17/1989	205	$47,831,200	273	$5,765,444
Shawangunk	360865	9/30/1982	9/25/2009	35	$9,098,500	7	$42,815
Ulster Town	360866	5/1/1985	9/25/2009	124	$29,771,500	219	$4,961,802
Wawarsing	360867	9/15/1983	9/15/1983	56	$12,174,700	89	$2,331,980
Woodstock	360868	9/27/1991	9/27/1991	154	$39,878,300	73	$406,452
Ulster County Totals				*1,346*	*$317,174,900*	*1279*	*$29,100,559*

*NSFHA: No Special Flood Hazard Area – all Zone C (determined to be outside the 500-year floodplain)

The average NFIP payment for the County overall was approximately $22,750 per individual loss – ranging from a maximum of $80,161 per loss in the Village of New Paltz to a minimum of $5,568 in Woodstock. Almost 50 percent of all NFIP paid losses in Ulster County have occurred in just four municipalities – the Olive, Shandaken, Ulster, and Wawarsing.

Repetitive Losses

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. The 2014 NYSHMP reports that there are more than 18,000 Repetitive Flood Loss properties and 1,126 Severe Repetitive Flood Loss properties in New York State.

According to FEMA repetitive loss property records[33], there are 187 repetitive loss properties located in Ulster County. These properties are associated with a total of 488 individual losses and $16,080,432 in claims payments under the NFIP, as shown in **Table 3a.13**, while **Table 3a.14** identifies the number and type of repetitive loss properties that are located in each identified flood hazard zone for each municipality. The approximate areas where RL properties are clustered are plotted in **Figures 3a.14 and 3a.15** in comparison with the extent of the mapped A/AE Zones (the Base/100-year floodplain). These figures do not show areas of the County where occasional RL properties are located in isolation or widely spaced and they show only the approximate areas covering clusters of RL properties, since the component data is subject to the 1974 Privacy Act. This legislation prohibits the public release of any information regarding individual NFIP claims or information which may lead to the identification of associated individual addresses and property owners. However, while this information is not available to the general public, the County may subsequently obtain comprehensive RL property data from FEMA for the purposes of targeted mitigation of RL areas or individual RL structures.

Two thirds (16 out of 24) of the municipalities in Ulster County are identified as having at least one Repetitive Loss (RL) property, with 28 (almost 40 percent) of these properties located in just one municipality, the Town of Ulster. The two municipalities with the next highest number of RL properties are the City of Kingston and the Town of Shandaken, with 12 each. Slightly more than three quarters of all RL properties are single-family residential buildings, while only 8 percent are non-residential. Data to permit a further breakdown of the non-residential structures into commercial, institutional, and so on was not readily available at the time of writing.

The average repetitive loss property in Ulster County has experienced 2.6 loss events: 69 percent have experienced two losses, 20 percent have experienced three, and 11 percent have experienced more than three, including two properties in the City of Kingston and the Town of Lloyd that are recorded as having experienced 8 losses each.

Table 3a.14 and **Figures 3a.14 and 3a.15** indicate that the majority of RL properties (62 percent) are located in the 100-year floodplain, and the remainder are approximately equally distributed across the 500-year floodplain and areas of minimal or no identified flood risk. Of the RL properties which are single family residential structures, 70 percent are located in the 100-year floodplain.

To summarize, almost one third of all NFIP payments in Ulster County may be attributable to just 6 percent of insured properties in the County (depending on how many of these properties remain insured by the NFIP).

[33] July 2013

Table 3a.13
NFIP Repetitive Loss Property Statistics
(Source: FEMA Region 2)

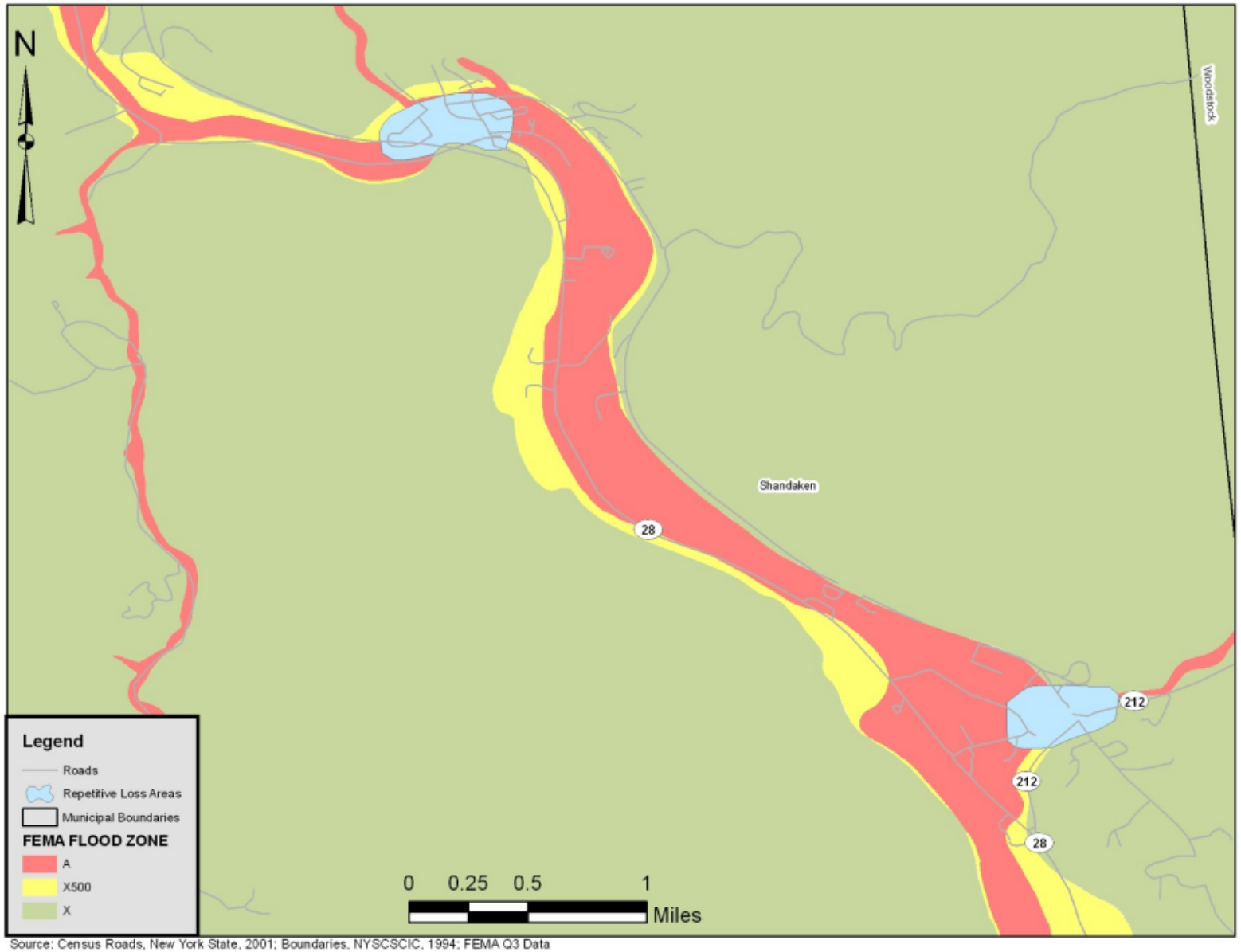
Jurisdiction	Single Family			Other Residential			Non-Residential			Total		
	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments
Denning, Town of										0	0	$0
Ellenville, Town of	1	2	$40,864							1	2	$40,864
Esopus, Town of										0	0	$0
Gardiner, Town of				1	2	$14,444				1	2	$14,444
Hardenburgh, Town of										0	0	$0
Hurley, Town of	1	2	26,289.48							1	2	$26,289
Kingston, City of	10	27	$380,666	1	2	$55,584	1	2	$39,950	12	31	$476,199
Kingston, Town of										0	0	$0
Lloyd, Town of				1	2	$13,357	1	8	$421,966	2	10	$435,322
Marbletown, Town of										0	0	$0
Marlborough, Town of										0	0	$0
New Paltz, Town of	1	2	$31,034							1	2	$31,034
New Paltz, Village of				1	3	$329,603				1	3	$329,603
Olive, Town of										0	0	$0
Plattekill, Town of	1	3	$55,594							1	3	$55,594
Rochester, Town of	1	2	$2,211							1	2	$2,211
Rosendale, Town of	1	2	$62,281							1	2	$62,281
Saugerties, Town of	2	4	$127,490							2	4	$127,490
Saugerties, Village of	1	2	$3,968							1	2	$3,968
Shandaken, Town of	10	24	$480,591	1	2	$7,369	1	2	$5,135	12	28	$493,095
Shawangunk, Town of										0	0	$0
Ulster, Town of	22	65	$1,961,274	3	7	$193,150	3	6	$127,779	28	78	$2,282,204
Wawarsing, Town of	4	8	$127,746				1	2	$7,936	5	10	$135,682
Woodstock, Town of							1	2	$6,110	1	2	$6,110
Totals	**55**	**143**	**$3,300,010**	**8**	**18**	**$613,506**	**8**	**22**	**$608,874**	**71**	**183**	**$4,522,390**

Table 3a.14
Repetitive Loss Properties by Municipality and Location in Mapped Flood Hazard Zones
(Source: FEMA Region 2)

Jurisdiction	A Zone (100-Year Floodplain)			X500 Zone (500-Year Floodplain)			Other Zone (>500-Year Floodplain)		
	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential
Denning, Town of							1		
Ellenville, Town of								1	
Esopus, Town of									
Gardiner, Town of									
Hardenburgh, Town of									
Hurley, Town of	1								
Kingston, City of	8	1	1				1		
Kingston, Town of				1					
Lloyd, Town of			1		1				
Marbletown, Town of									
Marlborough, Town of									
New Paltz, Town of	1								
New Paltz, Village of					1				
Olive, Town of									
Plattekill, Town of				1					
Rochester, Town of	1								
Rosendale, Town of				1					
Saugerties, Town of				2					
Saugerties, Village of	1								
Shandaken, Town of	5			4			1	1	1
Shawangunk, Town of									
Ulster, Town of	19	3	1				3		2
Wawarsing, Town of*	1			1		2	1		
Woodstock, Town of									
Totals	***37***	***4***	***3***	***10***	***2***	***2***	***7***	***2***	***3***

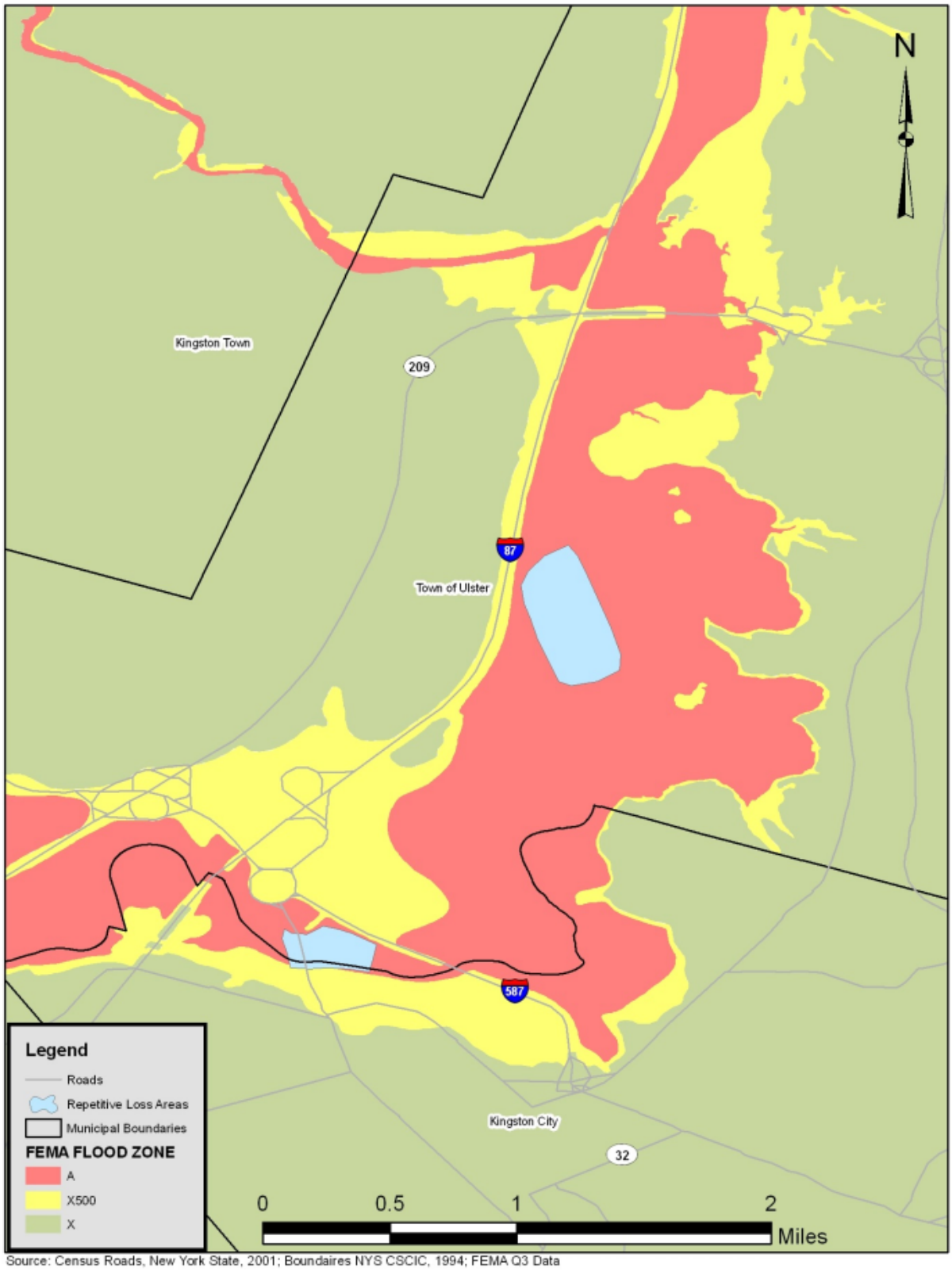
*Totals do not exactly match those in Table 3a.13 since address details were incomplete

Figure 3a.14
NFIP Repetitive Loss Property Clusters – Town of Shandaken



Source: Census Roads, New York State, 2001; Boundaries, NYSCSCIC, 1994; FEMA Q3 Data

Figure 3a.15
NFIP Repetitive Loss Property Clusters – Town of Ulster/City of Kingston



Source: Census Roads, New York State, 2001; Boundaires NYS CSCIC, 1994; FEMA Q3 Data

Probability of Occurrence – Flood

Flooding will continue to have a high probability of occurrence in Ulster County, and the probability of future occurrences in Ulster County is certain. The probability of future flood events based on magnitude and according to best available data is illustrated in **Figure 3a.13**, which indicates those areas susceptible to the 1 percent annual chance flood (100-year floodplain); the 1 percent annual chance flood with wave action (100-year coastal floodplain); and the 0.2 percent annual chance flood (500-year floodplain). The frequency of intense precipitation events in Ulster County is expected to increase in the future with climate change; this is likely to result in more riverine and flash flooding events.

Flooding can occur in Ulster County during any time of the year, but is most likely in the late winter and early spring months when severe or long-duration precipitation events combine with melting snow. Late-summer flooding is also common, due to thunderstorms and tropical systems.

Ice Jams

Location - Ice Jams

The identification of particular areas prone to ice jam flooding is difficult since the hazard can be extremely localized. Because of the sometimes unpredictable nature of ice jam floods, FEMA's Flood Insurance Rate Maps often do not reflect ice jam flood threats. However, available research and historic data suggests that ice jam flood hazard is most common in areas of flat terrain where the climate included extended periods of temperature below zero. Ice jams are very common in the northeastern United States, and the USACE Cold Region Research and Engineering Laboratory (USACE CRREL) reports that 1,667 ice jam events have been recorded in New York State between 1867 and 2015[34], a number exceeded only by the State of Montana.

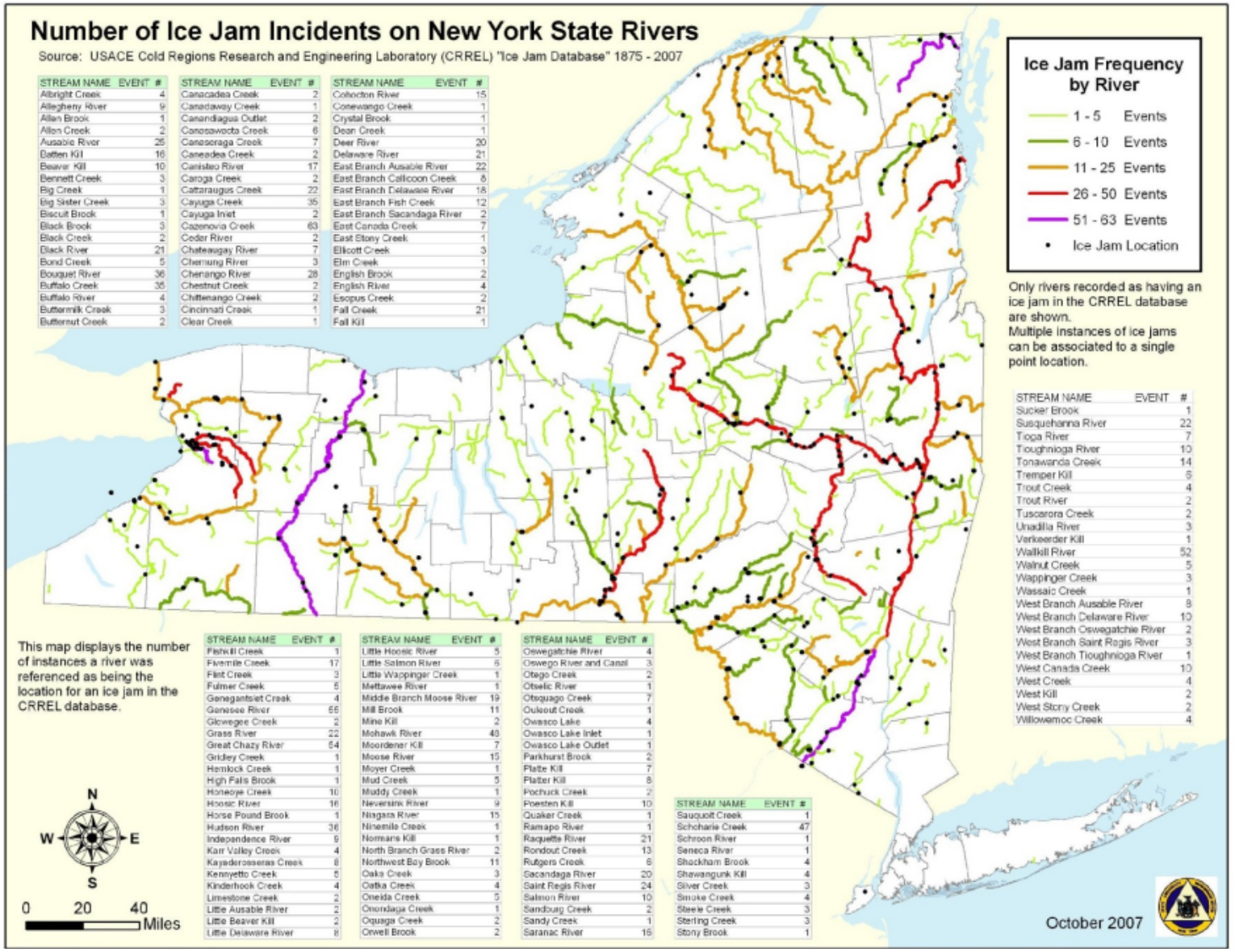
Figure 3a.16 shows the locations of ice jam incidents that have been recorded by the CRREL in New York State from 1875 to 2007. Multiple instances of ice jams may be associated with a single point location. Rivers and streams flowing through Ulster County on which more than one ice jam incident has been recorded by CRREL are presented in **Table 3a.15**[35].

Table 3a.15
Rivers and Streams in Ulster County with Recorded Ice Jam Incidents
(Source: USACE; CRREL)

River/Stream Name	Number of Recorded Ice Jam Incidents
Wallkill River	52
Rondout Creek	13
Mill Brook	11
Platte Kill	7
Shawangunk Kill	4
Esopus Creek	2

[34] CRREL Ice Jam Database last updated September 21, 2015.
[35] As noted by NYSEMO on Figure 3a.16.

Figure 3a.16
Ice Jam Incidents in New York State



STREAM NAME	EVENT #
Albright Creek	4
Allegheny River	9
Allen Brook	1
Allen Creek	2
Ausable River	25
Batten Kill	16
Beaver Kill	10
Bennett Creek	3
Big Creek	1
Big Sister Creek	3
Biscuit Brook	1
Black Brook	3
Black Creek	2
Black River	21
Bond Creek	5
Bouquet River	36
Buffalo Creek	35
Buffalo River	4
Buttermilk Creek	3
Butternut Creek	2

STREAM NAME	EVENT #
Canacadea Creek	2
Canadaway Creek	1
Canandaigua Outlet	2
Canaseraga Creek	7
Caneadea Creek	2
Canisteo River	17
Caroga Creek	2
Cattaraugus Creek	22
Cayuga Creek	35
Cayuga Inlet	2
Cazenovia Creek	63
Cedar River	2
Chateaugay River	7
Chemung River	3
Chenango River	28
Chestnut Creek	2
Chittenango Creek	2
Cincinnati Creek	1
Clear Creek	1

STREAM NAME	EVENT #
Cohocton River	15
Conewango Creek	1
Crystal Brook	1
Dean Creek	1
Deer River	20
Delaware River	21
East Branch Ausable River	22
East Branch Callicoon Creek	6
East Branch Delaware River	18
East Branch Fish Creek	12
East Branch Sacandaga River	2
East Canada Creek	7
East Stony Creek	1
Ellicott Creek	3
Elm Creek	1
English Brook	2
English River	4
Esopus Creek	2
Fall Creek	21
Fall Kill	1

STREAM NAME	EVENT #
Sucker Brook	1
Susquehanna River	22
Tioga River	7
Tioughnioga River	10
Tonawanda Creek	14
Tremper Kill	6
Trout Creek	4
Trout River	2
Tuscarora Creek	2
Unadilla River	3
Verkeerder Kill	1
Wallkill River	52
Walnut Creek	5
Wappinger Creek	3
Wassaic Creek	1
West Branch Ausable River	8
West Branch Delaware River	10
West Branch Oswegatchie River	2
West Branch Saint Regis River	3
West Branch Tioughnioga River	1
West Canada Creek	10
West Creek	4
West Kill	2
West Stony Creek	2
Willowemoc Creek	4

STREAM NAME	EVENT #
Fishkill Creek	1
Fivemile Creek	17
Flint Creek	3
Fulmer Creek	5
Genegantslet Creek	4
Genesee River	65
Glowegee Creek	2
Grass River	22
Great Chazy River	54
Gridley Creek	1
Hemlock Creek	1
High Falls Brook	1
Honeoye Creek	10
Hoosic River	16
Horse Pound Brook	1
Hudson River	36
Independence River	9
Karr Valley Creek	4
Kayaderosseras Creek	8
Kennyetto Creek	5
Kinderhook Creek	4
Limestone Creek	2
Little Ausable River	2
Little Beaver Kill	2
Little Delaware River	8

STREAM NAME	EVENT #
Little Hoosic River	5
Little Salmon River	6
Little Wappinger Creek	1
Mettawee River	1
Middle Branch Moose River	19
Mill Brook	11
Mine Kill	2
Mohawk River	40
Moordener Kill	7
Moose River	15
Moyer Creek	1
Mud Creek	5
Muddy Creek	1
Neversink River	9
Niagara River	15
Ninemile Creek	1
Normans Kill	1
North Branch Grass River	2
Northwest Bay Brook	11
Oaks Creek	3
Oatka Creek	4
Oneida Creek	5
Onondaga Creek	1
Oquaga Creek	2
Orwell Brook	2

STREAM NAME	EVENT #
Oswegatchie River	4
Oswego River and Canal	3
Otego Creek	2
Otselic River	1
Otsquago Creek	7
Outcut Creek	1
Owasco Lake	4
Owasco Lake Inlet	1
Owasco Lake Outlet	1
Parkhurst Brook	2
Platte Kill	7
Platter Kill	8
Pochuck Creek	2
Poesten Kill	10
Quaker Creek	1
Ramapo River	1
Raquette River	21
Rondout Creek	13
Rutgers Creek	6
Sacandaga River	20
Saint Regis River	24
Salmon River	10
Sandbug Creek	2
Sandy Creek	1
Saranac River	16

STREAM NAME	EVENT #
Sauquoit Creek	1
Schoharie Creek	47
Schroon River	1
Seneca River	1
Shockham Brook	4
Shawangunk Kill	4
Silver Creek	3
Smoke Creek	4
Steele Creek	3
Sterling Creek	3
Stony Brook	1

Extent – Ice Jams

Accumulated winter precipitation determines the magnitude of the spring runoff, which controls the severity of breakup and associated ice-jam flooding at any particular point in time. The ice jam hazard overall is considered to be of moderately low severity[36] in Ulster County. While ice jams occur frequently, damages tend to be localized and moderate. However, depending on the magnitude of the ice jam, major damages and losses can result (such as damaged roads, bridges, buildings, and homes). Warning time is typically at least one day. Impacts from ice jams tend to primarily affect areas located along rivers, tributaries or reservoirs. Serious injury or death is unlikely. The hazard duration is typically four days to one week, with a recovery time of one to two days. When ice jam events take place, typically, flooding occurs within the localized area of the event as a result.

Historic Occurrences – Ice Jams

The USACE CRREL[37] mapping indicates that ice jam incidents for which some details are available have been recorded at 12 locations within Ulster County. **Table 3a.16** presents details for a subset of recorded ice jam events in Ulster County for which at least the date and location were available.

Table 3a.16
Historical Occurrences of Ice Jams in Ulster County

Date	River/Stream	Municipality	Details/Description
2/13/2009	Wallkill River	Gardiner	Not available.
2/20/2008	Wallkill River	New Paltz	Flooding along Springtown Road between Kleine Kill Drive and Dug Road, and between Route 299 and Mountain West Road.
3/4/2007	Wallkill River	Gardiner	At junction of Wallkill River/Shawangunk Kill
2/23/2003	Wallkill River	Gardiner	Not available
2/23/2003	Rondout Creek	Rosendale	Not available
2/25/2000	Wallkill River	Gardiner	Flooding in vicinity of Route 44 bridge, some farm fields inundated
1/25/1999	Wallkill River	New Paltz	Springtown Road closed due to flooding between Dug Road and Mt. Rest
1/24/1999	Shawangunk Kill	Shawangunk	Road flooding, mainly in Orange County
1/29/1996	Wallkill River	New Paltz	Minor flooding for 1.5 miles between Tall Pines Lane and Ulster County Fairground
1/24/1996	Wallkill River	Gardiner	Minor flooding between Walden and Montgomery (Orange County) attributed to ice jam at Gardiner
3/16/1994	Wallkill River	Gardiner	Not available
3/10/1994	Rondout Creek	Rosendale	Not available
2/4/1982	Wallkill River	Gardiner	Not available
2/4/1982	Rondout Creek	Rosendale	Not available
2/11/1981	Esopus Creek	Shandaken	Not available
2/2/1981	Esopus Creek	Shandaken	Not available
1/25/1964	Shawangunk Kill	Shawangunk	Not available
3/18/1963	Shawangunk Kill	Shawangunk	Not available
3/13/1962	Rondout Creek	Rosendale	Not available
2/25/1961	Shawangunk Kill	Shawangunk	Not available

[36] As per Ulster County HAZNY, facilitated by UCECEM on January 2014 and prepared by a group of participants comprised of representatives from various local, County, State, public and private sector employers, heath care, emergency services, and transportation agencies.
[37] CRREL Ice Jam Database last updated September 21, 2015.

Table 3a.16 Historical Occurrences of Ice Jams in Ulster County			
1/22/1959	Rondout Creek	Rosendale	Not available
3/16/1948	Rondout Creek	Rosendale	Not available
3/4/1945	Rondout Creek	Rosendale	Not available
2/8/1941	Rondout Creek	Rosendale	Not available
3/15/1940	Rondout Creek	Rosendale	Not available
3/12/1936	Rondout Creek	Kingston	"Portions of … Kingston, in New York state, was inundated, and a score of barges, tugs and other craft were swept down Rondout Creek until they were halted by an ice jam and remoored. Three watermen were rescued. Nine Ulster county hamlets were abandoned due to rising waters on the Wallkill river. . . . Fog hitting from the Hudson River today disclosed a fleet of tugs and barges jammed in a huge ice pack where they were swept by raging Rondout Creek yesterday. No one was believed to be aboard. Watchers said they counted 20 or 30 vessels. In the group was a 100-foot steam yacht. This and others were torn away from dry docks a mile and a half up Rondout Creek when an ice jam broke*
3/4/1934	Rondout Creek	Rosendale	Not available
3/3/1926	Wallkill River	Gardiner	Not available

*As reported by *The Caledonian-Record*, March 13, 1936

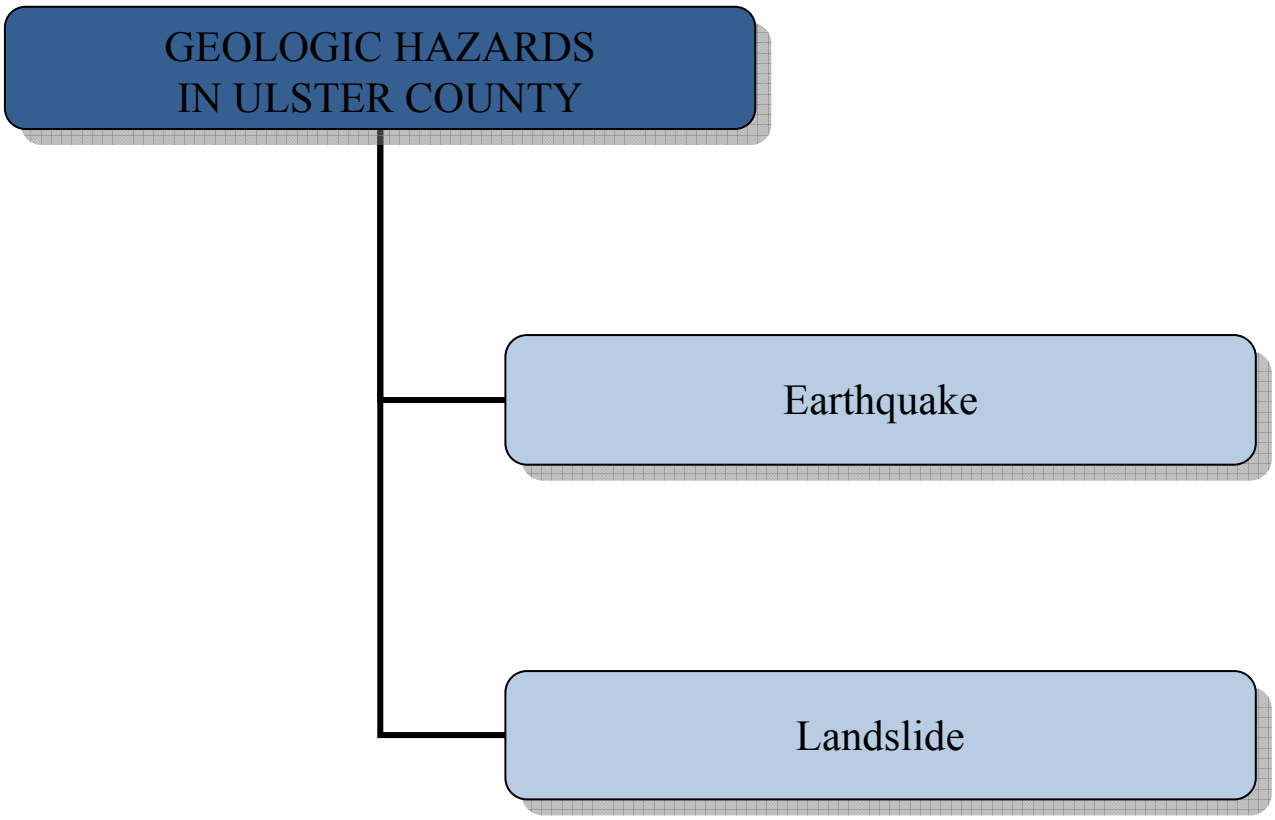
In addition to data sourced from USACE CRREL, local sources have indicated stormwater discharges are occasionally impeded by ice jams in the Town of Lloyd in March 2008.

A superseded version of the New York State Hazard Mitigation Plan (approved by FEMA in January 2005) mentions that an ice jam flooding event took place in Ulster County in January 1976, but gives no further details or description.

Probability of Occurrence – Ice Jams

Due to the nature of the terrain and the climate in Ulster County, ice jam events are essentially certain to occur, although whether or not such events will cause significant damage is less easy to predict, since records of actual damage caused by ice jams are scarce. The available data in the CRREL Ice Jam Database indicates an average annual number of 0.67 events per year within the County. An associated number of damage-causing occurrences per year has not been computed, since dollar damages per event are largely lacking. The probability of future ice jams in Ulster County is, however, certain. And based on historic occurrences, they are most likely to occur on the Wallkill River and Rondout Creek. Gardiner and Rosendale are the two municipalities most likely to be impacted by ice jams, based on the available data regarding historic occurrences.

GEOLOGIC HAZARDS

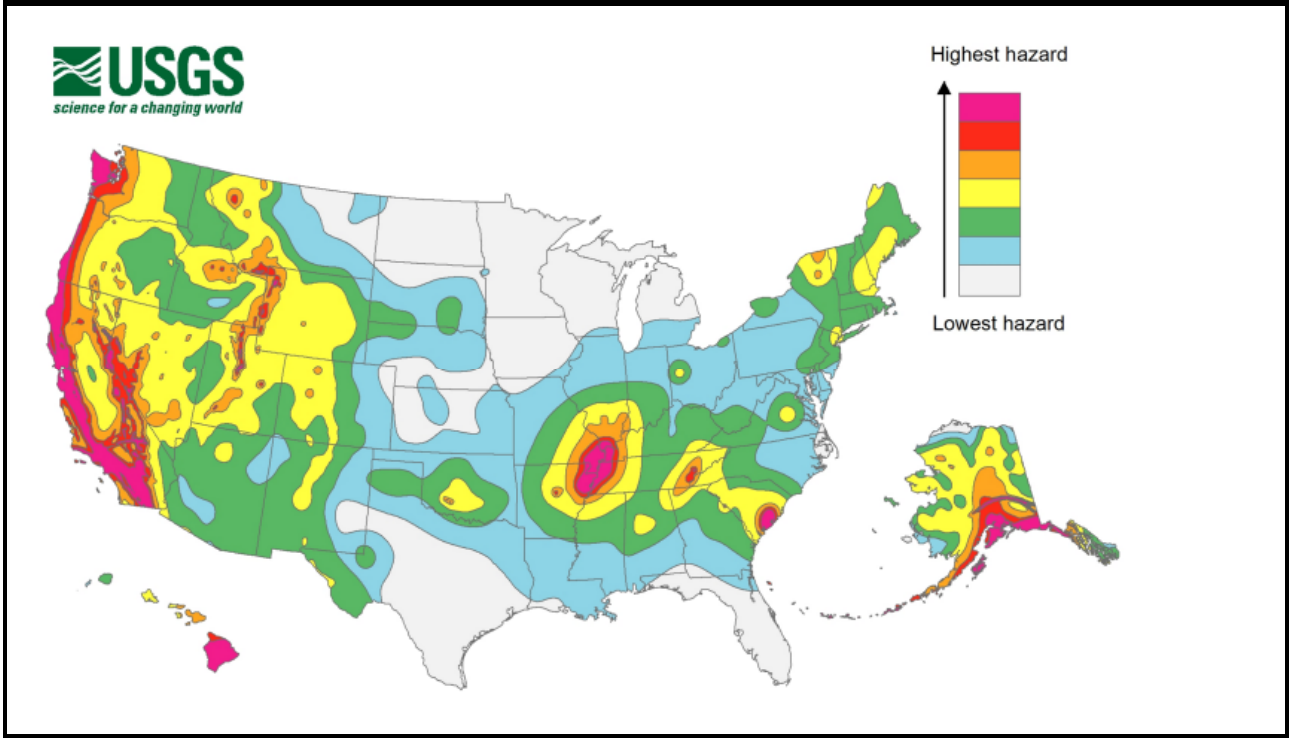


Earthquake

Location – Earthquake

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the East Coast does face moderate risk to less frequent, less intense earthquake events. **Figure 3a.17** shows relative seismic risk for the United States.

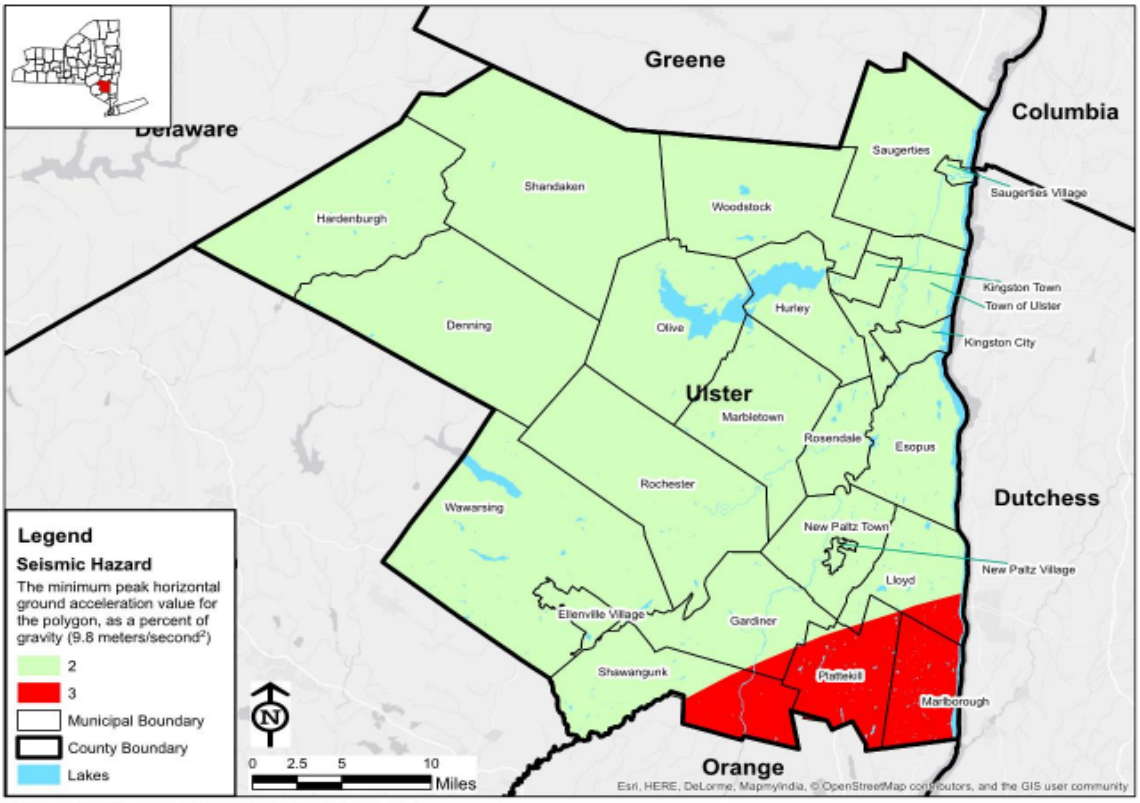
Figure 3a.17
United States Earthquake Hazard Map



Source: United States Geological Survey, 2014, http://earthquake.usgs.gov/hazards/products/conterminous/2014/HazardMap2014_lg.jpg

Figure 3a.18 shows the probability that ground motion will reach a certain level during an earthquake in Ulster County and the surrounding region. The data shows peak horizontal ground acceleration (the fastest measured change in speed for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. Ulster County is located in an area with peak ground acceleration (PGA) values between 2%g and 3%g, which represents is a relatively low seismic risk (in fact, FEMA only requires that the earthquake hazard be profiled when PGA values are 3%g or higher, which is only the case in a small, southern region of the County), but still enough to suggest that Ulster County is potentially susceptible to moderate, damaging earthquakes over time.

Figure 3a.18
Ulster County Earthquake Hazard Zones[38]



Source:USGS: Seismic Hazard Map for the United States, 2012.

Extent – Earthquake

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 3a.17**.

[38] USGS 2014 data online at http://earthquake.usgs.gov/hazards/products/conterminous/ only contained GIS files for PGA with a 2% probability of exceedance in 50 years. The FEMA requirement for evaluation of the need to perform an earthquake risk assessment, however, is tied to an evaluation of PGAs with a 10% probability of exceedance in 50 years; these were obtained in September 2014 from http://nationalatlas.gov/atlasftp.html?openChapters=chpgeol#chpgeol with metadata noting a year 2012 date.

Table 3a.17 Magnitude/Intensity Comparison for Earthquakes		
Magnitude	**Typical Maximum Modified Mercalli Intensity**	**Abbreviated Modified Mercalli Intensity Scale**
1.0 - 3.0	**I**	**I**. Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	**II - III**	**II**. Felt only by a few persons at rest, especially on upper floors of buildings.
		III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	**IV - V**	**IV**. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
		V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	**VI - VII**	**VI**. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
		VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 - 6.9	**VII - IX**	**VII**. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
		VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	**VIII** or higher	**VIII**. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
		IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
		X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
		XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
		XII. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Source: US Geological Survey (http://earthquake.usgs.gov/learn/topics/mag_vs_int.php, page last modified September 29, 2014)

An approximate relationship between PGA, magnitude, and intensity is shown in **Table 3a.18**. The table shows that, for an earthquake of expected severity for Ulster County and its participating jurisdictions (PGA values of 2%g to 3%g), perceived shaking would be light to moderate (depending upon the distance from the epicenter) and potential damage could range from none to very light (also depending upon the distance from the epicenter).

Table 3a.18
Earthquake Magnitude/Intensity Comparison

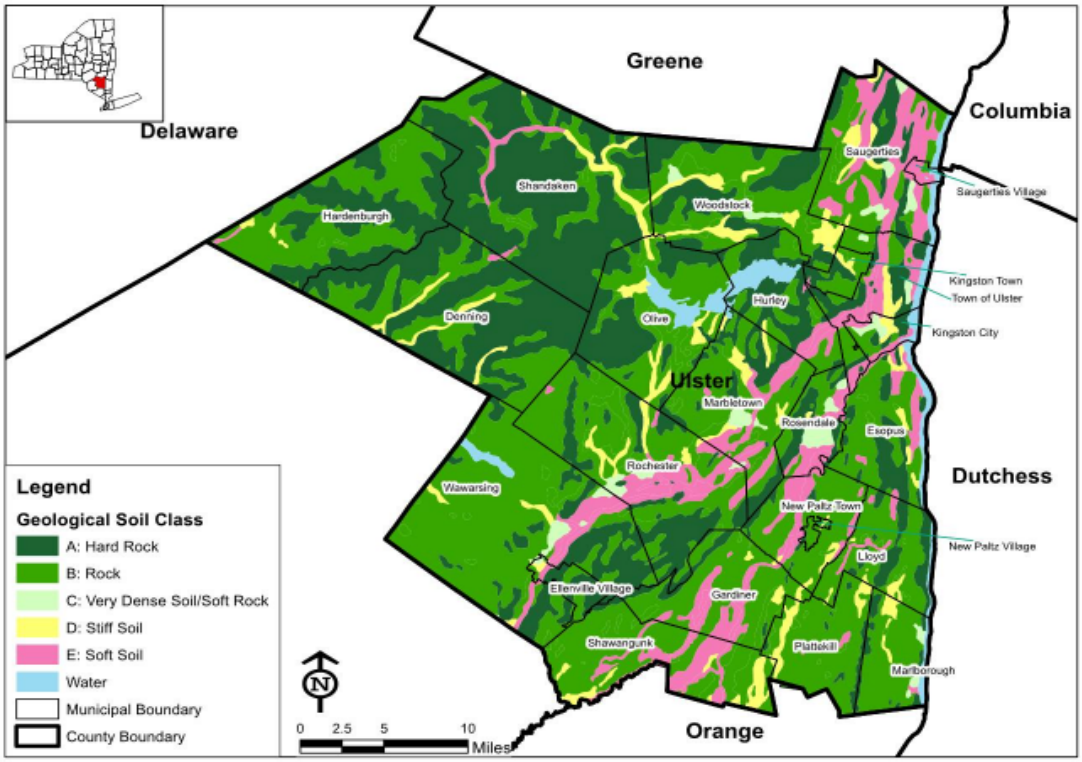
PGA	Magnitude	Intensity	Perceived Shaking	Potential Damage
< 0.17	1.0 - 3.0	I	Not Felt	None
0.17 – 1.4	3.0 – 3.9	II - III	Weak	None
1.4 – 9.2	**4.0 – 4.9**	**IV – V**	**IV. Light** **V. Moderate**	**IV. None** **V. Very Light**
9.2 - 34	5.0 – 5.9	VI – VII	VI. Strong VII. Very Strong	VI. Light VII. Moderate
34 - 124	6.0 – 6.9	VIII - IX	VIII. Severe IX. Violent	VIII. Moderate/Heavy IX. Heavy
> 124	7.0 and higher	X and higher	Extreme	Very Heavy

Sources: (1) FEMA Mitigation Planning "How-To" Guide 386-2 (as reported in the New York State Hazard Mitigation Plan 2005; (2) Wald, D., et al., 1999, Relationship between Peak Ground Acceleration, Peak Ground Motion, and Modified Mercalli Intensity in California", Earthquake Spectra, V. 15, p. 557-564; (3) Community Internet Intensity, USGS Modified Mercalli Intensity, and Instrumental Intensity. 1999. http://www-socal.wr.usgs.gov/ciim/pubs/ciim/node5.html (July 27, 2003).

An earthquake with a 10 percent chance of exceedance over 50 years in Ulster County would have a PGA of 2%g to 3%g and an intensity ranging from only IV to V, which would result in light to moderate perceived shaking, and damages ranging from none to very light. For comparison purposes, an earthquake of intensity IV on the Modified Mercalli Scale would most likely cause vibrations similar to heavy trucks driving over roads, or the sensation of a jolt. Hanging objects would swing; standing cars would rock; windows, dishes and doors would rattle; and, in the upper ranges of intensity IV, wooden walls and frames would creak. An earthquake of intensity V on the Modified Mercalli Scale would be felt outdoors, awaken sleepers, disturb or spill liquids, displace small unstable objects, swing doors, and cause shutters and pictures to move.

As noted in the New York State Hazard Mitigation Plan, soil type can have an impact on the severity of an earthquake at a given location. For example, soft soils (i.e., fill, sand) are more likely to amplify ground motion during an earthquake. Liquefaction is also more likely to occur in areas of soft soils. In contrast, harder soils (i.e., granite) tend to reduce ground motion during an earthquake. **Figure 3a.19** shows soil types in five basic categories with varying degrees in likelihood of amplifying the affects of an earthquake, with Category A being far less likely to amplify the seismic motion than Category E. **Table 3a.19** presents the area of each soil type quantified for each municipality. Over the County as a whole, the most prevalent soil type is Category B (approximately 50 percent of the County) and approximately 83 percent of the County is comprised of soil Categories A, B, or C indicating a generally low overall risk that the effects of earthquakes may be amplified by the soil type. The municipalities with the highest *prevalence* of soil types most likely to amplify the effects of seismic activity (Categories D and E) are Saugerties (both Town and Village), Ulster, Shawangunk, and the City of Kingston, all at over 25 percent.

Figure 3a.19
Ulster County Geological Soil Classification



Source: NEHRP Soil Class data from NYS Geological Survey

Table 3a.19
Ulster County Geological Soils Classification: Land Areas

Municipality	Total Acres	A		B		C		D		E		Unclassified	
		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Denning, Town of	67,627	40,139	59.4%	21,719	32.1%		0.0%	2,530	3.7%	164	0.2%		0.0%
Ellenville, Village of	5,584	3,081	55.2%	2,033	36.4%	140	2.5%	172	3.1%	231	4.1%		0.0%
Esopus, Town of	23,880	5,937	24.9%	12,845	53.8%		0.0%	1,041	4.4%	2,919	12.2%	372	1.6%
Gardiner, Town of	27,798	2,453	8.8%	18,789	67.6%		0.0%	706	2.5%	5,397	19.4%		0.0%
Hardenburgh, Town of	51,704	21,882	42.3%	28,261	54.7%		0.0%	399	0.8%	225	0.4%	53	0.1%
Hurley, Town of	19,143	8,695	45.4%	7,485	39.1%		0.0%	102	0.5%	1,817	9.5%	60	0.3%
Kingston, City of	4,791	959	20.0%	1,040	21.7%	640	13.4%	502	10.5%	866	18.1%	133	2.8%
Kingston, Town of	4,929	1,485	30.1%	2,750	55.8%		0.0%	370	7.5%	41	0.8%		0.0%
Lloyd, Town of	20,010	4,978	24.9%	12,548	62.7%		0.0%	700	3.5%	997	5.0%	73	0.4%
Marbletown, Town of	34,862	6,657	19.1%	19,345	55.5%	1,091	3.1%	1,970	5.7%	5,283	15.2%		0.0%
Marlborough, Town of	15,661	1,822	11.6%	11,653	74.4%	531	3.4%	906	5.8%	127	0.8%	179	1.1%
New Paltz, Town of	21,680	1,119	5.2%	13,423	61.9%		0.0%	597	2.8%	4,323	19.9%		0.0%
New Paltz, Village of	1,098	65	6.0%	865	78.8%		0.0%	63	5.7%	23	2.1%		0.0%
Olive, Town of	37,408	14,629	39.1%	19,333	51.7%		0.0%	3,002	8.0%	4	0.0%	83	0.2%
Plattekill, Town of	22,471	1,347	6.0%	17,979	80.0%		0.0%	2,025	9.0%	284	1.3%		0.0%
Rochester, Town of	57,154	13,790	24.1%	30,436	53.3%	1,308	2.3%	2,171	3.8%	8,046	14.1%		0.0%
Rosendale, Town of	12,786	3,322	26.0%	3,119	24.4%	1,997	15.6%	160	1.3%	2,995	23.4%		0.0%
Saugerties, Town of	41,328	7,199	17.4%	13,965	33.8%	1,638	4.0%	2,095	5.1%	13,068	31.6%	505	1.2%
Saugerties, Village of	1,141		0.0%	147	12.9%		0.0%		0.0%	783	68.6%	65	5.7%
Shandaken, Town of	76,662	59,226	77.3%	15,056	19.6%		0.0%	2,733	3.6%	1,878	2.4%		0.0%
Shawangunk, Town of	35,876	489	1.4%	24,144	67.3%		0.0%	3,292	9.2%	7,139	19.9%	11	0.0%
Ulster, Town of	17,154	4,815	28.1%	4,364	25.4%	442	2.6%	1,059	6.2%	4,854	28.3%	341	2.0%
Wawarsing, Town of	83,523	15,336	18.4%	54,238	64.9%	1,471	1.8%	982	1.2%	4,538	5.4%	118	0.1%
Woodstock, Town of	43,065	15,799	36.7%	21,221	49.3%	1,027	2.4%	4,660	10.8%		0.0%		0.0%
Ulster, County of	**727,333**	**235,223**	**32.3%**	**356,761**	**49.1%**	**10,285**	**1.4%**	**32,236**	**4.4%**	**66,002**	**9.1%**	**1,993**	**0.3%**

Source: NEHRP Soil Class data from NYS Geological Survey. 2010 Census Geographic Identifiers (G001).

Historical Occurrences - Earthquakes

As noted in the New York State Mitigation Plan, although the probability of damaging earthquakes in New York State is low, earthquakes do occur on a regular basis in New York. Most often, they are not felt by people and are not capable of causing property damage. **Figure 3a.20** illustrates the location of historical earthquakes in New York for the period 1973 to 2012, as per the NYSHMP 2014. **Figure 3a.21** illustrates the location of significant (magnitude 5.0 or greater) earthquake epicenters in New York, as obtained from a prior version of the New York State Hazard Mitigation Plan, for earthquakes that occurred between 1737 and May 1986. **Table 3a.20** presents details for earthquakes recorded in New York State since 1737 that were recorded in the NYS statistical yearbook. The only recorded event which specifically mentions Ulster County was the February 1855 incident, which is listed as a cryoseismic event. Cryoseisms (also known as "frost quakes") are generally caused by a sudden cracking action in frozen soil or rock saturated with water or ice. As water seeps down into the rock, it freezes and expands, putting stress on surrounding rock. This builds up until it is relieved explosively in a cryoseism.

Figure 3a.20
Significant Earthquake Epicenters in New York State (1973-2012)

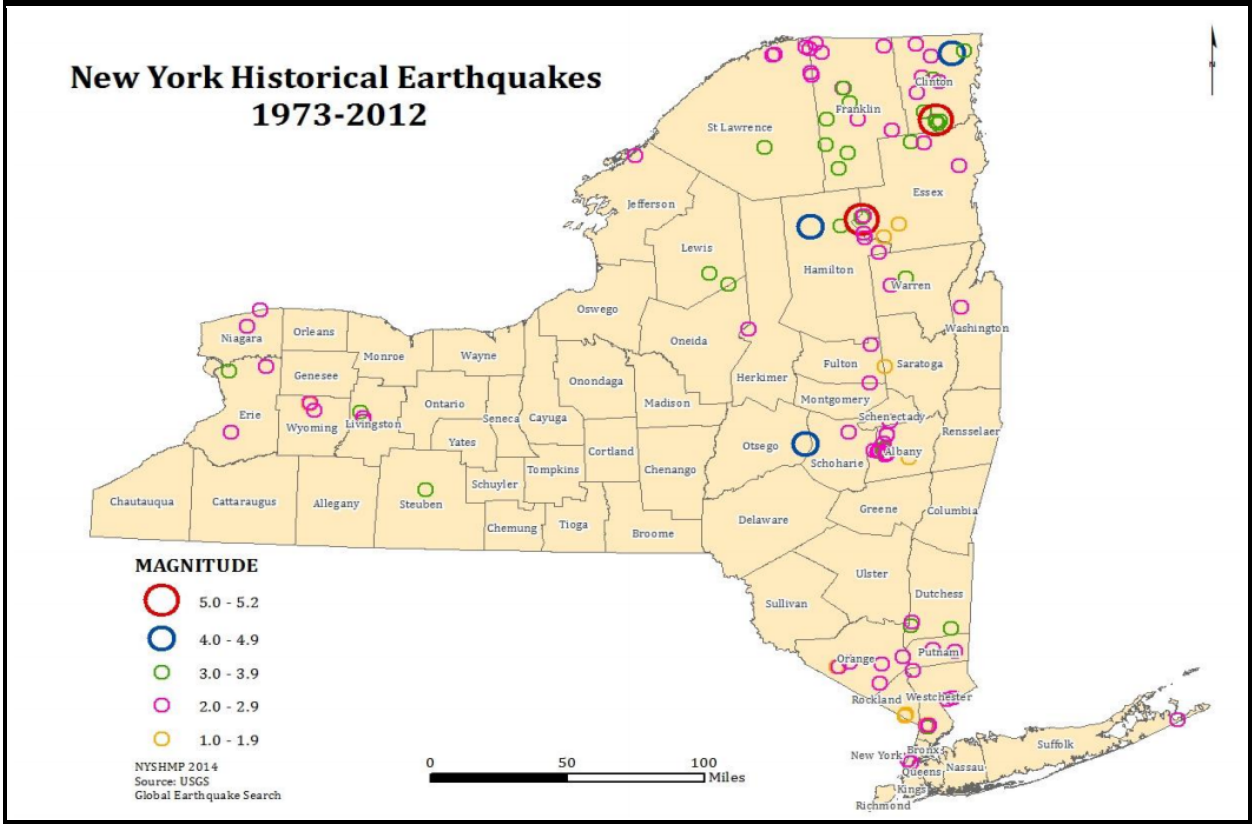


Figure 3a.21
Significant Earthquake Epicenters in New York State (1737-1986)

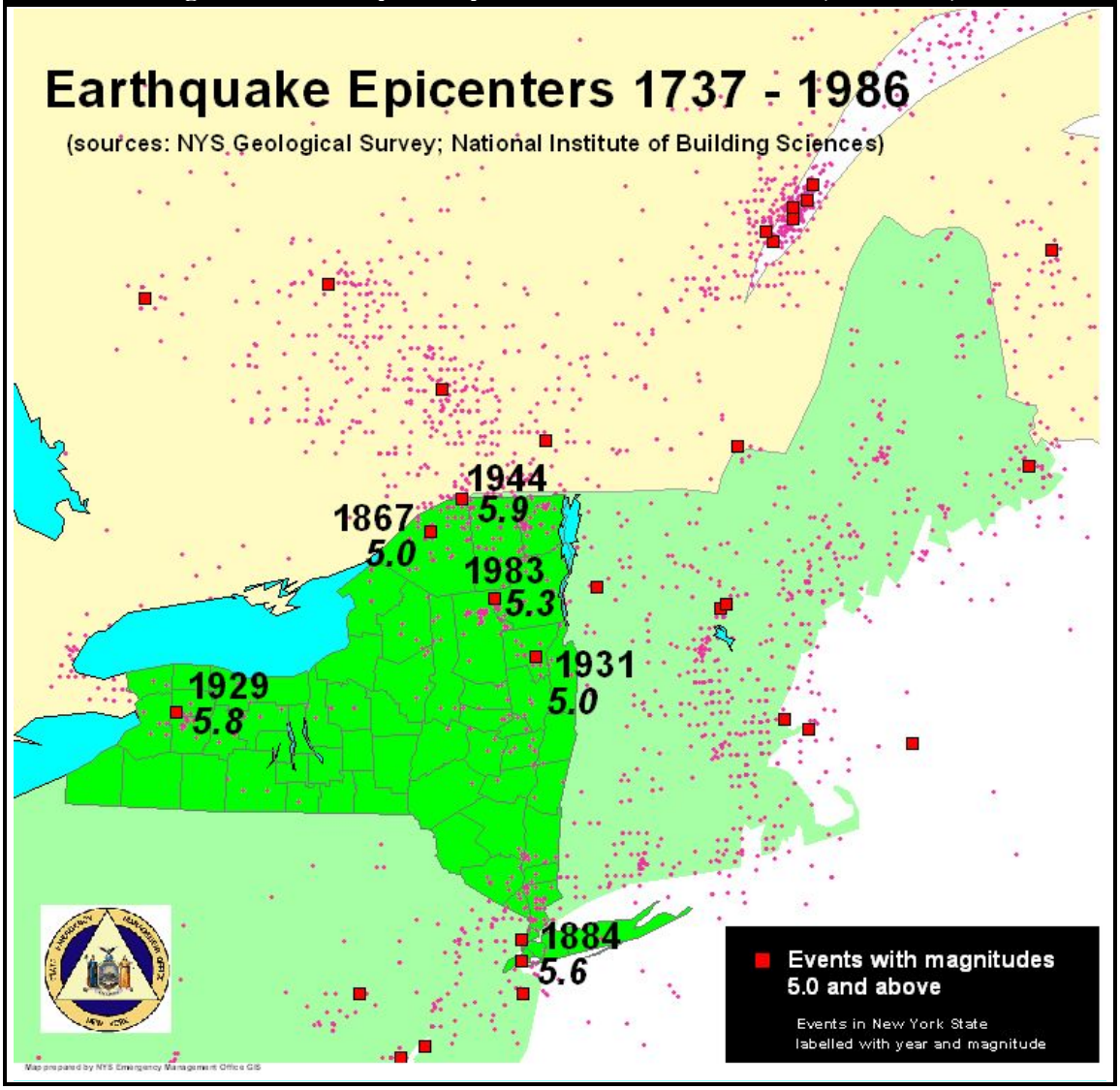


Table 3a.20
Earthquake History Throughout New York State (1737 – 2005)
Source: NYSEMO / NYS Statistical Yearbook 2006

Date	Location	Size	Damage Description
December 18, 1737	New York City	5.2	Bells rang, several chimneys fell
January 16, 1840	Herkimer	3.7	No reference and/or No damage reported
September 2, 1847	Offshore NYC	3.5	No reference and/or No damage reported
September 9, 1848	Rockland Lake	V	Felt by many
March 12, 1853	Lowville	VI	Machinery knocked over
February 7, 1855	**Saugerties**	**VI**	**Cryoseism**
October 23, 1857	Buffalo (Lockport)	4.0	Bells rang, crocks fell from shelves
December 18, 1867	Canton	4.7	Sleepers awakened

Table 3a.20
Earthquake History Throughout New York State (1737 – 2005)
Source: NYSEMO / NYS Statistical Yearbook 2006

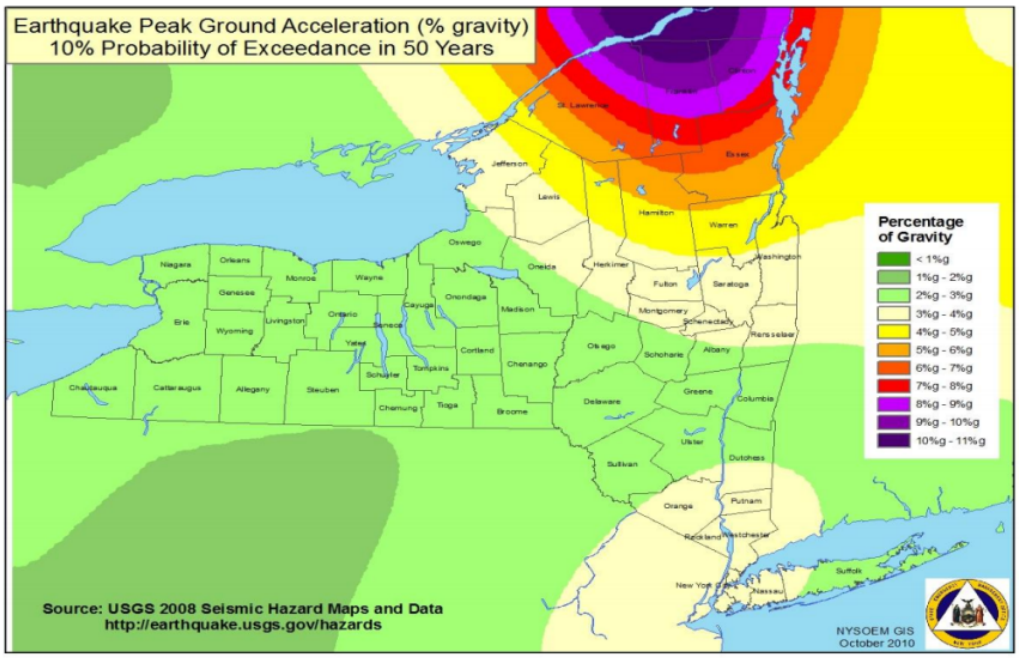
Date	Location	Size	Damage Description
December 11, 1874	Tarrytown	3.4	No reference and/or No damage reported
November 4, 1877	Lyon Mountain[1]	VII	Chimneys down, walls cracked, window damaged, crocks overturned
August 10, 1884	New York Bight (NYC)	5.2	Chimneys and bricks fell, walls cracked
May 28, 1897	Dannemora	4.5	No reference and/or No damage reported
February 3, 1916	Schenectady	3.8	Broke windows, people thrown out of bed
March 18, 1928	Saranac Lake	4.0	No reference and/or No damage reported
August 12, 1929	Attica	5.2	250 chimneys fell, brick buildings damaged, Attica prison walls, wells went dry
April 20, 1931	Warrensburg	4.8	Chimneys fell, church spire twisted
April 15, 1934	Dannemora	3.9	House shifted
July 9, 1937	Brooklyn	3.5	No reference and/or No damage reported
September 5, 1944	Corwall, Ontario/Massena, NY	5.8	Nearly all chimneys fell, buildings damaged, $2 million damage
September 5, 1944	Corwall, Ontario/Massena, NY	4.5	Chimneys destroyed, houses damaged
September 3, 1951	Rockland County	3.6	No reference and/or No damage reported
January 1, 1966	Attica	4.7	Chimneys and walls damaged
June 13, 1967	Attica	3.9	Chimneys and walls damaged
May 23, 1971	Blue Mountain Lake	4.1	No reference and/or No damage reported
May 23, 1971	Blue Mountain Lake	3.5	No reference and/or No damage reported
June 7, 1974	Wappingers Falls	3.0	Windows broken
June 9, 1975	Plattsburgh (Altona)	3.5	Chimneys and fireplaces cracked
November 3, 1975	Raquette Lake	4.0	No reference and/or No damage reported
February 2, 1983	Scarsdale-Lagrangeville	3.0	Chimneys cracked
October 7, 1983	Goodnow, Adirondack Mountains	5.1	Tombstones rotated, some cracked chimneys, windows broken, walls damaged
October 19, 1985	Ardsley	4.0	Windows broken, walls damaged
June 17, 1991	Richmondville	4.0	No reference and/or No damage reported
March 10, 1992	East Hampton, Suffolk County	4.1	No reference and/or No damage reported[2]
April 20, 2000	Newcomb	3.8	Aftershock of the 1983 event. No damage reported
April 20, 2002	Au Sable Forks	5.1	Cracked walls, chimneys fell, road collapsed, power outages
May 24, 2002	Au Sable Forks	3.1	Aftershock of the April 20, 2002 event, no damage reported

Probability of Occurrence – Earthquake

The probability of significant, damaging earthquake events affecting Ulster County is low. According to the United States Geological Survey (USGS), an earthquake with a 10 percent probability of exceedance over 50 years would have PGA values between 2%g and 3%g, which would result in light to moderate perceived shaking and damages ranging from none to very light. More destructive earthquakes are very rare, low probability events for Ulster County with highly infrequent recurrence periods. **Figure 3a.22** shows the peak ground acceleration with a 10 percent probability of exceedance over 50 years for New York State.

Figure 3a.22
Peak Ground Acceleration with a 10 Percent Probability of Exceedance over 50 years

Figure 3.7a: PGA % Seismic Hazard Map (USGS 2008 Seismic Hazard Map)



Note: Figure 3.7a map is based on USGS 2008 seismic hazard values. The U.S. Geological Survey updated the National Seismic Hazard Maps by incorporating new seismic, geologic, and geodetic information on earthquake rates and associated ground shaking. These 2008 maps supersede versions released in 1996 and 2002.

Landslide

Location – Landslide

The potential for landslides exists across the whole of New York State, although according to USGS and NYGS the vast majority of the state (80 percent) has a low susceptibility to the landslide hazard. Landslide hazard mapping has been completed for New York State. In general the highest potential for landslides can be found along major river and lake valleys that were formerly occupied by glacial lakes resulting in glacial lake deposits (glacial lake clays) and usually associated with steeper slopes, such as the Hudson River valley. USGS landslide susceptibility mapping uses three basic classifications to communicate the risk, in conjunction with three further classifications to communicate the combinations of susceptibility and incidence:

- High incidence (Greater than 15 percent of the area involved)
- Moderate incidence (1.5 to 15 percent of the area involved)

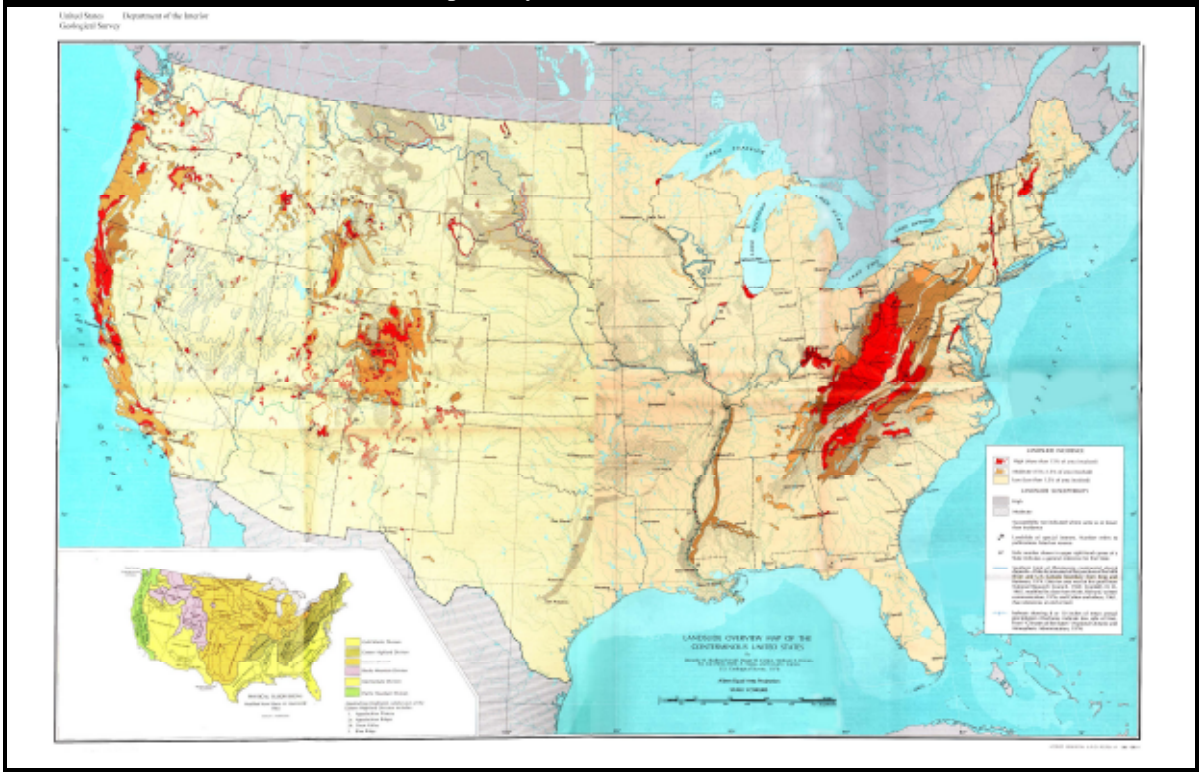
- Low incidence (Less than 1.5 percent of the area involved)
- High susceptibility/moderate incidence
- High susceptibility/low incidence
- Moderate susceptibility/low incidence

The USGS provides the following supporting narrative for the landslide hazard classifications:

> *"Susceptibility not indicated where same or lower than incidence. Susceptibility to land sliding was defined as the probably degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of land sliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated."*

Mapped areas of susceptibility in the conterminous United States are illustrated in **Figure 3a.23.**

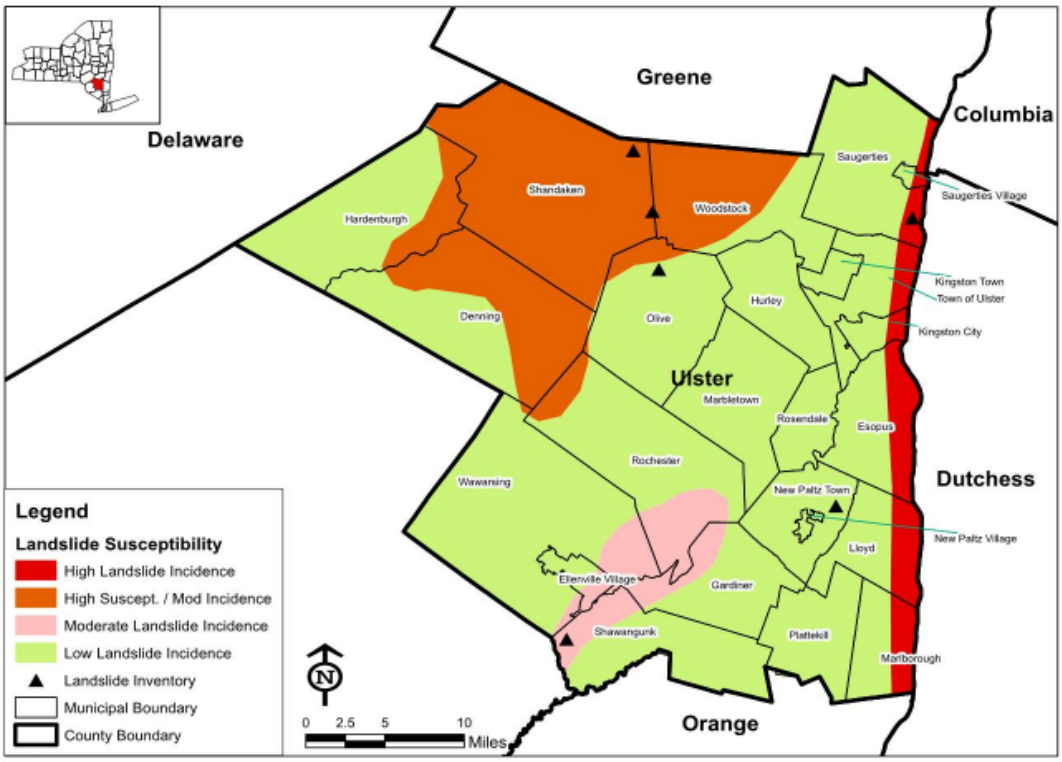
Figure 3a.23
Landslide Susceptibility in the Conterminous United States



Mapped areas of susceptibility in Ulster County are illustrated in **Figure 3a.24,** along with the locations of historic landslide occurrences as recorded by the NYS DHSES-OEM and described further under "Historical Occurrences." Areas with the highest susceptibility to landslides are located in a narrow band adjacent to the Hudson River (high susceptibility), and in the northern part of the County (high susceptibility/moderate incidence). Of the six categories of incidence and susceptibility listed above, only four have been identified in Ulster County. Two events occurred outside of mapped areas of high susceptibility in the Towns of Olive and New Paltz and, therefore, landslides are considered to be a

hazard for these communities as well. The Towns of Lloyd, Rosendale and Ulster have included mapping of potential landslide areas as part of their comprehensive plans.

Figure 3a.24
Landslide Susceptibility and Historical Incidents for Ulster County



Source: Landslide susceptibility data obtained from USGS, Nationalatlas.gov. Godt, Jonathan W., 200102. Landslide Incidence and Susceptibility in the Conterminous United States: U.S. Geological Survey Open-File Report 97-289, U.S. Geological Survey, Reston, VA. NYS landslide inventory data received from NYS DHSES-OEM.

Extent – Landslide

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels and developed hillsides where leach-field septic systems are used. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. Landslides occur when the slope or soil stability changes from stable to unstable, which may be caused by earthquakes, storms, volcanic eruptions, erosion, fire, or additional human-induced activities. Although in New York landslides are not as common as in some other parts of the country, they are a geologic hazard in areas with steep to moderate slopes or geologic units prone to failure.

Historic Occurrences - Landslides

The "Landslide Inventory Map of New York" produced by the New York State Geological Survey (NYSGS) in cooperation with the United States Geological Survey, plots the location of six landslides in

Ulster County between 1837 and 1989[39]. The available details for these events are presented in **Table 3a.21.**

Table 3a. 21
Landslide Events Recorded by NYSGS in Ulster County (1837 – 1989)

Cause	Town	Latitude	Longitude	Description *	Damage Estimate
Natural	Olive	41.990486	-74.259887	Earth Slump, primary transport - rotation	Not identified
Natural	Shandaken	42.044966	-74.267080	Earth Slump, primary transport - rotation	Not identified
Natural	Shandaken	42.102458	-74.289912	Earth Slump, primary transport - rotation	Not identified
Man-Induced	New Paltz,	41.766308	-74.045638	Bedrock Fall, Topple, Slump or Slope	Not identified
Man-Induced	Shawangunk	41.643183	-74.376621	Bedrock Fall, Topple, Slump or Slope	Not identified
Man-Induced	Saugerties	42.036446	-73.947581	Earth Slump, transport mech. rotation	Not identified

The NYSHMP 2008 included one record of a landslide in Ulster County on December 16, 1921. Two workers were killed when a wall in a clay bank failed in the village of Glasco, within the Town of Saugerties.

The NYSHMP 2014 reports one historic event in Ulster County for the period 1960 to 2012, which caused $50,000 in property damage and $500 in crop damage.

In addition to state-level information, local sources report a number of flood-related landslide incidents in the Town of Lloyd involving embankment failures adjacent to roads and streams between 2001 and 2007.

Probability of Occurrence – Landslides

Given the history of landslide occurrences in Ulster County, it is certain that future landslides will occur and the probability of future landslides in the County can be expressed as high. The NYSHMP 2014 estimates that the future probability of landslides in Ulster County is about a two percent chance in any given year (based on historic occurrences documented in SHELDUS for the period of 1960 to 2012, and dividing the documented number of occurrences (one) by the years of record (52). Applying this same methodology to the six events in the NYSGS database for the years 1837 to 1989 yields a future probability estimate of about a four percent chance in any given year.

Wildfires

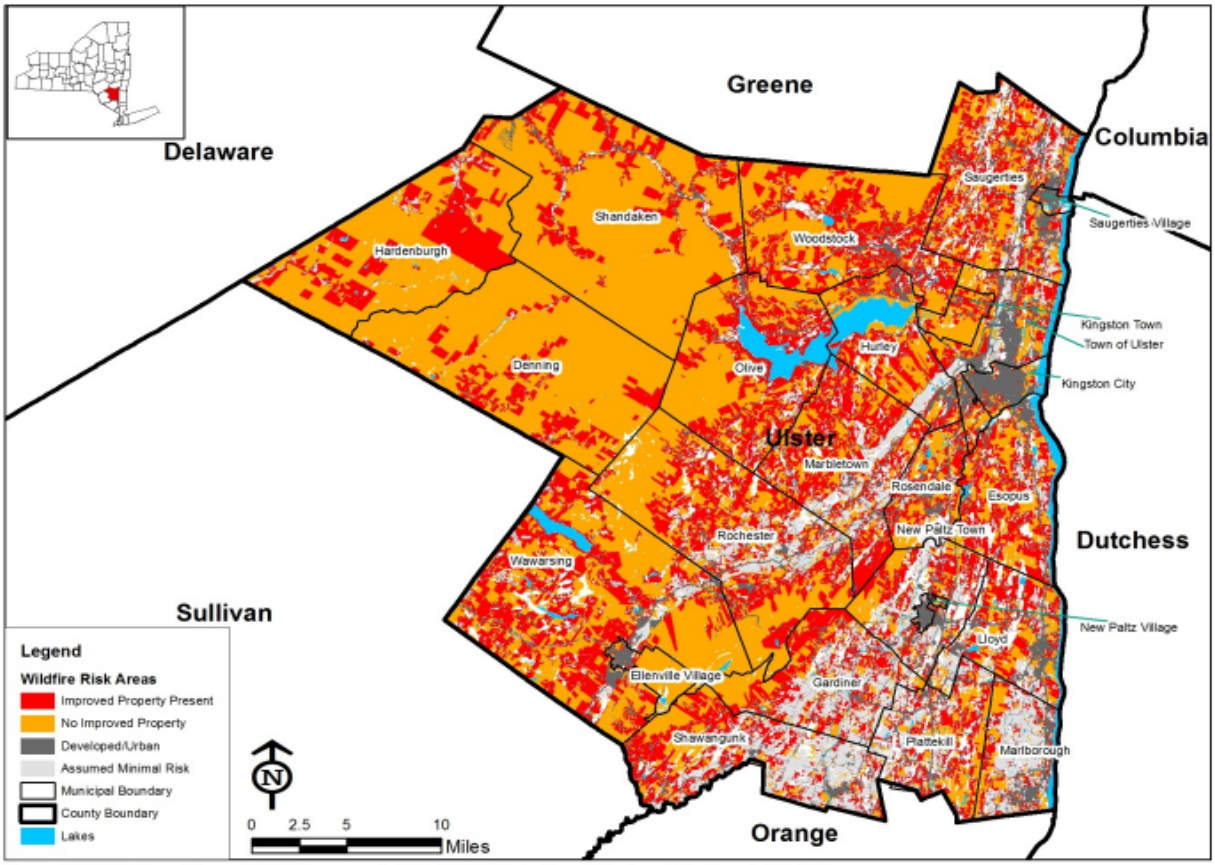
Location - Wildfires

Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity, at steeper slopes – particularly those that are far away from firefighting apparatus that would suppress the spread of wildfires once reported. **Figure 3a.25** shows the areas of Ulster County that are considered to be susceptible to

[39] As per email coordination with NYSDHSES-OEM on May 15, 2015, the NYSGS data set has not been updated to include more recent events.

wildfires (including the following land cover types: deciduous, evergreen, and mixed forest, shrub land, and grassland)[40]. In the figure, at-risk parcels with improved property present upon them are colored red; at-risk parcels with no improved property present are colored orange; cultivated agricultural land and pastureland areas that are not generally considered to be at significant risk from wildfire are colored light gray; and urban/developed parcels are colored dark gray. This allows a general determination to be made regarding those areas at risk from wildfire in which there is a higher likelihood that such fires could also pose a threat to lives and structures, in addition to susceptible areas where improved property is present (colored red) which have a direct interface with the wildfire hazard.

Figure 3a.25
Wildfire Hazard Areas in Ulster County



Source: NLCD 2011 Land Cover (2011 Edition, amended 2014), 2014. Ulster Parcel data from Ulster County GIS, 2014.

Wildfires are generally considered to be a moderately high hazard in Ulster County[41], particularly in the forested areas in the south and west of the County, where past wildfires have destroyed thousands of acres of forest with property loss running into the thousands of dollars. Many of the areas at risk from wildfires are also popular with hikers and campers. Several major transportation routes such as the New York State

[40] It should be noted that the vast majority of the wildfire risk areas consist of deciduous woodland (approximately 50 percent of the County land area and 70 percent of the wildfire risk area) while shrub and grassland areas are not present in significant quantities (together they make up less than one percent of the wildfire risk area).
[41] As per Ulster County HAZNY of January 8, 2014.

Thruway and Routes 44 and 28, leaving them vulnerable to closure during forest fire due to smoke conditions. Areas in Ulster County that are typically considered to be prone to wildfires generally tend to exhibit the lowest population densities in the County; and, as a result, exposure of people living and working in the highest hazard areas is often relatively low.

Extent – Wildfires

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. Two indices are commonly used to measure and monitor dryness of forest fuels and the possibility of fire ignitions becoming wildfires: the National Fire Danger Rating System's Buildup Index, and the Keetch-Byram Drought Index. Both can be used for fire preparedness planning, which includes the following: campfire and burning restrictions, fire patrol assignments, staffing of fire lookout towers, and readiness status for both observation and firefighting aircraft.

- The **Buildup Index (BUI)** is a number that reflects the combined cumulative effects of daily drying and precipitation in fuels with a 10-day time lag constant. The BUI can represent three to four inches of compacted litter or can represent up to six inches or more of loose litter (North Carolina Forest Service 2009).
- The **Keetch-Byram Drought Index (KBDI)** is a drought index designed for fire potential assessment as defined by the United States Department of Agriculture Forest Service. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers. The index increases each day without rain and decreases when it rains. The scale ranges from zero (no moisture deficit) to 800 (maximum drought possible). The Florida Forest Service states that the range of the index is determined by assuming that eight inches of moisture in a saturated soil is readily available to the vegetation. For different soil types, the depth of soil required to hold eight inches of moisture varies. A prolonged drought influences fire intensity, largely because more fuel is available for combustion. The drying of organic material in the soil can lead to increased difficulty in fire suppression.

There are also many other scales and fire weather indices that evaluate wildfire *potential* on any given day taking into account factors such as daily weather and vegetation condition information, fuel moisture, fuel hazard, moisture content in the lower atmosphere, etc.

Previous Occurrences – Wildfires

The Ulster County HAZNY of January 8, 2014 reports that wildfires occur frequently in the area. A sampling of more *notable*, historic occurrences in Ulster County includes:

> **April 2006.** A fire in the Cherrytown area outside of the Town of Rochester in Ulster County which started on April 30, 2006 destroyed more than 900 acres of forest in the Catskill Park. The 2014 NYSHMP described it as the largest wildfire in the state since 2002. The fire was fought by a dozen Ulster County fire teams led by the Accord Fire Department firefighters. Firefighters from Orange County and three volunteer departments from Sullivan County also assisted in the fire effort. Two inmate crews, State Department of Environmental Conservation forest rangers, and fire teams from two local nature preserves also offered their assistance. The fire was officially extinguished on May 12, 2006.
>
> **April 2008.** On April 17, 2008 a fire began off Route 44/55 in the Town of Rochester on lands managed by NYS Parks & Recreation. Before the fire was officially declared out on April 26th, it had consumed 3,100

acres of land in both Rochester and Wawarsing. To extinguish this fire it took the combined resources of the NYS Department of Environmental Conservation, NYS Emergency Management Office, NYS Office of Fire Prevention & Control, NYS Parks & Recreation, NYS Division of Military & Naval Affairs, New York State Police, fire departments from Ulster, Sullivan, Orange, Dutchess, Putnam and Westchester counties and other entities too numerous to mention. In addition to ground crews, helicopters and bulldozers were instrumental in building the fireline and extinguishing the full canopy fire. An urban area interface in a portion of Wawarsing required extensive resources to protect. Homes were protected by literally placing a fire truck in every driveway. Ultimately, there was only one serious injury to a first responder, and no homes were damaged. New York State officials consider it to be the largest forest fire in the State since 1995.

Spring 2015. Every year, on March 16th, the State Department of Environmental Conservation issues a residential brush burning ban that stays in effect through May 14th. Residential brush burning in towns with less than 20,000 residents is prohibited in the state through May 15th. In more populous towns, burning brush is banned year-round. A total of 47 brush fires were reported in Ulster County between March 16th and April 24th.

May 2015. More than 2,000 acres burned over several days in the Shawangunk Ridge State Forest. The fire began off Shawanga Lodge Road and Fire Tower Road in Mamakating, in nearby Sullivan County. It then spread to Ulster County's Cragsmoor and Walker Valley areas (Cragsmoor, in the Town of Wawarsing; and Walker Valley, in the Town of Shawngunk). Officials suspect it was started by a homeowner burning debris outdoors, in violation of a statewide burn ban. More than 250 volunteer firefighters and forest rangers worked to control the blaze. State Police and National Guard Blackhawk helicopters made hundreds of runs to scoop water from nearby ponds and lakes in attempt to extinguish the fire. About 50 homeowners evacuated as strong southerly winds pushed the fire toward developed areas. Thirty homes were saved. A shelter was opened at the Walker Valley Fire Department on Route 52 in Shawangunk.

Shawangunk Ridge State Forest Fire, May 2015. *(Photo courtesy of Frank Becerra Jr./The Journal News.)*

Local sources also report that the area over and around Illinois Mountain in the Town of Lloyd is subject to periodic brush and forest fires.

Probability of Occurrence - Wildfires

Wildfire probability depends on local weather conditions; outdoor activities such as camping, debris burning, and construction; and the degree of public cooperation with fire prevention measures. Wildfire events are expected to remain at least an occasional occurrence in Ulster County, and although there is insufficient readily available data that could be used to calculate actual probabilities, future occurrences of wildfires in the County is considered to be certain, particularly if drought conditions become more prevalent in the future with climate change. The likelihood of increased future development (particularly residential) could result in an increase in the length of the urban-wildland interface, an increase in the improved value of property within wildfire hazard zones, and a greater risk of property damage and danger to the public in future years. However, most wildfires in the County are typically contained and extinguished rather quickly and those events causing major property damage or life/safety threats are much less likely to occur.

Sections 3B and 3C - VULNERABILITY ASSESSMENT

Overview

As described in Section 2, as part of this first plan update, the planning team reassessed a full range of natural hazards and determined that no hazards should be added to or omitted from the 2009 list of identified hazards.

Section 3A profiled each identified hazard.

Sections 3B and 3C build upon the information provided in the *Hazard Profiles* (Section 3A) by identifying and characterizing an inventory of assets in Ulster County, and then assessing the potential impact and amount of damages that can be expected to be caused by each identified hazard event. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard, by jurisdiction. In so doing, Ulster County and each of its municipalities may better understand their own unique risks to identified hazards and be better prepared to evaluate and prioritize unique hazard mitigation actions for their communities.

This section begins with a summary description of the asset inventory as compiled for Ulster County through coordination with the Ulster County Office of GIS, as well as an explanation of the methodology applied to complete the multi-jurisdictional vulnerability assessment. The remainder of this section focuses on the results of the vulnerability assessment and is organized by hazard in similar format to the *Hazard Profiles* section, and as listed below.

- **Atmospheric Hazards**
  - Extreme Temperatures
  - Extreme Wind
  - Hurricane and Tropical Storm
  - Lightning
  - Nor'easter
  - Tornado
  - Winter Storm

- **Hydrologic Hazards**
  - Dam Failure
  - Drought
  - Flood
  - Ice Jam
  - Storm Surge

- **Geologic Hazards**
  - Earthquake
  - Landslide

- **Other Hazards**
  - Wildfire

3B - Identification and Characterization of Assets in Hazard Areas

An inventory of geo-referenced assets[1] in Ulster County was created in order to identify and characterize property and persons potentially at risk to the identified hazards. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, six categories of assets were created and then further assessed through geographic information systems (GIS) analysis. The six categories of assets include:

1. Improved property: This category includes all developed properties according to parcel data provided by Ulster County Department of Information Services (2014).

2. Emergency facilities: This category covers all facilities dedicated to the management and response of emergency or disaster situations, and includes emergency operations centers (EOCs[2]), fire stations, police stations, ambulance stations, and hospitals. Data sets for fire stations, police stations, ambulance stations, and hospitals were provided by Ulster County Office of GIS (2014); while EOCs were obtained from HAZUS.

3. Critical infrastructure and utilities: This category covers facilities and structures vital to the maintenance of basic living conditions in the county, and includes potable water treatment facilities, wastewater treatment facilities, public works facilities, airports, and waste transfer stations. Data on potable water treatment facilities and airports was provided by Ulster County Office of GIS (2015). Data on wastewater treatment facilities was obtained from HAZUS. Data on public works facilities and waste transfer stations was selected from parcel data provided by Ulster County Office of GIS (2014).

4. Other key facilities: This category covers facilities which may be capable of providing refuge and limited medical care and hence may be utilized as emergency shelters, and those which routinely house more vulnerable sectors of the county population, making them potentially especially vulnerable to identified hazards. Included in this category are schools and senior care facilities. Both data sets were provided by Ulster County Office of GIS (schools 2014; senior care facilities 2015).

5. Historic and cultural resources: This category includes those historic structures, landmarks and sites that are included in the New York State or National Register of Historic Places, as provided by the NYS Office of Information Technology Services (2015).

6. Population: This category covers the number of people residing in Ulster County as measured by the U.S. Census Bureau (Census 2010).

The remainder of this subsection provides a more detailed breakdown, by jurisdiction, of georeferenced assets that have been identified for inclusion in the multi-jurisdictional vulnerability assessment.

[1] While potentially not all-inclusive for Ulster County, "georeferenced" assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.

[2] HAZUS-MH® was queried for EOCs in Ulster County. HAZUS defines EOCs as municipal government disaster operation and communication centers deemed (for design) to be vital in emergencies; they are dedicated facilities used for emergency operations, separately and distinctly from hospitals, fire stations, police stations, etc. HAZUS data sets include no facilities meeting this definition in Ulster County's municipalities. An EOC database is not maintained at the county-level by Ulster County Office of GIS.

Improved Property

Improved property covers all development in the form of structures for residential, commercial, industrial, municipal, recreational, and utility uses. The total value of property improvements in the 24 Ulster County jurisdictions has been estimated at nearly $11.8 billion, based on parcel data as of 2014 supplied by Ulster County GIS. **Table 3b.1** lists the total number and percentage of improved parcels as well the total value of their improvements by jurisdiction. The data may not include some public buildings and other tax-exempt structures. This information includes the Towns of Esopus, Marbletown, and Rochester which did not participate in the Mitigation Plan Update.

Table 3b.1
Improved Property by Jurisdiction

Jurisdiction	Total Number of Parcels	Number of Improved Parcels	Percentage of Improved Parcels	Total Value of Improvements*
Denning, Town of	1,202	505	42.01%	$9,833,691
Ellenville, Village of	1,493	1,305	87.41%	$3,212,219
Esopus, Town of	4,298	3,218	74.87%	$664,657,631
Gardiner, Town of	2,914	2,277	78.14%	$496,051,960
Hardenburgh, Town of	776	327	42.14%	$33,780,150
Hurley, Town of	3,548	2,890	81.45%	$601,531,347
Kingston, City of	8,497	7,331	86.28%	$1,356,698,046
Kingston, Town of	653	405	62.02%	$52,412,700
Lloyd, Town of	4,261	3,508	82.33%	$715,492,192
Marbletown, Town of	3,926	2,880	73.36%	$820,874,962
Marlborough, Town of	3,849	3,039	78.96%	$498,122,686
New Paltz, Town of	2,994	2,573	85.94%	$546,080,883
New Paltz, Village of	930	831	89.35%	$658,909,400
Olive, Town of	3,127	2,340	74.83%	$830,987,819
Plattekill, Town of	3,499	2,734	78.14%	$444,556,917
Rochester, Town of	4,813	3,295	68.46%	$499,688,381
Rosendale, Town of	2,864	2,259	78.88%	$343,409,911
Saugerties, Town of	8,100	6,108	75.41%	$895,836,873
Saugerties, Village of	1,549	1,271	82.05%	$215,364,249
Shandaken, Town of	3,533	2,332	66.01%	$100,772,350
Shawangunk, Town of	4,618	3,869	83.78%	$170,465,425
Ulster, Town of	5,346	4,271	79.89%	$847,716,567
Wawarsing, Town of	4,782	3,281	68.61%	$13,835,638
Woodstock, Town of	4,773	3,692	77.35%	$971,926,625
Ulster County Total	**86,345**	**66,541**	**77.06%**	**$11,792,218,622**

*Not including public buildings and other tax-exempt structures, and reservoirs.
Source: Ulster parcel data from Ulster County GIS, 2014.

Emergency Facilities

There are 138 georeferenced emergency facilities in Ulster County, including 88 fire stations, 23 police stations, 24 ambulance stations, and 3 hospitals. **Table 3b.2** tabulates these emergency facilities by jurisdiction. Geographic coordinates (latitude and longitude) were used to determine the location of each facility. Note that some facilities in Table 3b.2 may be located in shared structures. This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update.

Table 3b.2
Emergency Facilities by Jurisdiction

Jurisdiction	Fire Stations	Police Stations	Ambulance Stations	Hospitals
Denning, Town of	1	0	0	0
Ellenville, Village of	3	1	1	0
Esopus, Town of	7	1	1	0
Gardiner, Town of	2	0	1	0
Hardenburgh, Town of	0	0	0	0
Hurley, Town of	4	0	3	0
Kingston, City of	9	2	1	2
Kingston, Town of	1	0	0	0
Lloyd, Town of	2	2	1	0
Marbletown, Town of	6	0	1	0
Marlborough, Town of	2	1	1	0
New Paltz, Town of	1	0	1	0
New Paltz, Village of	1	2	0	0
Olive, Town of	5	1	2	0
Plattekill, Town of	3	1	2	0
Rochester, Town of	3	1	1	0
Rosendale, Town of	5	1	1	0
Saugerties, Town of	8	0	0	0
Saugerties, Village of	2	2	1	0
Shandaken, Town of	5	2	2	0
Shawangunk, Town of	3	2	2	0
Ulster, Town of	6	2	1	0
Wawarsing, Town of	5	1	0	1
Woodstock, Town of	4	1	1	0
Total	88	23	24	3

Source: Data received from Ulster County GIS as of August 2014.

Critical Infrastructure and Utilities

There are 437 identified critical infrastructure and utility elements in Ulster County, including 373 water treatment facilities, 23 wastewater treatment facilities, 33 public works facilities, 5 airports, and 3 waste transfer stations. **Table 3b.3** shows critical infrastructure and utilities by jurisdiction. Geographic coordinates (i.e., latitude and longitude) were used to determine the location of each facility within each jurisdiction. This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update.

Table 3b.3
Critical Infrastructure and Utilities by Jurisdiction

Jurisdiction	Potable Water Treatment Facilities	Wastewater Treatment Facilities	Public Works Facilities	Airports	Waste Transfer Stations
Denning, Town of	6	0	2	0	0
Ellenville, Village of	5	1	1	0	0
Esopus, Town of	18	0	2	1	0
Gardiner, Town of	11	1	1	0	0
Hardenburgh, Town of	2	0	1	0	0
Hurley, Town of	12	0	1	0	0
Kingston, City of	4	1	6	0	2
Kingston, Town of	2	0	0	0	0
Lloyd, Town of	19	2	2	0	0
Marbletown, Town of	20	0	0	0	0
Marlborough, Town of	3	2	0	0	0
New Paltz, Town of	11	1	0	2	0
New Paltz, Village of	1	1	0	0	0
Olive, Town of	14	0	1	0	0
Plattekill, Town of	37	0	1	0	0
Rochester, Town of	36	0	2	0	0
Rosendale, Town of	21	1	1	0	0
Saugerties, Town of	31	2	2	0	0
Saugerties, Village of	0	1	1	0	0
Shandaken, Town of	29	1	3	0	0
Shawangunk, Town of	11	2	1	0	0
Ulster, Town of	27	2	1	1	1
Wawarsing, Town of	41	2	3	1	0
Woodstock, Town of	12	3	1	0	0
Total	373	23	33	5	3

Source: Data on potable Water Treatment Facilities and Airports sent by Ulster County GIS in May 2015. Data on Wastewater Treatment Facilities downloaded from HAZUS 2014. Data on Public Works Facilities and Waste Transfer Stations selected from parcel data sent by Ulster County GIS in September 2014.

Potable water treatment facilities include any community water supply facility serving 15 or more properties and identified by the County as a treatment plant or as some other supply facility which incorporates at least one treatment process. Many of the facilities listed in the table serve small communities or groups of properties.

Public works facilities include buildings for the storage and maintenance of vehicles and other equipment used to respond to emergency situations, apart from police, fire and ambulance stations, such as municipal highway departments.

"Airports" has been taken to mean substantial airfields with paved runways operating scheduled services or suitable for the operation of fixed-wing aircraft for the transporting of emergency response personnel and equipment.

The waste transfer stations listed in the table are the main facilities in Ulster County for the disposal of bulk (more than two cubic yards) solid waste by residents and commercial entities. In addition to these two principal facilities, there are 20 smaller municipal recycling centers in Ulster County.

Other Key Facilities

Other key facilities were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of such facilities located in hazard areas, which may guide the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. Schools and senior care facilities by jurisdiction are presented in **Table 3b.4.** This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update**.**

Table 3b.4
Other Key Facilities by Jurisdiction

Jurisdiction	Schools	Senior Care Facilities
Denning, Town of	0	0
Ellenville, Village of	4	0
Esopus, Town of	7	0
Gardiner, Town of	0	0
Hardenburgh, Town of	0	0
Hurley, Town of	1	0
Kingston, City of	11	3
Kingston, Town of	0	0
Lloyd, Town of	4	2
Marbletown, Town of	2	0
Marlborough, Town of	4	2
New Paltz, Town of	3	1
New Paltz, Village of	3	0
Olive, Town of	4	1
Plattekill, Town of	1	0
Rochester, Town of	4	0
Rosendale, Town of	1	0
Saugerties, Town of	7	2
Saugerties, Village of	1	2
Shandaken, Town of	1	0
Shawangunk, Town of	4	1
Ulster, Town of	6	1
Wawarsing, Town of	2	0
Woodstock, Town of	2	1
Total	**72**	**16**

Source: School data received from Ulster County GIS in August 2014, and Senior Care Facilities data in May 2015.

Historical and Cultural Resources

Historical and cultural resources were included in the asset identification and characterization to determine jurisdictions with particularly high numbers of culturally or historically valuable assets located in hazard areas, which may influence the focus of individual mitigation activities in the mitigation goals and strategy stage of the plan. At the State and Federal levels, official listings of historic resources are established and maintained to foster the preservation of particular cultural resources. The State and National Registers of Historic Places are the official listings of buildings, structures, districts, objects, and sites significant in the history, architecture, archaeology, engineering, and culture of the State and the nation. Cultural and historic resources are defined as follows:

Cultural Resources: As defined by the National Park Service in its "Cultural Resources Management Guidelines," cultural resources are: "*Those tangible and intangible aspects of cultural systems, both living and dead, that are valued by or representative of a given culture or that contain information about a culture . . . and [they] include but are not limited to sites, structures, districts, objects and artifacts, and historic documents associated with or representative of peoples, cultures, and human activities and events, either in the present or in the past. Cultural resources also can include the primary written and verbal data for interpreting and understanding those tangible resources.*"

Historic Resources: Historic resources are any cultural resource dating from the period between the onset of written records (which on Long Island is typically placed around the time of first European contact in the sixteenth century) and 50 years ago.

In the State of New York, the State Historic Preservation Office (SHPO) – within the New York State Office of Parks, Recreation and Historic Preservation – helps communities identify, evaluate, preserve, and revitalize their historic and cultural resources. The New York SHPO maintains GIS databases of all historic and cultural assets listed on the State and National Registers. To identify the resources of this nature located in Ulster County, GIS files were downloaded from the New York SHPO website (http://www.nysparks.state.ny.us/shpo/resources/index.htm). This data includes only those cultural and historic properties and sites that are included in the New York State or National Registers of Historic Places, or that have been determined Eligible for inclusion through federal or state processes as administered by the New York SHPO. Inclusion in this data set does not preclude the existence of other historic properties or sites not within this category or as yet unidentified.

Historical and cultural assets located in Ulster County are presented in **Table 3b.5**. According to New York SHPO and National Register of Historic Places data there are more than 160 such assets registered in Ulster County. According to the available records, State and Federally listed historical assets are located in all of the 23 municipalities covered by this hazard mitigation plan. This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update.

Table 3b.5 Historic and Cultural Resources by Jurisdiction		
Jurisdiction	**Asset Name/Description**	**Location**
Denning	Red Hill Fire Observation Tower	Red Hill
Ellenville Village	US Post Office--Ellenville	Liberty Pl.
Ellenville Village	Hunt, George and John R., Memorial	2 Liberty Street
Ellenville Village	Christ Lutheran Church	107 Center Street
Ellenville Village	Ellenville Downtown Historic District	Multiple
Esopus	Burroughs, John, Cabin	W of West Park
Esopus	Burroughs, John, Riverby Study	Between NY 9W and the Hudson River
Esopus	Esopus Meadows Lighthouse	Spans Hudson River
Esopus	Poppletown Farmhouse	Jct. of Old Post Rd. and Swarte Kill Rd.
Esopus	Klyne Esopus Reformed Dutch Church (former)	764 US 9W
Esopus	Payne, Col. Oliver Hazard, Estate	US 9W
Esopus	Cumming-Parker House	50 Appletree Road, Esopus
Esopus	Payne, Colonel Oliver H., Estate (Boundary Expansion)	Esopus, Ulster
Gardiner	Tuthilltown Grist Mill	Old Albany Post Road
Gardiner	Brykill	Bruynswick Rd.
Gardiner	Locust Lawn Estate	NY 32, SE of Gardiner
Gardiner	Lafevre, John A., House and School	NY 208, S of New Paltz
Gardiner	Aldrich, Peter, Homestead	168 Decker Rd.
Gardiner	Bevier House	Bevier Rd.
Gardiner	Van Vleck House	Bruynswick Rd.
Gardiner	Guilford-Bower Farmhouse	Albany Post Road
Gardiner	DuBoris, Hendrikus, House	600 Albany Post Rd.
Gardiner	Trapps Mountain Hamlet Histoiric District	Trapps Road off NY 44/55
Gardiner	Gardiner Schoolhouse	2340 NY 44/55
Gardiner	Jenkins-DuBois Farm and Mill Site Historic district	Jenkinstown Road
Gardiner	LeFevre, Abraham and Maria, House	56 Forest Glen Road
Hardenburgh	Beaverkill Valley Inn	Beaverkill Rd.
Hardenburgh	Grant Mills Covered Bridge	Mill Brook Road; North side; over Mill Brook
Hardenburgh	Balsam Lake Mountain Fire Observation Station	Balsam Lake Mountain
Hardenburgh	Coykendall, Samuel, Lodge	Alder Lake Road (CR 54)
Hurley	Hurley Historic District	Hurley St., Hurley Mountain Rd., and Schoonmaker Lane
Hurley	Hurley Historic District	Hurley St., Hurley Mountain Rd., and Schoonmaker Lane

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Hurley	Hurley Historic District	Hurley St., Hurley Mountain Rd., and Schoonmaker Lane
Hurley	Maverick Concert Hall	Concert Road
Kingston City	Chestnut Street Historic District	Roughly bounded by W. Chestnut St., Broadway, E. Chestnut, Livingston & Stuyvesant Sts.
Kingston City	Kingston Stockade District	Area bounded by both sides of Clinton Ave., Main, Green, and Front Sts.
Kingston City	Rondout-West Strand Historic District	Roughly bounded by Broadway, Roundout Creek, Ravine, Hone and McEntee Sts.
Kingston City	Kingston City Hall	408 Broadway
Kingston City	Kingston-Port Ewen Suspension Bridge	U.S. 9W
Kingston City	Senate House	NW side of Clinton Ave. near jct. with N. Front St.
Kingston City	West Strand Historic District	West Strand and Broadway
Kingston City	Community Theatre	601 Broadway
Kingston City	Kingston/Rondout 2 Lighthouse	Hudson River and Rondout Creek
Kingston City	Ponckhockie Union Chapel	91 Abruyn St.
Kingston City	Kingston City Library (Carnegie Library)	399 Broadway
Kingston City	VanSteenburgh, Tobias, House	93-103 Wall Street
Kingston City	CATAWISSA (Coastal Tugboat)	Hudson River
Kingston City	Old Dutch Church Parsonage	109 Pearl Street
Kingston City	Second Reformed Dutch Church of Kingston	213-223 Fair Street
Kingston City	Kenyon House	104 Fair Street
Kingston City	Boice House	110 Fair Street
Kingston City	Chichester House	116 Fair Street
Kingston City	Kirkland Hotel	2 Main Street
Kingston City	Smith, John, House	103 Albany Avenue
Kingston City	Albany Avenue, Building at 109	
Kingston City	Sharp Burial Ground	Albany Avenue
Kingston City	Ten Broeck, Jacob, Stone House	169 Albany Avenue
Kingston City	Albany Avenue, House at 184	184 Albany Avenue
Kingston City	Albany Avenue, House at 322	322 Albany Avenue
Kingston City	Albany Avenue, House at 356	356 Albany Avenue
Kingston City	Albany Avenue, House at 313	313 Albany Avenue
Kingston City	K. WHITTELSEY (Tugboat)	3 North Street at Rondout Creek
Kingston City	Forsyth, James and Mary, House	31 Albany Avenue
Kingston City	Palen, Frank A., House	74-76 St. James Street
Kingston City	First Reformed Protestant Dutch Church of Kingston	272 Wall Street
Kingston City	Cordts Mansion	82-152 Lindsley Avenue
Kingston City	Burger-Matthews House	105-107 Henry Street

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Kingston City	Yoemans, Moses, House	252-278 Delaware Avenue
Kingston City	Cornell Steamboat Company Machine Shop Building	108-110 East Strand Street
Kingston City	United States Lace Curtain Mills	165 Cornell St., Kingston, NY 12401
Kingston City	Brooklyn & Queens Transit Trolley No. 1000	89 E. Strand, Kingston, NY 12401
Lloyd	Yelverton, Anthony, House	39 Maple Ave.
Marbletown	Kripplebush Historic District	Kripplebush Road at intersections of Cooper and Pine Streets
Marbletown	Rest Plaus Historic District	Lucas Turnpike, Old Kings Road, Rest Place Road
Marbletown	Main Street Historic District	US 209
Marbletown	High Falls Historic District	
Marbletown	Wyncoop, Cornelius, Stone House	Main Street (US 209)
Marbletown	Lock Tender's House and Canal Store Ruin	40 Canal Road
Marbletown	Bevier Stone House	2687 US 209
Marlborough	Dubois-Sarles Octagon	17 South Street
Marlborough	Chapel Hill Bible Church	49 Bingham Road
Marlborough	Milton Railroad Station	41 Dock Road
Marlborough	Christ Episcopal Church	426 Old Post Road
Marlborough	Lattington Baptist Church	425 Old Indian Road
Marlborough	Elliot-Buckley House	204 Old Post Rd., Marlboro, NY 12542
Marlborough	Shady Brook Farm	351 Old Post Rd.,Marlborough NY 12542-6229
New Paltz Town	DuBois, Josiah, Farm	Libertyville Road
New Paltz Town	Lake Mohonk Mountain House Complex	NW of New Paltz, between Wallkill Valley on E and Roundout Valley on W
New Paltz Town	Locusts, The (Peter Eltinge House)	160 Plains Road
New Paltz Village	Huguenot Street Historic District	Huguenot St.
New Paltz Village	Hasbrouck, Jean, House	Huguenot and N. Front Sts.
New Paltz Village	Hasbrouck, Jean, House	Huguenot and N. Front Sts.
New Paltz Village	Hasbrouck, Major Jacob Jr., House	193 Huguenot Street
New Paltz Village	Elting Memorial Library	93 Main Street
New Paltz Village	New Paltz Downtown Historic District	USN 11143.000009
Olive	Olive and Hurley Old School Baptist Church	NY 28 at Reservoir Road
Olive	Bruneul, Emile, Studio and Sculpture Garden	4008 NY 28
Olive	Ashokan-Turnwood Covered Bridge	Over Esopus Creek
Plattekill	Hait, Thaddeus, Farm	75 Allhusen Rd.
Plattekill	Shuart, Johannis, House	41 Alhusen Road
Plattekill	Brown-Ellis House	382 Crescent Ave., Highland, NY 12528

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Rochester	Markle, Jacob F., Stone House	
Rochester	Barley, Zachariah, Stone House	90 Upper Whitfield Road
Rochester	Hornbeck Stone House	149 Whitfield Road
Rochester	Krom Stone House and Dutch Barn	Airport Road
Rochester	Middaugh Stone House and Dutch Barn	476 Mill Road
Rochester	Baker, Sebastian, Stone House	10 Doug Road
Rochester	Schoonmaker Stone House	Samsonville Road
Rochester	Hoornbeck, Jacob, Stone House	Boice Mill Road
Rochester	Davis Stone House	Davis Stone House
Rochester	Sahler Stone House	CR 29A
Rochester	Sahler Stone House and Dutch Barn	Winfield Road
Rochester	Stilwill Stone House	189 Old Kings Highway
Rochester	Stilwill-Westbrook Stone House	482 Old Kings Highway
Rochester	Van Wagenen Stone House and Farm Complex	2732 Lucas Turnpike
Rochester	Common School No. 10	Northside of Upper Cherrytown Rd.
Rochester	Westbrook, Dirck, Stone House	18 Old Whitfield Road
Rochester	Krom House	45 Upper Whitfield Road
Rochester	Rider, Johannes, Stone House	7 Upper Whitfield Road
Rochester	DuPuy, Ephraim, Stone House	193 Whitfield Road
Rochester	Krom, Lucas, Stone House	286 Whitfield Road
Rochester	Krom Stone House	31 Upper Whitfield Road
Rochester	Schoonmaker, C. K., Stone House	294 Queens Highway
Rochester	DuPuy, J, Stone House	Krum Road
Rochester	Sahler, J., House	US 209
Rochester	Winfield Corners Stone House	Winfield Road
Rochester	Jacobus Van Wagenen Stone House	2659 Lucas Turnpike
Rochester	Terwilliger-Smith Farm	160 Cherrytown Road
Rochester	Appeldoorn Farm	4938 Route 209, Accord, NY 12404
Rochester	Schoonmaker, Joachim, Farm	41 Garden Ln., Accord, NY 12404
Rochester	Alligerville Historic District (2015)	Rochetser, Ulster Co.
Rosendae	Perrine's Bridge	Over Wallkill River, immediately east of I-87
Rosendale	Snyder Estate Natural Cement Historic District	NY 213, 1/2 mi. W of Rosendale
Rosendale	Binnewater Historic District	Sawdust Ave., Breezy Hill and Binnewater Rds.
Rosendale	All Saints' Chapel	Main St.
Rosendale	DuBois-Deyo House	437 Springtown Road

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Saugerties	Trumpbour Homestead Farm	1789 Old Kings Hwy.
Saugerties	Wynkoop House	NY 32
Saugerties	Savage, Augusta, House and Studio	189 Old NY 32
Saugerties	"Opus 40"	50 Fite Road
Saugerties	Osterhoudt Stone House	1880 NY 32
Saugerties Village	Main-Partition Streets Historic District	Roughly bounded by Main, Partition, Market and Jane Sts.
Saugerties Village	Saugerties Lighthouse	Hudson River at Esopus Creek
Saugerties Village	Loerzel Beer Hall	213 Partition St.
Saugerties Village	DuBois-Kierstede Stone House	119 Main Street
Saugerties Village	Trinity Episcopal Church Complex	Church Street
Saugerties Village	Saugerties Public Library	91 Washington Avenue
Shandaken	Camp Wapanachki	5312 CR 212
Shandaken	Phoenicia Railroad Station	High Street
Shandaken	Elm Street Stone Arch Bridge	Elm Street over Alton Creek
Shandaken	Mill Street Stone Arch Bridge	Mill Street over Alton Creek
Shandaken	District School No. 14	Academy Street
Shandaken	Morton Memorial Library	Elm Street
Shandaken	Mount Tremper Fire Observation Tower	Mount Tremper
Shandaken	Ulster House Hotel	Main St. at Academy Rd.
Shandaken	Amelita Galli_Curci Estate	352 & 374 Galli-Curci Road
Shandaken	Pine Hill Historic District	Multiple
Shawangunk	Decker, Johannes, Farm	SW of Gardiner on Red Mill Rd. and Shawangunk Kill
Shawangunk	Crowell, J. B., and Son Brick Mould Mill Complex	Lippencott Rd.
Shawangunk	Dill Farm	Off Goebel Rd.
Shawangunk	Jansen, Thomas, House	Jansen Rd.
Shawangunk	Jansen, Johannes, House and Dutch Barn	Decker Rd.
Shawangunk	Terwilliger House	Hoagerburgh Rd.
Shawangunk	Reformed Dutch Church of New Hurley	N of Wallkill on NY 208
Shawangunk	Reformed Church of Shawangunk Complex	Hoagerburgh Rd.
Shawangunk	Decker, William, House	New Prospect Rd.
Shawangunk	Miller's House at Red Mills	Red Mills Rd. and Wallkill Ave.
Shawangunk	Pearl Street Schoolhouse	Awosting and Decker Rds.
Shawangunk	DuBois, Andries, House	75 Wallkill Avenue
Shawangunk	Bruynswyck School No. 8	Bruynswyck Road
Shawangunk	Van Keuren, Benjamin, House Ruin	Off Bruyn Turnpike

Table 3b.5
Historic and Cultural Resources by Jurisdiction

Jurisdiction	Asset Name/Description	Location
Shawangunk	Childs, Walstein, House	CR 129 (Sand Hill Road)
Town of Ulster	Ten Broeck, Benjamin, House	1019 Flatbush Road
Wawarsing	Cragsmoor Historic District	Roughly bounded by Henry, Cragsmoor and Sam's Point Roads
Wawarsing	Chetolah	S of Cragsmoor on Vista Maria Rd.
Wawarsing	Hoornbeek Store Complex	Main St. between Clinton & Church Sts.
Wawarsing	Spring Glen Synagogue	Old US 209
Wawarsing	Ontario & Western Railroad Passenger Station	On grounds of NYS Eastern Correctional Facility
Wawarsing	Ulster Heights Synagogue	Ulster Heights Road and Beaver Dam Road
Wawarsing	O&W Railroad Station at Port Ben	Tow Path Road
Wawarsing	Congregation Tifereth Yehuda Veyisroel	24-26 Minnewaska Trail, Wawarsing, NY 12246
Woodstock	Byrdcliffe Historic District	W of Woodstock at Glasco Tpke. and Larks Nest Rd.
Woodstock	National Youth Administration Woodstock Resident Work Center	NY 212 N side, E of Woodstock
Woodstock	Vosburg Turning Mill Complex	52 Hutchin Hill Road
Woodstock	Church of the Holy Transfiguration of Christ-on-the-Mount	Meads Mountain Road
Woodstock	Hasbrouck, Judge Jonathan, House	20 Elwyn Ln., Woodstock, NY 12498

Source: National Register Sites dataset from NYS Office of Information Technology Services, received via email on April, 28th, 2015.

Population

The U.S. Census Bureau[3] estimates that the population of Ulster County in 2010 was 182,493 persons, comprising 71,049 households. **Table 3b.6** shows population and household counts by jurisdiction. This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update.

Table 3b.6
Population and Households by Jurisdiction (2010 Census)

Jurisdiction	Population		Households	
	Total	% of County	Total	% of County
Denning, Town of	551	0.30%	234	0.33%
Ellenville, Village of	4,135	2.27%	1,578	2.22%
Esopus, Town of	9,041	4.95%	3,492	4.91%
Gardiner, Town of	5,713	3.13%	2,229	3.14%
Hardenburgh, Town of	238	0.13%	112	0.16%
Hurley, Town of	6,314	3.46%	2,693	3.79%
Kingston, City of	23,893	13.09%	10,217	14.38%
Kingston, Town of	889	0.49%	380	0.53%
Lloyd, Town of	10,863	5.95%	4,112	5.79%
Marbletown, Town of	5,607	3.07%	2,400	3.38%
Marlborough, Town of	8,808	4.83%	3,335	4.69%
New Paltz, Town of	14,003	7.67%	4,515	6.35%
New Paltz, Village of	6,818	3.74%	1,808	2.54%
Olive, Town of	4,419	2.42%	1,960	2.76%
Plattekill, Town of	10,499	5.75%	3,861	5.43%
Rochester, Town of	7,313	4.01%	2,936	4.13%
Rosendale, Town of	6,075	3.33%	2,572	3.62%
Saugerties, Town of	19,482	10.68%	8,163	11.49%
Saugerties, Village of	3,971	2.18%	3,971	5.59%
Shandaken, Town of	3,085	1.69%	1,505	2.12%
Shawangunk, Town of	14,332	7.85%	3,887	5.47%
Ulster, Town of	12,327	6.75%	4,961	6.98%
Wawarsing, Town of	13,157	7.21%	4,509	6.35%
Woodstock, Town of	5,884	3.22%	2,976	4.19%
Ulster County Total	**182,493**	**100%**	**71,049**	**100%**

Census data indicates that the population is growing and skewing older, with a rise in median age and number of older persons and a decreasing number of young children. The median age in Ulster County in 2010 was estimated to be 42 years. The average household size is 2.40 persons, and the median household income is $57,584. In terms of population segments that may potentially be at higher risk in general in terms of their ability to prepare for, respond to, and recover from natural disasters:

- 4.93 percent of the total population is under the age of five;
- 14.82 percent is over the age of 65;
- 11.3 percent of the population is living below the poverty level; and
- 13.8 percent of civilian noninstitutionalized persons hold disability status[4].

This information includes the Towns of Esopus, Marbletown and Rochester which did not participate in the Mitigation Plan Update.

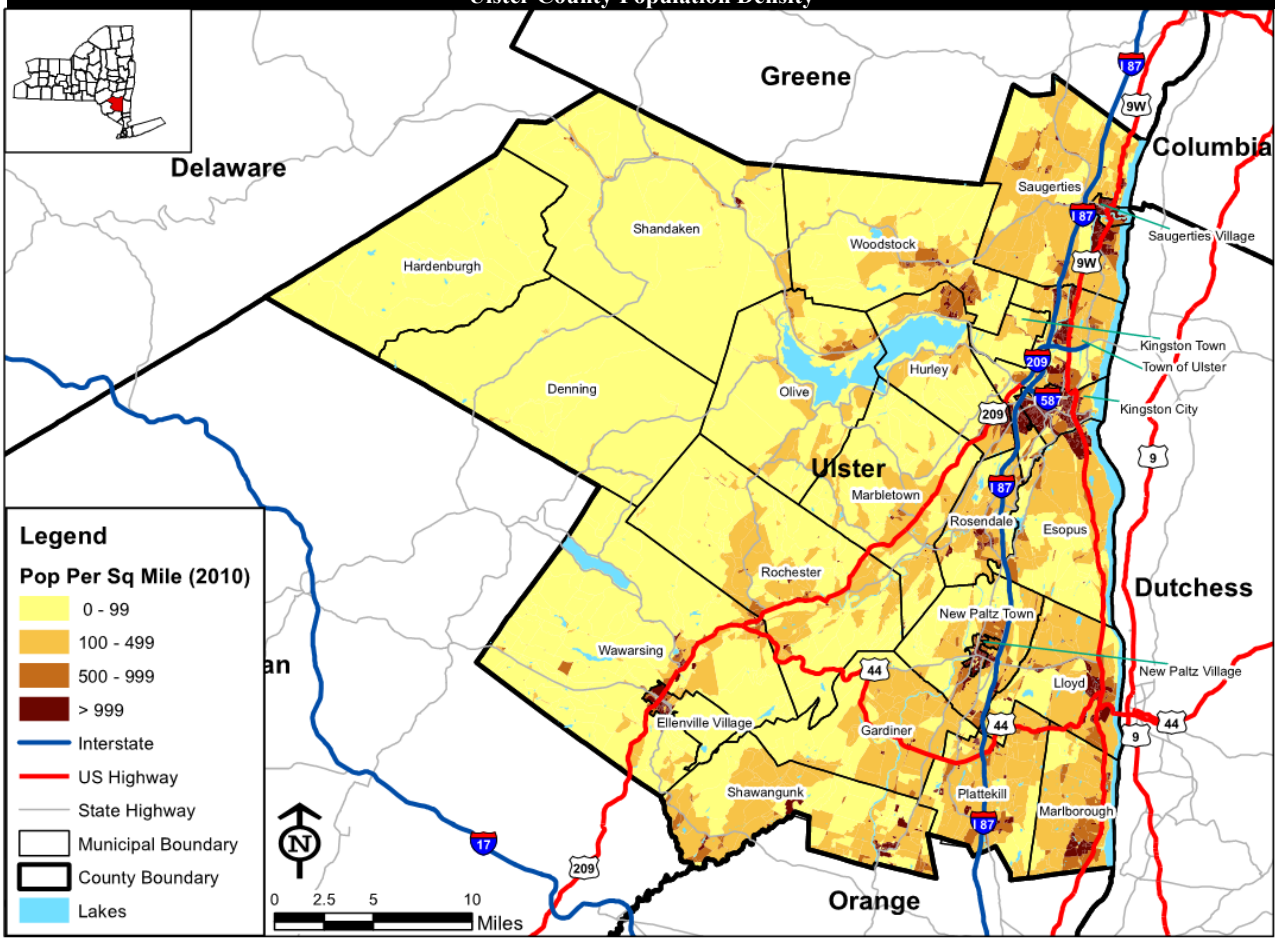
[3] U.S. Census Bureau, Census 2010
[4] U.S. Census Bureau, 2009-20133 5-Year American Community Survey

Table 3b.7
Vulnerable Sectors of the Population by Jurisdiction (2010 Census)

Jurisdiction	Total Population	Under 5 Years		65 Years and over		Vulnerable Population	
		Number of Persons	% of Total	Number of Persons	% of Total	Number of Persons	% of Total
Denning, Town of	551	25	4.54%	92	16.70%	117	21.23%
Ellenville, Village of	4,135	314	7.59%	502	12.14%	816	19.73%
Esopus, Town of	9,041	478	5.29%	1,379	15.25%	1,857	20.54%
Gardiner, Town of	5,713	283	4.95%	703	12.31%	986	17.26%
Hardenburgh, Town of	238	9	3.78%	52	21.85%	61	25.63%
Hurley, Town of	6,314	271	4.29%	1,280	20.27%	1,551	24.56%
Kingston, City of	23,893	1,565	6.55%	3,639	15.23%	5,204	21.78%
Kingston, Town of	889	39	4.39%	136	15.30%	175	19.69%
Lloyd, Town of	10,863	639	5.88%	1,593	14.66%	2,232	20.55%
Marbletown, Town of	5,607	237	4.23%	906	16.16%	1,143	20.39%
Marlborough, Town of	8,808	489	5.55%	1,195	13.57%	1,684	19.12%
New Paltz, Town of	14,003	430	3.07%	1,501	10.72%	1,931	13.79%
New Paltz, Village of	6,818	112	1.64%	485	7.11%	597	8.76%
Olive, Town of	4,419	161	3.64%	800	18.10%	961	21.75%
Plattekill, Town of	10,499	603	5.74%	1,284	12.23%	1,887	17.97%
Rochester, Town of	7,313	412	5.63%	952	13.02%	1,364	18.65%
Rosendale, Town of	6,075	289	4.76%	873	14.37%	1,162	19.13%
Saugerties, Town of	19,482	935	4.80%	3,134	16.09%	4,069	20.89%
Saugerties, Village of	3,971	192	4.84%	690	17.38%	882	22.21%
Shandaken, Town of	3,085	110	3.57%	608	19.71%	718	23.27%
Shawangunk, Town of	14,332	578	4.03%	1,398	9.75%	1,976	13.79%
Ulster, Town of	12,327	556	4.51%	2,403	19.49%	2,959	24.00%
Wawarsing, Town of	13,157	699	5.31%	1,733	13.17%	2,432	18.48%
Woodstock, Town of	5,884	188	3.20%	1,383	23.50%	1,571	26.70%
Ulster County Total	**182,493**	**8,996**	**4.93%**	**27,044**	**14.82%**	**36,040**	**19.75%**

Figure 3b.1 illustrates the residential population density across Ulster County. Most of the county's population is concentrated in eastern regions and generally in areas nearest to major thoroughfares. The City of Kingston and the Town of Saugerties are the two largest population centers; both are located in the County's northeast corner.

Figure 3b.1
Ulster County Population Density



Source: NYS GIS Program Office. US Census Bureau (2010).

SECTION 3C - Damage Estimates

Methodology

This multi-jurisdictional vulnerability assessment was conducted with two distinct methodologies, utilizing GIS-based analysis and a statistical risk assessment methodology. Each approach provides estimates for the potential **impact** of hazards by using a common, systematic framework for evaluation, including historical occurrence information provided in the *Hazard Profiles* section. The results of the multi-jurisdictional vulnerability assessment are provided for each hazard immediately following the summary of information provided through the hazard identification and analysis, as listed above.

A GIS-based analysis was conducted for seven hazards:

- dam failure;
- flood;
- storm surge;
- wave action;
- earthquake;
- landslide; and
- wildfire.

A statistical risk assessment approach was used to analyze eight hazards:

- extreme temperatures;
- extreme wind;
- hurricane and tropical storm;
- lightning;
- nor'easter;
- tornado;
- winter storm;
- drought; and
- ice jams.

Below is a brief description of these approaches.

GIS-Based Analysis

For GIS-based assessment, digital data was collected from local, state and national sources. ESRI® ArcGIS™ 9.3 was used to assess risk utilizing digital data for individual tax parcels and georeferenced point locations for buildings and critical facilities. Using these data layers, risk was assessed by estimating the value of buildings determined to be located in identified hazard areas. For the plan update, population estimates were refined using most recent Census data (2010) where the population and value of improved property exposed were estimated to be proportional to the area exposed; and the value of exposed property was refined using updated (2014) improvement values. The objective of the GIS-based analysis was to determine the estimated vulnerability of assets to the identified hazards for Ulster County using best available geospatial data. In so doing, local databases made available through the County such as local tax records, parcel boundaries, building footprints and critical facilities data, were used in combination with digital hazard data as included and described in the *Hazard Profiles* section. Where only a portion of a parcel was found to lie within a given hazard area, the ratio of area in to area out of the hazard area was applied to the value of improvements on the parcel to estimate the dollars exposed. A similar process was undertaken to estimate population exposed, where the percentage of Census block in the hazard area was applied to total census block population to estimate the population exposed to the hazard. The results of the analysis provided an estimated number of people, as well as the numbers and values of buildings and

critical facilities determined to be potentially at risk to those hazards with delineable geographic hazard boundaries. These hazards included the dam failure, flood, storm surge, wave action, earthquake, landslide, and wildfire hazards. A more specific description of the GIS-based analysis for each particular hazard is provided under the vulnerability assessment section of each respective hazard.

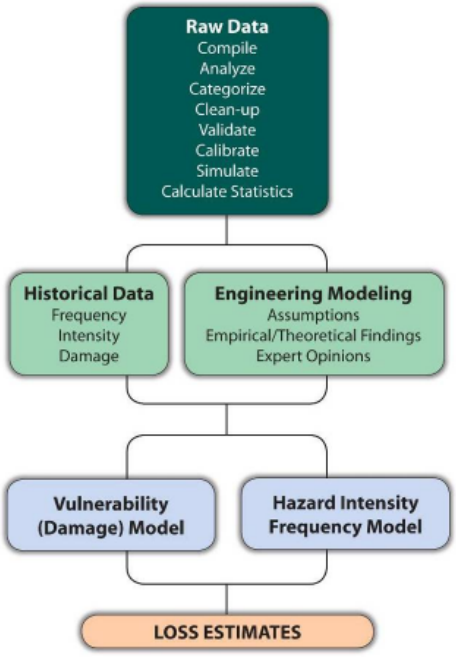
Statistical Risk Assessment Methodology

A statistical risk assessment methodology was applied to analyze hazards of concern that were outside the scope of the GIS-based risk assessment. This methodology uses a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information (presented in the *Hazard Profiles* section). This methodology was used to assess risk to the extreme temperatures, extreme wind, hurricane and tropical storms, lightning, nor'easter, tornado, winter storm, and drought hazards. Historical data for each hazard as described in the *Hazard Profiles* section was used and statistical evaluations were performed using manual calculations. The general steps used in the statistical risk assessment methodology are summarized below:

1. Compile data from local, state and national sources, as well as literature;
2. Clean up data, including removal of duplicate records and update losses to account for inflation;
3. Identify patterns in frequency, intensity, vulnerability and loss
4. Statistically and probabilistically extrapolate the patterns[1]; and
5. Produce meaningful results, including the development of annualized loss estimates.

Figure 3c.1 illustrates a conceptual model of the statistical risk assessment methodology as applied to Ulster County.

Figure 3c.1
Conceptual Model of the Statistical Risk Assessment Methodology



[1] In cases where historical events/losses were recorded for the county as a whole, losses were averaged across all jurisdictions in order to estimate losses by jurisdiction and calculate potential annualized losses by jurisdiction.

Risk (vulnerability) is presented in terms of potential annualized losses, whenever possible. In general, presenting results in the annualized form is useful in three ways:

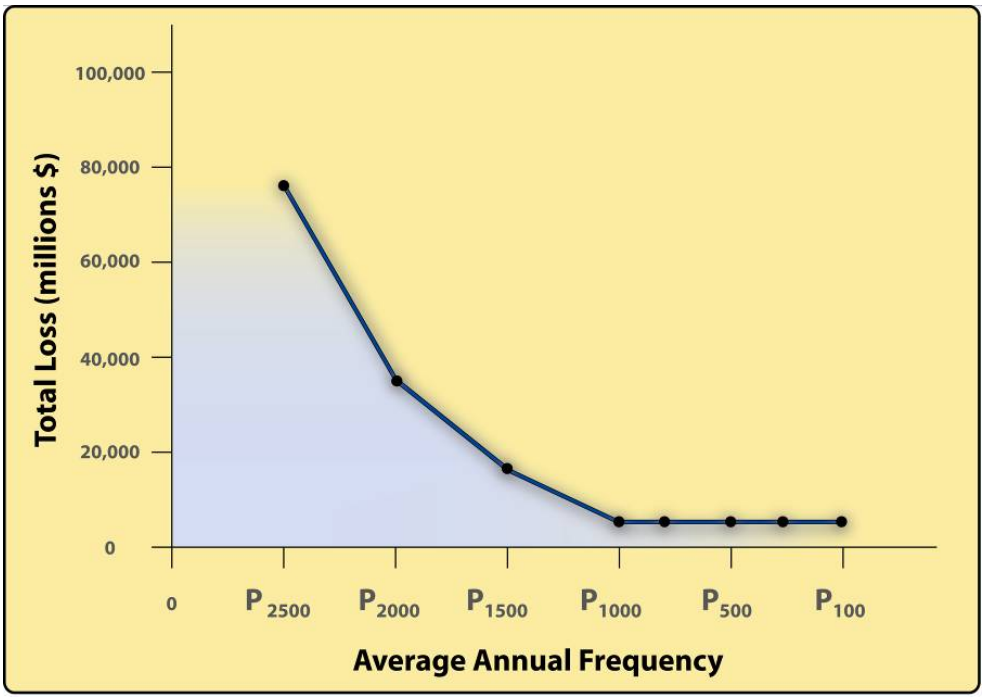
1. This approach accounts for the contribution of potential losses from all future disasters;
2. Annualized results for different hazards are readily comparable, thus easier to rank; and
3. The use of annualized losses is the most objective approach for evaluating mitigation alternatives.

Annualized losses for the hazards where the parametric approach was utilized were computed in a three-step process:

1. Compute/estimate losses for a number of scenario events with different return periods (i.e., 10-year, 100-year, 200-year, 500-year, etc.);
2. Approximate the Probability versus Loss Curve through curve fitting; and
3. Calculate the area under the fitted curve to obtain annualized losses.

This approach is illustrated graphically in **Figure 3c.2**. For other hazards where the statistical approach was used, the computations are based primarily on the observed historical losses.

Figure 3c.2
Graphical Representation of the Annualized Loss Methodology



The economic loss results are presented here using two interrelated risk indicators: Annualized Loss and Annualized Loss Ratio. The Annualized Loss is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., municipal jurisdiction). The Annualized Loss Ratio expresses estimated annualized loss normalized by assessed building value. The estimated Annualized Loss (AL) addresses the key idea of risk: the probability of the loss occurring in the study area (largely a function of building construction type and quality). By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced

presentation of the risk. The Annualized Loss Ratio (ALR) represents the AL as a fraction of the assessed value of the local inventory. This ratio is calculated using the following formula:

ALR = Annualized Losses / Total Exposure

The ALR gauges the relationship between average annualized loss and assessed values. This ratio can be used as a measure of vulnerability in the areas and, since it is normalized by assessed value, it can be directly compared across different geographic units such as metropolitan areas, counties or municipalities.

Loss estimates provided in this vulnerability assessment are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (i.e., incomplete inventories, demographics or economic parameters).

All conclusions are presented in "Conclusions on Hazard Risk" at the end of this section. Findings for each hazard are detailed in the hazard-by-hazard vulnerability assessment that follows.

Extreme Temperatures

Impacts - Extreme Temperatures

Extreme temperatures are primarily a threat to human life and health, though they are also hazardous to livestock and agricultural crops and occasionally might threaten property and infrastructure, and disrupt transportation systems. They can also exacerbate the impact of other hazards such as severe weather events that cause widespread power outages. Emergency responders are often called upon to work with public officials/non-profit agencies for heating/cooling venues, and to transport vulnerable sectors of the population to such venues. Extreme temperatures are likely to result in relatively minor impacts in Ulster County, with very few injuries (if any), minor and sporadic property damage, and minimal disruption on quality of life. Temporary shutdown of critical facilities to reduce energy usage or due to the fact that employees may not be able to get to the facility is possible. Common impacts associated with extreme heat in Ulster County include: injuries associated with swimming to escape extreme heat, and individuals seeking medical treatment for heat related illness (i.e., for heat stress, exhaustion, heat stroke, etc.), and power outages from an associated strain on electrical networks. Cooling centers are typically opened, and schools alter class schedules and/or activities to ensure student safety. Extreme heat events typically impact the elderly and disadvantaged most heavily. Primary impacts of concern for extreme cold temperatures include the life-threatening effects of overexposure hypothermia on people, particularly the elderly and disadvantaged. Other significant impacts include strains on livestock and agriculture.

Exposure and Damage Estimates – Extreme Temperatures

While all of Ulster County is exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not considered vulnerable to significant damage caused by extreme heat or cold events. Damages can occur when thermal tolerances of various systems are exceeded. Extreme cold can cause thermal cracking of paved surfaces, and freezing of pipes. Extreme heat can cause softening and traffic-related rutting of paved surfaces; and buckling of railway tracks. Extreme temperatures can place greater demand on utility systems, with possible associated power outages. While losses could be high for particular events, and could result in increased maintenance costs over time with frequent occurrences, average annual

property losses associated with extreme temperatures are anticipated to be minimal across the planning area. Extreme temperatures do however present a significant life and safety threat to Ulster County's population. Heat casualties are usually caused by lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being. Casualties resulting from extreme **cold** may result from a lack of adequate heat, carbon monoxide poisoning from unsafe heat sources and frostbite. The most vulnerable populations to cold casualties are the elderly or infirmed and low income households, as they may not be able to afford to operate a heat source on a regular basis and may not have immediate family or friends to look out for their well-being.

Given the lack of historical data and limited likelihood for structural losses resulting from extreme heat or cold occurrences in Ulster County, annualizing potential structural losses over a long period of time would most likely yield a negligible annualized loss estimate for the entire county.

Extreme Wind

Impacts - Extreme Wind

Impacts associated with extreme wind in Ulster County can be critical. Multiple deaths/injuries are possible, large portions of property in the affected area can be damaged or destroyed (depending on the nature of the event), and a complete shutdown of critical facilities for more than one week could all be possible, depending on the type of wind event and the nature of the event. Some extreme wind events can be forecasted; others are completely unpredictable. Emergency responders are called up for rescue, evacuations, road closures, and attending to the injured. Flying debris, in extreme wind events, can cause secondary impacts. Trees can be downed and buildings can be damaged. High winds can directly damage private property as well as roads and bridges, schools, hospitals, and other types of critical facilities along with utilities and communications facilities. In addition, impaired access to these facilities during extreme wind events can cause secondary, indirect damages. Extreme winds may stem from other hazards, including hurricanes and tropical storms, nor'easter, and tornadoes; however, only reported extreme wind events not related to other hazards are considered in this analysis. Vulnerability to winds from hurricanes and tropical storms, nor'easter, and tornadoes are addressed individually in other sections.

Exposure and Damage Estimates – Extreme Wind

Because it cannot be predicted where extreme winds may occur, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported extreme wind occurrences have been factored into this vulnerability assessment[2]. For the 2015 plan update, NCDC historical extreme wind loss data current as of July 2015 includes a total of 199 days with high wind, thunderstorm wind, and strong wind events in the 52 years between July 1963 and July 2015. All event records prior to the year 1993 include $0 in damages – presumably due to database limitations as opposed to decades of non-damaging wind events. Extreme wind events totaled approximately $3,115,000 in property damage. To estimate jurisdictional losses due to extreme wind, expected annualized losses were calculated for the 22 year period of record for which damages were recorded:

[2] It is possible that additional extreme wind events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

- NCDC losses for all wind events were obtained for the entire county ($3,115,000 total; using the 22 year period of record for which damages were recorded, this yields expected annualized losses of $141,591 countywide).
- The total value of all improvements in the County is estimated to be nearly $11.8 billion. Thus, based on recent historical data, annual extreme wind damage represents roughly 0.001 percent of the total improved property value in Ulster County.
- Since the extreme wind hazard is generally uniform across the planning area, this same percentage was applied to each of the County's jurisdictions to generate annualized expected property losses in each community.

Table 3c.1 shows potential annualized property losses and percent loss ratios resulting from the extreme wind hazard for each jurisdiction in Ulster County based on historic occurrences as reported by NCDC. For the plan update, population estimates were refined using year 2010 Census data[3], and annualized expected property losses were based on updated (2014) improvement values[4].

Table 3c.1
Potential Annualized Losses from Extreme Wind by Jurisdiction

Jurisdiction	Estimated Population At Risk*	Total Value of Improvements (Buildings) At Risk*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Denning, Town of	551	$9,833,691	$118	0.001%
Ellenville, Village of	4,135	$3,212,219	$39	0.001%
Esopus, Town of	9,041	$664,657,631	$7,981	0.001%
Gardiner, Town of	5,713	$496,051,960	$5,956	0.001%
Hardenburgh, Town of	238	$33,780,150	$406	0.001%
Hurley, Town of	6,314	$601,531,347	$7,223	0.001%
Kingston, City of	23,893	$1,356,698,046	$16,290	0.001%
Kingston, Town of	889	$52,412,700	$629	0.001%
Lloyd, Town of	10,863	$715,492,192	$8,591	0.001%
Marbletown, Town of	5,607	$820,874,962	$9,856	0.001%
Marlborough, Town of	8,808	$498,122,686	$5,981	0.001%
New Paltz, Town of	14,003	$546,080,883	$6,557	0.001%
New Paltz, Village of	6,818	$658,909,400	$7,912	0.001%
Olive, Town of	4,419	$830,987,819	$9,978	0.001%
Plattekill, Town of	10,499	$444,556,917	$5,338	0.001%
Rochester, Town of	7,313	$499,688,381	$6,000	0.001%
Rosendale, Town of	6,075	$343,409,911	$4,123	0.001%
Saugerties, Town of	19,482	$895,836,873	$10,756	0.001%
Saugerties, Village of	3,971	$215,364,249	$2,586	0.001%
Shandaken, Town of	3,085	$100,772,350	$1,210	0.001%
Shawangunk, Town of	14,332	$170,465,425	$2,047	0.001%
Ulster, Town of	12,327	$847,716,567	$10,179	0.001%
Wawarsing, Town of	13,157	$13,835,638	$166	0.001%
Woodstock, Town of	5,884	$971,926,625	$11,670	0.001%
Total	**182,493**	**$11,792,218,622**	**$141,591**	**0.001%**

* Since the extreme wind hazard area is countywide, 100 percent of the population and built environment is exposed and potentially at risk. Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

[3] Census 2010
[4] Ulster County Parcel data, 2014

Hurricanes and Tropical Storms

Impacts - Hurricanes and Tropical Storms

Hurricanes and tropical storms are capable of producing catastrophic impacts. A high number of deaths and/or injuries are possible, a large percentage of property in the affected area could be damaged or destroyed, and a complete shutdown of critical facilities would be possible for 30 days or more, depending on the nature of the event. The Ulster County HAZNY (2014) characterizes hurricanes as a moderately high hazard, with potential impacts throughout a large region, cascade effects are highly likely, occurring at a regular frequency, with more than two weeks recovery time, serious injury or death likely (but not in large numbers), severe damage to private property, and severe structural damage to public facilities is all possible.

Ulster County has an active history of hurricanes and tropical storms. According to NOAA historical records, ten hurricane or tropical storm tracks[5] have passed within 75 nautical miles of Ulster County since 1863. This includes two Category 1 hurricanes; and eight tropical storms. Of these ten events, two tracks traversed directly through Ulster County (a Category 1 hurricane in 1878 and a tropical storm in 1893). Recent events such as Sandy, Irene, and Lee have caused significant wind, flood and surge damages in Ulster County.

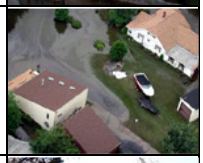
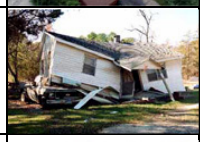
Impacts of hurricanes and tropical storms are associated with damages as a result of flooding (riverine and storm surge traversing up the Hudson River), and high winds. It is possible for the entire county to be impacted by hurricanes and tropical storms, though in different ways. For example, wind impacts may be widespread across the County. Riverine flooding would be expected in riverine flood zones, and would cause more severe types of structure damages in areas along the Hudson River susceptible to storm surge. Roads and bridges across the county would be susceptible to overtopping and damage from floodwaters. .

Impacts to the general public include evacuation and sheltering needs, as well as emergency response for those who shelter in place or are injured during the event. All property types are potentially impacted. Roads, bridges, schools, hospitals and other types of critical facilities are susceptible to wind and water damage. Secondary impacts would be associated with flying debris. Transportation, communications, and governmental services may be severely impacted. Impacts would be exacerbated when coincident with high tides, or during prolonged types of events that extend across several tidal cycles. Sea level rise will increase impacts over time.

Table 3c.2 describes the damage that could be expected for each category of hurricane. Damage during hurricanes might also result from spawned tornadoes, storm surge and inland flooding associated with heavy rainfall that usually accompanies these storms.

[5] Not including tropical depressions or extratropical systems.

Table 3c.2
Hurricane Damage Classifications

Storm Category	Damage Level	Description of Damages	Photo Example
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery and trees. Also, some coastal flooding and minor pier damage.	
2	MODERATE	Some roofing material, door and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings might break their moorings.	
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain might be flooded well inland.	
4	EXTREME	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain might be flooded well inland.	
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas might be required.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Exposure and Damage Estimates – Hurricanes and Tropical Storms

Hurricanes and tropical storms are complex combinations of discrete component hazards occurring simultaneously. The entirety of the County's built environment and population is potentially exposed to this hazard. Damages during these events result from the cumulative impacts of a wide range of hazards including flooding, storm surge, and high winds. No two hurricanes or tropical storms are identical. Even hurricanes of the same category can bring with them wildly different impacts depending on whether they occur during a time of high tide or low tide. Variations in inland wind affects and precipitation amounts, for example, can vary widely. Thus, it is difficult to estimate total potential losses from these cumulative effects in a manner that would allow for the calculation of a meaningful annual 'hurricane and tropical storm' average annual loss estimate. Vulnerability to the component hazards of hurricane and tropical storm events such as flooding, storm surge, and high winds are addressed separately in this section. Vulnerability is being expressed as the number of people and value of property at risk. All of the county's built environment and population ($11.8 billion in improved property, and 182,493 people) could potentially be impacted in some way by the hazards characteristically occurring during a hurricane or tropical storm.

Lightning

Impacts – Lightning

On average, 55 people are killed and hundreds are injured each year by lightning strikes in the United States. Lightning can strike communications equipment (i.e., radio or cell towers, antennae, satellite dishes, electrical transformers, etc.) and hamper communication and emergency response. Lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure, largely by igniting a fire. In addition, lightning can ignite vegetation to cause a wildfire. Lightning's impacts can typically be characterized as minor in Ulster County. Events are typically associated with very few injuries (if any), only minor property damage, and minimal disruption on quality of life. The shutdown of critical facilities, if at all, is typically only temporary in nature. Historical impacts in Ulster County have included direct health impacts to individuals struck by lightning, structure damages from fires caused by lightning, and impacts to emergency communications facilities when towers have been struck by lightning. Lightning occurs frequently in Ulster County but damaging events are relatively few in number and limited in scope when they do occur. Building codes requiring buildings to be grounded work to decrease damages. Members of the general public who are outdoors are particularly vulnerable during an event. Lightning most typically occurs within 10 miles of a thunderstorm.

Exposure and Damage Estimates – Lightning

Because it cannot be predicted where lightning may strike, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. For the plan update, NCDC historical lightning data current as of July 2015 was queried. The data includes a total of 16 lightning events between July 1996 and July 2015, resulting in nearly $654,000 in damages, one death, and 6 injuries. The lack of event records prior to the year 1996 is due to database limitations as opposed to decades without lightning events. To estimate jurisdictional losses due to lightning, expected annualized losses were calculated as follows for the 19 year period of record between July 1996 and July 2015:

- NCDC losses were obtained for the entire county (event records included specific loss histories totaling $654,000; using a 19 year period of record, this yields expected annualized losses of $34,421 countywide).
- The total value of all improvements in the County is estimated to be nearly $11.8 billion. Thus, based on recent historical data, annual lightning damage represents roughly 0.0003 percent of the total improved property value in Ulster County.
- Since the lightning hazard is uniform across the planning area, this same percentage was applied to each of the County's jurisdictions to generate annualized expected property losses in each community.

Table 3c.3 shows potential annualized property losses and percent loss ratios resulting from the lightning hazard for each jurisdiction in Ulster County based on historic occurrences as reported by NCDC. For the plan update, population estimates were refined using year 2013 Census block level data[6], and annualized expected property losses were based on updated (2011) improvement values[7].

[6] U.S. Census 2010

[7] Ulster County Parcel data, 2014.

Table 3c.3 Potential Annualized Losses from Lightning by Jurisdiction				
Jurisdiction	**Estimated Population At Risk***	**Total Value of Improvements (Buildings) At Risk***	**Annualized Expected Property Losses**	**Annualized Percent Loss Ratio**
Denning, Town of	551	$9,833,691	$29	0.0003%
Ellenville, Village of	4,135	$3,212,219	$9	0.0003%
Esopus, Town of	9,041	$664,657,631	$1,940	0.0003%
Gardiner, Town of	5,713	$496,051,960	$1,448	0.0003%
Hardenburgh, Town of	238	$33,780,150	$99	0.0003%
Hurley, Town of	6,314	$601,531,347	$1,756	0.0003%
Kingston, City of	23,893	$1,356,698,046	$3,960	0.0003%
Kingston, Town of	889	$52,412,700	$153	0.0003%
Lloyd, Town of	10,863	$715,492,192	$2,088	0.0003%
Marbletown, Town of	5,607	$820,874,962	$2,396	0.0003%
Marlborough, Town of	8,808	$498,122,686	$1,454	0.0003%
New Paltz, Town of	14,003	$546,080,883	$1,594	0.0003%
New Paltz, Village of	6,818	$658,909,400	$1,923	0.0003%
Olive, Town of	4,419	$830,987,819	$2,426	0.0003%
Plattekill, Town of	10,499	$444,556,917	$1,298	0.0003%
Rochester, Town of	7,313	$499,688,381	$1,459	0.0003%
Rosendale, Town of	6,075	$343,409,911	$1,002	0.0003%
Saugerties, Town of	19,482	$895,836,873	$2,615	0.0003%
Saugerties, Village of	3,971	$215,364,249	$629	0.0003%
Shandaken, Town of	3,085	$100,772,350	$294	0.0003%
Shawangunk, Town of	14,332	$170,465,425	$498	0.0003%
Ulster, Town of	12,327	$847,716,567	$2,474	0.0003%
Wawarsing, Town of	13,157	$13,835,638	$40	0.0003%
Woodstock, Town of	5,884	$971,926,625	$2,837	0.0003%
Total	**182,493**	**$11,792,218,622**	**$34,421**	**0.0003%**

* Since the lightning hazard area is countywide, 100 percent of the population and built environment is exposed and potentially at risk. Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Nor'easters

Impacts - Nor'easters

Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast by strong northeasterly winds at the leading edge of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves will increase and cause serious damage to coastal areas as the storm moves northeast. Nor'easters can be extremely large (up to 1,000 miles in diameter) and their duration can last for days and multiple tidal cycles, often causing major coastal flooding, erosion and damages that might even exceed the impacts of shorter-term hurricane events.

Impacts from nor'easters in Ulster County are primarily associated with high winds and flood hazards (riverine and storm surge) as well as heavy snowfall. Their impacts are often quite similar to winter storms

with significant snow accumulations, creating hazardous driving conditions, business/government office closures, potential for damage from snow accumulations on structures, etc. The entire county has some exposure and past effects have been widespread. Similar to hurricanes and tropical storms, nor'easters are capable of producing widespread impacts, depending upon the nature of the storm, its intensity, and duration. Possible impacts can include possible deaths/injuries, property damages, and functional downtime of critical facilities. Historical records in the NYSHMP 2014 are not specific to nor'easters, but are rather a tally of all types of winter storms. Six nor'easters stand out from 1993 to the present with most notable impacts. Recent events have caused significant wind and flood related damages in Ulster County. They have also resulted in power outages and hazardous driving conditions.

It is possible for the entire county to be impacted by nor'easters. Roads and bridges across the county would be susceptible to overtopping and damage from floodwaters.

Impacts to the general public include evacuation and sheltering needs, as well as emergency response for those who shelter in place or are injured during the event. All property types are potentially impacted. Roads, bridges, schools, hospitals and other types of critical facilities are susceptible to wind and water damage. Secondary impacts would be associated with roof damage due to snow loads. Transportation, communications, and governmental services may be severely impacted.

Exposure and Damage Estimates – Nor'easters

Because nor'easters often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. Similar to hurricanes and tropical storms, nor'easters are complex combinations of discrete component hazards occurring simultaneously. Damages during these events result from the cumulative impacts of component hazards such as flooding, surge traveling up the Hudson River, and high winds. No two nor'easters are identical. Even storms of the same magnitude and intensity can bring with them wildly different impacts depending on whether they occur during a time of high tide or low tide; and, since it is not uncommon for nor'easters to stall off of the coast, damages are typically affected by their duration. Variations in inland wind affects and precipitation amounts can also vary widely. Thus, it is difficult to estimate total potential losses from these cumulative effects in a manner that would allow for the calculation of a meaningful average annual loss estimate for nor'easters. Vulnerability is being expressed as the number of people and value of property at risk. All of the county's built environment and population could potentially be impacted by the hazards characteristically occurring during a nor'easter.

Tornado

Impacts - Tornado

Tornados are nature's most violent storms. The most intense tornados can cause fatalities and catastrophic damage to both trees and the built environment in a matter of seconds. The number of deaths, injuries, and dollar amount of damages can fluctuate drastically depending on the severity of the tornado and the degree and type of development in the damage path. Emergency responders are called upon for search and rescue, to tend to the injured, assist in evacuations, and to close roads and direct traffic. Transportation, communications, and the general operation of government could be affected by an incident. Property damage can be significant within the tornado's path. Trees can be damaged or destroyed. Power outages can occur. These impacts tend to be felt in rather limited areas, due to the nature of the tornado hazard itself (tornados with limited widths and path lengths after touchdown). The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size, and duration of the storm. Typically,

tornadoes cause the greatest damage to structures of light construction, including residential dwellings and particularly manufactured homes.

Exposure and Damage Estimates – Tornado

Historical evidence shows that Ulster County is vulnerable to tornadic activity. This hazard can result from severe thunderstorm activity or may occur during a major tropical storm or hurricane. Because it cannot be predicted where a tornado may touch down, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported tornadoes have been factored into this vulnerability assessment[8].

For the plan update, NCDC historical tornado data current as of October 2015 includes a total of 10 tornado events between September 1975 and July 2015, resulting in $3,125,000 in property damages. No events occurred since the last version of the plan was prepared. To estimate jurisdictional losses due to tornados, expected annualized losses were calculated as follows for the 45 year period of record:

- NCDC losses were obtained for the entire county ($3,125,000 total; using a 40 year period of record, this yields expected annualized losses of $78,125).
- The total value of all improvements in the County is estimated to be nearly $11.8 billion. Thus, based on recent historical data, annual tornado damage represents 0.0007 percent of the total improved property value in Ulster County.
- Since the tornado hazard is uniform across the planning area, this same percentage was applied to each of the County's jurisdictions to generate annualized expected property losses in each community.

Table 3c.4 shows potential annualized property losses and percent loss ratios resulting from the tornado hazard for each jurisdiction in Ulster County based on historic occurrences as reported by NCDC. For the plan update, population estimates were refined using year 2010 Census data[9], and annualized expected property losses were based on updated (2014) improvement values[10].

Table 3c.4
Potential Annualized Losses from Tornados by Jurisdiction

Jurisdiction	Estimated Population At Risk*	Total Value of Improvements (Buildings) At Risk*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Denning, Town of	551	$9,833,691	$65	0.0007%
Ellenville, Village of	4,135	$3,212,219	$21	0.0007%
Esopus, Town of	9,041	$664,657,631	$4,403	0.0007%
Gardiner, Town of	5,713	$496,051,960	$3,286	0.0007%
Hardenburgh, Town of	238	$33,780,150	$224	0.0007%
Hurley, Town of	6,314	$601,531,347	$3,985	0.0007%
Kingston, City of	23,893	$1,356,698,046	$8,988	0.0007%
Kingston, Town of	889	$52,412,700	$347	0.0007%
Lloyd, Town of	10,863	$715,492,192	$4,740	0.0007%
Marbletown, Town of	5,607	$820,874,962	$5,438	0.0007%
Marlborough, Town of	8,808	$498,122,686	$3,300	0.0007%
New Paltz, Town of	14,003	$546,080,883	$3,618	0.0007%
New Paltz, Village of	6,818	$658,909,400	$4,365	0.0007%

[8] It is possible that additional tornado events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.
[9] U.S. Census Bureau, 2010.
[10] Ulster County Parcel data, 2014.

Table 3c.4 Potential Annualized Losses from Tornados by Jurisdiction				
Jurisdiction	**Estimated Population At Risk***	**Total Value of Improvements (Buildings) At Risk***	**Annualized Expected Property Losses**	**Annualized Percent Loss Ratio**
Olive, Town of	4,419	$830,987,819	$5,505	0.0007%
Plattekill, Town of	10,499	$444,556,917	$2,945	0.0007%
Rochester, Town of	7,313	$499,688,381	$3,311	0.0007%
Rosendale, Town of	6,075	$343,409,911	$2,275	0.0007%
Saugerties, Town of	19,482	$895,836,873	$5,935	0.0007%
Saugerties, Village of	3,971	$215,364,249	$1,427	0.0007%
Shandaken, Town of	3,085	$100,772,350	$668	0.0007%
Shawangunk, Town of	14,332	$170,465,425	$1,129	0.0007%
Ulster, Town of	12,327	$847,716,567	$5,616	0.0007%
Wawarsing, Town of	13,157	$13,835,638	$92	0.0007%
Woodstock, Town of	5,884	$971,926,625	$6,439	0.0007%
Total	**182,493**	**$11,792,218,622**	**$78,125**	**0.0007%**

* Since the tornado hazard area is countywide, 100 percent of the population and built environment is exposed and potentially at risk. Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Winter Storms

Impacts – Winter Storms

Winter storms can have tremendous impacts on Ulster County. Though typically short in duration, winter storms can result in significant snow accumulations, with extensive impacts on local transportation via road, rail, and air. Impacts are exacerbated with storms having an ice component, as snow loads are increased and driving conditions substantially worsen. A severe winter storm can adversely affect roadways, utilities, business activities and can cause loss of life, frostbite, or freezing. The most common effect of winter storms and ice storms are traffic accidents, interruptions in power supply and communications. In addition, heavy snow loads can cause roof collapse in cases of inadequate design and/or maintenance, as the structural integrity of the structure is compromised. Power outages and temperatures below freezing for extended periods of time can cause pipes to freeze and burst. Heavily populated areas tend to be significantly impacted by losses of power and communications systems due to downed lines. Distribution lines can be downed by the weight of snow or ice, or heavy winds – particularly during periods of high winds – which can result in outages when limbs fall on power lines and communication lines. Secondary impacts from downed communication lines can hamper the response and recovery efforts due to lack of communication. When limbs and lines fall on roadways, transportation routes can be adversely affected and buildings and automobiles can be damaged. Secondary impacts from power outages can include frozen pipes, business losses, negative impacts on people associated with trying to heat their homes using portable heat sources (i.e., kerosene) or stoves including carbon monoxide poisoning and fire risks. Severe winter storms can also cause coastal flooding, coastal erosion, and wave action. If significant snowfall amounts melt quickly, inland flooding can occur as bankfull conditions are exceeded or in areas of poor roadway drainage. The impacts of snow and ice storms in the planning area are more likely to be major disruptions to transportation, commerce and electrical power as well as significant overtime work for government employees, rather than large scale property damages and/or threats to human life and safety. The severity of the effects of winter storms and ice storms increases as the amount and rate of precipitation increase. In addition, storms with a low forward velocity are in an area for a longer duration and become more severe in their affects. Storms that are in full force during the morning or evening rush hours tend to have their affects magnified because more people are out on the roadways and directly exposed. Ulster County's more rural jurisdictions could be expected to be impacted more by heavy snow and freezing rain due to access transportation issues and distances from major population centers and additional emergency response

resources. The human impact of winter storms tends to be exacerbated in areas of social vulnerability (for example, low income, and a high proportion of the very young and/or very old).

Exposure and Damage Estimates – Winter Storms

Because winter storms often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. For the plan update, NCDC historical winter storm data current as of October 2015 was queried for events categorized as: blizzards, heavy snow, ice storms, sleet, winter storms, and winter weather. The data includes a total of 122 winter weather days between January 1996 and July 2015, resulting in approximately $1.4 million in reported property damages. No event records are included prior to 1996. To estimate jurisdictional losses due to winter storms, expected annualized losses were calculated for the 19 year period of record to be $74,579 countywide. This result does not align with observed types of impacts in Ulster County during historic occurrences and does not appear to be including the order of magnitude of damages incurred. Research of the NYSHMP 2014 found that the State used SHELDUS data for the period of 1960 to 2012 to estimate losses ($49,207,868 million in property damages). The Ulster County plan update is hereby revised to incorporate the State's approach, as follows:

- SHELDUS losses were obtained for the entire county ($49,207,868; using a 42 year period of record, this yields expected annualized losses of $1,171,616).
- The total value of all improvements in the County is estimated to be nearly $11.8 billion. Thus, based on recent historical data, annual winter storm damage represents 0.01 percent of the total improved property value in Ulster County.
- Since winter storm hazard is uniform across the planning area, this same percentage was applied to each of the County's jurisdictions to generate annualized expected property losses in each community.

Table 3c.5 shows potential annualized property losses and percent loss ratios resulting from the winter storm hazard for each jurisdiction in Ulster County based on historic occurrences as reported by NCDC. For the plan update, population estimates were refined using year 2010 Census data[11], and annualized expected property losses were based on updated (2014) improvement values[12].

Table 3c.5
Potential Annualized Losses from Winter Storms by Jurisdiction

Jurisdiction	Estimated Population At Risk*	Total Value of Improvements (Buildings) At Risk*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Denning, Town of	551	$9,833,691	$977	0.01%
Ellenville, Village of	4,135	$3,212,219	$319	0.01%
Esopus, Town of	9,041	$664,657,631	$66,037	0.01%
Gardiner, Town of	5,713	$496,051,960	$49,285	0.01%
Hardenburgh, Town of	238	$33,780,150	$3,356	0.01%
Hurley, Town of	6,314	$601,531,347	$59,765	0.01%
Kingston, City of	23,893	$1,356,698,046	$134,795	0.01%
Kingston, Town of	889	$52,412,700	$5,207	0.01%
Lloyd, Town of	10,863	$715,492,192	$71,088	0.01%
Marbletown, Town of	5,607	$820,874,962	$81,558	0.01%
Marlborough, Town of	8,808	$498,122,686	$49,491	0.01%
New Paltz, Town of	14,003	$546,080,883	$54,256	0.01%
New Paltz, Village of	6,818	$658,909,400	$65,466	0.01%

[11] U.S. Census Bureau, 2010.
[12] Ulster County Parcel data, 2014.

Table 3c.5 Potential Annualized Losses from Winter Storms by Jurisdiction				
Jurisdiction	**Estimated Population At Risk***	**Total Value of Improvements (Buildings) At Risk***	**Annualized Expected Property Losses**	**Annualized Percent Loss Ratio**
Olive, Town of	4,419	$830,987,819	$82,563	0.01%
Plattekill, Town of	10,499	$444,556,917	$44,169	0.01%
Rochester, Town of	7,313	$499,688,381	$49,647	0.01%
Rosendale, Town of	6,075	$343,409,911	$34,119	0.01%
Saugerties, Town of	19,482	$895,836,873	$89,006	0.01%
Saugerties, Village of	3,971	$215,364,249	$21,398	0.01%
Shandaken, Town of	3,085	$100,772,350	$10,012	0.01%
Shawangunk, Town of	14,332	$170,465,425	$16,937	0.01%
Ulster, Town of	12,327	$847,716,567	$84,225	0.01%
Wawarsing, Town of	13,157	$13,835,638	$1,375	0.01%
Woodstock, Town of	5,884	$971,926,625	$96,566	0.01%
Total	**182,493**	**$11,792,218,622**	**$1,171,616**	**0.01%**

* Since the winter storm hazard area is countywide, 100 percent of the population and built environment is exposed and potentially at risk. Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Dam Failure

Impacts – Dam Failure

Dam failure presents a significant potential for disaster, in that significant loss of life and property would be expected in addition to the possible loss of power and water resources. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The best way to mitigate dam failure is through the proper construction, inspection, maintenance and operation of dams, as well as maintaining and updating Emergency Action Plans for use in the event of a dam failure.

Exposure and Damage Estimates – Dam Failure

Of the 28 "high" or "significant" hazard dams in Ulster County, three have been classified by the State as "major" dams and represent the most significant hazard risk based on the potential consequences of a dam failure. Major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more. In Ulster County, these include the Ashokan Reservoir Dam in Olive (water supply); the Rondout Reservoir Dam (Merriman Dam) in Wawarsing (water supply); and the Sturgeon Pool Dam in Esopus (hydroelectric). The value of improvements at risk was estimated based on the proportion of parcel area within estimated inundation areas (for example, if 10 percent of the parcel area was within a mapped area of inundation during a breach of the dam, 10 percent of the value of improvements on that parcel were also assumed to be at risk). **Table 3c.6** shows building value exposure to dam failure by jurisdiction for the County's three major, high hazard dams.

Table 3c.6
Estimated Potential Exposure of Improved Property* to Dam Failure

Ashokan Reservoir			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Esopus, Town of	$8,021,033	$664,657,631	1.2%
Hurley, Town of	$75,479,691	$601,531,347	12.5%
Kingston, City of	$497,029,741	$1,356,698,046	36.6%
Kingston, Town of	$15,231,439	$52,412,700	29.1%
Marbletown, Town of	$51,976,842	$820,874,962	6.3%
Olive, Town of	$19,001,927	$830,987,819	2.3%
Saugerties, Town of	$19,030,707	$895,836,873	2.1%
Saugerties, Village of	$36,305,039	$215,364,249	16.9%
Ulster, Town of	$356,785,543	$847,716,567	42.1%
Woodstock, Town of	$36,160,282	$971,926,625	3.7%
Total	**$1,115,022,245**	**$7,258,006,819**	**15.4%**
Rondout Reservoir			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Ellenville, Village of	$998,227	$3,212,219	31.1%
Esopus, Town of	$32,153,379	$664,657,631	4.8%
Kingston, City of	$71,086,377	$1,356,698,046	5.2%
Marbletown, Town of	$35,058,429	$820,874,962	4.3%
Rochester, Town of	$76,692,245	$499,688,381	15.3%
Rosendale, Town of	$74,904,174	$343,409,911	21.8%
Ulster, Town of	$5,248,863	$847,716,567	0.6%
Wawarsing, Town of	$2,882,679	$13,835,638	20.8%
Total	**$299,024,372**	**$4,550,093,355**	**6.6%**
Sturgeon Pool			
Municipality	**Exposed Improved Value**	**Total Municipal Improved Value**	**Exposed Value as % of Municipal Total**
Esopus, Town of	$11,639,489	$664,657,631	1.8%
Kingston, City of	$67,984,501	$1,356,698,046	5.0%
Rosendale, Town of	$9,577,933	$343,409,911	2.8%
Ulster, Town of	$4,082,759	$847,716,567	0.5%
Total	**$93,284,682**	**$3,212,482,155**	**2.9%**

* Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Protection of human life through administration of proper emergency notification and evacuation planning, and proper implementation of the emergency action plan, is crucial to minimizing social losses due to dam failure. Because the probability of occurrence of a dam failure event is so low, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for jurisdictions exposed to this hazard.

Drought

Impacts – Drought

Droughts are slow onset hazards, but, over time, they can severely affect crops, municipal water supplies, recreational resources, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. In addition, human actions and demands for water resources can accelerate drought-related impacts.

Exposure and Damage Estimates – Drought

Because drought impacts large areas and crosses jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop losses on agricultural lands and have no impact on buildings. To estimate land exposure to drought, cultivated cropland acreage was acquired from NLDC land cover classification data (2011 Edition, amended 2014). **Table 3c.7** shows cultivated cropland acreage in Ulster County by jurisdiction. Approximately 3.4 percent of land in Ulster County is used for cultivated; located each of the County's 24 communities.

Table 3c.7
Acreage of Cultivated Cropland by Jurisdiction

Jurisdiction	Land Area (Acres)	Area of Cultivated Cropland (Acres)	Proportion of Cultivated Cropland (as percentage of County total)
Denning, Town of	67,627	40	0.2%
Ellenville, Village of	5,584	24	0.1%
Esopus, Town of	23,880	306	1.2%
Gardiner, Town of	27,798	1,211	4.9%
Hardenburgh, Town of	51,704	61	0.2%
Hurley, Town of	19,143	896	3.6%
Kingston, City of	4,791	62	0.3%
Kingston, Town of	4,929	79	0.3%
Lloyd, Town of	20,010	901	3.7%
Marbletown, Town of	34,862	2,938	12.0%
Marlborough, Town of	15,661	3,560	14.5%
New Paltz, Town of	21,680	1,480	6.0%
New Paltz, Village of	1,098	43	0.2%
Olive, Town of	37,408	166	0.7%
Plattekill, Town of	22,471	1,557	6.3%
Rochester, Town of	57,154	3,675	15.0%
Rosendale, Town of	12,786	366	1.5%
Saugerties, Town of	41,328	1,601	6.5%
Saugerties, Village of	1,141	11	0.0%
Shandaken, Town of	76,662	63	0.3%
Shawangunk, Town of	35,876	2,875	11.7%
Ulster, Town of	17,154	1,010	4.1%
Wawarsing, Town of	83,523	1,445	5.9%
Woodstock, Town of	43,065	199	0.8%
Total	**727,333**	**24,567**	**3.4%**

Source: NLCD 2011 Land Cover (2011 Edition, amended 2014), 2014. 2010 Census Geographic Identifiers (G001).

The USDA 2012 Census of Agriculture County Profile for Ulster County was used to analyze the exposure of Ulster County crops to drought. It was assumed that the exposure of crops was equal to the total value of crops sold ($46.4 million). This represents roughly a substantial increase since the last version of the plan

was prepared (when the value of crops sold as reported in the USDA 2002 County Profile was $28.8 million). Agricultural losses, specifically losses to crops, in Ulster County could be significant during a drought. When drought begins, the agricultural sector is usually the first to be impacted because of its heavy reliance on stored soil water, which can rapidly be depleted during extended dry periods. When precipitation returns to normal, impacts on the agricultural sector are quick to diminish again due to the reliance on stored soil moisture.

For the 2009 Plan, to estimate losses due to drought, the NOAA NCDC database was evaluated for drought events in the ten years between 1998 and 2008. It was determined that these events caused approximately $50,000,000 in crop related damages (or $5,000,000 per year county-wide). Using this historical data for estimated annual damages county-wide, annual losses on a municipal level were estimated by distributed the annual county-wide losses using a weighted percentage of crop land/pasture land. This methodology did not take into account the degree of variation in value of various crops/livestock, or the degree of drought resistance and should be used for mitigation planning purposes only.

For this plan update, NCDC historical drought loss data was once again queried, this time for records current as of October 2015[13]. The data includes a total of two periods of drought between January 1996[14] and July 2015, both of which occurred between April and August of 1999. The event records estimated $0 in both property and crop damages for these events. This was presumed to be a function of ongoing changes to the NCDC data set, as opposed to true zero dollar losses, because episode narratives did present descriptions of often significant losses for these same events, but not in a manner that would permit an accurate breakdown of losses by jurisdiction or even by County.

The 2014 NYSHMP reports a SHELDUS total of three drought events in Ulster County from 1960 to 2012 and a total of $2,685,185 in crop damage ($895,062 per event; or $63,933 per year). Distributing across the 24 jurisdictions with land in agriculture based on the proportion of cultivated cropland in the community generates derived losses per jurisdiction, shown in **Table 3c.8**. Limitations in the data do seem to be resulting in the undercounting of actual damages and losses, and should be updated on a regular basis with each plan update as improved and more robust historic data becomes available.

Table 3c.8
Potential Annualized Losses from Drought by Jurisdiction

Jurisdiction	Estimated Population At Risk*	Area of Cultivated Cropland[15] (Acres)	Proportion of Cultivated Cropland (as percentage of Countywide total)	Annualized Estimated Crop Losses ($)
Denning, Town of	551	40	0.2%	$128
Ellenville, Village of	4,135	24	0.1%	$64
Esopus, Town of	9,041	306	1.2%	$767
Gardiner, Town of	5,713	1,211	4.9%	$3,133
Hardenburgh, Town of	238	61	0.2%	$128
Hurley, Town of	6,314	896	3.6%	$2,302
Kingston, City of	23,893	62	0.3%	$192
Kingston, Town of	889	79	0.3%	$192
Lloyd, Town of	10,863	901	3.7%	$2,366
Marbletown, Town of	5,607	2,938	12.0%	$7,672
Marlborough, Town of	8,808	3,560	14.5%	$9,270
New Paltz, Town of	14,003	1,480	6.0%	$3,836
New Paltz, Village of	6,818	43	0.2%	$128

[13] Queried on and still current as of October 2015; with data through July 2015.
[14] Events between 1950 and 1998 were not included in the NCDC database and, therefore, are not accounted for in this analysis.
[15] Cropland, pastureland, orchards, vineyards, nurseries and horticultural areas.

Table 3c.8 Potential Annualized Losses from Drought by Jurisdiction				
Jurisdiction	**Estimated Population At Risk***	**Area of Cultivated Cropland[15] (Acres)**	**Proportion of Cultivated Cropland (as percentage of Countywide total)**	**Annualized Estimated Crop Losses ($)**
Olive, Town of	4,419	166	0.7%	$448
Plattekill, Town of	10,499	1,557	6.3%	$4,028
Rochester, Town of	7,313	3,675	15.0%	$9,590
Rosendale, Town of	6,075	366	1.5%	$959
Saugerties, Town of	19,482	1,601	6.5%	$4,156
Saugerties, Village of	3,971	11	0.0%	$0
Shandaken, Town of	3,085	63	0.3%	$192
Shawangunk, Town of	14,332	2,875	11.7%	$7,480
Ulster, Town of	12,327	1,010	4.1%	$2,621
Wawarsing, Town of	13,157	1,445	5.9%	$3,772
Woodstock, Town of	5,884	199	0.8%	$511
Total	**182,493**	**24,567**	**100%**	**$63,933**

* Since the drought hazard area is countywide, 100 percent of the population is exposed and potentially at risk.

Flooding

Impacts – Flooding

Flooding can cause widespread damage throughout rural and urban areas, causing loss of life, injury, and severe structural damage to buildings, damaged or destroyed building contents, loss of function for flooded facilities, flooded roadways causing lengthy detour times and increased emergency response times, deposition of debris in and out of channels; damages to utility and communication networks; and agriculture losses. Flooding can cause damages to property, infrastructure, agriculture, and the environment. Local communities often bear the brunt of costs for emergency responders to provide guidance during the response phase, and lead the community through what is often a long recovery process thereafter. Buildings, roads, and bridges can be damaged or destroyed. Crops can be lost when farm fields are flooded. Functional downtime of businesses and/or damage to merchandise and equipment can have staggering impacts. Flooding can also cause sewage to backup into houses through drainpipes where backflow valves are not present. Unanchored fuel tanks can be easily moved by floodwater, causing environmental damage. When government facilities or critical facilities such as police stations, fire stations, hospitals, etc. are flooded – or where access routes to these structures are impassable due to floodwaters – impacts are even greater, with the community's ability to effectively and efficiently govern, provide emergency services and critical care for the injured. While recovery from these impacts can be quick for small-scale, short-duration events; larger events can cripple a community for weeks, months, and years to follow.

Exposure and Damage Estimates – Flooding

FEMA's 2013 Preliminary DFIRM flood mapping was overlaid upon the Ulster County Parcel data (2014) to identify the flood risk areas for all municipalities in the County, and the collated data is presented in **Tables 3c.9 and 3c.10**. All parcels that were intersected at any point by the DFIRM hazard area shape files were counted, and impacted improved property values were calculated by applying a percentage of the parcel area within the hazard area to the total improved value associated with that parcel to account for the uncertainty regarding the location of the structure(s) within each parcel, since without building footprint data it cannot be automatically assumed that all improvements lie exactly at the center of their associated parcels.

In total, about 5.7 percent of the County's land area lies within high or moderate flood risk zones[16], according to the Preliminary DFIRM mapping data. The Village of Saugerties has the highest proportion of land area within a high flood risk zone at 17.9 percent, followed closely by the Town of New Paltz (15 percent), Town of Ulster (13.9 percent) and City of Kingston (10.9 percent). For comparison purposes, the average Ulster County community has 6.4 percent of its land area in high risk flood zones, ranging from a low of zero percent in the Town of Plattekill, to 17.9 percent in the Village of Saugerties.

The GIS analysis indicates that the Towns of Shandaken, Denning, Kingston, and the Village of Ellenville have the greatest proportions of improved property values in high flood risk zones, with 22, 12, 11 and 10 percent in each municipality, respectively. For every other municipality in the County, the proportion of improved property within the mapped high flood risk zone is less than 9 percent. The average community value of improvements in high risk flood zones in Ulster County is $23.6 million; ranging from a minimum of zero dollars in the Town of Plattekill to a maximum of $84.8 million in the City of Kingston (followed by the Town of Woodstock with $60.9 million, Town of Olive with $60.1 million, and Town of Ulster with $52.3 million; every other community in the county has less than $45 million of improvements in high risk flood zones).

The assessment for this plan update represents an improvement over the prior version of the plan through use of more recent improvement values (2014), in addition to more recent and more accurate flood data (2013 Preliminary DFIRMs as opposed to the earlier Q3 data, which had a much higher potential margin of error).

For the purpose of generating an estimate of annual flood damages for the initial version of the plan in 2009, the NOAA NCDC database was queried to determine total flood damages for all recorded flood events in the County. At that time, the available period of recorded extended from 1998 to 2008, with total recorded property damages of $13,260,000 ($1,326,000 per year). Because the flood hazard is not uniform across the County, total annual damages were distributed across the County's 24 municipalities based on each community's proportional value of improved property in the flood hazard area to derive municipal average annual losses.

This same approach was used for this plan update. For the available period of recorded extending from January 1996 to July 2015, the NOAA NCDC database records 81 flood events with total recorded property damages of $24,171,000 ($1,272,158 per year). Because the flood hazard is not uniform across the County, total annual damages have been distributed across the County's 24 municipalities based on each community's proportional value of improved property in the 100-year flood hazard area to derive municipal average annual losses. The results are shown in **Table 3c.11.**

[16] FEMA Flood Zones A, AE, AO, X500

Table 3c.9
Acres of Land in Flood Hazard Areas by Municipality[17]

Municipality	Total Land Area (Acres)	High Flood Risk (Acres)	Moderate Flood Risk (Acres)	Low Flood Risk (Acres)	Land in High Flood Risk %	Land in Moderate Flood Risk %
		A, AE, AO	X500	X	A, AE, AO	X500
Denning, Town of	67,627	1,522	31	63,130	2.3%	0.0%
Ellenville, Village of	5,584	153	20	5,245	2.7%	0.4%
Esopus, Town of	23,880	1,571	79	22,221	6.6%	0.3%
Gardiner, Town of	27,798	2,100	206	25,780	7.6%	0.7%
Hardenburgh, Town of	51,704	1,003		50,027	1.9%	0.0%
Hurley, Town of	19,143	1,792	154	16,924	9.4%	0.8%
Kingston, City of	4,791	524	129	4,185	10.9%	2.7%
Kingston, Town of	4,929	87	44	4,610	1.8%	0.9%
Lloyd, Town of	20,010	1,989	85	17,987	9.9%	0.4%
Marbletown, Town of	34,862	2,768	6	32,445	7.9%	0.0%
Marlborough, Town of	15,661	88	20	15,630	0.6%	0.1%
New Paltz, Town of	21,680	3,247	254	16,953	15.0%	1.2%
New Paltz, Village of	1,098	90	14	962	8.2%	1.3%
Olive, Town of	37,408	1,047	305	36,279	2.8%	0.8%
Plattekill, Town of	22,471	-		22,268	0.0%	0.0%
Rochester, Town of	57,154	3,623	70	53,149	6.3%	0.1%
Rosendale, Town of	12,786	1,011	459	10,798	7.9%	3.6%
Saugerties, Town of	41,328	2,424	202	37,392	5.9%	0.5%
Saugerties, Village of	1,141	205	43	886	17.9%	3.8%
Shandaken, Town of	76,662	2,385	588	76,726	3.1%	0.8%
Shawangunk, Town of	35,876	2,056	202	33,510	5.7%	0.6%
Ulster, Town of	17,154	2,382	797	14,257	13.9%	4.6%
Wawarsing, Town of	83,523	3,551	189	74,537	4.3%	0.2%
Woodstock, Town of	43,065	1,518	328	41,429	3.5%	0.8%
Total	**727,333**	**37,136**	**4,225**	**677,330**	**5.1%**	**0.6%**

Source: FEMA: Preliminary DFIRM Data, 2013; Ulster County Parcel Data, 2014.

[17] Zones A/AE/AO (100-year floodplain), Zone X500 (500-year floodplain), and Zone X (areas above the 500-year floodplain)

Table 3c.10
Improved Values in Flood Hazard Areas by Municipality*

Municipality	Total Value of Improvements	Improved Value in High Flood Risk Areas	Improved Value in Moderate Flood Risk Areas	Improved Value in Low Flood Risk Areas	Improved Value in High Flood Risk Areas %	Improved Value in Moderate Flood Risk Areas %
		A, AE, AO	X500	X	A, AE, AO	X500
Denning, Town of	$9,833,691	$1,142,100	$109,125	$8,556,522	12%	1%
Ellenville, Village of	$3,212,219	$316,352	$71,663	$2,824,203	10%	2%
Esopus, Town of	$664,657,631	$19,121,774	$2,899,484	$642,530,727	3%	0%
Gardiner, Town of	$496,051,960	$29,220,826	$4,018,828	$462,812,319	6%	1%
Hardenburgh, Town of	$33,780,150	$1,954,326		$31,825,824	6%	0%
Hurley, Town of	$601,531,347	$19,882,899	$7,916,865	$573,731,604	3%	1%
Kingston, City of	$1,356,698,046	$84,778,461	$30,637,735	$1,241,281,899	6%	2%
Kingston, Town of	$52,412,700	$5,720,460	$3,493,358	$43,198,886	11%	7%
Lloyd, Town of	$715,492,192	$44,418,859	$7,187,797	$663,729,130	6%	1%
Marbletown, Town of	$820,874,962	$31,154,381	$647,720	$789,072,863	4%	0%
Marlborough, Town of	$498,122,686	$2,337,568	$1,470,972	$494,164,260	0%	0%
New Paltz, Town of	$546,080,883	$25,297,709	$3,454,996	$517,328,182	5%	1%
New Paltz, Village of	$658,909,400	$9,873,909	$1,540,749	$647,494,940	1%	0%
Olive, Town of	$830,987,819	$60,129,895	$24,792,453	$746,065,362	7%	3%
Plattekill, Town of	$444,556,917	$0		$439,281,460	0%	0%
Rochester, Town of	$499,688,381	$22,570,844	$2,165,847	$474,951,692	5%	0%
Rosendale, Town of	$343,409,911	$17,512,334	$26,000,718	$299,896,870	5%	8%
Saugerties, Town of	$895,836,873	$35,671,933	$5,576,892	$854,570,694	4%	1%
Saugerties, Village of	$215,364,249	$9,264,431	$4,393,298	$201,706,516	4%	2%
Shandaken, Town of	$100,772,350	$22,032,958	$11,881,738	$66,825,977	22%	12%
Shawangunk, Town of	$170,465,425	$8,636,448	$1,110,301	$159,646,684	5%	1%
Ulster, Town of	$847,716,567	$52,300,166	$53,004,399	$742,411,951	6%	6%
Wawarsing, Town of	$13,835,638	$1,047,980	$153,539	$12,280,275	8%	1%
Woodstock, Town of	$971,926,625	$60,936,828	$16,613,201	$894,114,062	6%	2%
Total	**$11,792,218,622**	**$565,323,442**	**$209,141,678**	**$11,010,302,902**	**5%**	**2%**

* Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Table 3c.11
Potential Annualized Losses from Flood by Jurisdiction

Jurisdiction	Total Value of Improvements*	Total Value of Improvements in the Flood Hazard Area	Proportion of Municipal Improvements in the 100yr Flood Hazard Area	Annual Loss Estimates, Flood
Denning, Town of	$9,833,691	$1,142,100	0.20%	$2,570
Ellenville, Village of	$3,212,219	$316,352	0.06%	$712
Esopus, Town of	$664,657,631	$19,121,774	3.38%	$43,030
Gardiner, Town of	$496,051,960	$29,220,826	5.17%	$65,756
Hardenburgh, Town of	$33,780,150	$1,954,326	0.35%	$4,398
Hurley, Town of	$601,531,347	$19,882,899	3.52%	$44,743
Kingston, City of	$1,356,698,046	$84,778,461	15.00%	$190,779
Kingston, Town of	$52,412,700	$5,720,460	1.01%	$12,873
Lloyd, Town of	$715,492,192	$44,418,859	7.86%	$99,957
Marbletown, Town of	$820,874,962	$31,154,381	5.51%	$70,107
Marlborough, Town of	$498,122,686	$2,337,568	0.41%	$5,260
New Paltz, Town of	$546,080,883	$25,297,709	4.47%	$56,928
New Paltz, Village of	$658,909,400	$9,873,909	1.75%	$22,219
Olive, Town of	$830,987,819	$60,129,895	10.64%	$135,311
Plattekill, Town of	$444,556,917	$0	0.00%	$0
Rochester, Town of	$499,688,381	$22,570,844	3.99%	$50,792
Rosendale, Town of	$343,409,911	$17,512,334	3.10%	$39,408
Saugerties, Town of	$895,836,873	$35,671,933	6.31%	$80,273
Saugerties, Village of	$215,364,249	$9,264,431	1.64%	$20,848
Shandaken, Town of	$100,772,350	$22,032,958	3.90%	$49,581
Shawangunk, Town of	$170,465,425	$8,636,448	1.53%	$19,435
Ulster, Town of	$847,716,567	$52,300,166	9.25%	$117,692
Wawarsing, Town of	$13,835,638	$1,047,980	0.19%	$2,358
Woodstock, Town of	$971,926,625	$60,936,828	10.78%	$137,127
Total:	**$11,792,218,622**	**$565,323,442**	**100.00%**	**$1,272,158**

***** Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Ice Jams

Impacts – Ice Jams

Flooding caused by ice jams is similar to flash flooding. Ice jam formation causes a rapid rise of water at the jam and extending upstream. Failure or release of the jam causes sudden flooding downstream. The suddenness of a jam's formation and release can cause more widespread and more significant impacts. So, too, can the degree of impacts be increased for longer duration events. The impacts of ice jam related flooding are the same as other types of flood impacts; see previous description on Page 3c-19.

Estimated Damages – Ice Jams

It is difficult to identify particular areas that are generally prone to ice jam flooding because the hazard can be very localized. The formation of ice jams depends on the weather and physical conditions in river channels. Unlike the typical violent flash flooding occurrences where steep terrain is present, ice jams are most likely to occur where the channel slope naturally decreases, where culverts freeze solid at headwaters of reservoirs, at natural channel restrictions such as bends and bridges, and along shallows where channels may freeze solid. The ice jam hazard and associated damages are assumed to be possible in eight of Ulster County's 24 municipalities where past occurrences are documented, based on a review of historical records in the USACE CRREL database of events. The CRREL database notes 64 events for the 90 year period of record between 1925 and 2015. Dollar damages are listed as unknown for most of the event records.

Due to the nature of the terrain and the climate in Ulster County, ice jam events are essentially certain to continue to occur in the future, although whether or not such events will cause significant damage is less easy to predict, since detailed records of actual damage caused by ice jams are scarce.

Damage from ice jam flooding usually exceeds that caused by open water flooding. Flood elevations are usually higher than predicted for free-flow conditions and water levels may change rapidly. Additional physical damage is caused by the force of ice impacting buildings and other structures. Because of the sometimes unpredictable nature of ice jam floods, FEMA's Flood Insurance Rate Maps often do not reflect ice jam flood threats.

Loss estimation methodologies are not currently available for estimating ice jam damages. Sufficient historical data regarding events and associated losses was not available to quantify here. For the purpose of this analysis, some assumptions have been made for planning purposes. First, CRREL reports 64 events over a 90 year period, or an average of 0.71 events per year. Due to the limitations of the data, meaningful estimates of average annual damages are not quantifiable for the impacted communities. Based on the number of historic occurrences, estimates have been made as whether or not average annual damages in each impacted community could be potentially significant (more than $5,000). With this rudimentary methodology, estimated average annual damages for ice jams are presented in **Table 3c.12**. The margin of error is likely quite high, using this methodology and given the assumptions necessary and limitations of the dataset.

Table 3c.12 Annual Loss Estimates – Ice Jams				
Jurisdiction	**Total Value of Improvements***	**Total Value of Improvements in the 100-year Flood Hazard Area**	**Number of Recorded Events**	**Annual Loss Estimates, Ice Jams***
Denning, Town of	$9,833,691	$1,142,100	2	U_N
Ellenville, Village of	$3,212,219	$316,352	2	U_N
Esopus, Town of	$664,657,631	$19,121,774	0	$0
Gardiner, Town of	$496,051,960	$29,220,826	38	U_S
Hardenburgh, Town of	$33,780,150	$1,954,326	0	$0
Hurley, Town of	$601,531,347	$19,882,899	0	$0
Kingston, City of	$1,356,698,046	$84,778,461	1	U_N
Kingston, Town of	$52,412,700	$5,720,460	0	$0
Lloyd, Town of	$715,492,192	$44,418,859	0	$0
Marbletown, Town of	$820,874,962	$31,154,381	0	$0
Marlborough, Town of	$498,122,686	$2,337,568	0	$0
New Paltz, Town of	$546,080,883	$25,297,709	3	U_N
New Paltz, Village of	$658,909,400	$9,873,909	0	$0
Olive, Town of	$830,987,819	$60,129,895	0	$0
Plattekill, Town of	$444,556,917	$0	0	$0
Rochester, Town of	$499,688,381	$22,570,844	0	$0
Rosendale, Town of	$343,409,911	$17,512,334	12	U_S
Saugerties, Town of	$895,836,873	$35,671,933	0	$0
Saugerties, Village of	$215,364,249	$9,264,431	0	$0
Shandaken, Town of	$100,772,350	$22,032,958	2	U_N
Shawangunk, Town of	$170,465,425	$8,636,448	4	U_N
Ulster, Town of	$847,716,567	$52,300,166	0	$0
Wawarsing, Town of	$13,835,638	$1,047,980	0	$0
Woodstock, Town of	$971,926,625	$60,936,828	0	$0
Total, County-wide:	**$11,792,218,622**	**$565,323,442**	**64**	**U_S**

* Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.
** U_S = Unquantifiable but likely to be significant
U_N = Unquantifiable but likely to be negligible

Earthquake

Impacts – Earthquake

Most earthquake-related property damage and deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the extent and duration of the shaking. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (in mountain regions and along hillsides), and liquefaction.

According to USGS data, damage caused by an earthquake will begin at a level of ground shaking (peak ground acceleration, or PGA) of approximately ten percent of the force of gravity (0.1g, or 10%g). Below this level, damages are typically very slight except in unusually vulnerable facilities. Damages from ground shaking at 10%g to 20%g tend to be minor to moderate, with only unusually poor buildings being subject to potential collapse. Events in the range of 20%g to 50%g may cause significant damage in some modern buildings and very high levels of damage (include collapse) in poorly designed buildings. Events more than 50%g may cause higher levels of damage in many buildings, even those designed to resist seismic forces. The probability of significant, damaging earthquake events affecting Ulster County is low. According to the United States Geological Survey (USGS), an earthquake with a 10 percent probability of

exceedance over 50 years would have PGA values between 2%g and 3%g, which would result in light to moderate perceived shaking and damages ranging from none to very light. More destructive earthquakes are very rare, low probability events for Ulster County with highly infrequent recurrence periods.

Exposure and Damage Estimates – Earthquake

Because earthquakes often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted.

Seismic hazard maps for New York show because of the low frequency of occurrence and the relatively low levels of ground shaking that would be experienced; the entire State of New York can be expected to have a low-to-moderate risk to earthquake damage as compared to other areas of the country.

Historical records indicate the occurrence of approximately one earthquake per year in New Jersey. The most likely earthquake in New Jersey is not likely to be particularly intense, or particularly damaging.

Earthquakes with higher PGAs cause more damage, but have a lower probability of occurrence. Conversely, earthquakes with low PGAs such as those that could potentially impact Ulster County, have a higher probability of occurrence but would only cause negligible to minor damage due to light shaking. In comparison to PGAs above 0.25g which can cause strong to violent shaking and major damage, expected PGAs for Ulster County will likely only cause negligible to light shaking and negligible to minor damage. Estimated losses for a 100-year earthquake event in Ulster County are considered to be negligible. **Table 3c.13** shows NYSHMP estimated annualized losses[18], extracted from their HAZUS probabilistic earthquake run for return periods of 100, 250, 500, 750, 1000, 1500, 2000, and 2500-year events.

Table 3c.13
Annualized Earthquake Losses for Ulster County*

Category	Annualized Losses
Structural Damage	$76,000
Non-structural Damage	$219,000
Contents Damage	$70,000
Inventory Loss	$2,000
Relocation Loss	$47,000
Capital Related Loss	$21,000
Wage Loss	$28,000
Rental Income Loss	$27,000
Total Annualized Loss	**$489,000**

**Source: New York State Hazard Mitigation Plan, 2014*

For the purpose of estimating annual earthquake damages at this time, we have compared the 2014 State Plan's estimated annual earthquake losses for Ulster County ($489,000) to the total value of all improvements in Ulster County ($11,792,218,622) and have determined that based on this, annualized losses represent roughly 0.004 percent of Ulster County's improved property value. Applying this same percentage to each of the County's municipalities (since the earthquake hazard is nearly uniform across the county) yields the following estimated annual damages to improved property for earthquakes. Note that these estimates do not directly incorporate any magnification of damages due to soil type.

[18] NYSHMP, 2014.

Table 3c.3 Potential Annualized Losses from Earthquake by Jurisdiction			
Jurisdiction	**Estimated Population At Risk***	**Total Value of Improvements**	**Annual Loss Estimate, Earthquakes**
Denning, Town of	551	$9,833,691	$408
Ellenville, Village of	4,135	$3,212,219	$133
Esopus, Town of	9,041	$664,657,631	$27,562
Gardiner, Town of	5,713	$496,051,960	$20,570
Hardenburgh, Town of	238	$33,780,150	$1,401
Hurley, Town of	6,314	$601,531,347	$24,944
Kingston, City of	23,893	$1,356,698,046	$56,260
Kingston, Town of	889	$52,412,700	$2,173
Lloyd, Town of	10,863	$715,492,192	$29,670
Marbletown, Town of	5,607	$820,874,962	$34,040
Marlborough, Town of	8,808	$498,122,686	$20,656
New Paltz, Town of	14,003	$546,080,883	$22,645
New Paltz, Village of	6,818	$658,909,400	$27,324
Olive, Town of	4,419	$830,987,819	$34,459
Plattekill, Town of	10,499	$444,556,917	$18,435
Rochester, Town of	7,313	$499,688,381	$20,721
Rosendale, Town of	6,075	$343,409,911	$14,241
Saugerties, Town of	19,482	$895,836,873	$37,149
Saugerties, Village of	3,971	$215,364,249	$8,931
Shandaken, Town of	3,085	$100,772,350	$4,179
Shawangunk, Town of	14,332	$170,465,425	$7,069
Ulster, Town of	12,327	$847,716,567	$35,153
Wawarsing, Town of	13,157	$13,835,638	$574
Woodstock, Town of	5,884	$971,926,625	$40,304
Total:	**182,493**	**$11,792,218,622**	**$489,000**

* Since the earthquake hazard area is county-wide, 100 percent of the population is exposed and potentially at risk. Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.

Landslide

Impacts – Landslide

Potential impacts of landslides include environmental disturbance, property and infrastructure damage, and injuries or fatalities. Landslide impacts are typically limited to those areas immediately surrounding the slope failure. The structural integrity of buildings in the affected area can be compromised, or the entire building can be destroyed. Roadways and drainage systems in affected areas can be damaged or destroyed as well. Because landslides happen without warning, loss of life and injuries in affected areas are also possible.

Exposure and Damage Estimates - Landslide

To estimate exposure to landslide, the determination of value and population at-risk was calculated through GIS analysis by calculating the proportion of a parcel or census block lying within an area mapped as having high landslide incidence or susceptibility, and applying that same ratio to the parcel value to estimate value of improvements at risk. **Table 3c.14** shows exposure to landslide by jurisdiction.

Table 3c.14
Exposure to Landslide by Jurisdiction

Jurisdiction	Total Assessed Value of Improvements* (Buildings)	Total Assessed Value of Buildings Located in Areas Mapped as Having High Landslide Susceptibility and/or Incidence**	Percent of Total Building Value Exposed to Landslide***
Denning, Town of	$9,833,691	$3,632,011	36.9%
Ellenville, Village of	$3,212,219	$0	0.0%
Esopus, Town of	$664,657,631	$357,458,025	53.8%
Gardiner, Town of	$496,051,960	$0	0.0%
Hardenburgh, Town of	$33,780,150	$1,290,881	0.0%
Hurley, Town of	$601,531,347	$0	0.0%
Kingston, City of	$1,356,698,046	$112,373,244	8.3%
Kingston, Town of	$52,412,700	$0	0.0%
Lloyd, Town of	$715,492,192	$449,566,124	62.8%
Marbletown, Town of	$820,874,962	$0	0.0%
Marlborough, Town of	$498,122,686	$251,661,609	50.5%
New Paltz, Town of **	$546,080,883	Potential for > $0	Potential for > 0.0%
New Paltz, Village of	$658,909,400	$0	0.0%
Olive, Town of	$830,987,819	$74,098,386	8.9%
Plattekill, Town of	$444,556,917	$0	0.0%
Rochester, Town of	$499,688,381	$1,733,715	0.3%
Rosendale, Town of	$343,409,911	$0	0.0%
Saugerties, Town of	$895,836,873	$145,954,807	16.3%
Saugerties, Village of	$215,364,249	$33,838,043	15.7%
Shandaken, Town of	$100,772,350	$100,720,305	99.9%
Shawangunk, Town of	$170,465,425	$0	0.0%
Ulster, Town of	$847,716,567	$59,826,905	7.1%
Wawarsing, Town of	$13,835,638	$2,226	0.02%
Woodstock, Town of	$971,926,625	$433,178,552	44.6%
Total:	**$11,792,218,622**	**$2,025,334,832**	**17.2%**

* Value of improvements at risk may not include some public buildings, tax exempt structures, and reservoirs.
**Exposure calculated by GIS analysis using local improved values in high landslide incidence/susceptibility areas. Due to limitations in the horizontal accuracy of the USGS GIS data used for mapping, actual exposure is likely to be very different from the estimates above (higher in some areas, and lower in others). Future updates of the plan should use any new USGS landslide hazard area mapping as it becomes available.
*** Potential for >$0, Potential for > 0%, Town of New Paltz: The USGS does not include mapped areas of high landslide susceptibility/incidence in the Town of New Paltz; therefore, GIS analyses of exposure of people and property to the hazard yields zero results. However, because landslides are more likely to occur in locations where they have happened previously, the presence of historic occurrences in the Town would suggest some potential exposure of people and property that are not able to be captured or estimated using best available data and analysis methodologies.

Any damage resulting from a landslide would most likely be localized, and it is unlikely that all areas of high landslide susceptibility/incidence in the county would experience landslide impacts at the same time. Therefore, it is difficult to estimate potential losses in a landslide event. Given the lack of detailed historical loss data on significant landslide occurrences in Ulster County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for all jurisdictions exposed to this hazard.

Wildfire

Impacts – Wildfires

Wildfires have the potential to destroy large portions of a community. Firefighters are at risk during the time that they are trying to contain and control the blaze. Loss of life and injuries are possible for people living, working, or traveling through an impacted area. Beyond the loss of vegetation that wildfires leave in their wake, structures in the wildland/urban interface can be severely damaged or destroyed. Following a large wildfire, the possibility exists for significant increases in stormwater runoff, mudslides, and landslides which can lead to downstream flooding. Depending on the scale of the impacted area and the type and numbers of buildings and infrastructure impacted, secondary effects are possible on local economies and the social fabric of communities following the event.

Exposure and Damage Estimates - Wildfires

To estimate exposure to wildfire, the determination of value at-risk was calculated through GIS analysis by calculating the proportion of a parcel located within areas of Ulster County that are considered to be potentially susceptible to wildfires (including the following land cover types: deciduous, evergreen, and mixed forest, shrub land, and grassland), and applying that same ratio to the census block population and parcel value to estimate the value of improvements at risk. Nearly 40 percent of the total value of improvements in the County is located in areas considered to be potentially susceptible to wildfires. **Table 3c.23** shows exposure to wildfire by jurisdiction.

Table 3c.23
Exposure to Wildfire by Jurisdiction

Jurisdiction	Total Value of Improvements (Buildings)	Value of Improvements Within Wildfire Risk Zones	Percent of Total Building Value Exposed to Wildfire
Denning, Town of	$9,833,691	$8,679,468	88.3%
Ellenville, Village of	$3,212,219	$276,026	8.6%
Esopus, Town of	$664,657,631	$276,807,524	41.6%
Gardiner, Town of	$496,051,960	$230,036,799	46.4%
Hardenburgh, Town of	$33,780,150	$29,103,365	86.2%
Hurley, Town of	$601,531,347	$299,583,956	49.8%
Kingston, City of	$1,356,698,046	$63,215,694	4.7%
Kingston, Town of	$52,412,700	$31,961,497	61.0%
Lloyd, Town of	$715,492,192	$183,600,368	25.7%
Marbletown, Town of	$820,874,962	$530,638,537	64.6%
Marlborough, Town of	$498,122,686	$80,199,911	16.1%
New Paltz, Town of **	$546,080,883	$219,033,719	40.1%
New Paltz, Village of	$658,909,400	$52,985,802	8.0%
Olive, Town of	$830,987,819	$613,656,214	73.8%
Plattekill, Town of	$444,556,917	$207,150,489	46.6%
Rochester, Town of	$499,688,381	$298,781,174	59.8%
Rosendale, Town of	$343,409,911	$144,155,713	42.0%
Saugerties, Town of	$895,836,873	$398,297,739	44.5%
Saugerties, Village of	$215,364,249	$15,573,966	7.2%
Shandaken, Town of	$100,772,350	$63,170,776	62.7%

Table 3c.23 Exposure to Wildfire by Jurisdiction			
Jurisdiction	**Total Value of Improvements (Buildings)**	**Value of Improvements Within Wildfire Risk Zones**	**Percent of Total Building Value Exposed to Wildfire**
Shawangunk, Town of	$170,465,425	$63,856,816	37.5%
Ulster, Town of	$847,716,567	$148,445,522	17.5%
Wawarsing, Town of	$13,835,638	$9,593,001	69.3%
Woodstock, Town of	$971,926,625	$676,607,139	69.6%
Total:	**$11,792,218,622**	**$4,645,411,214**	**39.4%**

Given the lack of detailed historical loss data on significant wildfire occurrences resulting in large-scale structural losses in Ulster County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate in each jurisdiction exposed to this hazard.

Conclusions on Hazard Risk

The results of this vulnerability assessment are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in Ulster County through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in Ulster County. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in Ulster County. This final step in the risk assessment provides the necessary information for local officials to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the county.

Using the previously described methodology, economic results were estimated for the different hazards profiled earlier in this section. The economic loss results are summarized in **Table 3c.24** using Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., jurisdiction). The estimated AL addresses the two key components of risk: the probability of the hazard occurring in the jurisdiction and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

Table 3c.24
Annualized Building Losses by Hazard by Jurisdiction

Jurisdiction	Atmospheric							Hydrologic					Geologic		Other
	Extreme Temperatures	Extreme Wind	Hurricane & Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Dam Failure	Drought* *(Crop Losses Only)*	Flood	Ice Jam	Surge	Earthquake	Landslide	Wildfire
Denning, Town of	U_N	$118	U_S	$29	U_S	$65	$977	$0	$128	$2,570	U_N	$0	$408	U_N	U_N
Ellenville, Village of	U_N	$39	U_S	$9	U_S	$21	$319	U_N	$64	$712	U_N	$0	$133	$0	U_N
Esopus, Town of	U_N	$7,981	U_S	$1,940	U_S	$4,403	$66,037	U_N	$767	$43,030	$0	$0	$27,562	U_N	U_N
Gardiner, Town of	U_N	$5,956	U_S	$1,448	U_S	$3,286	$49,285	$0	$3,133	$65,756	U_S	U_S	$20,570	$0	U_N
Hardenburgh, Town of	U_N	$406	U_S	$99	U_S	$224	$3,356	$0	$128	$4,398	$0	$0	$1,401	U_N	U_N
Hurley, Town of	U_N	$7,223	U_S	$1,756	U_S	$3,985	$59,765	U_N	$2,302	$44,743	$0	$0	$24,944	$0	U_N
Kingston, City of	U_N	$16,290	U_S	$3,960	U_S	$8,988	$134,795	U_N	$192	$190,779	U_N	$0	$56,260	U_N	U_N
Kingston, Town of	U_N	$629	U_S	$153	U_S	$347	$5,207	U_N	$192	$12,873	$0	U_S	$2,173	$0	U_N
Lloyd, Town of	U_N	$8,591	U_S	$2,088	U_S	$4,740	$71,088	$0	$2,366	$99,957	$0	$0	$29,670	U_N	U_N
Marbletown, Town of	U_N	$9,856	U_S	$2,396	U_S	$5,438	$81,558	U_N	$7,672	$70,107	$0	U_S	$34,040	$0	U_N
Marlborough, Town of	U_N	$5,981	U_S	$1,454	U_S	$3,300	$49,491	$0	$9,270	$5,260	$0	$0	$20,656	U_N	U_N
New Paltz, Town of **	U_N	$6,557	U_S	$1,594	U_S	$3,618	$54,256	$0	$3,836	$56,928	U_N	U_S	$22,645	U_N	U_N
New Paltz, Village of	U_N	$7,912	U_S	$1,923	U_S	$4,365	$65,466	$0	$128	$22,219	$0	$0	$27,324	$0	U_N
Olive, Town of	U_N	$9,978	U_S	$2,426	U_S	$5,505	$82,563	U_N	$448	$135,311	$0	$0	$34,459	U_N	U_N
Plattekill, Town of	U_N	$5,338	U_S	$1,298	U_S	$2,945	$44,169	$0	$4,028	$0	$0	$0	$18,435	$0	U_N
Rochester, Town of	U_N	$6,000	U_S	$1,459	U_S	$3,311	$49,647	U_N	$9,590	$50,792	$0	$0	$20,721	U_N	U_N
Rosendale, Town of	U_N	$4,123	U_S	$1,002	U_S	$2,275	$34,119	U_N	$959	$39,408	U_S	$0	$14,241	$0	U_N
Saugerties, Town of	U_N	$10,756	U_S	$2,615	U_S	$5,935	$89,006	U_N	$4,156	$80,273	$0	$0	$37,149	U_N	U_N
Saugerties, Village of	U_N	$2,586	U_S	$629	U_S	$1,427	$21,398	U_N	$0	$20,848	$0	U_S	$8,931	U_N	U_N
Shandaken, Town of	U_N	$1,210	U_S	$294	U_S	$668	$10,012	$0	$192	$49,581	U_N	U_S	$4,179	U_N	U_N
Shawangunk, Town of	U_N	$2,047	U_S	$498	U_S	$1,129	$16,937	$0	$7,480	$19,435	U_N	$0	$7,069	$0	U_N
Ulster, Town of	U_N	$10,179	U_S	$2,474	U_S	$5,616	$84,225	U_N	$2,621	$117,692	$0	$0	$35,153	U_N	U_N
Wawarsing, Town of	U_N	$166	U_S	$40	U_S	$92	$1,375	U_N	$3,772	$2,358	$0	U_S	$574	U_N	U_N
Woodstock, Town of	U_N	$11,670	U_S	$2,837	U_S	$6,439	$96,566	U_N	$511	$137,127	$0	$0	$40,304	U_N	U_N
Total	**U_S**	**$141,591**	**U_S**	**$34,421**	**U_S**	**$78,125**	**$1,171,616**	**U_S**	**$63,933**	**$1,272,158**	**U_S**	**U_S**	**$489,000**	**U_S**	**U_S**

**Potential Crop Losses Only; Data allowed for estimate of a county-wide total but not a jurisdiction specific estimate. Communities with USDA reported 0 acres in agriculture were assigned $0 average annual crop losses for planning purposes. U_N = Unquantifiable presumably negligible (< $5,000 annual average damage). U_S = Unquantifiable potentially significant (>$5,000 annual average damage*

SECTION 3d - RISK ASSESSMENT: EXISTING LAND USES AND FUTURE DEVELOPMENT TRENDS IN HAZARD AREAS

Section Overview

Ulster County has a total land area of 1,124 square miles[1], much of which has already been developed. However, a large amount of land remains undeveloped. Future development may affect hazard vulnerability. This section will provide information for communities to better understand the potential implications of future growth and development with regard to hazard vulnerability, and how community resiliency can be increased by integrating hazard mitigation practices and principles in local decision making processes regulating land use and new development.

The Ulster County Planning Department is responsible for managing the County's Comprehensive Plan Document. The department has accomplished this task through the adoption of individual Housing, Transportation, and Open Space Plans. The Ulster County Greenway Compact, currently in progress, will be a unifying document to connect each of these individual planning efforts.

Per General Municipal Law and the Ulster County Compact, the Ulster County Planning Board (UCPB) and its staff is responsible for reviewing municipal plans, law amendments, site plans and special permits, and area and use variances as it relates to having a countywide impact. The UCPB offers constructive criticism and technical advice to help communities achieve their long term planning goals as its response to these referred actions. The Department offers a Land Use Referral Guide and maintains a local land use library to aide communities in the referral process.

Historic Context

While much of Ulster County's lands are mountainous, many of its river valleys were occupied by Native American tribes (i.e., the Esopus tribe of Lenape Indians, the Wappingers, and the Mohawk) who used the land for farming. The Esopus occupied what is present-day Kingston at the time that Henry Hudson first explored the Hudson River in 1609. Five years later, a trading post was established by the Dutch at this location. Conflicts with the Native American populations ensued until the late 1600's, with settlements being established and subsequently broken up several times at various locations. In September 1664, a treaty was signed establishing the boundaries of Native lands and requiring that these lands could not be taken without payment and mutual agreement. Over the next two decades, Esopus lands were bought up by the settlers, who generally clustered in the County's broad river valleys of the Rondout, Esopus and Walkill which provided access and transportation of goods.

Ulster County was formally established in 1683. Thereafter, early settlers used the land for trading, farming and agriculture. In 1777, the capital of New York State was established in Kingston. Before the turn of the century, the County was largely an agrarian society.

Dairy farms and the growing of grain crops were the main types of farming of the 1800's and early 1900's. Over the course of the 1800's, the County's streams provided advantageous mill power. The Delaware and Hudson Canal, which linked Pennsylvania with the Hudson River at Rondout near Kingston, was completed in 1825. The first sawmill was built in 1827. Valuable minerals were mined and transported. By the late 1800's, commerce - carried on by means of river and canal - was large and

[1] As per Census 2010.

increasing. The County had become known for its cement manufacture and stone quarrying, sawmills, gristmills, and tanneries; manufacture of glass, earthenware, iron, sole leather, and axes; agriculture in the form of lands adapted to grazing, dairying, growing of spring grain, and fruit growing; brick manufactures and stone trade; cement and lime factories; breweries; paper mills; growth of hemlock and hardwood. The rapid growth of railroads in the late 1800's quickly replaced the Delaware and Hudson Canal as the primary means of transporting goods and services to and from Ulster County. By 1910, the canal was no longer used. Trolley cars had come into vogue and soon thereafter the automobile, truck and refrigeration services rapidly increased as means of transporting merchandise. By the 1930's, passenger service had practically ceased in the county; and by the late 1950's, it became evident that the use of the railroads for transport of goods and services had also begun to decline. Throughout the 1900's, apple orchards and grape vineyards increased in number and replaced many acres once tilled for farm crops. Large corporations, such as IBM, brought thousands of people to the area in the latter half of the 20th Century, when much of the Hudson River Valley was known as "Tech Valley", thereby creating new centers of increased population, and need for more schools and housing. Over time, however, many of these large corporations closed their doors and/or relocated to other areas, leaving lasting impacts on the local economy to this day.

The influx of people, structures, and infrastructure over time has exposed more assets to the effects of natural hazards. For example, early development in the County tended to be in floodplains, as those areas provided access to fresh water, fertile land for farming, easy access to transportation (boat, and also rail and canal systems which often paralleled major rivers), and flat land for construction. Over time, these early settlements expanded into many of the communities that make up Ulster County today. We now know, however, the tremendous cost and economic burden associated with buildings and infrastructure located in the floodplain. Some of Ulster County's worst natural disasters have been due to flooding, and its impacts on the people and property in the region's many floodplain areas. Today, all of Ulster County's communities participate in FEMA's National Flood Insurance Program, and have adopted floodplain management ordinances to regulate new construction and substantial improvements in floodplain areas to offer protection during a 100-year event. Another example involves the County's many steep slopes. While historic development tended to steer away from Ulster County's steep slopes in favor of relatively easy construction on flat lands in the valleys, there is a certain demand today for development on hillsides that offer views of the County's scenic mountains and valleys. This increases landslide risk as well as wildfire risk. Some communities have adopted steep slope ordinances, for example, to regulate development and mitigate this risk. As Ulster County continues to grow, it will face ongoing challenges of expanding in a manner that balances a need for fostering economic growth while doing so in a manner that mitigates risk and strives toward community resiliency.

Land Use

Figure 3d.1 presents a graphical depiction of updated land use in Ulster County. More than half the County land area is forested, with only a little under 7 percent of the County classified as developed. While cultivated land and other farmland accounts for less than 10 percent of the County's land area, agriculture/farming is locally considered to be of paramount importance to the economy and the character of the County.

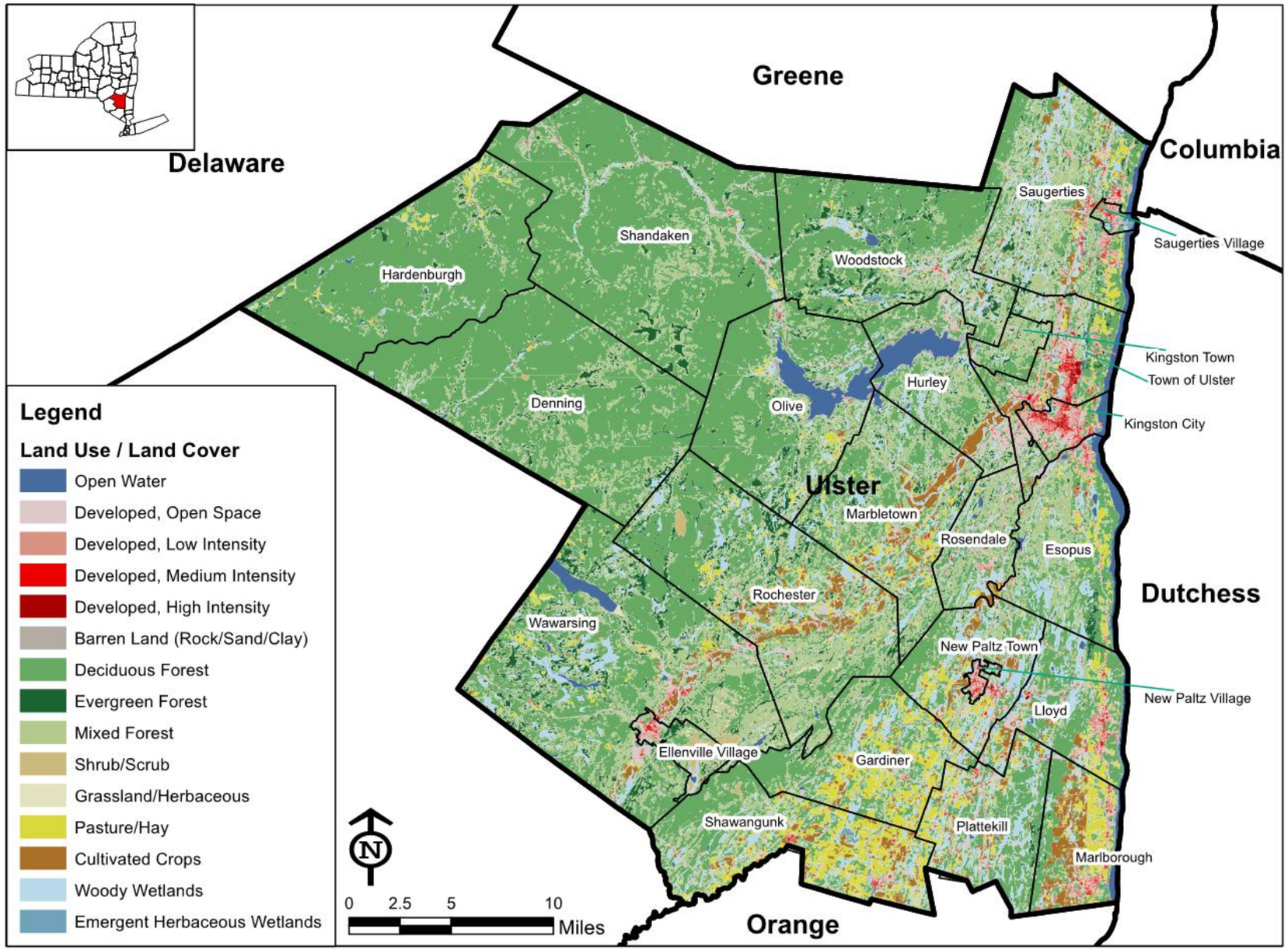
Ulster County has a long history of open space protection. Our Shawangunk Ridge and "forever wild" Catskill Forest Preserve are two of the most significant open spaces in the Hudson Valley. Each community in the county has valuable open space resources. Abundant and critical water resources, rich biodiversity, renowned recreational and historic sites, and valuable, productive agricultural lands are all part of Ulster County's open space landscape. These contribute to the well-being of the region's

environment, economy and quality of life. The Ulster County Open Space Plan is the result of input from stakeholder groups throughout the County. It is founded on an understanding of sound resource management and planning policies that reflect the needs and values of the people, places, and existing natural resources of the County. It was brought to fruition through the joint efforts of the Environmental Management Council and the County Planning Board.

Notable areas of designated open space include:

- Catskill Forest Preserve with 160,000 acres
- Minnewaska State Park with 12,000 acres
- Mohonk Preserve with more than 6,500 acres
- Two County parks (one with over 3,000 feet of Hudson River Frontage and one with 150 acres)

Figure 3d.1: Ulster County Land Use / Land Cover



Source: NLCD 2011 Land Cover (2011 Edition, amended 2014), 2014.

Changes in Land Use

The initial 2009 HMP was prepared using National Land Cover Databased (NLCD) 2001 land cover data. Best available data at the time of the plan update was NLCD 2011 land cover data. **Table 3d.1** shows changes in land use since the last version of the plan was prepared. Some changes observed in this plan update are due, in large part, to having better imagery available that enabled their delineators to refine polygon classifications and line placements to more accurately map the landscape. Other refinements have included additional water categories (from previous wetland classifications) that have increased the reported water area. These improvements do affect the acreage values of many categories previously reported in the 2009 HMP (which used NLCD 2001 Use/Land Cover data). Despite the impact of various base data adjustments to actual acreages, the percentages shown in the following table seems to affirm general, local observations regarding changes in land use where local agricultural and forested areas continue to be developed.

Table 3d.1
Ulster County Land Cover Estimates

Description of Land Use	Percent of Land Use, 2009 HMP*	Percent of Land Use, 2015 HMP Update	Change in Land Use , Acres, year to 2011
Open Water	2.7%	2.8%	480
Developed, Open Space	4.8%	4.7%	-445
Developed, Low Intensity	1.2%	1.4%	1,511
Developed, Medium Intensity	0.4%	0.6%	914
Developed, High Intensity	0.2%	0.2%	306
Barren Land (Rock/Sand/Clay)	0.2%	0.2%	227
Deciduous Forest	50.4%	53.9%	26,235
Evergreen Forest	5.2%	6.0%	6,115
Mixed Forest	15.9%	14.7%	-9,269
Shrub/Scrub	0.2%	0.6%	2,887
Grassland/Herbaceous	0.4%	0.2%	-1,292
Pasture/Hay	4.4%	4.5%	604
Cultivated Crops	4.1%	3.3%	-5,976
Woody Wetlands	9.7%	6.6%	-22,913
Emergent Herbaceous Wetlands	0.1%	0.3%	1,047

* NLCD 2001 Land Cover Data
** NLCD 2011 Land Cover Data

Changes in Population

As population increases, more residential and commercial buildings, infrastructure, public facilities and other assets will be constructed to support such growth, likely increasing a jurisdiction's overall exposure to natural hazards. Therefore, population growth is considered a general indicator of potential future hazard vulnerability.

Best readily available population data at the time the last version of this Plan was prepared was Census 2000. At that time the estimated County population was 177,749. For the plan update, Census 2010 estimated the population of the County at 182,493 – roughly a 2.7 percent increase over the year 2000 data that was reported in the last version of this Plan. Population changes are documented in **Table 3d.2**. A

general trend of slightly increasing population in the near term is expected to continue, with the County's Transportation Plan projecting a population of 214,999 by the year 2020. Looking further out, the Cornell Program on Applied Demographics estimates that Ulster County's population will decrease, with a population projection of 178,028 by the year 2030 and 170,141 by the year 2040. Population growth is therefore not expected to have tremendous impacts on land use in Ulster County in the near future.

Table 3d.2
Change in Population Since the Last Version of the Plan was Prepared

Jurisdiction	Population 2000*	Population 2010**	Change Since Population Reported in Last Version of Plan (2000 to 2010)
Ulster, County of	**177,749**	**182,493**	**4,744**
Denning, Town of	516	551	35
Ellenville, Village of	4,130	4,135	5
Esopus, Town of	9,331	9,041	-290
Gardiner, Town of	5,238	5,713	475
Hardenburgh, Town of	208	238	30
Hurley, Town of	6,564	6,314	-250
Kingston, City of	23,456	23,893	437
Kingston, Town of	908	889	-19
Lloyd, Town of	9,941	10,863	922
Marbletown, Town of	5,854	5,607	-247
Marlborough, Town of	8,263	8,808	545
New Paltz, Town of	12,830	7,185	-5,645
New Paltz, Village of	6,034	6,818	784
Olive, Town of	4,579	4,419	-160
Plattekill, Town of	9,892	10,499	607
Rochester, Town of	7,018	7,313	295
Rosendale, Town of	6,352	6,075	-277
Saugerties, Town of	19,868	15,511	-4,357
Saugerties, Village of	4,995	3,971	-1,024
Shandaken, Town of	3,235	3,085	-150
Shawangunk, Town of	12,022	14,332	2,310
Ulster, Town of	12,544	12,327	-217
Wawarsing, Town of	12,889	9,022	-3,867
Woodstock, Town of	6,241	5,884	-357

* Census 2000
** Census 2010

Based on historic population trends and projections, Ulster County's overall population growth represents an overall county-wide increase in exposure and potential vulnerability of people to natural hazards – particularly during periods when the County's population swells with visitors. While population declines were observed in 13 jurisdictions (ranging from a low of -19 persons in the Town of Kingston to a high of -5,645 persons in the Town of New Paltz); population increases were observed in the balance of jurisdictions (ranging from a low of 5 persons in the Village of Ellenville to a high of 2,310 persons in the Town of Shawangunk).

Changes in Residential Construction

Another general indicator of development since the last version of this Plan was prepared is the quantity of new, privately owned residential housing units that were authorized to be built in that time period. The US Census Building Permits Survey was queried for Ulster County, with results shown in **Table 3d.3**. Given the state of the economy, only 763 residential construction permits were approved from the years 2010 through 2014. Roughly 92 percent were single family units and about eight percent were multi-family units. While overall exposure is increased with more units present, it is not likely that overall vulnerability has increased to the same degree because development in hazard areas would have been built to codes and standards that would offer better protection from hazard events.

Table 3d.3
Annual New Privately-Owned Residential Building Permits[2]

Jurisdiction	2000	2005	2010	2011	2012	2013	2014	Residential Construction in the Last Five Years (2010-2014)
Ulster County	**474**	**790**	**168**	**143**	**152**	**136**	**164**	**763**
single family	463	767	154	125	140	133	151	703
single family % of total	*97.7%*	*97.1%*	*91.7%*	*87.4%*	*92.1%*	*97.8%*	*92.1*	*92.1%*
multi-family	11	23	14	18	12	3	13	60
multi-family % of total	*2.3%*	*2.9%*	*8.3%*	*12.6%*	*7.9%*	*2.2%*	*7.9%*	*7.9%*

Protected Open Space

As stated in the Ulster County Open Space Plan (2007), Ulster County has a long history of open space preservation. The environmental conservation movement has its roots here. With the "forever wild" Catskill Forest Preserve and Minnewaska State Park, Ulster County has two of the most significant open spaces in the region. In addition, each community in the county has valuable open space resources. Abundant and critical water resources, rich biodiversity, renowned recreational and historic sites, and valuable, productive agricultural lands are all part of Ulster County's open space landscape. These contribute to the well-being of the region's environment, economy and quality of life. However, these resources are still at risk. Much is already protected, but current development activity and existing regulatory controls foster a pattern of intrusion into our open spaces. Limited availability of water and sewer infrastructure is also a barrier in preventing a more compact land use pattern. These issues have become increasingly important as development proposals continue to accelerate in Ulster County. The County Open Space Plan proposes a pro-active regional approach – one that embraces scientific, legal, financial, and participatory tools to determine where and how growth is undertaken. Overwhelming evidence points to the benefits of preserving open space and growing "smart." Communities that plan ahead to protect open spaces, preserve their natural resources while creating a vision for accommodating sustainable and compact development are likeliest to succeed economically.

Furthermore, the identification and acquisition of land to be maintained as protected open space presents a significant opportunity for jurisdictions to minimize future hazard exposures and vulnerability.

[2] Source: US Census Building Permits Survey, online at http://censtats.census.gov/cgi-bin/bldgprmt/bldgdisp.pl

In addition to County, State and Federal protected open spaces, municipal jurisdictions in Ulster County also safeguard open space through their own local preservation measures (municipal land reserved for open space plus preserved farmland). Though often done for conservation, recreation or other community purposes, protecting lands located in identified natural hazard zones can help jurisdictions meet complementary hazard mitigation objectives and can qualify the communities for additional points under the Community Rating System (CRS). It is often found that those natural areas deemed targets for open space protection are often also identified as potential hazard zones (i.e., environmentally-sensitive lands such as wetlands, floodplains, etc.). Approximately 32 percent of the County is protected open space. Significant areas of designated protected open space[3] are shown in **Table 3d.4** and **Figure 3d.2.**

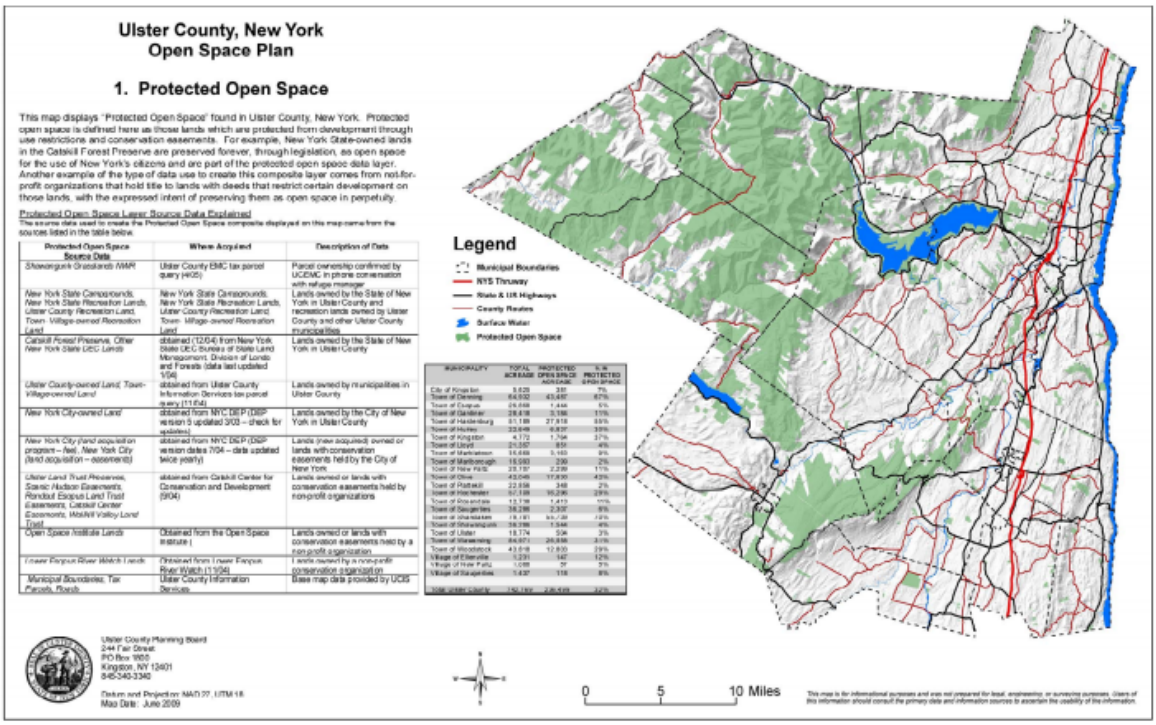
Table 3d.4
Preserved Open Space in Ulster County

Open Space Classification	Approximate Acres	Percent of Total Land Area
Ulster, County of	**236,499**	**32%**
Denning, Town of	43,487	67%
Ellenville, Village of	147	12%
Esopus, Town of	1,444	5%
Gardiner, Town of	3,184	11%
Hardenburgh, Town of	27,918	55%
Hurley, Town of	6,837	30%
Kingston, City of	381	7%
Kingston, Town of	1,764	37%
Lloyd, Town of	851	4%
Marbletown, Town of	3163	9%
Marlborough, Town of	299	2%
New Paltz, Town of	2,299	11%
New Paltz, Village of	57	5%
Olive, Town of	17830	42%
Plattekill, Town of	348	2%
Rochester, Town of	16,296	29%
Rosendale, Town of	1,413	11%
Saugerties, Town of	2,307	6%
Saugerties, Village of	118	8%
Shandaken, Town of	55,739	70%
Shawangunk, Town of	1,544	4%
Ulster, Town of	504	3%
Wawarsing, Town of	26,558	31%
Woodstock, Town of	12,803	29%

SOURCE: Ulster County Open Space Plan, 2007

[3] Ulster County Office of GIS, Preserved Open Space, 2008

Figure 3d.2 – Ulster County, New York Protected Open Space



Land Use Planning in Ulster County

Incorporated municipal governments in New York State have been granted broad "home rule" powers enabling them to provide services to their residents and to regulate the quality of life within their jurisdictions. The New York State Constitution establishes these rights and responsibilities under Articles VIII (titled "Local Finances") and IX (titled "Local Government", but commonly referred to as the "Home Rule" article). Democratically elected legislative bodies at the municipal level are granted the power to enact local laws as needed in order to provide services to their citizens and fulfill their various obligations.

Under this home rule system, in New York State, traditional planning authority is granted to municipal government, including the regulation of land use through zoning and land subdivision.

- The Ulster County Planning Department serves a coordination function for those elements that are best served on a regional level, reviewing and commenting on many local land use decisions. The authority to approve or disapprove proposals, however, rests in the hands of the local municipalities. The Ulster County Planning Department is responsible for managing the County's Comprehensive Plan Document. The department has accomplished this task through the adoption of individual Housing, Transportation, and Open Space Plans. The Ulster County Greenway Compact, currently in progress, will be a unifying document to connect each of these individual

planning efforts. The County has completed or is working on an economic development strategy, a housing strategy, an open space plan, a stormwater management program and a long range transportation plan.

- The Ulster County Planning Board is responsible for the review of local site plans, special permits, variances, comprehensive plans and zoning amendments (however, a local town planning board may take action contrary to the recommendations made by the County Planning Board by a majority plus one vote).

Influences on Future Development in Ulster County

Ulster County's economy and population continue to grow. Future development in Ulster County is influenced by:

- **Ulster County Comprehensive Plan**. The department has accomplished this task through the adoption of individual documents, as follows:

  - ***Ulster Tomorrow, A Sustainable Economic Development Plan for Ulster County (2007)***. This plan is the collaborative effort of Ulster County, UCDC, and the Ulster County IDA. This strategic planning effort is designed to help the County's delivery of economic development services, coordinate the various activities of the system, and provide focus to the economic development efforts across our large and geographically diverse county.

  - ***Ulster County Open Space Plan (2007)***. The plan recommends a strategic approach to open space resource management in Ulster County. It represents pro-active regional approach – one that embraces scientific, legal, financial, and participatory tools to determine where and how we grow. Overwhelming evidence points to the benefits of preserving open space and growing "smart." Communities that plan ahead to protect open spaces, preserve their natural resources while creating a vision for accommodating sustainable and compact development are likeliest to succeed economically.

  - ***Long Range Transportation Plan (LTRP), Year 2035 (2010).***The most recent update of the Ulster County Long Range Transportation Plan was completed in August 2010. The process entails a comprehensive evaluation of transportation needs across most modes of travel and includes an extensive public outreach effort. The study effort involved an update to the current status of the transportation system in Ulster County, identified future needs and strategies, outlined financing options and incorporated the desires of the public. Outcomes of the long range transportation planning process include the identification of policy, project, financial and evaluation strategies and priorities. Emphasis of the Year 2035 LRTP Update included improved integration of multimodal transportation systems, safety, congestion management, and maintenance of both the highway and public transit systems. Quality-of-life issues and non-motorized modes of transportation were given increased attention as a part of the update process.

  - ***Housing Strategies Plan (2005).*** This study examines the trends in the County's housing costs, its economy and the relationship between these factors and household income-wage growth as it relates to affordability. The study found that despite signs of a turnaround in the County's economic fortunes, the ability to afford housing in nearly all communities has not kept pace with its rising costs. It also found that the gap between income and soaring housing prices has gotten dramatically worse in the last seven to eight years. As a result,

many residents are finding it harder and harder to obtain decent housing without paying an uncomfortably high and increasingly larger percentage of their earnings-income. This is true whether the housing choice involves homeownership or rental.

- ***Greenway Compact (currently in progress).*** The Greenway planning approach is one of thinking regionally as communities plan locally. It includes physical connections and linkages between communities for local and regional benefit. Additionally, it extends beyond physical linkages to encourage voluntary regional cooperation among the communities and counties of the Hudson River Valley to address issues of collective concern and promote mutually beneficial regional approaches. The Greenway Compact program provides a process for voluntary regional cooperation to further the Greenway criteria of natural and cultural resource protection, regional planning, economic development, public access, and heritage and environmental education. For communities that choose to participate, a variety of financial and procedural benefits are available. The Greenway has designated the counties as the basic planning areas for the development of the Greenway Compact, although sub-county associations of local governments may also be able to prepare a regional planning compact.

  Each Compact area will develop a regional planning compact that addresses the Greenway's five criteria:

  1. Natural and Cultural Resource Protection. Protect, preserve and enhance natural resources including natural communities, open spaces and scenic areas as well as cultural resources including historic places and scenic roads.
  2. Economic Development. Encourage economic development that is compatible with the preservation and enhancement of natural and cultural resources including agriculture, tourism and the revitalization of established community centers and waterfronts.
  3. Public Access. Promote increased public access to the Hudson River through the creation of riverside parks and the development of the Hudson River Valley Greenway Trail System.
  4. Regional Planning. Communities can work together to develop mutually beneficial regional strategies for natural and cultural resource protection, economic development (including necessary public facilities and infrastructure), public access and heritage and environmental education
  5. Heritage and Environmental Education. Promote awareness among residents and visitors about the Valley's natural, cultural, scenic and historic resources

  Each Compact area will also:

  - Incorporate provisions to identify development of regional impact and areas of regional concern and
  - Identify necessary public facilities and infrastructure consistent with the Greenway criteria.

  The voluntary participation of municipalities in county Compacts preserves local decision-making authority while providing expanded opportunities for regional cooperation. Public and community participation in the development of county Greenway plans is critical to their success. Greenway compacts reflect the concerns of local communities and provide a regional context for local planning efforts.

- **Municipal Regulatory Tools.** Municipalities have various regulatory tools at their disposal to influence land uses and development trends over time. As part of the initial hazard mitigation plan development process, participating jurisdictions were asked to complete a questionnaire in order to provide information regarding land use regulatory capabilities in each municipality. As part of the 2015 hazard mitigation plan update process, participating jurisdictions were asked to review and provide updates to the land use regulatory capabilities they reported when the last version of the plan was prepared. Based on information provided by the municipalities as part of the first plan update, administration and enforcement of the New York State Uniform Fire Prevention and Building Code (Uniform Code) occurs at the local level with all participating municipalities reporting local administration. One hundred percent of participating municipalities reported having local zoning statutes; 95 percent of participating municipalities reported having local subdivision statutes; and 90 percent of participating municipalities reported having local comprehensive plans in place. New York State is a Home Rule State and therefore the County does not have its own building, zoning, or subdivision statues. Details are shown in **Table 3d.5** (further information on these and other regulatory tools are discussed in Section 4).

Table 3d.5
Communities with Land Use Regulations
(Source: Capability Assessment Questionnaire responses)

Community	Building Statutes	Zoning Code	Subdivision Statutes	Comprehensive Plans
Ulster, County of	Not applicable	Not applicable	Not applicable	■
Denning, Town of	■	■	■	■
Ellenville, Village of	■	■	■	■
Esopus, Town of	Did not participate			
Gardiner, Town of	■	■	■	■
Hardenburgh, Town of	■	■	■	■
Hurley, Town of	■	■	■	■
Kingston, City of	■	■	■	■
Kingston, Town of	■	■	■	
Lloyd, Town of	■	■	■	■
Marbletown, Town of	Did not participate			
Marlborough, Town of	■	■	■	■
New Paltz, Town of	■	■	■	■
New Paltz, Village of	■	■	■	■
Olive, Town of	■	■	■	
Plattekill, Town of	■	■	■	■
Rochester, Town of	Did not participate			
Rosendale, Town of	■	■	■	■
Saugerties, Town of	■	■		■
Saugerties, Village of	■	■	■	■
Shandaken, Town of	■	■	■	■
Shawangunk, Town of	■	■	■	■
Ulster, Town of	■	■	■	■
Wawarsing, Town of	■	■	■	■
Woodstock, Town of	■	■	■	■

At both the County and municipal levels, land use and development planners in departments, federations, boards and councils are active in guiding Ulster County's growth and work toward providing a unified framework for development that coordinates activities between municipalities and the County overall.

Development Trends

Ulster County is located about 70 miles north of New York City and 45 miles south of Albany, making it a unique area that residents from New York City can go to escape the costs, pressures and densities of life in a major metropolitan area. It also makes the County an excellent place for businesses to be located that serve the State of New York's two most important cities.

It is likely that, in the future, Ulster County will continue to balance the pressures of supporting its agricultural communities while fostering the development of new industries. Population is expected to remain about the same through 2030. A sharp increase in the proportion of the populace aged 65 years and older could spawn various types of age-restricted housing. The County's location between the Hudson River and the Catskill Mountains ensures that development cannot get too intense, especially since the County, the State, the local jurisdictions and private organizations have done an excellent job of ensuring that much of the County will remain in pubic open space. Ulster County continues to work with many stakeholders in communities throughout the county beginning the process of planning, funding, and implementing improvements on Main Streets, where funding is being leveraged with other investments in our communities including transportation, housing, and infrastructure improvements.

Impact of Recent Severe Storms – Irene, Lee, and Sandy

Hurricane Irene (August 28, 2011), Tropical Storm Lee (September 7, 2011), and Superstorm Sandy (October 29, 2012) hit Ulster County with full force. The torrential downpour caused water levels in the Rondout Creek, Wallkill River, and Lower and Upper Esopus Creek to reach record heights causing widespread flash flooding. Homes, businesses and infrastructure were destroyed, particularly in low-lying areas. Countless roads were closed due to flood waters overtopping culverts; bridges were closed isolating residents; and the force of the stormwater caused substantial infrastructure damage to water mains, sewage treatment facilities, and water delivery systems throughout the region. Stream banks were overtopped and severely eroded, flooding dozens of homes and depositing natural and man-made debris throughout the stream corridors. Businesses were severely flooded, leaving residents without access to basic necessities for weeks. Residents were forced to evacuate their homes, moving to shelters established in local emergency service buildings, schools, and community centers. County-wide shelters were set up. The physical damage to roads, bridges, homes, and other essential infrastructure resulted in short and long term economic impacts that rippled throughout the County and the region. Irreparable losses to commodity farms, power failures, and, in some cases, isolation from economic centers complicated and delayed recovery efforts. Tourism, a major industry in this region, suffered greatly through both an overall loss of revenue and lost wages due to postponed. Today, Ulster County municipalities are still recovering from the damage caused by Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee.

While some property acquisitions have occurred on a relatively small scale in certain locations, the observed impact of this disaster on land uses and development trends is generally that communities have tended toward building back damaged and destroyed structures in their previous locations to higher codes and standards and in a manner that provides some level of hazard mitigation, as opposed to precluding new development or substantial improvements in at-risk areas. This more disaster-resistant building stock, along with the many hazard mitigation initiatives being undertaken (i.e., mitigation of roads, bridges, culverts, drainage systems, etc.) has the effect of increasing the overall level of resilience, and decreasing vulnerability for many such communities during future events of this nature.

Re-assessment of Local Land Uses and Development Trends

As part of the development of the initial plan in 2009, the Core Planning Group was asked to provide responses to a Land Uses and Development Trends Worksheet for their individual jurisdictions. The worksheet consisted of the following two questions:

1. Please describe development trends occurring within your jurisdiction, such as the predominant types of development occurring, location, expected intensity, and pace by land use. While details are preferred, it is ok if your feedback is qualitative and quite general, such as "*high-occupancy, high-density residential development is occurring near the waterfront*".

2. Does your jurisdiction enforce regulations/ordinances/codes to protect new development from the effects of natural hazards? (Some examples might be floodplain management ordinances enforcing FEMA's NFIP for new development or substantial improvements in the floodplain; steep slope ordinances for community's which may have landslide hazards; earthquake resistant design criteria and/or high wind design criteria; or buffer zones in wildfire hazard areas.) If so, please describe.

Responses were updated as part of the 2015 Plan Update, and are reported in **Table 3d.6**.[4] Copies of each jurisdiction's response can be found in **Jurisdictional Annexes of Appendix 1.1 (Worksheet 3)**.

[4] As part of the 2015 Plan Update, municipalities were asked to review their prior responses (as submitted during the development of the initial plan) and either (a) certify that they still hold true unchanged, or (b) identify any changes that have occurred since that time. Their responses have been incorporated into Table 3d.6.

Table 3d.6
Summary of Responses - Land Uses and Development Trends Worksheet *(Source: Core Planning Group Members)*

Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Ulster, County of	> **Agriculture** - Farming has a long, rich history in Ulster County which is being threatened by residential development. Family farms that have for generations been the predominant land use within many communities are being replaced with housing developments. Ulster County is working to preserve several agriculture districts in the various fertile valleys of the County. Significant portions of the floodplains of the Rondout and Esopus stream valleys are in agriculture. Losses of both lands from erosion and crops occur during heavy flooding. > **Industrial Development** - Several areas of the County have been identified as potential "shovel-ready" candidates. The areas that are being touted as potential manufacturing/ industrial sites are the Tech City complex in the Town of Ulster, the Saugerties Kings Highway District and Kingston Business Park in the City of Kingston. Other sites with water, sewer and roadways that can support expanded business use including South Putt Corners Road in New Paltz and Business Parks along Route 9w in Lloyd. > **Tourism Development** – Several major resort developments are moving toward approvals and likely to be constructed in the next few years. These include Williams Lake Hotel in Rosendale, and the Belleayre Resort in Shandaken. These resorts presents challenges in design and implementation as they are located in heavily wooded areas and some section of the resorts are on steep slopes. Wildfires are of concern as are heavy thunderstorms that can overload stormwater systems. These represent a trend to reach the upscale market from New York Metro Area. Others, not located in hazard areas are the Wine Village in Highland and Diamond Mills in Saugerties and hotels in New Paltz and Ulster. Waterfront development has occurred in Kingston however these use existing historic buildings and recognize that flooding will occur. > **Housing**- The several large housing projects that are planned (including those in Kingston and Gardiner) have avoided hazard areas. The biggest trend that continues although abated is rural housing development in wooded areas that increases the risk of wildfires and access associated with flooded roads.	Most land use regulations/ ordinances are implemented at the local level through local governing bodies and the planning and zoning boards. Every municipality in the County participates in the National Flood Insurance Protection Program. Flood mapping has been updated in all municipalities with new topographic information and detailed flood maps are available in the NYC Watershed towns. Every municipality enforces the NYS Uniform Fire and Prevention & Building Code. Communities are much more aware of risks associated with flooding and have responded by restricting uses and reducing density in flood prone areas. In addition, some communities now restrict development in areas where access is across a floodplain and cannot be elevated above it. Additionally, seven towns have adopted steep slope ordinances for slopes greater than 15 to 20 percent. Dangers associated with wildfires are addressed during individual site reviews; however, few regulations or guidelines are in place to assist local boards. The Ulster County Planning Board is responsible for the review of local site plans, special permits, variances, comprehensive plans and zoning amendments. However, a local town planning board may take action contrary to the recommendations made by the County Planning Board by a majority plus one vote.

Table 3d.6
Summary of Responses - Land Uses and Development Trends Worksheet *(Source: Core Planning Group Members)*

Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Denning, Town of	The Town of Denning does not have any major construction going on at the present time. The building that is being done is scattered around the Town.	Denning enforces current regulations for development in the floodplain. For other hazards such as wind and landslides, the Town follows the New York State Building Code.
Ellenville, Village of	The Village of Ellenville upcoming development will experience a strong growth when a proposed casino (The Nevele Resort, Casino, and Spa) is built in the Town of Wawarsing but in close proximity to the Village. The Village will be responsible for supplying water and sewer services. With the casino creating new jobs and making Ellenville a destination for many tourists and travelers, the Village is also expecting growth within commercial and residential developments.	The Village of Ellenville does enforce their codes pertaining to new developments and discusses it in Chapter 109 – Flood Damage Prevention. The code specifically states, "A floodplain development permit is hereby established for all construction and other development to be undertaken in areas of special flood hazard in this community for the purpose of protecting its citizens from increased flood hazards and insuring that new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertaken any development in an area of special flood hazard, without a valid floodplain development permit. New construction and substantial improvements to structures shall be construed with materials and utility equipment resistant to flood damage. New construction and substantial improvements to structures shall be constructed using methods and practices that minimize flood damage. New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at least two feet above the base flood elevation or be designed to prevent water from entering and accumulating within the components during a flood and to resist hydrostatic and hydrodynamic loads and stresses." With this code, the Village Building Inspector has the authority to approve or deny any new floodplain development permits.
Esopus, Town of	Did not participate	
Gardiner, Town of	The predominant type of development occurring in the Town of Gardiner is single family dwellings primarily located on individual lots of two to five acres or in previously approved subdivisions with lots of two to five acres. There has been very little new commercial development, however several previously existing sites have been improved upon. The Town has enacted Chapter 220 of the Town Code as the Zoning Law and it contains several sections that pertain to and limit development in fragile or sensitive areas. The Town also has an active program to preserve open space and conserve farm related properties.	Chapter 121 of the Gardiner Town Code, Flood Damage Protection, addresses the issues of development in the floodplain, based on the FEMA Flood Insurance Rate Map of 9/25/2009 and the "Flood Insurance Study, Town of Gardiner, NY, Ulster County" dated 7/16/2007. The current Zoning Law, Chapter 220 of the Town Code, contains the following sections that specifically address development in potentially hazardous/fragile environments: 220-13 creates a Flood Plain Overlay District; 220-16 creates the Shawangunk Ridge Protection District; 220-34 addresses Excavation, Grading and Clear Cutting; 220-35 regarding Wetlands and Water Course Protection; and 220-36 regarding Steep Slope Regulations.

Table 3d.6
Summary of Responses - Land Uses and Development Trends Worksheet *(Source: Core Planning Group Members)*

Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Hardenburgh, Town of	The Town of Hardenburgh does not have any major construction going on at the present time. The building that is being done is scattered around the Town.	The Town of Hardenburgh enforces current New York State building code regulations for development in the floodplain. Other hazards such as wind and landslides, the Town follows the New York State building code.
Hurley, Town of	Hurley has very little open land (not forested) left for developing, and as such experiences single family home building on a moderate to low scale. Hurley has seen interest recently on developing a PRD, but this application was withdrawn. The Planning Board has approved a new subdivision recently which may result in a few new homes being built on Dug Hill Road.	Certified no change since 2009 assessment. At this time, the Town of Hurley enforces the regular regulations and building codes, with no ordinances concerning only the effects of natural hazards. That being said, the regular Codes have the function of protecting the *burden* and the surrounding area from chemical hazards. Recent *MS4* regulations are in place
Kingston, City of	Development trends in the City of Kingston are focused on the Rondout Creek Hudson River area of the city. These proposed developments are of mixed use and density. While primarily condominium and single family homes there is a light industrial and commercial component as well. These proposals if developed fully would add as many as 2000 units of housing with a commensurate increase in population. These developments primarily involve the reuse of industrial areas that have been abandoned for many years. The city has developed a waterfront redevelopment plan and has established zoning requirements for development within the Hudson River and Rondout Creek areas. There has been acquisition of properties along the Rondout Creek however no firm development plans for this area has been submitted to the city. It is anticipated that this will be an area of significant development in the near future. This is an area previously used for industrial applications, oil storage and junk yards. Most of these parcels have been cleared and are ready for reuse. Additionally the city continues to pursue development of its industrial park. There are presently two tenants Alcoa operating 70,000 square foot manufacturing facility and Armor Dynamics a new tenant in a 10,000 square foot building with a proposed 70,000 square foot addition. There are three additional development sites in the complex which would support light industrial development. There have been several other residential projects proposed for other areas of the city which have not been pursued.	Certified no change since 2009 assessment. The City of Kingston does enforce regulations/codes and local ordinance that regulate new development with regard to natural hazards. Applicable New York State Building and Fire Codes address wind and snow load design criteria for new construction. The city through its land use and site plan approval process regulates storm water runoff and control. The city floodplain coordinator and city engineer are part of the approval process in the development of site plan approvals and the issuance of building permits.

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Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Kingston, Town of	The Town of Kingston does not have any major construction going on at the present time. The building that is being done is scattered around the Town. There is a pre-existing seventy five lot subdivision located across the road from the Sawkill Creek. This neighborhood has the potential to flood. The developer removed six feet of soil before homes were built. Other areas of the Town of Kingston have steep slopes that front on County and State roads.	Certified no change since 2009 assessment. The Town of Kingston enforces current New York State building code regulations for development in the floodplain. Other hazards such as wind and landslides, the Town follows the New York State building code.
Lloyd, Town of	The Town of Lloyd is experiencing strong growth on the Eastern side of Illinois Mountain, which in effect splits the Town in its center, in the Route 9W and Route 44/55 corridor. There is a mix of commercial development and medium density residential development and medium density residential development. The Twalfskill Creek, one of our identified flood prone basins, sits between these two corridors. A large commercial project is being reviewed by our Planning Board for the Route 9W and Route 299 corner, which will impact the unnamed water course which joins the Twalfskill in the Hamlet of Highland. Further, light residential and some light commercial development continues in the Black Creek Basin, another identified flood prone watercourse. Other proposed projects include residential developments in the Lower Twalfskill basin (single family dwellings), further light residential developments along the Route 44/55 corridor. The Western side of Illinois Mountain is light residential and agricultural, with scattered commercial sites.	Certified no change since 2009 assessment. The Town of Lloyd Code includes regulations for flood plains, stormwater management, and our code on zoning has language that encourages the Planning Board to review with water management in mind. The Town is also working on a new chapter for the regulation of construction near watercourses in the town, which would restrict construction in and near boundaries of watercourses in the town. The Town also works with the DEC for enforcement of SWPP (Lloyd is an MS4 community) through a municipal code officer.
Marbletown, Town of	Did not participate	
Marlborough, Town of	The predominant land use for the Town continues to be active agricultural. There has been a consistent increase of residential structures built over the past five years, averaging 16 new homesteads per year. There are currently two multi-family housing projects before the Town Planning Board, but there has been little to no activity involving them these past few years. There continues to be little to no commercial or industrial development within the community.	Marlborough is in the process of updating its codes. The existing code does have language to help guide development and protect for the effects of natural hazards: Chapter 8-Conservation Advisory Council; Chapter 29-Exposure to Disease Control Plan; Chapter 47-Building Construction; Chapter 48-911 Numbering of Buildings; Chapter 75-Clearing & Grading; Chapter 89-SEQRA Review; Chapter 93-Explosives & Blasting; Chapter 97-Flood Damage Protection; Chapter 134-Subdivision of Land; Chapter 135-Stormwater Management; Chapter 155-Zoning (Steep Slope/Right to Farm). Minor changes have been made to Chapter 47-Building Construction Code, since 2009. The Town became an MS4 Town in 2003.

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Summary of Responses - Land Uses and Development Trends Worksheet *(Source: Core Planning Group Members)*

Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
New Paltz, Town of	Development trends in the community over the past 40 years has included robust commercial development in the 1970's and 1980's along the edges of the Village of New Paltz with relatively small scale residential development outward from the more densely populated Village and into the primarily more rural portions of the Town. Expansion of the SUNY New Paltz College has been the focus of development of new dormitories and classroom facilities in the past 10 years. Only a minor amount of new commercial or residential development has taken place in the past five or more years in response to the weak regional economy. Multi-family housing has been limited primarily to the Village (although single family conversions to student housing apartments has been common place) with minimal apartment complexes or light industrial developments occurring in the Town due to public water and sewer service being offered only by Town water and sewer districts that are located primarily near the perimeter of the Village. In the past few years, a larger senior citizen community (Woodland Pond) was developed at the edge of the Village boundaries and commercial redevelopment has occurred in the Town's commercial district. Minor light industrial development has occurred and there are present development plan applications for student housing, a hotel, minor chain retail and a major hotel/waterpark near the developed areas of the Town.	In response to concerns of safety of residents and emergency service responders during the more frequent flooding events on the Walkill River, the Town enacted new regulations following the new FEMA mapping adoption in 2010. These regulations discourage new development in Special Flood Hazard Areas by requiring proof of safe access during the 100-year flood events for both residential and commercial development. These areas encourage uses like agriculture and recreation that are less prone to the effects of floodwaters. Additionally, the Town enacted laws that regulate clearing and grading and development on steep slopes. A wetland and watercourse protection law was also enacted in 2005 and again in 2001, which the validity of a court challenge is presently being decided. In 2013, the Town was designated as an MS4 community and a Stormwater Program has been developed to more closely regulated stormwater management in the community.
New Paltz, Village of	Response was not provided in 2009 or 2015.	
Olive, Town of	The Town of Olive is comprised of 40,000 acres of which the State of New York owns 8,172 acres and the City of New York owns 10,778. We have very little developable land as the City of New York under the 1997 Memorandum of Agreement has implemented their land acquisition program throughout the watershed – which comprises approximately 75 percent of the Town of Olive. Recent development has primarily been single family residences, alterations of single family homes, and/or garages and wood stove permits.	The Town of Olive adopted Subdivision Regulations in 1965, Zoning Laws in 1975, and entered into the NFIP in November of 1984 with the most current flood law being adopted in 1987.

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Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Plattekill, Town of	The Town of Plattekill currently does not contain any significant flood plain areas as cited by the FEMA Community Status Report and is considered a Non-Special Flood Hazard Area (NSFHA). The community has remained predominantly residential and agricultural based and has not shown any significant residential growth over the last several years. There have been approximately 25 new residential building permits issued each year. Many of the larger subdivisions before the Towns' Planning Board, which were started several years back, have either been withdrawn or cancelled by the applicant due to the current condition of the economy. There have been no significant growth concentrations within any specific areas of the municipality and residential development has occurred sporadically throughout the town. There has been very little multi-family construction over the past five years with one 10-unit project nearing completion. Over the last several years, the Town has seen a small increase in its commercial base, with the construction of a small-scale grocery center and other smaller multiple use buildings. Without the availability of public water and sewer anywhere within the Town, the commercial projects tend to be smaller in scale.	The Town of Plattekill has actively been involved in the review and implementation of development projects over the past several years. In 2007, the Town adopted into their Town Code, Chapter 89 referencing Stormwater Management and Erosion and Sediment Control measures. This Chapter regulates land improvements and the possible environmental conditions resulting from the development of land. Currently, the Planning Board and the Town Engineer reviews both the SWPPPs and SPDES permits for the Town. Input from other town departments is also solicited and used to help render decisions on development projects.
Rochester, Town of	Did not participate	
Rosendale, Town of	Rosendale is an area with much land that is constrained either by slope, flood plain or wetland. By contrast, Rosendale has a topography that seems almost corrugated in character. This is particularly true in the glaciated areas in the northern part of Town, among Binnewater Lakes. Heading south, these steep slopes descend to Rondout Creek. The Shawangunk Ridge rises just south of the creek. The only extensive flat area in Town is in the vicinity of Tillson. However, much of the flatland is located in floodplain. Consequently, unlike neighboring towns, Rosendale has little land that is easily developed. The Planning Board has seen in the past several years several large subdivisions, including lot line adjustments and minor subdivisions. The Planning Board also has experienced various site plan approvals. These site plans have been primarily on existing commercial structures where businesses have been revitalized, renovated, changed used, expanded or created. There has been a revitalization of the Main Street Business District. The Town Board recently approved an Economic Enterprise	The Town of Rosendale currently enforces regulations, ordinances, and Local codes including NYS rules and regulations and Federal requirements. These regulatory requirements are applied when applicable to protect and promote public health, safety, morals, comfort, convenience, economy, Town aesthetics and the general welfare of the public. The Town has adopted local codes that enforce zoning, they are found in chapter 75. Chapter 75 Article V has regulation 75-27 that specifically addresses flood damage prevention. The Town's Local Codes can be viewed at Town of Rosendale's Web site. These are some of the Codes and Regulations administered and enforced by the Town: (Town of Rosendale Local Town Codes, Rules and Regulations; Ulster County Health Department and Other County Rules and Regulations; NYS Environmental Quality Review 6NYCRR Part 617; NYS Town Law; NYS Municipal Law; NYS Residential Code; NYS Uniform Fire Prevention and Building Code; NYS Vehicle and Traffic Law; NYS Wetlands; NYS Stormwater; NYS Parks, Recreation and Historic

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Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	Overlay District to allow the redevelopment of underutilized buildings on the Route 32 corridor and encourage reuse of abandoned schools and churches throughout the town. The Town has approved redevelopment of the Williams Lake Hotel site in Binnewater. The proposed project is located on a 779 acre site that has a long history of industrial and commercial use, most recently as an outdated 95 room hotel with amenities and an internal road and trail system. The concept plan anticipates a LEED Gold-certified 130-room hotel, 154 for sale homes (attached townhouses and detached single family homes) and a spa and wellness center. The development will consist of roughly 66 acres of the 779, leaving the remainder of the property undeveloped. The Town has seen the restoration of the Rosendale Trestle opening up the rail trails. The Williams Lake Project has given public access through their property along the rail trail. These two things have increased the number of visitors to our town for recreation. The Town has opened up new parking lots and a Way Station to support the influx of visitors.	Preservation Law; Federal Wet Lands). These Codes, Laws, Rules, and regulations are administered, regulated and enforced by various departments within the Town. Some Departments and Boards within the Town only regulate and apply code as a requirement, such as the Town Board, Planning Board and Zoning Board of Appeals. Whereas other departments such as the Building Department, Code Enforcement Officer, Fire Marshal and Police Department apply administer and enforce the Regulations and Laws when needed.
Saugerties, Town of	High density residential development has lessened in recent years, the number of permits issued has diminished, and the predominant type of development has been detached single-family residential, many close to waterways; these require review by the Planning Board that includes a stormwater review component.	The Town enforces the regulation of new growth from the effects of natural hazards, including enforcement of FEMA's NFIP for new development or substantial changes in the floodplain, steep slope review for landslide hazard potential, earthquake resistant design criteria, and high wind design criteria. The Town does not currently enforce buffer zones in wildfire hazard areas because none have been identified. The Town has found that the old flood maps are preferable to the new (2009) ones because the new ones have no in-field verifications. The Town reports that no base flood elevations have been established and that grant monies will be needed to do so.
Saugerties, Village of	The Village of Saugerties has experienced extensive residential growth, primarily in single family housing with some multiple dwellings. A co-housing project of 14 units and conversion of an abandoned factory into 89 units of low-income senior housing are exceptions. Another empty factory was converted into a Town Hall complex (located in the Village). There are no industrial or agricultural uses within the Village.	Low-lying areas of the Village along Lighthouse Drive and Ferry Street are subject to severe flooding. Floodplain permits are required for all construction within these areas. All new construction must be two feet above floodplain level. The Village encourages property owners to elevate their homes where possible. The Waterfront Advisory Board reviews all new construction. The Village reports that they are the only upstate community with the legal right to regulate their waterways and that they have several strict regulations as to type and size of construction, vessel speed limits, etc.

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Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Shandaken, Town of	Last year and this year, most of our developments are alterations and repairs to single family homes. We had four single family homes being built. We get a lot of sheds, garages, wood stove permits. 75 percent of our town is owned by the State. We do not have much land to develop.	The Town of Shandaken has zoning codes and flood plain management ordinances for development near the Esopus Creek. Additionally, the Town of Shandaken has adopted (June 2013) a Town specific Flood Hazard Mitigation Plan and are currently in process of entering into the Community Rating System.
Shawangunk, Town of	The Town is approximately 56.5 square miles in size. The predominant land uses, in acreage, continue to be agriculture, open space, and vacant land uses. According to the Town's Farmland Preservation Plan, approximately 21 percent of the Town's area is in agricultural use. Most agricultural uses are located in the Wallkill River Valley, which encompasses the mid and easterly sections of the Town. Much of the Town's open space and vacant land uses are found on the flanks and hilltops of Shawangunk Ridge in the western portion of Shawangunk. Residential uses, primarily single-family detached dwellings, are found throughout the entire Town, but tend to be concentrated in the southerly area within and around the hamlet of Wallkill, and adjoining communities in nearby Orange County, including Pine Bush and Walden. Depending on location, the minimum lot size ranges from 0.5 acres in the established hamlets which are served by public water and sewer, to 7 acres in the Shawangunk Ridge area. Other uses, including commercial uses, are located in the Wallkill and Walker Valley hamlets, along Route 300, Route 208, and Route 52, and scattered throughout the community. Because the Town is the southernmost town in Ulster County, and closer in proximity to growth areas in the NYC metropolitan region, it had been experiencing significant developmental pressures prior to the economic recession. In 2014, applicants are beginning to revisit applications, update them, and reappear before the boards. Most applications which received decisions in the past 5 years have been primarily small lot (3 or less) subdivisions. At this time, there are approximately six subdivisions that have received preliminary or final subdivision which have not commenced construction – these represent 93 single-family lots. Four proposed subdivisions, totaling approximately 239 lots, have received positive declarations under SEQRA and have yet to submit environmental impact statements. There are at least another eight projects that are "dormant" which	The Town of Shawangunk board and officials enforce local regulations, and ensure that state and federal regulations are complied with during land use application reviews. The Town regulates new development from the effects of natural hazards, primarily through regulations contained in the Town Zoning Law and other laws including: The Zoning Law mandates the submission of cluster subdivisions for subdivisions of four lots or more. Among its purposes, the cluster subdivision regulations recommend preservation of the following resources to limit impacts to natural hazard areas: lands with slopes of 15% or more, the 100-year floodplain, or land with unique or unusual landforms (e.g., Shawangunk Ridge). The cluster subdivision layout limits impacts to these resources by placing them within dedicated open space areas, protected by conservation easement. The Zoning Law, in Section 177-11, requires that among other features, the 100-year floodplain be subtracted from net acreage when calculating minimum lot area. The effect is that development is reduced in areas where this natural hazard is present. During application review, it is the Planning Board's policy to prohibit development from the floodplain. It does so by imposing map notes which require that dwellings be sited in the areas outside the floodplain, or outside of other environmental sensitive or natural hazard areas. The Zoning Law establishes two zoning districts, the RS-1 and RS-2 (Ridge Stewardship zones), which regulate the slopes and ridgetop of Shawangunk Ridge. A purpose for protecting these areas is to limit development on extreme slopes and fragile soils. The law limits vegetation removal to 20,000 square feet without site plan approval, and it limits the density of residential development to one dwelling unit per 3 to 7 acres. Article XV, Stormwater Management and Erosion & Sediment Control, of the Zoning Law regulates land development to ensure that stormwater runoff is controlled and mitigated. The intent of the law is to control stormwater quantity/quality so as to reduce impacts to

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Community	1. Land Uses and Development Trends in Hazard Areas	2. Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	could add over an additional 200 lots. A 60-dwelling unit, mixed residential/commercial development is commencing review at this time. These projects are scattered throughout the Town, although the largest projects are in the vicinity of the Wallkill hamlet. It is anticipated that the Planning Board will continue to play a critical role in ensuring that projects are designed to limit impacts to natural hazard areas through the site and subdivision review process.	receiving streams, including the potential to increase flooding. Local Law 1 of 2007 establishes the regulations applicable to the administration and enforcement of the local land use and building laws. In particular, it ensures that building permits are issued only in strict accordance with the plans that have been approved by the applicable board to ensure that the conditions and limitations which may have been imposed during land use application review are followed at all steps of the development process. Local Law 2 of 2009, Flood Damage Prevention, regulates activities proposed within the special flood hazard area (100-year floodplain); it requires that an applicant obtain a floodplain development permit prior to undertaking any development within a special flood hazard areas. The law requires that developments be reviewed to assess their impact on the floodway, and construction standards are imposed on structures proposed to be situated within a special flood hazard area.
Ulster, Town of	At the time the last version of the plan was prepared, the Town of Ulster was reviewing a 25-lot subdivision fronting the Esopus Creek (six of the 25 being on the water front), and also a 100-lot subdivision across the street from the Esopus Creek. The 25-lot subdivision was approved, but after several years the property owner later requested that the lots be recombined; this request was granted (none of the lots had been developed). The 100-lot subdivision request was later withdrawn. At this time there is no planned development in the Town.	The Town of Ulster continues to enforce building code regulations for both new construction and renovation in the flood plain. Other hazards and wildfire buffer zones, the Town of Ulster defers to the current New York State Building Code.
Wawarsing, Town of	Last year and this year, most of our developments are repairs to single family homes, Oak Ridge Roads, Hamlet of Spring Glen, Mountaindale Road, Carlo Drive Development in Kerhonkson, Banadics Road, Arrowhead Road, Cape Avenue aka Ulster Heights Road (County of Ulster Road), Lewis Road, Agricultural on Berme Road, South Gully Road.	The Town of Wawarsing enforces current New York State Building code regulations for development in the floodplain. Other hazards such as wind and landslides, the Town follows the New York State Building Code. Future plan to update current Comprehensive Plan to be reviewed.
Woodstock, Town of	The Town of Woodstock Planning Board is reviewing the Town's Comprehensive Plan to determine if changes are needed to update specific zoning district development standards in hazard areas or sensitive areas such as aquifer and critical environmental areas. Most of the Town's developable lands have already been developed, leaving hazard areas at risk unless planned development can be implemented.	The Town of Woodstock adopted Wetlands and Watercourse Protection Standards in 2009.

Potential for Future Development to Impact Vulnerability for Non-delineable Hazards

Some hazards have discrete, delineable hazard areas associated with them. In other words, lines can be drawn on a map to show approximate areas that are potentially susceptible to the hazard versus those that are not. Delineable hazards identified in this plan include coastal erosion, dam failure, flooding, storm surge, wave action, and wildfires. In this section, we will address the potential for future development trends to impact vulnerability for non-delineable hazards. These hazards could impact any location – their geographic footprint is county-wide. **Non-delineable hazards identified in this plan include extreme temperatures, extreme wind, lightning, tornados, drought, earthquakes; and severe storms such as hurricanes, tropical storms, nor'easters, and winter storms.** Because these hazard areas cover the entirety of Ulster County and each of its municipalities, future development trends in non-delineable hazard areas would be the same as those observed county-wide.

Development is occurring throughout the county, and population is growing. As a whole, Ulster County faces the challenge of accommodating growth while preserving environmentally sensitive lands and open space. As population increases and more residential and commercial buildings, infrastructure, public facilities and other assets are constructed to support such growth, potential future hazard vulnerability is likely to increase. In general, more people, buildings, and infrastructure will be exposed to natural hazards over time. If current demographic trends continue, the proportion of the population representing young children, the elderly, and those with other special needs is likely to increase somewhat in the foreseeable future.

Ulster County and its communities are cognizant of the risks that it faces due to the impacts of natural hazards. Management of risk in the midst of growth is of paramount importance in each community's overall attainment of sustainability and disaster resiliency. Many municipalities have programs in place today which address certain natural hazards – whether it is a comprehensive or master plan, floodplain management ordinance, or steep slope ordinance. New development on vacant parcels is likely to increase exposure to natural hazards – though many impacts are expected to be reduced or eliminated because they are built to codes and standards which, in many cases, offer a certain degree of protection from future damages. In addition to development of vacant parcels, several of Ulster County's communities are undergoing significant redevelopment. Older buildings (built before current codes and standards were adopted) are being demolished and replaced with new buildings built to current codes and standards. This trend has been observed in Ulster County in recent years, and it has been exacerbated due to the recovery process from the impacts of storms Irene, Lee, and Sandy. This type of development in hazard areas can work to somewhat reduce overall vulnerabilities for those parcels due to the fact that the redeveloped structures are being built to higher codes and standards than the previous structures had been.

In terms of conditions affecting vulnerability, Greenfield development (development that occurs on previously undeveloped parcels), is more likely to result in an increase in a community's vulnerability to natural hazards because it represents a net increase in exposure of people and property. Redevelopment, on the other hand, is not always as straightforward. Redevelopment bringing pre-existing building stock into compliance with current codes and standards could offer a certain degree of protection from future events, and decrease a community's overall vulnerability. However, redevelopment where pre-existing building stock is replaced with higher value or higher density development could, in turn, increase a community's overall vulnerability.

Extreme Temperatures. The extreme temperature hazard area covers the whole of Ulster County and is essentially uniform for all jurisdictions; therefore, future development trends for the extreme temperature hazard area would be the same as those county-wide. If current demographic trends continue, the

proportion of the population whose health can be particularly vulnerable to extremes in temperature (for example, the young and elderly) is likely to increase in the foreseeable future.

Extreme Wind. One hundred percent of the land and built environment in the County is susceptible to extreme wind events. This is also true for currently vacant (developable) parcels. The wind hazard area encompasses the entire planning region and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the extreme wind hazard area would be the same as those development trends identified on a municipal basis earlier in this chapter. New construction is subject to the requirements of the New York State Uniform Fire Prevention and Building Code (Uniform Code), which contains provisions for wind resistant design. It is anticipated that while an increasing number of structures will be present, they will be built to a code that will offer a certain degree of protection from the most frequent high wind events.

Lightning. One hundred percent of the land and built environment in the participating jurisdictions is susceptible to lightning. This is also true for currently vacant (developable) parcels. The lightning hazard area encompasses the entire planning region and is uniform from one jurisdiction to the next. Therefore, future development trends for the extreme wind hazard area would be the same as those development trends identified on a municipal basis earlier in this chapter. New construction is subject to the requirements of the New York State Uniform Fire Prevention and Building Code (Uniform Code), which contains provisions for lightning resistant design. It is anticipated that while an increasing number of structures will be present, they will be built to codes which include basic measures to protect against lightning strikes.

Tornados. One hundred percent of the land and built environment in the County is susceptible to tornado events. This is also true for currently vacant (developable) parcels. The tornado hazard area encompasses the entire planning region and is essentially uniform from one jurisdiction to the next. Therefore, future development trends for the tornado hazard area would be the same as those development trends identified on a municipal basis earlier in this chapter. New construction is subject to the requirements of the New York State Uniform Fire Prevention and Building Code (Uniform Code), which contains provisions for wind resistant design including the extreme high winds experienced during tornados. It is anticipated that while an increasing number of structures will be present, they will be built to a code that will offer a certain degree of protection from the most frequent high wind events.

Drought. The drought hazard area encompasses the entire planning region and is uniform from one jurisdiction to the next, although the local impact depends on the prevalence of agricultural land in individual municipalities. While the individual jurisdictions often strive to focus on the preservation of farmland and other open space, possible pressures on agricultural land to be zoned for residential and other development, may reduce the economic effects of drought on agriculture, while the impact on potable water supplies may increase.

Severe Storms: Hurricanes, Tropical Storms, Nor'easters, and Winter Storms. One hundred percent of the land and built environment in the participating jurisdictions is susceptible to severe weather events. This is also true for currently vacant (developable) parcels. Severe weather events such as hurricanes/tropical storms, nor'easters, tornadoes, and winter storms/ice storms can occur anywhere in the participating jurisdictions. These events have certain hazards associated with them, depending on the particular event, and include: flooding, storm surge, wave action, coastal erosion, and extreme winds. Refer elsewhere in this section for discussions regarding development trends in those hazard areas. Note that for winter storms and nor'easters, the New York State Uniform Fire Prevention and Building Code (Uniform Code) also contains provisions regarding snow/ice loads. It is anticipated that while an increasing number of structures will be present, they will be built to codes which include basic measures to protect against the potentially crushing effects of high accumulations of snow and ice on roofs.

Potential for Future Development to Impact Vulnerability for Delineable Hazards

Dam Failure. The New York State Department of Environmental Conservation Dam Safety Program maintains an inventory of dams in the State and conducts safety inspections of dams, completes technical reviews of proposed dam construction or modification, monitoring of remedial work for dam safety compliance, and is involved in emergency preparedness activities. At the time of writing, research of readily available data sources did not reveal any dams proposed or under construction, in addition to those listed by the US Army Corps of Engineers National Inventory of Dams, or the Stanford University National Performance of Dams Program.

Table 3d.7
Potential for Future Development to Impact Dam Failure Hazard Vulnerability

Jurisdiction	DAM FAILURE		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[5] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of	■	■	■
Kingston, City of			
Kingston, Town of			
Lloyd, Town of	■	■	■
Marbletown, Town of	■	■	■
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of			
Olive, Town of	■	■	■
Plattekill, Town of	■	■	■
Rochester, Town of	■	■	■
Rosendale, Town of	■	■	■
Saugerties, Town of			
Saugerties, Village of			
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

Flood. Individuals and larger developers often look toward land along rivers, streams, canals, bays, and near the ocean for development because of the passive and active recreational opportunities that they offer. In turn, flood hazard areas (for flooding and storm surge) are often areas where development pressures are high due to the recreational value of these lands, particularly in communities where the amount of undeveloped land is small and the density of development is high. Development within mapped flood hazard areas is currently regulated for communities participating in FEMA's National

[5] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Flood Insurance Program (NFIP). All municipalities in the County participate in FEMA's National Flood Insurance Program, and thereby must have in place a floodplain management ordinance to regulate activities in the floodplain, as well as a designated floodplain manager/NFIP Coordinator to enforce the relevant ordinances. This will work to protect new development and substantial improvements in the County's floodplains. In addition, the Towns of Rosendale and Shandaken have included a discussion of floodplains in their comprehensive plan. The Town of Lloyd doesn't include floodplains, but does include a section on the restraints to development due to hydrologic considerations. While an increased number of assets could be susceptible, it is assumed that they will be built to codes that will offer a certain degree of protection from the most frequent events.

Table 3d.8
Potential for Future Development to Impact Flood Hazard Vulnerability

Jurisdiction	FLOOD		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[6] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of	■	■	■
Kingston, City of	■	■	■
Kingston, Town of	■	■	■
Lloyd, Town of	■	■	■
Marbletown, Town of	■	■	■
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of	■	■	■
Olive, Town of	■	■	■
Plattekill, Town of	■	■	■
Rochester, Town of	■	■	■
Rosendale, Town of	■	■	■
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

[6] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Ice Jams. The ice jam hazard is similar to the flood hazard in that ice jams may cause rivers and streams to overflow their banks. If a structure is near the banks of the rivers or streams, it may also be subject to structural damage from the impact of ice striking the structure. The jurisdictions' flood hazard ordinances are assumed to currently deal with the flooding aspect of the ice jam hazard, and future damages due to this hazard will depend on development within the floodplain and adherence to the relevant building codes.

Table 3d.9
Potential for Future Development to Impact Ice Jam Hazard Vulnerability

Jurisdiction	ICE JAMS		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[7] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of	■	■	■
Kingston, City of	■	■	■
Kingston, Town of	■	■	■
Lloyd, Town of	■	■	■
Marbletown, Town of	■	■	■
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of	■	■	■
Olive, Town of	■	■	■
Plattekill, Town of	■	■	■
Rochester, Town of	■	■	■
Rosendale, Town of	■	■	■
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

[7] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Storm Surge. The Hudson River Valley is vulnerable to coastal storms and their associated storm surges. The River is actually a tidal estuary over its 153 mile course from the New York Harbor to the Federal Dam at Troy. Coastal storm surge in the Atlantic Ocean during certain hurricanes and tropical storms can cause a surge of water to flow up the Hudson River and inundate portions of communities along its banks. During Sandy, the USGS reported that the Hudson River was approximately six feet higher than normal near Poughkeepsie, peaking at 9.54 feet. Risk will increase over time with rising sea levels. Local flood hazard ordinances offer some degree of protection from this hazard, and future damages will depend on the nature and magnitude of development within the floodplain and the degree of adherence to the relevant building codes.

Table 3d.10
Potential for Future Development to Impact Surge Hazard Vulnerability

Jurisdiction	SURGE		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[8] that can mitigate risk?
Ulster, County of			
Denning, Town of			
Ellenville, Village of			
Esopus, Town of	■	■	■
Gardiner, Town of			
Hardenburgh, Town of			
Hurley, Town of			
Kingston, City of	■	■	■
Kingston, Town of			
Lloyd, Town of	■	■	■
Marbletown, Town of			
Marlborough, Town of	■	■	■
New Paltz, Town of			
New Paltz, Village of			
Olive, Town of			
Plattekill, Town of			
Rochester, Town of			
Rosendale, Town of			
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of			
Shawangunk, Town of			
Ulster, Town of	■	■	■
Wawarsing, Town of			
Woodstock, Town of			

[8] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Earthquakes. The earthquake hazard area encompasses the entirety of Ulster County. PGA values of between 2 and 3%g have a 10 percent chance of being exceeded over 50 years. The earthquake hazard area encompasses the entire County planning area and is nearly uniform from one jurisdiction to the next, although the effects of an earthquake may vary from one jurisdiction and across jurisdictions as the soil type varies. While new development could lead to an increased number of assets susceptible to this hazard in the future, new construction is subject to the requirements of the New York State Uniform Fire Prevention and Building Code (Uniform Code), which contains provisions for earthquake resistant design. It is anticipated that while an increasing number of structures will be present, they will be built to a code that will offer a certain degree of protection from the most frequent events.

Table 3d.11
Potential for Future Development to Impact Earthquake Hazard Vulnerability

Jurisdiction	EARTHQUAKE		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[9] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of	■	■	■
Kingston, City of	■	■	■
Kingston, Town of	■	■	■
Lloyd, Town of	■	■	■
Marbletown, Town of	■	■	■
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of	■	■	■
Olive, Town of	■	■	■
Plattekill, Town of	■	■	■
Rochester, Town of	■	■	■
Rosendale, Town of	■	■	■
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

[9] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Landslides. Scattered areas of the County are susceptible to landslide activity as described in Section 3a. Although there are few recorded examples of significant landslide events in Ulster County, the future may bring an increased frequency of events if vacant parcels and wildland areas in the relevant areas continue to be built on. The Towns of Lloyd, Rosendale and Ulster have included mapping of potential landslide areas as part of their comprehensive plan. They had previously determined that those areas could be at risk and consider the areas a constraint to development.

Table 3d.12
Potential for Future Development to Impact Landslide Hazard Vulnerability

Jurisdiction	LANDSLIDES		
	Hazard Potential[10]	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[11] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of			
Kingston, City of			
Kingston, Town of	■	■	■
Lloyd, Town of	■	■	■
Marbletown, Town of			
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of			
Olive, Town of	■	■	■
Plattekill, Town of			
Rochester, Town of	■	■	■
Rosendale, Town of	■[12]		
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

[10] Landslides are considered to be a hazard for those communities in mapped areas of high/moderate incidence/susceptibility, as shown here with the '■' symbol. Landslides, while possible, are not likely to occur in the balance of the county lying in areas of low incidence/susceptibility.
[11] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.
[12] Rosendale is outside of mapped areas of high/moderate incidence/susceptibility; however, it has been added here due to its inclusion of particular areas of landslide interest in its comprehensive plan.

Wildfires. Areas that are typically considered to be safe from wildfires include highly urbanized, developed areas that are not contiguous with vast areas of wild lands. Areas typically considered to be prone to wildfires include large tracts of wild lands containing heavier fuels with high continuity such as those forested areas in many parts of the County. Pressure to develop some forested areas, especially for residential use, will generally result in increases to the urban-wildlife interface and the value of improved property within these areas in most jurisdictions, and hence an increased risk of future property damage and public danger due to wildfires.

Table 3d.13
Potential for Future Development to Impact Wildfire Hazard Vulnerability

Jurisdiction	WILDFIRES		
	Hazard Potential	Potential for Future Development to Increase Hazard Vulnerability	Are measures identified in the jurisdiction's plan integration strategy[13] that can mitigate risk?
Ulster, County of	■	■	■
Denning, Town of	■	■	■
Ellenville, Village of	■	■	■
Esopus, Town of	■	■	■
Gardiner, Town of	■	■	■
Hardenburgh, Town of	■	■	■
Hurley, Town of	■	■	■
Kingston, City of	■	■	■
Kingston, Town of	■	■	■
Lloyd, Town of	■	■	■
Marbletown, Town of	■	■	■
Marlborough, Town of	■	■	■
New Paltz, Town of	■	■	■
New Paltz, Village of	■	■	■
Olive, Town of	■	■	■
Plattekill, Town of	■	■	■
Rochester, Town of	■	■	■
Rosendale, Town of	■	■	■
Saugerties, Town of	■	■	■
Saugerties, Village of	■	■	■
Shandaken, Town of	■	■	■
Shawangunk, Town of	■	■	■
Ulster, Town of	■	■	■
Wawarsing, Town of	■	■	■
Woodstock, Town of	■	■	■

[13] See Jurisdictional Annexes of Appendix 1.2; Worksheet 6.

Conclusion

Ulster County is balancing the objectives of preserving natural, cultural and historic resources; facing the reality of an economy which is undergoing a big change as the nation moves into the post-industrial era; and, seeing development that is driven by agricultural and natural resources as well as the occurrences of the nation's largest urban area only 70 miles away. The County is involved in economic development, housing, open space, stormwater and transportation planning projects – among others. This is an indication that they are concerned with their communities and want to ensure that they are safe, thriving and appealing places to live, work, and play.

The following recent development trends are expected to continue in the future:

- The County and its' jurisdictions are expected to continue to focus on preserving open space throughout the area;
- Most new development is expected to continue to occur in the Hudson River Valley, especially along Interstate Highway 87 corridor;
- Additional development is expected to take place along transportation corridors in the County, particularly in and around existing hamlets that have developed throughout the County;
- Redevelopment is expected to take place throughout the County, as sites that were vacated due to changes in the economy are reused, modified or replaced;
- Agriculture and natural resources is expected to continue to be a focus of the Ulster County economy;
- Ulster County is expected to continue to be both recreational destination and drive both the commercial and industrial development in the County;
- Ulster County is expected to continue to be a location where individuals that seek to leave the bustle of the New York City urban area seek to locate;
- Ulster County communities are generally expected to continue their historic practice of rebuilding after major disasters, as vast areas of preserved open space render much of the county undevelopable and, due to the considerable areas of mountainous terrain, valleys and river valleys are often the most readily-developable locales.

As such, the County and its jurisdictions will continue to focus on:

1. Preserving open space throughout the County;
2. Ensuring that development within the County will meet the minimum requirements of the National Flood Insurance Program as well as meeting the County's minimum Stormwater Management requirements;
3. Enforcing minimum building codes meeting the requirements of New York State Building Code;
4. Ensuring that development is limited to areas that are not subject to high landslide potential.

Note: All data was taken from websites of Ulster County or the participating jurisdictions.

SECTION 3E – CONCLUSIONS ON HAZARD RISK

Priority Risk Index

The hazard profiles presented in this section were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its guidance document entitled *Local Mitigation Planning Handbook*. It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts; and carefully considers the findings in other relevant plans, studies and technical reports.

In order to draw some meaningful planning conclusions on hazard risk for Ulster County as a whole and each participating jurisdiction, the hazard profiling and risk assessment processes were used to generate hazard classifications according to a "Priority Risk Index" (PRI) - a tool used to measure the degree of risk for identified hazards in a particular planning area. The purpose of the PRI, described further below, is to categorize and prioritize all potential hazards as high, moderate or low risk. The PRI is used to assist the Ulster County Planning Committee in gaining consensus on the determination of those hazards that pose the most significant threat to Ulster County based on a variety of factors. The PRI is not scientifically based, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in Ulster County based on standardized criteria. Combined with the asset inventory and quantitative vulnerability assessment provided in the previous sections, the summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for Ulster County jurisdictions to consider as part of their proposed mitigation strategies. Each jurisdiction focused on the identification of mitigation actions that will reduce or eliminate their own unique hazard risks.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor[1], as summarized in **Table 3a.21**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below. According to the weighting scheme applied for Ulster County, the highest possible PRI value is 4.0.

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

As part of the 2015 Plan Update, the application of the PRI was done for *every* participating jurisdiction. Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the CPG.

[1] The Ulster County Planning Committee, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

Table 3e.1
Priority Risk Index for Ulster County

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	10%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

PRI Results

The application of the PRI was done separately for each jurisdiction in Ulster County, and for the County as a whole. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Planning Committee and results of the vulnerability assessment. The results were then used in calculating PRI values and making final determinations for the risk assessment.

Table 3e.2 summarizes the degree of risk assigned to each category for all identified hazards based on the application of the PRI for Ulster County, as a whole.

Table 3e.3 presents an overview of the PRI Results for each jurisdiction.

Detailed tables for each jurisdiction (similar to Table 3e.2) are included in **Appendix 3e.1**.

Table 3e.2
Summary of PRI Results for Ulster County*

Hazard	Category/Degree of Risk											
	Probability	PROBABILITY INDEX VALUE	Impact	IMPACT INDEX VALUE	Spatial Extent	SPATIAL INDEX VALUE	Warning Time	WARNING INDEX VALUE	Duration	DURATION INDEX VALUE	PRI Score	Hazard Ranking
Atmospheric Hazards												
Extreme Temperatures	Highly Likely	4	Minor	1	Large	4	More than 24 hours	1	Less than one week	3	2.7	M
Extreme Wind	Highly Likely	4	Limited	2	Large	4	More than 24 hours	1	Less than 24 hours	2	2.9	M
Hurricane & Tropical Storm	Possible	2	Catastrophic	4	Small	2	More than 24 hours	1	Less than one week	3	2.6	M
Lightning	Highly Likely	4	Minor	1	Negligible	1	Less than 6 hours	4	Less than 6 hours	1	2.2	L
Nor'easter	Likely	3	Minor	1	Large	4	More than 24 hours	1	Less than one week	3	2.4	M
Tornado	Possible	2	Catastrophic	4	Negligible	1	Less than 6 hours	4	Less than 6 hours	1	2.5	M
Winter Storm	Highly Likely	4	Minor	1	Large	4	More than 24 hours	1	Less than one week	3	2.7	M
Hydrologic Hazards												
Dam Failure	Unlikely	1	Catastrophic	4	Negligible	1	Less than 6 hours	4	Less than 6 hours	1	2.2	L
Drought	Possible	2	Minor	1	Large	4	More than 24 hours	1	More than one week	4	2.2	L
Flood	Highly Likely	4	Critical	3	Small	2	6 to 12 hours	3	Less than one week	3	3.1	H
Ice Jam	Likely	3	Minor	1	Negligible	1	More than 24 hours	1	Less than one week	3	1.8	L
Surge	Unlikely	1	Critical	3	Negligible	1	More than 24 hours	1	Less than one week	3	1.8	L
Geologic Hazards												
Earthquake	Unlikely	1	Minor	1	Large	4	Less than 6 hours	4	Less than 6 hours	1	1.9	L
Landslide	Possible	2	Critical	3	Small	2	Less than 6 hours	4	Less than one week	3	2.6	M
Other Natural Hazards												
Wildfire	Possible	2	Critical	3	Small	2	Less than 6 hours	4	Less than one week	3	2.6	M

* **Key:** **Red = High hazard raking;** **Orange = Moderate hazard ranking;** **Yellow = Low hazard ranking.**

Table 3e.3
PRI Results for Each Jurisdiction

Jurisdiction	Atmospheric Hazards							Hydrologic Hazards					Geologic Hazards		Wildfire
	Extreme Temperatures	Extreme Wind	Hurricane and Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Dam Failure	Drought	Flood	Ice Jams	Storm Surge	Earthquake	Landslide	
ULSTER COUNTY	**2.7**	**2.9**	**2.6**	**2.2**	**2.4**	**2.5**	**2.7**	**2.2**	**2.2**	**3.1**	**1.8**	**1.8**	**1.9**	**2.6**	**2.6**
Denning, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Ellenville, Village of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Esopus, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	1.8	1.9	2.6	0.0
Gardiner, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Hardenburgh, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Hurley, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	#N/A	0.0
Kingston, City of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	#N/A	2.2	3.1	1.8	1.8	1.9	#N/A	0.0
Kingston, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	#N/A	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Lloyd, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	1.8	1.9	2.6	0.0
Marbletown, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	#N/A	0.0
Marlborough, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	1.8	1.9	2.6	0.0
New Paltz, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
New Paltz, Village of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	#N/A	2.2	3.1	1.8	#N/A	1.9	#N/A	0.0
Olive, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Plattekill, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	#N/A	0.0
Rochester, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Rosendale, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	#N/A	0.0
Saugerties, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	#N/A	2.2	3.1	1.8	1.8	1.9	2.6	0.0
Saugerties, Village of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	#N/A	2.2	3.1	1.8	1.8	1.9	2.6	0.0
Shandaken, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Shawangunk, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Ulster, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	1.8	1.9	2.6	0.0
Wawarsing, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0
Woodstock, Town of	2.7	2.9	2.6	2.2	2.4	2.5	2.7	2.2	2.2	3.1	1.8	#N/A	1.9	2.6	0.0

#N/A = the hazard is not applicable in this jurisdiction

Final Determinations

The conclusions drawn from the application of the PRI process for Ulster County, including the PRI results and input from the Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk and Low Risk. Hazards with a PRI of 3.0 or more were deemed "high risk"; hazards with a PRI between 2.4 and 2.9 were deemed "moderate risk"; and hazards with a PRI of 2.3 or less were deemed "low risk". For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Ulster County. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates[2]. **Table 3e.4** presents conclusions on hazard risk for the County as a whole, based on the PRI scores for each hazard in the County. **Table 3e.5** presents an overview of the resultant hazard risk rankings for each jurisdiction. Detailed tables for each jurisdiction are included in **Appendix 3e.1**.

[2] Overall conclusions on hazard risk were re-evaluated as part of the first plan update for every participating jurisdiction.

Table 3e.4 Hazard Risk Rankings for Ulster County	
HIGH RISK **PRI ≥ 3.0**	Flood
MODERATE RISK **2.4 ≤ PRI ≤ 2.9**	Extreme Temperatures Extreme Wind Hurricane and Tropical Storm Nor'easter Tornado Winter Storm Landslide Wildfire
LOW RISK **PRI ≤ 2.3**	Lightning Dam Failure Drought Ice Jam Surge Earthquake

Table 3e.3
Hazard Risk Rankings for Each Jurisdiction

Jurisdiction	Atmospheric Hazards							Hydrologic Hazards					Geologic Hazards		
	Extreme Temperatures	Extreme Wind	Hurricane and Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Dam Failure	Drought	Flood	Ice Jams	Storm Surge	Earthquake	Landslide	Wildfire
ULSTER COUNTY	M	M	M	L	M	M	M	L	L	H	L	L	L	M	M
Denning, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Ellenville, Village of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Esopus, Town of	M	M	M	L	M	M	M	L	L	H	L	L	L	M	L
Gardiner, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Hardenburgh, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Hurley, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	#N/A	L
Kingston, City of	M	M	M	L	M	M	M	#N/A	L	H	L	L	L	#N/A	L
Kingston, Town of	M	M	M	L	M	M	M	#N/A	L	H	L	#N/A	L	M	L
Lloyd, Town of	M	M	M	L	M	M	M	L	L	H	L	L	L	M	L
Marbletown, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	#N/A	L
Marlborough, Town of	M	M	M	L	M	M	M	L	L	H	L	L	L	M	L
New Paltz, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
New Paltz, Village of	M	M	M	L	M	M	M	#N/A	L	H	L	#N/A	L	#N/A	L
Olive, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Plattekill, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	#N/A	L
Rochester, Twon of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Rosendale, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	#N/A	L
Saugerties, Town of	M	M	M	L	M	M	M	#N/A	L	H	L	L	L	M	L
Saugerties, Village of	M	M	M	L	M	M	M	#N/A	L	H	L	L	L	M	L
Shandaken, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Shawangunk, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Ulster, Town of	M	M	M	L	M	M	M	L	L	H	L	L	L	M	L
Wawarsing, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
Woodstock, Town of	M	M	M	L	M	M	M	L	L	H	L	#N/A	L	M	L
#N/A = the hazard is not applicable in this jurisdiction															

Key Risk Findings

Key Risk Findings are problem statements developed from the risk assessment by each participating jurisdiction. Each jurisdiction was encouraged to consider different types of mitigation actions for addressing their highest hazards and Key Risk Findings.

Key Risk Findings for Ulster County are presented in **Table 3e.6**. Key Risk Findings provided by participating jurisdictions are included in **Appendix 3e.1**.

Table 3e.6
Key Risk Findings for Ulster County

Currently there are no municipalities in Ulster County enrolled in the NFIP's CRS. Many residents and businesses in Ulster County will likely see much higher insurance rates in the near future with approximately 600 of the 1400 policyholders likely to be affected by the removal of pre-FIRM subsidies.
Plank Road is a 3.5-mile County road that is impacted often by flooding. There are several locations where flood damage occurs repeatedly, including several road embankments and at culverts that often plug or are undersized and overtop. This is a vital road for the community as it is the only other way to access points west of Mount Tremper other than State Route 28, which is susceptible to flood damage at an undersized bridge in Mount Tremper and at "Campground Curve" near Phoenicia.
Stony Clove Lane Bridge is a County-owned bridge located at the base of a dead end town road. It provides access to nearly 40 homes and is likely undersized. The bridge has proven to be subject to repetitive erosion/depositional-related damages.
Bridge 202 on Plank Road is a County-owned bridge that has been shown through recent HEC-RAS modeling to cause a significant backwatering effect during 50-year storms that inundates Miller Road, a dead-end road with about 20 homes.
Bridge Street Bridge is a County-owned bridge that provides crucial ingress and egress from the Hamlet of Phoenicia. The structure has been damaged (and closed for several months) on two occasions since 2005.
The Old Mount Tremper Bridge is a County-owned bridge that has been closed since 1986 because of its deteriorated condition and could pose a downstream flood hazard if it collapses into the Esopus Creek.
A section of Ulster County Route 47 downstream of McKenely Hollow, as well as the terminus of the road itself (intersection with County Route 47) and surrounding homes, is very vulnerable to moderate storms and has been inundated by flooding on several occasions since the 1980s. Several locations within one mile upstream and downstream are very vulnerable to embankment failure from flooding, which would also force road closure if it were to fail. This is a critical road for access to several businesses, State land, and a large and remote YMCA Campus.
Creekside Drive is a County road that is impacted often by flooding. There are several locations where flood damage occurs repeatedly, including several road embankments and at the location of a critical bridge. This is a vital road for the community as it is the only other way to access the western portion of the County other than State Route 28, which is susceptible to flood damage.
Just outside of the Hamlet of Woodstock, a portion of Ohayo Mountain Road (300 feet) is slumping into the Saw Kill. There are areas where guard rails are sinking into the stream, where the road is eroding into the stream, and where the stream is undermining the road.
Currently an under-sized/clogged culvert causes inundation on well-traveled Glenford-Wittenberg Road in a populated neighborhood during small flow events. The impasse results in a 15-mile detour over the top of Ohayo Mountain.
Currently an under-sized culvert causes inundation of well-traveled Zena-Sawkill Road during moderate flows resulting in a roadway that becomes impassable and results in a 2-mile detour through a dense residential neighborhood.
Currently an under-sized culvert on Zena-Sawkill Road, in conjunction with a low spot in the road, causes backwatering and inundation of a well-traveled road even during moderate flows resulting in a roadway that becomes impassable and results in a 5-mile detour through a residential neighborhood.
A critical mountainous road in a rural portion of the Town is extremely vulnerable to washouts during flash flooding events, resulting in loss of ingress/egress (County Route 42) through remote areas located above a susceptible structure and unpredictable stream section.
County Route 3 routinely floods during small storms cutting of ingress/egress.
Debris-accumulating at Route 42 Maltby Hollow Bridge causes flooding up and downstream and erosional hazard to the road and bridge abutments. More than 100 homes upstream would be cut off from the rest of the town.
Because of diminishing capacity to convey floodwaters effectively, water is scouring out eastern abutment of the Route 42 Watson Hollow Bridge as well as causing a backwatering effect upstream of the bridge, resulting in inundation and other erosion problems.
Unstable banks, gravel deposition, and accumulation of woody debris are problems along County Route 42 in the Hamlet of West Shokan. The problem area is roughly a mile from Ashokan Reservoir to Maltby Hollow. This area is the only access/egress for 183 homes. Two of the highest importance areas are at Longitude: -74.283762/ Latitude: 41.967746; and at Longitude: -74.286900/Latitude: 41.966992.
In the Dry Brook Watershed there are several vulnerable locations that frequently become inundated or routinely wash out during the flash floods that often hit the steep mountainsides and narrow valleys in the Town. Because many of the town roads are dead-ends, residents and emergency responders get cut-off.

Table 3e.6 Key Risk Findings for Ulster County
The Dry Brook stream has deposited a large gravel bar and threatens to encroach into Dry Brook Road (County Route 49) cutting off ingress egress by the residents upstream. Location is on dead end road which would cut-off access to residents and emergency personnel if it fails.
A section of Ulster County Route 47 along the West Branch Neversink River (a very remote mountainous area less than 5 miles away from Frost Valley YMCA, a camp that hosts roughly 38,000 people annually), is very vulnerable to even moderate (10-year) storms and has been inundated and washed out by flooding on several occasions since the 1980s. Not only is this is a critical road for access to State land and the remote YMCA Campus, it also serves as the only ingress/egress for a hundred homes (and emergency service personnel) other than a 70 mile, two hour detour.
With several significant flooding events within the past decade, gravel bars have formed and large woody debris has accumulated at many locations throughout the Town along the West Branch Neversink River. Several of these depositional areas are in locations that either direct streamflow alongside or directly at Frost Valley Road, or are located just upstream of bridges.
The Wallkill River (and the Klein Kill Creek), in the vicinity of the Village of New Paltz, inundates portions of several Ulster County roads in this populated area, resulting in dangerous rescue conditions for emergency responders and lengthy detours for residents and first responders alike. Of particular concern are three areas prone to inundation along sections of: County Rd #18A between State Route 299 and Mountain Rest Road, as well as the portion along the Klein Kill (Humpo Creek); County Road #117 between Springtown Road and Libertyville Road; County Road #61 from its junction with State Route 299 going 3/4-mile south.
Kyserike Road (Ulster County Road 29A) is an important local road that services several homes and farms. In this location, a low-lying stretch of road frequently becomes inundated by the Kripplebush Creek causing detours and requiring routine maintenance.
Bruynswick Road is a critical road that services dozens of homes and businesses. In this location, a decaying culvert continues to cause backwatering and requires constant maintenance. Inundation of the roadway is common and results in lengthy detours.
Binnewater Road is a critical road that services dozens of homes and businesses. In this location, a decaying culvert continues to cause backwatering and requires constant maintenance. Inundation of the roadway is common and results in lengthy detours.
Creek Locks Road (UC Road #73) is a critical road that services dozens of homes and businesses. In this location, a large embankment continues to slump into the Rondout Creek. This site continues to worsen each year, and soon the failure will impact the road, resulting in lengthy detours.
Ulster County Rd #13 (Tongore Road) is a critical road that connects the Lower Esopus Valley with NYS Route 213. In this location, a large embankment continues to slump into the Esopus Creek. This site continues to worsen each year, and soon the failure will impact the road, resulting in lengthy detours.
River Road (Ulster County Road #81) is a critical road that serves dozens of homes, businesses, and highly-used pubic access areas on the hillside along the Hudson River. Due to erosion, multiple locations along this road continually slump and slide down to the river, cutting off access and resulting in lengthy detours.

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SECTION 4 - CAPABILITIES AND RESOURCES

Performing a Capability Assessment is one step of a FEMA-approved hazard mitigation plan update. A mitigation planning Capability Assessment consists of taking an in-depth look at community mechanisms (such as plans, codes, ordinances, staffing, etc.) that can affect hazard mitigation activities. Performing the Capability Assessment helps communities identify the regulatory, administrative, technical, and fiscal capacities and capabilities of their jurisdiction and consider ways that these tools can be used to further hazard mitigation and disaster resiliency goals.

Capability Assessments were undertaken by each participating jurisdiction as part of the development of the first edition of the Hazard Mitigation Plan in 2009. At that time, URS distributed worksheets[1] to the UCECEM and the Core Planning Group in order to initiate this capability assessment. The worksheets requested information pertaining to existing plans, polices, and regulations that contribute to or hinder the ability to implement hazard mitigation actions. They also requested information pertaining to the legal and regulatory capability, technical and administrative capacity, and fiscal capability of each jurisdiction. Completed worksheets were received in 2008 from Ulster County and nine jurisdictions (Ulster County, Gardiner, Hurley, Kingston City, Kingston Town, Lloyd, Marlborough, New Paltz Village, Shandaken, and Ulster), illustrating each jurisdiction's capabilities to implement a hazard mitigation strategy.

For the 2015 Plan Update, each JAT was asked to review their prior feedback, and identify any changes that have occurred since the initial plan was developed. Each JAT either: (a) reviewed their prior feedback and certified that all information previously provided was still current, or (b) reviewed their prior feedback and provided markups to the consultant noting any changes in capabilities that have occurred since that time. Jurisdictions that had not performed a local capability assessment during the development of the initial plan were required to do so during the plan update. During the 2015 Plan Update, each JAT also provided an assessment of their overall legal and regulatory, technical and administrative, and fiscal capabilities; and then identified opportunities for bridging recognized gaps in capabilities to ensure that they are in line with jurisdictional mitigation actions and goals. Each jurisdiction documented their assessment of capabilities on Worksheet 4 – Capability Assessment Update. The consultant used worksheet responses to update this plan section to reflect each jurisdiction's assessment of their current capabilities. Capability assessment updates for each jurisdiction are included in **Appendix 1.2 – Worksheets: Municipal Annexes**. As part of the plan update, 22 jurisdictions have assessed their capabilities (the original ten, plus the following twelve additional jurisdictions: Denning, Ellenville, Hardenburgh, New Paltz Town, Olive, Plattekill, Rosendale, Saugerties Town, Saugerties Village, Shawangunk, Wawarsing, and Woodstock). Seven of the ten jurisdictions that provided feedback in the 2009 Plan have reported some changes in their local capabilities over the first plan maintenance cycle (Ulster County, Gardiner, Kingston City, Kingston Town, New Paltz Village, Shandaken, and Ulster). Three jurisdictions (Esopus, Marbletown, and Rochester) did not participate in the 2015 plan update and did not undertake a capability assessment.

This plan section describes the activities currently reported to be underway which contribute to or can be utilized for hazard mitigation. This assessment of capabilities emphasizes the technical and financial resources available at the State and Federal levels, which the County can access to effectively implement a hazard mitigation program.

[1] During the initial plan development process, URS distributed FEMA's Capability Assessment Worksheet to each jurisdiction ("Worksheet Job Aid #2: Local Hazard Mitigation Capabilities", as included in the FEMA How-To #3 *Developing the Mitigation Plan,* online at *http://www.fema.gov/media-library-data/20130726-1521-20490-5373/howto3.pdf*) .

Capabilities and Resources – Ulster County and Participating Jurisdictions

Legal and Regulatory Capability

As indicated in **Table 4.1**[2], Ulster County and its incorporated jurisdictions have several policies, programs, and capabilities, which help to prevent and minimize future damages resulting from hazards. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. The checkbox (■) indicates that the local government reported to have that particular code, ordinance, or plan.

Table 4.1 - Jurisdictional Legal and Regulatory Capabilities

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purposes Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive Plan	Capital Improvements Plan	Economic Development Plan	Emergency Response Plan	Post-Disaster Recovery Plan	Post-Disaster Recovery Ordinance	Real Estate Disclosure Ordinance	Evacuation plan	Overall legal and regulatory capability to implement hazard mitigation strategies*
Ulster, County of							■	■	■	■				■	M
Denning, Town of	■	■	■	■		■	■			■					M
Ellenville, Village of	■	■	■	■		■	■	■	■	■					M
Esopus, Town of	Did not participate.														
Gardiner, Town of	■	■	■	■	■	■	■	■	■	■	■				H
Hardenburgh, Town of	■	■	■	■		■	■			■	■			■	M
Hurley, Town of	■	■	■	■		■	■			■	■				M
Kingston, City of	■	■	■	■		■	■	■	■	■	■			■	M
Kingston, Town of	■	■	■	■		■								■	M
Lloyd, Town of	■	■	■	■	■	■	■			■					M
Marbletown, Town of	Did not participate.														
Marlborough, Town of	■	■	■	■	■	■	■	■	■	■	■	■		■	M
New Paltz, Town of	■	■	■			■	■			■					M
New Paltz, Village of	■	■	■			■	■			■					M
Olive, Town of	■	■	■			■									L
Plattekill, Town of	■	■	■			■	■			■					L
Rochester, Town of	Did not participate.														
Rosendale, Town of	■	■	■	■	■	■	■		■	■	■			■	M
Saugerties, Town of	■	■		■	■	■	■		■	■					M
Saugerties, Village of	■	■	■			■	■		■	■	■			■	M
Shandaken, Town of	■	■	■	■		■	■			■	■			■	H
Shawangunk, Town of	■	■	■	■		■	■								L
Ulster, Town of	■	■	■	■		■	■			■				■	M
Wawarsing, Town of	■	■	■	■		■	■	■		■	■				M
Woodstock, Town of	■	■	■	■		■	■				■			■	H

* H=High, M=Moderate, L=Low Capabilities

[2] A description of each legal and regulatory capability that was considered can be found in **Appendix 4.1.**

Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is contingent upon its staff and resources. Administrative capability is determined by evaluating whether there are an adequate number of personnel to complete mitigation activities. Similarly, technical capability can be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in surveying and Geographic Information Systems.

Table 4.2 provides a summary of the administrative and technical capabilities currently in place in each participating jurisdiction. The checkbox (■) indicates that the local government reported that they maintain a staff member for the given function.

Table 4.2 - Jurisdictional Administrative and Technical Capabilities

Jurisdiction	Planner(s) with knowledge of land development and management practices	Engineer(s) with knowledge of land development and management practices	Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Planner(s) or engineer(s) with an understanding of natural and/or human caused hazards	Floodplain manager	Surveyors	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant writers	Code Enforcement Official	Public Works or Highway Superintendent	Emergency Management Coordinator	Overall technical capability to implement hazard mitigation strategies*	Overall administrative capability to implement hazard mitigation strategies*
Ulster, County of	■	■	■	■		■	■	■		■	■		■	■	H	H
Denning, Town of			■	■	■		■			■		■	■	■	M	L
Ellenville, Village of	■	■	■	■	■	■						■	■	■	M	L
Esopus, Town of	Did not participate.															
Gardiner, Town of	■	■	■	■	■		■			■	■	■	■	■	M	H
Hardenburgh, Town of				■	■		■					■	■	■	M	M
Hurley, Town of	■	■	■	■	■	■						■	■		M	M
Kingston, City of	■	■	■	■	■		■			■	■	■	■	■	H	H
Kingston, Town of			■		■			■		■	■	■	■	■	M	H
Lloyd, Town of	■	■		■	■		■	■				■	■	■	M	M
Marbletown, Town of	Did not participate.															
Marlborough, Town of	■	■	■	■	■	■	■	■	■	■	■	■	■	■	M	M
New Paltz, Town of		■	■	■	■	■	■			■	■	■	■	■	H	H
New Paltz, Village of	■	■	■	■	■	■	■	■		■	■				H	H
Olive, Town of					■							■	■	■	L	M
Plattekill, Town of	■	■	■	■	■	■	■	■		■		■	■	■	M	M
Rochester, Town of	Did not participate.															
Rosendale, Town of	■	■	■	■		■					■	■	■	■	H	H
Saugerties, Town of	■	■	■	■	■		■	■		■	■	■	■	■	M	L
Saugerties, Village of	■	■	■	■	■		■	■			■	■	■	■	H	M
Shandaken, Town of	■	■	■	■	■		■	■	■	■	■	■	■	■	M	M
Shawangunk, Town of	■	■	■	■	■		■					■	■	■	L	M
Ulster, Town of	■	■	■	■	■	■		■		■	■	■	■	■	M	H
Wawarsing, Town of					■		■			■	■				L	M
Woodstock, Town of	■	■	■		■							■	■	■	H	L

* H=High, M=Moderate, L=Low Capabilities

Fiscal Capability

The ability of a local government to implement mitigation activities is also associated with the funding available for policies and projects. Funding for such initiatives is often based on local revenue and financing, as well as outside grants. Costs associated with mitigation activities range from staffing and administrative costs to the actual cost of the mitigation project.

Table 4.3 provides a summary of the fiscal capabilities currently in place in each participating jurisdiction. The checkbox (■) indicates that the financial resource was reported to be available in the local jurisdiction for mitigation purposes.

Table 4.3 - Jurisdictional Fiscal Capabilities

Jurisdiction	Community Development Block Grants (CDBG)	Capital Improvements Project Funding	Authority to Levy Taxes for Specific Purposes	Fees for Water, Sewer, Gas, or Electric Service	Impact Fees for Homebuyers or Developers for New Developments/Homes	Incur Debt through General Obligation Funds	Incur Debt through Special Tax and Revenue Bonds	Incur Debt through Private Activity Bonds	Withhold Spending in Hazard-Prone Areas	Other	Overall fiscal capability to implement hazard mitigation strategies*
Ulster, County of	■	■				■	■			■	L
Denning, Town of			■			■	■				L
Ellenville, Village of	■	■	■	■			■				L
Esopus, Town of	Did not participate.										
Gardiner, Town of		■	■	■		■			■		M
Hardenburgh, Town of	■	■					■				M
Hurley, Town of		■	■		■	■	■	■			L
Kingston, City of	■	■	■	■	■	■					L
Kingston, Town of	■	■	■	■		■	■				M
Lloyd, Town of	■		■	■	■	■	■		■		L
Marbletown, Town of	Did not participate.										
Marlborough, Town of	■	■	■	■	■	■	■				M
New Paltz, Town of			■	■		■	■				L
New Paltz, Village of	■	■	■	■	■	■					M
Olive, Town of				■							L
Plattekill, Town of	■	■	■		■	■					H
Rochester, Town of	Did not participate.										
Rosendale, Town of	■	■	■	■		■					L
Saugerties, Town of	■	■	■	■	■	■				■	L
Saugerties, Village of		■	■	■	■	■				■	L
Shandaken, Town of	■	■	■	■	■	■	■	■	■	■	M
Shawangunk, Town of		■	■	■		■					L
Ulster, Town of	■	■	■	■		■	■				L
Wawarsing, Town of	■	■	■	■	■	■	■		■		L
Woodstock, Town of	■		■	■	■	■	■			■	H

* H=High, M=Moderate, L=Low Capabilities

Conclusion

This capability assessment finds that Ulster County and its participating jurisdictions which submitted completed capability assessment worksheets collectively have a significant level of legal, technical, and fiscal tools and resources necessary to implement hazard mitigation strategies. As shown in the preceding tables, legal and regulatory capabilities to implement hazard mitigation strategies were considered to be moderate to high in 86 percent of the responding jurisdictions. Similarly, technical capabilities were considered to be moderate to high in 86 percent of the responding jurisdictions; and administrative capabilities were considered to be moderate to high in 82 percent of the responding jurisdictions. Fiscal capabilities to implement hazard mitigation strategies were considered to be moderate to high by far fewer respondents, with only 36 percent of the responding jurisdictions. One hundred percent of the responding jurisdictions considered their political leadership's willingness to enact policies and programs that reduce hazard vulnerabilities as moderate or high - even if met with opposition. Each jurisdiction also considered ways of improving their capabilities to ensure that they are in-line with their mitigation actions and goals. Local responses are provided in **Table 4.4**. This table also shows that municipalities have identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals.

Table 4.4 – Opportunities for Improving Local Capabilities						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Admin Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
Ulster, County of	**M**	**H**	**L**	**H**	**H**	**None identified.**
Denning, Town of	M	M	L	L	M	We are currently working with the County and the local stream management program to assess and alleviate potential flood mitigation hazards in our community, and identify and ultimately access mitigation funding to address the hazards.
Ellenville, Village of	M	M	L	L	M	To bridge gaps in the local capabilities arena and make sure that the mitigation actions and goals are implemented, the Village of Ellenville has hired their village engineer, Barton & Loguidice, DPC. As a municipal consulting engineering firm for the past 11 years for the Village, B&L is committed to helping the Village and making sure the public welfare is in the best interest. As for fiscal gap, there are many different grants and financing for communities that can be applied for to help implement the hazard mitigation strategies that the Village has decided to implement, an example is NY Rising.
Esopus, Town of	Did not participate.					
Gardiner, Town of	H	M	M	H	H	None identified.
Hardenburgh, Town of	M	M	M	M	M	We are a small municipality. We have administrators that are life-long residents with extensive knowledge of our streams, infrastructure, soils, and stream erosion patterns based on historic information. Our senior citizens have conveyed this information to Town administrators.
Hurley, Town of	M	M	L	M	M	Questions regarding classifying the district and allowable uses where the majority of our special flood hazard area exists. Pursue and support any avenues available that promote buyouts of repetitive loss properties.
Kingston, City of	M	H	L	H	H	We need to better educate all parties involved in hazard mitigation. I believe that with better understanding of the hazards we would be better prepared. Sometimes I feel that the only time we discuss this is when it happens; this needs to stop. Bi-monthly meetings with city leaders are a start. The Common Council should also be involved in this process. Reviewing what other communities have done and using proven plans.
Kingston, Town of	M	M	M	H	H	The Town of Kingston government officials have a high level of awareness regarding local flooding disaster evacuation issues. In addition all local governments in New York State fiscal budgets are strained by increased pressure to reduce spending. This has been the main impediment to locally funded projects. The actions could be expedited with more frequent funding opportunities from both New York State and the Federal Government Agencies.
Lloyd, Town of	M	M	L	M	H	None identified.
Marbletown, Town of	Did not participate.					
Marlborough, Town of	M	M	M	M	H	The town has made strides over the years to develop town codes and zoning to help mitigate and potential environmental hazards within the community and also has a very supportive town board that actively ensures administrative support is given to the different town departments.

Table 4.4 – Opportunities for Improving Local Capabilities						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Admin Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
New Paltz, Town of	M	H	L	H	H	The Town has been and is committed to trying to maximize the availabilities of State and Federal grants for hazard mitigation. We will be considering an impact fee for all new commercial property development and large scale residential development as these can potentially increase the need for additional infrastructure to minimize the impact of storm water runoff into local streams and tributaries that contribute to flooding during weather events. The Town is also attempting to get a PILOT (payment in lieu of taxes) from the State of New York to offset the amount of property that is off of the tax rolls. Due to the 2 percent tax cap and the large percentage of tax exempt properties located within the Town of New Paltz, creating an overburden to the taxpayer, additional tax levies are not an option at this time.
New Paltz, Village of	M	H	M	H	M	Developing.
Olive, Town of	L	L	L	M	M	In January 2014 a Flood Advisory Committee was appointed by the Olive Town Board and we are currently applying for and receiving funding from the Ashokan Watershed Stream Management Program (AWSMP) to do Local Flood Analysis (LFA) on the portion of the Esopus Creek running within the Town of Olive as well as a portion of the Bushkill Stream. In addition, funds will be provided to do a Town wide Flood Mitigation Plan. A majority of the funding for the FMP will be coming from the AWSMP and a grant has been received from the Hudson River Valley Greenway for doing the FMP for the portion of the Town of Olive that is not in the Ashokan Watershed. We have received proposals in response to RFPs from six engineering firms for doing the LFA & the FMP and will be interviewing two of those firms on November 13, 2014. Once the LFA is completed we are hoping that the NY Community Rising funds will be available to implement proposed mitigation projects. Everyone in Olive is concerned about implementing hazard mitigation but funding at the local level is extremely limited, especially with the fiscal pressures from New York State. With outside funds we will be able to assess, plan, and implement mitigation. With proper funding anything is possible.
Plattekill, Town of	L	M	H	M	H	Look at and revise local laws and zoning codes to help alleviate hazards. Look at updating the 2003 Town Comprehensive Master Plan to help support stronger building codes. Look at reviewing and updating our Town Emergency Management Plan if applicable. Work with all town department heads and staff to develop an open line of communication to help better prepare the community for any potential disasters.
Rochester, Town of	Did not participate.					
Rosendale, Town of	M	H	L	H	H	The town will depend on assistance in funding if needed along with the NY Rising identified improvements. The town is in the process of installing a generator that will help support the technical & administrative areas. We are expecting DEC to install generator at the Flood Control Station to keep the system running during flood emergencies.

Table 4.4 – Opportunities for Improving Local Capabilities						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Admin Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
Saugerties, Town of	M	M	L	L	M	1. Provide funding to participate in the Hazard Mitigation Plan and develop and enact the goals required. 2. Provide informational materials, logistical and legal support and funding to be used in floodplains and other hazard-prone areas. 3. Provide clearer guidelines and timelines on developing and implementing whatever is needed. 4. Describe support structures for localities being provided by county/state haz mit agencies. How do we fit in? 5. The questions above usually cannot be answered in single-word responses. For example, Saugerties has very good legal and regulatory and technical capabilities overall, but our capabilities in major disaster incidents are severely crimped by fiscal impediments; our fiscal capabilities are low generally and are not geared to handle hazard mitigation strategies; and our administrative capabilities are very good in action but not defined in a plan or other formal way for major hazard mitigation events. Our political leadership wants to do the right thing but often needs the support structure to make that happen, and that costs money.
Saugerties, Village of	M	H	L	M	H	Try to work jointly with the Town of Saugerties which surrounds our Village and has a much larger tax base to implement strategies. The area of potential flooding is relatively small and we have devoted much time and effort to dealing with our flooding problems. I feel that we are in good overall shape to respond to future natural emergencies. We have a very community-minded population with lots of able volunteers.
Shandaken, Town of	H	M	M	M	H	The Town of Shandaken lies wholly within the Catskill State Forest Preserve and the New York City Watershed. This provides us opportunities from funding sources that may not be available to jurisdictions outside of these environmentally sensitive areas including but not limited to sizable "Good Neighbor Funds" provided through NYC-DEP and USDA monies for Emergency Watershed Protection funding. We also reside in a low-moderate income community and economically depressed region of the County, this affords us grant opportunities for projects that we generally could not afford from our current tax base. We have fostered strong partnerships with many of the agencies operating throughout the Town and are keenly aware of our environment and pride ourselves on being its local stewards as it affects our quality of life and economy.
Shawangunk, Town of	L	L	L	M	M	None identified.
Ulster, Town of	M	M	L	H	H	Local officials have a high level of awareness regarding local flood disaster evacuation issues. Fiscal budgets of all local governments in the State are strained by increased pressure to reduce spending. This has been the main impediment to locally funded projects. The six homes currently in the process of being purchased are being funded by FEMA. The actions could be expedited with more frequent funding opportunities from both New York State and the Federal Government Agencies.

Table 4.4 – Opportunities for Improving Local Capabilities						
Jurisdiction	**Overall Legal & Regulatory Capability**	**Overall Technical Capability**	**Overall Fiscal Capability**	**Overall Admin Capability**	**Overall Level of Political Willingness**	**Locally identified opportunities to bridge recognized gaps in capabilities to ensure that they are in-line with jurisdictional mitigation actions and goals**
Wawarsing, Town of	M	L	L	M	M	More inter-governmental cooperation and unity between all Federal, State, County and Town for Emergency Preparedness and mitigation.
Woodstock, Town of	H	H	H	L	M	The Town will educate to the extent practicable the appropriate department heads with regard to dealing with potential hazards affecting our community. It should be noted that flooding is the principal hazard, and wind secondary.

Capabilities and Resources – State of New York

The State's Plan includes an evaluation of the State's overall pre- and post- hazard mitigation policies, programs, and capabilities; the policies related to development in hazard prone areas; and the State's funding capabilities. The Ulster County Multi-Jurisdictional Hazard Mitigation Plan incorporates many of the resources identified in the State Plan to demonstrate the capabilities present for local jurisdictions to consider in the development of local hazard mitigation. Please refer to **Appendix 4.2** for additional information, including but not limited to State grant and loan funding sources with the potential to address hazard mitigation projects that can be accessed by local jurisdictions. It provides an overview of these funding sources, potential availability, applicability of pre- or post- disaster requirements, and the type of funding that is available. The State Plan should be referred to directly for more specifics (on the web at http://www.dhses.ny.gov/oem/mitigation/plan.cfm).

This capability assessment finds that the State of New York's various departments collectively have a significant level of legal, technical, and fiscal tools and resources necessary for implementation of hazard mitigation strategies.

Capabilities and Resources – Federal

The Federal government offers a wide range of funding and technical assistance programs to help make communities more disaster resistant and sustainable. Additional information – including a partial list of documents, websites, and funding and technical assistance programs that communities can access to assist in their long-term recovery – can be found in **Appendix 4.3**. Further information on these and other Federal programs can be found in the Catalog of Federal Domestic Assistance (CFDA) available on online at www.cfda.gov.

This capability assessment finds that the various Federal agencies collectively have a significant level of resources necessary to support local implementation of hazard mitigation strategies.

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SECTION 5 - MITIGATION GOALS

Goals were developed by taking into consideration both state and jurisdictional goals for mitigation. The goals or actions in this County plan are broadly aligned with the goals of the State of New York's Hazard Mitigation Plan. None of the goals or actions in this County plan contradicts the goals of the State Hazard Mitigation Plan. In fact, the Ulster County Multi-Jurisdictional Hazard Mitigation Plan Goals are in support of furthering the State's goals in many ways. The goals and actions of this County plan are also aligned with, and in support of, the goals of the Ulster NY Rising Community Reconstruction Plan (NYRCRP) and the NYRCRP for the Towns of Shandaken and Hardenburgh.

New York State Hazard Mitigation Plan - Vision and Goals

New York State's 2014 Hazard Mitigation Plan Vision Statement reads:

> **"New York State will continually aim to reduce deaths, injuries, and economic losses stemming from natural hazards, and to lead by example in fostering community resilience and protecting the environment in the face of future natural events to improve the lives of the people of the State."**

The 2014 New York State Hazard Mitigation Plan's goals are:

- **Goal 1:** Promote a comprehensive state hazard mitigation policy framework for effective mitigation programs that includes coordination between federal, state, and local organizations for planning and programs.
- **Goal 2:** Protect property including public, historic, private structures, and critical facilities and infrastructure.
- **Goal 3:** Increase awareness and promote relationships with stakeholders, citizens, elected officials, and property owners to develop opportunities for mitigation of natural hazards.
- **Goal 4:** Encourage the development and implementation of long-term, cost-effective, and resilient mitigation projects to preserve and/or restore the functions of natural systems.
- **Goal 5:** Build stronger by promoting mitigation actions that emphasize sustainable construction and design measures to reduce or eliminate the impacts of natural hazards.

NYRCRP Ulster Communities - Vision and Goals

The March 2014 Ulster NYRCRP presents proposed programs, policies and construction initiatives developed by the NYRCR Ulster Communities (the Villages of Ellenville, New Paltz and Saugerties; and the Towns of New Paltz, Rochester, Rosendale, Saugerties, Wawarsing and Woodstock). The plan's vision statement reads:

> **"Our vision is to protect our residents and our man-made and natural resources by implementing ecologically-sound policies and programs that will sustain our local and regional environments and promote further growth in our economies."**

The goals of the Ulster NYRCRP are:

- Advance educational outreach to ensure our residents understand natural hazards and how they can protect themselves, their homes, neighborhoods, and communities against future disasters.
- Contribute to community recovery and regional preparedness with a defined approach to crisis planning, attracting and retaining volunteers, and enhanced communication between and among our municipalities and emergency services.
- Identify a plan for business continuity designed to ensure the availability of goods and services and to advance economic opportunity in the region.
- Develop policy, design, and construction standards to make our community more resilient in the future.
- Cultivate partnerships among private organizations, public agencies, and municipalities to address hazard mitigation, and ensure coordinated preparedness, and response.
- Identify and evaluate natural resources, waterways, and watersheds to restore, preserve, protect, and conserve our natural assets and reduce the vulnerability of our watersheds to storm-related hazards.

NYRCRP for the Towns of Shandaken and Hardenburgh - Vision and Goals

The March 2014 NYRCRP for the Towns of Shandaken and Hardenburgh presents proposed and featured projects to increase resiliency against future disasters, based on the needs identified during the planning process, and an assessment of the vulnerability of critical assets in both Towns. Through collaborative discussions, stakeholder engagement, review of existing plans and studies, and a focused intention towards holistic community recovery, the Committee adopted the following vision to guide the recovery and resiliency efforts of the Towns of Shandaken and Hardenburgh:

> **"To rebuild stronger, safer and more vibrant communities that will be more resilient in the face of future disasters by planning and developing actions to secure funding and other resources."**

The goals of the NYRCRP for the Towns of Shandaken and Hardenburgh are:

- Reduce the impact of flooding on the built environment in the Towns, including critical facilities, transportation infrastructure, and communications systems.
- Enhance economic vitality through revitalizing hamlet centers, diversifying the business base, and promoting economic growth and tourism.
- Ensure essential services are available for all before, during, and after a disaster.
- Develop initiatives to address housing challenges related to flood risk, affordability, availability, and limited parcel availability.
- Protect, preserve, and enhance natural, cultural, and historic resources and assets.

Ulster County Multi-Jurisdictional Hazard Mitigation Plan Goals

Hazard Mitigation Plan Goals are long-term statements of what the participating jurisdictions hope to achieve over time through implementation of the plan. They are based on the findings of the risk assessment, and apply to each jurisdiction adopting the plan (and its updates).

Ulster County and its participating jurisdictions will continually aim to reduce deaths, injuries, and economic losses stemming from natural hazards, and to lead by example in fostering community resilience and protecting the environment in the face of future natural events to improve the lives of the people of the County.

As part of the 2015 Plan Update process, the 2009 Plan goals were reviewed. They were deemed to still be relevant, and in alignment with the goals expressed in the NYSHMP, the Ulster Communities NYRCRP, and the NYRCRP for the Towns of Shandaken and Hardenburgh. Therefore, Ulster County's 2015 Plan Goals are as follows:

1. Promote disaster-resistant development.
2. Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters.
3. Reduce the possibility of damage and losses due to drought.
4. Reduce the possibility of damage and losses due to flooding caused by floods, hurricanes and nor'easters.
5. Reduce the possibility of damage and losses due to earthquakes.
6. Reduce the possibility of damage and losses due to lightning strikes.
7. Reduce the possibility of damage and losses due to ice jams.
8. Reduce the possibility of damage and losses due to dam failure.
9. Reduce the possibility of damage and losses due to landslides.
10. Reduce the possibility of damage and losses due to wildfires.
11. Reduce the possibility of damage and losses due to winter storms.
12. Reduce the possibility of damage and losses due to extreme temperatures.
13. Reduce the possibility of damage and losses due to tornadoes and high winds caused by windstorms, hurricanes and nor'easters.
14. Reduce the possibility of damages to emergency and critical facilities from damage due to flooding, wildfires, and extreme winds.

Ulster County is committed to focusing on hazard mitigation as a means of fostering resiliency. The 2009 Plan has been expanded as part of this first plan update to include the following key objectives that will serve as guiding principles for mitigation as the plan is implemented in the years to come:

- Ensure all component municipalities remain in good standing / participate in the National Flood Insurance Program (NFIP);
- Increase public awareness through identification of high risk areas and areas of repetitive loss;
- Discourage development of areas in floodplains or Special Flood Hazard Areas (SFHA) and other high risk areas;
- Minimize damage to existing buildings subject to damage from natural hazards;

- Protect and maintain critical facilities.
- Improve floodplain conveyance through modification or removal of flood facilities when appropriate.
- Utilize best available data to identify the location and potential impacts of natural hazards on people, property and natural environment.
- Improve systems that provide warning and emergency communications.
- Retrofit, purchase, or relocate structures in high hazard areas including those known to be repetitively damaged.
- Coordinate hazard mitigation efforts, including planning and projects, with other mitigation efforts within the planning area to leverage all potential partnerships.
- Inform the public on the risk exposure to natural hazards and ways to increase the public's capability to prepare, respond, recover and mitigate the impacts of these events.
- Increase resilience and the continuity of operations of identified critical facilities
- Support programs within the planning area that are recognized under the federal Community Rating System program.
- Seek mitigation projects that provide the highest degree of natural hazards protection at the least cost.
- Seek risk reduction projects that minimize or mitigate their impacts on the environment.

SECTION 6 – MITIGATION STRATEGIES

Overview

Each jurisdiction that participated in the 2009 Plan developed a unique mitigation strategy – an action plan describing how their mitigation actions would be implemented, prioritized, administered, and incorporated into the community's existing planning mechanisms. Each jurisdiction developed an action plan unique to their community and its specific vulnerabilities and capabilities.

As part of the 2015 Plan Update, participants were required to provide updated mitigation strategies. This was done using a two-step process.

1. First, each participating jurisdiction provided updates regarding the status and relevance of each action previously included in the 2009 Plan, along with a determination of which measures to would be carried forward to the updated 2015 Plan mitigation strategies, and which would be omitted. They also described changes in local priorities since the last plan was approved. Documentation of this step can be found on each jurisdiction's Worksheet 5, as included in Appendix 1.2 – Worksheets: Municipal Annexes.
2. Next, each participating jurisdiction considered updated risk information to add new mitigation measures to their local strategies.

To jumpstart the process of updating local mitigation strategies, URS hosted a working session of the full CPG on November 21, 2014. This session was attended by representatives of the County and the Towns of Denning, Kingston, Marlborough, New Paltz, Plattekill, Rosendale, Shandaken, Ulster, and Wawarsing; and the Village of Saugerties. Thereafter, one-on-one working sessions were held with municipal JATs at UCECEM on July 21, 2015 and August 5, 2015. These sessions were attended by representatives of the County; the Towns of Gardiner, Kingston, Lloyd, Marbletown, New Paltz, Olive, Plattekill, Rochester, Ulster, and Wawarsing; and the Villages of Ellenville, New Paltz, and Saugerties.
At the working sessions, communities were reminded that their hazard mitigation strategies represent the heart of the overall hazard mitigation plan, and URS provided information on how to develop or update a local mitigation strategy. NY Rising communities were reminded that their flood mitigation strategies should directly link with those proposed under NY Rising. The workshops presented attendees with a chance to begin to:

- Develop actions to reduce risk and make your community more disaster-resilient;
- Develop cost-effective actions that save the community money in the long run;
- Build a strategy for the successful implementation of the community's mitigation action plan;
- Coordinate with other local officials, planners and stakeholders on potential hazard mitigation ideas and projects;
- Use worksheets, examples and other tools to help you and your community build a mitigation strategy that makes a connection between natural hazard risk, action and implementation;
- Communicate directly with URS mitigation planning staff to better understand how to develop an effective and worthwhile Hazard Mitigation Plan.

The working sessions were intended to be strictly informational. Communities did not develop their strategies at the working sessions but, rather, developed them later in coordination with their respective JAT members. The consultant was available throughout the process to answer questions and provide feedback, even outside of these working sessions.

Communities evaluated a range of mitigation actions to address their greatest vulnerabilities and key risk findings. In the CPG, members often referred to developing mitigation strategies for what they considered their "highest hazards" – those of greatest concern due to high average annual damages and/or isolated key risk findings where the level of risk was deemed to be unacceptable. Mitigation actions were not considered for hazards that were not identified for a given community. "Lesser hazards" – those of least concern due to low average annual damages and/or risk findings where the identified risk was deemed to be acceptable – were typically addressed via less tangible measures, often via education and awareness programs.

Range of Actions and Projects

Mitigation actions are specific actions, projects, activities, or processes taken to reduce or eliminate long-term risk to people and property from the hazards and their impacts. Implementing mitigation actions helps achieve the plan's goals. The actions to reduce vulnerability to threats and hazards form the core of the plan and are a key outcome of the planning process. In general, the primary types of mitigation actions that were considered by the participating communities to reduce their long-term vulnerability include:

- local plans and regulations;
- structure and infrastructure projects;
- natural systems protection; and
- education and awareness programs.

As part of the hazard mitigation plan update, each participating jurisdiction identified and analyzed a comprehensive range of specific mitigation actions and projects to reduce the impacts of the hazards identified in the risk assessment. The comprehensive range means that jurisdictions analyzed, or evaluated, different types of mitigation actions (i.e., a mix of structural and non-structural approaches). Emphasis was placed on mitigating the impacts or vulnerabilities identified in the risk assessment, not on the hazards themselves. These impacts and vulnerabilities were summarized in **Section 3E** of this plan which documents each community's identified hazards, their subset of highest hazards for mitigation consideration, and key risk findings.

To identify potential mitigation actions, each jurisdiction started with the problem statements identified from the risk assessment (**Section 3E**), and developed mitigation actions for addressing those problems. The mitigation actions ultimately selected by each jurisdiction were a function of each jurisdiction's particular range of capabilities for implementing hazard mitigation projects (as outlined in **Section 4**).

A subset of the typical types of actions that were considered by the jurisdictions (in 2009 and 2015) is listed and described in **Table 6.1**, and is organized according to the Mitigation Goal the action is intended to help achieve.

Table 6.1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
1	Promote disaster-resistant development.	1.A	Join the National Flood Insurance Program (for non-participating or suspended communities).
		1.B	Ensure that local comprehensive plans incorporate natural disaster mitigation techniques by requiring a courtesy- review of draft plans by the County Emergency Management Agency.
		1.C	Explore the need for hazard zoning and high-risk hazard land use ordinances.
		1.D	Organize an annual event / fair for homeowners, builders and county and local jurisdictions that includes sale of NOAA weather radios, dissemination of information brochures about disasters and building retrofits, demonstration of "defensible-space" concept and fire resistant construction materials (for roofs/exterior finishes and inflammable coverings for openings like chimneys and attics) etc.
		1.E	Develop a stormwater management plan that includes subdivision regulations to control run-off; both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.
2	Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters.	2.A	Expand and disseminate GIS and other hazard information on the internet.
		2.B	Develop a plan and seek funding for backup electric and telecommunications systems in local government-owned critical facilities.
		2.C	Support and fund Community Emergency Response Team (CERT) programs that also include a mitigation component.
		2.D	Create a virtual and physical library that contains all technical studies, particularly natural resources.
		2.E	Expand GIS to collect and develop more sophisticated hazard mapping. Use information to update the mitigation plan. Ensure information will be available to the public and to relevant communities and agencies.
		2.F	Provide training for inspection and enforcement of adopted codes and ordinances.
3	Reduce the possibility of damage and losses due to drought.	3.A	Encourage citizens to implement water conservation measures by distributing water saving kits which include replacement shower heads, flow restrictors, and educational pamphlets that describe water saving techniques. Also encourage conservation by offering rebates for ultra-low-flow toilets.
		3.B	Modify water utility rate structure to influence consumer water use including: increasing rates during summer months and imposing excess use charges during times of water shortage.
		3.C	Reduce water use for landscaping by imposing mandatory water-use restrictions during times of water shortage. Also, develop a demonstration garden to exhibit water conservation techniques.
		3.D	Publish and distribute pamphlets on water conservation techniques and drought management strategies.
		3.E	Develop and adopt an emergency water allocation strategy to be implemented during severe drought.
		3.F	Implement water metering and leak detection programs followed by water main repair/replacement to reduce losses.
		3.G	Encourage beneficial re-use of treated wastewater effluent through cooperative projects with dischargers, agriculture and other major water users to distribute or provide this alternative source of water.

Table 6.1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
4	Reduce the possibility of damage and losses due to flooding caused by floods, hurricanes, and nor'easters.	4.A	Join the National Flood Insurance Program. As a participant, floodplains within the participating community will be identified and mapped. In return, the participating community will become eligible for flood insurance as long as the local governing body adopts and enforces a compliant floodplain ordinance.
		4.B	Limit uses in floodways to those tolerant of occasional flooding, including but not limited to agriculture, outdoor recreation, and natural resource areas.
		4.C	Develop a Countywide gauging and warning system for flash and riverine flooding.
		4.D	Continue to implement best management practices for floodplain areas.
		4.E	Identify and document repetitively flooded properties. Explore mitigation opportunities for repetitively flooded properties, and if necessary, carry out acquisition, relocation, elevation, and flood-proofing measures to protect these properties.
		4.F	Conduct a routine stream maintenance program (for currently non-participating communities) and seek financial assistance to clean-out stream segments with heavy sediment deposits.
		4.G	Develop specific mitigation solutions for flood-prone roadways and intersections under the leadership of State DOT. Develop a work plan identifying when sites will be surveyed and what role the local government can play in the selection and implementation of mitigation activities (e.g. any monetary or contextual support through the local capital improvement plan).
		4.H	Implement identified stormwater recharge, rate or volume projects identified in Regional Stormwater Management Plans to decrease "flash" in streams during/after storm events.
		4.I	Implement specific actions to enhance/improve participation in/compliance with National Flood Insurance Program (NFIP)
5	Reduce the possibility of damage and losses due to earthquakes.	5.A	Retrofit old/dilapidated critical facilities.
		5.B	Public awareness through video/brochures about simple steps homeowners can take to mitigate damage.
		5.C	Examine provisions for earthquake resistant retrofits for existing structures and infrastructure, paying particular attention to unreinforced masonry structures built prior to the adoption of building codes requiring earthquake resistant design for new construction.
6	Reduce the possibility of damage due to lightning strikes	6.A	Carry out inventory of compliance with existing local codes/standards, especially for critical facilities.
		6.B	Adopt building safety codes such as National Fire Protection Association (NFPA) -780, Standard for the Installation of Lightning Protection Systems (1997).
		6.C	Public awareness/outreach regarding use of ground outlets and surge protectors in homes and businesses.
7	Reduce the possibility of damage and losses due to ice jams	7.A	Implement monitoring and early warning measures at key locations
		7.B	Investment in ice-clearing/breaking equipment and appropriate training for county personnel.
		7.C	Construction of ice control structures such as booms, tension weirs and sloped-block barriers.

Table 6.1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
8	Reduce the possibility of damage and losses due to dam failures.	8.A	Enforce participation in/compliance with National and NYSDEC / NYSEMO Dam Safety Programs.
		8.B	Investigate sources of funding to assist private dam owners to complete required repairs/maintenance. Investigate low interest loans to owners and/or jurisdiction acting as guarantor of private owners' loans.
		8.C	Notify owners of property in dam break inundation areas of risks, implement restrictions for new development in these areas.
9	Reduce the possibility of damage and losses due to landslides.	9.A	Create comprehensive geological mapping for areas prone to landslides and rockslides.
		9.B	Locally identify and map specific areas of potential slope failure and limit future development in these areas.
		9.C	Develop a public outreach program that addresses the economic impacts of landslides on personal property.
		9.D	Consider adopting a steep slope ordinance, if one is not already in place, to regulate development on these higher risk areas.
		9.E	Develop a vegetation management plan. Proper vegetation can supply slope-stabilizing root strength, and facilitate in intercepting precipitation. Establishing and maintaining appropriate vegetation of areas above the bluff slope may be the single most important and cost-effective mitigation measure available.
10	Reduce the possibility of damage and losses due to wildfires	10.A	In consultation with NYSDEC Forest Protection & Fire Management and local forest rangers, develop mapping of wildland/urban interface areas.
		10.B	Develop inventory of addresses for route alerting during wildfire emergencies that require public warning and information.
		10.C	In consultation with NYSDEC Forest Protection & Fire Management and local forest rangers, review local EOPs for possible wildfire components regarding Fire-Rescue, Alert Warning Communications, and Evacuation.
		10.D	Prescribed burning for hazard reduction.
		10.E	Initiate a public outreach program for homeowners.
		10.F	Retrofit buildings with fire resistant materials, especially roofing.
		10.G	Implement Community brush and debris removal and hazard fuels reduction.
		10.H	Use Firewise landscaping in higher risk areas.
		10.I	Mitigation for streets, highways, and roads that provide key fire access and fuelbreaks.
11	Reduce the possibility of damage and losses due to winter storms.	11.A	Promote (or purchase, for critical facilities) NOAA weather radios.
		11.B	Educate residents about driving in winter storms and handling winter-related health effects
		11.C	Plant ice and windstorm-resistant trees and implement landscaping practices to reduce tree-related hazards
		11.D	Bury utility lines to avoid power outage due to winter storms (if risk is very high then only this action might be cost-effective)
12	Reduce the possibility of damage and losses due to extreme temperatures.	12.A	Develop and distribute outreach tools for homeowners and building permit applicants on protection of structures against cold weather damage and proper maintenance of heating/cooling systems.
		12.B	Review existing emergency response plans for enhancement opportunities: work with social support agencies, homeowners associations and general public to develop and implement monitoring and warning systems focused on vulnerable populations and provision of adequate shelter facilities.

Table 6.1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
13	Reduce the possibility of damage and losses due to tornadoes and high winds caused by windstorms, hurricanes and nor'easters.	13.A	Adopt an ordinance to require safe rooms in mobile home parks
		13.B	Provide low interest loans (or other form of financial assistance) for building safe rooms.
		13.C	Provide technical assistance for building safe rooms.
		13.D	Adopt an ordinance to require hurricane clips on new construction.
		13.E	Install hurricane clips and wind shutters on existing development-particularly emergency facilities and shelters built before existing codes were adopted to offer some degree of wind protection.
14	Reduce the possibility of damages to emergency facilities from flooding, wind damage and wildfire damage.	14.A	Conduct a study to determine the year-built and level of protection (flood, wind) for each emergency facility.
		14.B	On completion of 11.A, seek funding for mitigation projects for emergency facilities not currently designed for protection from flooding and high wind.

In addition to these general types of mitigation actions, the Core Planning Group and JATs also considered a much broader range of more specific mitigation actions that had been identified throughout the course of the planning process as specific problems and/or problem areas were brought to light in their community; and used the actions and projects included in **FEMA's "*Mitigation Ideas*"** document ("Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013", online at www.fema.gov/media library data/20130726 1904 25045 0186/fema_mitigation_ideas_final508.pdf) to further broaden the scope of items for consideration. Many also considered and incorporated:

- New York Rising Community Reconstruction Program (NYRCRP). The NYRCRP is a planning and implementation process established by the State of New York to provide rebuilding and resiliency assistance to communities severely damaged by Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy. The two March 2014 NY Rising Community Reconstruction Plans, for a combined total of 11 Ulster County communities, present proposed programs and featured projects, policies and construction initiatives developed by the communities, which include the Villages of Ellenville, New Paltz and Saugerties; and the Towns of Hardenburgh, New Paltz, Rochester, Rosendale, Saugerties, Shandaken, Wawarsing and Woodstock. Initial project recommendations were generated by each NYRCR Planning Committee, which was comprised of residents, business owners and municipal representatives from each of Ulster County's 11 NYRCR Communities. Each Committee met approximately every other week from September 2013 through March 2014. Materials were circulated to the Planning Committee before and after each meeting and also posted to the NYRCR website. The Planning Committee members also created Facebook pages, posted relevant materials to their municipal websites, held additional meetings within their communities, and attended municipal meetings to report on their NYRCR Plan progress. Four public engagement meetings were held throughout the eight month planning process. These meetings provided the opportunity for Ulster County residents to learn about the NYRCR planning process and provide input to help develop community-driven plans for a more resilient future. The format and venue of the Public Engagement Meetings varied, but generally

included power point presentations, display boards and mapping, workgroups with maps and markers, survey sheets and comment boxes. **The 11 NY Rising communities considered their respective NYRCRP initiatives when formulating their mitigation strategies as part of this plan update.**

Ulster County and its municipalities will always consider those actions they believe to be the most important during the recovery process, in addition to those actions and project types that have been specifically listed per county and municipality. Due to the effects of recent disasters, this section has been amended to include the following mitigation actions and project types:

Flood Mitigation Actions. Retrofitting structures prone to periodic flooding is an effective mitigation technique to reduce the flood loss of property and is consistent with all of the goals. Techniques include the elevation of structures, acquisition, mitigation reconstruction, dry flood proofing, wet flood proofing, and drainage improvements and installation of generators.

- Elevation: involves raising a structure on a new foundation so that the lowest floor is above the Base Flood Elevation (BFE). Almost any type and size of structure can be elevated (depending on the location of the structure – the stricter regulations governing construction in A zones such as higher BFEs may preclude the elevation of certain types of structure in coastal areas). As part of this plan update, local floodplain administrators in each community provided feedback describing the implementation of the NFIP in their respective jurisdictions. The City of Kingston, Town of New Paltz, and Village of Saugerties indicated that their current floodplain management ordinance already exceeds FEMA or State minimum requirements. Based on the language of local codes for these communities, the City of Kingston and Town of New Paltz both regulate to a minimum of BFE plus two feet; while the Village of Saugerties regulates to a minimum of BFE plus four feet.

- Acquisition of structures: or "buyout" option is the most effective mitigation technique to reduce the loss of property due to flooding. The owners of repetitive flood loss structures or substantially damaged structures sell their structure to the community on a cost share basis for the fair market value of the structure prior to the last flood event. The structure is demolished and removed with a deed restriction placed on the property in perpetuity, thus eliminating the structure from future flood damage. This approach is most effective when flood prone structures located within the same vicinity are grouped together and acquired. The remaining property can be converted into usable recreational space with minor structure restrictions. It should be noted that owners of repetitive loss structures may be required to pay higher flood insurance rates if they fail to mitigate the structure.

- Mitigation Reconstruction: is a component of the Severe Repetitive Loss (SRL) grant program that allows demolition and reconstruction of structures when traditional elevation cannot be implemented. This activity can be used for structures that were substantially damaged or destroyed. Currently this is a pilot program utilized mainly on the gulf coast but can be considered a potential approach to mitigation activities.

- Dry flood proofing: techniques include the building of floodwalls adjacent to existing walls, the installation of special doors to seal out floodwaters, and special backflow valves for water and sewer lines. Generally, dry floodproofing is only approvable for non-residential structures.

- Wet flood proofing: includes measures applied to a structure that prevent or provide resistance to damage from flooding while allowing floodwaters to enter the structure or area.

Generally, this includes properly anchoring the structure, using flood resistant materials below the BFE, protection of mechanical and utility equipment, and use of openings or breakaway walls. Application of wet flood proofing as a flood protection technique under the NFIP is limited to enclosures below elevated residential and non-residential structures and to accessory and agricultural structures that have been issued variances by the community. Wet flood proofing also includes low cost mitigation measures such as raising air conditioners, heat pumps, and hot water heaters on platforms above the BFE.

- Drainage: Improving the drainage capacity around roads and low-lying areas is a time-tested technique to mitigate flood damage. Maintenance of drainage canals and laterals is essential to maximize their efficiency and continued long term effectiveness. Actions in general to reduce the effects of flooding are widening and deepening the earthen canals, cleaning of existing ditches, and replacing existing culverts, upgrading pumps, and installing check valves and inverts in certain culverts. Maintaining and improving drainage serves to assist the communities with problems experienced from floods, hurricanes, tornadoes and thunderstorms/lightning/high winds.

- Generators: Another cost effective retrofitting technique includes the installation of generators. By providing power with generators during and after severe storms many critical facilities may continue to provide necessary services to the community. The installation of generators serves to assist the communities with problems experienced from floods, hurricanes, tornadoes and thunderstorms/lightning/high winds.

Wind Mitigation Actions. Retrofits to protect against wind damage are an effective mitigation technique to reduce property losses due to wind and are consistent with all of the goals. Techniques include retrofits to existing structures, and burying electric power lines..

- Structural Retrofits. Structures can be retrofitted to withstand high winds by installing hurricane shutters, roof tie-downs and other storm protection features. The exterior integrity is maintained by protecting the interior of the structure and providing stability against wind hazards associated with hurricanes. These types of measures can be relatively inexpensive and simple to put in place. It should be noted that for the structural retrofits to work, the structure must be basically sound prior to the retrofit.

- Burying Power Lines. Another retrofitting technique is to bury electric power lines to avoid tree limbs falling on them or from wind damage resulting in a break in service to the consumer. Burying electric power lines serves to assist the communities with problems experienced from floods, hurricanes, ice, tornadoes and thunderstorms/lightning/high winds.

Early Warning Systems. Early warning systems serve to assist the communities with problems experienced from floods, hurricanes, tornadoes and thunderstorms/lightning/high winds as well as other lower priority hazards. With sufficient warning of a flood, a community and its residents can take protective measures such as moving personal property, cars, and people out of harm's way. When a flood threat recognition system is combined with an emergency response plan that addresses the community's flood problems, considerable flood damage can be prevented. This system must be coupled with warning the general public, carrying out appropriate tasks, and coordinating the flood response plan with operators of critical facilities. A comprehensive education and outreach program is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when warning is disseminated. Ulster County would like to improve its public notification system to alert citizens of the county regarding the possibility of impending flooding caused by hurricanes, tropical storms, and heavy rains resulting from prolonged

thunderstorms. A warning period is available for most emergency situations, although the amount of lead time may vary from hazard to hazard. Proper use of this warning period will save lives, reduce injuries, and protect property.

Earthquake Mitigation Actions. Significant seismic events, while not common to the region, do pose a potentially significant threat to Ulster County and the surrounding area. The most practical preventative actions to be considered concerns appropriate building code enforcement. While this is not necessarily practical for existing structures except for during renovations or reconstruction, there are activities that can be taken to mitigate further exposure to risk.

- Building Retrofit: The use of reinforced concrete materials in combination with cross ties is a proven technique to provide current structures with additional stabilization. The addition of seismic stabilizer platforms for important critical mechanicals within buildings will significantly reduce adverse impacts.

Mitigation Action Plans for Each Jurisdiction

Each jurisdiction documented their local evaluation process using FEMA Region 2's Mitigation Action Worksheet[1]. **Mitigation Action Worksheets completed by each JAT are included in Appendix 1.2 – Worksheets: Municipal Annexes (with one worksheet per mitigation action)**. Each community's collection of projects in their local annex is referred to as their local "Mitigation Action Plan" or "Mitigation Strategy".

The action worksheets document each jurisdiction's analysis of actions and/or projects considered to reduce the impacts of hazards identified in the risk assessment, and identify the actions and/or projects that each jurisdiction intends to implement. Action evaluation criteria are shown in **Table 6.2.** Special emphasis was placed on the extent to which benefits would be maximized according to a planning level assessment of whether the costs appeared to be reasonable as compared to the anticipated benefits. Worksheets also document how the actions identified will be prioritized, implemented, and administered by each jurisdiction. Priorities (how important the action is) are generally identified as high, medium, or low priority based on each jurisdiction's own assessment of action evaluation criteria. Responsible agencies are documented, along with potential resources for implementation (i.e., staff, funding, materials, etc.) and an estimated timeframe for completion.

Table 6.2 - Action Evaluation Criteria	
Cost Effectiveness	
Losses avoided (i.e., benefits)	- How effective will the action be at protecting lives and preventing injuries? - How significant will the action be at reducing damage to structures and infrastructure?
Cost estimate	- How much do you estimate it will cost to implement the action?
Cost effectiveness (i.e., benefit/cost)	- Do the losses avoided outweigh the cost of the action? - In other words, will it save your community money in the long term? - Eliminate actions that are not cost effective
Other Factors	
Technical	- Is the mitigation action technically feasible? - Eliminate actions that are not.
Political	- Is there overall public support for the mitigation action? - Is there the political will to support it?
Legal	- Does the community have the authority to implement the action?

[1] FEMA Region 2's "Mitigation Action Worksheets", as distributed at the four, FEMA-hosted Mitigation Strategy Workshops in nearby Monmouth County, NJ on April 2-5, 2013. As per this workshop, priority indicated as high, medium, or low with no need to rank.

Table 6.2 - Action Evaluation Criteria	
Environmental	- What are the potential environmental impacts of the action? - Will it comply with environmental regulations?
Social	- Will the proposed action affect one segment of the population? - Will it disrupt established neighborhoods, break up voting districts or cause the relocation of lower income people?
Administrative capability	- Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
Local champion	- Is there a strong advocate for the action among local departments and agencies that will support its implementation?
Other community objectives	- Does the action further other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation?

Unique action items are included for each jurisdiction requesting approval of the plan. Mitigation action plans were developed uniquely by each jurisdiction participating in this plan, with no competition between jurisdictions.

Not all of the actions initially considered were ultimately selected for community action plans based on existing local conditions such as technical feasibility, political acceptance, lack of funding, or other constraints. The actions locally-deemed to be most suitable for the jurisdiction to implement were carried over for detailed evaluation and prioritization. The community and County action plans that were ultimately developed, together with action items spearheaded at the County level with local participation, include action items to address every hazard profiled in this mitigation plan. Communities will consider widening the scope of their mitigation strategies at each update to encompass a greater range of hazards, following progress or completion of the actions in their initial strategies.

Table 6.3 is an overview-level summary of the general types and numbers of projects comprising each local mitigation action plan. **Please refer to Municipal Annexes in Appendix 1.2 for detailed information about each action item.** Together, Ulster County and its jurisdictions intend to implement nearly 200 hazard mitigation actions or projects to reduce risk from natural disasters.

Note that some jurisdictions have opted to include emergency response and preparedness actions in their local mitigation action plans. While these types of actions may be included herein as part of a local action plan, they are not credited toward meeting the plan's mitigation action requirement.

Table 6.3 – Overview of Local Mitigation Strategies								
Jurisdiction	Highest hazards - at a minimum - are addressed in the mitigation strategy?	Key risk findings addressed?	Number of Actions Identified	Mitigation Action Types				
				Local Planning /Regulations	Structure and Infrastructure Projects	Natural Systems Protection	Education / Awareness Programs	Preparedness / Response Activities
Ulster, County of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	35	3	27	1	4	0
Denning, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	16	0	16	0	0	0
Ellenville, Village of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	4	0	2	2	0	0
Esopus, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Esopus did not participate.					
Gardiner, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	8	0	4	0	1	3
Hardenburgh, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	20	1	17	0	0	2
Hurley, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	3	0	3	0	0	0
Kingston, City of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	7	0	6	0	0	1
Kingston, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	3	0	3	0	0	0
Lloyd, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Not yet received					
Marbletown, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Marbletown did not participate.					
Marlborough, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Not yet received					
New Paltz, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	6	0	6	0	0	0
New Paltz, Village of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	9	2	6	0	1	0
Olive, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	28	1	22	1	1	3
Plattekill, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Not yet received					
Rochester, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Rochester did not participate.					
Rosendale, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Not yet received					
Saugerties, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	5	1	2	1	1	0

Table 6.3 – Overview of Local Mitigation Strategies								
Jurisdiction	**Highest hazards - at a minimum - are addressed in the mitigation strategy?**	**Key risk findings addressed?**	**Number of Actions Identified**	**Mitigation Action Types**				
				Local Planning /Regulations	**Structure and Infrastructure Projects**	**Natural Systems Protection**	**Education / Awareness Programs**	**Preparedness / Response Activities**
Saugerties, Village of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	4	0	2	0	0	2
Shandaken, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	19	3	10	1	0	5
Shawangunk, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	Not yet received					
Ulster, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	6	0	6	0	0	0
Wawarsing, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	7	0	4	0	0	3
Woodstock, Town of	Highest hazards - at a minimum - addressed in mitigation strategy	Key risk findings addressed	22	1	20	0	0	1
Total Number of Actions County-wide*:			**202**	**12**	**156**	**6**	**8**	**20**

* Totals will increase on receipt of actions from the Towns of Lloyd, Marlborough, Plattekill, Rosendale, and Shawangunk.

FIGURE IN DEVELOPMENT

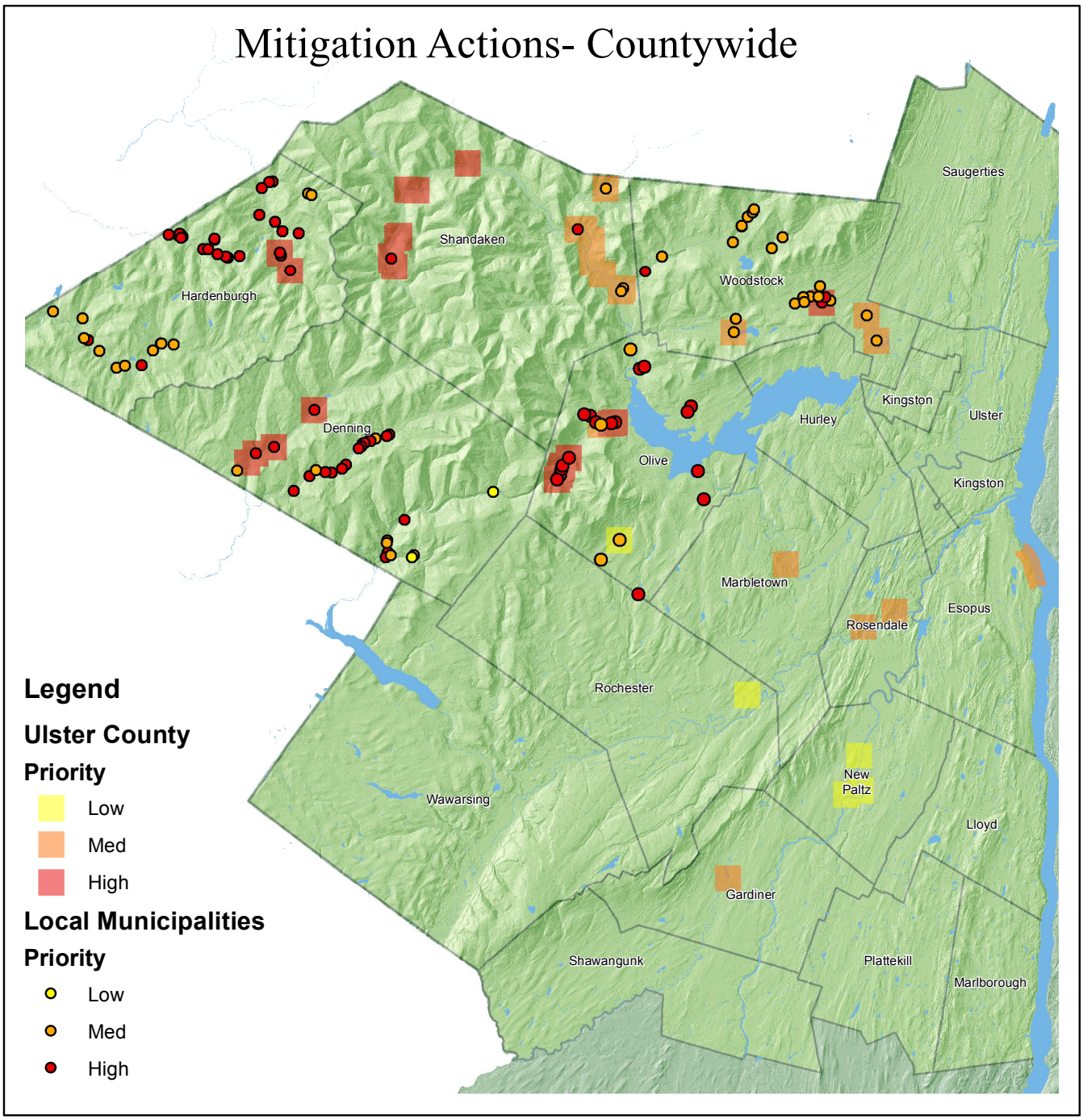

FIGURE IN DEVELOPMENT

SECTION 7 - PLAN MAINTENANCE AND INTEGRATION

A formal plan maintenance process for monitoring, evaluating, and updating the Hazard Mitigation Plan must take place to ensure that the Plan – and specifically the mitigation strategy - remains current and relevant. Updates are required every five years from the date the plan is approved[1]. Regularly scheduled evaluations during the five-year cycle are important to assess the effectiveness of the program and to reflect changes that may affect mitigation priorities, and a process must be undertaken to keep the public engaged throughout the plan's ongoing implementation. As part of the 2015 Plan Update, the UCECEM and the County JAT have reviewed the 2009 to 2014 plan maintenance procedure, and have opted to pursue a very similar strategy for the next five years (2015 to 2020) though some changes have been made to account for both expressed municipal preferences for a slightly modified approach in some areas, and minor differences in the FEMA guidance since the initial plan was prepared.

The UCECEM will continue to take the lead role in coordinating the overall plan maintenance effort, with ongoing support and feedback from the County JAT. Mr. Steven Peterson, who was identified as Coordinator for the 2015 Plan update, will oversee the overall plan maintenance process. Each CPG member will take the lead role on plan maintenance activities for their respective jurisdiction[2]. **Details of County and municipal responsibilities with regard to plan maintenance and integration are described in the remainder of this section.[3]**

Monitoring the Plan

An important step in any mitigation planning process is to document the method by which the CPG will monitor the plan's implementation throughout the five-year period of record. The lead entity in each jurisdiction coordinates with other departments/agencies responsible for implementing hazard mitigation actions identified in the plan in order to maximize the opportunities to implement actions, track progress of actions, identify and address any barriers to implementation of the actions, and to take advantage of grant funding opportunities. Monitoring the plan, therefore, becomes part of the regular function of the office and position to which it is assigned.

Approach. The plan monitoring approach outlined in the 2009 Plan and shown below was reselected for the next 5 year cycle. However, reference to the old FEMA How-To #4, Worksheet #1 Progress Monitoring Report has been replaced by something more user-friendly and tailored to some specific requests of the participants, as the old worksheet had been found to be fairly intimidating during the first plan maintenance phase. Additional details are presented below.

Annual Work Progress Monitoring Reports will be prepared by the County and each participating jurisdiction to track the progress of each of their respective hazard mitigation actions. Annual Work Progress Monitoring Reports shall be prepared by the team members listed on Worksheet 1 submittals in **Appendix 1.2** for each participating jurisdiction and submitted on an annual basis to both UCECEM and their local governing body at this same time to demonstrate local progress or changes to-date, beginning one year from the date of FEMA's approval of the Final plan. UCECEM will maintain a central repository of responses. A blank Annual Work Progress Monitoring Report is included at the end of this subsection. The Annual Work Progress Monitoring Reports provide an overview of the hazard mitigation

[1] After FEMA completes its plan review and determines that all requirements have been adequately addressed, it issues a determination of "Approvable Pending Adoption". Participating jurisdictions then each move forward with formally adopting the plan. For multi-jurisdictional plans, FEMA considers the plan approval date to be the date of the first jurisdictional adoption.

[2] Many jurisdictions have more than one individual CPG member. In completing the Statement of Authority to Participate (discussed in Section 1), each jurisdiction designated a primary CPG representative as well as an alternate. For plan maintenance purposes, it is the position title of the person designated as the 'primary representative' who is responsible for shepherding plan maintenance activities.

[3] Feedback was solicited on a draft of this plan section as distributed via email from URS to UCECEM on March 24, 2014 and again on October 22, 2015 with feedback received on December 15, 2015 and subsequently incorporated.

action(s), responsible and supporting agencies/entities responsible for implementation, a delineation of the various project milestones, the current status of the project, any issues that may hinder implementation; and next steps.

Annual Work Progress Monitoring Reports are to be completed by each municipality once per year for each project in their mitigation strategy, beginning one year from the date of FEMA's approval of the Final plan[4].

Past Progress. The 2009 Plan was approved by FEMA on March 9, 2009; therefore, according to the process outlined above, Annual Work Progress Monitoring Reports were targeted for municipal completion and submittal to UCECEM in January of 2010, 2011, 2012, 2013, and 2014. Each of the jurisdictions took strides toward implementing their hazard mitigation initiatives. However, project tracking and monitoring were hampered by lack of funds and lack of staff. UCECEM received a very limited number of Annual Work Progress Monitoring Reports during Cycle 1 (2009-2011). Monitoring of progress in 2011, 2012 and 2013 was hampered by Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy, following which many communities found that all available resources were dedicated to urgent recovery efforts. Thereafter, monitoring occurred on a more ad-hoc level, with verbal evaluations and discussions as opposed to direct, paper tracking. This highlighted a need for increased vigilance at the local level to both implement mitigation strategies and monitor progress accordingly.

- 2010 to 2013 – Plan monitoring occurred on an ad-hoc basis at the jurisdiction and County levels, with verbal evaluations and discussions of progress as opposed to direct, paper tracking.
- 2014 to 2015 – As part of this hazard mitigation plan update, project progress was tracked via Worksheet #5, for all progress made on mitigation projects over the whole of the first planning cycle. Detailed tracking (copies of Worksheet 5 submittals for each jurisdiction) is provided in **Appendix 1.2 – Worksheets: Municipal Annexes**, and additional information may be obtained by contacting members of the relevant County or municipal JAT as listed in each Municipal Annex Worksheet #1.

[4] For multi-jurisdictional plans, this is the date of the first jurisdictional adoption of the plan, regardless of whether the first jurisdiction is a county government entity or some other local municipal government.

Annual Work Progress Monitoring Report

Municipality:		Progress Report Period:		Date Prepared:	

Mitigation Action Project Title:

Brief Project Description:			
Risk Addressed:			
Who is responsible for implementing the action?	Contact Person *(include name, title, department, phone, email)*:		
Has the project been initiated (check one): __yes ___no *If yes, when?* *If no, why not?*	List Supporting Agencies and Contacts *(if any)*:		
Status (check one): __on schedule __completed __delayed* * *If delayed subsequent to initiation, explain here:*	Original target date for completion:	Current estimated target date for completion:	
Original cost estimate:	Cost Status (check one): __ unchanged __overrun _underrun *If overrun/underrun, explain here:*	Anticipated overrun amount:	Anticipated underrun amount:

Description of the Project *(fill in table with a description of each phase, if applicable, and the time frame for completing each phase):*		
Project Milestones *(e.g. grant application, approval, design, permitting, construction, etc.)*	**Complete? (y/n)**	**Projected Completion Date**

Annual Work Progress Monitoring Report

Municipality:		Progress Report Period:		Date Prepared:	

Mitigation Action Project Title:

Indicator of Success: *In most cases, you will describe any damages/losses that have been avoided as a result of the project. Leave blank if project is not completed. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.*
What was accomplished during this reporting period?
What obstacles, problems, or delays did you encounter, if any? *(i.e., Was there political support for the action? Were enough funds available? Were workloads equitably or realistically distributed? Was new information discovered about the risks or community that made implementation difficult or no longer sensible? Was the estimated time of implementation reasonable? Were sufficient resources (funds, personnel) available?)*
How was each problem resolved?
What is/are the next step(s) to be accomplished over the next reporting period?
If the action has been completed, were the outcomes as expected?
Other comments:

Evaluating the Plan

After a mitigation plan is formally approved by FEMA and adopted by participating jurisdictions, it should be evaluated on a regular basis in order to assess the effectiveness of the plan at achieving its stated purpose and goals.

Approach. The plan evaluation approach outlined in the 2009 Plan and shown below was reselected for the 2015 Plan Update.

The Core Planning Group will convene once per year for an **Annual Plan Evaluation Meeting**. Annual Plan Evaluation Meetings will be led by UCECEM and will be conducted within three months after each annual batch of Annual Work Progress Monitoring Reports are due (see "Monitoring", above). At each meeting, the Core Planning Group will review the Annual Work Progress Monitoring Reports, and use the following criteria as points for group discussion to evaluate the effectiveness of the plan at achieving its stated purpose and goals:

- Do the goals and objectives address current and expected conditions?
- Has the nature and magnitude of risks changed?
- Are the current resources appropriate for implementing the plan?
- Are there any implementation problems (such as technical, political and/or legal), or coordination issues with the other agencies and/or Committee members?
- Have the outcomes occurred as expected?
- Have the agencies and other Committee partners participated as proposed?
- Where shortcomings are identified, what can be done to bring things back on track?
- What is the current progress with regard to plan integration?
- Have any comments been received on the plan from municipalities/public/stakeholders?

Following each Annual Plan Evaluation Meeting, the UCECEM will prepare meeting minutes that will document, at a minimum, the Group's consensus responses to the topics above. UCECEM will distribute meeting minutes to all Core Planning Group members via email, and will post meeting minutes on the web site.

Past Progress. The 2009 Plan was approved by FEMA on March 9, 2009. According to the process above, Annual Plan Evaluation Meetings were targeted for January of 2010, 2011, 2012, 2013, and 2014. Plan evaluation activities in 2011, 2012 and 2013 were hampered by Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy, following which many communities found that all available resources were dedicated to urgent recovery efforts. Thereafter, evaluation occurred as described below. This highlighted a need for increased vigilance at the local level to both implement mitigation strategies and monitor progress and overall plan evaluation accordingly.

- 2010 to 2015. Plan evaluation discussions occurred on an ad-hoc basis at the jurisdiction and County levels, with verbal evaluations and discussions of progress as opposed to direct, paper tracking.

Updating the Plan

As part of the process to maintain FEMA mitigation funding eligibility, a plan update must always be submitted to NYSOEM/FEMA for their review. This must occur within five years of the plan's approval by FEMA (and during subsequent five-year cycles thereafter).

Approach. The plan update approach outlined in the 2009 Plan was expanded upon and slightly modified for the 2015 Plan Update.

The Ulster County Hazard Mitigation Plan was first approved by FEMA on March 9, 2009. An update was due on March 9, 2014. The County applied for, and was granted, an extension to this project timeline for several reasons:

- First, the planning process was severely hampered with response and recovery efforts related to Irene, Lee, and Sandy in 2011 and 2012 - and even into 2013 and later with Sandy recovery and NY Rising planning processes as CPG members and their communities were working above capacity during much of the first plan maintenance cycle.
- Second, the County did not have the funding available to contract out the plan update in the absence of a grant to offset the cost of the project. Ulster County and its jurisdictions initiated the process for this first required plan update by submitting a planning grant application to FEMA on May 1, 2012 under the HMGP program. Notification of grant award was received on September 19, 2012 (HMGP-4020 Planning Grants). URS was identified by the County to facilitate the update process; a notice to proceed was issued on August 13, 2013 – only 7 months before the end of the first five-year cycle.
- Third, in the midst of response and recovery from three federally declared disasters, and an abbreviated project timeline available, the prior UCECEM Director (who had played a lead County role for the initial plan development and early phases of the first update) was retiring, with his tenure ending on August 21, 2014 and the Deputy Director assuming the duties of both Deputy and Acting Director for some time thereafter.

This 2015 plan update represents the first required update of the document. UCECEM has taken the lead on Plan development and updates, and will continue to do so in the future. UCECEM shall be responsible for ensuring that the plan is maintained in accordance with all applicable guidance and regulations.

The Update Process Itself. Regardless of whether or not a plan update is grant funded[5], the following must occur within 5 years from the date that the plan is adopted by the first of its participating jurisdictions:

- An updated planning process must be undertaken.
- An updated plan document must be prepared.
- The updated document must be resubmitted to FEMA (through NJOEM).
- The updated plan must be reviewed by FEMA, who will provide formal comments indicating both required and recommended revisions.
- At a minimum, all required revisions must be addressed.
- The revised document needs to be routed back to FEMA, who will review to ensure that all required revisions have been satisfactorily addressed. If so, they will deem the plan "approvable pending adoption."
- The plan must then be adopted by participating jurisdictions.

[5] Funding the Updates. In the past, Ulster County has sought out grant funding to offset the fairly significant costs associated with both the initial plan development and the first plan update. Should the County wish to do so in the future, FEMA's Hazard Mitigation Grant Program (HMGP) or Pre-disaster Mitigation Program (PDM) would continue to be the most applicable funding sources. The HMGP is a post-disaster program. Under this program, funds become available state-wide for applicants with approved hazard mitigation plans in place each time there is a Federal disaster declaration anywhere in the state. A certain portion of HMGP disaster funds are set aside for projects; the remainder is set aside for planning. The PDM program is a pre-disaster program. Under this program, funds are appropriated annually and are competitive at a national level. Annual appropriation amounts tend to vary widely, and its availability in the future is not guaranteed. If the UCECEM is interested in obtaining grant funds for the next required plan update (2015 to 2020) then a grant application should be submitted for the first opportunity after the plan is adopted. This would allow for the possibility of the application not being approved on the first pass, and would allow sufficient time for an alternate approach to be taken within the requisite 5-year window. If grant funding is selected as the primary funding source for any given update cycle, the County should be keenly aware of grant application review times, as well as applicable County procurement rules, when moving forward. It is not uncommon for grant submittal, review, approval, RFP issuance, review of proposals, selection of a contractor, and contract negotiations and contract execution to take one to two years out of the 5-year cycle. In addition, grant funding is not guaranteed so the County should be prepared with a backup funding source for meeting requirements if outside assistance does not materialize.

Allowing one year for the update process, and one year for the review/approval/adoption process has historically been observed. That having been said, it is recommended that the County initiate each requisite plan update no later than three years after the plan's approval date[6]. If grant funding is sought, applications should be submitted at the first opportunity following the plan's approval date (and no later than two years after the plan is approved).

The plan update involves a comprehensive review and evaluation of each section of the plan, and also discusses the results of evaluation and monitoring activities detailed in the Plan Maintenance section of the previously approved plan. Plan updates may validate the information in the previously approved plan, or may involve a major plan rewrite. A plan update cannot be an annex referring to the previously approved plan; it must stand on its own as a complete and current plan. Plans are required to be updated to reflect changes in development, progress in local mitigation actions, and changes in priorities. Other criteria considered during the update included:

- if changing situations have modified goals/objectives/actions and/or hazards;
- if additional information is available to perform more accurate vulnerability assessments;
- if it is determined that participating jurisdictions wish to be added to and/or removed from the Plan; or
- if it is determined that the Plan no longer addresses current and expected future conditions.

At the time of each update, UCECEM shall consult with NYSOEM and FEMA for the latest Guidance in place regarding plan updates to ensure that the latest criteria are addressed in the update process. Plan updates will be posted on the County web site, and made available in hard copy at the UCECEM offices.

Past Progress. The 2009 Plan was approved by FEMA on March 9, 2009. UCECEM applied for grant funds under FEMA's HMGP program to offset the cost of the update on May 2, 2012; notification of grant award was received on September 20, 2012. URS was selected to facilitate the update process. A contract was subsequently negotiated, with URS receipt of a notice to proceed on August 13, 2013. The County extended the initial plan update target timeline to allow the CPG to meet local participation requirements, and to incorporate NY Rising program recommendations into local mitigation strategies. This document represents the first plan update.

Public Participation in Plan Maintenance

The public and other stakeholders must be given opportunities to become involved during the Plan's regular maintenance and implementation. It is important to understand perceptions of the plan's effectiveness and degree of success to help maintain support for the plan and provide accountability for those responsible for its maintenance and implementation.

Approach. The following array of activities was selected by UCECEM based on feedback received from Core Planning Group Members at the time of development of the initial plan in 2009. These activities were reviewed as part of the 2015 Plan Update and the following activities were selected for the 2015 to 2020 planning cycle:

- UCECEM will continue to maintain the mitigation planning website.
- Each participating jurisdiction will maintain a link on their jurisdiction's web page to the County mitigation planning website, if they have not already done so.
- UCECEM will prepare an annual fact sheet on the plan. This fact sheet will be submitted via email to Core Planning Group members for posting on community notice boards, at a

[6] After FEMA completes its plan review and determines that all requirements have been adequately addressed, it issues a determination of "Approvable Pending Adoption". Participating jurisdictions then each move forward with formally adopting the plan. For multi-jurisdictional plans, FEMA considers the plan approval date to be the date of the first jurisdictional adoption.

minimum, and preferably supplemented with distribution at meetings as applicable. UCECEM will post the fact sheet on the County mitigation plan web site.

- Participating jurisdictions will conduct annual interviews and/or smaller meetings with civic groups, the public and other stakeholders. This will be accomplished through incorporating discussion of the mitigation plan into other regularly attended meetings.
- Participating jurisdictions will consider annual flyers, newsletters, newspaper advertisements, and Radio/TV announcements to supplement annual interviews/meetings, and will implement some or all of these at the discretion of the jurisdiction. At a minimum, the County will issue an annual press release.
- Participating jurisdictions are responsible for keeping track of any comments they receive on the plan, and bringing these forward for discussion at the Annual Plan Evaluation Meetings.

Past Progress. UCECEM reports the following progress was made in continued outreach to the public and other stakeholders over the first plan maintenance cycle:

- UCECEM has successfully continued to maintain the mitigation planning website.
- Continual outreach to the public at various events.
- UCECEM provides Multi-Jurisdictional Hazard Mitigation Plan Fact Sheet and website information to county staff.
- Beginning in 2013, all participating jurisdictions conducted regular outreach to the public and other stakeholders regarding the plan update. Their activities are summarized in the Outreach Logs for each jurisdiction, as included in Municipal Annexes of **Appendix 1.2.**

Plan Integration

For a participating jurisdiction to succeed in reducing risk in the long term, the information and recommendations of the hazard mitigation plan must be integrated into day-to-day local government operations, as well as into comprehensive plans. Throughout the planning process, partnerships are formed between departments and agencies, and sustained actions between these partners will increase the community's resilience to disasters. "Plan integration" can be thought of as the process whereby each participating jurisdiction will incorporate the mitigation plan findings and projects into other planning mechanisms (local governance structures that are used to manage local land use development, building codes and community decision making).

Approach. The overall approach of the 2009 Plan included various plan integration options for municipalities to choose from during the plan maintenance phase. It was not specific as to which jurisdictions would undertake which activities. However, the latest FEMA guidance requires multi-jurisdictional plans to be more specific, identifying what particular activities will be undertaken by each specific jurisdiction. To this end, as part of the 2015 Plan update process, municipalities were asked to consider a range of possible plan integration activities, and by completing a worksheet, select a series of jurisdiction-specific activities from this list of options(with flexibility to add additional, unlisted options at their individual discretion). A wide range of possibilities was considered, such as: protecting life and property in high hazard areas by limiting densities of new development; increasing resilience by limiting the extension of public infrastructure in high hazard areas; and adding a specific hazard mitigation element to the next update of local master, general or comprehensive plans - to name a few. **Worksheet 6 (see jurisdictional annexes of Appendix 1.2)** documents the full range of plan integration options that were considered, as well as each jurisdiction's identified plan integration activities that will be undertaken during the 2015 to 2020 plan maintenance cycle. Each jurisdiction has committed to undertake these activities over the next five-year plan maintenance cycle.

Past Progress. As part of the 2015 Plan Update, the targeted plan integration activities from the last version of the plan were put into tabular form on a worksheet, and each jurisdiction was asked to complete the worksheet to indicate their respective accomplishments. A summary of Plan Integration activities that were undertaken during the first plan maintenance cycle is also provided on **Worksheet 6 (see jurisdictional annexes of Appendix 1.2)**.

SECTION 8 - FOR MORE INFORMATION

If you have any questions or comments on the Multi-Jurisdictional Hazard Mitigation Plan for Ulster County, New York, additional information can be obtained by contacting:

Steven Peterson, Director
Ulster County Department of Emergency Communications/Emergency Management
238 Golden Hill Lane
Kingston, New York 12401-6440
Phone: 845-331-7000
Fax: 845-331-1738
E-Mail: spet@co.ulster.ny.us

For jurisdiction specific information, it is recommended that the individuals identified as representatives of the jurisdictions in Section 1 of this plan be contacted.

You may also wish to refer to the County's website or the communities' websites for additional information on the mitigation plan process. Information about this hazard mitigation plan is maintained on the Ulster County website at:

www.ulstercountyny.gov/emergencyservices/management/haz_mit/index.html

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APPENDIX CD

Appendices for the
Ulster County Multi-jurisdictional Hazard Mitigation Plan
are included herein on CD only.

Appendices

Appendix 1.1 – Statements of Authority to Participate
Appendix 1.2 – Worksheets: Municipal Annexes

- 1.2.1 Annex – Ulster County
- 1.2.2 Annex – Denning, Town of
- 1.2.3 Annex – Ellenville, Village of
- 1.2.4 Annex – Esopus, Town of
- 1.2.5 Annex – Gardiner, Town of
- 1.2.6 Annex – Hardenburgh, Town of
- 1.2.7 Annex – Hurley, Town of
- 1.2.8 Annex – Kingston, City of
- 1.2.9 Annex – Kingston, Town of
- 1.2.10 Annex – Lloyd, Town of
- 1.2.11 Annex – Marbletown, Town of
- 1.2.12 Annex – Marlborough, Town of
- 1.2.13 Annex – New Paltz, Town of
- 1.2.14 Annex – Olive, Town of
- 1.2.15 Annex – Plattekill, Town of
- 1.2.16 Annex – Rochester, Town of
- 1.2.17 Annex – Rosendale, Town of
- 1.2.18 Annex – Saugerties, Town of
- 1.2.19 Annex – Saugerties, Village of
- 1.2.20 Annex – Shandaken, Town of
- 1.2.21 Annex – Shawangunk, Town of
- 1.2.22 Annex – Ulster, Town of
- 1.2.23 Annex – Wawarsing, Town of
- 1.2.24 Annex - Woodstock, Town of

Appendix 1.3 – Meeting Materials
Appendix 1.4 – County Press Releases and Articles in Local News Media
Appendix 1.5 – Jurisdictional Website Coverage of the Plan
Appendix 1.6 – Natural Hazards Survey Results
Appendix 1.7 – Comments on the September 2015 Draft Plan
Appendix 2.1 – Hazard Descriptions
Appendix 3c.1 – Assets in Hazard Areas
Appendix 3c.2 – Historic in Hazard Areas
Appendix 3e.1 – Hazard Rankings and Key Risk Findings
Appendix 4.1 – Legal and Regulatory Tool Descriptions
Appendix 4.2 – State Resources
Appendix 4.3 – Federal Resources

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