5.1 METHODOLOGY AND TOOLS

This section describes the methodology and tools used to support the risk assessment process.

5.1.1 Methodology

The risk assessment process used for this Plan update is consistent with the process and steps presented in FEMA 386-2, State and Local Mitigation Planning How-to-Guide, Understanding Your Risks – Identifying Hazards and Estimating Losses (FEMA, 2001). This process identifies and profiles the hazards of concern and assesses the vulnerability of assets (population, structures, critical facilities and the economy) at risk in the community. A risk assessment provides a foundation for the community's decision makers to evaluate mitigation measures that can help reduce the impacts of a hazard when one occurs (Section 9 of this plan).

Step 1: The first step of the risk assessment process is to identify the hazards of concern. FEMA's current regulations only require an evaluation of natural hazards. Natural hazards are natural events that threaten lives, property, and many other assets. Often, natural hazards can be predicted, where they tend to occur repeatedly in the same geographical locations because they are related to weather patterns or physical characteristics of an area.

Step 2: The next step of the risk assessment is to prepare a profile for each hazard of concern. These profiles assist communities in evaluating and comparing the hazards that can impact their area. Each type of hazard has unique characteristics that vary from event to event. That is, the impacts associated with a specific hazard can vary depending on the magnitude and location of each event (a hazard event is a specific, uninterrupted occurrence of a particular type of hazard). Further, the probability of occurrence of a hazard in a given location impacts the priority assigned to that hazard. Finally, each hazard will impact different communities in different ways, based on geography, local development, population distribution, age of buildings, and mitigation measures already implemented.

Steps 3 and 4: To understand risk, a community must evaluate what assets it possesses and which assets are exposed or vulnerable to the identified hazards of concern. Hazard profile information combined with data regarding population, demographics, general building stock, and critical facilities at risk, located in Section 4. The hazard profile information prepares the community to develop risk scenarios and estimate potential damages and losses for each hazard.

5.1.2 Tools

To address the requirements of DMA 2000 and better understand potential vulnerability and losses associated with hazards of concern, Morris County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Our standardized tools used to support the risk assessment are described below.

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

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national-, state-, and community-level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard methodology, HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a GIS-based software tool that applies engineering and scientific risk calculations, which have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are

accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH provided data for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, and threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. The guidance Using HAZUS-MH for Risk Assessment: How-to Guide (FEMA 433) was used to support the application of HAZUS-MH for this risk assessment and plan. More information on HAZUS-MH is available at http://www.fema.gov/plan/prevent/hazus/index.shtm.

In general, probabilistic analyses were performed to develop expected/estimated distribution of losses (mean return period losses) for the flood and wind hazards. The probabilistic hazard generates estimates of damage and loss for specified return periods (e.g., 100- and 500-year). For annualized losses, HAZUS-MH version 2.1 calculates the maximum potential annual dollar loss resulting from various return periods averaged on a "per year" basis. It is the summation of all HAZUS-supplied return periods (e.g., 10, 50, 100, 200, 500-year) multiplied by the return period probability (as a weighted calculation). In summary, the estimated cost of a hazard each year is calculated.

Custom methodologies in HAZUS-MH version 2.1 (HAZUS-MH) were used to assess potential exposure and losses associated with hazards of concern for Morris County:

Inventory: The 2010 U.S. Census data at the Census-block level was used to estimate hazard exposure at the municipal level. The default demographic data in HAZUS-MH 2.1, based on the 2000 U.S. Census, was used to estimate potential sheltering and injuries for this analysis.

The default building inventory in HAZUS-MH was updated and replaced with a custom building inventory developed for the County. The updated building inventory was developed using structure-specific assessor data (MOD-IV), as well as parcel information. Attributes provided in the spatial files were used to further define each structure in terms of occupancy class, construction type etc. The square footage calculated from building footprints, number of stories for each structure, and RS Means 2014 were used to calculate the replacement cost value for each building. Contents were estimated based on the occupancy class (residential contents estimated as 50% of the improved value; non-residential contents estimated as 100% of the improved value).

The critical facility inventory (essential facilities, utilities, transportation features and user-defined facilities) was updated beginning with all GIS data provided by Morris County. Both the critical facility and building inventories were formatted to be compatible with HAZUS-MH and its Comprehensive Data Management System (CDMS). Specific facility information is not provided in this HMP due to the sensitive nature of the critical facility inventory.

Flood: The 1- and 0.2-percent annual chance flood events were examined to evaluate the County's risk to the flood hazard. These flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

An update to specific riverine reaches in Morris County were released in March 2015 through a FEMA preliminary DFIRM; these updated reaches were combined with the FEMA preliminary DFIRM released in 2012. Together these flood boundaries were used to evaluate the County's exposure to this hazard.

The 2015 preliminary DFIRM depth grids provided by NJDEP were mosaicked with the depth grids generated by Tetra Tech for the 2014 State HMP and were incorporated into HAZUS-MH. The depth grids were integrated into HAZUS-MH and the model was run to estimate potential losses at the structure level using the County's custom structural building inventory.

The Hazus-MH model uses 2000 U.S. Census demographic data. This data was not updated for this analysis; however, the 2010 U.S. Census data was used to estimate population exposure to provide the best available output. In addition, to estimate exposure, the DFIRM flood boundaries were used. Hazus-MH 2.1 calculated the estimated damages to the general building stock and critical facilities based on the depth grid generated and the default Hazus damage functions in the flood model.

Severe Storm: A HAZUS-MH probabilistic analysis was performed to analyze the wind hazard for Morris County. The probabilistic hurricane hazard activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identify those with tracks associated with the county. Annualized losses and the 100- and 500-year mean return period (MRP) were examined. Default demographic data in HAZUS-MH and updated building and critical facility data were used for the analysis.

Earthquake: A Level 2 HAZUS-MH analysis using a probabilistic scenario was performed to analyze the earthquake hazard losses for Morris County (annualized losses and 100-, 500- and 2,500-year MRP losses). In order to account for the effects of local soil conditions for estimating ground motion and landslide and liquefaction potential, the National Earthquake Hazards Reduction Program (NEHRP) soil classification as well as liquefaction and landslide susceptibility spatial data created by the New Jersey Geologic and Water Survey (NJGWS) were incorporated into HAZUS-MH.

In addition to the probabilistic scenarios mentioned, an annualized loss run was conducted in HAZUS-MH 2.1 to estimate the annualized general building stock dollar losses for the county. The annualized loss methodology combines the estimated losses associated with ground shaking for eight return periods: 100-, 250-, 500-, 750-, 1000-, 1500-, 2000-, and 2500-year, which are based on values from the USGS seismic probabilistic curves. Annualized losses are useful for mitigation planning because they provide a baseline upon which to (1) compare the risk of one hazard across multiple jurisdictions and (2) compare the degree of risk of all hazards for each participating jurisdiction.

Geologic Hazards: The New Jersey Geologic Survey (currently known as the NJGWS) determined landslide susceptibility for nine counties in New Jersey (Bergen, Morris, Hudson, Middlesex, Monmouth, Morris, Morris, Somerset, and Union). Based upon the analysis using NJGWS data, the areas of landslide susceptibility are specific to hilly or mountainous areas with steep slopes and erodible soils. Additionally, the NJGWS created a spatial data set identifying the location of carbonate bedrock throughout the state; this data was used to identify potential hazard areas for subsidence and sinkholes. These two spatial data sets were used to estimate population, building stock and critical facility exposure in Morris County.

Wildfire: The New Jersey Forest Fire Service (NJFFS) uses Wildfire Fuel Hazard data to assign wildfire fuel hazard rankings across the State. This data, developed in 2009, is based upon NJDEP's 2002 Land Use/Land Cover datasets and NJDEP's 2002 10-meter Digital Elevation Grid datasets. For the wildfire hazard, the NJFFS Wildfire Fuel Hazard "extreme", "very high" and "high" areas are identified as the wildfire hazard area. The statistics in the "moderate" to "low" areas are also reported.

To determine vulnerability, a spatial analysis was conducted using the NJFFS Fuel Hazard Area guidelines. When the analysis determined the hazard area would impact the area in a jurisdiction, or the location of critical facilities, these locations were deemed potentially vulnerable to the hazard. The limitations of this analysis are recognized, and as such the analysis is only used to provide a general estimate.

For Morris County's risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

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

These factors can result in a range of uncertainty in loss estimates, possibly by a factor of two or more. Therefore, potential exposure and loss estimates are approximate. These results do not predict precise results and should be used to understand relative risk. Over the long term, Morris County will collect additional data to assist in developing refined estimates of vulnerabilities to natural hazards.