5.4.5 WILDFIRE

This section provides a profile and vulnerability assessment for the wildfire hazard.

HAZARD PROFILE

This section provides profile information including description, location, extent, previous occurrences and losses and the probability of future occurrences.

Description

According to the New York State Hazard Mitigation Plan (NYS HMP), wildfire is defined as an uncontrolled fire spreading through natural or unnatural vegetation that often has the potential to threaten lives and property if not contained. Wildfires that burn in or threaten to burn buildings and other structures are referred to as wildland urban interface fires. Wildfires include common terms such as forest fires, brush fires, grass fires, wildland urban interface fires, range fires or ground fires. Wildfires do not include those fires, either naturally or purposely ignited, that are controlled for a defined purpose of managing vegetation for one or more benefits (NYS HMP, 2011 – need proper reference).

Wildfire in New York State is based on the same science and environmental factors as any wildfire in the world. Fuels, weather, and topography are the primary factors that determine the natural spread and destruction of every wildfire. New York State, including Delaware County, has large tracts of diverse forest lands. Although destructive fires do not occur on an annual basis, New York's fire history shows a cycle of fire occurrence that result in human death, property loss, forest destruction, and air pollution (NYS HMP, 2011 – need proper reference).

There are three different classes of wildfires: surface fires, ground fires, and crown fires. Surface fires are the most common type and burns along the forest floor, moving slowly and killing or damaging trees. Ground fires are usually started by lightning and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees.

FEMA indicates that there are four categories of wildfires that are experienced throughout the U.S. These categories are defined as follows:

- Wildland fires – fueled almost exclusively by natural vegetation. They typically occur in national forests and parks, where Federal agencies are responsible for fire management and suppression.
- Interface or intermix fires – urban/wildland fires in which vegetation and the built-environment provide fuel
- Firestorms – events of such extreme intensity that effective suppression is virtually impossible. Firestorms occur during extreme weather and generally burn until conditions change or the available fuel is exhausted.
- Prescribed fires and prescribed natural burns – fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes (FEMA, 1997).

The potential for wildfire, and its subsequent development (growth) and severity, is determined by three principal factors including the area's topography, the presence of fuel, and weather. These factors are described below:

Topography - Topography can have a powerful influence on wildfire behavior. The movement of air over the terrain tends to direct a fire's course. Gulches and canyons can funnel air and act as a chimney, intensifying fire behavior and inducing faster spread rates. Saddles on ridgetops tend to offer lower resistance to the passage of air and will draw fires. Solar heating of drier, south-facing slopes produces upslope thermal winds that can complicate behavior.

Slope is an important factor. If the percentage of uphill slope doubles, the rate at which the wildfire spreads will most likely double. On steep slopes, fuels on the uphill side of the fire are closer physically to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Terrain can inhibit wildfires: fire travels downslope much more slowly than it does upslope, and ridgetops often mark the end of wildfire's rapid spread (FEMA, 1997).

Fuel - Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading can be used to describe the amount of vegetative material available. If this doubles, the energy released can also be expected to double. Each fuel type is given a burn index, which is an estimate of the amount of potential energy that may be released, the effort required to obtain a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities and some burn more easily than others. Grass releases relatively little energy but can sustain very high rates of spread (FEMA, 1997). According to the U.S. Forest Service, a forest stand may consist of several layers of live and dead vegetation in the understory (surface fuels), midstory (ladder fuels), and overstory (crown fuels). Fire behavior is strongly influenced by these fuels. Each of these layers provides a different type of fuel source for wildfires.

- Surface fuels consist of grasses, shrubs, litter, and woody material lying on the ground. Surface fires burn low vegetation, woody debris, and litter. Under the right conditions, surface fires reduce the likelihood that future wildfires will grow into crown fires.
- Ladder fuels consist of live and dead small trees and shrubs; live and dead lower branches from larger trees, needles, vines, lichens, mosses, and any other combustible biomass located between the top of the surface fuels and the bottom of the overstory tree crowns.
- Crown fuels are suspended above the ground in treetops or other vegetation and consists mostly of live and dead fine material. When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies are the primary fuel layer in a forest crown fire (U.S. Forest Service, 2003).

Weather / Air Mass - Weather is the most important factor in the make-up of a fire's environment, yet it is always changing. Air mass, which is defined by the National Weather Service (NWS) as a body of air covering a relatively wide area and exhibiting horizontally uniform properties, can impact wildfire through climate, including temperature and relative humidity, local wind speed and direction, cloud cover, precipitation amount and duration, and the stability of the atmosphere at the time of the fire (NWS, 2009). Extreme weather leads to extreme events and it is often a moderation of the weather that marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce vigorous fire activity. Fronts and thunderstorms can produce winds that are capable of radical and sudden changes in speed and direction, causing similar changes in fire activity. The rate of spread of a fire varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The most damaging firestorms are typically marked by high winds (FEMA, 1997).

Fire probability depends on local weather conditions, outdoor activities (e.g. camping, debris burning, and construction), and the degree of public cooperation with fire prevention measures. Dry weather, such as drought, can increase the likelihood of wildfire events. Lightning can also trigger wildfire and urban fire events. Other natural disasters can increase the probability of wildfires by producing fuel in both urban and rural areas. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks; pull down overhead power lines; or damage pavement and underground utilities (NVRC, 2006).

Extent

The extent (that is, magnitude or severity) of wildfires depends on weather and human activity. There are several tools available to estimate fire potential, extent, danger and growth including, but not limited to the following:

Wildland/Urban Interface (WUI) is the area where houses and wildland vegetation coincide. Interface neighborhoods are found all across the U.S., and include many of the sprawling areas that grew during the 1990s. Housing developments alter the structure and function of forests and other wildland areas. The outcomes of the fire in the WUI are negative for residents; some may only experience smoke or evacuation, while others may lose their homes to a wildfire. All states have at least a small amount of land classified as WUI. To determine the WUI, structures per acre and population per square mile are used. Across the U.S., 9.3-percent of all land is classified as WUI. The WUI in the area is divided into two categories: intermix and interface. Intermix areas have more than one house per 40 acres and have more than 50-percent vegetation. Interface areas have more than one house per 40 acres, have less than 50-percent vegetation, and are within 1.5 miles of an area over 1,235 acres that is more than 75-percent vegetated (Stewart et al., 2006).

Concentrations of WUI can be seen along the east coast of the U.S., where housing density rarely falls below the threshold of one housing unit per 40 acres and forest cover is abundant. In the mid-Atlantic and north central regions of the U.S., the areas not dominated by agriculture have interspersed WUI and low density vegetated areas. Areas where recreation and tourism dominate are also places where WUI is common, especially in the northern Great Lakes and Missouri Ozarks (Stewart et al., 2006).

Wildland Fire Assessment System (WFAS) is an internet-based information system that provides a national view of weather and fire potential, including national fires danger, weather maps and satellite-derived "greenness" maps. It was developed by the Fire Behavior unit at the Fire Sciences Laboratory in Missoula, Montana and is currently supported and maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho (USFS, Date Unknown).

Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS (NWS, Date Unknown). Fire Danger Rating level takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. This information is provided by local station managers (USFS, Date Unknown). Table 5.4.5-1 shows the fire danger rating and color code.

Table 5.4.5-1. Fire Danger Rating and Color Code

Fire Danger Rating and Color Code	Description
Low (L) (Dark Green)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (M) (Light Green or Blue)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.

Fire Danger Rating and Color Code	Description
High (H) (Yellow)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH) (Orange)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E) (Red)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash (trunks, branches, and tree tops) or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Source: USFS, Date Unknown

The ***Fire Potential Index (FPI)*** is derived by combining daily weather and vegetation condition information and can identify the areas most susceptible to fire ignition. The combination of relative greenness and weather information identifies the moisture condition of the live and dead vegetation. The weather information also identifies areas of low humidity, high temperature, and no precipitation to identify areas most susceptible to fire ignition. The FPI enables local and regional fire planners to quantitatively measure fire ignition risk (USGS, 2005). FPI maps are provided on a daily basis by the U.S. Forest Service. The scale ranges from 0 (low) to 100 (high). The calculations used in the NFDRS are not part of the FPI, except for a 10-hour moisture content (Burgan et al, 2000).

Fuel Moisture (FM) content is the quantity of water in a fuel particle expressed as a percent of the oven-dry weight of the fuel particle. FM content is an expression of the cumulative effects of past and present weather events and must be considered in evaluating the effects of current or future weather on fire potential. FM is computed by dividing the weight of the "water" in the fuel by the oven-dry weight of the fuel and then multiplying by 100 to get the percent of moisture in a fuel (NWS, Date Unknown).

There are two kinds of FM: live and dead. Live fuel moistures are much slower to respond to environmental changes and are most influenced by things such as a long drought period, natural disease and insect infestation, annuals curing out early in the season, timber harvesting, and changes in the fuel models due to blow down from windstorms and ice storms (NOAA, Date Unknown). Dead fuel moisture is the moisture in any cured or dead plant part, whether attached to a still-living plant or not. Dead fuels absorb moisture through physical contact with water (such as rain and dew) and absorb water vapor from the atmosphere. The drying of dead fuels is accomplished by evaporation. These drying and wetting processes of dead fuels are such that the moisture content of these fuels is strongly affected by fuel sizes, weather, topography, decay classes, fuel composition, surface coatings, fuel compactness and arrangement (Schroeder, and Buck, 1970).

Fuels are classified into four categories which respond to changes in moisture. This response time is referred to as a time lag. A fuel's time lag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. The four categories include:

- 1-hour fuels: up to ¼-inch diameter – fine, flashy fuels that respond quickly to weather changes. Computed from observation time, temperature, humidity, and cloudiness.

- 10-hour fuels: ¼-inch to one-inch in diameter - computed from observation time, temperature, humidity, and cloudiness or can be an observed value.
- 100-hour fuels: one-inch to three-inch in diameter - computed from 24-hour average boundary condition composed of day length (daylight hours), hours of rain, and daily temperature/humidity ranges.
- 1000-hour fuels: three-inch to eight-inch in diameter - computed from a seven-day average boundary condition composed of day length, hours of rain, and daily temperature/humidity ranges (National Park Service, Date Unknown).

The ***Keetch-Byram Drought Index (KBDI)*** is a drought index designed for fire potential assessment. It is a number representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers (USFS, Date Unknown). The index increases each day without rain and decreases when it rains. The scale ranges from 0 (no moisture deficit) to 800 (maximum drought possible). The range of the index is determined by assuming that there is eight inches of moisture in a saturated soil that 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 (Florida Forest Service, Date Unknown).

The ***Haines Index***, also known as the Lower Atmosphere Stability Index, is a fire weather index based on stability and moisture content of the lower atmosphere that measures the potential for existing fires to become large fires. It is named after its developer, Donald Haines, a Forest Service research meteorologist, who did the initial work and published the scale in 1988 (Storm Prediction Center [SPC], Date Unknown).

The Haines Index can range between 2 and 6. The drier and more unstable the lower atmosphere is, the higher the index. It is calculated by combining the stability and moisture content to the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point different. The index, as listed below, has shown to correlate with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior (USFS, Date Unknown).

- Very Low Potential (2) – moist, stable lower atmosphere
- Very Low Potential (3)
- Low Potential (4)
- Moderate Potential (5)
- High Potential (6) – dry, unstable lower atmosphere (USFS, Date Unknown)

The Haines Index is intended to be used all over the U.S. It is adaptable for three elevation regimes: low elevation, middle elevation, and high elevation. Low elevation is for fires at or very near sea level. Middle elevation is for fires burning in the 1,000 to 3,000 feet in elevation range. High elevation is intended for fires burning above 3,000 feet in elevation (SPC, Date Unknown).

The ***Landscape Fire and Resource Management Planning Tools Project (LANDFIRE)*** is a five-year, multi-partner project. The project is producing comprehensive and consistent maps and data describing vegetation, fire and fuel characteristics for the entire U.S. LANDFIRE is a shared project between the U.S. Department of Agriculture Forest Service and the U.S. Department of the Interior. The project has several principal partners, which include the USFS Missoula Fire Sciences Laboratory, the USGS Center for Earth Resources Observation and Science, and the Nature Conservancy (LANDFIRE, Date Unknown).

Additionally, the U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station developed a historical natural fire regimes dataset. The fire regimes are described in terms of frequency and severity and represent pre-settlement, historical fire processes. Fire regimes I and II represent frequent fire return intervals. The 0-35+ years/low severity fire regime (I) occurs mostly on forested land. The 0-35+years/stand-replacement regime (II) occurs mostly on grasslands and shrublands. Fire regimes III, IV, and V have longer fire return intervals and occur on forest lands, shrublands, and grasslands. These coarse-scale data were developed for national-level planning and were not intended to be used at finer spatial scales (Schmidt et al., 2002).

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).

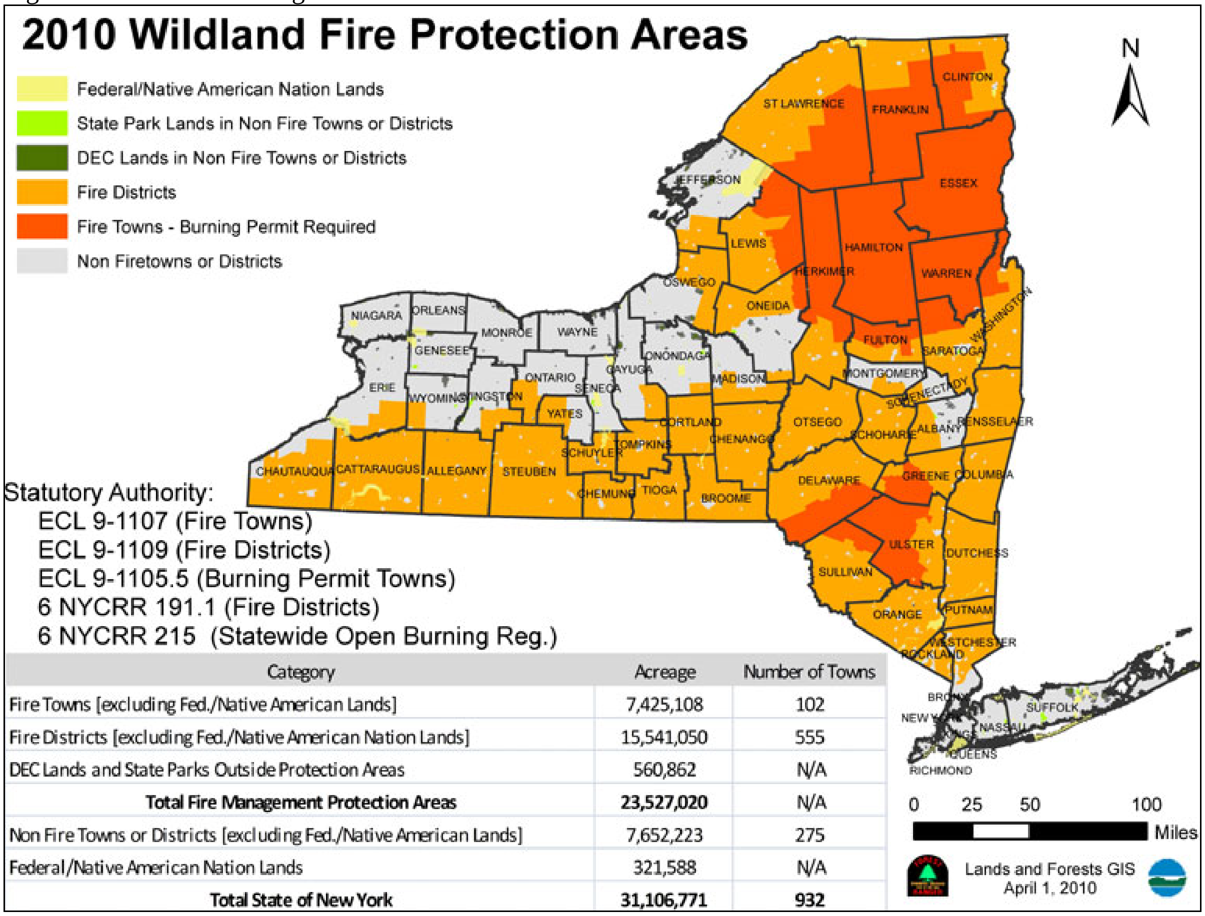
Location

According to the U.S. Fire Administration (USFA), the fire problem in the U.S. varies from region to region. This often is a result of climate, poverty, education, demographics, and other causal factors (USFA, 2012). Wildfires occur in virtually all of the U.S. The western portion of the U.S. is subject to more frequent wildfires, due to their more arid climate and prevalent conifer and brush fuel types. Wildfires have proven to be the most destructive in California, but have become an increasingly frequent and damaging phenomenon nationwide (FEMA, 1997). States with a large amount of wooded, brush, and grassy areas, such as California, Colorado, New Mexico, Montana, Kansas, Mississippi, Louisiana, Georgia, Florida, North and South Carolina, Tennessee, Massachusetts, and the national forests of the western U.S. are at highest risk for wildfires (University of Florida, 1998).

Wildfires do occur in New York State. Many areas in the State, particularly those that are heavily forested or contain large tracts of brush and shrubs, are prone to fires. New York State has over 18 million acres of non-Federal forested land, along with an undetermined amount of open space and wetlands. The Adirondacks, Catskills, Hudson Highlands, Shawangunk Ridge, and Long Island Pine Barrens are examples of fire-prone areas (NYSDEC, Date Unknown).

The New York State Forest Ranger Division provides forest fire protection for 657 municipalities in the State. Figure 5.4.5-1 displays the fire protection areas in New York State. This figure indicates that Delaware County is part of the wildfire protection area.

Figure 5.4.5-1. Forest Ranger Division Wildfire Protection Areas



Category	Acreage	Number of Towns
Fire Towns [excluding Fed./Native American Lands]	7,425,108	102
Fire Districts [excluding Fed./Native American Nation Lands]	15,541,050	555
DEC Lands and State Parks Outside Protection Areas	560,862	N/A
Total Fire Management Protection Areas	**23,527,020**	N/A
Non Fire Towns or Districts [excluding Fed./Native American Lands]	7,652,223	275
Federal/Native American Nation Lands	321,588	N/A
Total State of New York	**31,106,771**	**932**

Source: NYSDEC, 2010

Wildfire/Urban Interface (WUI) in New York State/Delaware County

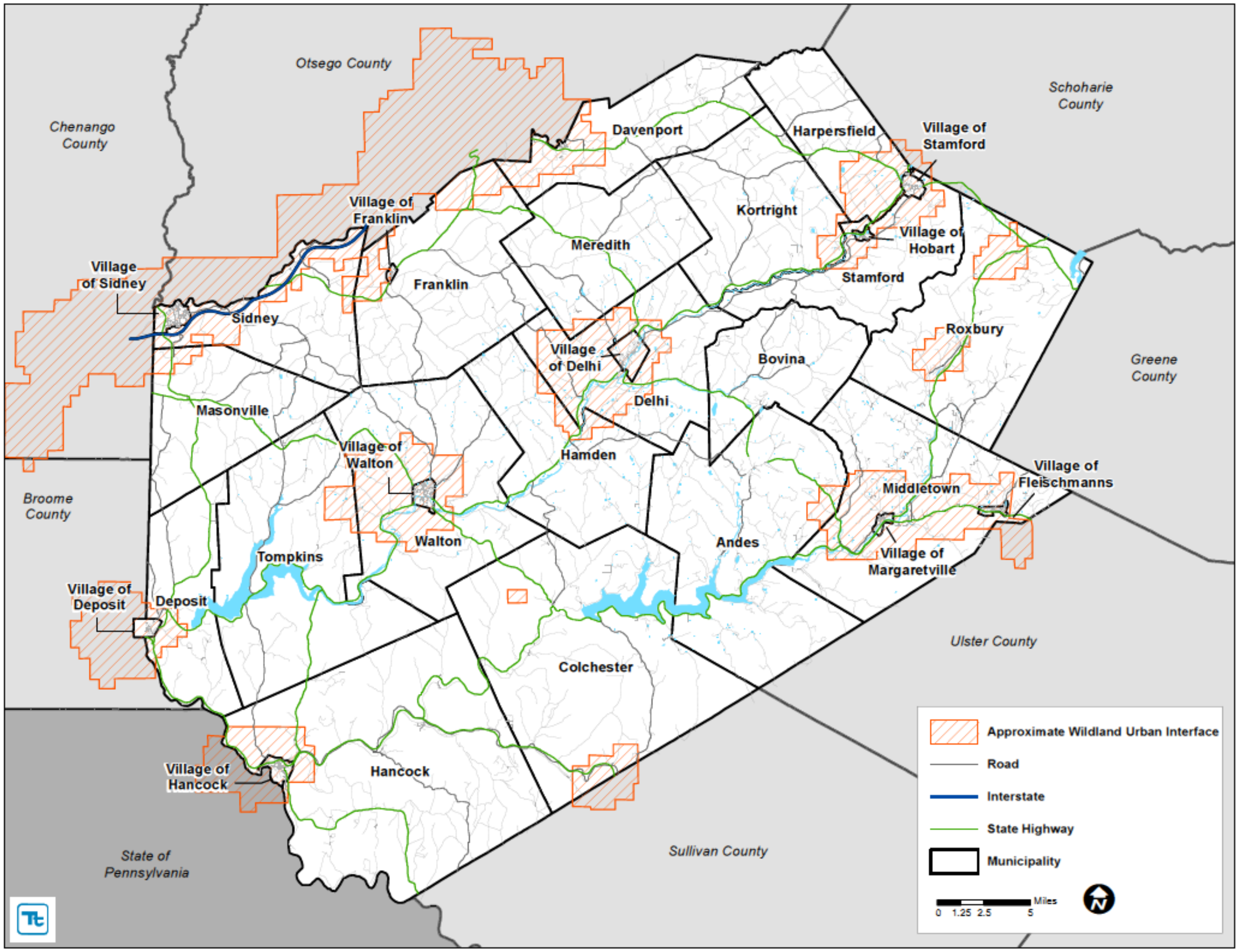
As previously defined, the NYS HMP indicates that New York State has all three types of WUI interfaces. The Adirondack and Catskill Mountains contain large tracts of forests with the mixed, and to a lesser extent, the classic interface occurring throughout. The remainder of the State contains classic and mixed interfaces with some major cities containing an occluded interface. The population migration from an urban to suburban and rural living will continue, increasing the possibility of loss and/or damage to structures in the WUI. Many property owners are unaware that a threat from a wildfire exists or that their homes are not defensible from it. Water supplies at the scene in the WUI are often inadequate. Access by firefighting equipment is often blocked or hindered by driveways that are either narrow, winding, dead-ended, have tight turning radii or have weight restrictions. Most wildland fire suppression personnel are inadequately prepared for fighting structural fires and local fire departments are not usually fully-trained or equipped for wildfire suppression. Further, the mix of structures, ornamental vegetation and wildland fuels may cause erratic fire behavior. These factors and others substantially increase the risk to life, property and economic welfare in the WUI. While there are many interface communities throughout New York and Delaware County, an official list that details the location, type of interface and surrounding fuel make-up does not exist (NYS HMP DRAFT, 2011).

The Geospatial Multi-Agency Coordination Group (GeoMAC) is an internet-based mapping application developed by various government agencies, designed for fire managers to access online maps of current or recent fire locations (ranging from 2002 to 2011) and perimeters in the conterminous 48 states and

Alaska (GeoMAC, 2011). This mapping application identifies not only where fires have occurred during that time period, but also identifies the WUI within the states and counties of the U.S. Figure 5.4.5-2 presents the WUI within Delaware County.

A more detailed WUI (interface and intermix) was obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison which also defines the wildfire hazard area. The California Fire Alliance determined that areas within 1.5 miles of wildland vegetation are the approximate distance that firebrands can be carried from a wildland fire to the roof of a house. Therefore, even structures not located within the forest are at risk to wildfire. This buffer distance, along with housing density and vegetation type were used to define the WUI illustrated in Figure 5.4.5-3 below (University of Wisconsin, date unknown). Using this WUI, approximately 383 square miles or approximately 26-percent of the County is located in the WUI (interface and intermix).

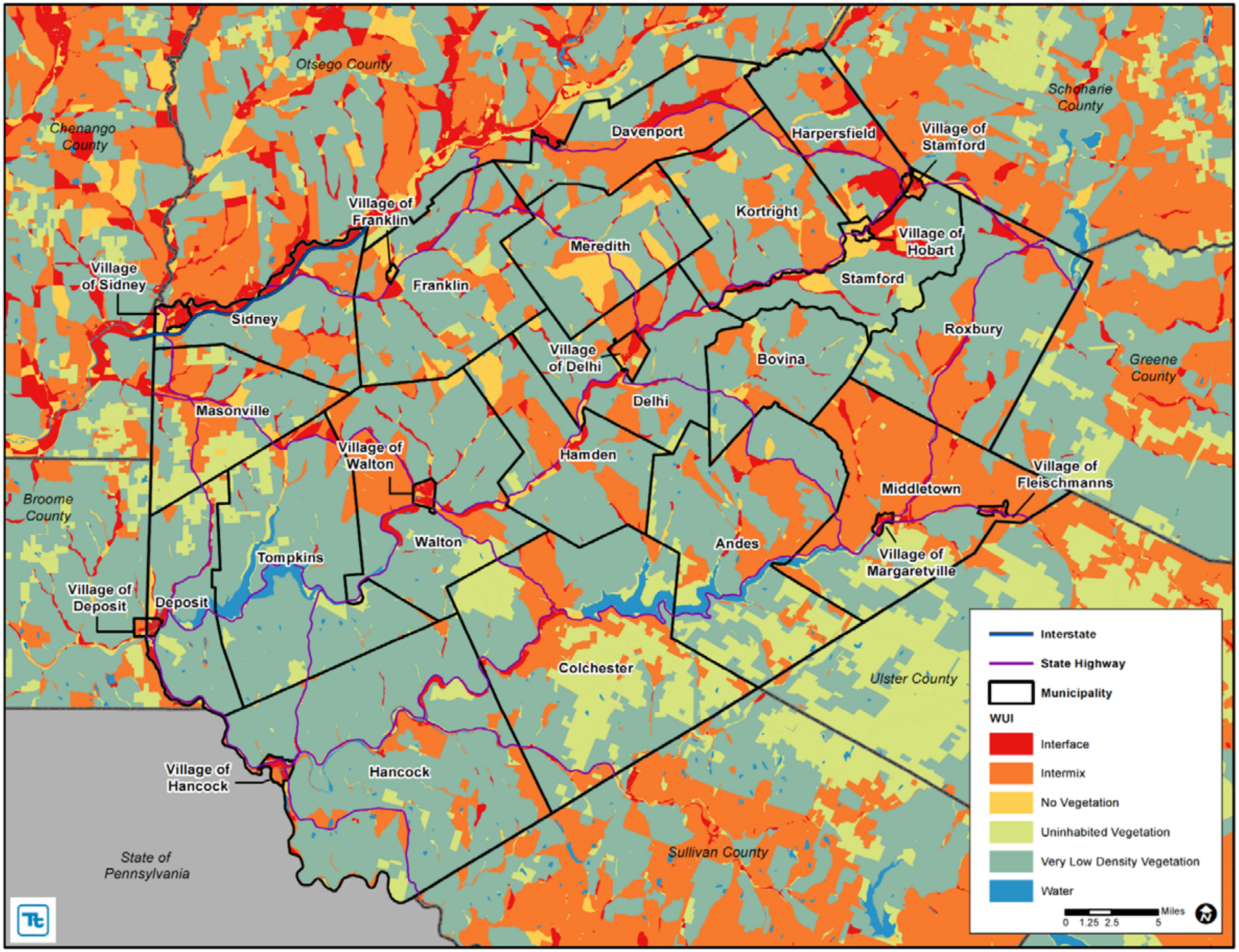
Figure 5.4.5-2. GeoMAC Wildland Urban Interface in Delaware County



Source: GeoMAC, 2012

Note: The WUI digitized boundary created for this plan should be considered approximate.

Figure 5.4.5-3. SILVIS Wildland Urban Interface in Delaware County



Source: Radeloff et al, 2005

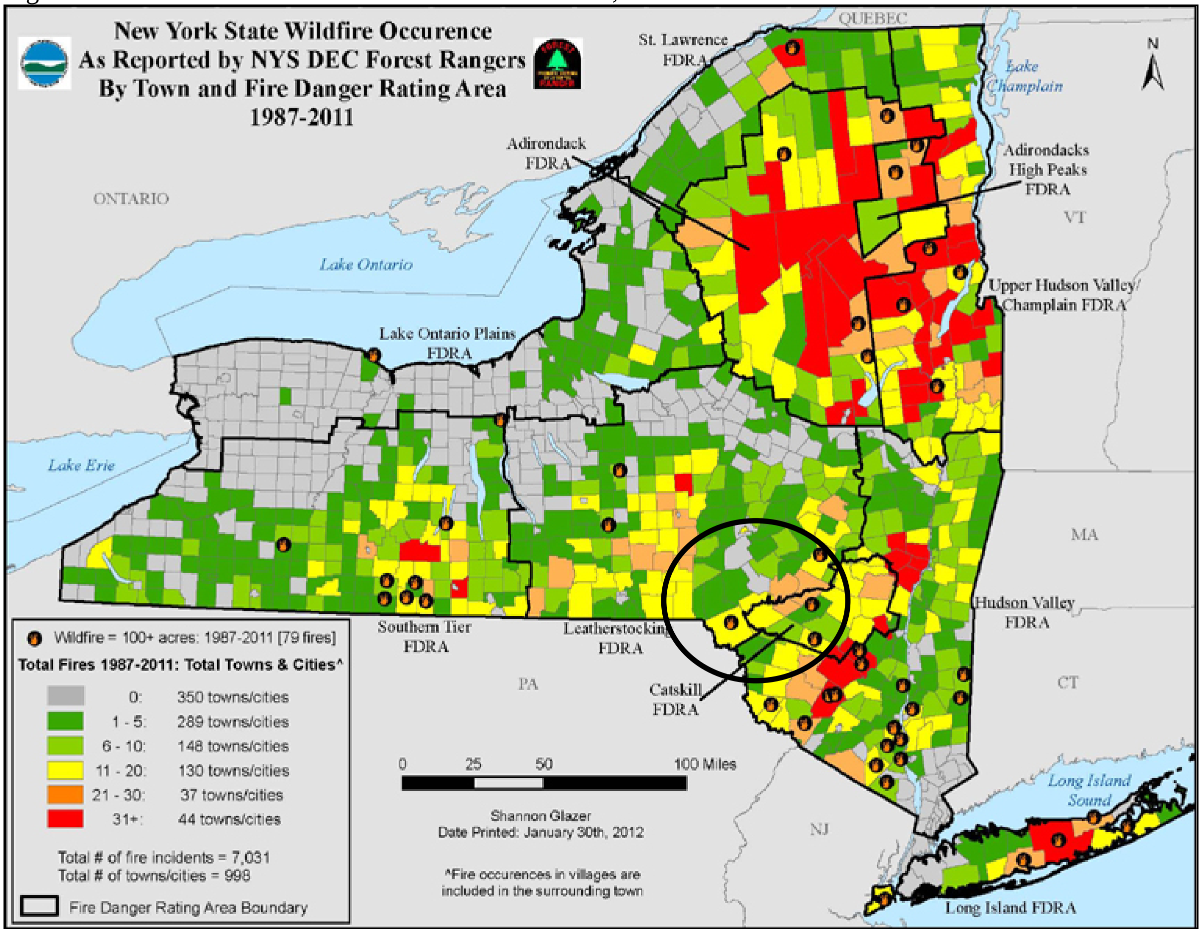
Previous Occurrences and Losses

The short-term effects of wildfires can include destruction of timber, forest, wildlife habitats, scenic vistas, and watersheds. Business and transportation disruption can also occur in the short-term. Long-term effects can include reduced access to recreational areas, destruction of community infrastructure and cultural and economic resources (USGS, 2006).

Wildfire occurrence in New York State is based on two data sources – the New York State Forest Ranger force and the New York State Office of Fire Prevention and Control. The New York State Forest Ranger is a division of the NYSDEC. It has fought fires and retained records for over 125 years. Between 1985 and 2009, the Division has suppressed over 7,600 wildfires that burned over 71,000 acres. The New York State Office of Fire Prevention and Control indicated that between 2000 and 2009, fire departments throughout the State responded to over 76,000 wildfires, brush fires, grass fires and other outdoor fires (NYSDEC, Date Unknown).

According to the Ranger Division wildfire occurrence data from 1985 through 2009, 96-percent of wildfires in the State were human-caused. Debris burning accounted for 32-percent; arson accounted for 16-percent; campfires accounted for 13-persent; children accounted for 13-percent; smoking, equipment, and railroads accounted for 26-percent; and lightning accounted for four-percent of all wildfires (NYSDEC, Date Unknown). Figure 5.4.5-4 illustrates the occurrences of wildfires in New York State, between 1987 and 2011. According to this figure, Delaware County had over 100 acres burned between 1987 and 2011. No additional information was found regarding these wildfire events in the County.

Figure 5.4.5-4. Wildfire Occurrences in New York State, 1987-2011



Source: NYSDEC, Date Unknown

Note: The black circle indicates the location of Delaware County.

Probability of Future Events

Wildfire experts say there are four reasons why wildfire risks are increasing:

- Fuel, in the form of fallen leaves, branches and plant growth, have accumulated over time on the forest floor. Now this fuel has the potential to "feed" a wildfire.
- Increasingly hot, dry weather in the U.S.
- Changing weather patterns across the country.
- More homes built in the areas called the Wildland/Urban Interface, meaning homes are built closer to wildland areas where wildfires can occur (NYS HMP, 2011 – need proper reference).

Modern scientific thought has led to the emergence of "controlled burns" in wildfire vulnerable areas (such as those found in the Adirondack Region and Central Pine Barrens of Long Island). These controlled burns have reduced the risk for extreme wildfires, but the risk still exists. It is likely that New York State will experience small wildfires throughout the state on a yearly basis (as the State has regularly experienced in the past). However, advanced methods of wildfire management and control and a better understanding of the fire ecosystems should reduce the number of devastating fires in the future (NYS HMP, 2011 – need proper reference).

In Section 5.3, the identified hazards of concern for Delaware County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for ranking hazards. Based on historical records and input from the Planning Committee, the probability of occurrence for wildfire in the County is considered 'Frequent' (likely to occur more than once every 25 years, as presented in Table 5.3-3).

Wildfires and Climate Change

According to the U.S. Fire Service (USFS), climate change will likely alter the atmospheric patterns that affect fire weather. Changes in fire patterns will, in turn, impact carbon cycling, forest structure, and species composition. Climate change associated with elevated greenhouse gas concentrations may create an atmospheric and fuel environment that is more conductive to large, severe fires (USFS, 2011).

Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the climate/fire/vegetation interactions is essential for addressing issues associated with climate change that include:

- Effects on regional circulation and other atmospheric patterns that affect fire weather
- Effects of changing fire regimes on the carbon cycle, forest structure, and species composition, and
- Complications from land use change, invasive species and an increasing wildland-urban interface (USFS, 2011).

It is projected that higher summer temperatures will likely increase the high fire risk by 10 to 30-percent. Fire occurrence and/or area burned could increase across the U.S. due to the increase of lightning activity, the frequency of surface pressure and associated circulation patterns conductive to surface drying, and fire-weather conditions, in general, which is conductive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels and extending fire seasons and areas burned (USFS, 2011).

Future changes in fire frequency and severity are difficult to predict. Global and regional climate changes associated with elevated greenhouse gas concentrations could alter large weather patterns; therefore, affecting fire-weather conducive to extreme fire behavior (USFS, 2011).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following text evaluates and estimates the potential impact of the wildfire hazard on Delaware County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, safety and health, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Wildfire hazards can impact significant areas of land, as evidenced by wildfires throughout the U.S. over the past several years. Fire in urban areas has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas. Wildfire, however can spread quickly, become a huge fire complex consisting of thousands of acres, and present greater challenges for allocating resources, defending isolated structures, and coordinating multi-jurisdictional response. If a wildfire occurs at a WUI, it can also cause an urban fire and in this case has the potential for great damage to infrastructure, loss of life, and strain on lifelines and emergency responders because of the high density of population and structures that can be impacted in these areas.

Data and Methodology

Information regarding the wildfire hazard included input and data from the Planning Committee, NYS HMP, GeoMAC, SILVIS and other local sources of documentation for this area. The asset data (population, building stock and critical facilities) presented in the County Profile section (Section 4) was used to support an evaluation of assets exposed and the potential impacts and losses associated with this hazard. To determine what assets are exposed to wildfire, available and appropriate GIS data was overlaid upon the hazard area. The limitations of this analysis are recognized and are only used to provide a general estimate. Over time additional data will be collected to allow better analysis for this hazard. Available information and a preliminary assessment are provided below.

Impact on Life, Health and Safety, General Building Stock, Critical Facilities and the Economy

As demonstrated by historic wildfire events in New York and other parts of the country, potential losses include human health and life of residents and responders, structures, infrastructure and natural resources. In addition, wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism.

Wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from work to fight these fires (Central Pine Barrens, 2007).

Delaware County is located in the 'very high' Leatherstocking and Catskill fire danger rating areas (NYS Draft HMP, 2011). According to GeoMAC, portions of Delaware County are considered to be in a WUI zone (refer to Figure 5.4.5-3). For the purpose of this Plan, all structures in the WUI zone are at some risk of being impacted by a wildfire. All assets in, and adjacent to the WUI zone around these hazard areas of concern, including population, structures, critical facilities, lifelines, and businesses, as described in the County profile section (Section 4), are considered vulnerable to wildfire.

According to 2006 land use/land cover data, approximately 78% of the land in Delaware County is forested land (Table 5.4.5-X) (USGS, 2011). As shown in Figure 5.4.5-2 below, urban areas are located adjacent to forested and farmlands. Both vegetation and structures serve as fuel for wildfire events.

Table 5.4.5-2. Land Use Summary for Delaware County

Land Use Category	Total Area (square miles)	Percent of Delaware County
Barren (Quarry)	5.7	0.4
Developed	50.1	3.4
Farmland	233.3	15.9
Forested	1,140.1	77.6
Water	17	1.2
Wetlands	22.4	1.5
TOTAL	**1,468.6**	**100**

Source: USGS, 2011

To estimate the population located within the WUI, the GeoMAC and SILVIS WUI boundaries (intermix and interface) were overlaid upon the 2000 Census population data (U.S. Census, 2000). The Census blocks with their center (centroid) within the boundary were used to calculate the estimated population exposed to this hazard. Table 5.4.5-3 summarizes the estimated population exposed (present in the approximate WUI boundary) by municipality.

Table 5.4.5-3. Estimated Population Located within the WUI in Delaware County

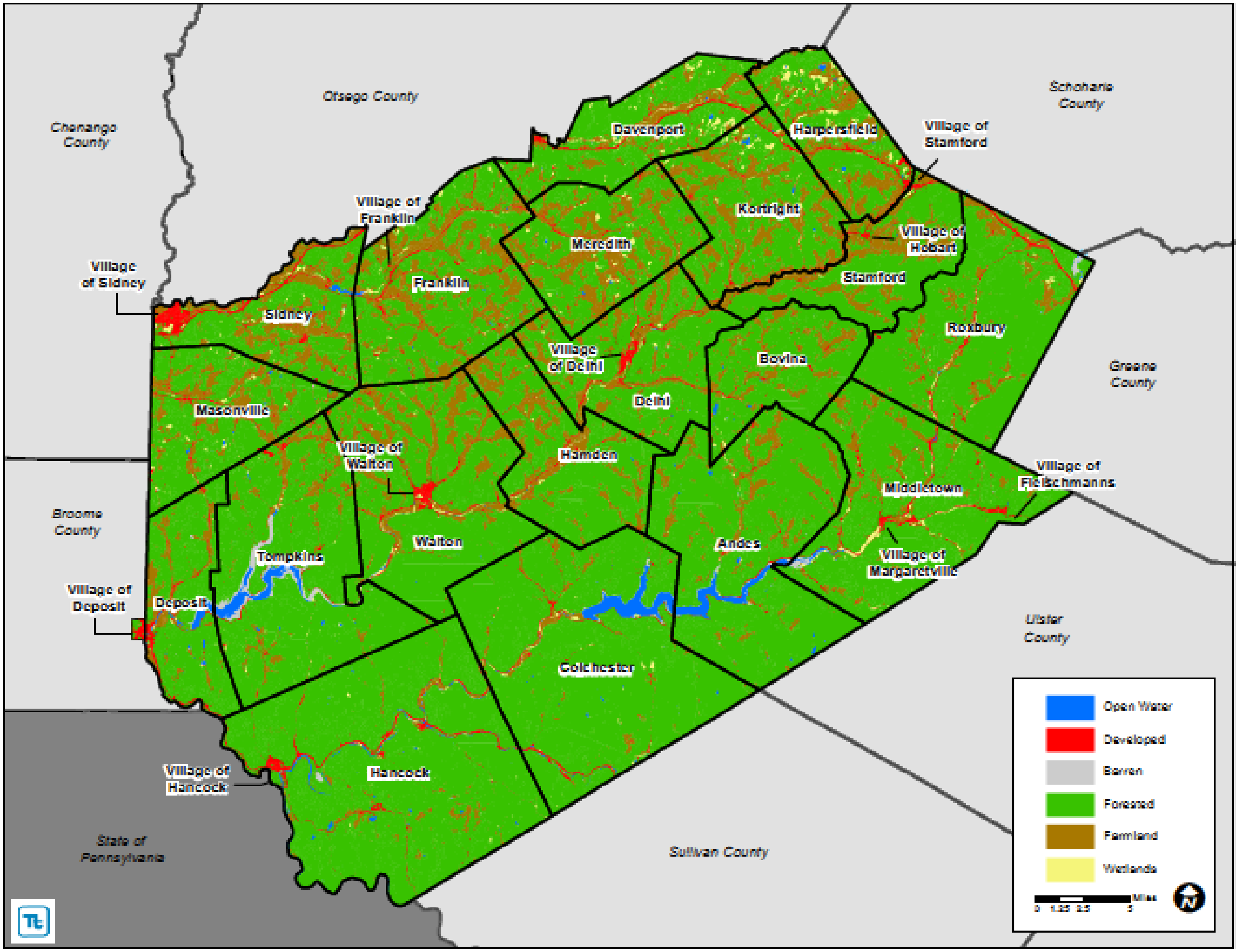
Municipality	Total Population (U.S. Census 2000)	GeoMAC Estimated Population Exposed	% of Total	SILVIS Estimated Population Exposed	% Total
Andes (T)	1,356	54	4	692	51.0
Bovina (T)	664	0	0	301	45.3
Colchester (T)	2,046	194	9	1,030	50.3
Davenport (T)	2,774	957	34	2,290	82.6
Delhi (T)	2,046	1,119	55	899	43.9
Delhi (V)	2,583	2,583	100	1,416	54.8
Deposit (T)	803	74	9	243	30.3
Deposit (V)	1,939	1,900	98	1,813	93.5
Fleischmanns (V)	308	308	100	308	100
Franklin (T)	2,219	308	14	1,074	48.4
Franklin (V)	402	91	23	223	55.5
Hamden (T)	1,280	123	10	734	57.3
Hancock (T)	2,216	233	11	1,067	48.1
Hancock (V)	1,217	1,217	100	1,217	100
Harpersfield (T)	1,045	292	28	752	72.0
Hobart (V)	291	291	100	0	0.0

Municipality	Total Population (U.S. Census 2000)	GeoMAC Estimated Population Exposed	% of Total	SILVIS Estimated Population Exposed	% Total
Kortright (T)	1,633	230	14	972	59.5
Margaretville (V)	536	536	100	536	100
Masonville (T)	1,405	147	10	1,012	72.0
Meredith (T)	1,588	7	0	536	33.8
Middletown (T)	3,207	1,257	39	2,893	90.2
Roxbury (T)	2,509	647	26	1,708	68.1
Sidney (T)	2,073	802	39	1,368	66.0
Sidney (V)	4,068	4,068	100	4,003	98.4
Stamford (T)	1,652	1,098	66	1,207	73.1
Stamford (V)	558	558	100	438	78.5
Tompkins (T)	1,109	91	8	543	49.0
Walton (T)	2,533	934	37	1,621	64.0
Walton (V)	3,070	3,070	100	3,070	100
Delaware County	**49,130**	**23,189**	**47**	**33,966**	**69.1**

Source: HAZUS-MH 2.0; GeoMAC, 2012; Radeloff et al, 2005

Buildings constructed of wood or vinyl siding are generally more likely to be impacted by the fire hazard than buildings constructed of brick or concrete. According to HAZUS-MH's default general building stock database, compiled from Census 2000 data, approximately 67% of the buildings in the County are constructed of wood.

Figure 5.4.5-5. Land Cover in Delaware County



Source: USGS, 2011

Table 5.4.5-4. Building Stock Replacement Value Located within the GeoMAC WUI in Delaware County

		GeoMAC				SILVIS			
Municipality	Total GBS RV in Municipality	Total GBS RV Exposed	% of Total	Residential GBS RV Exposed	Commercial GBS RV Exposed	Total GBS RV Exposed	% of Total	Residential GBS RV Exposed	Commercial GBS RV Exposed
Andes (T)	$252,234,000	$6,138,000	2.4	$5,750,000	$0	$131,062,000	52.0	$106,159,000	$15,616,000
Bovina (T)	$123,665,000	$0	0.0	$0	$0	$49,942,000	40.4	$46,938,000	$380,000
Colchester (T)	$311,970,000	$25,129,000	8.1	$24,359,000	$770,000	$129,076,000	41.4	$104,875,000	$13,808,000
Davenport (T)	$258,713,000	$99,140,000	38.3	$53,046,000	$32,926,000	$208,774,000	80.7	$133,754,000	$47,531,000
Delhi (T)	$255,930,000	$153,257,000	59.9	$122,618,000	$11,416,000	$101,296,000	39.6	$83,100,000	$9,854,000
Delhi (V)	$421,060,000	$421,060,000	100	$229,366,000	$102,358,000	$303,308,000	72.0	$130,931,000	$92,149,000
Deposit (T)	$87,244,000	$5,015,000	5.7	$4,739,000	$148,000	$20,867,000	23.9	$20,867,000	$0
Deposit (V)	$282,948,000	$278,171,000	98.3	$125,561,000	$105,798,000	$266,162,000	94.1	$120,632,000	$99,564,000
Fleischmanns (V)	$67,135,000	$67,135,000	100	$43,008,000	$19,662,000	$65,551,000	97.6	$42,028,000	$19,058,000
Franklin (T)	$228,869,000	$31,480,000	13.8	$26,413,000	$500,000	$94,713,000	41.4	$89,795,000	$2,199,000
Franklin (V)	$44,114,000	$8,743,000	19.8	$4,924,000	$1,331,000	$20,549,000	46.6	$13,022,000	$3,545,000
Hamden (T)	$169,106,000	$12,225,000	7.2	$9,634,000	$2,156,000	$88,394,000	52.3	$71,598,000	$7,111,000
Hancock (T)	$287,811,000	$29,110,000	10.1	$16,864,000	$11,992,000	$111,349,000	38.7	$96,498,000	$8,921,000
Hancock (V)	$175,325,000	$175,325,000	100	$84,524,000	$59,197,000	$173,863,000	99.2	$84,524,000	$57,735,000
Harpersfield (T)	$100,244,000	$23,433,000	23.4	$23,343,000	$0	$72,240,000	72.1	$63,524,000	$4,538,000
Hobart (V)	$34,768,000	$34,768,000	100	$26,966,000	$4,124,000	$0	0.0	$0	$0
Kortright (T)	$191,923,000	$32,990,000	17.2	$30,114,000	$2,876,000	$95,719,000	49.9	$84,303,000	$9,302,000
Margaretville (V)	$92,097,000	$92,097,000	100	$47,318,000	$27,223,000	$91,567,000	99.4	$47,318,000	$27,223,000
Masonville (T)	$139,908,000	$12,341,000	8.8	$10,863,000	$1,478,000	$89,094,000	63.7	$75,766,000	$4,460,000
Meredith (T)	$178,080,000	$946,000	0.5	$526,000	$420,000	$59,895,000	33.6	$50,260,000	$7,768,000
Middletown (T)	$476,361,000	$147,503,000	31.0	$133,611,000	$10,308,000	$432,085,000	90.7	$357,406,000	$45,583,000
Roxbury (T)	$424,341,000	$81,822,000	19.3	$60,378,000	$12,284,000	$289,022,000	68.1	$211,606,000	$57,801,000
Sidney (T)	$204,357,000	$81,583,000	39.9	$70,305,000	$3,263,000	$129,318,000	63.3	$113,615,000	$8,923,000
Sidney (V)	$577,306,000	$577,306,000	100	$324,161,000	$162,419,000	$487,029,000	84.4	$316,089,000	$122,214,000
Stamford (T)	$299,277,000	$177,862,000	59.4	$113,212,000	$39,700,000	$187,860,000	62.8	$129,510,000	$35,364,000
Stamford (V)	$91,808,000	$91,808,000	100	$51,187,000	$8,194,000	$73,190,000	79.7	$32,569,000	$8,194,000
Tompkins (T)	$126,345,000	$7,170,000	5.7	$7,170,000	$0	$56,226,000	44.5	$43,077,000	$9,152,000
Walton (T)	$230,761,000	$70,273,000	30.5	$61,263,000	$6,878,000	$134,875,000	58.4	$123,189,000	$9,274,000
Walton (V)	$416,797,000	$416,797,000	100	$219,097,000	$105,117,000	$408,581,000	98.0	$219,097,000	$97,347,000
Delaware County	**$6,550,497,000**	**$3,160,627,000**	**48.3**	**$1,930,320,000**	**$732,538,000**	**$4,371,607,000**	**66.7**	**$3,012,050,000**	**$824,614,000**

Source: HAZUS-MH 2.0; GeoMAC, 2012; Radeloff et al, 2005
Notes: GBS = General Building Stock; RV = Replacement Value; WUI = Wildland Urban Interface

It is recognized that a number of critical facilities, transportation and utility assets are located in the wildfire hazard area, and are also vulnerable to the threat of wildfire. Many of these facilities are the locations for vulnerable populations (i.e., schools, senior facilities) and responding agencies to wildfire events (i.e., fire, police). Table 5.4.5-5 summarizes critical facilities identified by Delaware County that are located within the wildfire hazard area.

Table 5.4.5-5. Facilities in SILVIS WUI in Delaware County

Type	Name	Municipality
School	ANDES CENTRAL SCHOOL	Andes (T)
Shelter	Methodist Church	Andes (T)
Fire	Andes VFD	Andes (T)
Fire	Bovina VFD	Bovina (T)
Shelter	Downsville Fire Hall	Colcehster (T)
User Defined	Amato Mobile Home Park	Colcehster (T)
Shelter	Cooks Falls Fire Hall	Colchester (T)
Shelter	Downsville Highway Garage	Colchester (T)
User Defined	Downsville Highway Garage	Colchester (T)
User Defined	DPW	Colchester (T)
Police	Town of Colchester PD	Colchester (T)
Fire/EMS	Downsville VFD and EMS	Colchester (T)
Fire	Cooks Falls VFD	Colchester (T)
School	CHARLOTTE VALLEY CENTRAL SCHOOL	Davenport (T)
Shelter	Methodist Church	Davenport (T)
Shelter	Charlotte Valley School	Davenport (T)
User Defined	Alcott Chase Mobile Home Park	Davenport (T)
User Defined	Rons Lane MHP	Davenport (T)
User Defined	Patrol Garage	Davenport (T)
User Defined	Pine Ridge Mobile Home Park	Davenport (T)
User Defined	Town Highway Garage	Davenport (T)
Fire	Davenport VFD	Davenport (T)
Fire	Pindars Corners VFD	Davenport (T)
Fire	East Meredith VFD	Davenport (T)
User Defined	County Garage & Office	Davenport (V)
User Defined	Camp Shankitunk 4H	Delhi (T)
User Defined	Delaware County Court House	Delhi (T)
User Defined	Town Hall	Delhi (T)
User Defined	Leisure Village Mobile Home Park	Delhi (T)
EMS	Cooperstown Medical Transport	Delhi (T)
Senior	Delhi Senior Community	Delhi (V)
School	DELAWARE ACADEMY	Delhi (V)
User Defined	Town DPW	Delhi (V)
User Defined	NYS DPW	Delhi (V)
User Defined	Hamiltons MHP	Delhi (V)
User Defined	Delhi-Tel	Delhi (V)
User Defined	Village Hall	Delhi (V)
User Defined	Board of Elections - 1 page Ave	Delhi (V)

Type	Name	Municipality
User Defined	Cabinet Shop - 1 Page ave	Delhi (V)
User Defined	99 Main Street - County Bldg	Delhi (V)
User Defined	111 Main Street - County Bldg	Delhi (V)
User Defined	Salt Shed - 1 Page Ave	Delhi (V)
User Defined	Pole Barn - 1 Page Ave	Delhi (V)
User Defined	Cty Garage Wickham Office - 1 Page ave	Delhi (V)
User Defined	DPW Garages/DPW/DCPD	Delhi (V)
Police	Delaware County Sherrif's Dep't.	Delhi (V)
Police	Delhi Village PD	Delhi (V)
Fire	Delhi VFD	Delhi (V)
EOC	EOC - Public Safety Building	Delhi (V)
Senior	Meadow Park Apartments	Deposit (V)
School	DEPOSIT CENTRAL SCHOOL	Deposit (V)
Shelter	DEPOSIT CENTRAL SCHOOL	Deposit (V)
Shelter	Maple Lane Assembly of God Church	Deposit (V)
Shelter	Evaculation Shelter	Deposit (V)
User Defined	Town of Deposit Town Hall	Deposit (V)
User Defined	Bryces Trailer Park	Deposit (V)
User Defined	Bryces Trailer Park	Deposit (V)
User Defined	Evacuation Shelter - Maple Lane Assembly of God	Deposit (V)
User Defined	Village Hall	Deposit (V)
User Defined	Town of Sanford Offices	Deposit (V)
User Defined	DPW Garage	Deposit (V)
User Defined	Town of Sanford Highway	Deposit (V)
User Defined	Meadow Park Apartment Complex	Deposit (V)
User Defined	Millenium/Columbia Gas Line Control Station	Deposit (V)
User Defined	UHS Family Care Center	Deposit (V)
Police	Deposit Village PD	Deposit (V)
Fire/EMS	Village of Deposit Fire/EMS	Deposit (V)
User Defined	Village Hall and Library	Fleischmanns (V)
User Defined	DPW Garage	Fleischmanns (V)
Fire	Fleischmanns VFD	Fleischmanns (V)
User Defined	Highway Garage and Comm Tower	Franklin (T)
School	FRANKLIN CENTRAL SCHOOL	Franklin (V)
Shelter	Franklin Central School	Franklin (V)
Shelter	FRANKLIN CENTRAL SCHOOL	Franklin (V)
Medical	DC Chapter - NYS ARC Bldg.	Hamden (T)
Shelter	Church	Hamden (T)
Shelter	Church	Hamden (T)
User Defined	DPW Garage	Hamden (T)
School	THE FAMILY SCHOOL	Hancock (T)
Fire	East Branch VFD	Hancock (T)
Medical	Lourdes Health Clinic	Hancock (V)
School	HANCOCK CENTRAL SCHOOL	Hancock (V)
User Defined	Read Senior Housing	Hancock (V)

Type	Name	Municipality
User Defined	New Highway Garage	Hancock (V)
User Defined	Shelter - Hancock Central School Messenger Hall	Hancock (V)
User Defined	Town of Hancock Muni Hall	Hancock (V)
User Defined	Torche's Trailer Park	Hancock (V)
User Defined	Village Municipal Hall	Hancock (V)
Police	Hancock Village PD	Hancock (V)
Fire	Hancock VFD	Hancock (V)
Shelter	Shelter	Hanock (V)
User Defined	Highway Garage	Harpersfield (T)
User Defined	Utsayantha Boulders	Harpersfield (T)
User Defined	Boyle Small Wind Tower	Harpersfield (T)
User Defined	Town Hall	Harpersfield (T)
Fire	Bloomville VFD	KORTRIGHT (T)
Medical	Margaretville Memorial Hospital	Margaretville (V)
Medical	Office of Mental Ret. & Dev. Dis.	Margaretville (V)
School	MARGARETVILLE CENTRAL SCHOOL	Margaretville (V)
Shelter	United Methodist Church	Margaretville (V)
User Defined	Post 216 Legion Hall	Margaretville (V)
User Defined	Dollar General	Margaretville (V)
User Defined	Fairview Library	Margaretville (V)
User Defined	DPW Garage	Margaretville (V)
User Defined	Municipal Hall	Margaretville (V)
Police	NYS Trooper (Margaretville)	Margaretville (V)
EMS	Margaretville Memorial Hospital (Ambu)	Margaretville (V)
Fire/EMS	Arkville VFD	Margaretville (V)
Fire	Margaretville VFD	Margaretville (V)
Fire	Masonville VFD	Masonville (T)
Senior	Arkville Senior Apartments	Middletown (T)
Shelter	Delaware Cty American Red Cross	Middletown (T)
Shelter	Head Start	Middletown (T)
User Defined	Patrol Garage	Middletown (T)
Fire	Halcottsville VFD	Middletown (T)
Senior	Grand Gorge Apartments	Roxbury (T)
Senior	Kirkside Adult Home	Roxbury (T)
School	ROXBURY CENTRAL SCHOOL	Roxbury (T)
School	NORTHERN CATSKILLS ALTERNATIVE SCHO	Roxbury (T)
User Defined	Suburban Propane Bulk Storage	Roxbury (T)
User Defined	Old Highway Garage	Roxbury (T)
User Defined	Grand Gorge PRV Building	Roxbury (T)
User Defined	New Highway Garage	Roxbury (T)
Fire	Roxbury VFD	Roxbury (T)
User Defined	Patrol Garage	Sidney (T)
User Defined	DPW	Sidney (T)
Fire	Sidney Center VFD	Sidney (T)
Medical	Tri-Town Regional Hospital	Sidney (V)

Type	Name	Municipality
Senior	Sidney Senior Village	Sidney (V)
School	Sidney Central Grade School Building #2	Sidney (V)
School	Head Start School	Sidney (V)
Shelter	Sidney Central Grade School Building #2	Sidney (V)
User Defined	Sidney Civic Center	Sidney (V)
User Defined	Dorm Authority NYS Senior	Sidney (V)
User Defined	E Main Street MHP	Sidney (V)
Police	Sidney PD	Sidney (V)
Fire/EMS	Sidney VFD and EMS	Sidney (V)
Fire	Sidney VFD	Sidney (V)
Fire	Sidney Training Center	Sidney (V)
Police	DEC Region 4	Stamford (T)
Fire	South Kortright VFD	Stamford (T)
Medical	Stamford Health Care Society, Inc.	Stamford (V)
Senior	Stamford Village Apartments	Stamford (V)
Senior	Seventh Heaven	Stamford (V)
Senior	Robinson Terrace	Stamford (V)
School	BOCES	Stamford (V)
School	STAMFORD CENTRAL SCHOOL	Stamford (V)
Fire	Trout Creek VFD	Tompkins (T)
User Defined	Pine Brook Park	Walton (T)
User Defined	Country Meadow Park	Walton (T)
User Defined	Town Highway	Walton (T)
Medical	Delaware Valley Hospital	Walton (V)
Medical	Delaware County Health Clinic	Walton (V)
Senior	Mountainview Estates	Walton (V)
Senior	Westbook Apartments	Walton (V)
School	WALTON (TOWNSEND) CENTRAL SCHOOL	Walton (V)
School	WALTON CENTRAL SCHOOL	Walton (V)
User Defined	Town Clerks Office	Walton (V)
User Defined	Village Clerks Office	Walton (V)
User Defined	Village DPW	Walton (V)
User Defined	Walton Shop	Walton (V)
Police	Walton Village PD	Walton (V)
Police	NYS Armory	Walton (V)
Fire	Walton VFD	Walton (V)

Source: Radeloff et al, 2005

Wildfire can also severely impact roads and infrastructure. Of particular note, Interstate 88 and the following State Highways are located in the wildfire hazard area: State Highways 10, 17, 206, 23, 268, 28, 30, 357, 8 and 97. Major north-south and east-west corridors through Towns and Villages in the County are vulnerable to this hazard which should be considered for evacuation route purposes.

The Department of Environmental Conservation's (DEC) Division of Forest Protection is New York's lead agency for wildfire mitigation. As a "Home Rule" State, the local fire departments have the primary responsibility (incident command) for the control and containment of wildfires in their jurisdiction (2011 NYS HMP).

Due to a lack of data regarding past structural and economic losses specific to Delaware County or its municipalities, it is not possible to estimate losses due to wildfire events at this time.

Future Growth and Development

As discussed in Section 4, areas targeted for future growth and development have been identified across the County. Specific areas of development within the WUI hazard area are indicated on hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Additional Data and Next Steps

Data regarding the construction of structures in the study area, such as roofing material, fire detection equipment, structure age, etc., and proximity to fast burning/high intensity vegetative communities should be identified for further evaluation. Development and availability of such data would permit a more detailed estimate of potential vulnerabilities, including loss of life and economic damages, based on the population and resources exposed to the hazard.

GeoMAC does not illustrate any historic wildfire extents in Delaware County from 2002 to 2011 (GeoMAC, 2012). Other historic wildfire extent maps were not readily available and will be required to identify the geographic locations where wildfires have taken place in the past and areas prone to wildfires. Such data can be developed over time; however, based on the frequency of past wildfire events in the County, collection of this data is a lower priority than data collection for more prevalent hazard categories.

Overall Vulnerability Assessment

While it is not possible to predict when and where a fire will start, the Delaware County and its local fire departments are well-equipped and prepared to respond to fires as they arise.

The overall hazard ranking determined for this HMP for the wildfire hazard is ‘Medium’, with a ‘Frequent’ probability of occurrence (hazard event is likely to occur within 25 years) (refer to Section 5.3, Tables 5.3-3 and 5.3-6).

The status of fire risk in the County will continue to be monitored and ongoing and new mitigation efforts to prevent fires and control them when they arise will continue to be developed.