5.4.5 LANDSLIDE

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

HAZARD PROFILE

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

Description

Landslides are a major geologic hazard that occurs in all 50 states. Nationwide, landslides cause over $3 billion in damages and account for over 25 deaths each year. In New Jersey, landslides are a hazard in areas with steep to moderate slopes and where geologic formations are prone to failure. Landslides can damage utilities, property, and transportation routes. Over time, 19 fatalities have been attributed to landslides in the State of New Jersey (Pallis, 2009).

Landslides are caused by one or a combination of the following factors: change in slope of the terrain, increased load on the land, shocks and vibrations, change in water content, groundwater movement, frost action, weathering of rocks, and removing or changing the type of vegetation covering slopes. Landslide hazard areas are where the land has characteristics that contribute to the risk of the downhill movement of material, such as the following:

- A slope greater than 33-percent
- A history of landslide activity or movement during the last 10,000 years
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable
- The presence or potential for snow avalanches
- The presence of an alluvial fan, indicating vulnerability to the flow of debris or sediments
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel.

Landslides are typically triggered by other natural hazards, such as earthquakes, heavy rain, floods or wildfires. Frequency of landslides is often related to the frequency of these other hazards. They can occur suddenly or slowly. Assessing the geology, vegetation, and amount of predicted precipitation for an area can assist in predicting landslides. Warning signs for landslide activity include:

- Springs, seeps or saturated ground in areas that have not typically been wet before
- New cracks or unusual bulges in the ground, street pavement or sidewalk
- Soil moving away from foundations
- Ancillary structures, such as decks and patios, tilting and/or moving relative to the main house
- Tilting or cracking of concrete floors and foundations
- Broken water lines and other underground utilities
- Leaning telephone poles, trees, retaining walls or fences
- Offset fence lines
- Sunken or down-dropped road beds
- Rapid increase in creek water levels, possibly accompanied by increased turbidity
- Sudden increase in creek water levels though rain is still failing or just recently ended
- Sticking doors and windows, and visible open spaces indicating jambs and frames out of plumb

- A faint rumbling sound that increases in volume as the landslide nears
- Unusual sounds, such as trees cracking or boulders knocking together (USGS, 2009).

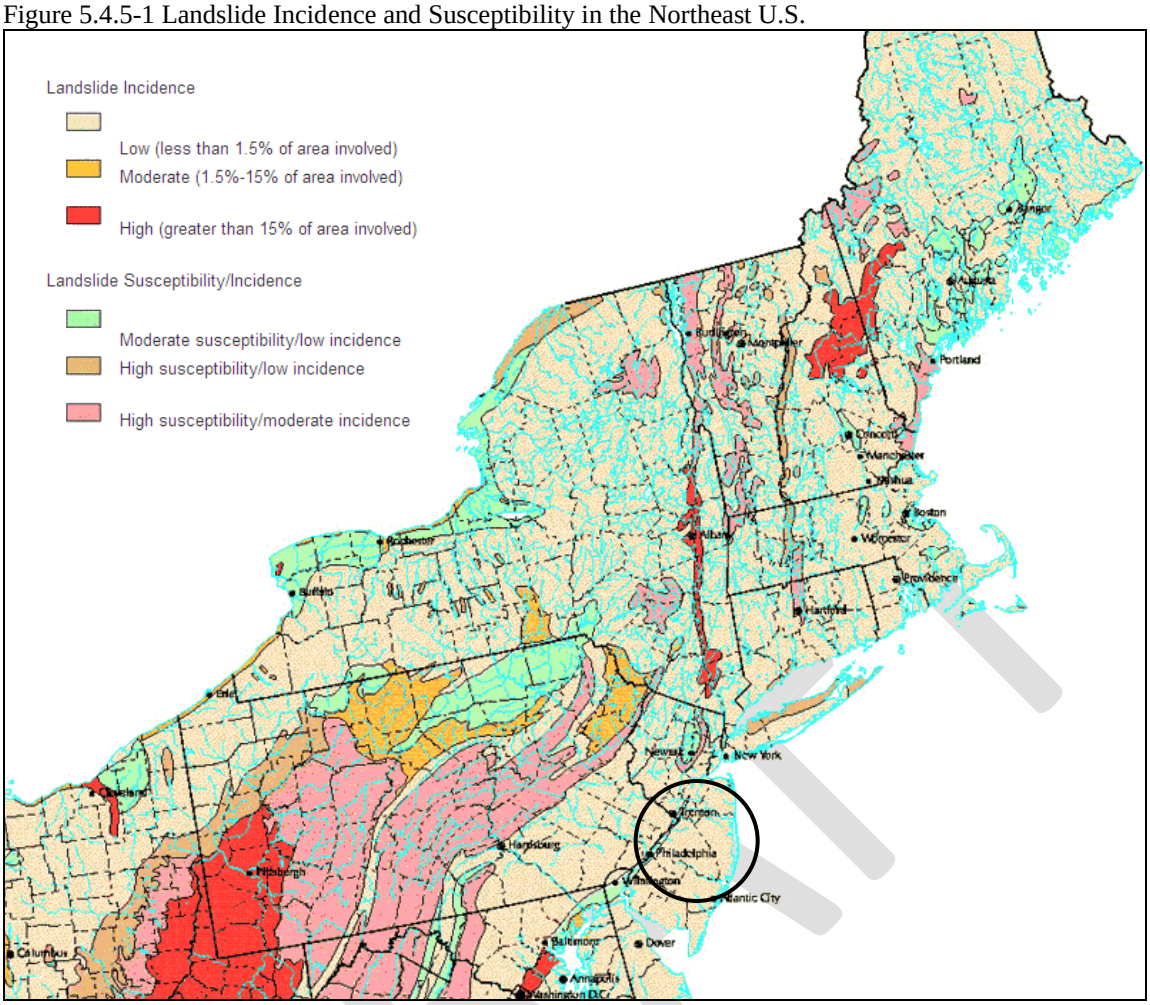
Extent

To determine the extent of a landslide hazard, the affected areas need to be identified and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, defined below:

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15-percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15-percent of an area has been involved; and low incidence means that less than 1.5-percent of an area has been involved. (Geological Hazards Program, Date Unknown).
- Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding (Geological Hazards Program, Date Unknown).

Figure 5.4.5-1 depicts the landslide incidence and susceptibility of the northeastern U.S., identifying areas that have the potential for landslides. These areas are determined by correlating some of the principal factors that contribute to landsliding, such as steep slopes, weak geologic units that lose strength when saturated, and poorly drained rock or soil, with the past distribution of landslides.

Figure 5.4.5-1 Landslide Incidence and Susceptibility in the Northeast U.S.



Source: USGS, 1982

Note: The circle indicates the approximate location of Burlington County. A majority of the County has a low landslide incidence (less than 1.5% of area involved); however, the northwestern/southwestern border of the County has a moderate susceptibility/low incidence.

Landslide incidence is defined as the number of landslides that have occurred in a given geographic area. Susceptibility to landsliding is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past (Geological Hazards Program, Date Unknown). Figure 5.4.5-6 depicts the landslide susceptibility in New Jersey. Figure 5.4.5-7 depicts the landslide susceptibility in Burlington County.

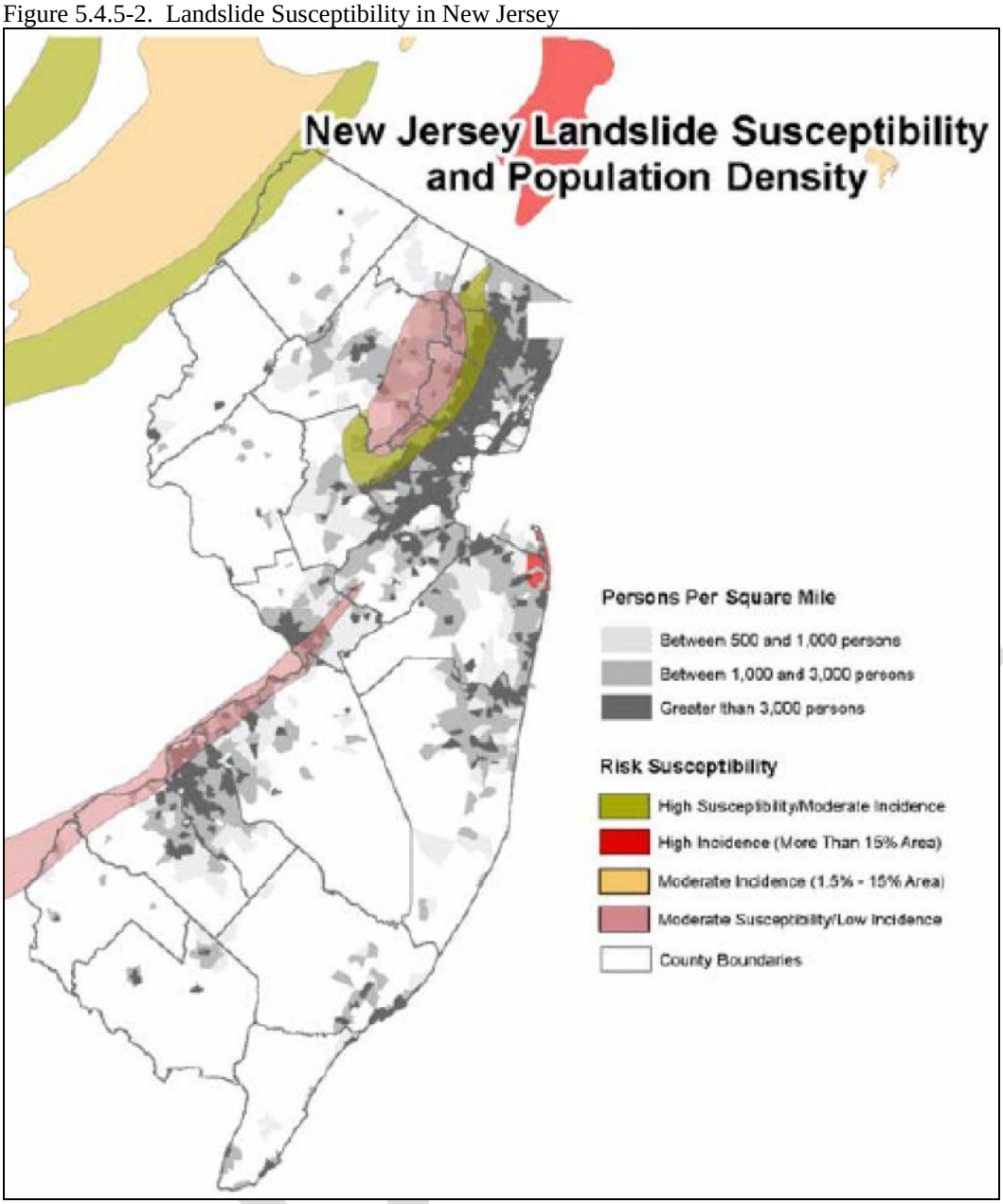
The map units are split into three incidence categories according to the percentage of the area affected by landslides. High incidence means greater than 15 percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15 percent of an area has been involved; and low incidence means that less than 1.5 percent of an area has been involved. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding (Geological Hazards Program, Date Unknown).

Location

The entire U.S. experiences landslides and other ground failure hazards, with 36 states having moderate to highly severe landslide hazards. Landslide losses are increasing in the U.S. and worldwide as development expands in areas previously left undeveloped because they were not as stable as other areas. The resulting encroachment of developments into hazardous areas, expansion of transportation infrastructure, deforestation of landslide-prone areas, and changing climate patterns may lead to increasing landslide losses in the future. However, the potential increase in the risk posed by the landslide hazard can be curbed through better understanding and mapping of the hazards and improved capabilities to mitigate and respond to the landslide hazard (Spiker and Gori, 2003).

Natural landslides occur throughout New Jersey where streams or wave action undermine banks, bluffs, and slopes. Rock falls occur wherever there are near-vertical cliffs. The largest geological erosional landsliding occurs in the Atlantic Highlands in portions of the Atlantic Highlands Borough, Highlands Borough, and Middletown Township (Figure 5.4.5-2). Slump blocks are present in the bluffs of the Atlantic Highlands area along the south side of Sandy Hood Bay and the north side of the Navesink River (NJ OEM, 2005).

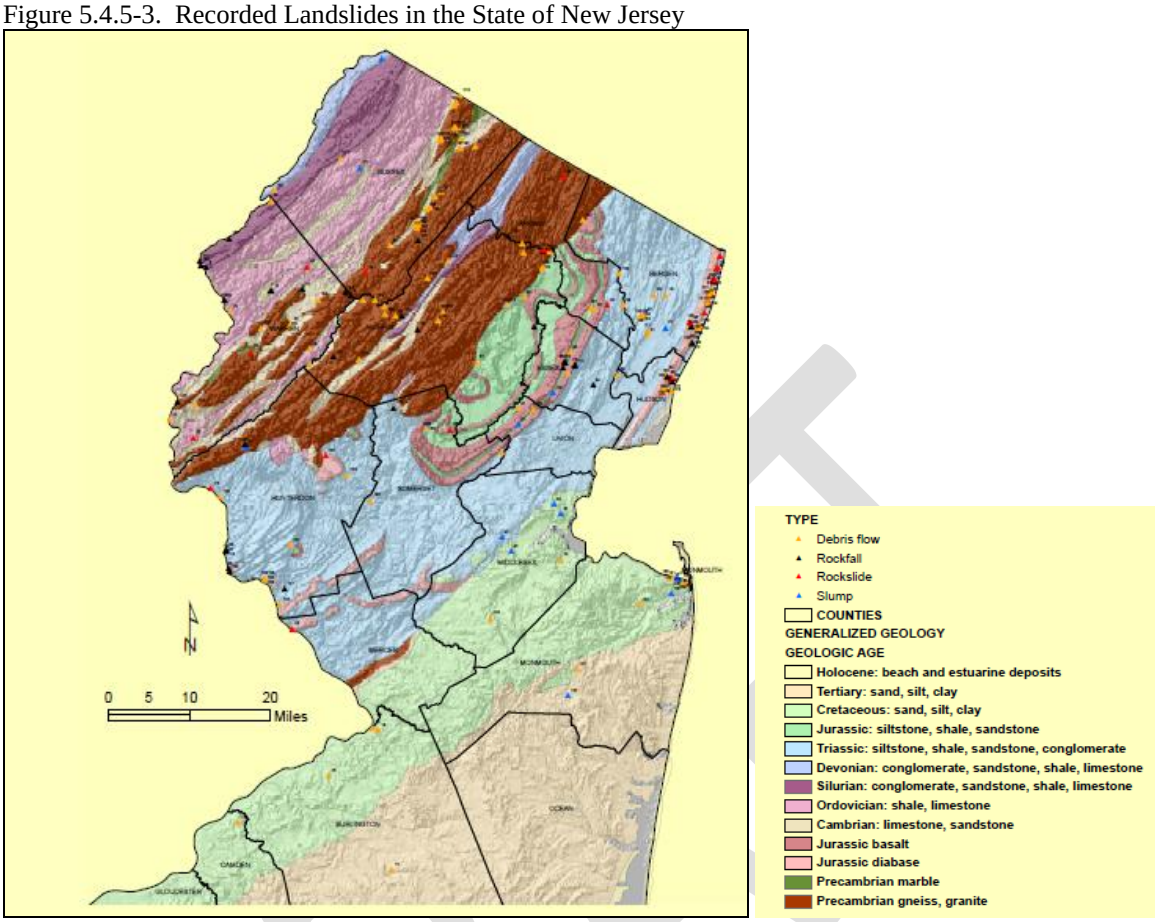
Figure 5.4.5-2. Landslide Susceptibility in New Jersey



Source: NJ HMP, 2012

The location of landslides is highly site-specific, although Figures 5.4.5-2 and Figure 5.4.5-3 show the general location of the hazard in Burlington County, based on historical events and technical analysis. Figure 5.4.5-2 shows a moderate susceptibility/low incidence to landslides along the northwestern most edge of the county, and low incidence (or less than 1.5% of the area is susceptible) throughout the remainder of the County. Figure 5.4.5-3 provides a graphic depiction of all NJDEP recorded landslides in the State of New Jersey through 2012, with a total of four landslides occurring in Burlington County. The image is clipped in the middle of Burlington County, due to a lack of recorded incidences in the southern part of the county.

Figure 5.4.5-3. Recorded Landslides in the State of New Jersey



Source: NJDEP, 2012

Previous Occurrences and Losses

As identified through the review of variety of sources, landslide events have been the most common ground failure throughout New Jersey. Information regarding land subsidence throughout the State was scarce, therefore indicating that this hazard may not be a common occurrence.

Historical records of ground failures (primarily landslide events) in New Jersey date back to the 1900s. Based on all sources researched, several notable ground failure events have directly or indirectly impacted Burlington County between the 1900s and 2013, and are identified in Table 5.4.5-1 below. Figure 5.4.5-9 displays the locations of some landslide incidences listed in Table 5.4.5-1.

As identified through the review of variety of sources, landslide events have been the most common ground failure throughout New Jersey. Information regarding land subsidence throughout the State was scarce, therefore indicating that this hazard may not be a common occurrence in the State and Burlington County.

NOAA's NCDC storm events data base did not list any landslide events for Burlington County between 1950 and April 30, 2013. The Hazard Research Lab at the University of South Carolina's Spatial Hazard Events and Losses Database for the U.S. (SHELDUS) did not list any landslide events for Burlington County between 1960 and 2012.

Between 1954 and 2013, FEMA declared that the State of New Jersey experienced one landslide-related disaster (DR) classified as one or a combination of the following disaster types: severe storms, flooding and mudslides. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Of those events, Burlington County has not been declared as a disaster area in any landslide event (FEMA, 2013).

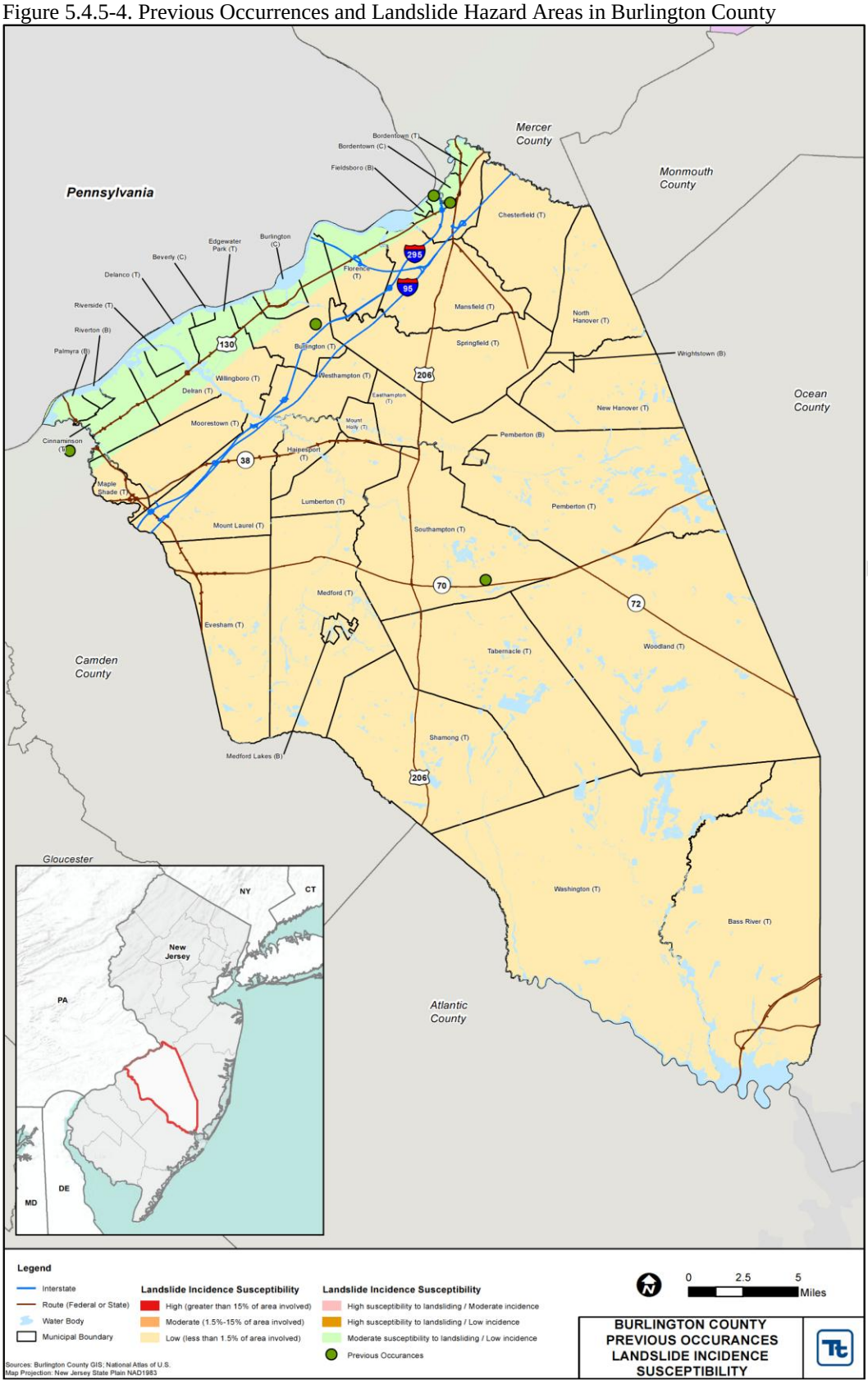
Based on all sources researched, known landslide events that have affected Burlington County and its municipalities are identified in Table 5.4.5-1. Table 5.4.5-1 may not include all events that have occurred throughout the County and region. Events previously reported in the 2008 County HMP are sourced as "Burlington County HMP".

Table 5.4.5-1. Landslide Events between 1893 and 2007

Date of Events	Event Type	FEMA Declaration Number	County Designated?	Location and Description	Source(s)
May 14, 1893	Debris Flow	N/A	N/A	Heavy rain caused a landslide of a 50-foot bank above a home in the Township of Bordentown to fall on the home and knock it off of its foundation. The two-story home was buried and destroyed.	NJGS
December 1902	Debris Flow	N/A	N/A	Heavy rain caused a landslide at the Irondale School (Township of Bordentown). Tons of earth gave way and a portion covered the last bound track of the Amboy Division Railroad.	NJGS
November 1908	Debris Flow	N/A	N/A	A quarry worker in the Township of Burlington was crushed to death under a landslide of hundreds of tons of earth in the Bowen gravel pit.	NJGS
1982	Debris Flow	N/A	N/A	Heavy rains caused a debris flow at the BEMS Big Hill Landfill in the Township of Southampton, causing damage to nearby homes.	NJGS
March 2007	N/A	N/A	N/A	A landslide occurred along the riverfront in the Township of Mansfield	NJDEP

Source: NJGS, 2013; FEMA, 2013; Burlington County HMP, 2008
FEMA Federal Emergency Management Agency
NJGS New Jersey Geological Society

Figure 5.4.5-4. Previous Occurrences and Landslide Hazard Areas in Burlington County



Source: Godt, 2011 (Geology WMS Layer from the National Atlas of the United States); NJGS, 2006

Probability of Future Events

Vulnerability to landslide hazards is a function of location, type of human activity, use, and frequency of landslide events. The effects of landslides on people and structures can be lessened by total avoidance of landslide hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Local governments can reduce landslide effects through land use policies and regulations. Individuals can reduce their exposure to hazards by educating themselves on past hazard history of the site and by making inquries to planning and engineering departments of local governments (National Atlas, 2007).

The NJ HMP indicates that natural landslides occur throughout New Jersey where streams or wave action undermine banks, bluffs, and slopes. Erosion can cause instability in these areas over time, eventually allowing gravity to break portions of the slope loose, moving material downslope. Today, in some areas, building and transportation development has now become an even greater force in altering the landscape than erosion. Both of these processes cause slope failure and result in a landslide (NJ OEM, 2005). Although a majority of Burlington County has a low susceptibility to landslides, they have occurred in various locations throughout the County.

While it is possible for landslides to occur within Burlington County, the probability of future occurrence is low. The vast majority of the County (96 percent) lies outside of mapped hazard areas. Therefore, the probability would be low; however, that probability would increase slightly within the narrow band of land roughly bounding the Delaware River in the northwestern portion of Burlington County in the municipalities of: Cities of Beverly and Burlington, Townships of Burlington, Cinnaminson, Delanco, Delran, Edgewater Park, Riverside and Florence, and the Boroughs of Palmyra and Riverton, and a small portion (approximately 2 percent) of the Township of Moorestown. Areas of past landslides are also more susceptible. NJGS' Scott Stanford indicated in March 2007 that the landslide hazard in Burlington County is basically restricted to small areas of steep banks along creeks and rivers, where slumping could be caused by undercutting or gullying by streams, such as along riverbanks and tributaries to the Delaware such as the Rancocas and Crosswicks Creeks (Burlington County HMP, 2008).

In Section 5.3, the identified hazards of concern for Burlington County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for landslides in the County is considered 'rare' (not likely to occur within 100 years, as presented in Table 5.3-3).

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. The following section discusses the potential impact of the ground failure hazard on Burlington County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact to: (1) life, safety and health of County residents, (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

Overview of Vulnerability

Vulnerability to ground failure hazards is a function of location, soil type, geology, type of human activity, use, and frequency of events. The effects of ground failure on people and structures can be lessened by total avoidance of hazard areas or by restricting, prohibiting, or imposing conditions on hazard-zone activity. Local governments can reduce ground failure effects by educating themselves on past hazard history of the site and by making inquiries to planning and engineering departments of local governments (National Atlas, 2007).

Data and Methodology

In an attempt to estimate Burlington County's vulnerability to ground failure due to landslides, the Geology - Landslide Incidence and Susceptibility GIS layer from National Atlas was used to coarsely define the general landslide susceptible area. The Geology - Landslide Incidence and Susceptibility GIS layer was overlaid upon the Burlington County municipalities, 2010 Census population data, custom building inventory and Burlington County's critical facility inventory to estimate exposure.

According to Radbruch-Hall et.al., the Landslide Incidence and Susceptibility GIS layer from National Atlas '….was prepared by evaluating formations or groups of formations shown on the geologic map of the United States (King and Beikman, 1974) and classifying them as having high, medium, or low landslide incidence (number of landslides) and being of high, medium, or low susceptibility to landsliding. Thus, those map units or parts of units with more than 15 percent of their area involved in landsliding were classified as having high incidence; those with 1.5 to 15 percent of their area involved in landsliding, as having medium incidence; and those with less than 1.5 percent of their area involved, as having low incidence. This classification scheme was modified where particular lithofacies are known to have variable landslide incidence or susceptibility. In continental glaciated areas, additional data were used to identify surficial deposits that are susceptible to slope movement. Susceptibility to landsliding was defined as the probable degree of response of the areal rocks and soils to natural or artificial cutting or loading of slopes or to anomalously high precipitation. High, medium, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. For example, it was estimated that a rock or soil unit characterized by high landslide susceptibility would respond to widespread artificial cutting by some movement in 15 percent or more of the affected area. We did not evaluate the effect of earthquakes on slope stability, although many catastrophic landslides have been generated by ground shaking during earthquakes. Areas susceptible to ground failure under static conditions would probably also be susceptible to failure during earthquakes' (Radbruch-Hall, 1982).

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

Table 5.4.5-2 summarizes the area within each hazard ranked area, specific to Burlington County jurisdictions. To estimate the population located within the ground failure hazard areas, the approximate hazard area boundaries were overlaid upon the 2010 Census population data (U.S. Census, 2010). The Census blocks with their center (centroid) within the boundary of the landslide incidence hazard areas were used to calculate the estimated population considered exposed to this hazard. Tables 5.4.5-3 and 5.4.5-4 summarize the population within each identified area by municipality (U.S. Census 2010).

Impact on General Building Stock

In general, the built environment located in the high susceptibility zones and the population, structures and infrastructure located downslope are vulnerable to this hazard. In an attempt to estimate the general building stock vulnerable to this hazard, the building replacement values (buildings and contents) were determined for the buildings with their centroids within the approximate landslide and karst hazard areas.

Table 5.4.5-2. Total Assessed Value of Improvements Exposed to Landslides in Burlington County

Municipality	Total Assessed Value of Improvements	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Bass River Township	$112,293,600	$112,293,600	100%		0.0%
Beverly*	$72,091,800		0.0%	$72,091,800	100%
Bordentown	$298,534,950	$10,317,000	3.5%	$288,217,950	96.5%
Bordentown Township	$997,461,800	$715,065,900	71.7%	$282,395,900	28.3%
Burlington	$571,882,875	$17,979,300	3.1%	$553,903,575	96.9%
Burlington Township	$2,097,110,708	$1,348,003,851	64.3%	$749,106,857	35.7%
Chesterfield Township	$666,455,492	$666,455,492	100%		0.0%
Cinnaminson Township	$1,304,483,700	$25,016,100	1.9%		0.0%
Delanco Township	$290,621,560		0.0%	$290,621,560	100%
Delran Township	$1,474,866,100	$234,433,000	15.9%	$1,240,433,100	84.1%
Eastampton Township	$421,225,400	$421,225,400	100%		0.0%
Edgewater Park Township	$528,294,400		0.0%	$528,294,400	100%
Evesham Township	$4,389,240,875	$4,389,240,875	100%		0.0%
Fieldsboro Borough	$48,903,400		0.0%	$48,903,400	100%
Florence Township	$1,040,584,300	$328,463,000	31.6%	$712,121,300	68.4%
Hainesport Township	$367,702,666	$367,702,666	100%		0.0%
Lumberton Township	$1,164,991,807	$1,164,991,807	100%		0.0%
Mansfield Township	$899,612,400	$889,371,100	98.9%	$10,241,300	1.1%
Maple Shade Township	$1,405,067,900	$1,334,291,300	95.0%	$70,776,600	5.0%
Medford Lakes Borough	$1,297,069,100	$1,297,069,100	100%		0.0%
Medford Township	$980,612,600	$980,612,600	100%		0.0%

Municipality	Total Assessed Value of Improvements	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Moorestown Township	$3,410,132,200	$3,371,566,200	98.9%	$38,566,000	1.1%
Mount Holly Township	$1,079,081,000	$1,079,081,000	100%		0.0%
Mount Laurel Township	$2,396,695,600	$2,396,695,600	100%		0.0%
New Hanover Township	$852,205,300	$852,205,300	100%		0.0%
North Hanover Township	$498,418,446	$498,418,446	100%		0.0%
Palmyra Borough	$254,304,240		0.0%	$254,304,240	100%
Pemberton Borough	$63,520,200	$63,520,200	100%		0.0%
Pemberton Township	$2,014,515,095	$2,014,515,095	100%		0.0%
Riverside Township	$349,218,580		0.0%	$349,218,580	100%
Riverton Borough	$207,879,600		0.0%	$207,879,600	100%
Shamong Township	$294,159,200	$294,159,200	100%		0.0%
Southampton Township	$549,437,950	$549,437,950	100%		0.0%
Springfield Township	$282,324,750	$282,324,750	100%		0.0%
Tabernacle Township	$580,603,200	$580,603,200	100%		0.0%
Washington Township	$13,020,400	$13,020,400	100%		0.0%
Westampton Township	$919,859,000	$919,859,000	100%		0.0%
Willingboro Township	$1,705,779,550	$1,196,375,150	70.1%	$509,404,400	29.9%
Woodland Township	$305,887,600	$305,887,600	100%		0.0%
Wrightstown Borough	$47,025,100	$47,025,100	100%		0.0%
Burlington County	**$36,253,174,444**	**$28,767,226,282**	**79.4%**	**$7,486,047,162**	**20.6%**

Source: Burlington County Department of Information Technology, 2013; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
*Beverly data source: 2011 NJGIN MODIV

Table 5.4.5-5 list the total assessed value of improvements and replacement cost value (structure and contents) of the general building stock exposed to this hazard.

Table 5.4.5-3. Estimated Area Exposed to Landslides in Burlington County

Municipality	Total Area in Acres	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low		Moderate/Low	
		Acres	% of Total	Acres	% of Total
Bass River Township	50,140	50,140	100%	0	0%
Beverly	486	0	0%	486	100%
Bordentown	618	36	6%	581	94%
Bordentown Township	5,926	3,295	56%	2,632	44%
Burlington	2,426	147	6%	2,272	94%
Burlington Township	8,992	5,532	62%	3,477	39%
Chesterfield Township	13,736	13,736	100%	0	0%

Cinnaminson Township	5,099	51	1%	5,040	99%
Delanco Township	2,190	0	0%	2,190	100%
Delran Township	4,654	872	19%	3,772	81%
Eastampton Township	3,723	3,723	100%	0	0%
Edgewater Park Township	1,976	0	0%	1,976	100%
Evesham Township	18,943	18,932	100%	0	0%
Fieldsboro Borough	224	0	0%	224	100%
Florence Township	6,559	3,411	52%	3,137	48%
Hainesport Township	4,344	4,343	100%	0	0%
Lumberton Township	8,327	8,327	100%	0	0%
Mansfield Township	14,010	13,576	97%	446	3%
Maple Shade Township	2,451	2,244	92%	207	8%
Medford Lakes Borough	812	812	100%	0	0%
Medford Township	25,474	25,475	100%	0	0%
Moorestown Township	9,585	9,415	98%	164	2%
Mount Holly Township	1,837	1,837	100%	0	0%
Mount Laurel Township	14,066	14,073	100%	0	0%
New Hanover Township	14,483	14,483	100%	0	0%
North Hanover Township	11,203	11,203	100%	0	0%
Palmyra Borough	1,673	0	0%	1,673	100%
Pemberton Borough	403	403	100%	0	0%
Pemberton Township	40,171	40,164	100%	0	0%
Riverside Township	1,048	0	0%	1,047	100%
Riverton Borough	614	0	0%	614	100%
Shamong Township	28,791	28,824	100%	0	0%
Southampton Township	28,446	28,422	100%	0	0%
Springfield Township	18,924	18,920	100%	0	0%
Tabernacle Township	31,688	31,725	100%	0	0%
Washington Township	66,539	67,067	101%	0	0%
Westampton Township	7,104	7,101	100%	0	0%
Willingboro Township	5,175	3,540	68%	1,654	32%
Woodland Township	61,001	60,439	99%	0	0%
Wrightstown Borough	1,146	1,146	100%	0	0%
Burlington County	**525,009**	**493,412**	**94%**	**31,592**	**6%**

Table 5.4.5-4. Estimated Population Exposed to Landslides in Burlington County

Municipality	Total Population (U.S. Census 2010)	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low		Moderate/Low	
		Pop.	% of Total	Pop.	% of Total
Bass River Township	1,443	1,443	100%		
Beverly	2,577			2,577	100%
Bordentown	3,924	1,93	4.92%	3,731	95.08%
Bordentown Township	11,367	7,598	66.84%	3,769	33.16%
Burlington	9,920	352	3.55%	9,568	96.45%
Burlington Township	22,594	14,032	62.10%	8,562	37.90%
Chesterfield Township	7,699	7,699	100%		
Cinnaminson Township	15,569	208	1.34%	15,361	98.66%
Delanco Township	4,283			4283	100%
Delran Township	16,896	3,185	18.85%	13,711	81.15%
Eastampton Township	6,069	6,069	100%		
Edgewater Park Township	8,881			8,881	100%
Evesham Township	45,538	45,538	100%		
Fieldsboro Borough	540			540	100%
Florence Township	12,109	2,598	21.46%	9,511	78.54%
Hainesport Township	6,110	6,110	100%		
Lumberton Township	12,559	12,559	100%		
Mansfield Township	8,544	8,486	99%	58	0.68%
Maple Shade Township	19,131	17,736	92%	1,395	7.29%
Medford Lakes Borough	4,146	4,146	100%		
Medford Township	23,033	23,033	100%		
Moorestown Township	20,726	20,680	99.78%	46	0.22%
Mount Holly Township	9,536	9,536	100%		
Mount Laurel Township	41,864	41,864	100%		
New Hanover Township	7,385	7,385	100%		
North Hanover Township	7,678	7,678	100%		
Palmyra Borough	7,398			7398	100%
Pemberton Borough	1,409	1,409	100%		
Pemberton Township	27,912	27,912	100%		
Riverside Township	8,079			8,079	100%
Riverton Borough	2,779			2,779	100%
Shamong Township	6,490	6,490	100%		
Southampton Township	10,464	10,464	100 %		
Springfield Township	3,414	3,414	100%		
Tabernacle Township	6,949	6,949	100%		
Washington Township	687	687	100%		
Westampton Township	8,813	8,813	100%		

Municipality	Total Population (U.S. Census 2010)	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low		Moderate/Low	
		Pop.	% of Total	Pop.	% of Total
Willingboro Township	31,629	22739	71.89%	8890	28.11%
Woodland Township	1,788	1788	100%		
Wrightstown Borough	802	802	100%		
Burlington County	**448,734**	**339,595**	**75.67%**	**109,139**	**24.32%**

Source: U.S. Census 2010; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
Note: Pop. = Population

Table 5.4.5-5. Total Assessed Value of Improvements Exposed to Landslides in Burlington County

Municipality	Total Assessed Value of Improvements	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Bass River Township	$112,293,600	$112,293,600	100%		0.0%
Beverly*	$72,091,800		0.0%	$72,091,800	100%
Bordentown	$298,534,950	$10,317,000	3.5%	$288,217,950	96.5%
Bordentown Township	$997,461,800	$715,065,900	71.7%	$282,395,900	28.3%
Burlington	$571,882,875	$17,979,300	3.1%	$553,903,575	96.9%
Burlington Township	$2,097,110,708	$1,348,003,851	64.3%	$749,106,857	35.7%
Chesterfield Township	$666,455,492	$666,455,492	100%		0.0%
Cinnaminson Township	$1,304,483,700	$25,016,100	1.9%		0.0%
Delanco Township	$290,621,560		0.0%	$290,621,560	100%
Delran Township	$1,474,866,100	$234,433,000	15.9%	$1,240,433,100	84.1%
Eastampton Township	$421,225,400	$421,225,400	100%		0.0%
Edgewater Park Township	$528,294,400		0.0%	$528,294,400	100%
Evesham Township	$4,389,240,875	$4,389,240,875	100%		0.0%
Fieldsboro Borough	$48,903,400		0.0%	$48,903,400	100%
Florence Township	$1,040,584,300	$328,463,000	31.6%	$712,121,300	68.4%
Hainesport Township	$367,702,666	$367,702,666	100%		0.0%
Lumberton Township	$1,164,991,807	$1,164,991,807	100%		0.0%
Mansfield Township	$899,612,400	$889,371,100	98.9%	$10,241,300	1.1%
Maple Shade Township	$1,405,067,900	$1,334,291,300	95.0%	$70,776,600	5.0%
Medford Lakes Borough	$1,297,069,100	$1,297,069,100	100%		0.0%
Medford Township	$980,612,600	$980,612,600	100%		0.0%
Moorestown Township	$3,410,132,200	$3,371,566,200	98.9%	$38,566,000	1.1%
Mount Holly Township	$1,079,081,000	$1,079,081,000	100%		0.0%
Mount Laurel Township	$2,396,695,600	$2,396,695,600	100%		0.0%
New Hanover Township	$852,205,300	$852,205,300	100%		0.0%
North Hanover Township	$498,418,446	$498,418,446	100%		0.0%
Palmyra Borough	$254,304,240		0.0%	$254,304,240	100%
Pemberton Borough	$63,520,200	$63,520,200	100%		0.0%
Pemberton Township	$2,014,515,095	$2,014,515,095	100%		0.0%
Riverside Township	$349,218,580		0.0%	$349,218,580	100%
Riverton Borough	$207,879,600		0.0%	$207,879,600	100%
Shamong Township	$294,159,200	$294,159,200	100%		0.0%
Southampton Township	$549,437,950	$549,437,950	100%		0.0%
Springfield Township	$282,324,750	$282,324,750	100%		0.0%
Tabernacle Township	$580,603,200	$580,603,200	100%		0.0%
Washington Township	$13,020,400	$13,020,400	100%		0.0%
Westampton Township	$919,859,000	$919,859,000	100%		0.0%
Willingboro Township	$1,705,779,550	$1,196,375,150	70.1%	$509,404,400	29.9%

Municipality	Total Assessed Value of Improvements	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Woodland Township	$305,887,600	$305,887,600	100%		0.0%
Wrightstown Borough	$47,025,100	$47,025,100	100%		0.0%
Burlington County	**$36,253,174,444**	**$28,767,226,282**	**79.4%**	**$7,486,047,162**	**20.6%**

Source: Burlington County Department of Information Technology, 2013; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
*Beverly data source: 2011 NJGIN MODIV

Table 5.4.5-6. Estimated General Building Stock Replacement Cost Value Exposed to Landslides in Burlington County

Municipality	Total GBS RCV	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Bass River Township	$158,762,000	$158,762,000	100%		0.0%
Beverly City	$351,041,000		0.0%	$351,041,000	100%
Bordentown City	$611,161,000	$12,381,000	2.0%	$598,780,000	98.0%
Bordentown Township	$1,225,803,000	$918,661,000	74.9%	$307,142,000	25.1%
Burlington City	$1,419,313,000	$23,959,000	1.7%	$1,395,354,000	98.3%
Burlington Township	$3,257,758,000	$2,191,018,000	67.3%	$1,066,740,000	32.7%
Chesterfield Township	$482,451,000	$482,451,000	100%		0.0%
Cinnaminson Township	$2,375,176,000	$31,173,000	1.3%	$2,344,003,000	98.7%
Delanco Township	$484,972,000		0.0%	$484,972,000	100%
Delran Township	$2,136,079,000	$371,415,000	17.4%	$1,764,664,000	82.6%
Eastampton Township	$712,944,000	$712,944,000	100%		0.0%
Edgewater Park Township	$959,473,000		0.0%	$959,473,000	100%
Evesham Township	$6,451,252,000	$6,451,252,000	100%		0.0%
Fieldsboro Borough	$72,125,000		0.0%	$72,125,000	100%
Florence Township	$1,509,320,000	$215,102,000	14.3%	$1,294,218,000	85.7%
Hainesport Township	$839,062,000	$839,062,000	100%		0.0%
Lumberton Township	$1,504,149,000	$1,504,149,000	100%		0.0%
Mansfield Township	$1,954,839,000	$1,926,462,000	98.5%	$28,377,000	1.5%
Maple Shade Township	$2,346,098,000	$2,205,857,000	94.0%	$140,241,000	6.0%
Medford Lakes Borough	$560,603,000	$560,603,000	100%		0.0%
Medford Township	$3,746,510,000	$3,746,510,000	100%		0.0%
Moorestown Township	$4,209,509,000	$4,173,379,000	99.1%	$36,130,000	0.9%
Mount Holly Township	$1,650,406,000	$1,650,406,000	100%		0.0%
Mount Laurel Township	$6,985,988,000	$6,985,988,000	100%		0.0%
New Hanover Township	$1,604,641,000	$1,604,641,000	100%		0.0%
North Hanover Township	$685,211,000	$685,211,000	100%		0.0%
Palmyra Borough	$942,785,000		0.0%	$942,785,000	100%
Pemberton Borough	$187,379,000	$187,379,000	100%		0.0%

Municipality	Total GBS RCV	Landslide Incidence		Landslide Susceptibility/Incidence	
		Low	% of Total	Moderate/ Low	% of Total
Pemberton Township	$3,248,981,000	$3,248,981,000	100%		0.0%
Riverside Township	$885,809,000		0.0%	$885,809,000	100%
Riverton Borough	$352,198,000		0.0%	$352,198,000	100%
Shamong Township	$797,191,000	$797,191,000	100%		0.0%
Southampton Township	$1,305,540,000	$1,305,540,000	100%		0.0%
Springfield Township	$461,104,000	$461,104,000	100%		0.0%
Tabernacle Township	$931,897,000	$931,897,000	100%		0.0%
Washington Township	$108,601,000	$108,601,000	100%		0.0%
Westampton Township	$1,326,163,000	$1,326,163,000	100%		0.0%
Willingboro Township	$3,602,996,000	$2,599,739,000	72.2%	$1,003,257,000	27.8%
Woodland Township	$115,483,000	$115,483,000	100%		0.0%
Wrightstown Borough	$140,021,000	$140,021,000	100%		0.0%
Burlington County	**$62,700,794,000**	**$48,673,485,000**	**77.6%**	**$14,027,309,000**	**22.4%**

Source: Burlington County Department of Information Technology, 2013; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States); HAZUS-MH v2.1

Notes: GBS = General Building Stock; RCV = Replacement Cost Value.
The total building count and total replacement values are the sum of all seven general occupancy classifications (residential, commercial, industrial, agricultural, religious, government and educational) for that jurisdiction.

Impact on Critical Facilities

To estimate exposure, the approximate landslide hazard areas were overlaid upon the essential and municipal facilities. Table 5.4.5-7 lists the essential facilities (i.e., police, fire, EOCs, hospitals and schools) that are located in the low/moderate Landslide susceptibility/incidence hazard areas.

Table 5.4.5-7. Emergency Critical Facilities Exposed to Estimated Landslide Hazard Areas in Burlington County

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
Municipal (Edgewater	400 DELANCO RD	BEVERLY CITY	EOC	x
BEVERLY - EDGEWATER PARK EMERG SQUAD	703 MELBOURNE AV	BEVERLY CITY	EMS	x
BEVERLY CITY FIRE DEPARTMENT	446 BROAD ST	BEVERLY CITY	FIRE	x
BEVERLY CITY POLICE DEPT	446 BROAD ST	BEVERLY CITY	POLICE	x
BEVERLY ELEMENTARY SCHOOL	601 BENTLEY AVE	BEVERLY CITY	SCHOOL	x
BEVERLY FIRE CO #1	440 LAUREL ST	BEVERLY CITY	FIRE	x
BEVERLY SCHOOL	601 BENTLEY AVE	BEVERLY CITY	SCHOOL	x
BEVERLY SUPERINTENDENT'S OFC	601 BENTLEY AVE	BEVERLY CITY	ADMIN	x
Beverly/Edgewater Park	LEFT SIDE PLATFORM	BEVERLY CITY	CSWPR	x
BOARD OF EDUCATION	401 BROAD ST	BEVERLY CITY	BOARD OF ED	x
BOARD OF EDUCATION SECRETARY	401 BROAD ST	BEVERLY CITY	BOARD OF ED	x
CHILD STUDY TEAM	401 BROAD ST	BEVERLY CITY	CHILD STUDY TM	x
HOPE HOSE FIRE CO #2	400 BROAD ST	BEVERLY CITY	FIRE	x
ST JOSEPH'S SCHOOL	524 WARREN ST	BEVERLY CITY	SCHOOL	x
ST JOSEPH'S SCHOOL	524 WARREN ST	BEVERLY CITY	SCHOOL	x
Station 321	51 GROVEVILLE RD	BORDENTOWN CITY	EOC	x
Bordentown	RIGHT SIDE PLATFORM	BORDENTOWN CITY	CSWPR	x
BORDENTOWN CITY POLICE DEPT	324 FARNSWORTH AV	BORDENTOWN CITY	POLICE	x
BORDENTOWN REGION SCHOOL DIST	78 CROSSWICKS ST	BORDENTOWN CITY	ADMIN	x
CLARA BARTON ELEMENTARY SCHOOL	100 CROSSWICKS ST	BORDENTOWN CITY	SCHOOL	x
CONSOLIDATED FIRE ASSOCIATION	20 CROSSWICKS ST POBox 47	BORDENTOWN CITY	FIRE	x
HOPE HOSE HUMANE CO #1	150 W BURLINGTON ST	BORDENTOWN CITY	EMS	x
HOPE HOSE HUMANE FIRE CO #1	150 W BURLINGTON ST POB 666	BORDENTOWN CITY	FIRE	x
HOPE HOSE HUMANE FIRE CO #1	150 W BURLINGTON ST	BORDENTOWN CITY	FIRE	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
MACFARLAND JUNIOR SCHOOL	87 CROSSWICKS ST	BORDENTOWN CITY	SCHOOL	x
MACFARLAND JUNIOR SCHOOL	87 CROSSWICKS ST	BORDENTOWN CITY	SCHOOL	x
ST. MARY SCHOOL	30 ELIZABETH ST.	BORDENTOWN CITY	SCHOOL	x
Station 609	150 W BURLINGTON ST	BORDENTOWN CITY	EOC	x
MISSION FIRE CO #1	51 GROVEVILLE RD	BORDENTOWN TWP	FIRE	x
NJ STATE POLICE - BORDENTOWN	301 US 130	BORDENTOWN TWP	POLICE	x
Burlington City Police	525 High Street	BURLINGTON CITY	POLICE	x
DAVITA BURLINGTON NORTH	1164 ROUTE 130 NORTH	BURLINGTON CITY	DIALYSIS	x
ALL SAINTS SCHOOL	510 HIGH ST	BURLINGTON CITY	SCHOOL	x
BULINGTON CITY FIRE DEPARTMENT	525 HIGH STREET	BURLINGTON CITY	FIRE	x
BURLINGTON BOARD OF EDUCATION	518 LOCUST AVE	BURLINGTON CITY	BOARD OF ED	x
BURLINGTON BRISTOL BRIDGE POLICE DEPT	348 CONOVER ST	BURLINGTON CITY	POLICE	x
BURLINGTON CITY HIGH SCHOOL	100 DEWEY ST	BURLINGTON CITY	SCHOOL	x
BURLINGTON GENERATING STATION HELIPORT(PSEG)	901 W BROAD ST	BURLINGTON CITY	Private	x
Burlington South Park & Ride	LEFT AND RIGHT SIDE PLATFORM	BURLINGTON CITY	CSWPR	x
Burlington Town Center Station	RIGHT SIDE PLATFORM	BURLINGTON CITY	CS	x
CAPTAIN JAMES LAWRENCE SCHOOL	316 BARCLAY ST	BURLINGTON CITY	SCHOOL	x
ELIAS BOUDINOT ELEMENTARY SCHL	W PEARL & ELLIS STS	BURLINGTON CITY	SCHOOL	x
ENDEAVOR EMERGENCY SQUAD	19 E UNION ST	BURLINGTON CITY	EMS	x
HOLY LIGHT CHRISTIAN ACADEMY	133 E UNION ST	BURLINGTON CITY	SCHOOL	x
MITCHELL FIRE CO #3	300 FEDERAL ST POB 668	BURLINGTON CITY	FIRE	x
Municipal	525 HIGH ST	BURLINGTON CITY	EOC	x
NEPTUNE HOSE CO #5	721 BORDENTOWN RD POB 283	BURLINGTON CITY	FIRE	x
NIAGARA HOSE CO 6	656 HWY 541	BURLINGTON CITY	FIRE	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
NJSP MARINE POLICE	601 NEW PEARL ST	BURLINGTON CITY	POLICE	x
SAMUEL SMITH ELEMENTARY SCHOOL	250 FARNER AVE	BURLINGTON CITY	SCHOOL	x
ST MARY'S HALL -DOANE ACADEMY	350 RIVERBANK	BURLINGTON CITY	SCHOOL	x
ST PAUL'S PAROCHIAL SCHOOL	250 JAMES ST	BURLINGTON CITY	SCHOOL	x
WILBUR WATTS INTERMEDIATE SCHL	HIGH ST & WOOD ST	BURLINGTON CITY	SCHOOL	x
WILBUR WATTS MIDDLE SCHOOL	550 HIGH ST	BURLINGTON CITY	SCHOOL	x
BEVERLY ROAD FIRE CO #2	1001 BEVERLY RD	BURLINGTON TWP	FIRE	x
Police HQ	900 MANOR RD	CINNAMINSON TWP	EOC	x
Cinnaminson	CENTER ISLAND PLATFORM	CINNAMINSON TWP	CSWPR	x
CINNAMINSON BOARD OF EDUCATION	905 S RTE 130	CINNAMINSON TWP	BOARD OF ED	x
CINNAMINSON FIRE STATION 201	1725 CINNAMINSON AV	CINNAMINSON TWP	FIRE	x
CINNAMINSON FIRE STATION 202	1900 TAYLORS LN	CINNAMINSON TWP	FIRE	x
CINNAMINSON HIGH SCHOOL	1197 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x
CINNAMINSON HIGH SCHOOL	1197 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x
CINNAMINSON MIDDLE SCHOOL	312 NORTH FORKLANDING RD	CINNAMINSON TWP	SCHOOL	x
CINNAMINSON MIDDLE SCHOOL	312 FORKLANDING RD	CINNAMINSON TWP	SCHOOL	x
CINNAMINSON TWP FIRE DEPT	1621 RIVERTON ROAD	CINNAMINSON TWP	FIRE	x
CINNAMINSON TWP POLICE DEPT	900 MANOR RD	CINNAMINSON TWP	POLICE	x
ELANOR RUSH SCHOOL	1200 WYNWOOD DR	CINNAMINSON TWP	SCHOOL	x
MEMORIAL SCHOOL	2195 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x
NEW ALBANY ELEMENTARY SCHOOL	2701 NEW ALBANY RD	CINNAMINSON TWP	SCHOOL	x
PROJECT CHALLENGE	2195 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x
ST CHARLES BORROMEO ROMAN SCHL	2500 BRANCH PIKE	CINNAMINSON TWP	SCHOOL	x
STUDENT ACTIVITY CENTER	2195 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x
WESTFIELD FRIENDS SCHOOL	2201 RIVERTON RD	CINNAMINSON TWP	SCHOOL	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
Municipal	515 BURLINGTON AVE	DELANCO TWP	EOC	x
Delanco	LEFT AND RIGHT SIDE PLATFORM	DELANCO TWP	CSWPR	x
DELANCO EMERGENCY SQUAD	1800 BURLINGTON AV	DELANCO TWP	EMS	x
DELANCO POLICE	770 COOPER ST	DELANCO TWP	P	x
DELANCO TOWNSHIP SCHOOL DIST	411 WALNUT ST	DELANCO TWP	ADMIN	x
M JOAN PEARSON SCHOOL	BURLINGTON AVE & LILAC LA	DELANCO TWP	SCHOOL	x
WALNUT STREET ELEMENTARY SCHL	411 WALNUT ST	DELANCO TWP	SCHOOL	x
WASHINGTON FIRE CO #1	1800 BURLINGTON AV POB 5021	DELANCO TWP	FIRE	x
DAVITA DELRAN	8008 ROUTE 130 NORTH	DELRAN TWP	DIALYSIS	x
Municipal	900 CHESTER AVE	DELRAN TWP	EOC	x
DELRAN CHILD STUDY TEAM	52 HARTFORD RD	DELRAN TWP	CHILD STUDY TM	x
DELRAN EMERGENCY SQUAD	900 CHESTER AVE	DELRAN TWP	EMS	x
DELRAN FIRE CO #1	9 S BRIDGEBORO ST	DELRAN TWP	FIRE	x
DELRAN FIRE CO#2	1020 CHESTER AV	DELRAN TWP	FIRE	x
DELRAN FIRE DEPARTMENT	900 CHESTER AVENUE	DELRAN TWP	FIRE	x
DELRAN INTERMEDIATE SCHOOL	20 CREEK ROAD	DELRAN TWP	SCHOOL	x
DELRAN MIDDLE SCHOOL	905 CHESTER AVE	DELRAN TWP	SCHOOL	x
DELRAN POLICE DEPT	900 CHESTER AVE	DELRAN TWP	POLICE	x
DELRAN TOWNSHIP BOARD OF EDCTN	52 HARTFORD RD	DELRAN TWP	BOARD OF ED	x
DELRAN TOWNSHIP HIGH SCHOOL	50 HARTFORD RD	DELRAN TWP	SCHOOL	x
DELRAN TOWNSHIP HIGH SCHOOL	50 HARTFORD RD	DELRAN TWP	SCHOOL	x
HOLY CROSS HIGH SCHOOL	5035 HWY 130	DELRAN TWP	SCHOOL	x
MAC MILLAN RESTRICTED HELISTOP	900 CHESTER AVENUE	DELRAN TWP	Private	x
MILLBRIDGE ELEMENTARY SCHOOL	282 CONROW RD	DELRAN TWP	SCHOOL	x
MONTESSORI ACADEMY OF NJ	28 CONROW ROAD	DELRAN TWP	SCHOOL	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
Municipal	400 DELANCO RD	EDGEWATER PARK TWP	EOC	x
EDGEWATER PARK TWP POLICE	400 DELANCO RD	EDGEWATER PARK TWP	POLICE	x
MAGOWAN ELEMENTARY SCHOOL	405 CHERRY AVE	EDGEWATER PARK TWP	SCHOOL	x
MILDRED MAGOWAN ELEMENTARY SCHOOL	405 CHERRIX AVE	EDGEWATER PARK TWP	SCHOOL	x
SAMUEL M RIDGEWAY SCHOOL	300 DELANCO RD	EDGEWATER PARK TWP	SCHOOL	x
SAMUEL M RIDGEWAY SCHOOL	300 DELANCO RD	EDGEWATER PARK TWP	SCHOOL	x
Municipal	18 WASHINGTON ST	FIELDSBORO BORO	EOC	x
FIELDSBORO POLICE DEPT	204 WASHINGTON ST	FIELDSBORO BORO	POLICE	x
Station 402 / Munici	711 BROAD ST	FLORENCE TWP	EOC	x
Florence Park & Ride	CENTER ISLAND PLATFORM	FLORENCE TWP	CSWPR	x
Roebling	LEFT SIDE PLATFORM	FLORENCE TWP	CSWPR	x
FLORENCE CHILD STUDY CTR	440 WEST FOURTH STREET	FLORENCE TWP	CHILD STUDY TM	x
FLORENCE FIRE DEPARTMENT	401 FIREHOUSE LA	FLORENCE TWP	FIRE	x
FLORENCE FIRE VOLUNTER FIRE COMPANY	401 FIREHOUSE LA	FLORENCE TWP	FIRE	x
FLORENCE MEMORIAL HIGH SCHOOL	CEDAR LANE	FLORENCE TWP	SCHOOL	x
FLORENCE MEMORIAL MIDDLE SCHOOL	500 EAST FRONT ST	FLORENCE TWP	SCHOOL	SCHOOL
FLORENCE TOWNSHIP MIDDLE SCHOOL	500 E FRONT ST	FLORENCE TWP	SCHOOL	x
FLORENCE TOWNSHIP MMRL HS	500 E FRONT ST	FLORENCE TWP	SCHOOL	x
FLORENCE TOWNSHIP SCHOOL DIST	201 CEDAR ST	FLORENCE TWP	ADMIN	x
FLORENCE TWP POLICE DEPT	711 BROAD ST	FLORENCE TWP	POLICE	x
MACELLA I DUFFY SCHOOL	208 W 2ND ST	FLORENCE TWP	SCHOOL	x
RIVERBANK CHARTER SCHL OF EXCELLENCE	1300 HORNBERGER AVE & PARISH LN	FLORENCE TWP	SCHOOL	x
RIVERFRONT SCHOOL	500 E FRONT ST	FLORENCE TWP	SCHOOL	x
ROEBLING ELEMENTARY SCHOOL 5	1300 HORNBERGER AV	FLORENCE TWP	SCHOOL	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
HOWARD R YOCUM ELEMENTARY SCHL	748 N FORKLANDING RD	MAPLE SHADE TWP	SCHOOL	x
KNIGHTS OF COLUMBUS HALL	636 NORTH FORKLANDING ROAD	MAPLE SHADE TWP	USER DEFINED	x
Station 801	115 W BROAD ST	PALMYRA BORO	EOC	x
CHARLES STREET ELEMENTARY SCHL	100 W CHARLES ST	PALMYRA BORO	SCHOOL	x
CHARLES STREET ELEMENTARY SCHOOL	100 WEST CHARLES ST	PALMYRA BORO	SCHOOL	x
DELAWARE AVENUE SCHOOL	301 DELAWARE AVE	PALMYRA BORO	SCHOOL	x
PALMYRA ADULT HIGH SCHOOL	DELAWARE AVE & 4TH ST W	PALMYRA BORO	SCHOOL	x
PALMYRA AMBULANCE ASSOCIATION	125 W BROAD ST	PALMYRA BORO	EMS	x
PALMYRA BOARD OF EDUCATION	301 DELAWARE AVE	PALMYRA BORO	BOARD OF ED	x
PALMYRA CHILD STUDY TEAM	301 DELAWARE AVE	PALMYRA BORO	CHILD STUDY TM	x
PALMYRA COMMUNITY EDUCATION	4TH & DELAWARE AVE	PALMYRA BORO	SCHOOL	x
PALMYRA FIRE DEPT	115 W BROAD ST	PALMYRA BORO	FIRE	x
PALMYRA HIGH SCHOOL	5TH & WEART BLVD	PALMYRA BORO	SCHOOL	x
PALMYRA POLICE DEPT	20 W BROAD ST	PALMYRA BORO	POLICE	x
TACONY PALMYRA BRIDGE POLICE DEPT	1300 HYW 73	PALMYRA BORO	POLICE	x
TRI-BOROUGH OFFICERS' ASSOCIATION	115 W BROAD ST	PALMYRA BORO	FIRE	x
Palmyra	RIGHT SIDE PLATFORM	PALMYRA BORO	CS	x
PALMYRA COMMUNITY CENTER	30 W BROAD STREET	PALMYRA TWP	CS	x
36th Street	NA	Pennsauken Township	CS	x
Pennsauken/Route 73 Park & Ride	LEFT AND RIGHT SIDE PLATFORM	Pennsauken Township	CSWPR	x
Station 701	4 W SCOTT ST	RIVERSIDE TWP	EOC	x
Riverside	LEFT AND RIGHT SIDE PLATFORM	RIVERSIDE TWP	CSWPR	x
RIVERSIDE CHILD STUDY TEAM	112 E. WASHINGTON ST	RIVERSIDE TWP	CHILD STUDY TM	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
RIVERSIDE FIRE CO #1	4 W SCOTT ST	RIVERSIDE TWP	FIRE	x
RIVERSIDE HIGH SCHOOL	112 WASHINGTON ST	RIVERSIDE TWP	SCHOOL	x
RIVERSIDE MIDDLE SCHOOL	112 E. WASHINGTON ST	RIVERSIDE TWP	SCHOOL	x
RIVERSIDE TOWNSHIP BOARD EDCTN	112 E. WASHINGTON ST	RIVERSIDE TWP	BOARD OF ED	x
RIVERSIDE TOWNSHIP HIGH SCHOOL	112 E. WASHINGTON ST	RIVERSIDE TWP	SCHOOL	x
RIVERSIDE TWP ELEMENTARY SCHL	112 E. WASHINGTON ST	RIVERSIDE TWP	SCHOOL	x
RIVERSIDE TWP POLICE DEPT	1 W SCOTT ST	RIVERSIDE TWP	POLICE	x
SCHOOL SUPERINTENDENT OFFICE	120 WASHINGTON ST	RIVERSIDE TWP	ADMIN	x
ST PETER'S RELIGIOUS EDUCATION	101 MIDDLETON ST	RIVERSIDE TWP	SCHOOL	x
ST PETER'S SCHOOL	101 MIDDLETON ST	RIVERSIDE TWP	SCHOOL	x
SUPERINTENDENT OF SCHOOLS	120 WASHINGTON ST	RIVERSIDE TWP	ADMIN	x
Municipal	505A HOWARD ST	RIVERTON BORO	EOC	x
RIVERTON BORO POLICE DEPT	501 5TH ST	RIVERTON BORO	POLICE	x
RIVERTON BOROUGH PUBLIC SCHOOL	600 5TH ST	RIVERTON BORO	SCHOOL	x
RIVERTON BOROUGH SCHOOL DIST	600 5TH ST	RIVERTON BORO	ADMIN	x
RIVERTON FIRE CO	505 HOWARD ST	RIVERTON BORO	FIRE	x
RIVERTON SCHOOL	502 5TH ST	RIVERTON BORO	SCHOOL	x
Riverton	RIGHT SIDE PLATFORM	RIVERTON BORO	CSWPR	x
ALPHA BAPTIST CHURCH	15 ROSE STREET	WILLINGBORO TWP	SCHOOL	x
BOOKBINDER SCHOOL	56 BROOKLAWN DR	WILLINGBORO TWP	SCHOOL	x
BURLINGTON COUNTY COLLEGE	300 WILLINGBORO PARKWAY	WILLINGBORO TWP	SCHOOL	x
CATHEDRAL OF LOVE SCHOOL	139 BEVERLY RANCOCAS RD	WILLINGBORO TWP	SCHOOL	x
CORPUS CHRISTI SCHOOL	11 SUNSET RD	WILLINGBORO TWP	SCHOOL	x
J.C. STUART ELEMENTARY SCHOOL	70 SUNSET RD	WILLINGBORO TWP	SCHOOL	x
LOURDES MEDICAL CENTER	218A SUNSET RD	WILLINGBORO TWP	Hospital	x

Name	Address	Municipality	Type	Landslide Susceptibility/ Incidence Moderate/ Low
LOURDES SPECIALTY HOSPITAL	218 SUNSET RD	WILLINGBORO TWP	Hospital	x
RANCOCAS HOSPITAL HELIPORT	218A SUNSET RD	WILLINGBORO TWP	Private	x
W.R JAMES SR. ELEMENTARY SCHOOL	41 PINETREE LN	WILLINGBORO TWP	SCHOOL	x

Source: Burlington County Department of Information Technology, 2013; Godt, 2011 (Geology WMS Layer from the National Atlas of the United States)
Note: 'X' indicates the facility's presence in the identified area.

Impact on the Economy

Ground failure's impact on the economy and estimated dollar losses are difficult to measure. As stated earlier, ground failure can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, ground failure threatens transportation corridors, fuel and energy conduits and communication lines (USGS, 2003). Estimated potential damages to general building stock can be quantified as discussed above. For the purposes of this analysis, general building stock damages are discussed further.

Direct building losses are the estimated costs to repair or replace the damage caused to the building. There are zero buildings located in the high incidence and high/moderate susceptibility/incidence landslide hazard areas. A total risk exposure of $14 billion or approximately 22% of Burlington County's total inventory is estimated for the buildings located in the landslide moderate susceptibility/low incidence area. These dollar value losses to Burlington County's total building inventory replacement value would impact Burlington County's tax base and the local economy.

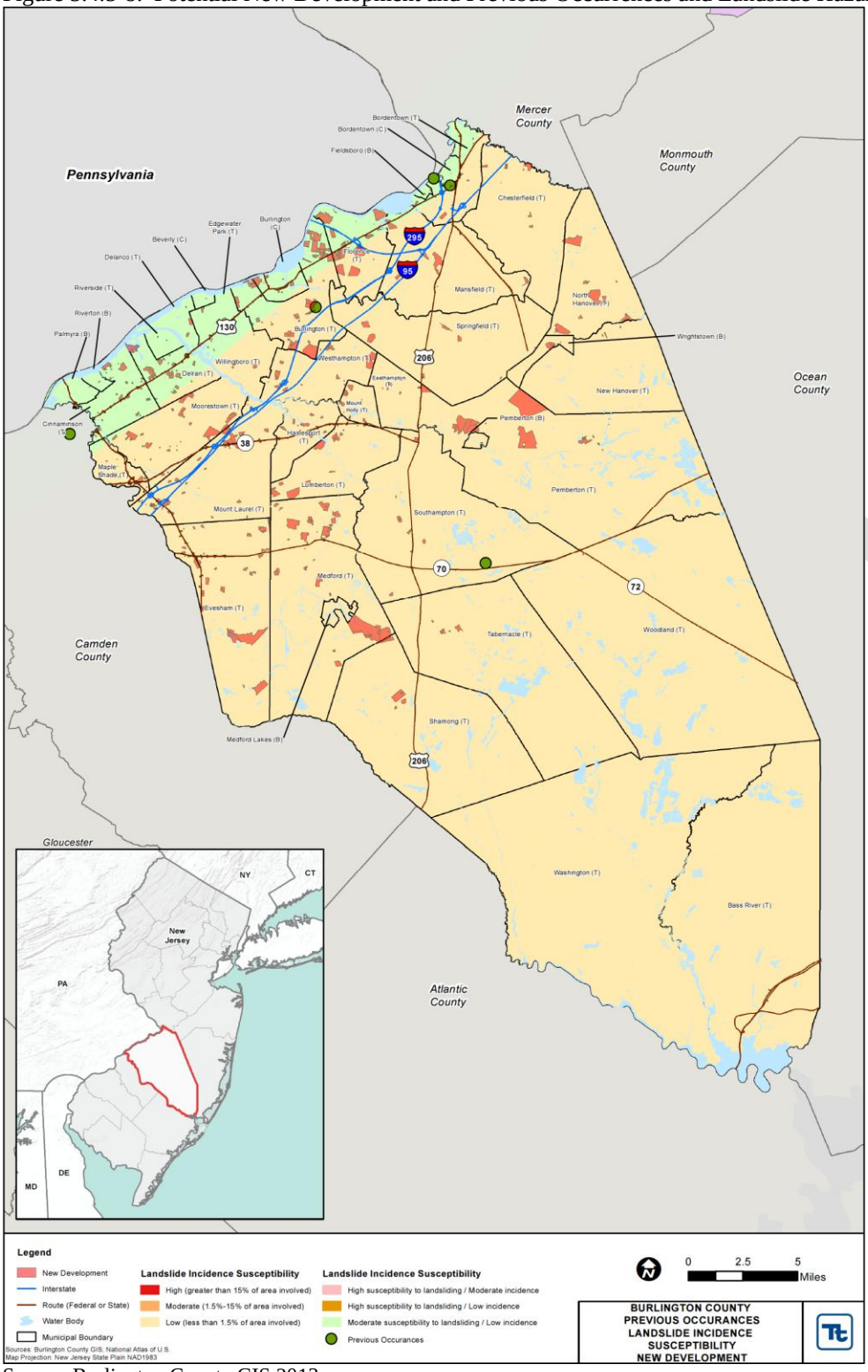
New Jersey Turnpike, Route 295, and Route 130 are the major roadways that traverse the western portion of the county from northeast to southwest. These roads serve as the major thoroughfares of the county and run through the most densely populated areas of the county. The landslide moderate susceptibility/low incidence area in Burlington County is located along the western boundary of the county adjacent to the Delaware River. Route 130 is the only major roadway that is located within this hazard area. The Garden State Parkway traverses the southeastern corner of the county, but is not located in the landslide moderate susceptibility/low incidence area.

Since the county is substantially developed in the areas adjacent to the Delaware River many of the major utilities including power generation plants and regional sewerage treatment plants are located with the landslide moderate susceptibility/low incidence area.

Future Growth and Development

As discussed in Section 4 and Volume II, Section 9, areas targeted for future growth and development have been identified across Burlington County. It is anticipated that new development within the identified hazard area will be exposed to such risks.

Figure 5.4.5-8. Potential New Development and Previous Occurrences and Landslide Hazard Areas



Source: Burlington County GIS 2013

Additional Data and Next Steps

Obtaining historic damages to buildings and infrastructure incurred due to ground failure will help with loss estimates and future modeling efforts, given a margin of uncertainty. More detailed landslide susceptibility zones can be generated so that communities can more specifically identify high hazard areas. A pilot study was conducted for Schenectady County, New York as described in the 2011 New York State Hazard Mitigation Plan to develop higher resolution landslide susceptibility zones. The methodology included using the Natural Resource Conservation Services (NRCS) Digital Soil Survey soil units and their associated properties including the American of State Highway Transportation Officials (AASHTO) rating, liquid limit, hydrologic group, percentage of silt and clay, erosion potential and slope derived from high resolution digital elevation models. Further, research on rainfall thresholds for forecasting landslide potential may also be an option for Burlington County.