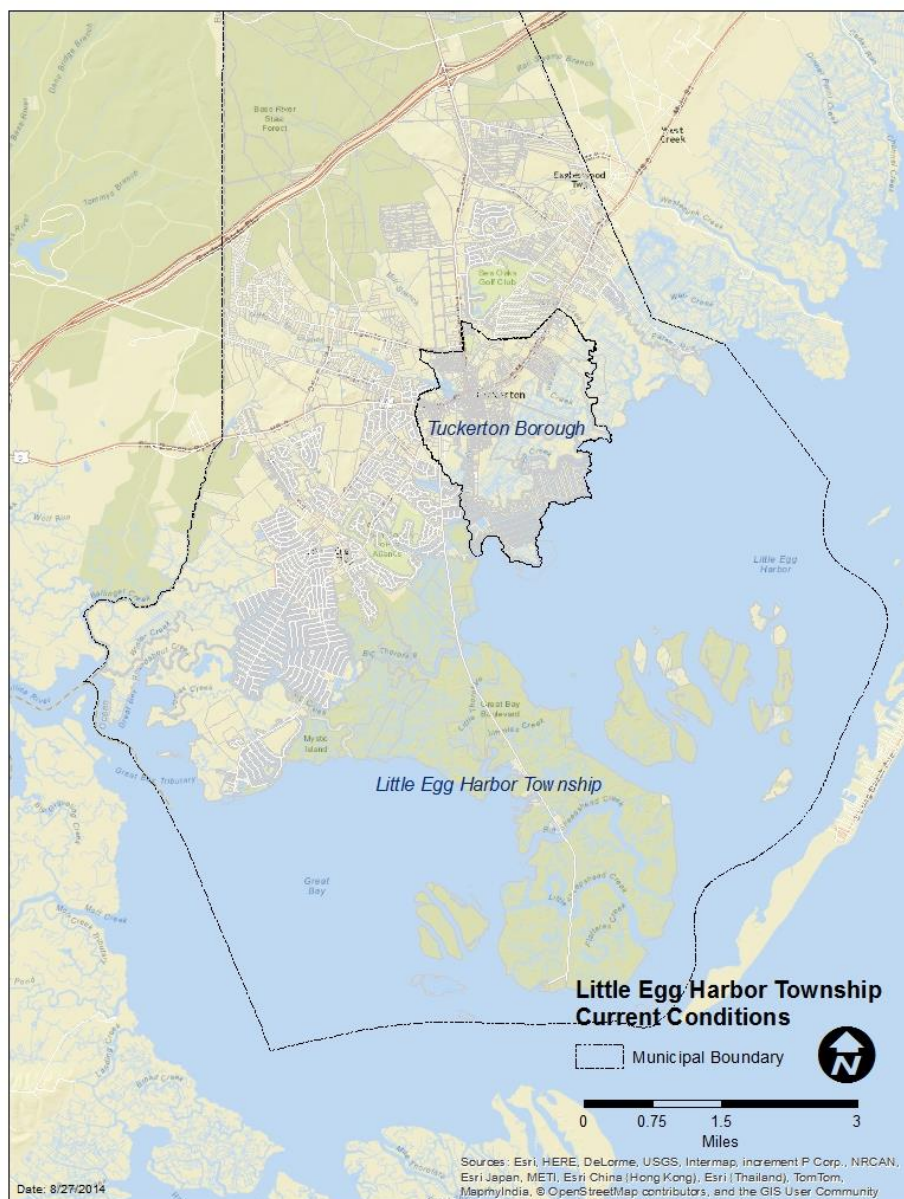




## LITTLE EGG HARBOR TOWNSHIP VULNERABILITY AND EXPOSURE ANALYSIS



FEBRUARY 2015

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**NOTE: The figures and tables presented in this report have been developed and should be used exclusively for Planning Purposes only.**

**A Note of Appreciation**  
**Members of the Little Egg Harbor Township/Tuckerton Borough**  
**Joint Steering Committee**

This report would not have been possible without the guidance, insights and active participation of the **Little Egg Harbor Township/Tuckerton Borough Joint Steering Committee**. Following are the names of the members of the Committee:

**Lisa Auermuller** ..... Jacques Cousteau National Estuarine Research Reserve  
**Sam Colangelo** ..... Tuckerton Borough Council  
**Jim Edwards** ..... Tuckerton Borough Council  
**Mark Ellis** ..... Little Egg Harbor Codes Officer  
**Michael Fromosky** ..... Little Egg Harbor Township  
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**James Edwards** ..... Tuckerton Borough Council  
**Marilyn Kent** ..... Tuckerton Beach Association  
**Susan R. Marshall** ..... Mayor, Tuckerton Borough  
**David McKeon** ..... Director, Ocean County Department of Planning  
**Earl Sutton, Jr.** ..... Little Egg Harbor Municipal Utilities Authority  
**Mark Villinger** ..... Principal Planner, Ocean County Department of Planning

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## RISK ASSESSMENT

### INTRODUCTION

Over the past nine years New Jersey has experienced eleven flood-related events that were declared Federal Disasters by the President of the United States. Currently there is consensus among numerous scientifically-based studies that the state can expect to experience an increasing rate and intensity of storms in the foreseeable future<sup>1</sup>. Given New Jersey's settlement patterns, with extremely high-density residential and commercial development along its coastal fringe, and in light of the economic return the state depends upon from tourism at the shore – approximately \$35.9 billion of state GDP in 2013, or 6.9% of the state's economy<sup>2</sup> - it's particularly important to evaluate the **potential** risk and vulnerabilities inherent in exposure to such storms. The extent of vulnerability has considerable consequences for the health of the state's residents, ecosystems, natural and built environments. And understanding risk is particularly important in guiding rebuilding and recovery strategies and financial investment.

The purpose of a risk assessment is to evaluate vulnerability to hazards a community is likely experience. The vulnerability assessment can then serve as a framework for identifying and prioritizing those actions that most effectively reduce or avoid future losses. The technical definition of the term "**risk**" is expected future losses; **vulnerability** is the tendency of something to be damaged when exposed to a hazard and **exposure** is the value of structures and number of people exposed to hazards. This assessment is intended to provide a basis for Little Egg Harbor Township's recovery and mitigation strategies by evaluating vulnerability and quantifying exposure.

One of the more prominent hazards that Little Egg Harbor Township faces is flooding caused by extreme rainfall events, storm surge and sea level rise. Flooding events are likely to be accompanied by coastal erosion - particularly along unprotected, bay-side coastal areas - which will exacerbate flood hazards. Consequently, this Risk Assessment focuses on the Township's vulnerability to flood hazards and evaluates the types, number and value of structures within the Township that are exposed to flood and storm surge events as well as projections of sea level rise.

### BACKGROUND

Little Egg Harbor Township is located in southern Ocean County and is bordered by Stafford, Eagleswood and Bass River Townships. The Borough of Tuckerton is entirely encompassed within Township borders. The Township is bisected by the Garden State Parkway - the portion north of the Parkway is within the New Jersey Pinelands Area and the portion of the Township south of the Parkway is regulated by New Jersey's Coastal Facilities Review Act. The municipality's year-round population, according to the 2010 Census, was 20,065<sup>3</sup>, a 26% increase as compared to the 2000 census count of 15,945. Little Egg Harbor is approximately 74 square miles in area, almost 9% of which is developed (4,137 acres) - the bulk of which is clustered along the Township's coastal areas - 30% of the Township is forested (primarily north of the Parkway), and less than 1% is barren or in agricultural use. The largest portion of the area of the municipality, approximately 37% (17,368 acres), is comprised of water bodies including Great Bay and Little Egg Harbor and an additional 24% (11,444 acres) is wetlands (*see Figure 1 below and Table 1 on page 5*), which provide vital protection against coastal flooding and storm events.

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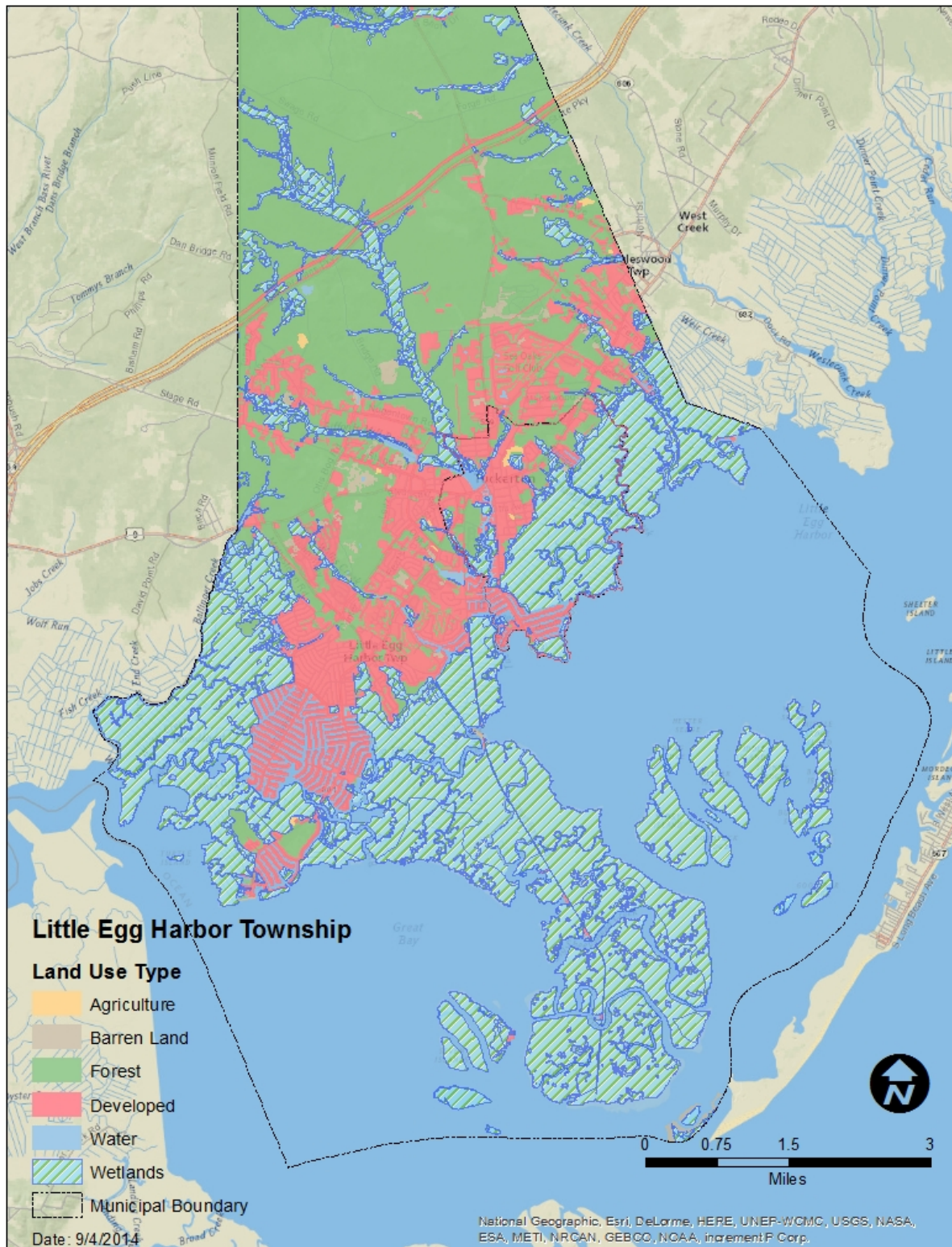
<sup>1</sup> See "What We Know, The Realities, Risks And Response To Climate Change", American Association for the Advancement of Science, 2014. "Climate Change 2013, The Physical Science Basis" Intergovernmental Panel on Climate Change. Climate Change 2014, Impacts, Adaptation and Vulnerabilities", Intergovernmental Panel on Climate Change. "State of the Climate, New Jersey", 2013, Rutgers Climate Institute.

<sup>2</sup> The figure represents direct, indirect and induced impacts. Source: "The Economic Impact of Tourism in New Jersey, Tourism Satellite Account, Calendar Year 2013", Tourism Economics

<sup>3</sup> American Community Survey, 2008-2012, U.S. Census Bureau



Figure 1: Land Use Land Cover



## 1. VULNERABILITY

In this section, various factors of vulnerability with respect to flooding from future storm events are examined, including:

- The extent of the Township's flood zones;
- The amount of Federal disaster recovery assistance that has been made available to the municipality and individual property owners to address damage from prior storm events the Township has experienced;
- Impacts of current and projected sea level rise and inundation on the Township's marshes and wetlands;
- The relationship of the location of the Township's community facilities and infrastructure to the its flood zones; and
- The relationship of the Township's zoning districts to its flood zones.

### 1.1 Flood Zones

The Federal Emergency Management Agency (FEMA) defines flood zones as geographic areas subject to varying levels of flood risk and types of flooding. These zones are delineated on Flood Insurance Rate Maps (FIRMs) and Flood Hazard Boundary Maps (FHBMs). FEMA delineates four different flood hazard areas:

- Special Flood Hazard Areas – High Risk;
- Coastal High Hazard Areas – High Risk;
- Moderate and Minimal Risk Areas; and
- Undetermined Risk Areas.

Each of these areas has an associated series of flood zones defined by FEMA and included the **Flood Zones Table** provided in **Appendix 1** of this report. March, 2014 Preliminary Flood Plain maps currently available for Little Egg Harbor, illustrated in **Figure 2** below, show that in total, almost 36%, or less than 17,000 acres, of the area of the Township is located within a Special Flood Hazard Area. The remainder of the Township is either designated as a minimal risk zone or open water.

#### **A Zone**

Special Flood Hazard Areas (SFHA) have a 1% annual probability of being inundated by flooding and structures located in these zones have a 26% chance of flooding within the life of a standard 30-year mortgage. These are areas of highest vulnerability to flooding inundation. The A zone, one of three SFHA zones within the Township, encompasses 3.6% (1,695 acres) of the total area of the municipality.

#### **AE Zone**

As with the A Zone, the Township's second SFHA, the AE Zone, encompasses a relatively small proportion of the area of the Township, slightly more than 4.5%, or approximately 2,149 acres. However, the developed portion of the AE zone comprises 23% of the township's developed area.

#### **VE Zone**

The VE Zone is a Coastal High Hazard Area (CHHA), which has a 1% annual probability of being inundated by flooding and is subject to high velocity wave action. As with properties within the SFHA, structures within a CHHA zone have a 26% chance of flooding within the life of a standard 30-year mortgage. In Little Egg Harbor the VE Zone encompasses the peninsula that extends into the Great Bay and the island areas within the Township boundaries. In total, this zone covers 28% of the area of the Township but it is primarily comprised of water and wetlands. **It's important to note that in March, 2014 the Township argued that areas on the seaward side of Iowa Court and East Anchor Drive should not be included the VE Zone. Evidently these changes have been approved and these areas will likely be reclassified in the**

**AE Zone.** However, as of the date of this report they have yet to be reflected in the digital FIRM maps available on FEMA's web site and not factored into the following tables and maps (see Appendix 4).

### **.2 Pct. Annual Chance**

The .2% Zone, also referred to as the 500-year flood plain and X-Shaded zone, defined as a Moderate Risk Zone, encompasses .4% (189 acres) of the area of the Township. According to FEMA, buildings in Moderate and Minimal Risk zones can be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems.

### **X-Unshaded Zones**

The entire area of the Township is included within a FEMA flood zone. The areas of the Township **outside** the SFHAs, CHHAs and the areas with a .2 Percent Annual chance of flooding, are areas of minimal risk, also referred to as the X-unshaded Zone. These areas encompass 39% (18,285 acres) of the area of the Township, mostly the northerly portion of the municipality.

**Figure 2: FEMA Flood Zones**

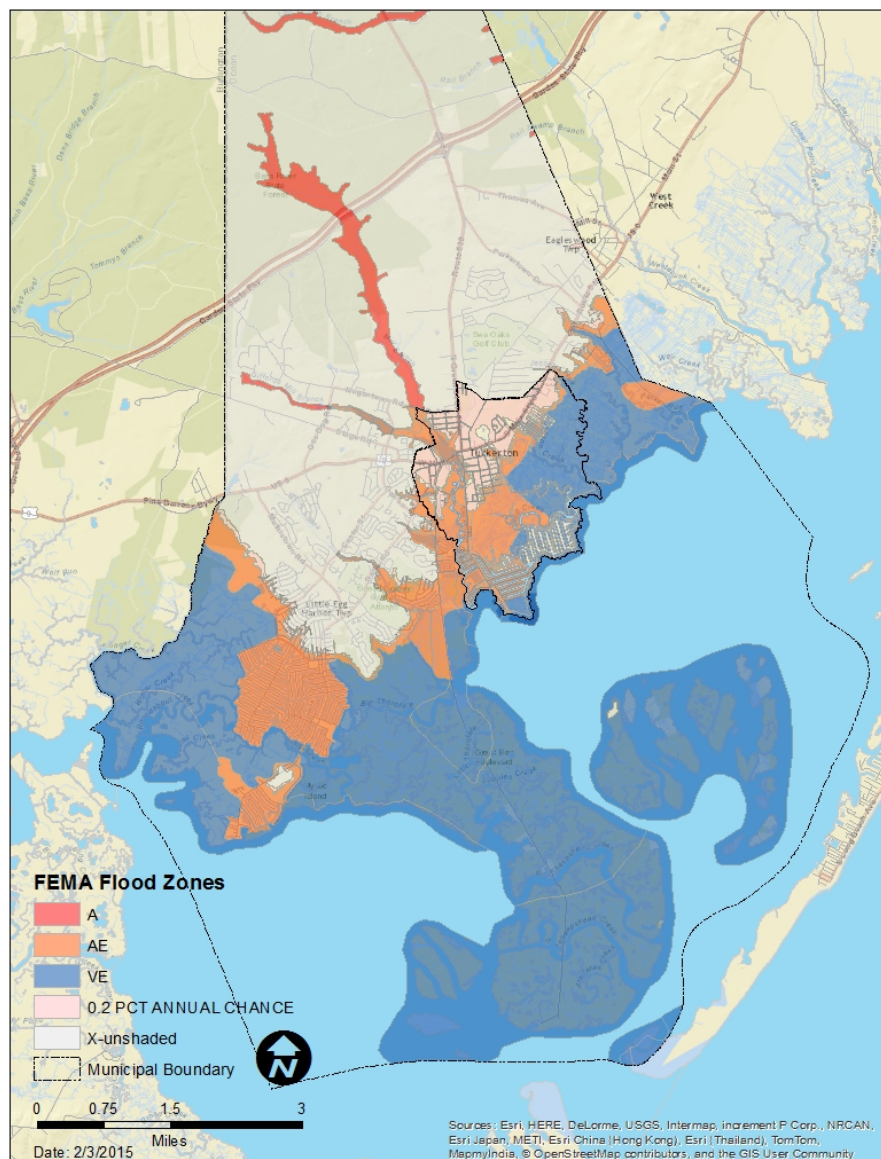
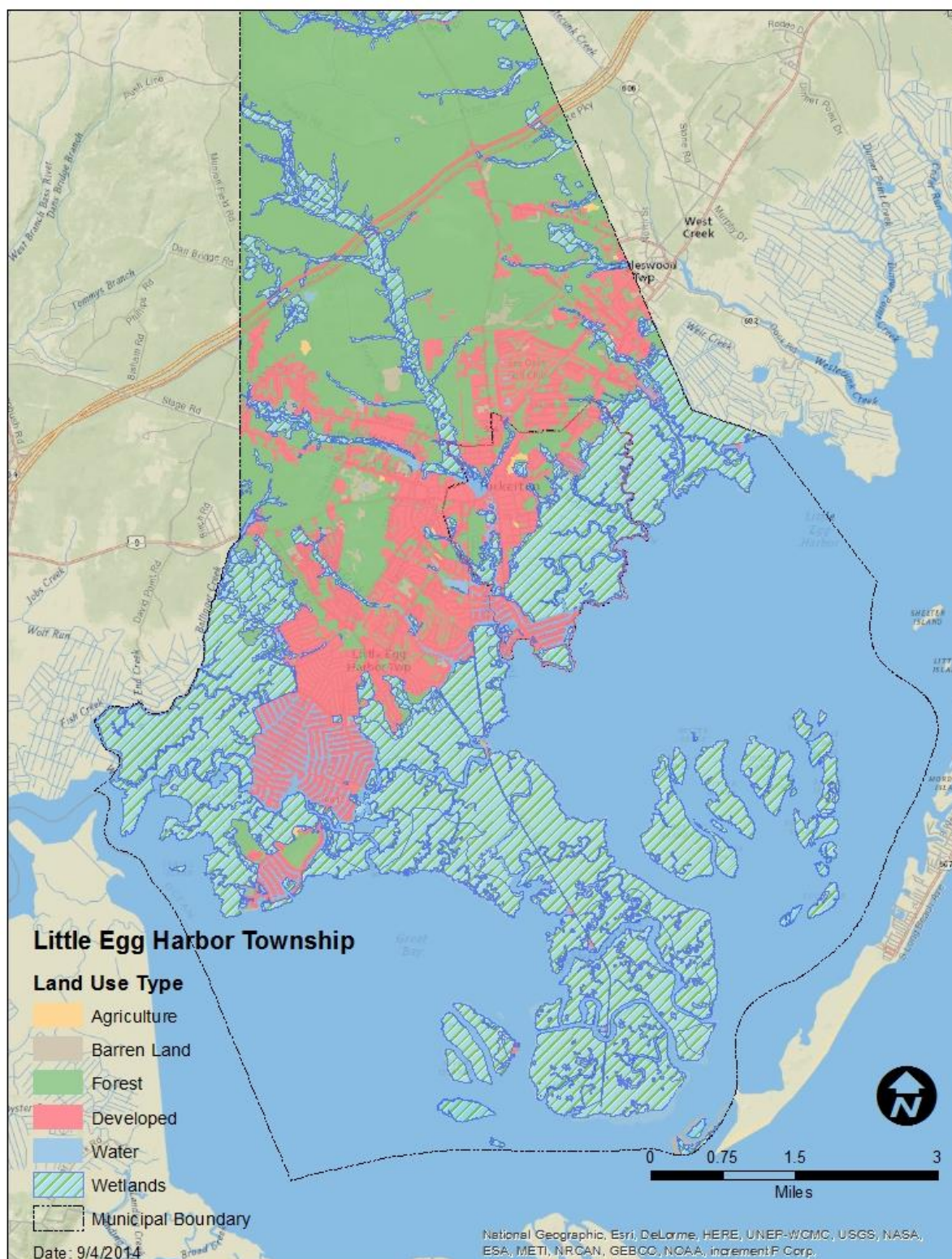




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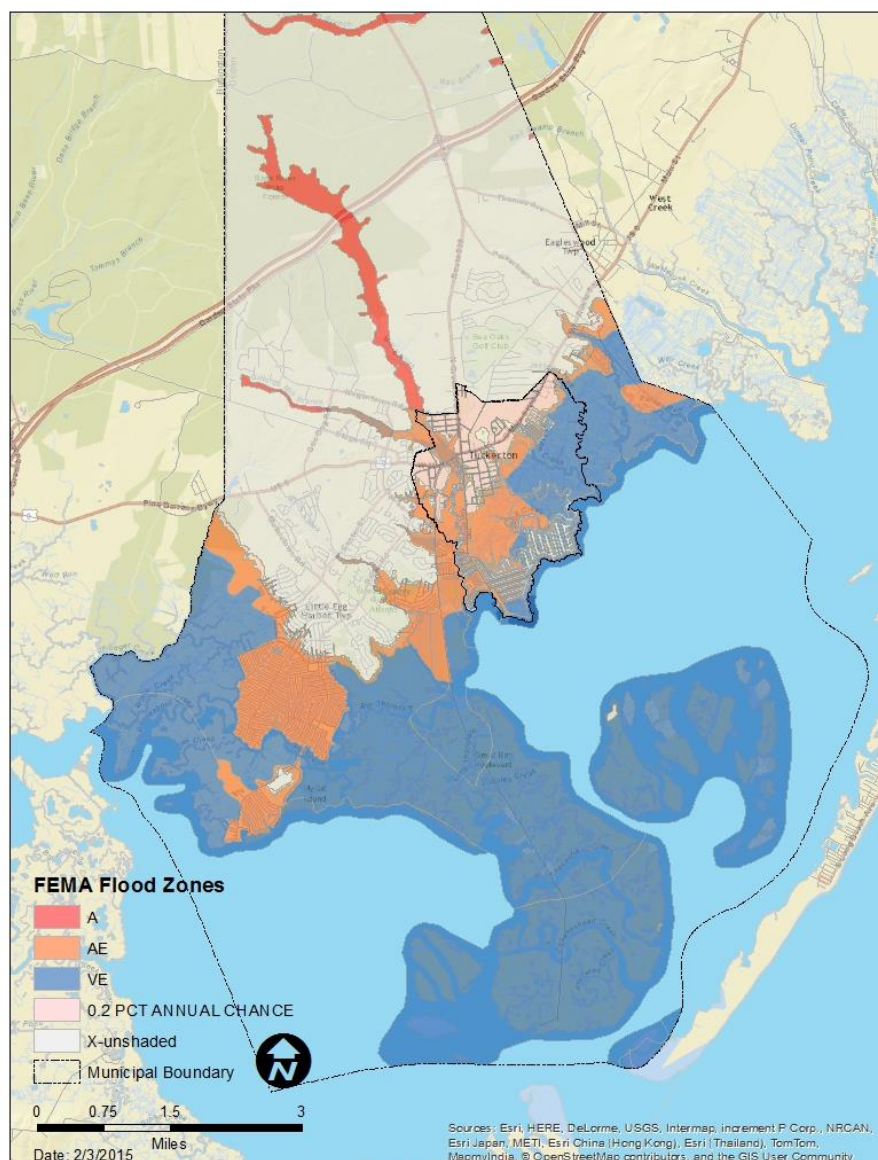
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**Table 1: Land Use Type by Flood Zone**

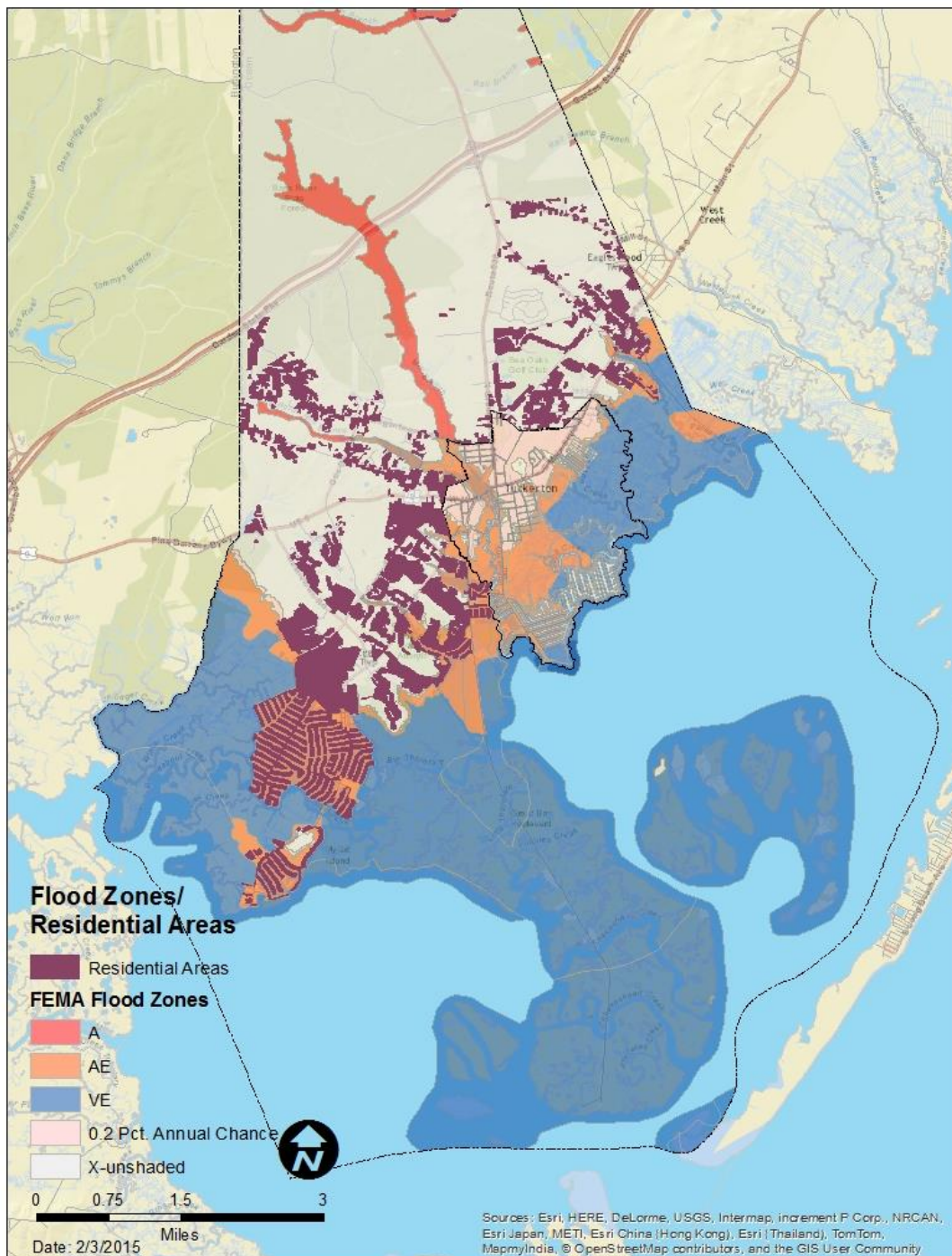
Land Use Type	Total Area (acres)	Area in A Zone	Area in AE Zone	Area in VE Zone	.2 Pct Annual Chance	X-Unshaded	Open Water
Agriculture	33	7	3	0	1	22	0
Barren	303	44	2	35	0	222	0
Forest	14,056	180	171	14	28	13,664	0
Developed	4,137	11	940	48	103	3,035	0
Water	17,369	138	373	4,906	0	39	11,913
Wetlands	11,445	1,315	660	8,109	57	1,304	0
<b>Total</b>	<b>47,343</b>	<b>1,695</b>	<b>2,149</b>	<b>13,112</b>	<b>189</b>	<b>18,285</b>	<b>11,913</b>
<b>% of Total</b>	<b>100%</b>	<b>4%</b>	<b>5%</b>	<b>28%</b>	<b>0%</b>	<b>39%</b>	<b>25%</b>
<b>Residential</b>	<b>2,977</b>	<b>5</b>	<b>833</b>	<b>5</b>	<b>89</b>	<b>2,045</b>	<b>0</b>

**Table 1** shows that 24% of the Developed Area of Little Egg Harbor (999 acres) is located in the A, AE, or VE FEMA flood zones. As noted above, these zones have the highest vulnerability to regular flooding inundation. **Table 1** also indicates that over 84% (843 acres) of the developed area of the Township located within these highly vulnerable zones is occupied by residential land uses. 99% of this residential area (833 acres), encompassing the relatively large residential enclaves of Osborne and Mystic Islands, is located within the AE Flood Zone. 5 acres is located in the A Zone and 5 acres is located in the VE Zone. Residential areas in these highly vulnerable zones constitute over 28% of the total residential area of Little Egg Harbor. Homeowners in these areas are required to have flood insurance if they have a mortgage and they have a 26% chance of experiencing a flood over the course of a 30-year mortgage term<sup>4</sup>.

<sup>4</sup> FEMA Map Service Center at <https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA+Flood+Zone+Designations>



Figure 3: Residential Areas/FEMA Flood Zones



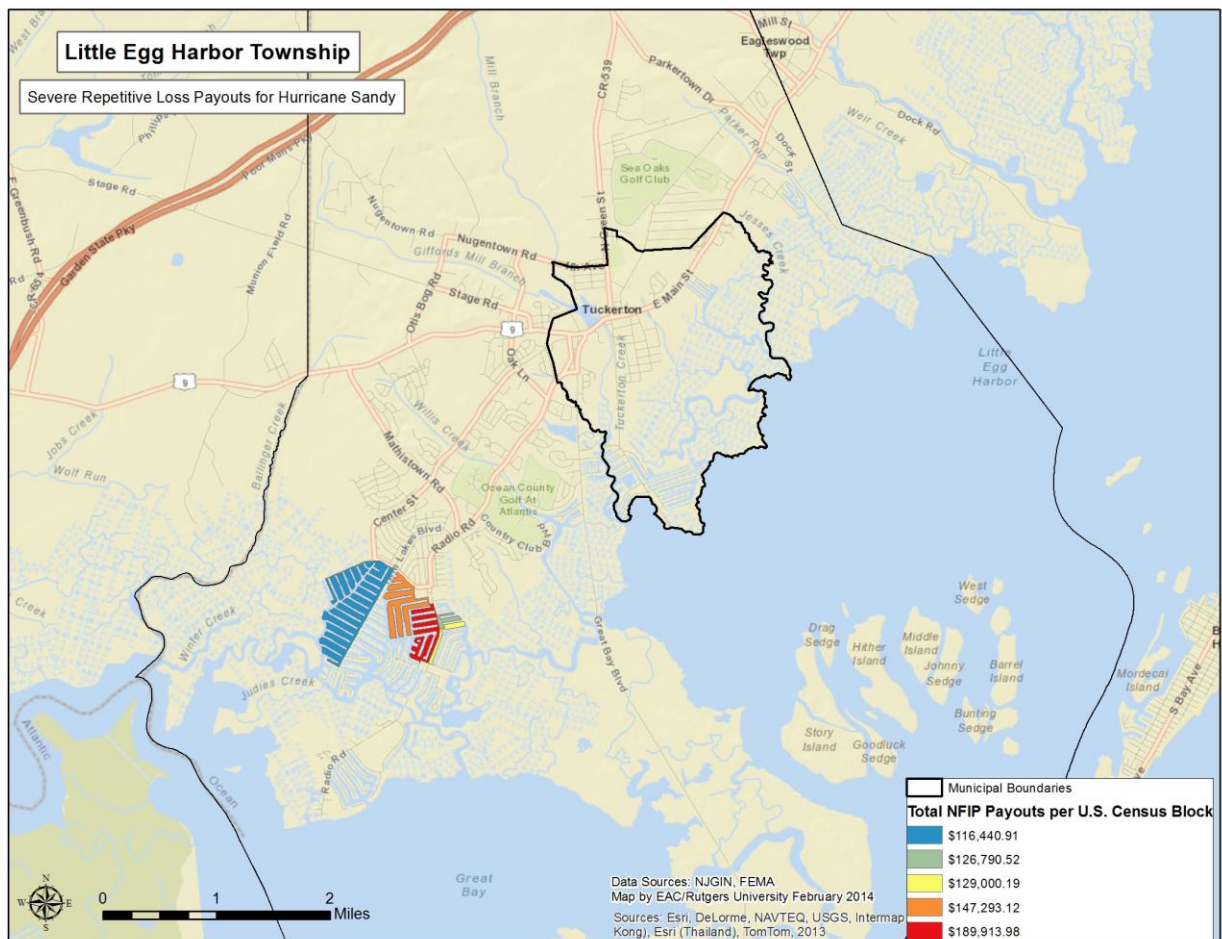
### 1.2 Federal Recovery Assistance

There are three principal sources of Federal assistance available to municipalities and individual property owners for disaster recovery: National Flood Insurance Program (NFIP), Public Assistance (PA), and Individual Assistance (IA). It's important to note that all payout figures quoted below are provided at the census block group or tract level to ensure data anonymity.

### 1.2.1 National Flood Insurance Program (NFIP)

The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the program. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. FEMA defines a Repetitive Loss (RL) property as "any insurable building for which two or more claims of more than \$1,000 were paid through the NFIP within any rolling ten-year period, since 1978." A Severe Repetitive Loss (SRL) is defined as "a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claim payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding \$5,000 and with cumulative amount of such claims payments exceeding \$20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property. The two claims must have occurred within any 10-year period and must be greater than 10 days apart.

Figure 4: Severe Repetitive Loss Payouts



According to the information on NFIP payouts in the Repetitive Loss database held by the New Jersey Department of Environmental Protection for Hurricane Sandy, as of 11/30/13, there were a total of 6 claims payments in Little Egg Harbor for a total of \$709,400 made to properties concentrated within the Township's Osborne Island residential neighborhood. Payouts ranged from \$116,440 to \$189,900. An examination of the payout data maps reveals that several of the census block group areas where payouts were made in the Township following Sandy were the same areas where payouts were made

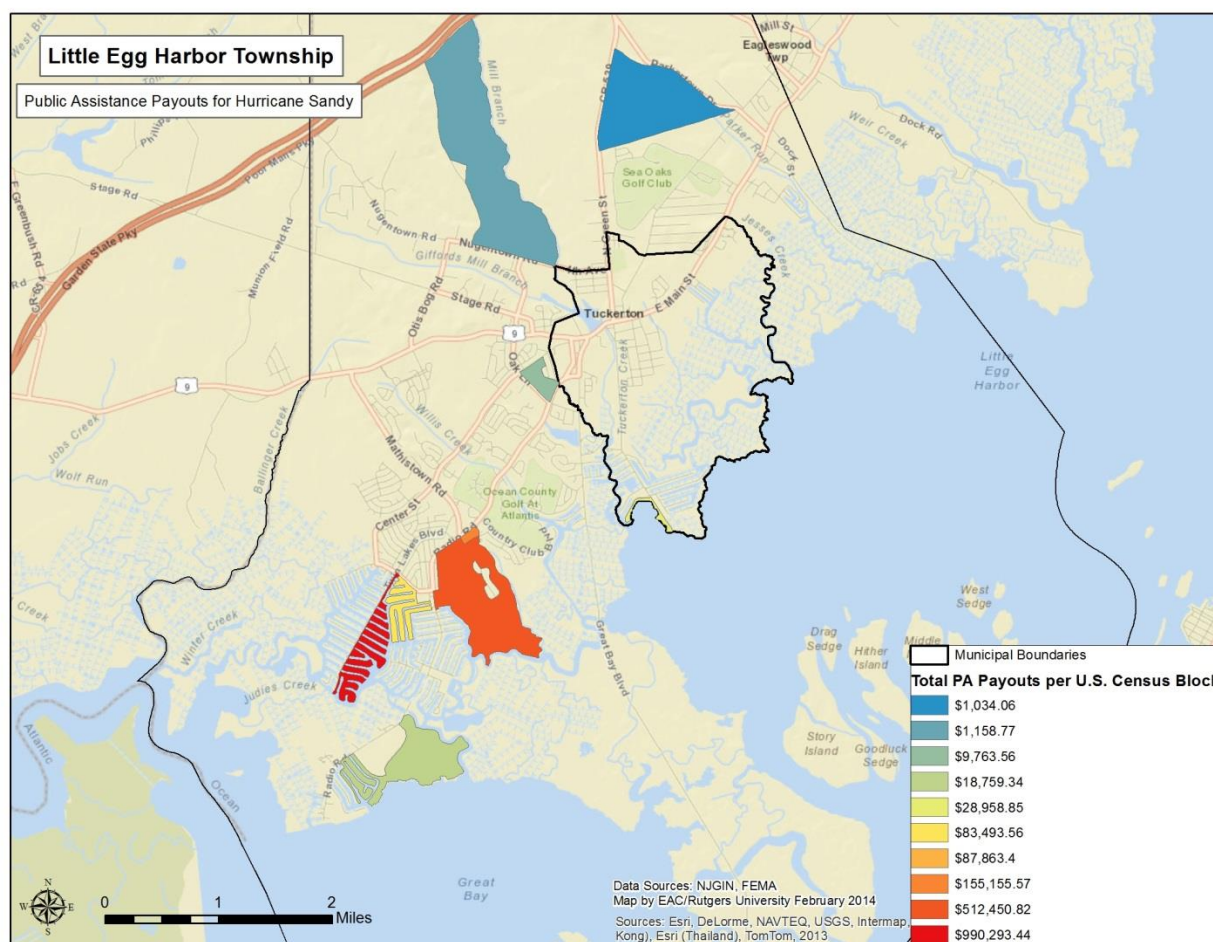


following Hurricane Irene and unnamed Storm Events #1206, which was declared a major disaster on March 3, 1998 and #1897 which was declared a major disaster on April 2, 2010.<sup>5</sup> (See **Appendix 3: Pre-Sandy Payout Maps**).

### 1.2.2. Public Assistance (PA)

FEMA's Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. This program provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process. Following Hurricane Sandy, there were a total of 33 public assistance grants made to the Township for a total amount of \$1,881,900, as of 11/30/13.

Figure 5: Public Assistance Payouts



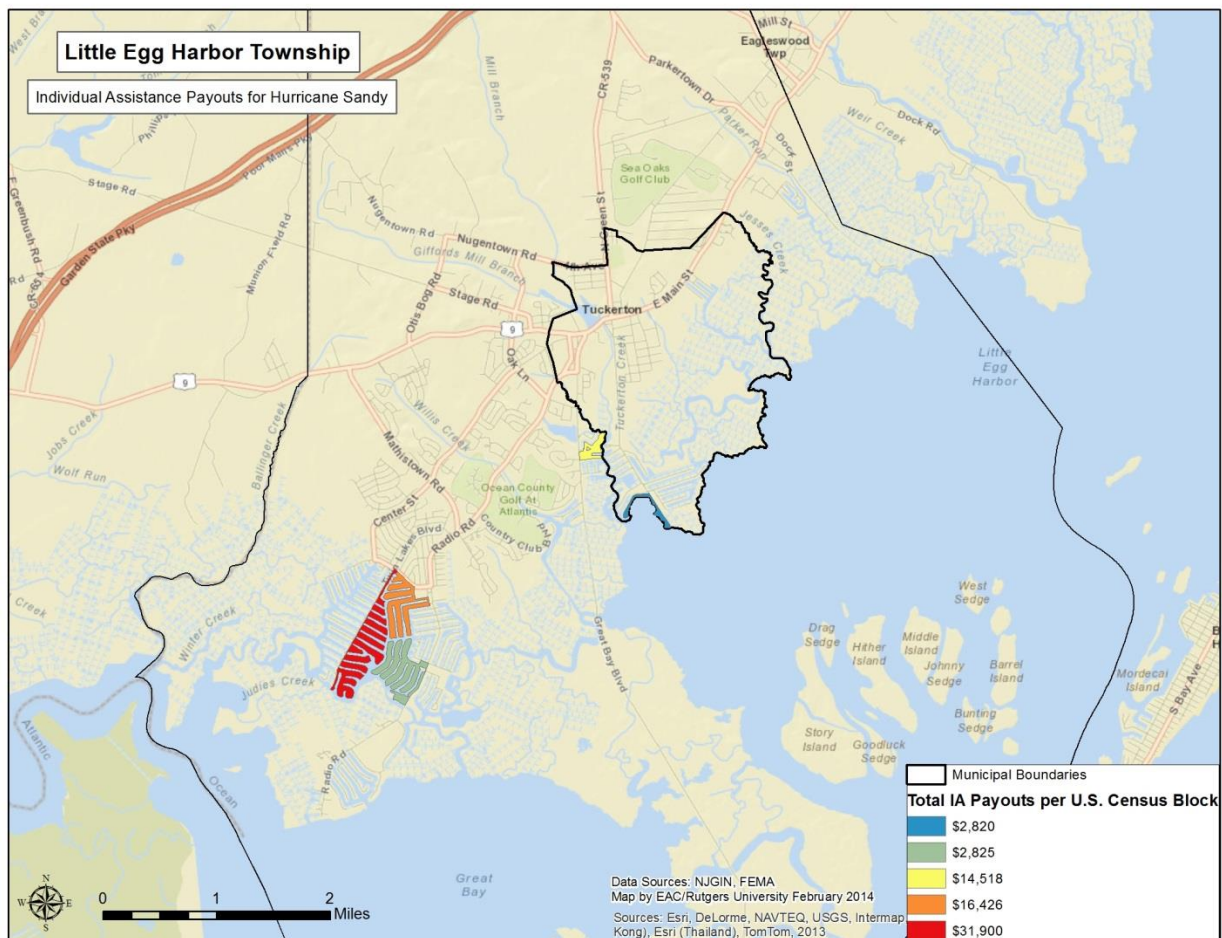
<sup>5</sup> Storm Event #1206, an un-named storm, primarily affected Atlantic, Cape May and Ocean Counties, activating Federal Public, Individual and Hazard Mitigation Assistance programs. Storm Event # 1897 refers to the incident period of March 12, 2010 to April 15, 2010, a Nor'easter for which Governor Christie requested a declaration of Public Assistance for 12 counties on March 26, 2010 and for which President Obama declared a major disaster on April 2, 2010.



### 1.2.3. Individual Assistance (IA)

FEMA Individual Assistance (IA) program provides financial or direct assistance to individuals and families whose property has been damaged or destroyed as a result of a federally-declared disaster, and whose losses ***are not*** covered by insurance. It is meant to help meet critical expenses that cannot be covered in other ways. This assistance provides for temporary housing, repair or replacement of a primary residence that is not covered by insurance. Following Sandy, a total of 13 individual assistance payouts were made to qualifying individual and families living in Little Egg Harbor, for a total payout of \$68,500, as of 11/30/13. Payment amounts ranged from \$2,800 to \$31,900 per census block group.

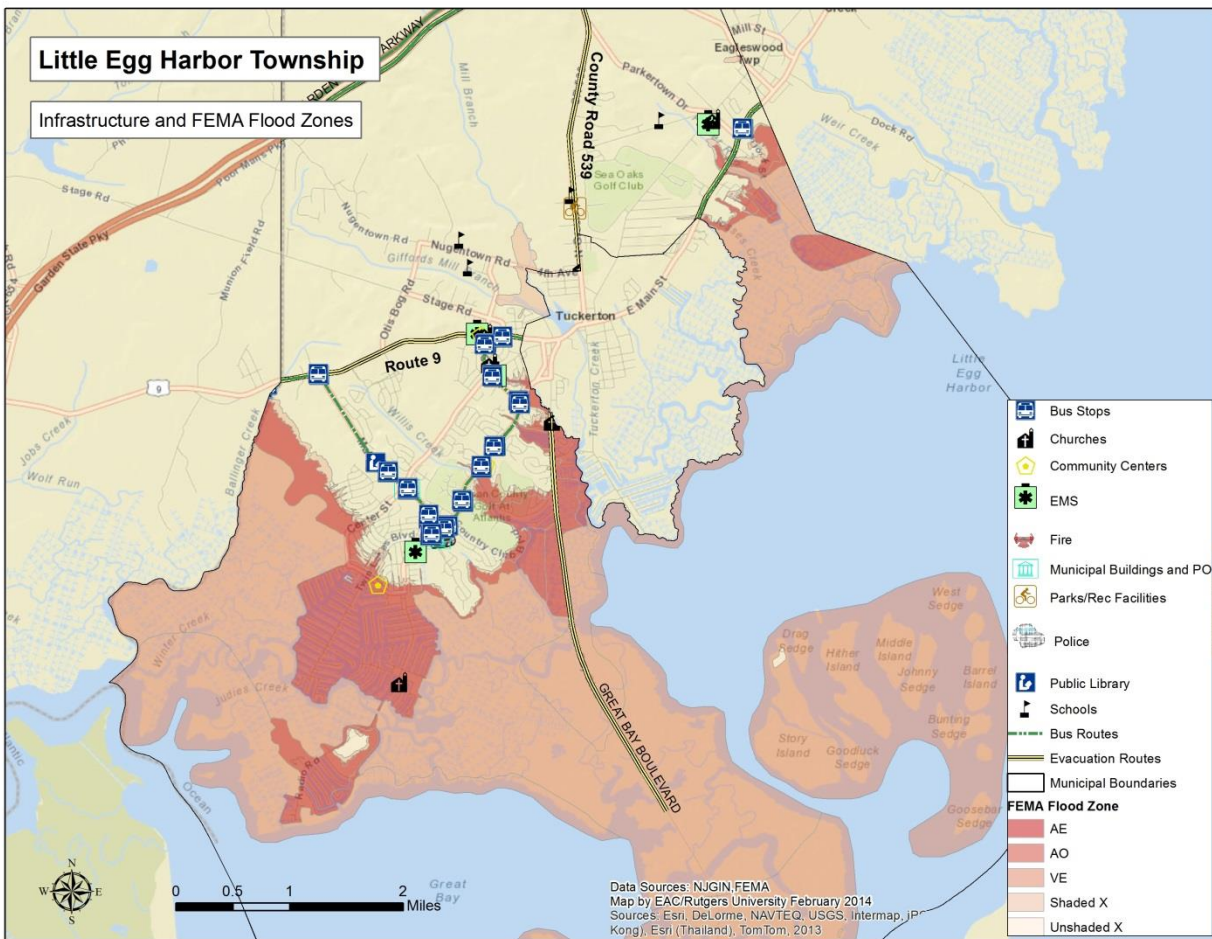
Figure 6: Individual Assistance Payouts



### 1.3. Critical Services and Infrastructure

Little Egg Harbor Township's capacity to respond to severe storms and flooding events is, to a large extent, predicated on the extent to which these events are likely to impact critical infrastructure - such as evacuation routes – and emergency services – such as police and fire services. The following map shows the location of critical facilities throughout Little Egg Harbor and their proximity to areas of probable future inundation.

Figure 7: Infrastructure Exposure



**Figure 7**, above, shows that the AE Special Hazard Flood (1% annual flood risk) Zone extends inland through the Township to the intersection of US Highway 9 and Firehouse Drive. The map indicates that the entire 1.7 mile stretch of Great Bay Boulevard through the Township is within the AE flood zone. Access on this roadway is likely to be impeded during flooding events. This is significant because Great Bay Boulevard is Little Egg Harbor’s principal north/south evacuation route. Fortunately, the Township’s administration, police and fire stations and all but approximately 100 linear feet of a bus route are not within flood zone boundaries. However, the community center at 319 W. Cala Breeze Way and 2 of the municipality’s churches – the Living Water Christian Center at 1103 Radio Road, and the Jersey Shore Baptist Chapel at 249 Great Bay Blvd. - are located within the AE zone. During flooding events, community centers, churches and schools frequently are used to shelter families that are forced to evacuate residential areas in peril. Due to their location, these church and community center buildings would not be suitable shelter sites.

As is evident from the map above, several of the Township’s roadways, either segments or entire lengths, are within flood hazard areas. A list of the names of these roadways is provided in **Appendix 2** to this report.

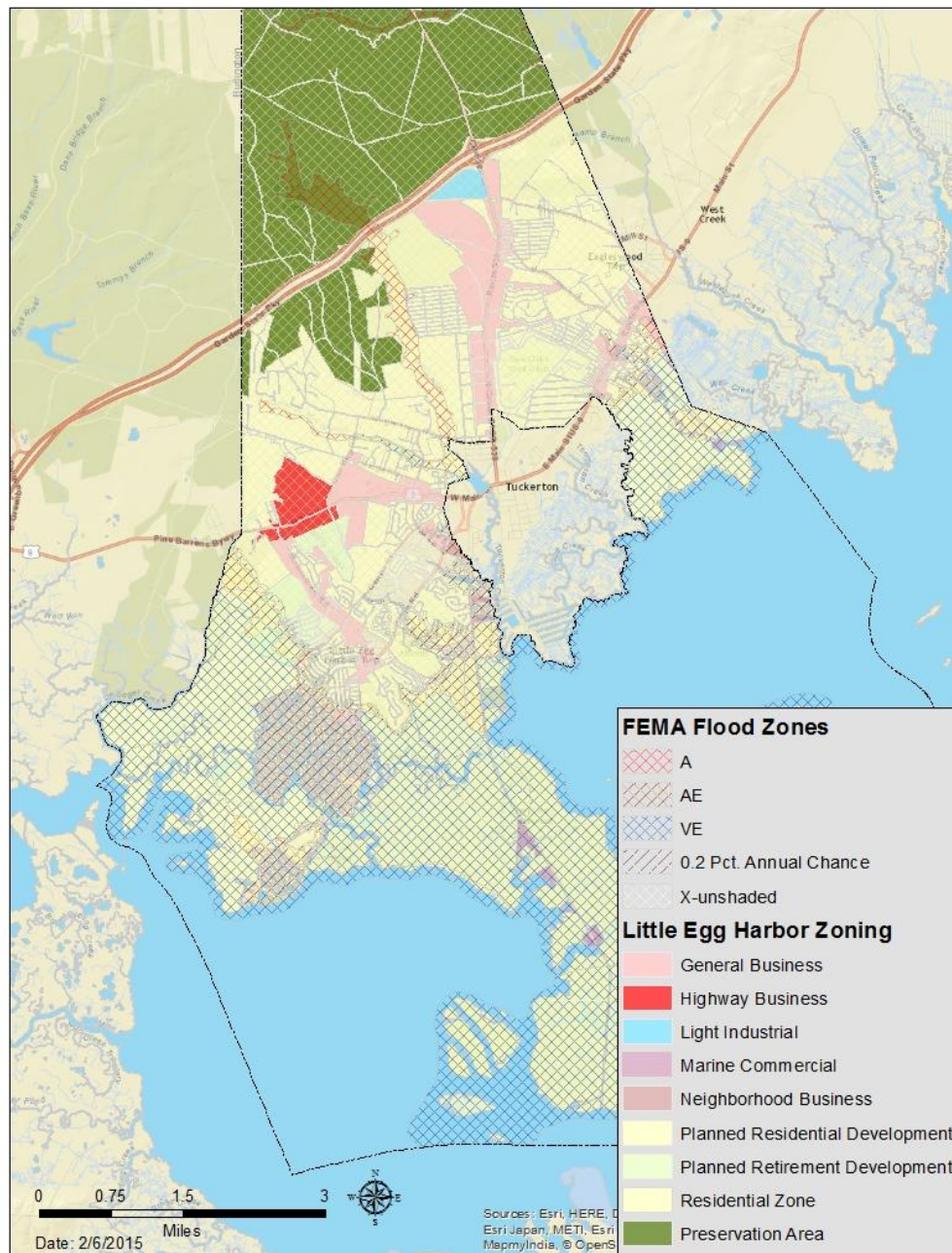
#### 1.4. Zoning and Land Use

A municipality’s zoning regulations determine where certain land uses will occur, and how buildings will be configured on lots within a range of use zones. For generations New Jersey’s coastal communities



have permitted relatively dense residential and commercial development patterns within close proximity to coastlines to take advantage of the attractive and unparalleled natural resource of the state's shore areas. This development has largely occurred without regard to exposure to storms and flooding. However, as sea levels rise and the probability of more intense and frequent storm events increases, it is necessary to evaluate the extent to which these historic development patterns put people and property in increasing jeopardy and consider alternatives to minimize or avoid such risk.

**Figure 8: Flood Zones/Zoning**



**Figure 8** and **Table 2** reveal that substantial portions of Little Egg Harbor's zoning districts are located within FEMA flood zones. Overall, 54% of zoned areas in Little Egg Harbor Township are designated for some form of residential use – either single or multifamily. Over 34% of areas zoned for residential uses



are located within the A, AE or VE zones (1% annual flood risk) in the Township and therefore are at considerable risk. 88% of the Township's Neighborhood Business district (14.1 acres) and 4% of the General Business district (50 acres) are located in the AE zone.

In addition to flood risk, the portions of the residential areas within the VE Zone, 51%, are subject to storm-induced velocity wave action. This is also the case for 83% of areas zoned Marine Commercial and 61% of areas zoned Waterfront Development that are located in the VE zone.

**Table 2: Zoning/FEMA Flood Zones**

Zoning District	FEMA Flood Zones					Total	Acres in A, AE or VE	% in A, AE or VE
	A	AE	VE	.2 Pct. Annual	X-Unshaded			
Forest Area	371	0	0	0	1,204	1,575	371	24%
Forest Area Cluster	0	0	0	0	83	83	0	0%
General Business	0	50	12	12	1,250	1,324	62	5%
Highway Business	0	0	0	0	256	256	0	0%
Light Industrial	0	0	0	0	84	84	0	0%
Marine Commercial	0	16	78	0	0	94	94	100%
Multi-Family Residential	0	26	0	8	183	217	26	12%
Neighborhood Business	0	14	0	1	1	16	14	88%
Pinelands Village	30	0	0	0	52	81	30	36%
Planned Residential Develop.	0	0	0	0	349	349	0	0%
Planned Retirement Develop.	0	97	57	23	267	444	153	35%
Preservation Area	969	0	0	0	8,212	9,181	969	11%
Residential Zone	285	1,371	8,226	121	5,076	15,079	9,882	66%
Senior Citizen/General Business	0	0	0	0	2	2	0	0%
Waterfront Development	0	59	92	0	0	152	152	100%
<b>Total</b>	<b>1,654</b>	<b>1,633</b>	<b>8,465</b>	<b>165</b>	<b>17,019</b>	<b>28,937</b>	<b>11,752</b>	<b>41%</b>

### 1.5 Wetlands Impacts

A comparison of **Figures 1** (page 2), **9** (page 17) and **10** (page 18) illustrate that by 2050 a considerable portion of the protective marsh areas that currently buffer vast extents of Little Egg Harbor Township's coastal areas will be inundated and will not provide protection for more inland developed areas. **Table 1** on page 5 indicates that almost 90% (10,084 acres) of the Township's wetland areas are in the A, AE or VE flood zones. The extent to which these areas are vulnerable to future storm events or flooding as a result of sea-level rise is an important factor for the community to consider as it evaluates its adaptation strategy options. These tidal wetlands serve several critical functions; they furnish essential spawning, foraging, and nesting habitat for fish, birds, and other wildlife. They function as the ecosystem's "kidneys," filtering contaminants, nutrients, and suspended sediments, allowing for higher water quality than would otherwise occur. Important finfisheries and shellfisheries are supported by tidal wetlands. They sequester more carbon than any other habitat in the watershed. And notably, they represent our first line of defense against storm surge and flooding. Acre for acre, tidal wetlands likely provide more ecosystem services than any other habitat type in the watershed.<sup>6</sup>

Salt marsh vegetation is adapted to tidal flooding. However, permanently inundated marshlands risk die-off and conversion to open water. Consequently, tidal wetlands are particularly susceptible to sea level rise. As a report from the Partners for the Delaware Estuary indicates, "*Tidal marshes maintain an elevation relative to sea level by the gradual accumulation of dead plant matter and sediment. Whether marshes keep pace with sea level rise or not depends on many factors, such as their productivity,*

<sup>6</sup> "Climate Change in the Delaware Estuary", Partners for the Delaware Estuary, June 2010, p.29, <http://delawareestuary.org/sciencereports>

*sediment supply from other areas, nutrient loadings, wave and current energies, and the rate of sea level rise.”*<sup>7</sup> Marsh survival, therefore, depends on a balance between erosion and drowning and marshland accretion. Although it appears that accretion has slowed inundation within the Township’s coastal areas somewhat, it’s unclear whether the rate of future accumulation will keep pace with rising sea levels. And some reports suggest that it’s not likely that the balance can be maintained.<sup>8</sup>

## 2. INUNDATION IMPACTS

A report published by Kenneth Miller and Robert Kopp, of Rutgers University indicates that over the past century, sea levels along the New Jersey coast have risen at a rate of approximately 3.8 mm (.15 inches)/year, roughly half of which is attributable to coastal subsidence. This rate has gradually accelerated into the current century.<sup>9</sup> According to Kopp, 70,000 more people were affected by Hurricane Sandy in the NY/NJ area due to sea level rise (SLR) than would have been the case had there been no such increase<sup>10</sup>. Rising sea levels will likely result in permanent inundations of areas that currently are frequently flooded and frequent inundation of areas that only episodically flood currently.

Permanent inundation from sea level rise is only one of the hazards that climate change presents to New Jersey’s coastal property and infrastructure. Higher average sea levels lead to higher storm surges and increased flooding risks<sup>11</sup>, even if the intensity or frequency of storms remains unchanged<sup>12</sup>. Kemp and Horton (2013) found that, while the record 13.9-foot storm tide in New York Harbor during Hurricane Sandy was primarily due to the coincidence of the strongest winds with high tide, SLR driven by historical climate change added more than one foot to that 13.9 foot total<sup>13</sup>. The impact of climate change on flooding during coastal storms is greater and more immediate than the impacts of inundation from gradually rising sea levels<sup>14</sup>. Potential damage of flooding from hurricanes and Nor’easters is projected to increase by 14%-36% in New Jersey by 2030, due to sea level rise.

Changing climate conditions are also predicted to drive increasing storm intensity. Recent research indicates that New Jersey is receiving more of its annual precipitation from intense storms than it has in the past<sup>15</sup>. This increases the risk of flash floods, urban flooding, and coastal flooding, which are all closely tied to heavy precipitation events<sup>16</sup>.

In order to assess the extent to which the Little Egg Harbor Township is exposed to flood inundation and storm surge it’s necessary to evaluate the probable impacts of near-term sea-level rise for the community. An evaluation for the year 2050 is particularly informative because of the extent of possible impacts of predicted sea-level elevations by that time period. **Figure 9** (page 17) illustrates that these impacts will occur in what is presently the most densely populated residential portions of the Township.

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<sup>7</sup> *ibid*

<sup>8</sup> Atlantic Sea Level Rise, Lagoonal Marsh Loss and Wildlife Habitat Implications, Erwin, Michael R., University of Virginia, USGS, <http://www.pwrc.usgs.gov/resshow/erwin1rs/erwin1rs.htm>

<sup>9</sup> “A Geological Perspective On Sea-Level Rise and Its Impacts Along the U.S. Mid-Atlantic Coast”, K. G. Miller, R.E. Kopp, B.P. Horton, J.V. Browning, A. C. Kemp, AGU Publications, Department of Earth and Planetary Sciences, Rutgers University, 5 Dec. 2013

<sup>10</sup> Robert Kopp interview, WHYY “Radio Times” interview, July 1, 2014

<sup>11</sup> Frumhoff et al. 2007

<sup>12</sup> Frazier et al. 2010

<sup>13</sup> American Climate Prospectus, Economic Risks in the US, 2014

<sup>14</sup> *Ibid*

<sup>15</sup> “State of the Climate: New Jersey, 2013”; Broccoli, Kaplan, Loikith, Robinson; Rutgers Climate Institute

<sup>16</sup> American Climate Prospectus, Economic Risks in the US, 2014

### **Exposure Analysis Procedure**

This section of the analysis estimates the value of properties potentially exposed to flooding and sea level rise for 2050 sea level rise projections. ***It's important to stress that the data presented herein are intended for planning purposes only.*** In estimating the extent of the Township's future exposure as a result of flood inundation it was necessary to perform a detailed geographic analysis of the community. This analysis began with a determination of the current mean higher high water (MHHW) tide levels at the Township's coast. MHHW is a measure of the higher of the two high tides that occur each day, averaged over a 19-year period.<sup>17</sup> Once the MHHW was established, it was necessary to determine the extent to which areas within the Township would be subject to flooding under various future scenarios – for the purpose of this assessment, predicted sea-level rise for the periods 2030, 2050 and 2100 were considered, consistent with the Miller et al. report.<sup>18</sup> However, as noted above, ***this analysis focused on projections to 2050.***

The next step of the risk assessment was to evaluate specifically which parcels within the Township were likely to be affected under the two scenarios: Mean Higher High Water Level and FEMA 1% Storm given an increase in sea-level rise for 2050 as projected by Miller et al. This was accomplished by analyzing and mapping the predicted inundation extent for each scenario. The predicted extent was then overlaid with the 2012 MOD-IV data set assembled and maintained by the New Jersey Division of Taxation and posted on the New Jersey Geographic Information Network web site<sup>19</sup>. Parcels with 10% or more inundation were included in this parcel-level calculation, under the assumption that if a parcel was less than 10% inundated it is not likely to experience significant structural damage. Parcels were also eliminated from the calculation if the structure did not overlap with the inundation extent. In addition, all parcels with units that have been elevated since Hurricane Sandy were identified, mapped and excluded from the calculation. According to data provided by Township officials, as of July 2014, 115 dwellings (48 new units and 67 existing units) have been elevated above the Base Flood Elevation in accordance with zoning regulations put into effect in Little Egg Harbor Township following the Hurricane. However, although units may be elevated above flood stage, at-grade streets and infrastructure will continue to be exposed to inundation, which is likely to negatively affect property value over time.

Evaluating property tax information and the inundated parcels in tandem enabled an assessment of probable damage at the parcel level, under the 2050 sea-level rise scenario<sup>20</sup>, by comparing the predicted depths of inundation throughout the Township. The scenarios were modeled using 1-meter Digital Elevation data derived from LiDAR (Light Detection and Ranging - remote sensing technology) collected in 2006. The output from this comparison was further refined through the application of depth

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<sup>17</sup> The MHHW is the average of all high water heights observed over the National Tidal Datum Epoch - the specific 19-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water, etc.) for tidal datums. For Little Egg Harbor Township, the mean higher high tide was derived from the National Oceanic and Atmospheric Administration vertical datum transformation tool. The higher high tide extent is interpolated from regional tidal stations and is dynamic along the shoreline.

<sup>18</sup> See Footnote 6

<sup>19</sup> [https://njgin.state.nj.us/NJ\\_NJGINExplorer/DataDownloads.jsp](https://njgin.state.nj.us/NJ_NJGINExplorer/DataDownloads.jsp)

<sup>20</sup> The 2050 scenario was determined to be a reasonable planning horizon for the purpose of the detailed assessment of exposure value. The Miller et. al. report projects low, central and high sea level rise values for 2030, 2050 and 2100. For 2050, the values range from a low of 1.08' to a high of 1.94'. ***For the purpose of this analysis the central value, 1.48', was added to the current day MHHW.***



damage curves, which are used to estimate the percentage of structural damage based on relative flood depths.<sup>21</sup>

### 2.1. Exposure Analysis: 2050 Sea Level Rise Scenario

**Tables 3** and **4** were developed in accordance with the procedure outlined above. **Table 3** breaks down the number vulnerable parcels by property classification and **Table 4** provides a breakdown of value of inundated parcels – “**exposure value**” - under the 2050 sea-level rise scenario<sup>22</sup>. The value of vulnerable parcels is the sum of two factors, the parcel *land value* and *improvement value* (value of structures occupying the parcel). These two factors are presented separately in **Table 4**. **Figure 9** (page 17) illustrates the 2050 Sea Level Rise inundation extent, demonstrating the projected impact within the boundaries of the Township. It’s important to note that since it’s not possible to predict what the Township’s actual property values will be in 2050; exposure values presented in this analysis reflect the municipality’s **current** assessment values.

**Table 3: Vulnerable Parcels  
2050 Sea Level Rise Scenario**

Property Class (Class Code)	Total Township Lots	Vulnerable Lots	% Vulnerable Lots	Total Township Acres	Vulnerable Acres	% Vulnerable Acres
Vacant (1)	1,690	176	10%	2,567	232	9%
Residential (2)	10,219	711	7%	3,180	130	4%
Farm (3A)	2	1	50%	51	6	11%
Farm (3B)	15		0%	516		0%
Commercial (4A)	170	13	8%	1,134	34	3%
Industrial (4B)	2		0%	5		0%
Apartment (4C)	2		0%	8		0%
Public School Property (15A)	8		0%	169		0%
Public Property (15C)	914	128	14%	21,704	8,679	40%
Church/Charitable (15D)	22		0%	47		0%
Other Exempt (15F)	190	3	2%	31	5	15%
<b>Total</b>	<b>13,234</b>	<b>1,032</b>	<b>8%</b>	<b>29,411</b>	<b>9,085</b>	<b>31%</b>

As **Table 3** reveals, under the 2050 sea-level rise scenario, 1,032 of the Township’s 13,234 parcels (approximately 8%) and 31% (9,085 acres) of the total area of the community (29,411 acres) will be inundated<sup>23</sup>. **Table 4** indicates that the value of the affected properties represents slightly more than \$237.5 million or 8% of the total assessed value of the Township. Although only a relatively small portion of the total assessed value of the community will be affected, it is important to note that over 13% of the current total assessed value of the commercial areas of the community will be affected due to inundation.<sup>24</sup>

<sup>21</sup> Developed by the U.S Army Corps of Engineers, <http://planning.usace.army.mil/toolbox/library/EGMs/egm04-01.pdf>

<sup>22</sup> For the purpose of the analysis the depth damage function for residential, 2-story structures, with at-grade elevations was applied.

<sup>23</sup> All parcels less than 10% flooded were not considered inundated and not included in the exposure value

<sup>24</sup> The analysis treated residential and commercial damages equally, costs associated with interruption or loss of business operations were not factored into the exposure value.

**Table 4: Exposure Value –Vulnerable Parcels  
2050 Sea Level Rise Scenario**

Property Class (Class Code)	Total Township Value	Vulnerable Land Value	Vulnerable Improvement Value	Vulnerable Parcels Value	% of Total Township Value
Vacant (1)	\$127,218,970	\$14,063,025	\$0	\$14,063,025	11%
Residential (2)	\$2,532,950,891	\$124,229,100	\$80,983,750	\$205,212,850	8%
Farm (3A)	\$284,800	\$35,800	\$0	\$35,800	13%
Farm (3B)	\$70,379	\$0	\$0	\$0	0%
Commercial (4A)	\$141,570,271	\$7,541,700	\$10,656,500	\$18,198,200	13%
Industrial (4B)	\$326,472	\$0	\$0	\$0	0%
Apartment (4C)	\$3,060,000	\$0	\$0	\$0	0%
Public School Property (15A)	\$44,413,500	\$0	\$0	\$0	0%
Public Property (15C)	\$107,931,000	\$20,323,900	\$653,200	\$20,977,100	19%
Church/Charitable (15D)	\$15,632,100	\$0	\$0	\$0	0%
Other Exempt (15F)	\$33,760,911	\$487,800	\$992,500	\$1,480,300	4%
<b>Total</b>	<b>\$3,007,219,294</b>	<b>\$166,681,325</b>	<b>\$93,285,950</b>	<b>\$259,967,275</b>	<b>9%</b>
<b>Net Taxable Value<sup>25</sup></b>	<b>\$2,805,481,783</b>	<b>\$145,869,625</b>	<b>\$91,640,250</b>	<b>\$237,509,875</b>	<b>8%</b>

Parcel-level property values presented in the exposure value tables in this report are obtained from the MOD-IV data set assembled and maintained by the New Jersey Division of Taxation and posted on the New Jersey Geographic Information Network web site<sup>26</sup>. The data presently available is an extract from the Division of Taxation’s 2012 MOD IV database.

The 2012 General Tax Rate tables for New Jersey Counties and Municipalities is posted on New Jersey’s Department of Treasury, Division of Taxation’s web site.<sup>27</sup> The applicable table for Ocean County indicates that the 2012 General Tax Rate for Little Egg Harbor Township was \$1.74 per \$100 of assessed value. Based on this rate, under the 2050 Sea Level Rise scenario the loss to Township of \$259.5 million of assessed value would result in a potential loss of 9% of Little Egg Harbor Township’s total tax revenues, which, in 2012 was \$50,643,193.<sup>28 29</sup>

<sup>25</sup> Taxable value is the value of all non-exempt parcels.

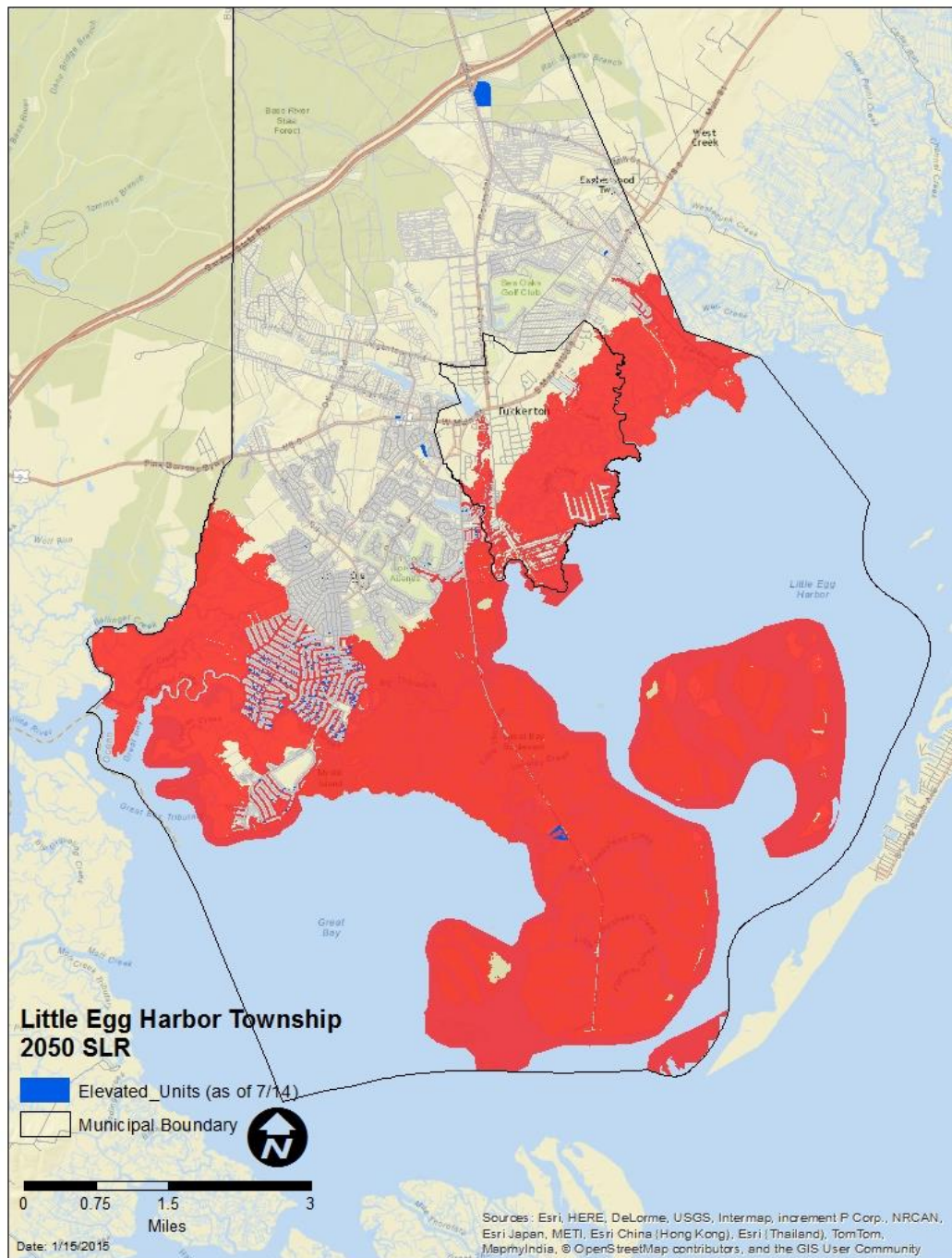
<sup>26</sup> [https://njgin.state.nj.us/NJ\\_NJGINExplorer/DataDownloads.jsp](https://njgin.state.nj.us/NJ_NJGINExplorer/DataDownloads.jsp)

<sup>27</sup> <http://www.state.nj.us/treasury/taxation/lpt/taxrate.shtml>

<sup>28</sup> Includes county, school and municipal taxes levied

<sup>29</sup> The total net taxable valuation calculated using the 2012 MOD IV data tables is \$110,329,706, or 3.79% **less** than the figure reported in the “**Municipal Information Sheet**” posted on New Jersey’s Division of Local Government Services web site ([http://www.nj.gov/dca/divisions/dlgs/resources/fiscal\\_rpts.shtml](http://www.nj.gov/dca/divisions/dlgs/resources/fiscal_rpts.shtml)) for Little Egg Harbor Township, \$2,914,852,816. However, because the Municipal Information Sheet does not provide detail by Property Class, and because the data tables are derived from a parcel-level analysis, it’s not possible to directly calculate the difference in exposure values between the two figures. Furthermore, adjusting the calculated and reported values to match will not significantly alter the proportion of the net Exposure Value to the Total Township Net Value.

Figure 9: 2050 Sea-level Rise



## 2.2 Exposure Analysis: 2050 Sea Level Rise with 1% Annual Flood

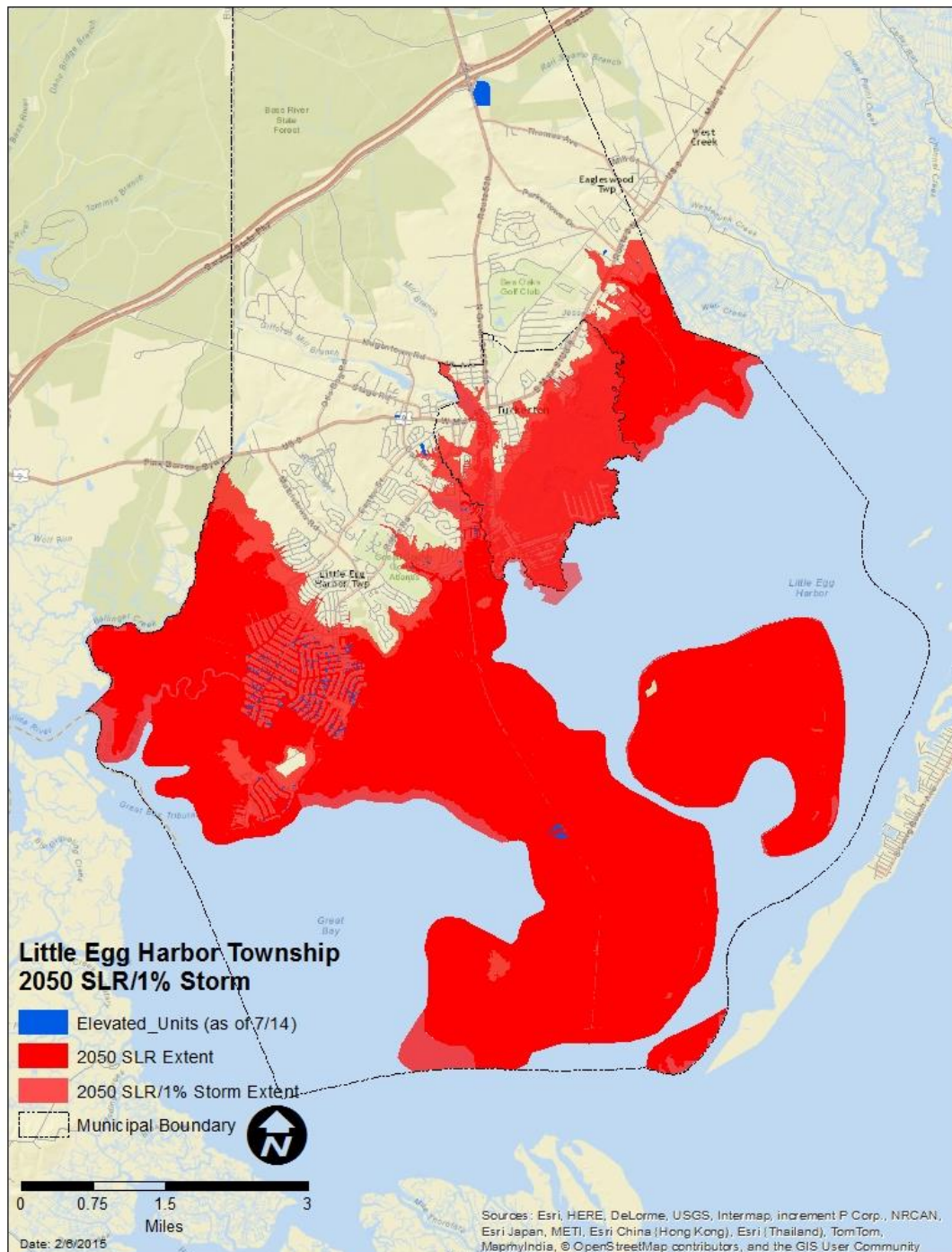
The foregoing 2050 Sea Level Rise scenario assumes that areas of the municipality will be regularly inundated and, therefore, exposure values included total land and structural values for all parcels that are projected to be more than 10% inundated. However, for those additional parcels impacted under the 2050 Sea Level Rise plus 1% Storm scenario, land value may or may not be affected. Structures on properties that may be inundated by episodic flooding (e.g., a 1% storm) can and often are rebuilt. Since it's not possible to predict which parcels may or may not be suitable for redevelopment under this future scenario, three alternative exposure values have been calculated assuming: **1)** 100% of the land



value is permanently extinguished; **2)** 50% of exposed land value is permanently lost, and **3)** no land value is permanently lost.

**Figure 10: 2050 Sea-level Rise Scenario under a 1% Storm Event**, identifies areas that will be affected in locations throughout the Township under this future scenario, differentiating between the inundated areas under the 2050 sea level rise scenario and those additional areas that would be affected by the 1% storm event.

**Figure 10: 2050 Sea-level Rise with 1% Annual Flood**



**Table 5: Exposure: Inundated Parcels - 2050 Sea Level Rise with 1% Annual Flood**

Property Class (Class Code)	Total Township Lots	Vulnerable Lots	% Vulnerable Lots	Total Township Acres	Vulnerable Acres	% Vulnerable Acres
Vacant (1)	1,690	366	22%	2,567	348	14%
Residential (2)	10,219	4,083	40%	3,180	686	22%
Farm (3A)	2	1	50%	51	6	11%
Farm (3B)	15	0	0%	516	0	0%
Commercial (4A)	170	54	32%	1,134	62	5%
Industrial (4B)	2	0	0%	5	0	0%
Apartment (4C)	2	0	0%	8	0	0%
Public School Property (15A)	8	0	0%	169	0	0%
Public Property (15C)	914	180	20%	21,704	8,795	41%
Church/Charitable (15D)	22	5	23%	47	4	9%
Other Exempt (15F)	190	22	12%	31	7	24%
<b>Total</b>	<b>13,234</b>	<b>4,711</b>	<b>36%</b>	<b>29,411</b>	<b>9,909</b>	<b>34%</b>

**Figure 10** illustrates that by 2050, a 1% storm would inundate all areas of the Township subject to flooding under the 2050 Sea Level Rise scenario as well as a somewhat larger portion of the municipality. **Table 5** indicates that under this scenario a total of 4,711 (36%) (1,032 under 2050 Sea Level Rise plus 3,679 parcels under the 1% storm scenario) of the Township's 13,234 parcels, will be inundated, - parcels on which building have been elevated are excluded. The area of these parcels would exceed 9,900 acres, comprising 34% of the total area of the community.

**Table 6** reveals that a **100% loss of land value** associated with the 3,679 parcels subject to inundation in a 2050 1% flood, in addition to the value of the 1,032 parcels subject to 2050 sea level rise inundation, would result in an overall loss (land value plus structure value) of \$884.7 million, or 32% of the total assessed value of the Township, based on Little Egg Harbor's present day property values.

**Table 6: Exposure Value: Inundated Parcels  
2050 Sea-Level Rise with 1% Annual Flood (100% Extinguished Land Value)**

Property Class (Class Code)	Total Township Value	Vulnerable Land Value	Vulnerable Improvements Value	Vulnerable Parcels Value	% of Total Township Value
Vacant (1)	\$127,218,970	\$35,336,605	\$0	\$35,336,605	28%
Residential (2)	\$2,531,992,218	\$622,158,180	\$200,003,735	\$822,161,915	32%
Farm (3A)	\$284,800	\$35,800	\$0	\$35,800	13%
Farm (3B)	\$70,379	\$0	\$0	\$0	0%
Commercial (4A)	\$141,570,271	\$14,740,700	\$12,459,403	\$27,200,103	19%
Industrial (4B)	\$326,472	\$0	\$0	\$0	0%
Apartment (4C)	\$3,060,000	\$0	\$0	\$0	0%
Public School Property (15A)	\$44,413,500	\$0	\$0	\$0	0%
Public Property (15C)	\$107,931,000	\$29,434,800	\$723,750	\$30,158,550	28%
Church/Charitable (15D)	\$15,632,100	\$1,141,100	\$267,402	\$1,408,502	9%
Other Exempt (15F)	\$33,760,911	\$3,073,200	\$1,676,900	\$4,750,100	14%
<b>Total</b>	<b>\$3,006,260,621</b>	<b>\$705,920,385</b>	<b>\$215,131,190</b>	<b>\$921,051,575</b>	<b>31%</b>
<b>Net Taxable Value</b>	<b>\$2,804,523,110</b>	<b>\$672,271,285</b>	<b>\$212,463,138</b>	<b>\$884,734,423</b>	<b>32%</b>

**Table 7** assumes a **50% loss in land value** for parcels inundated in the event of a 1% flood, in addition to the parcels subject to 2050 Sea Level Rise inundation. This alternative assumes that the decline in land value would apply to all inundated parcels, including those with elevated structures. Under this alternative, the total loss (value of exposed land and structures) would amount to \$645.6 million or approximately 23% of the Township's total assessed value.

**Table 7: Exposure Value: Vulnerable Parcels**  
**2050 Sea-Level Rise with 1% Annual Flood (50% Extinguished Land Value)**

Property Class (Class Code)	Total Township Value	Vulnerable Land Value	Vulnerable Improvement Value	Vulnerable Parcels Value	% of Total Township Value
Vacant (1)	\$127,218,970	\$25,133,309	\$0	\$25,133,309	20%
Residential (2)	\$2,532,950,891	\$405,613,490	\$191,177,660	\$596,791,150	24%
Farm (3A)	\$284,800	\$35,800	\$0	\$35,800	13%
Farm (3B)	\$70,379	\$0	\$0	\$0	0%
Commercial (4A)	\$141,570,271	\$11,141,200	\$12,459,342	\$23,600,542	17%
Industrial (4B)	\$326,472	\$0	\$0	\$0	0%
Apartment (4C)	\$3,060,000	\$0	\$0	\$0	0%
Public School Property (15A)	\$44,413,500	\$0	\$0	\$0	0%
Public Property (15C)	\$107,931,000	\$24,879,350	\$723,750	\$25,603,100	24%
Church/Charitable (15D)	\$15,632,100	\$570,550	\$267,402	\$837,952	5%
Other Exempt (15F)	\$33,760,911	\$2,153,050	\$1,542,849	\$3,695,899	11%
<b>Grand Total</b>	<b>\$3,007,219,294</b>	<b>\$469,526,749</b>	<b>\$206,171,003</b>	<b>\$675,697,752</b>	<b>22%</b>
<b>Net Taxable Value</b>	<b>\$2,805,481,783</b>	<b>\$441,923,799</b>	<b>\$203,637,002</b>	<b>\$645,560,801</b>	<b>23%</b>

**Table 8** assumes **no loss in land value** for parcels inundated in the event of a 1% flood, in addition to the parcels subject to 2050 Sea Level Rise inundation. This alternative assumes that the impacts of inundation would be applicable to all parcels within the inundation extent, including those with elevated structures. Under this alternative, the total loss (value of exposed land and structures) would amount to \$349.5 million or approximately 12% of the Township's total assessed value.

**Table 8: Exposure Value: Vulnerable Parcels**  
**2050 Sea-Level Rise with 1% Annual Flood (0% Extinguished Land Value)**

Property Class (Class Code)	Total Township Value	Vulnerable Land Value	Vulnerable Improvement Value	Vulnerable Parcels Value	% of Total Township Value
Vacant (1)	\$127,218,970	\$14,063,025	\$0	\$14,063,025	11%
Residential (2)	\$2,531,992,218	\$124,229,100	\$191,177,660	\$315,406,760	12%
Farm (3A)	\$284,800	\$35,800	\$0	\$35,800	13%
Farm (3B)	\$70,379	\$0	\$0	\$0	0%
Commercial (4A)	\$141,570,271	\$7,541,700	\$12,459,342	\$20,001,042	14%
Industrial (4B)	\$326,472	\$0	\$0	\$0	0%
Apartment (4C)	\$3,060,000	\$0	\$0	\$0	0%
Public School Property (15A)	\$44,413,500	\$0	\$0	\$0	0%
Public Property (15C)	\$107,931,000	\$20,323,900	\$723,750	\$21,047,650	20%
Church/Charitable (15D)	\$15,632,100	\$0	\$267,402	\$267,402	2%
Other Exempt (15F)	\$33,760,911	\$487,800	\$1,542,849	\$2,030,649	6%
<b>Grand Total</b>	<b>\$3,006,260,621</b>	<b>\$166,681,325</b>	<b>\$206,171,003</b>	<b>\$372,852,328</b>	<b>12%</b>
<b>Net Taxable Value</b>	<b>\$2,804,523,110</b>	<b>\$145,869,625</b>	<b>\$203,637,002</b>	<b>\$349,506,627</b>	<b>12%</b>



## CONCLUSION

The preceding analysis indicates that, ***if no actions are taken to minimize future risk***, under the 2050 Sea Level Rise projection of 1.48 feet, 55% of the area of Township, or over 9,000 acres – encompassing 1,300 parcels - would be exposed to flood inundation. The land value and the value of the structures currently constructed on the parcels subject to inundation would amount to over \$237.5 million dollars, or 8% of the net taxable assessed value of the community, based on the Township's present day valuation. By 2050, a 1% storm, coupled with projected sea level rise would almost quadruple the number of parcels that would be at risk of inundation to over 4,700, exposing 34% of the area of the Township to flooding. The loss in the Township's assessed value from the impact of such inundation is estimated to range from \$358 million to \$884 million, or from 13% to 32% of the total assessed value of the community. In addition, the above analysis indicates that almost 36% of the area of the Township (16,956 acres) currently located within high-risk FEMA flood zones are zoned for residential and commercial development. Furthermore, over 90% (10,000 acres) of the Township's wetlands areas are located in high-flood risk AE or VE flood zones. These areas currently provide spawning, foraging, and nesting habitat and are the Township's first line of defense against flooding and storm surge providing critical protection to the adjacent residential and commercial areas.

This vulnerability and exposure analysis is intended to serve as the basis for an informed discussion among the elected and municipal officials of Little Egg Harbor Township and the between the municipal officials and the residents of the community about how best to prepare for and adapt to potential risks associated with projections of sea level rise and associated increasing flooding. The information presented in this report should better equip the Township to make sound near and long-term land use planning and development decisions and formulate efficient and effective public investment strategies to guide recovery management, reconstruction, resiliency and adaptation measures. To that end, the data raises several questions, including but certainly not limited to:

- What types of infrastructure should the Township invest in that are most resistant to flooding, and can improve stormwater management capacity, particularly in those areas that are projected to be at risk?
- What strategies should the Township pursue to protect residential and commercial development in vulnerable areas along the coastline as well as the infrastructure that serves these areas?
- What measures can be taken to preserve, protect and extend the Township's coastal marshes and wetlands that currently serve as protective buffers? What is the likely impact to the economy and quality of life if these important natural resources revert to open water as a consequence of inundation?
- What emergency response measures can the Township put in place in the event that flooding makes critical evacuation routes impassable?
- What land use strategies can be employed to help gradually shift development to areas that would avoid or minimize risks of exposure to future flooding and inundation? How can those strategies be designed to best protect the safety of the residents at risk areas, retain community character and preserve the Township's economic stability?
- How can the Township most effectively engage residents in discussion about vulnerability as well interim and long-term strategies that would be most suited to respond to potential risk?
- In view of the fact that effect strategies to address vulnerability may entail regional responses, what are the appropriate county, state and federal-level partnerships the Township needs to foster to help manage future challenges?

- What interim measures are needed, such as modifications/updates to floodplain management regulations, building codes and elevation standards to ensure public safety? Are current standards effective and what monitoring measures should be enacted to gauge the need for regulatory changes over time?

It's important to note that the Township has already started taking steps toward considering risk and vulnerability in its planning processes. In accordance with recently adopted **Resolution No 2014-16**, Little Egg Harbor has appointed a subcommittee to begin a Master Plan Reexamination Process. The Resolution explicitly indicates that the Township intends to update its zoning ordinance to "*address post-Sandy strategies and policies related to hazard mitigation and community resiliency, and to align the Township's zoning and development regulations with the Township's comprehensive planning strategy to support recovery and improve resiliency*" in accordance with recommendations and strategies set forth in the Township's Strategic Recovery Planning Report (SRPR). Assuring coordination among the SRPR, master plan and the Township's zoning regulations is a critical first step in evaluating actions the Township may need to take to respond to future sea-level rise. The Township should ensure that its capital budget is also reconsidered and coordinated with the master plan and SRPR strategies so that its future capital investments contribute to a well-planned and coordinated adaptation program.

### Appendix 1: Definitions of FEMA Flood Zones

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. These zones are depicted on the published Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM).

#### Special Flood Hazard Areas – High Risk

[Special Flood Hazard Areas](#) represent the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

Zone	Description
A	Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown.
AE, A1-A30	Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown within these zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.)
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone.
AO	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1–3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection.
A99	Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion. No BFEs or flood depths are shown.

#### Coastal High Hazard Areas – High Risk

[Coastal High Hazard Areas](#) (CHHA) represent the area subject to inundation by 1-percent-annual chance flood, extending from offshore to the inland limit of a primary front al dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory purchase requirements apply in these zones.

Zone	Description
V	Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed coastal analyses have not been performed, no BFEs or flood depths are shown.
VE, V1-V30	Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic coastal analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1–V30.)



### Moderate and Minimal Risk Areas

Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in [participating communities](#), but is not required by regulation in these zones. Nearly 25-percent of all flood claims filed are for structures located within these zones.

Zone	Description
B, X (shaded)	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.)
C, X (unshaded)	Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.)

### Undetermined Risk Areas

Zone	Description
D	Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in <a href="#">participating communities</a> .

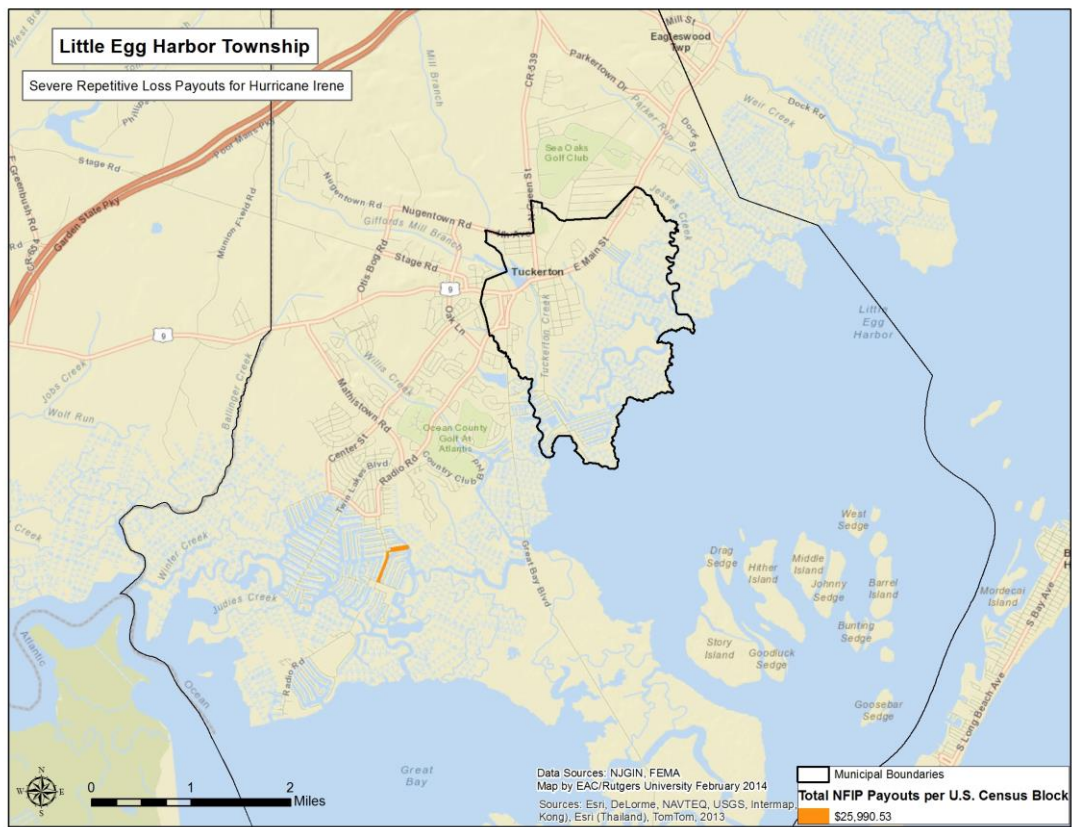
**Appendix 2: Inundated Roadways 2050 Sea Level Rise with 1% Annual Flood Scenario**

1. Alden Ct	47. E Sail Dr	92. Maryland Rd
2. Ashley Ct	48. E Schuylkill Dr	93. Middle Holly Ln
3. Atlantis Blvd	49. E Shrewsbury Dr	94. Mirror Lake Dr
4. Bay Harbor Blvd	50. E Susquehanna Dr	95. Mohican Ln
5. Bayview Dr	51. E Thames Rd	96. Montana Dr
6. Beach Dr	52. Falcon Dr	97. Mountain Lake Rd
7. Betsy Ross Ln	53. Flax Ct	98. N Binnacle Dr
8. Boom Way	54. Flax Isle Dr	99. N Boom Way
9. Brook St	55. Frog Water Ln	100. N Burgee Dr
10. Cala Breeze Way	56. Grace Pl	101. N Captain Dr
11. Cayuga Lake Dr	57. Great Bay Blvd	102. N Commodore Dr
12. Cedarbrook Ct	58. Greenbriar Dr	103. N Ensign Dr
13. Center St	59. Greenwood Lake Rd	104. N Forecastle Dr
14. Champions Dr	60. Hatteras Ct	105. N Holly Lake Dr
15. Chapel Ln	61. Holden St	106. N Shore Dr
16. Cherry St	62. Holly Lane Dr	107. N Spinnaker Dr
17. Chesapeake Ct	63. Hollyberry Rd	108. Nantucket Ct
18. Colonial Dr	64. Hunter Ct	109. National Union Blvd
19. Columbia Rd	65. Hunter Dr	110. Oak Ln
20. Corpus Christi Bay Ct	66. Iowa Ct	111. Oakland Bay Ct
21. Country Club Blvd	67. Jarsebowski Way	112. Ocean Blvd
22. Country Club Dr	68. Jefferson Ln	113. Ohio Dr
23. County Rte 10	69. Juniper Dr	114. Oneida Lake Dr
24. County Rte 12	70. Kadlubeck Way	115. Osbourne Ct
25. County Rte 601	71. Kansas Rd	116. Overlook Dr
26. Cranberry Lake Dr	72. Kentucky Dr	117. Persimmon Dr
27. Daddy Tucker Dr	73. Lake Champlain Dr	118. Pinehurst Dr
28. Danbury Dr	74. Lake Crystalbrook Dr	119. Plantation Dr
29. Deer Run Rd	75. Lake Deerbrook Dr	120. Playhouse Rd
30. Dyke Pl	76. Lake Erie Ct	121. Polonia Way
31. E Anchor Dr	77. Lake George Ct	122. Ramapo Rd
32. E Boat Dr	78. Lake Huron Dr	123. Revere Dr
33. E Brig Dr	79. Lake Medford Ln	124. Revolutionary Dr
34. E Cala Breeze Way	80. Lake Michigan Dr	125. Rivercrest Dr
35. E Delaware Dr	81. Lake Saint Clair Dr	126. Rocky Rd
36. E Dory Dr	82. Lake Singleton Ct	127. S Baltimore Dr
37. E Holly Ln	83. Lake Superior Dr	128. S Binnacle Dr
38. E Hudson Dr	84. Lakewood Ct	129. S Boom Way
39. E Mohawk Dr	85. Lantern Pl	130. S Boom Way
40. E Mullica Rd	86. Lenape Dr	131. S Boston Dr
41. E Navasink Dr	87. Lexington Dr	132. S Burgee Dr
42. E Pimlico Rd	88. Lighthouse Dr	133. S Captain Dr
43. E Playhouse Dr	89. Littlefield Ln	134. S Commodore Dr
44. E Potomac Dr	90. Louisiana Dr	135. S Dayton Dr
45. E Potomac Rd	91. Mariners Pt E	136. S Ensign Dr
46. E Raritan Dr		137. S Forecastle Dr

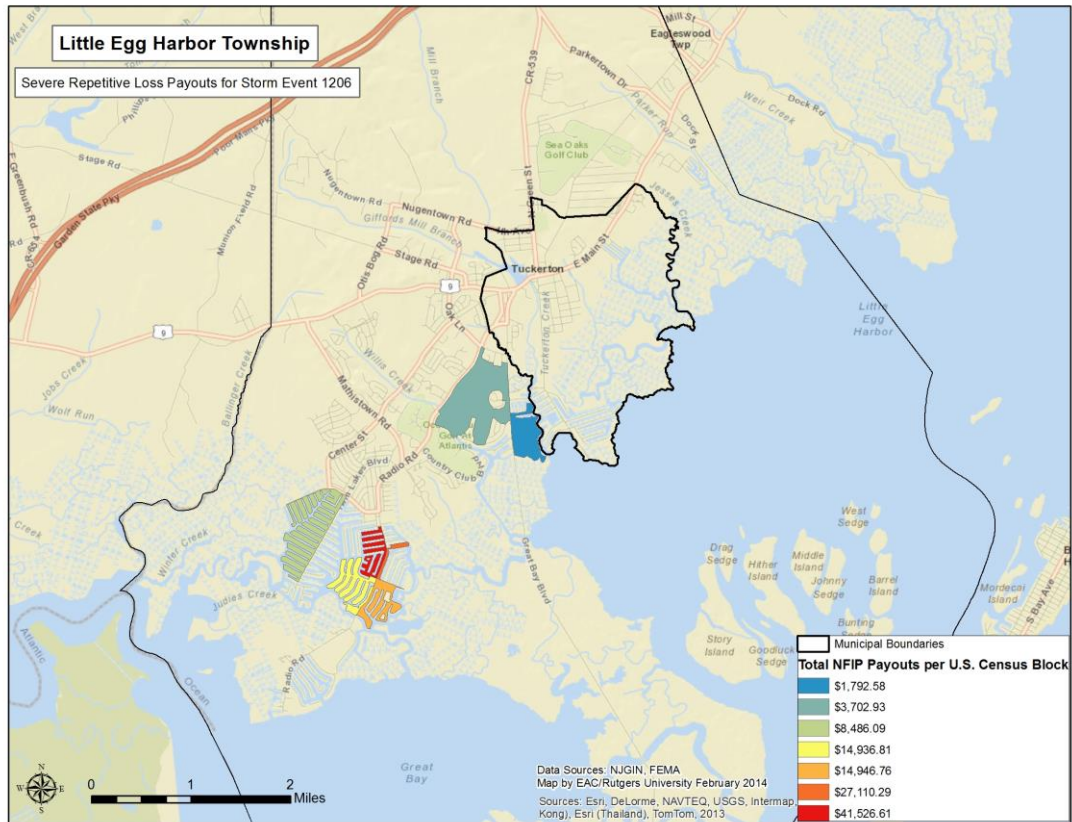
- 138. S Longboat Dr
- 139. S Los Angeles Dr
- 140. S Miami Dr
- 141. S Portland Dr
- 142. S Pulaski Blvd
- 143. S Spinnaker Dr
- 144. S Trenton Dr
- 145. Sea Isle Dr
- 146. Sea Isle Dr
- 147. Sea Meadow Ln
- 148. Seameadow Dr
- 149. Seminole Dr
- 150. Seneca Lake Dr
- 151. Ship Dr
- 152. Silver Lake Ct
- 153. Southwinds Dr
- 154. Spar Ct
- 155. Staysail Dr
- 156. Surfside Blvd
- 157. Tall Timber Dr
- 158. Toms Ct
- 159. Twin Lakes Blvd
- 160. US Hwy 9
- 161. Valley Forge Dr
- 162. Vulcan Way
- 163. W Anchor Dr
- 164. W Boat Dr
- 165. W Brig Dr
- 166. W Cala Breeze Way
- 167. W Delaware Dr
- 168. W Dory Dr
- 169. W Holly Ln
- 170. W Hudson Dr
- 171. W Mohawk Dr
- 172. W Mullica Rd
- 173. W Potomac Dr
- 174. W Raritan Dr
- 175. W Sail Dr
- 176. W Schuylkill Dr
- 177. W Susquehanna Dr
- 178. W Thames Rd
- 179. Yorktowne Dr



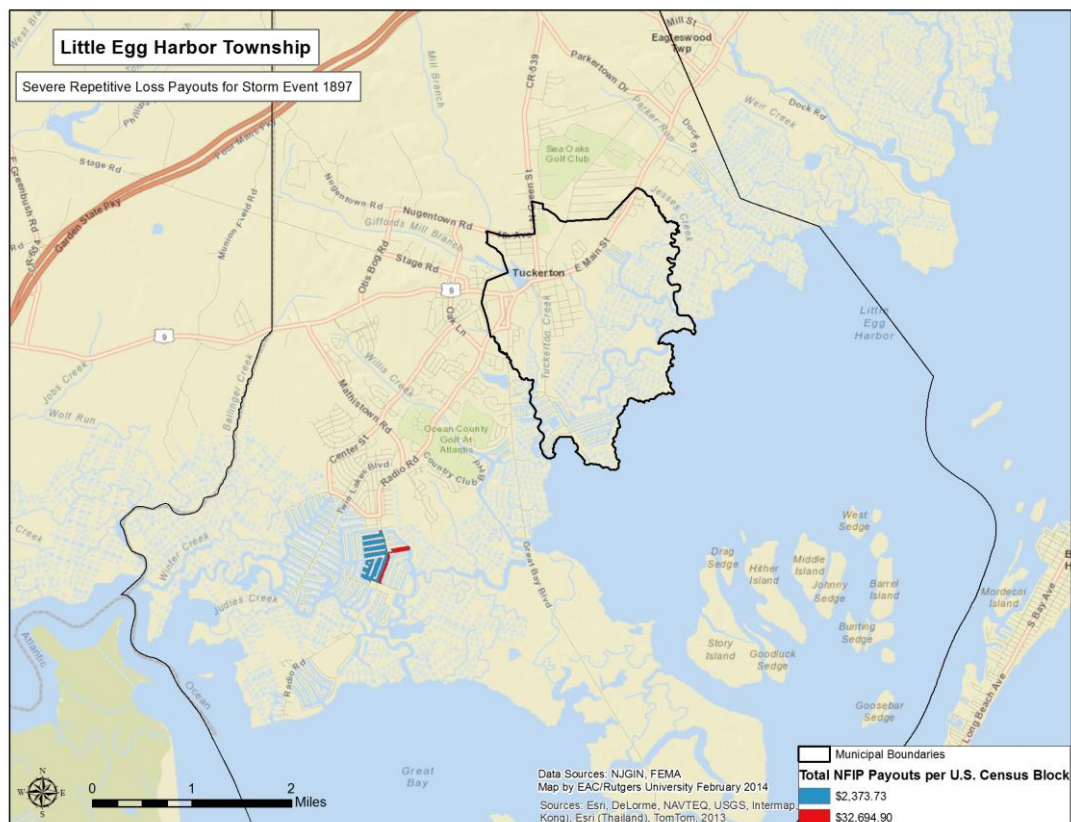
### Appendix 3: Pre-Sandy Federal Recovery Assistance Payout Maps



This map shows total NFIP payouts in the Severe Repetitive Loss database held by the New Jersey Department of Environmental Protection for Hurricane Irene. The Census Block shown in orange received severe and repetitive loss payouts totaling \$25,990.53.



This map shows total NFIP payouts in the Severe Repetitive Loss database held by the New Jersey Department of Environmental Protection for Storm Event 1206, which refers to the incident period of February 4, 1998 to February 8, 1998. Total payments per Census Block ranged from \$1,792.58 (shown in blue) to \$41,526.61 (shown in red).



This map shows total NFIP payouts in the Severe Repetitive Loss database held by the New Jersey Department of Environmental Protection for Storm Event 1897, which refers to the incident period of March 12, 2010 to April 15, 2010. Total payments per Census Block ranged from \$2,373.73 (shown in blue) to \$32,694.90 (shown in red).



#### **Appendix 4: Little Egg Harbor Township FEMA FIRM V-Zone Revisions**

## Jason Worth

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**From:** Timothy Morris  
**Sent:** Thursday, March 20, 2014 4:20 PM  
**To:** Schaefer, Robert  
**Cc:** Jason Worth; James Oris; Avishek Chhibber; Yilmaz, Tolga; Smith, Curtis S.  
**Subject:** RE: V-Zone Locations - Little Egg Harbor Township  
**Attachments:** AREAS\_OF\_CONCERN-PANEL0578.pdf; AREAS\_OF\_CONCERN-PANEL0586.pdf; AREAS\_OF\_CONCERN-PANEL0567.pdf

Dear Mr. Schaefer:

T&M Associates has been asked by Little Egg Harbor Township to review the placement of V Zones at specific areas within the Township as depicted on the attached mark-ups of the Preliminary Work Maps. Based on our initial review of the Maps, the Coastal Hazard Analysis Modeling Program (CHAMP) input and output files, as well as the associated digital elevation models (DEM), we are requesting clarification on the locations of the V Zone at the following locations, referenced by panel number and associated "areas of concern" (AOC), as shown on the attached exhibits:

### Panel 0567

The location of the V Zone in AOC 1 extends across Iowa Court and into the front yards of the homes to the south, and extends through the yard of the southern-most property. The V Zone in AOC 2, located immediately to the southwest, stops on the seaward side of Ohio Ct, without impacting any properties except for the eastern-most home at the end of the cul-de-sac. While the elevations along Iowa Ct are generally 1 to 2 feet lower than the elevations along Ohio Court, both roadways are well below the 100 year Stillwater Elevation (SWE) of 9.2. Why does the V Zone extend across Iowa Ct, impacting residential properties, when it does not extend across Ohio Ct.?

### Panel 0578:

Along the eastern-most residential properties at the ends of the roadways from N. Burgee Dr. north to Brig Dr. E., indicated in AOC 1, the V-zone typically ends at the bulkheads, as seen at the eastern end of N. Burgee Dr. However, at some locations the V Zone extends several feet onto the easternmost residential properties, such as at the end of N. Spinnaker Dr, which, similar to N. Burgee Dr, has a range of ground surface elevations behind the bulkheads of 3.5 to 4.0 ft. Is there a reason that the V Zone extends onto some of these properties and not others?

Likewise, Munro's marina, shown in AOC 2, has elevations behind the bulkhead of approximately 3.5 to 4.0 ft. Why does the V Zone extend across the entire site instead of stopping at the bulkhead as it does at the roadways to the south, such as N. Burgee Dr., which is also exposed to the bay on its southern side?

### Panel 0586

Similarly, the location of the V Zone extends onto some of the residential properties located along the southern ends of the three roadways in AOC 1, but not onto others, such as those at the southeastern end of S. Burgee Dr. The elevations behind the bulkheads range from approximately 3.3 to 3.7 in all of these areas. Is there a reason that the V Zone extends onto some of these properties and not others?

Additionally, could the placement of new bulkheads at certain locations, such as at Munro's marina, impact the location of the V Zone?

Please let us know what you think regarding the above referenced issues and the best way to proceed so that we may inform the Township. If you have any questions or need any additional information please do not hesitate to contact me.

Thanks for your assistance!

Tim



Timothy A. Morris, P.E.

Group Manager

11 Tindall Road, Middletown, NJ 07748

Tel: 732-865-9451 | Mobile: 908-692-6302

[tmorris@tandmassociates.com](mailto:tmorris@tandmassociates.com)

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**From:** Schaefer, Robert [<mailto:Robert.Schaefer@fema.dhs.gov>]  
**Sent:** Monday, March 17, 2014 5:09 PM  
**To:** Timothy Morris  
**Cc:** Jason Worth; James Oris; Avishek Chhibber; Yilmaz, Tolga; Smith, Curtis S.; Duell, Scott  
**Subject:** RE: V-Zone Locations - Little Egg Harbor Township

Good Afternoon Tim,

As discussed by telephone today, we would greatly appreciate it if you would provide us with details, by email, of the locations where you have questions regarding the placement of V Zones in the Township of Little Egg Harbor. The best way to provide those details would be by means of marked-up copies of the relevant sections of the Preliminary Work Maps accompanied by short narratives. After review we will get back to you with our thoughts and path forward.

The data should be sent to myself and copied to Tolga Yilmaz ([tolga.yilmaz@urs.com](mailto:tolga.yilmaz@urs.com)) and Curtis Smith ([curtis.s.smith@urs.com](mailto:curtis.s.smith@urs.com))

Thank you  
Bob

Robert J. Schaefer, P.E., P.P., C.M.E.  
Civil Engineer, Risk Analysis Branch  
DHS \ FEMA Region II Mitigation Division  
Jacob K. Javits Federal Building  
26 Federal Plaza, 13<sup>th</sup> Floor, Room 1337, New York, NY 10278  
Desk 212-680-8808 | Cell 347-882-7989 | Fax 212-680-3603  
Email: [Robert.Schaefer@fema.dhs.gov](mailto:Robert.Schaefer@fema.dhs.gov)

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**From:** Timothy Morris [<mailto:TMorris@tandmassociates.com>]  
**Sent:** Friday, March 14, 2014 12:19 PM  
**To:** Schaefer, Robert  
**Cc:** Jason Worth; James Oris; Avishek Chhibber  
**Subject:** V-Zone Locations - Little Egg Harbor Township

Robert,

We have been asked by Little Egg Harbor Township to review the locations of the V-zones at several specific locations in the Township, which included detailed reviews of the CHAMP input and output files for transects in the vicinity of these locations, and provide them with some feedback on the rationale for the placement of the V-zones at these locations on the preliminary work maps.

Is there someone with whom we could speak that could provide us with some insight into the locations of V-zones at specific sites in Little Egg Harbor Township, so that we may respond to the Township's concerns?

Your assistance is very much appreciated.

Sincerely,

Tim Morris



Timothy A. Morris. P.E.

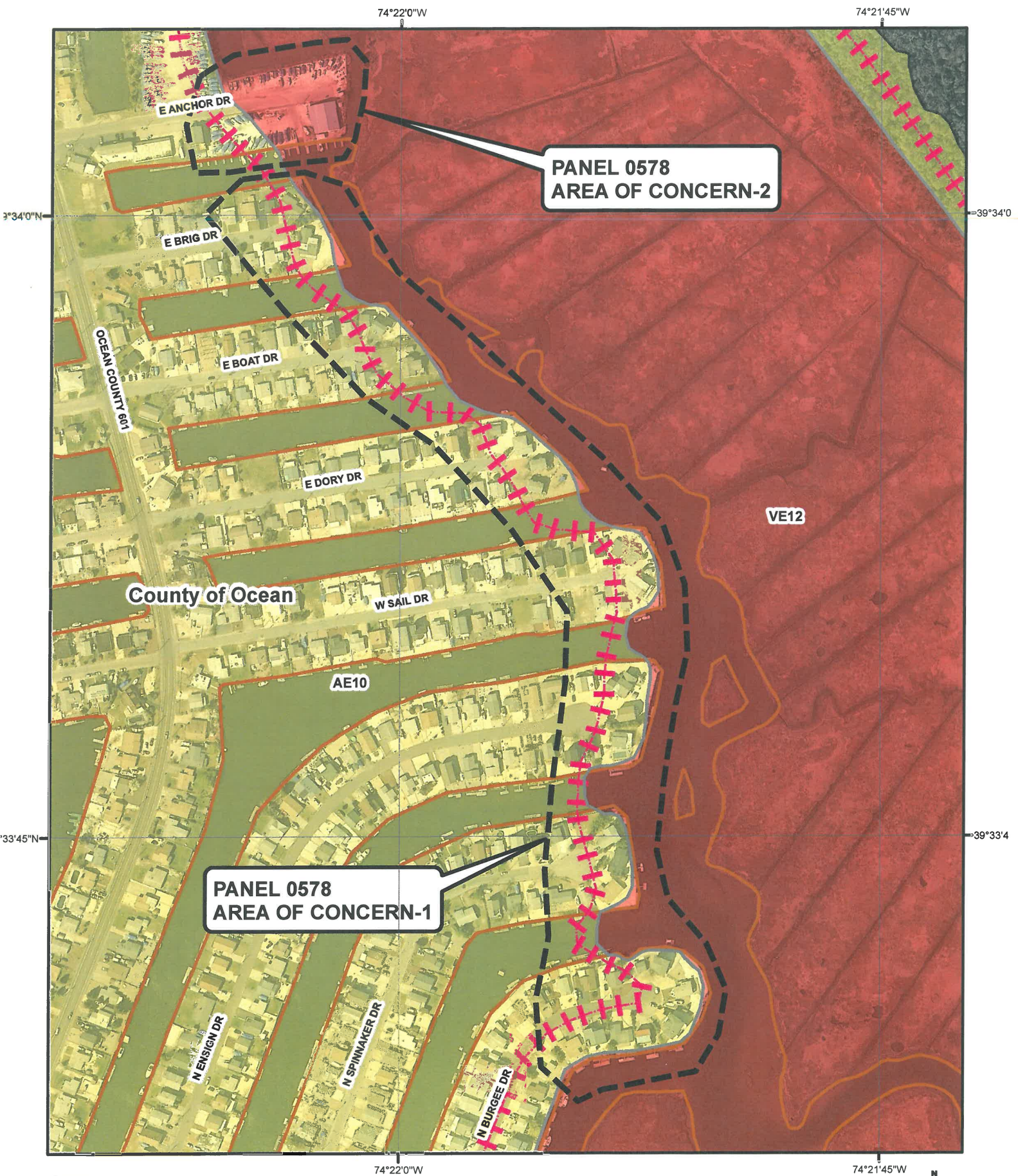
Group Manager

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[tmorris@tandmassociates.com](mailto:tmorris@tandmassociates.com)

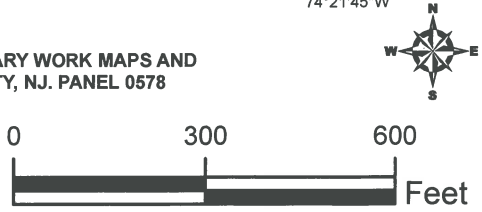




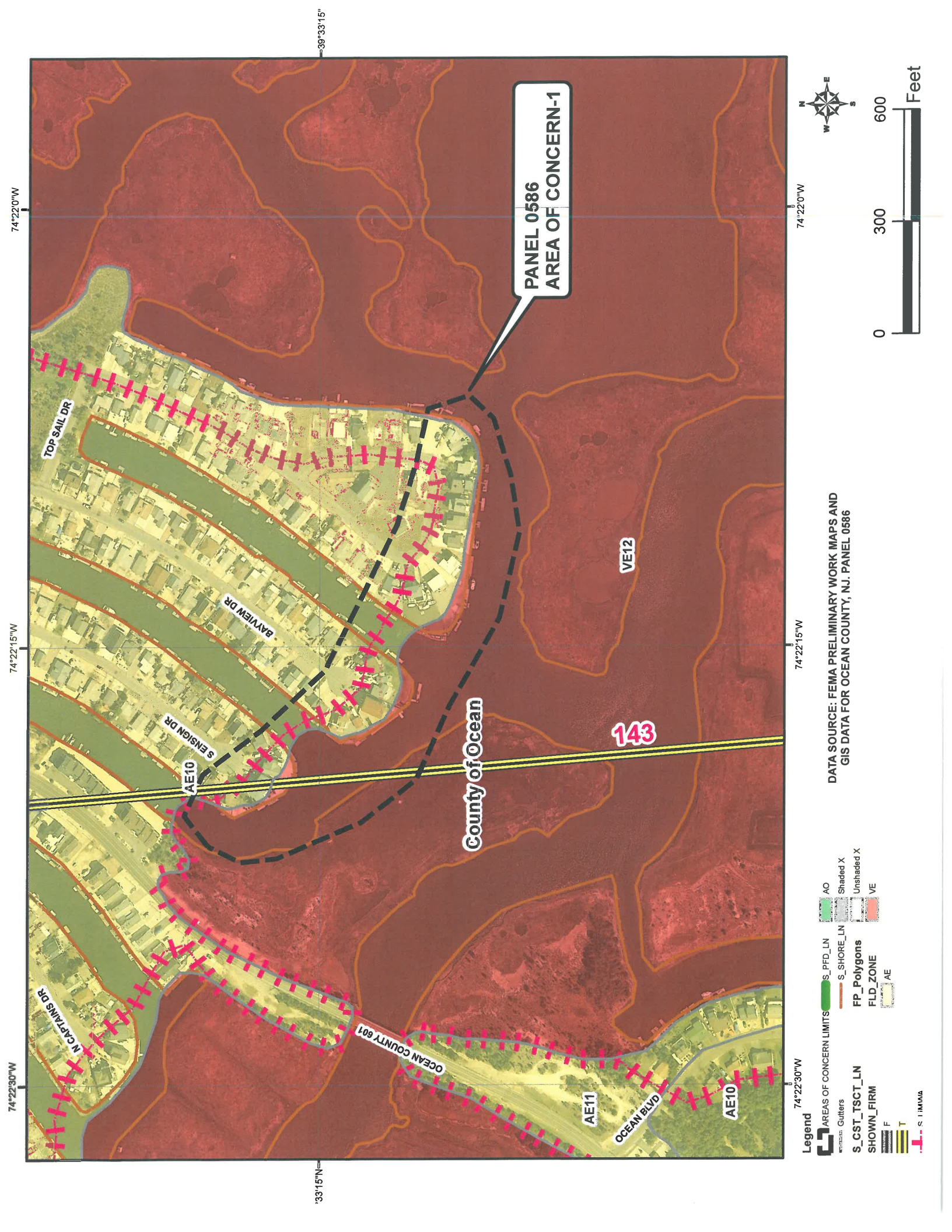
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| Gutters                 | S_SHORE_LN  | Shaded X   |
| S_CST_TSCT_LN           | FP_Polygons | Unshaded X |
| SHOWN_FIRM              | FLD_ZONE    | VE         |
| F                       | AE          |            |
| T                       |             |            |
| S 11MVA                 |             |            |

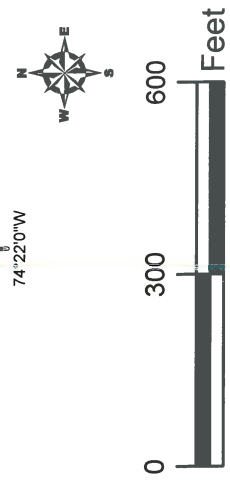
DATA SOURCE: FEMA PRELIMINARY WORK MAPS AND GIS DATA FOR OCEAN COUNTY, NJ. PANEL 0578







PANEL 0586  
AREA OF CONCERN-1



DATA SOURCE: FEMA PRELIMINARY WORK MAPS AND  
GIS DATA FOR OCEAN COUNTY, NJ. PANEL 0586

