Go to Presentation >

Go to Report >

RUTGERS
New Jersey Climate Change Resource Center

Commercial Township Flood Hazard Assessment

Doug Leung, MCRP Candidate
NJ Climate Resilience Corps

RUTGERS
New Jersey Climate Change Resource Center

Overview

- Commercial Township Overview
- NJDEP Flood Inundation Models
- Land Parcels Vulnerable to Flooding – Various Scenarios
- FEMA-FIRM Flood Zones
- Hurricane Sandy
- Social Vulnerability
- Overburdened Communities
- Critical Infrastructure

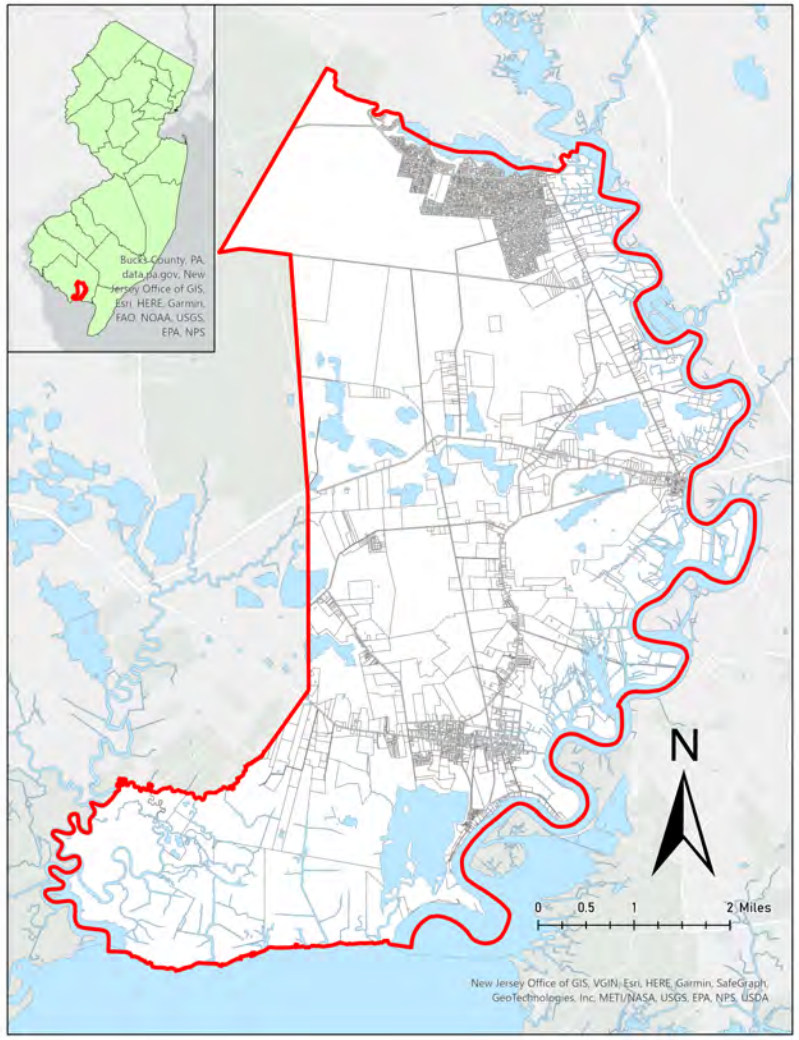
RUTGERS
New Jersey Climate Change Resource Center

Caveats

- The data and maps in this analysis illustrate the scale of potential flooding, not the exact location, and do not account for erosion, subsidence, or future construction. As with all remotely sensed data, all features should be verified with a site visit.
- The data, maps, and information provided here should be used only as a screening-level tool for management decisions and not for navigation, permitting, or other legal purposes.
- The flood modeling does not include flood protection structures, such as berms, levees, dikes, floodwalls, etc.
- For parcel flooding, the building footprint data is not used. Instead, a parcel is considered flooded only if the inundation covers at least 60% of the parcel.
- The land value and improvement value come from MOD IV data and are for the entire parcel. We do not have data to consider only basement and/or first-floor flooding.

RUTGERS
New Jersey Climate Change Resource Center

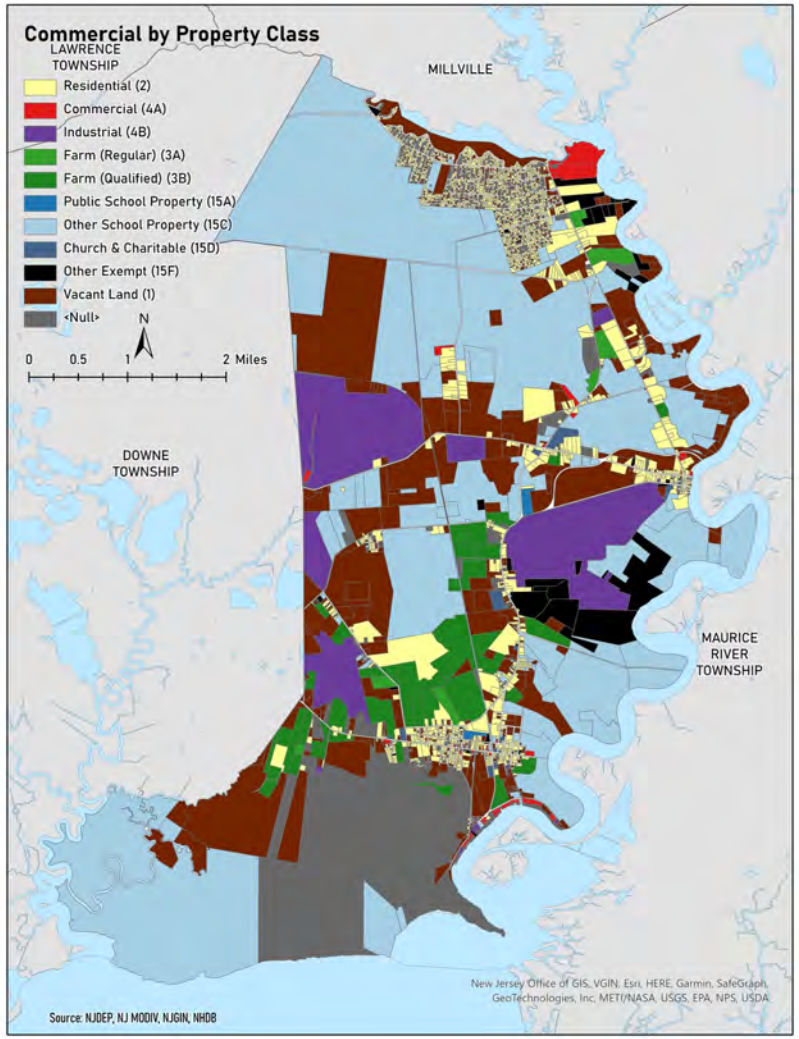
Commercial Township, Cumberland County, NJ



Demographics (ACS, 2020 5 Year Estimates)	
Population	4,936
Growth Since 2010	-5.0%
Area	34.41 sq. mile.
Pop. Density	143/ sq. mile
Average HH Size	2.75
Housing Units / Occupied	1,776 / 2096 (84.7%)
Owner Occupied Units	1,179 (66.4% of all occupied)
Median HH Income	$45,931
Poverty	18%
Unemployment Rate (16 y/o and older)	4.3%
Median Rental Cost	$1,066 /month
Median House Value	$122,000
Median Age	38.7 years
White Population (alone)	77.2%
Non-White Population	22.8%
Less than HS Education (25 years and older)	12.1%

RUTGERS
New Jersey Climate Change Resource Center

Commercial Township, Cumberland County, NJ



PROPERTY CLASS	# PARCELS TOTAL
Residential (2)	2,046
Commercial (4A)	57
Industrial (4B)	15
Farm Total (3A & 3B)	47
School and Public Property (15A, 15C)	209
Church & Charitable (15D)	27
Other Exempt (15F)	53
Vacant (1)	1,382
<Null Data>	523
TOTAL	4,353

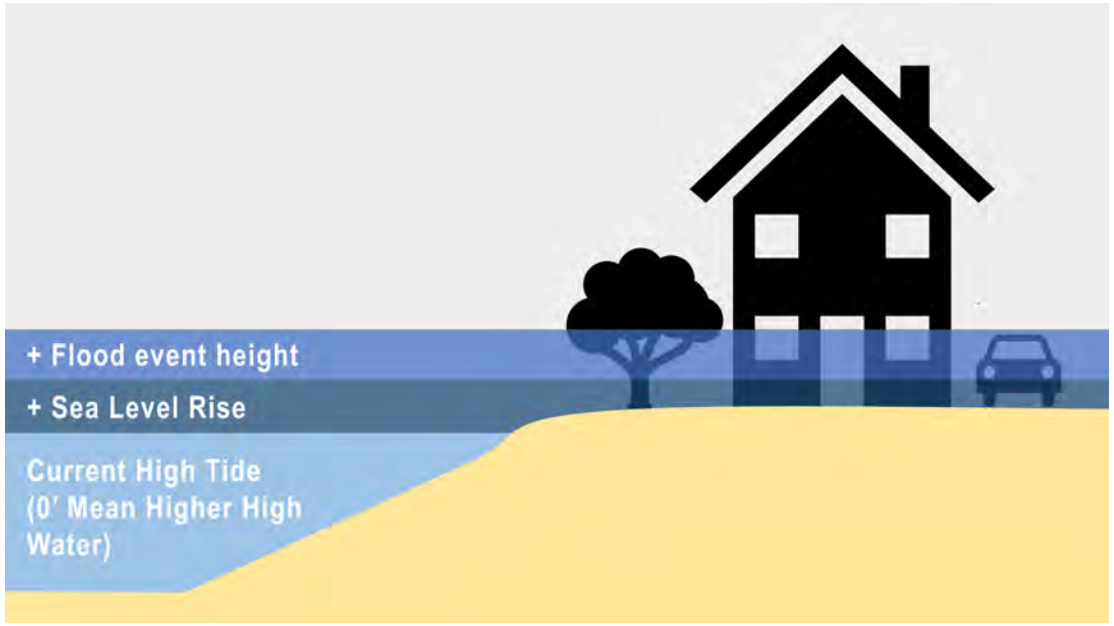
RUTGERS
New Jersey Climate Change Resource Center

Total Water Level (above Mean Higher High Water)

- Mean Higher High Water (MHHW) is a tidal datum developed by the National Oceanic and Atmospheric Administration (NOAA). It is the average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch.

- Total Water Level – The 'still water' inundation above Mean Higher High Water (MHHW). These water levels allow you to visualize the impact of future sea level rise combined with potential flood events up to 20ft of inundation.

- **Seawater that rises past the MHHW line is considered inundation**, and therefore water level measurements relative to MHHW can be considered as proxies for measurements of inundation.



RUTGERS
New Jersey Climate Change Resource Center

Sea Level Rise – NJDEP Guidance to NJ, June 20221

Year	Low End	At least a 66% chance between			High End
	Greater than a 95% chance SLR exceeds	*Greater than an 83% chance SLR exceeds*	*~50% chance SLR exceeds*	*Less than a 17% chance SLR exceeds*	*Less than a 5% chance SLR exceeds*
2000			0		
2010			0.2 ft		
2020	0.1 ft	0.3 ft	0.5 ft	0.7 ft	0.9 ft
2030	0.3 ft	0.5 ft	0.8 ft	1.1 ft	1.3 ft
2040	0.5 ft	0.7 ft	1.1 ft	1.5 ft	1.9 ft
2050	0.7 ft	0.9 ft	1.4 ft	2.1 ft	2.6 ft
2060	0.8 ft	1.2 ft	1.8 ft	2.5 ft	3.1 ft
2070	1.0 ft	1.4 ft	2.2 ft	3.1 ft	3.8 ft
2080	1.1 ft	1.6 ft	2.6 ft	3.8 ft	4.8 ft
2090	1.2 ft	1.8 ft	3.0 ft	4.4 ft	5.8 ft
2100	1.3 ft	2.0 ft	3.3 ft	5.1 ft	6.9 ft
2110	1.6 ft	2.3 ft	3.7 ft	5.7 ft	8.1 ft
2120	1.6 ft	2.4 ft	4.1 ft	6.4 ft	9.4 ft
2130	1.7 ft	2.6 ft	4.5 ft	7.1 ft	10.9 ft
2140	1.9 ft	2.9 ft	4.9 ft	7.7 ft	12.4 ft
2150	2.1 ft	3.1 ft	5.2 ft	8.3 ft	13.8 ft

Notes: All values are 19-year means and are measured with respect to a 1991-2009 baseline. Projections are 19-year

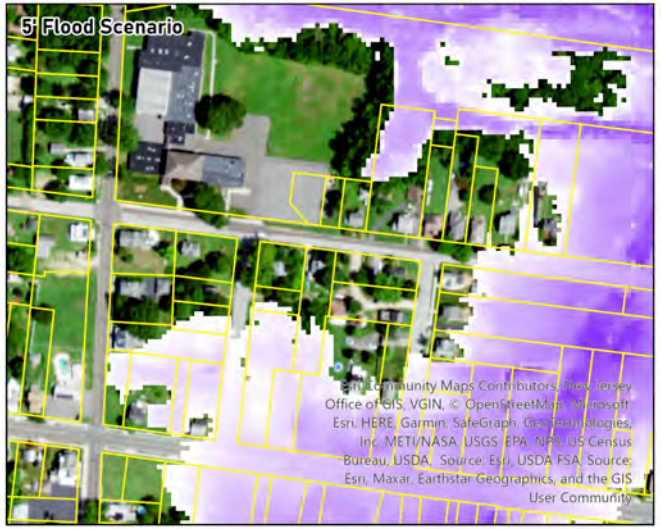
- Sea Level Rise (SLR) projections in feet for New Jersey from **2000 to 2150** under a moderate emissions scenario.
- The table gives the planning thresholds for the various years. Collectively, the 2ft, 3ft, 5ft, and 7ft levels are **standard state planning benchmarks**.
- NJDEP SLR Guidance for NJ recommends that planners analyze
  - 2ft SLR that is likely unavoidable
  - 5.1ft SLR sufficient to plan for most activities in a community, and
  - 6.9ft SLR for those **critical activities*** for which damages would have debilitating effects on public health and safety.
- Additionally, NJOPA's Municipal Plan Endorsement Guidance requires that "communities assess flood risks that a minimum identifies areas within the municipality that are subject to exposure to 3- 5- and 7- feet of sea level rise and the 1% (100-year) and 0.2% (500-year) storms as part of the Municipal Self-Assessment."

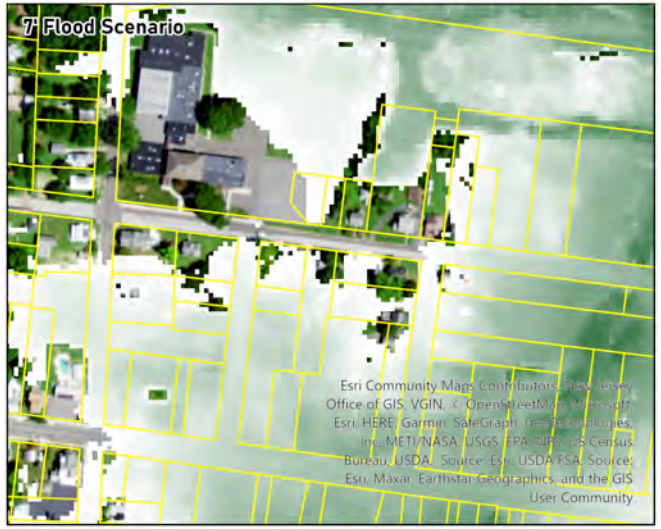
***Activities with less risk tolerance should plan for the upper end of the likely range (<17% Chance SLR exceeds).** These include most activities, including single and multi-family residential structures, commercial developments, most energy transmission, and water treatment infrastructure, evacuation routes and bridges, hospitals, or public transit facilities.

The state thinks about it in terms of SLR, we use TWL

RUTGERS
New Jersey Climate Change Resource Center

Inundation Analysis Criteria

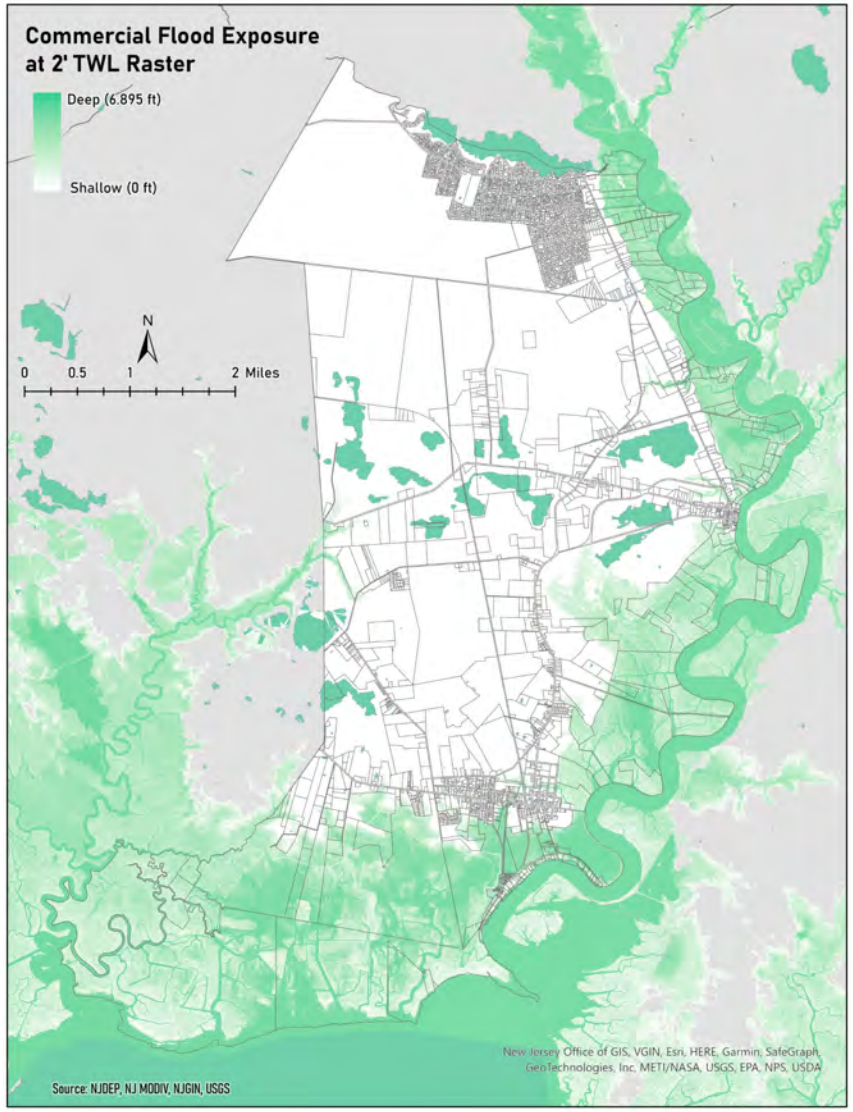


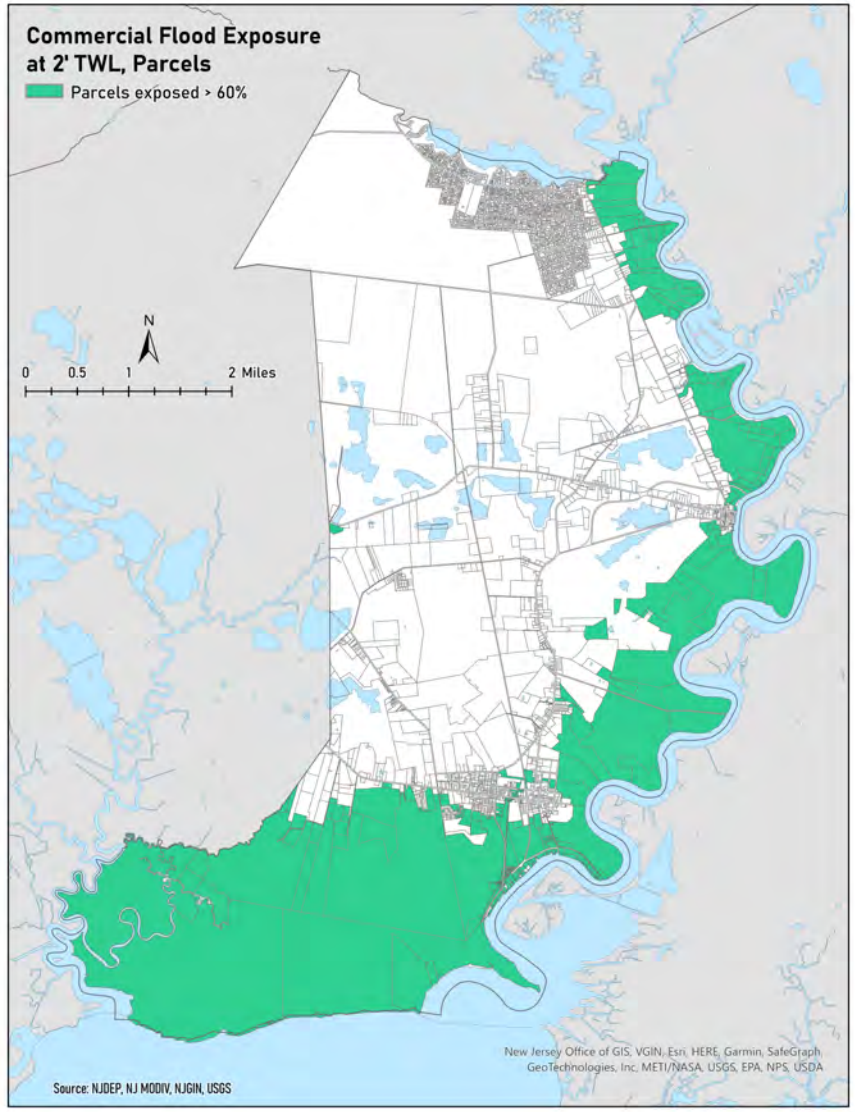


- For analysis: 60% inundation standard
- Small, residential parcels

RUTGERS
New Jersey Climate Change
Resource Center

2' TWL

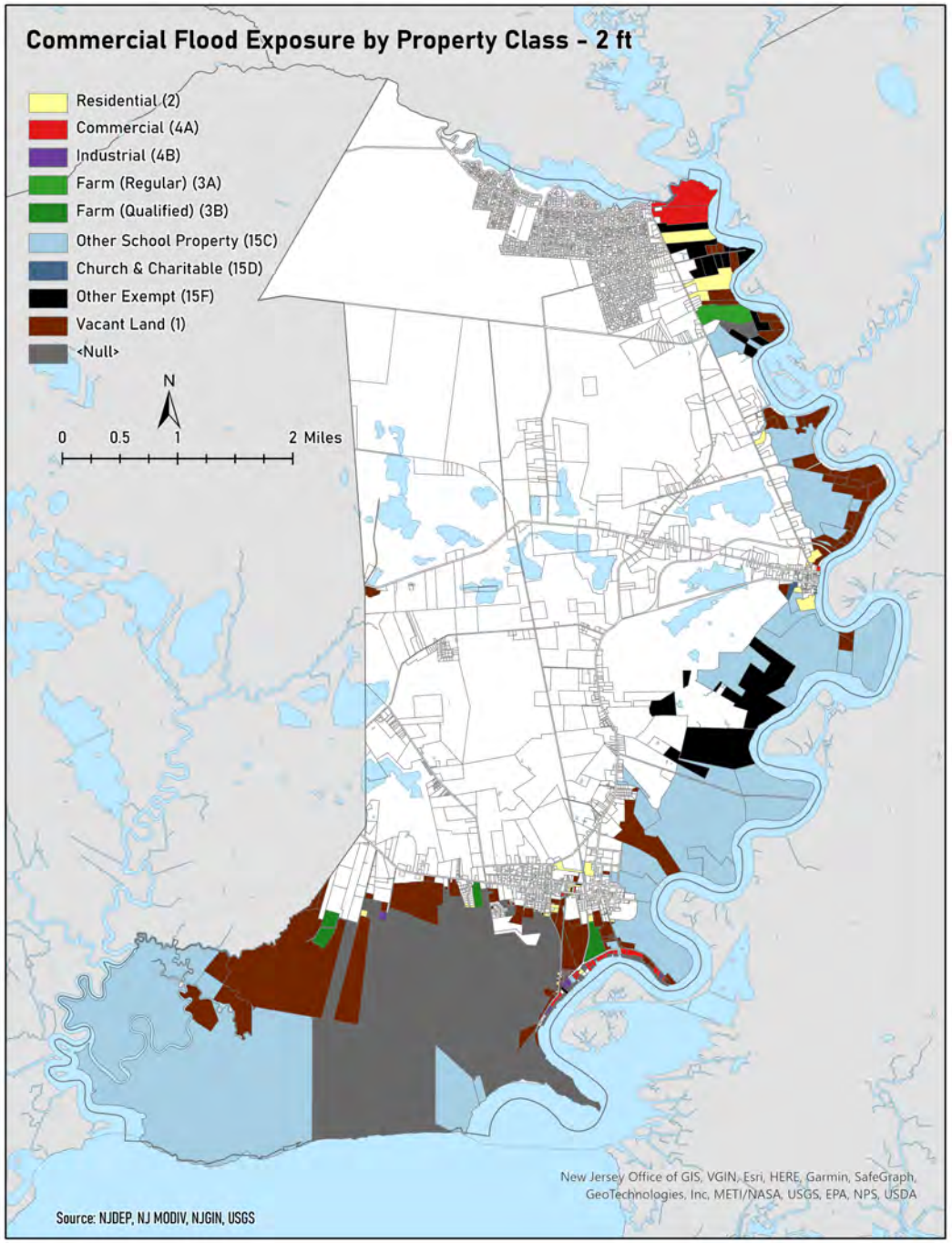




RUTGERS
New Jersey Climate Change Resource Center

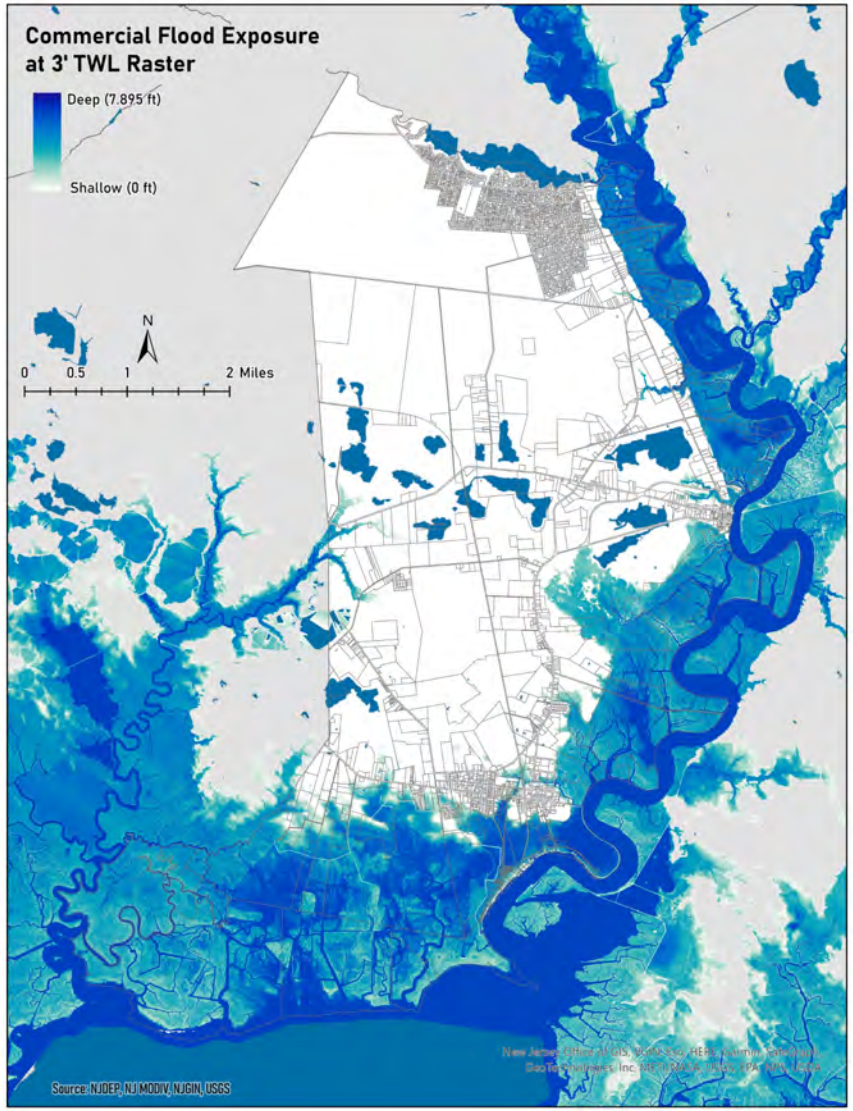
2' TWL Land Parcels

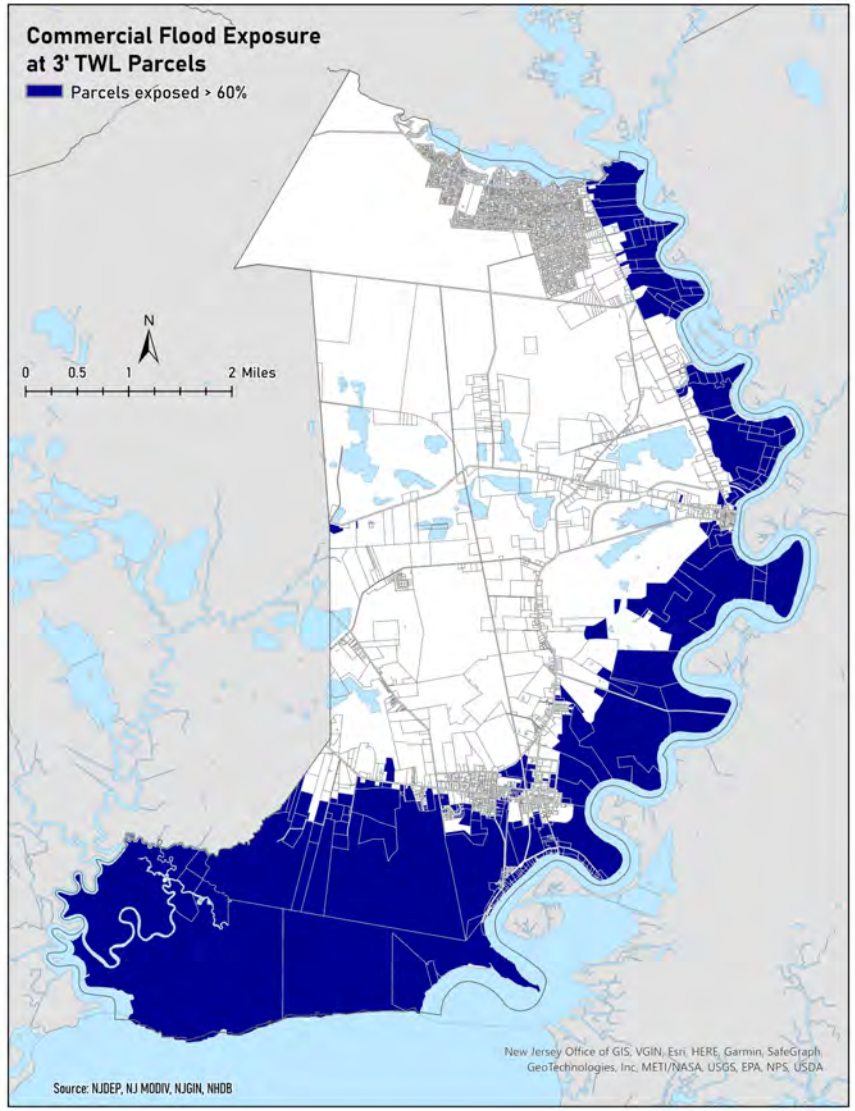
PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	31	$3,184,300.00	$1,481,000.00	0	1.52
Commercial (4A)	24	$2,039,200.00	$2,307,200.00	0	42.11
Industrial (4B)	6	$1,675,900.00	$499,300.00	0	40
Farm Total (3A & 3B)	5	$107,600.00	$85,400.00	1	10.64
School and Public Property (15A, 15C)	45	$2,999,800.00	$1,467,200.00	0	21.53
Church & Charitable (15D)	2	$0.00	$25,800.00	0	7.41
Other Exempt (15F)	20	$1,591,000.00	$528,300.00	0	37.74
Vacant (1)	155	$0.00	$4,161,300.00	0	11.81
<Null Data>	59	*<Null Data>*	*<Null Data>*	59	*<Null Data>*
TOTAL	**347**	**$11,597,800.00**	**$10,555,500.00**	**59**	



RUTGERS
New Jersey Climate Change
Resource Center

3' TWL

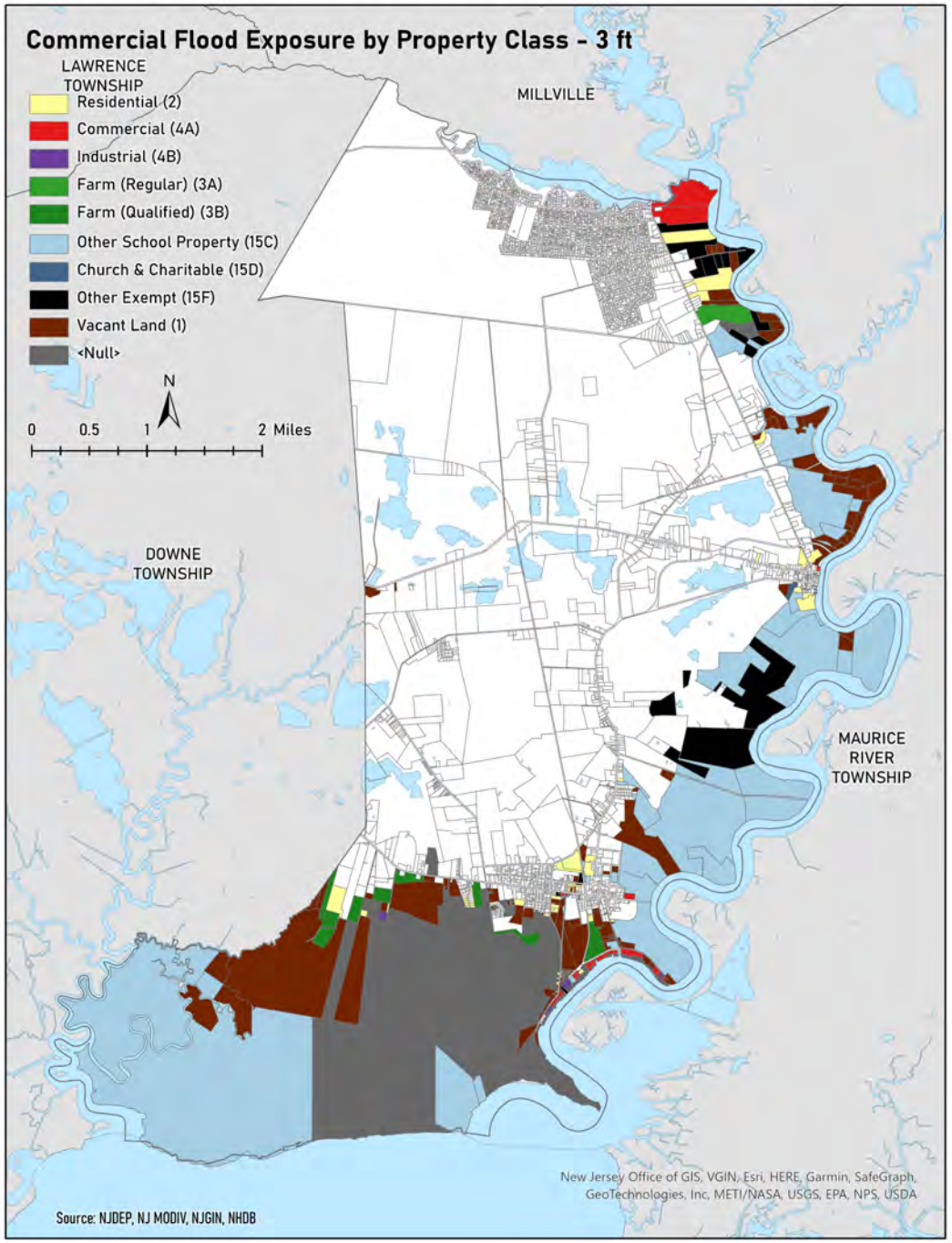




RUTGERS
New Jersey Climate Change Resource Center

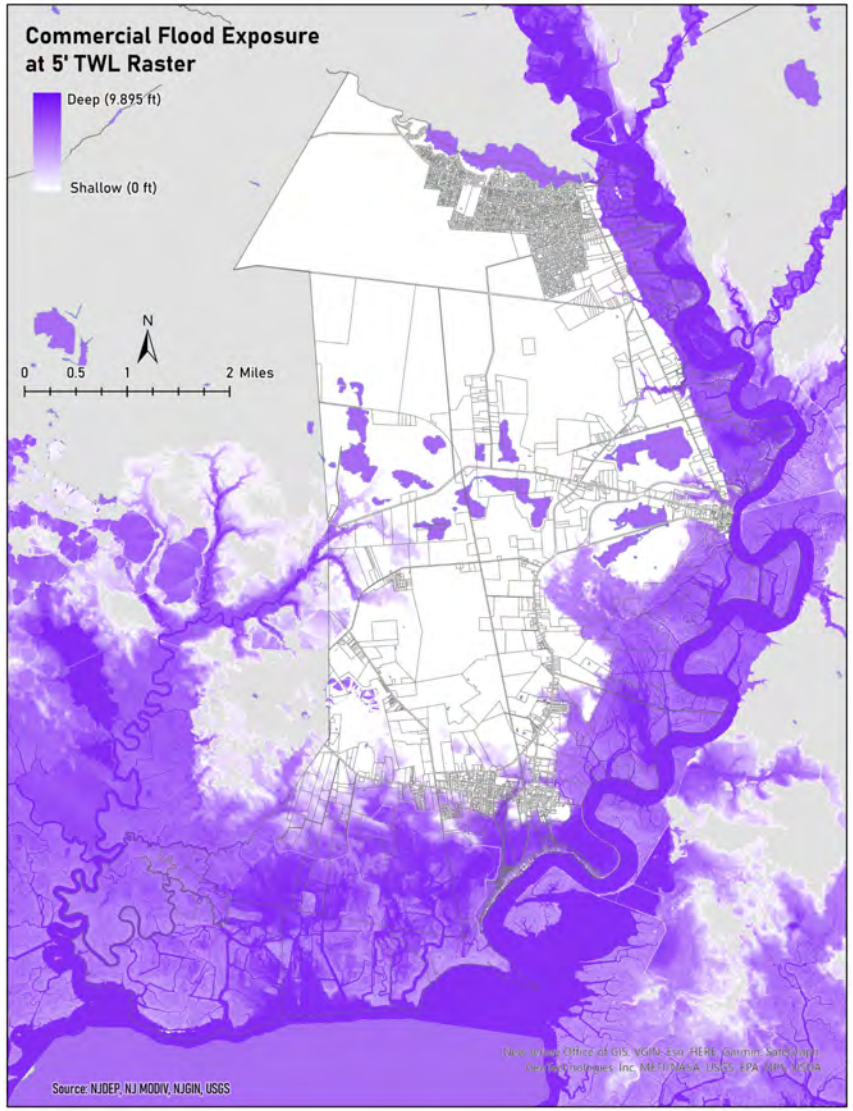
3' TWL Land Parcels

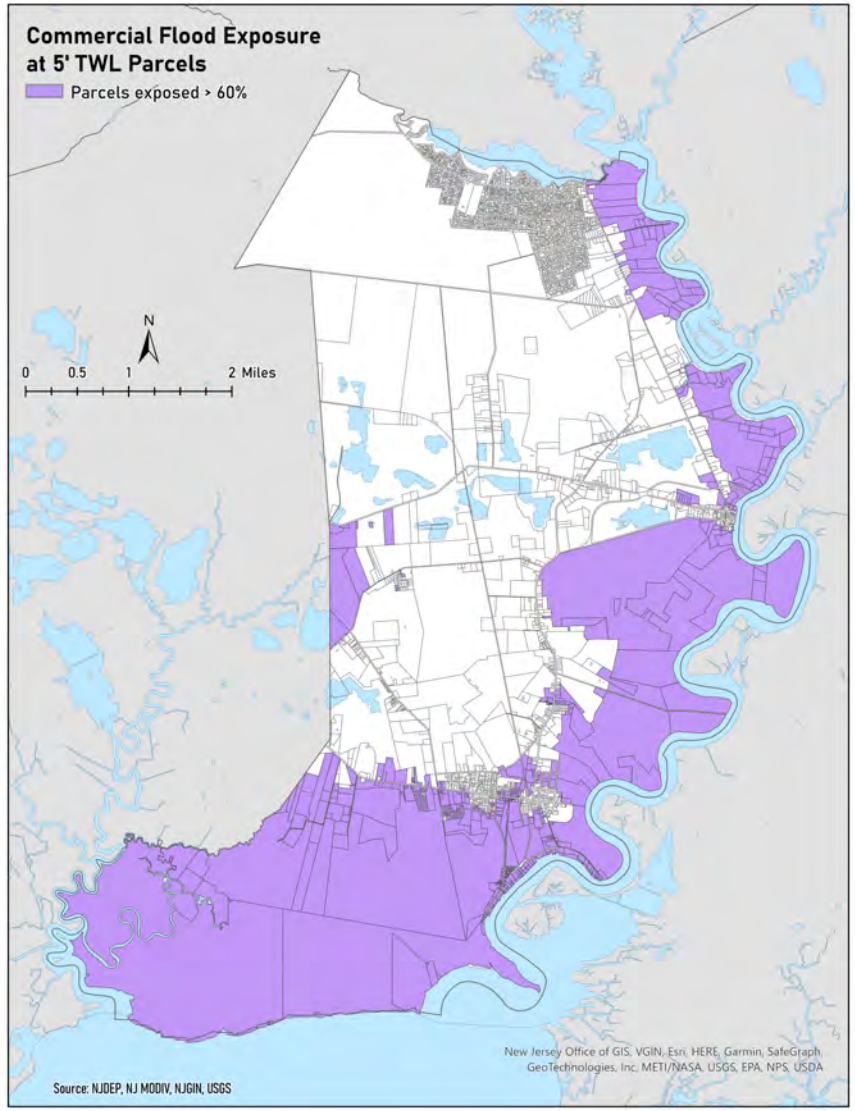
PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	54	$5,269,700.00	$2,445,900.00	0	2.64
Commercial (4A)	29	$2,332,900.00	$2,474,300.00	0	50.88
Industrial (4B)	6	$1,675,900.00	$499,300.00	0	40
Farm Total (3A & 3B)	10	$107,600.00	$125,600.00	0	36.79
School and Public Property (15A, 15C)	47	$2,999,800.00	$1,512,200.00	0	23.04
Church & Charitable (15D)	2	$0.00	$25,800.00	0	7.41
Other Exempt (15F)	23	$2,008,500.00	$652,900.00	0	43.4
Vacant (1)	165	$0.00	$4,265,900.00	0	12.58
<Null Data>	71	*<Null Data>*	*<Null Data>*	71	*<Null Data>*
TOTAL	**407**	**$14,394,400.00**	**$12,001,900.00**	**71**	



RUTGERS
New Jersey Climate Change
Resource Center

5’ TWL

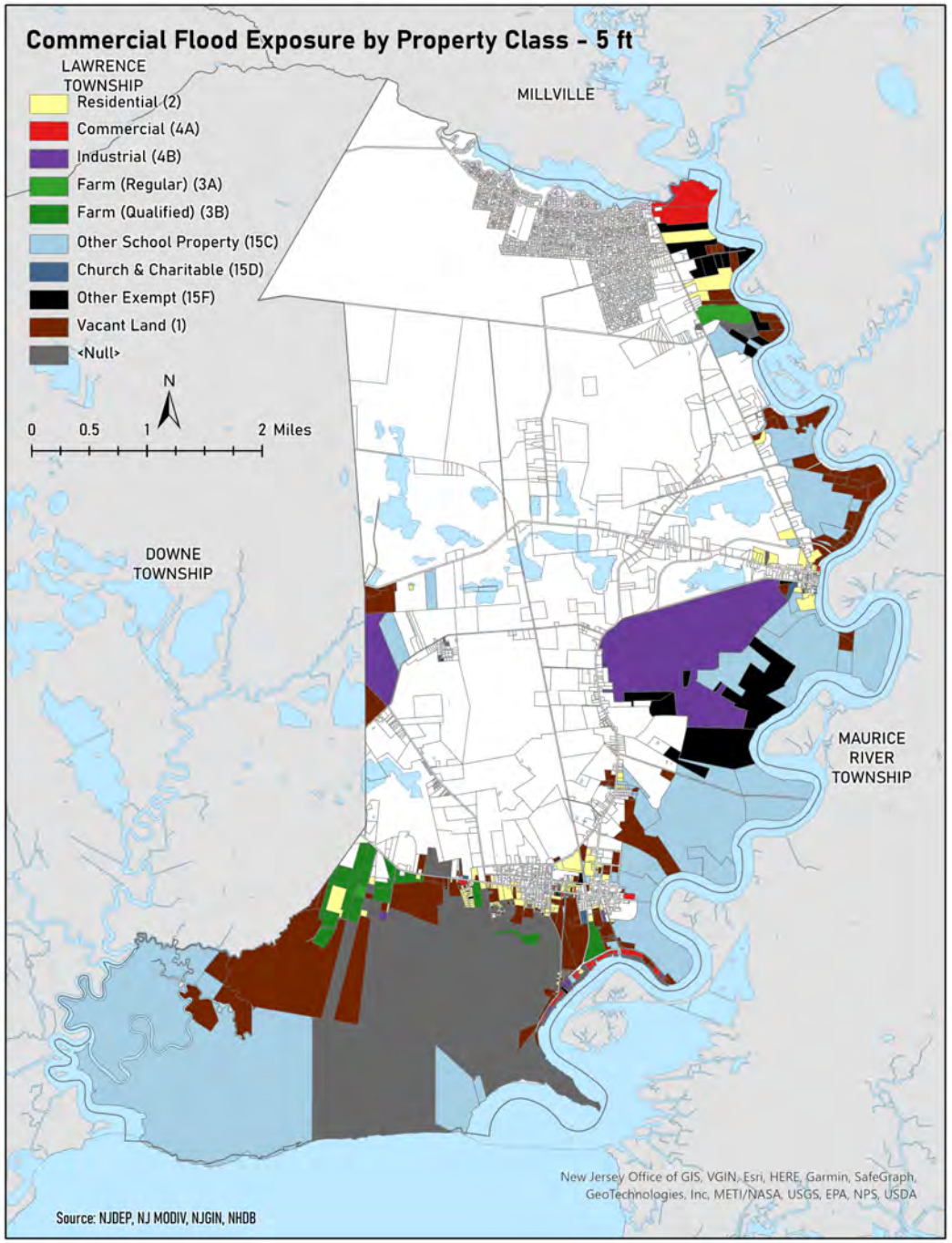




RUTGERS
New Jersey Climate Change Resource Center

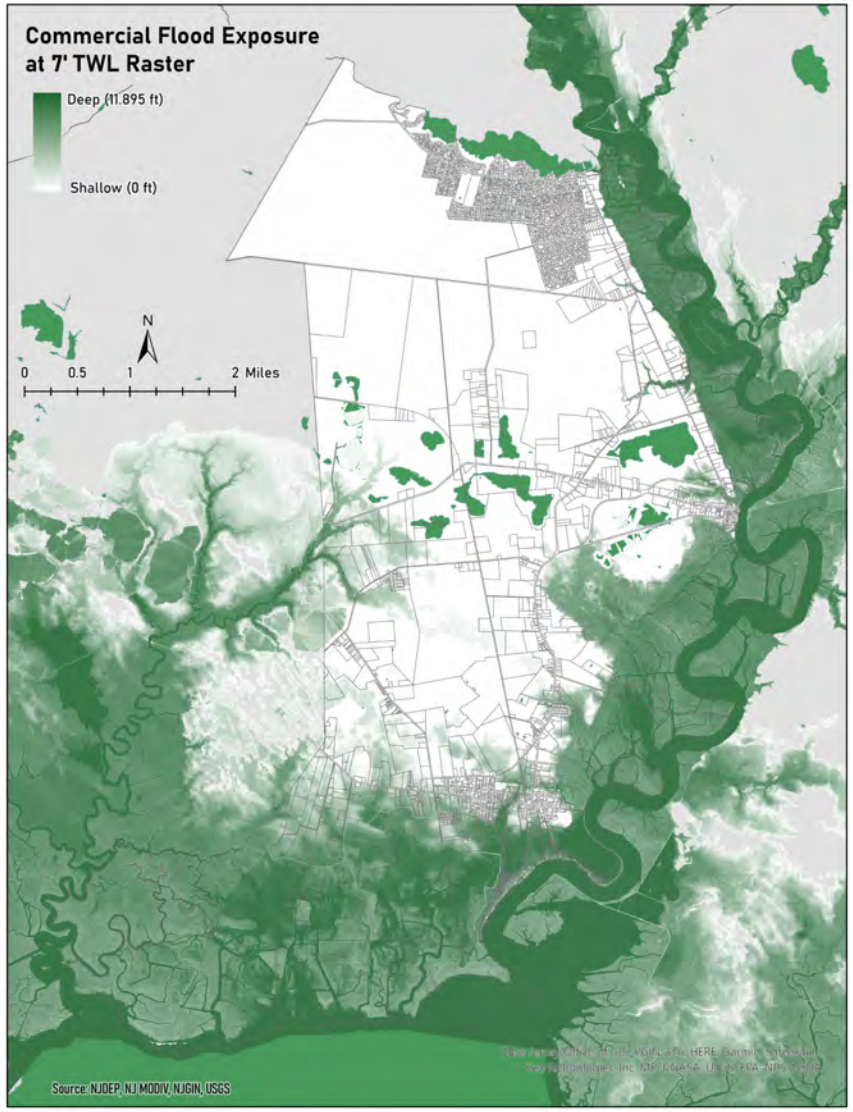
5' TWL Land Parcels

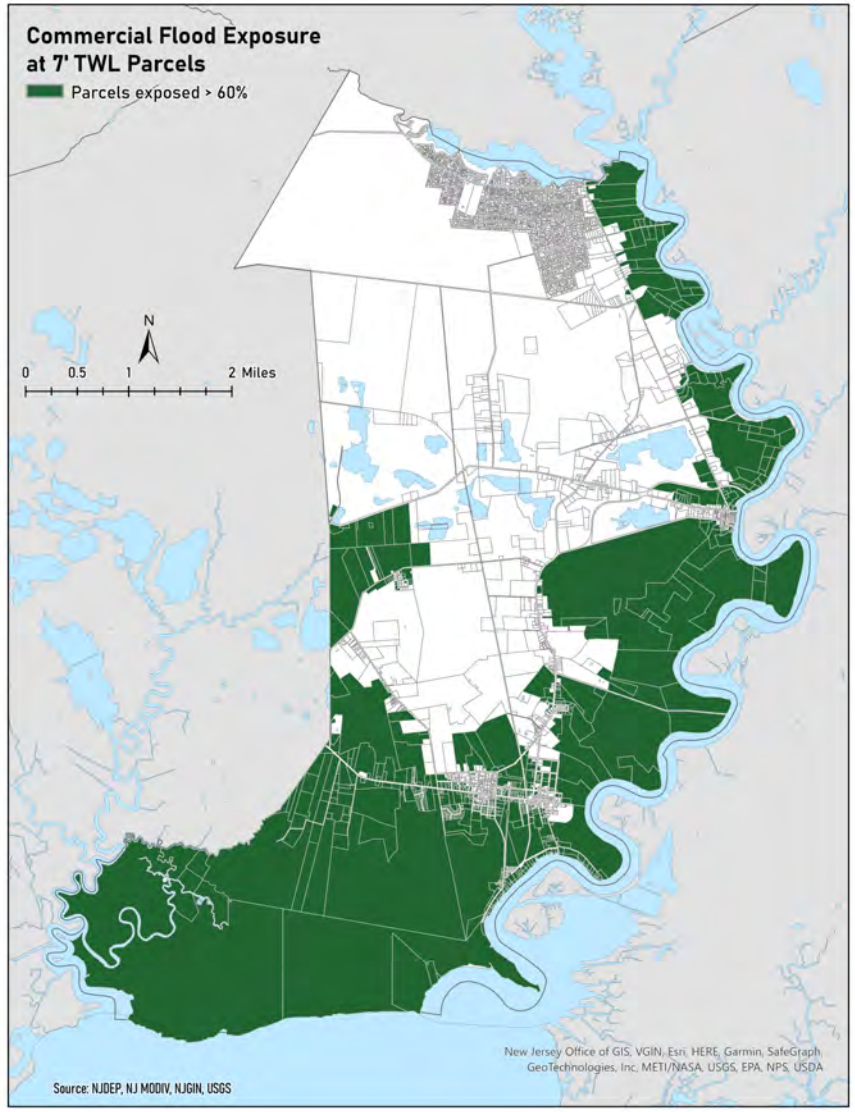
PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	145	$13,093,700.00	$5,627,300.00	0	7.09
Commercial (4A)	33	$2,962,700.00	$2,775,300.00	0	57.89
Industrial (4B)	10	$3,685,400.00	$1,710,900.00	0	66.67
Farm Total (3A & 3B)	16	$287,800.00	$197,300.00	0	63.57
School and Public Property (15A, 15C)	57	$2,999,800.00	$1,703,400.00	0	27.94
Church & Charitable (15D)	5	$489,600.00	$125,300.00	0	18.52
Other Exempt (15F)	26	$2,109,000.00	$735,400.00	0	49.06
Vacant (1)	213	$0.00	$4,673,600.00	0	16.23
<Null Data>	93	*<Null Data>*	*<Null Data>*	93	*<Null Data>*
TOTAL	**598**	**$25,628,000.00**	**$17,548,500.00**	**93**	



RUTGERS
New Jersey Climate Change
Resource Center

7' TWL

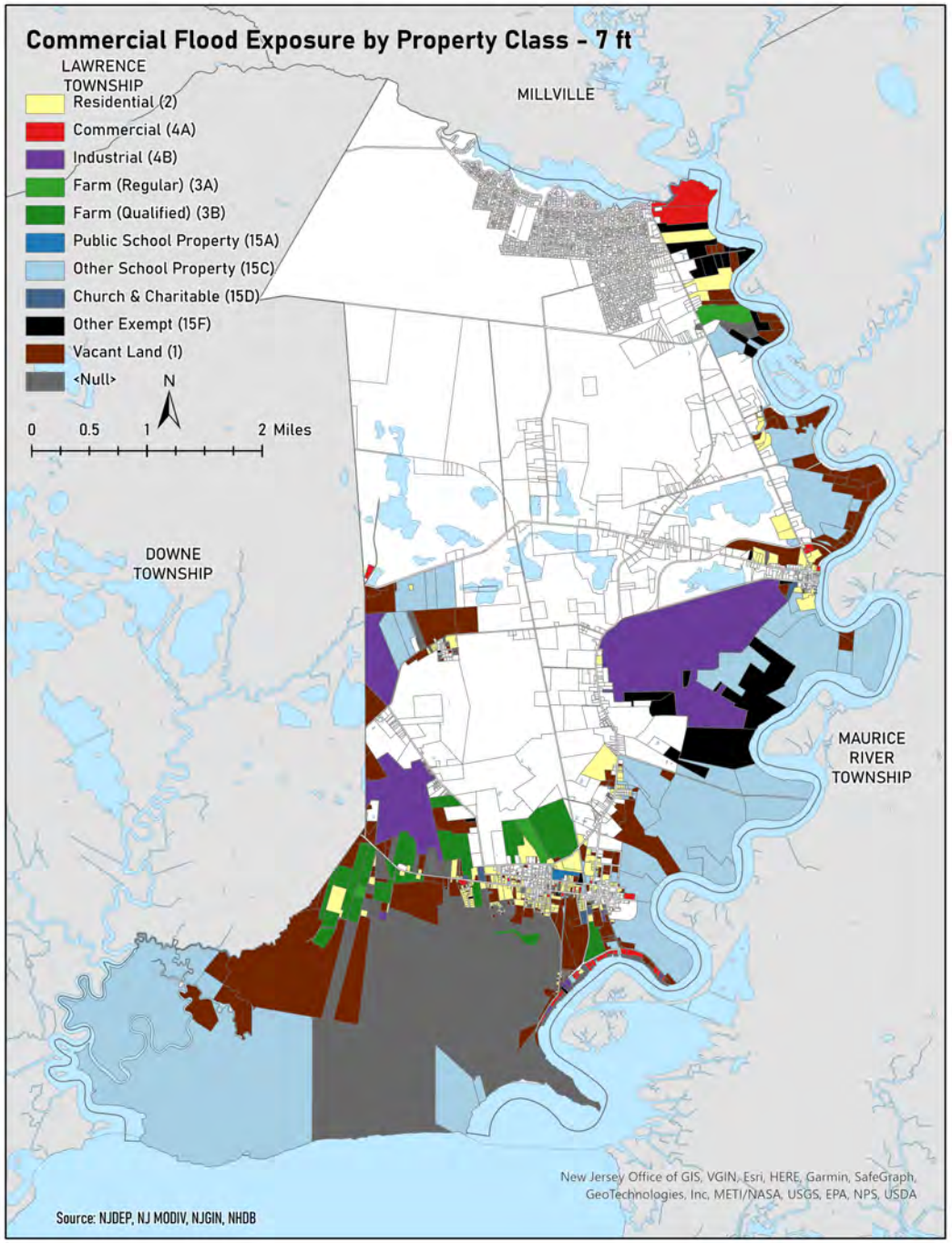




RUTGERS
New Jersey Climate Change Resource Center

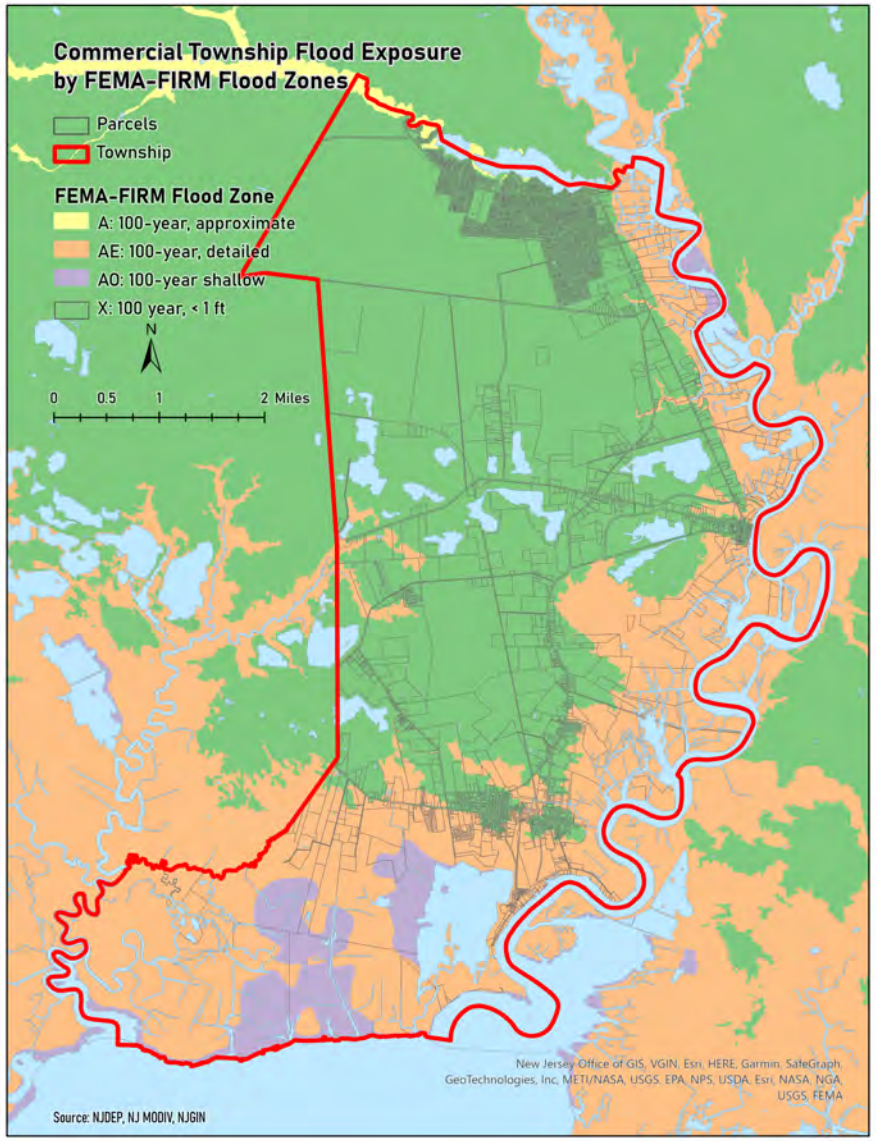
7' TWL Land Parcels

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	282	$26,116,200.00	$10,387,200.00	0	13.78
Commercial (4A)	41	$3,880,200.00	$3,137,500.00	0	71.93
Industrial (4B)	11	$3,962,600.00	$2,620,700.00	0	73.33
Farm Total (3A & 3B)	22	$287,800.00	$275,300.00	1	46.81
School and Public Property (15A, 15C)	71	$8,852,600.00	$2,221,100.00	0	73.82
Church & Charitable (15D)	10	$1,919,500.00	$277,100.00	0	37.04
Other Exempt (15F)	30	$2,429,000.00	$887,500.00	0	56.6
Vacant (1)	265	$0.00	$5,304,100.00	0	20.2
<Null Data>	112	*<Null Data>*	*<Null Data>*	112	*<Null Data>*
TOTAL	**844**	**$47,447,900.00**	**$25,110,500.00**	**113**	



RUTGERS
New Jersey Climate Change Resource Center

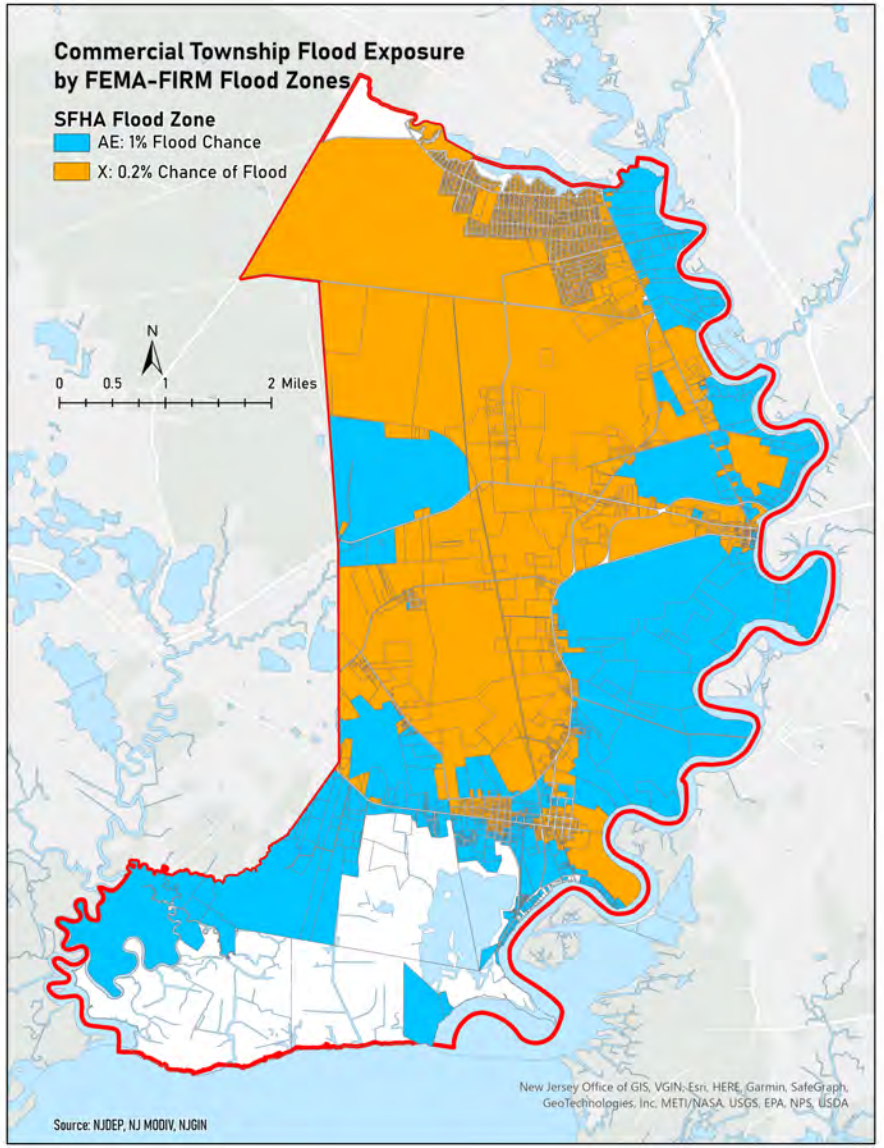
FEMA FIRM Flood Zones



- Flood zones are geographic areas that the FEMA has defined according to varying levels of flood risk.
- These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map.
- Each zone reflects the severity or type of flooding in the area.
- Flood Zones include A, AE, VE which are 1% chance of flood zones (High Risk Zones), the X-500 or the 0.2% chance of flood (Low Risk Zone) , and X which is the least risk zone

RUTGERS
New Jersey Climate Change Resource Center

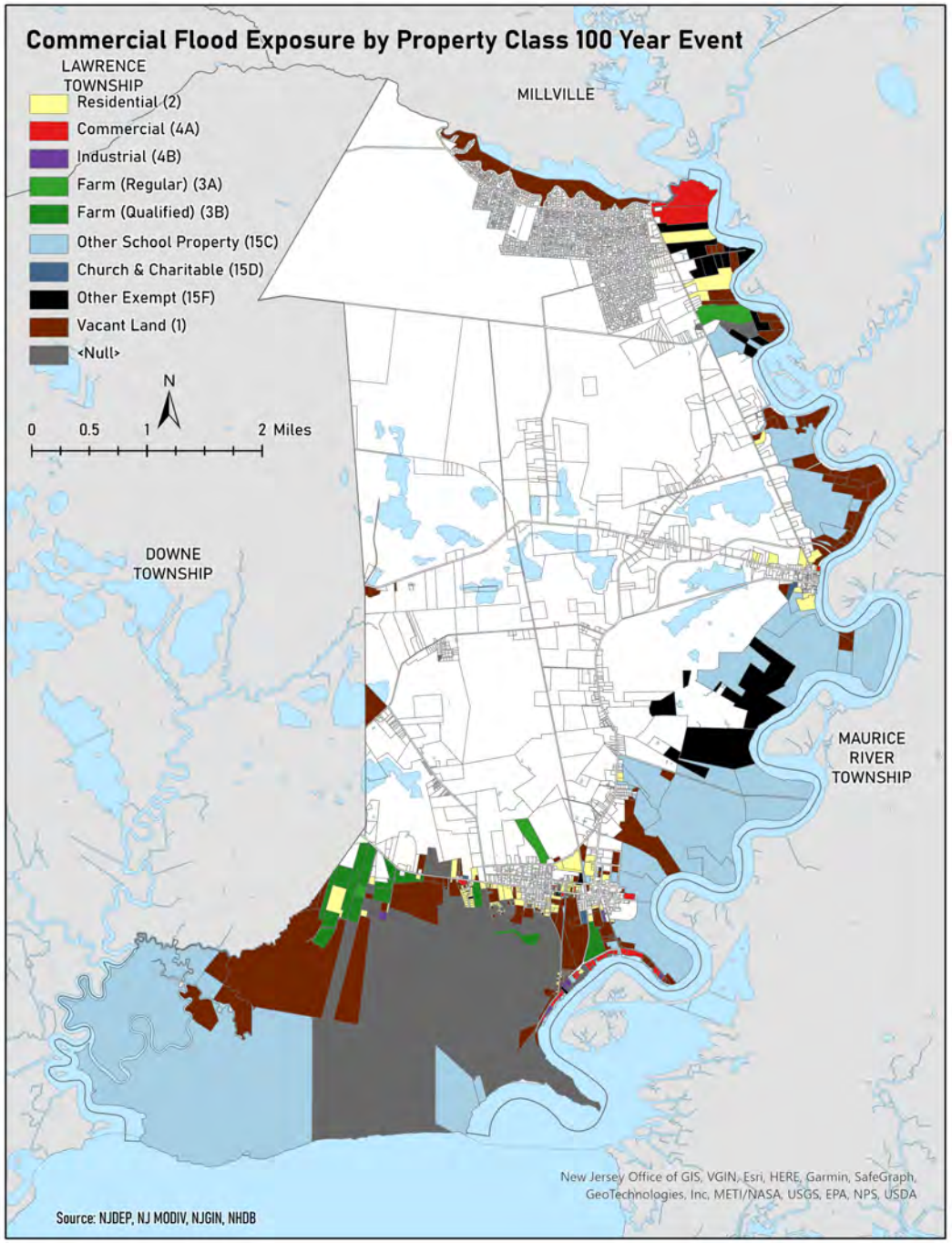
100-Year (1%) and 500-Year (0.2%) Event Parcels



RUTGERS
New Jersey Climate Change Resource Center

100-Year (1%) Event

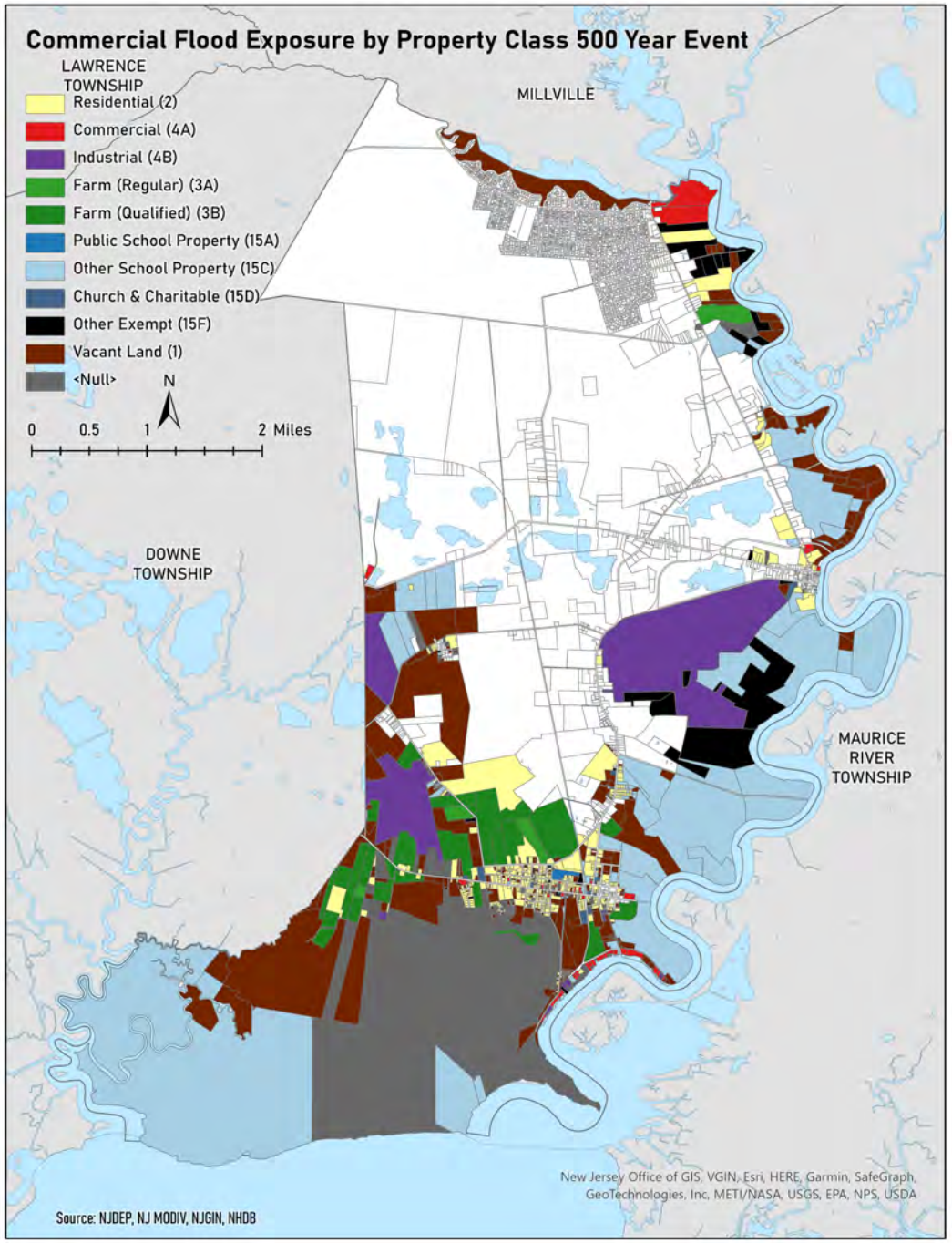
PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	132	$11,682,100.00	$5,143,600.00	0	6.45
Commercial (4A)	33	$2,962,700.00	$2,775,300.00	0	57.89
Industrial (4B)	8	$2,107,100.00	$559,300.00	0	53.33
Farm Total (3A & 3B)	17	$287,800.00	$197,300.00	0	36.17
Public and School Property (15A, 15C)	50	$2,999,800.00	$1,616,800.00	0	24.51
Church & Charitable (15D)	4	$489,600.00	$124,000.00	0	14.81
Other Exempt (15F)	24	$2,109,000.00	$691,600.00	0	45.28
Vacant (1)	205	$0.00	$4,594,200.00	0	15.63
<Null Data>	68	<Null Data>	<Null Data>	68	<Null Data>
TOTAL	**541**	**$22,638,100.00**	**$15,702,100.00**	**68**	



RUTGERS
New Jersey Climate Change Resource Center

500-Year (0.2%) Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	449	$41,780,000.00	$15,769,000.00	0	21.95
Commercial (4A)	46	$4,058,800.00	$3,307,600.00	0	80.7
Industrial (4B)	11	$3,962,600.00	$2,620,700.00	0	73.33
Farm Total (3A & 3B)	31	$332,700.00	$404,600.00	1	65.96
School and Public Property (15A, 15C)	80	$9,014,300.00	$2,465,300.00	0	38.28
Church & Charitable (15D)	18	$3,322,200.00	$445,100.00	0	66.67
Other Exempt (15F)	34	$2,852,400.00	$1,034,500.00	0	64.15
Vacant (1)	325	$0.00	$6,189,100.00	0	24.77
<Null Data>	110	<Null Data>	<Null Data>	110	<Null Data>
TOTAL	994	$65,323,000.00	$32,235,900.00	111	



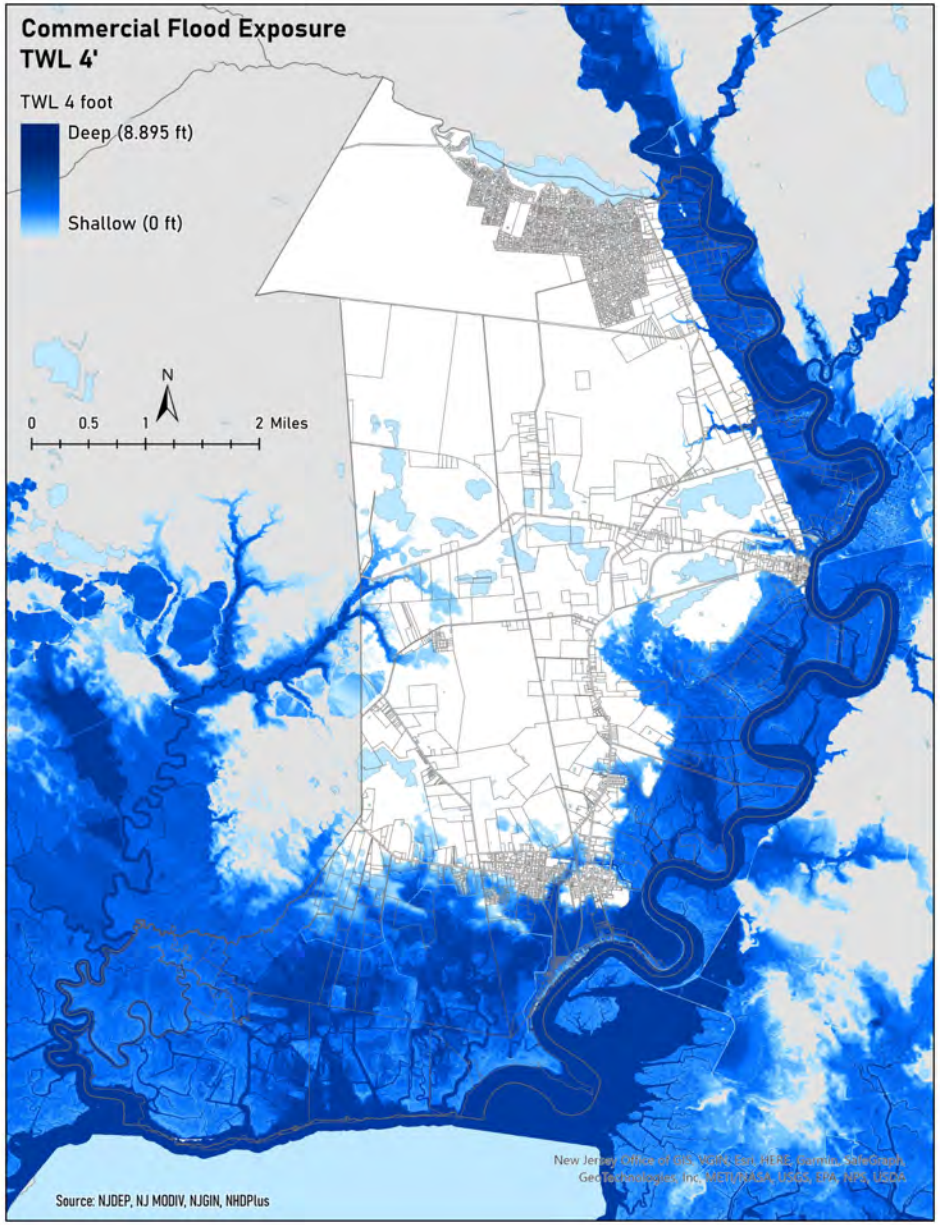
RUTGERS
New Jersey Climate Change
Resource Center

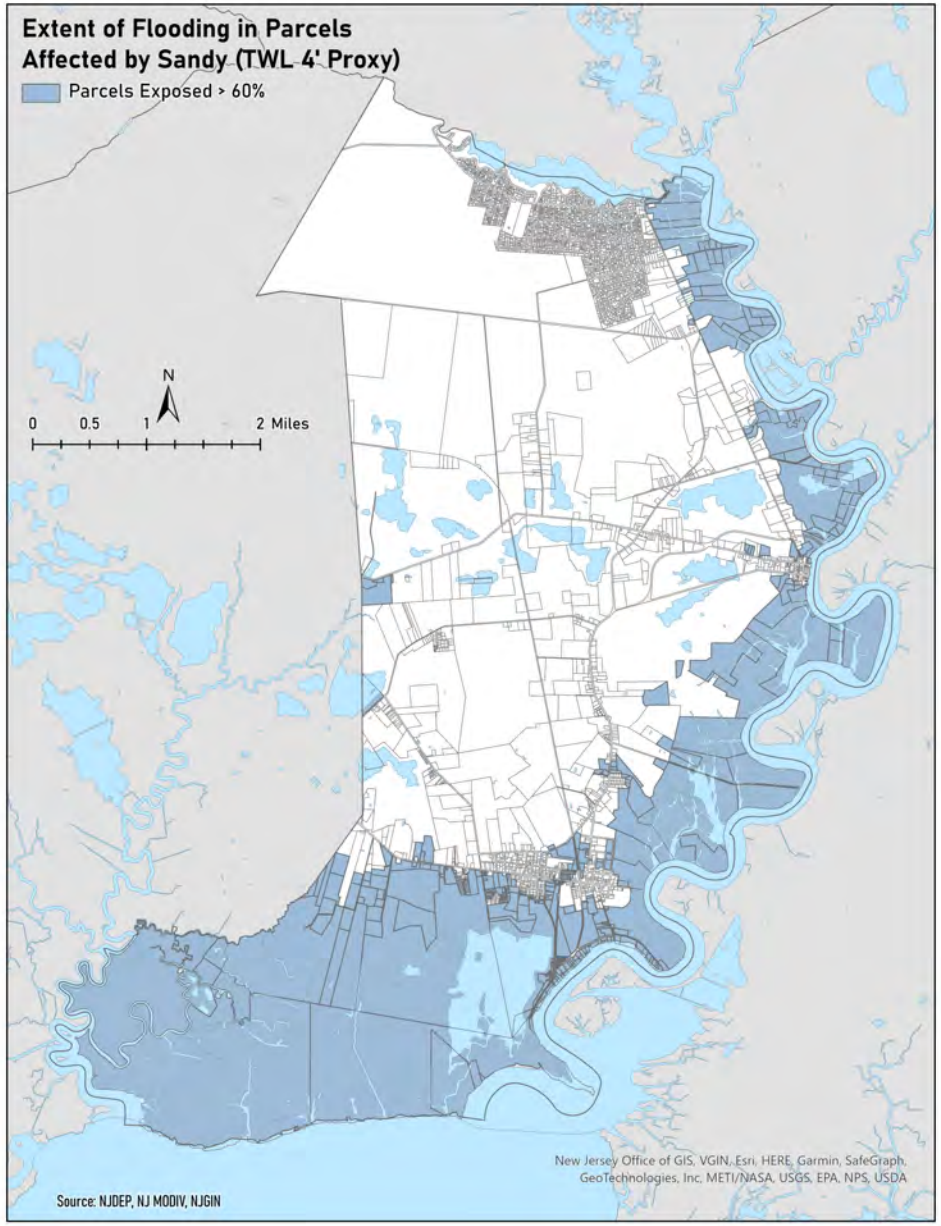
Hurricane Sandy

Data Overview, Extent of Flooding, 4' TWL Analysis

RUTGERS

Extent of Flooding TWL 4' (Sandy Proxy)

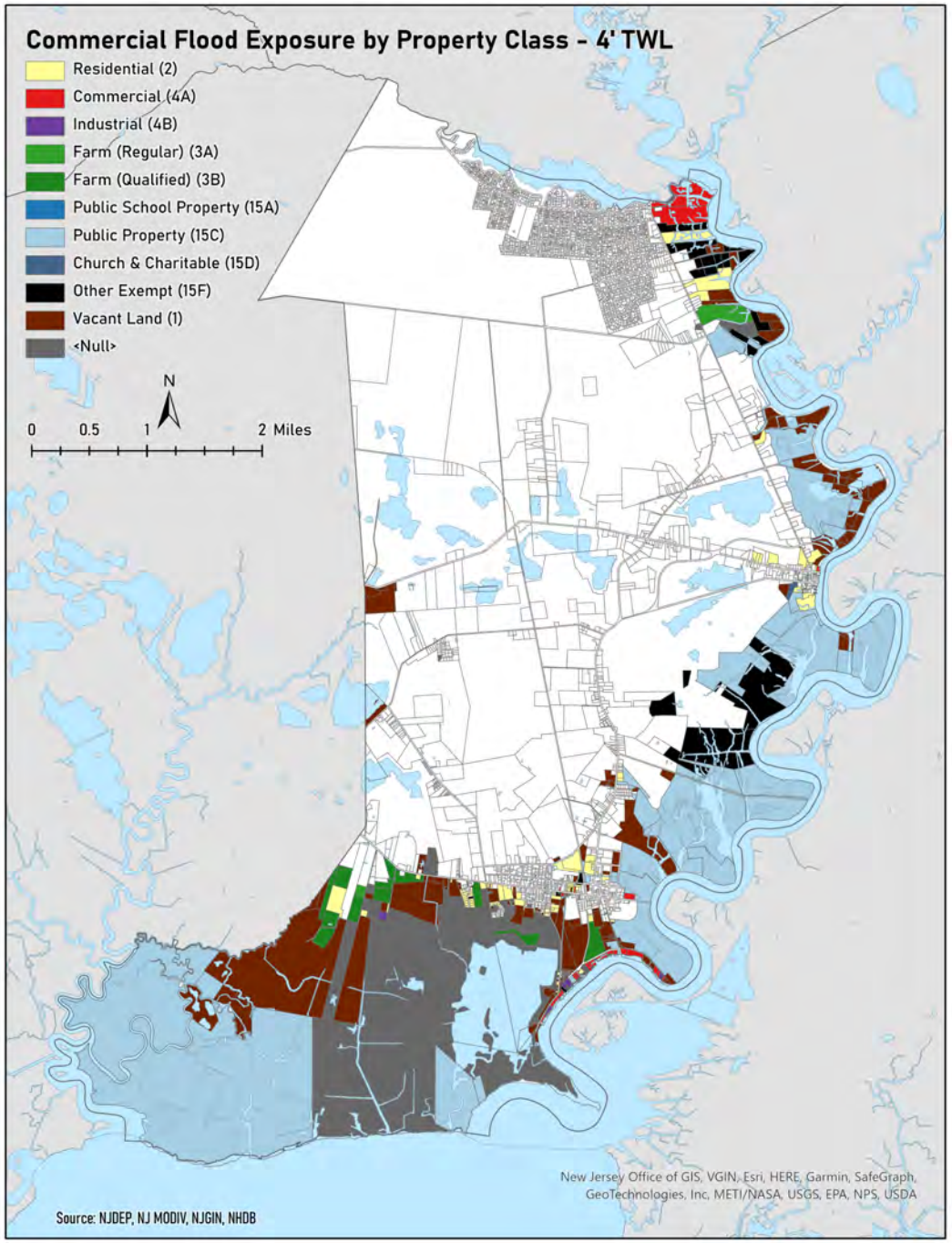




RUTGERS
New Jersey Climate Change Resource Center

TWL 4' Event

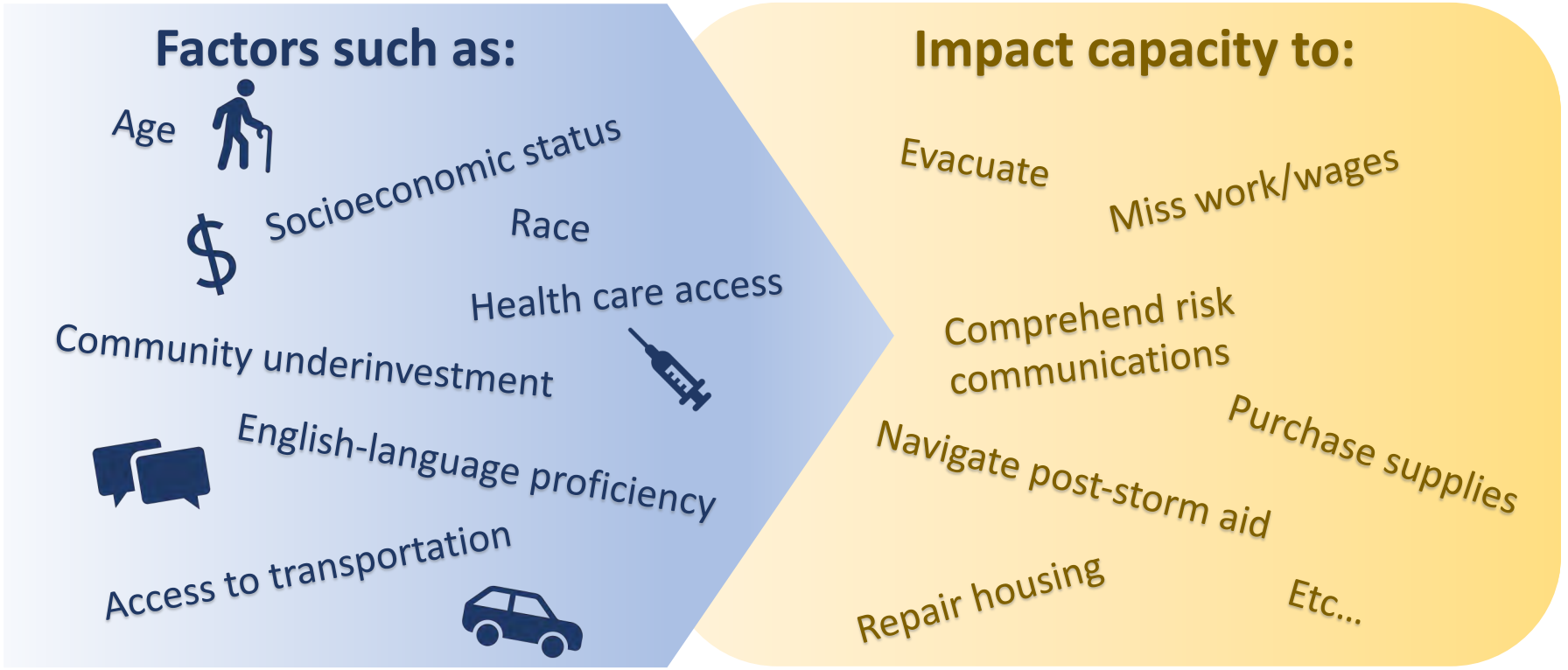
PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT VALUE, FLOODED	LAND VALUE, FLOODED
Residential (2)	105	$9,471,200.00	$4,287,900.00
Commercial (4A)	32	$2,754,900.00	$2,675,300.00
Industrial (4B)	8	$3,485,300.00	$1,651,700.00
Farm Total (3A & 3B)	15	$287,800.00	$185,500.00
Public & School Property (15A, 15B, 15C)	50	$2,999,800.00	$1,619,100.00
Church & Charitable (15D)	2	$0.00	$25,800.00
Other Exempt (15F)	25	$2,109,000.00	$712,300.00
Vacant (1)	194	$0.00	$4,578,600.00
TOTAL	**431**	**$21,108,000.00**	**$15,736,200.00**



RUTGERS
New Jersey Climate Change Resource Center

Social Vulnerability Index (SVI) Concept

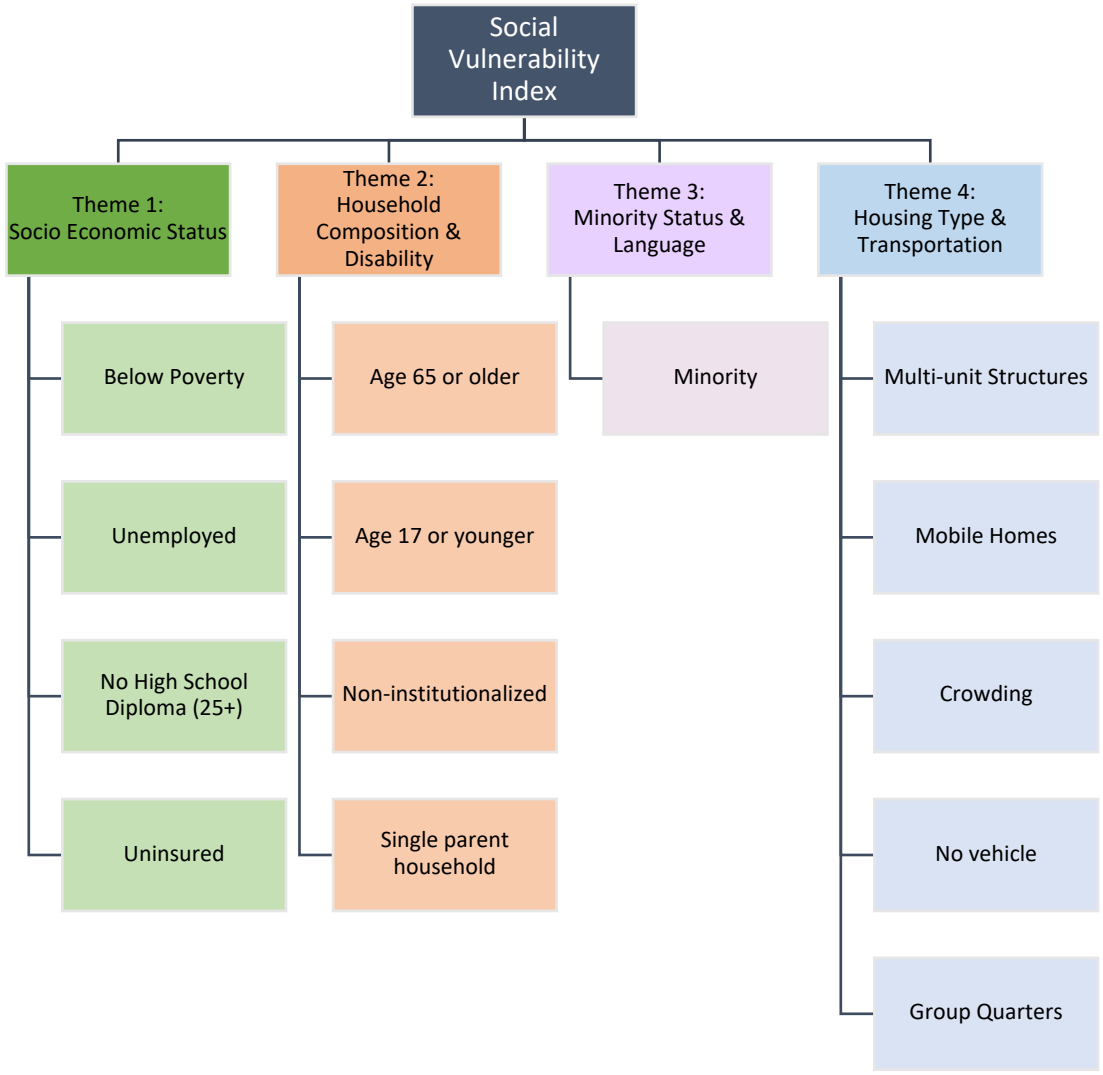
- Some people are disproportionately impacted by flooding. socio-economic
- Existing factors make it harder to prepare and/or recover.



RUTGERS
New Jersey Climate Change Resource Center

Social Vulnerability Index (SVI) Concept

- The Social Vulnerability Index (CDC/ATSDR SVI) is maintained by the **Geospatial Research, Analysis, and Services Program** (GRASP)
- Measures the social vulnerability of US communities to disasters, including natural disasters, disease outbreaks, and public health emergencies.
- The percentile ranking values range from **0 to 1**, with higher values indicating greater vulnerability.
- SVI calculates a single vulnerability score for each community based on demographic, socioeconomic, and household/housing characteristics.
- Each tract receives a separate ranking for each of the four themes.

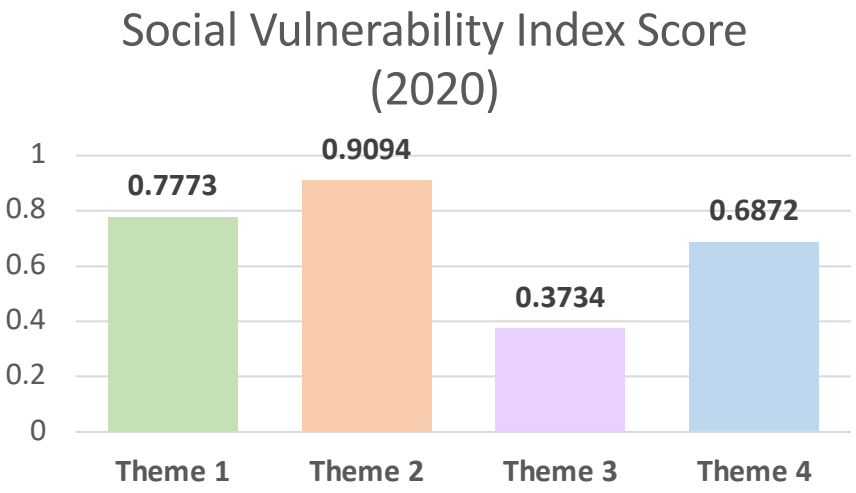


RUTGERS
New Jersey Climate Change Resource Center

Social Vulnerability in Commercial Township

(Source: CDC and ACS 5-year estimates 2016-20)

- **SVI Score = 0.78** indicates a moderately high level of vulnerability in the town



Overall Social Vulnerability (Tract Level)	Themes	15 Variables (Census)	Estimate	Percentage	Percentile
	Theme 1: Socioeconomic Status	Below 150% Poverty	1911	39.1%	0.9087
		Unemployed	157	7.9%	0.7551
		Housing-burdened units	667	37.2%	0.7095
		No High School Diploma (age 25+)	394	12.1%	0.7036
		Uninsured	260	5.3%	0.4954
	Theme 2: Household Characteristics	Age 65 or older	683	13.8%	0.4053
		Age 17 or younger	1414	28.6%	0.8801
		Noninstitutionalized Disabled	1336	27.1%	0.9848
		Single-parent Household	223	12.5%	0.8612
	Theme 3: Racial & Ethnic Minority Status	Minority	1387	28.1%	0.3734
	Theme 4: Housing Type & Transportation	Multi-unit Structures	0	0%	0.0
		Mobile Homes	411	19.5%	0.9871
		Crowding	25	1.4%	0.4574
		No Vehicle	84	4.7%	0.4113
		Group Quarters	18	0.4%	0.6284

RUTGERS
New Jersey Climate Change Resource Center

Overburdened Communities

An Overburdened Community (OBC), as defined by the law, is any census block group, as determined by the most recent United States Census, in which:

1. **at least** 35 percent of the households qualify as low-income households (at or below twice the poverty threshold as determined by the United States Census Bureau);
2. **at least** 40 percent of the residents identify as minority or as members of a State recognized tribal community; or
3. **at least** 40 percent of the households have limited English proficiency (without an adult that speaks English "very well," according to the United States Census Bureau).

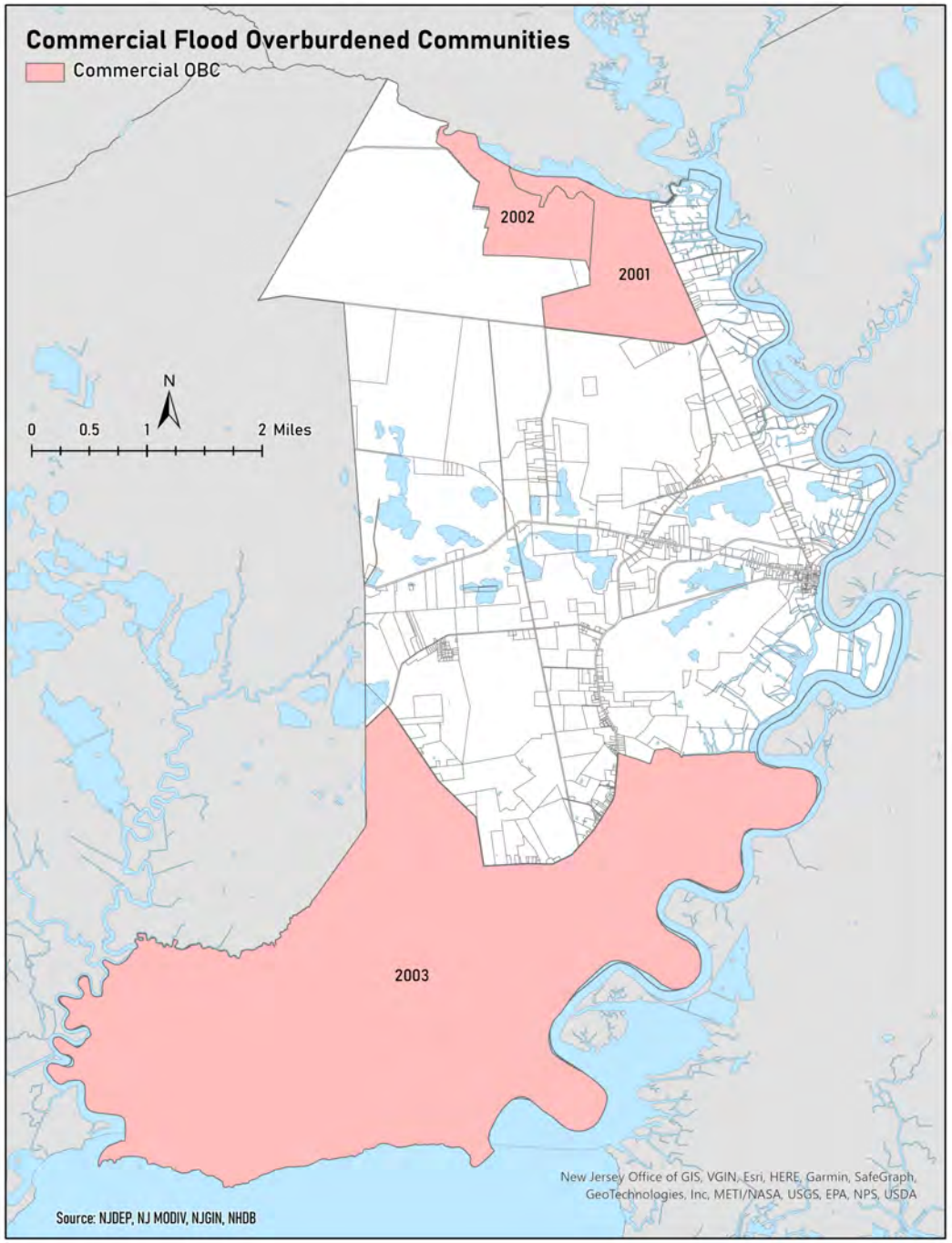
New Jersey's Environmental Justice Law (N.J.S.A. 13:1D-157) passed on **September 18, 2020**, requires NJDEP **to assess the impact of facilities on overburdened communities'** environmental and public health.

RUTGERS
New Jersey Climate Change Resource Center

Overburdened Communities

Overburdened Community Block Group Identifier	340110102001	340110102002	340110102003
Total Population	1116	1497	1646
Total Households (HHs)	484	497	541
Low-Income Population	601 (53.85 %)	819 (54.71 %)	749 (45.50 %)
Minority Population	337 (28.95%)	326 (21.78 %)	580 (35.24 %)
HHs with limited English Proficiency	10	12	10

Combined, three OBCs = 86.3% of the township population



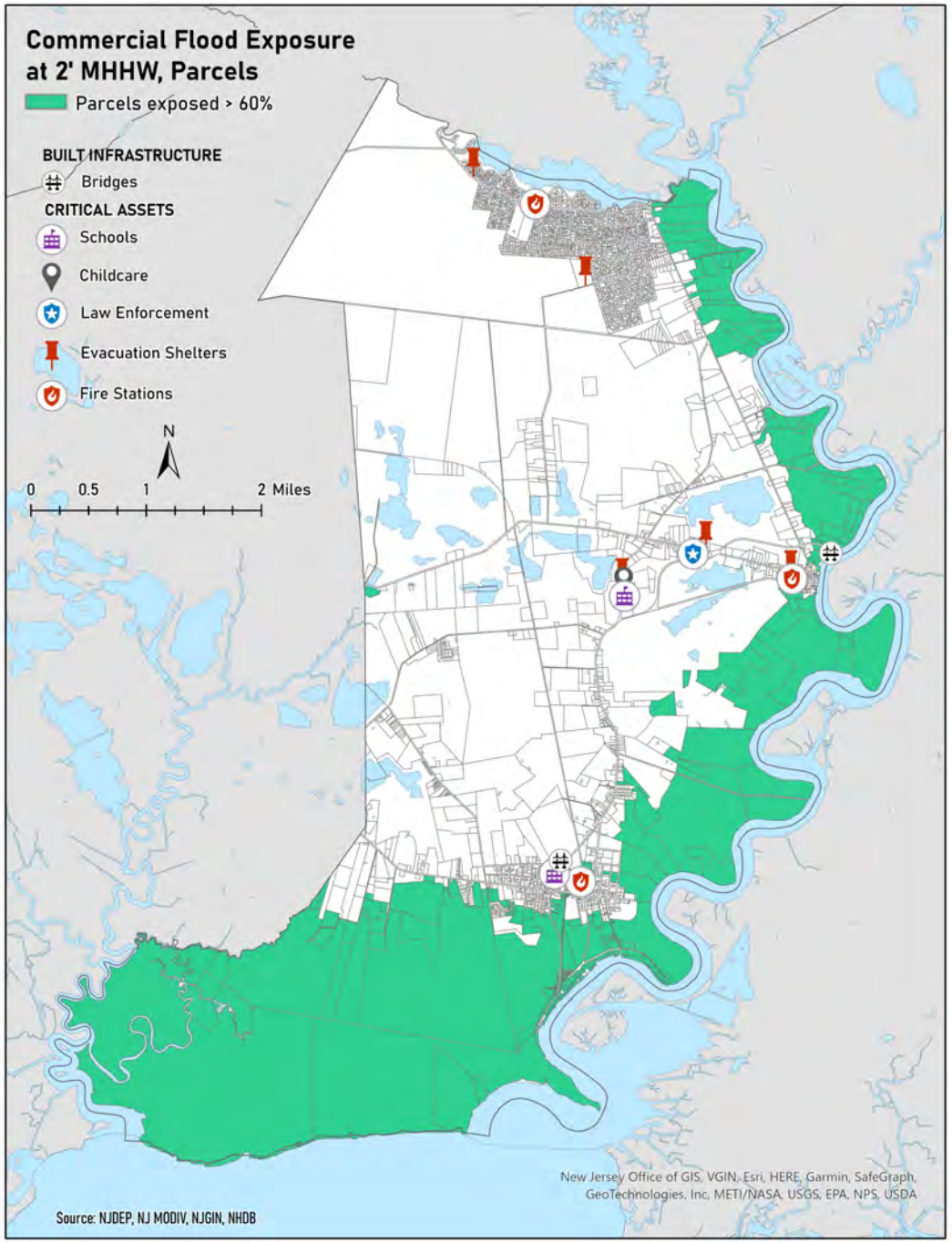
Critical Infrastructure

- Critical assets play a crucial role in education, care, and public safety and may be vulnerable to flooding.
- Built infrastructure, such as bridges and evacuation routes, may also be at risk of flooding, and its exposure must be understood to aid in community flood planning.
- Understanding their exposure to flood events and access roads is important for community planning.

RUTGERS
New Jersey Climate Change Resource Center

Inundated Critical Infrastructure, 2' TWL

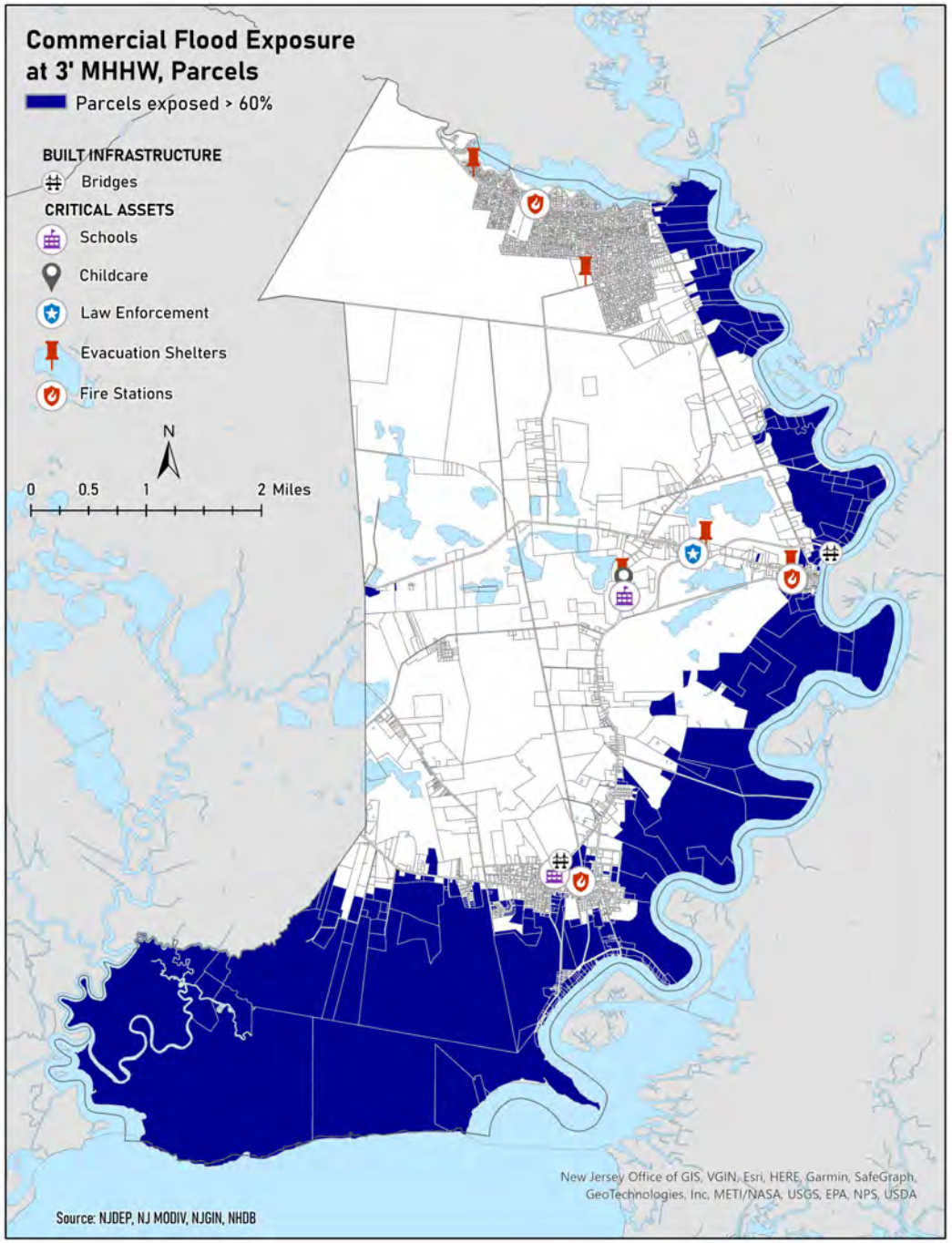
The sea level rise by 2150 (greater than 50% chance) + today's annual flood or 100-year flood by 2070



RUTGERS
New Jersey Climate Change Resource Center

Inundated Critical Infrastructure, 3' TWL

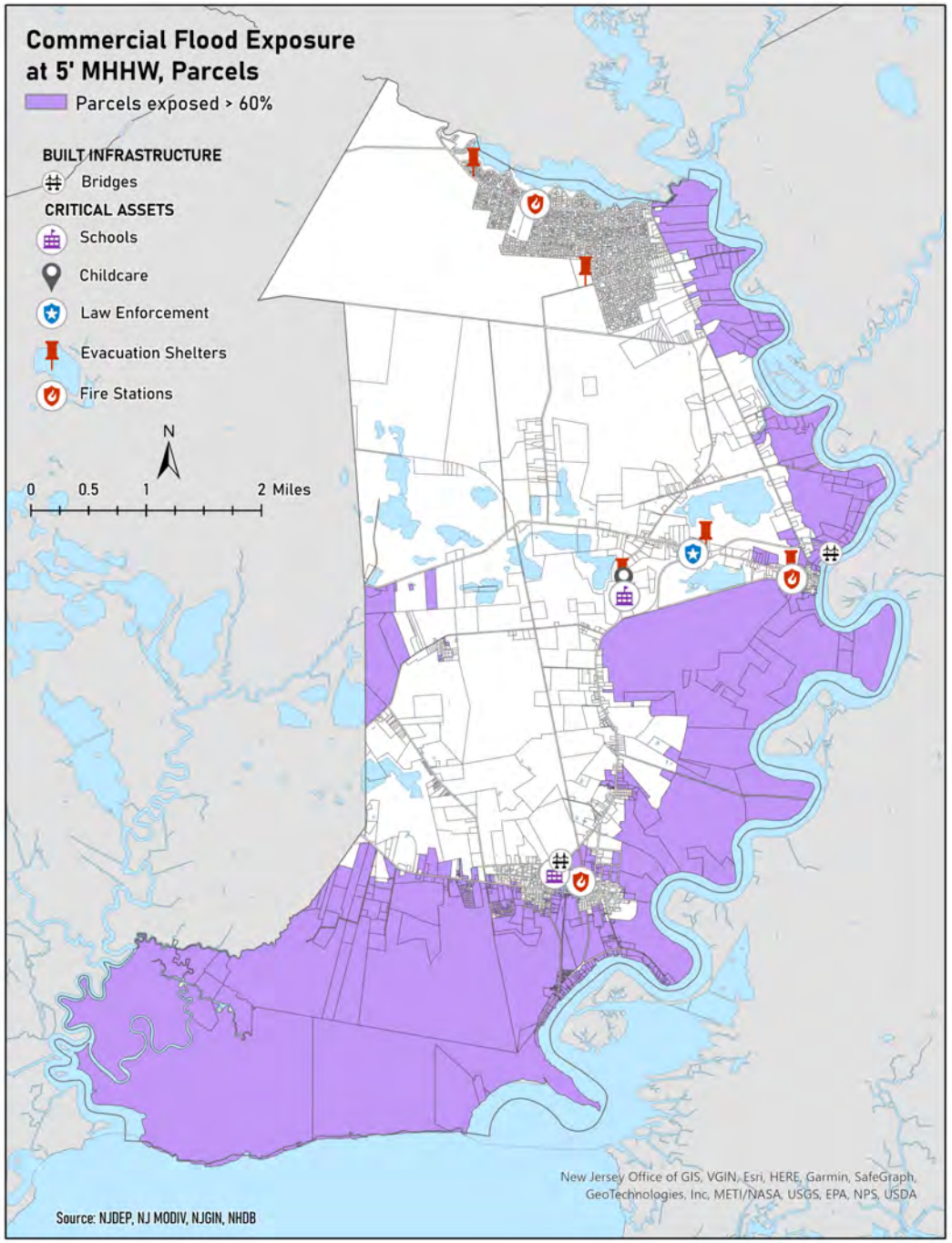
Permanent inundation by the year 2150 (greater than 83% chance) under a moderate inundation scenario or today's 10-year flood.



RUTGERS
New Jersey Climate Change Resource Center

Inundated Critical Infrastructure, 5' TWL

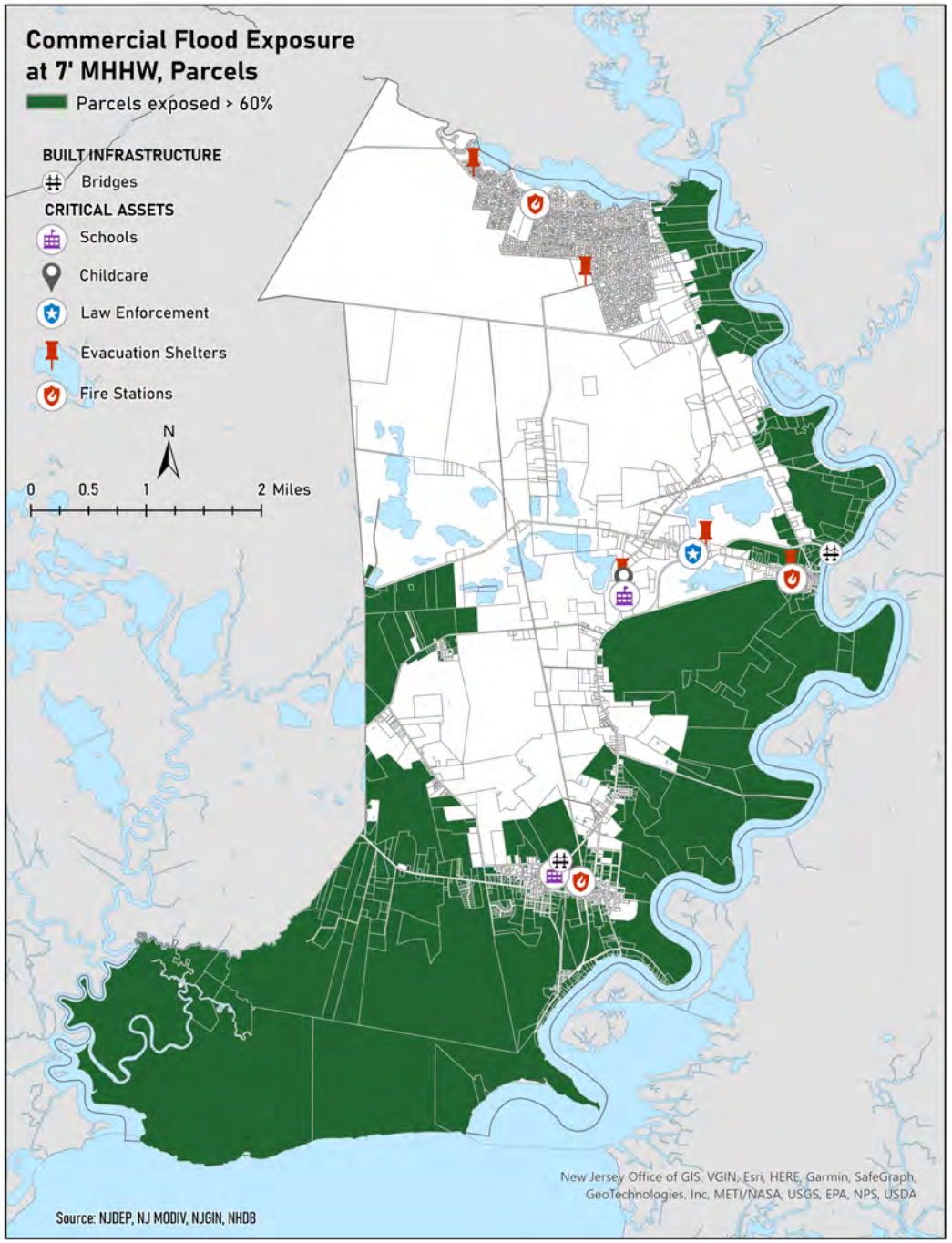
Permanent inundation by the year 2150 (greater than 50%chance) under a moderate inundation scenario or today's100-year flood.



RUTGERS
New Jersey Climate Change Resource Center

Inundated Critical Infrastructure, 7' TWL

The sea level rise by 2150 (greater than 50% chance) +today's annual flood or 100-year flood by 2070

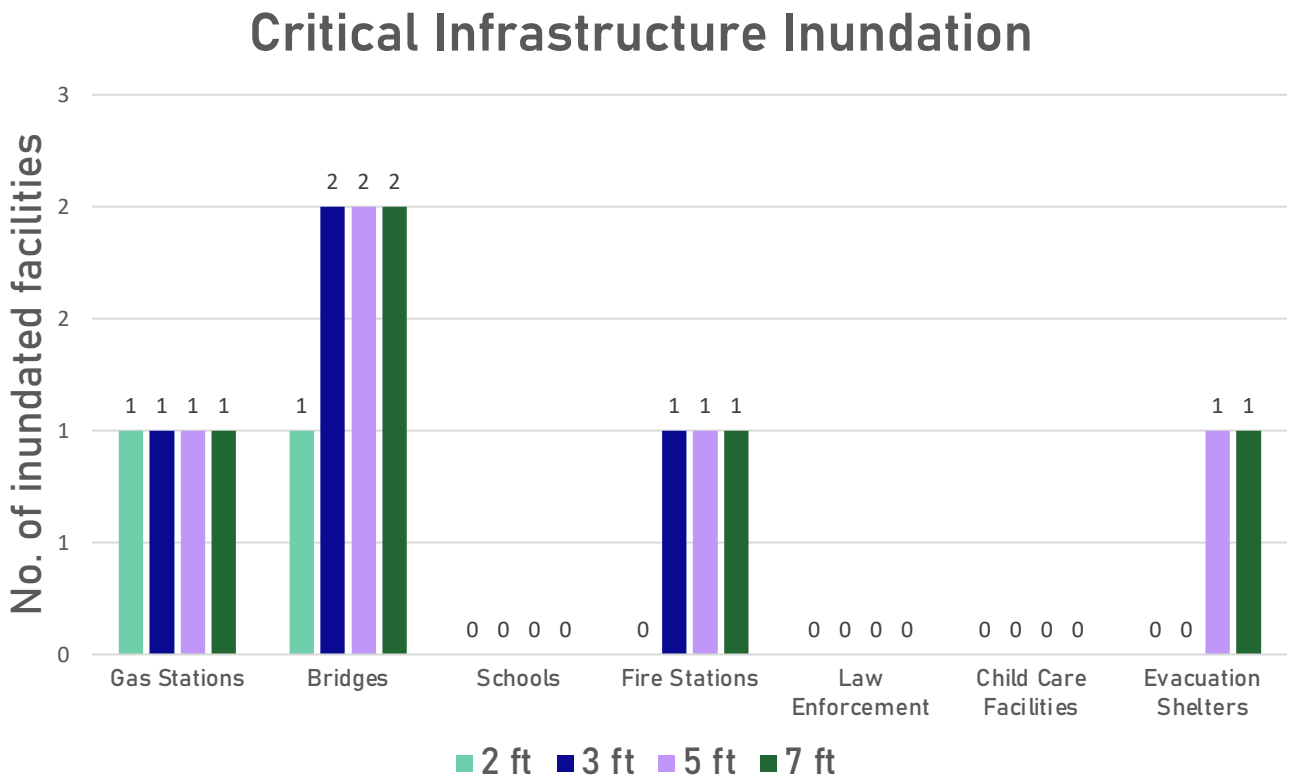


RUTGERS
New Jersey Climate Change Resource Center

Critical Infrastructure

Critical Facilities inundated at various flooding scenarios

Category	2 ft	3 ft	5 ft	7 ft	Total in municipality
Bridges	1	2	2	2	2
Schools	0	0	0	0	2
Fire Stations	0	1	1	1	3
Law Enforcement	0	0	0	0	1
Child Care Facilities	0	0	0	0	1
Evacuation Shelters	0	0	1	1	5



FLOOD ASSESSMENT

FOR

COMMERCIAL TOWNSHIP, CUMBERLAND COUNTY, NEW JERSEY

MARCH 2023

Assessment Completed by Rutgers Climate Corps

RUTGERS
New Jersey Climate Change Resource Center

Climate Resilience Corps
njclimateresourcecenter.rutgers.edu

TABLE OF CONTENTS

1. PURPOSE

The goal of this Coastal Vulnerability Assessment (CVA) is to analyze and summarize the possible impacts of different coastal (tidally-influenced) flooding scenarios in Commercial Township, New Jersey (hereafter "Commercial"). Using various tools and documents, a team from the Rutgers Climate Resilience Corps (hereafter "Rutgers") has identified current vulnerabilities associated with housing, local economy, public assets, and natural resources, among other social and physical Commercial assets. This CVA will help relevant NJ state agencies understand the potential impacts of coastal flooding in Commercial.

The data, maps, and information provided here should be used only as a screening-level tool for management decisions and not for navigation, permitting, or other legal purposes. Commercial should not rely on these data to analyze monetary losses from a specific event on individual properties or parcels.

In this report, Rutgers provides a flood exposure analysis for neighborhood-level planning and identification of potential flood exposure. The information in this report may be used to support the requirements of the New Jersey Office of Planning Advocacy (NJOPA) Plan Endorsement process, which aims to ensure that municipalities comply with state regulations and policies in their planning efforts. The information in this report may also be used to partially support the requirements of the New Jersey Municipal Land Use Law (Section 19 of P.L. 1975 c.291 C.40:55D-28) for municipalities to incorporate a Climate Change Related Hazard Vulnerability Assessment (CCRHVA) into the land use plan element adopted as part of municipal master plan updates.

The report focuses on flooding scenarios arising from sea level rise, storm surge, and high tides and does not encompass flooding from heavy rainfall/stormwater events. The data used in this CVA is not a substitute for property-specific flood hazard modeling and engineering studies that consider detailed building elevations and hydrodynamic conditions. Instead, the CVA provides a broader understanding of the regional flooding implications for future assessments.

2. Introduction and Methodology of Analysis

Water Levels

Rutgers assessed the impact of **2, 3, 5, and 7 feet of flooding using a Total Water Level (TWL) approach**.[1,2] TWL represents the "still water" inundation above Mean Higher High Water (MHHW) during a flood event. These water levels allow one to visualize the impact of future sea level rise combined with potential flood events (Figure 1). MHHW is the high-water tidal elevation determined by averaging the higher of each day's two high tides at a particular tide station during a National Tidal Datum Epoch, typically a 19-year time period.[3]

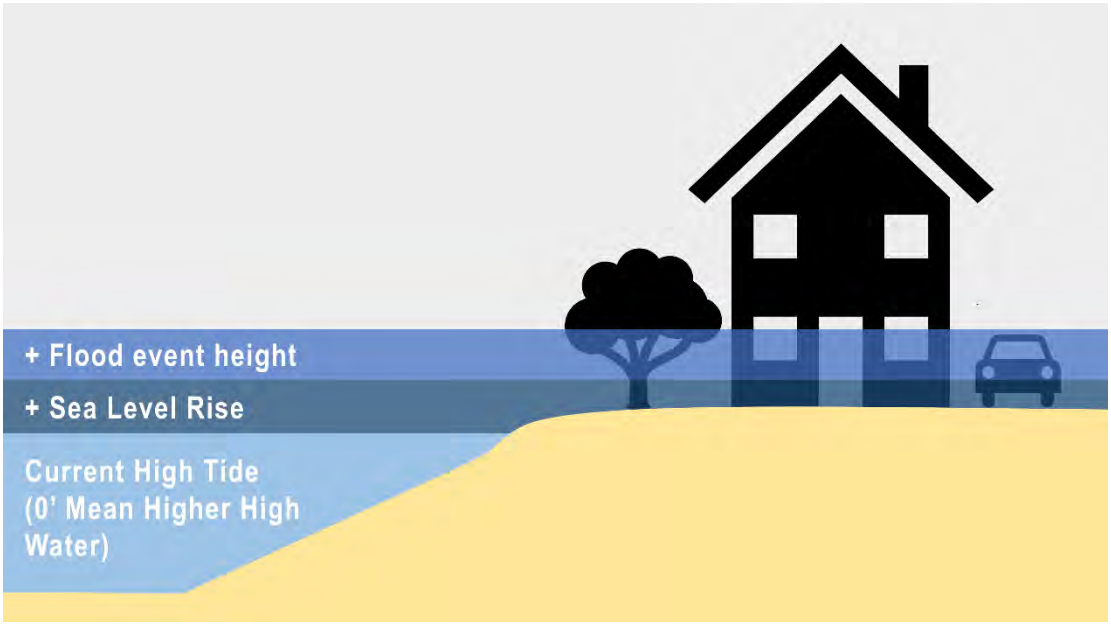


Figure 1: Total Water Level Approach

Thus, in this report, a 2-foot flood scenario indicates there are two additional feet of Total Water Level (above the local MHHW level). In other words, the a tidal waterbody's surface would be approximately two feet higher than the typical daily high tide.

Water levels above the MHHW can be caused by periodic tidal cycles, short-term storm surge events, gradual phenomena such as sea-level rise, or any of these in combination. In the future, the same water levels that occur during storm surge floods today may appear as high-tide flooding (HTF) during sunny days because of sea-level rise.

The four flooding scenarios used in this CVA follow the NJDEP's Sea Level Rise Guidance for New Jersey, which recommendations to "utilize 2100 as a planning horizon." Each of the flooding scenarios is within

---

[1] Alvin Chin et al., "The Climate Planning Tool - Flooding Primer," ArcGIS StoryMaps, October 14, 2022, https://storymaps.arcgis.com/stories/261ed651c9124ce29947512e94e14b1f.

[2] R.E. Kopp et al., "New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel" (Trenton, NJ: Rutgers, The State University of New Jersey, 2019), https://njclimateresourcecenter.rutgers.edu/wp-content/uploads/2020/03/STAP_FINAL_FINAL_12-4-19.pdf.

[3] https://tidesandcurrents.noaa.gov/datum_options.html. See also National Hurricane Center blogpost 1/29/2016.

the likely range of impacts projected for 2100, meaning that there is at least a 66% chance that between 2 to 5 feet of sea-level rise will occur by 2100.[4]

Collectively, these four water levels should be thought of as State planning benchmarks. NJDEP's Sea-Level Rise Guidance for New Jersey recommends that planners analyze: (1) 2 feet of sea-level rise that "is likely unavoidable," (2) 5.1 feet of sea-level rise sufficient to plan for most activities in a community, and (3) a high-end estimate of 6.9 feet for those critical activities for which damages would have "debilitating effects" on public health and safety.[5]

Sources of Data

Rutgers conducted this analysis using publicly available data in ESRI ArcGIS, a GIS software that allows users to work with maps and geographic information. ArcGIS data is commonly available as a shapefile (*i.e.,* a series of unique points, lines, or polygons which store information about a given area or object) or raster (*i.e.,* continuous data that can be overlayed on top of a given area). The following resources were used for this CVA and mapped on the "NAD_1983_Stateplane _New_ Jersey_FIPS_2900_Feet" coordinate system:

- New Jersey Municipal Boundaries shapefile.[6]
- Total Water Level raster files provided in 2017. These show the extent and depth of flood inundation, for different MHHW levels (2-, 3-, 5-, and 7-feet).[7]
- Flood Insurance Rate Map (FIRM) National Flood Hazard Layer shapefile. These show the extents of flood hazard zones.[8]
- MOD-IV Statewide Parcels shapefile. MOD-IV is the New Jersey Property Tax System, and this dataset provides information regarding where each property is located, the property's class (*e.g.,* whether the property is residential, commercial, etc.), the net value[9] of each property, and other relevant information. Source: The statewide composite of parcels data for New Jersey was developed during the Parcels Normalization Project in 2008-2014 by the NJ Office of Information Technology, Office of GIS (NJOGIS).[10]
- New Jersey 2020 Social Vulnerabilities Index shapefile and CDC/ATSDR Social Vulnerability Index (2020). The CDC's Social Vulnerability Index created by the Geospatial Research, Analysis Services Program (GRASP) aimed at helping public health officials and emergency response

[4] NJDEP, "Sea-Level Rise Guidance for Planning & Decision-Making," June 2021, https://www.nj.gov/dep/bcrp/resilientnj/docs/dep-guidance-on-sea-level-rise-2021.pdf.
[5] NJDEP.
[6] New Jersey Office of GIS, "Municipal Boundaries of NJ" (NJGIN Open Data, August 23, 2022), https://njogis-newjersey.opendata.arcgis.com/datasets/3d5d1db8a1b34b418c331f4ce1fd0fef_2.
[7] "Total Water Level (0-20 Ft)," 2017, https://njmaps1.rad.rutgers.edu/arcgis/rest/services/CoastalFlooding.
[8] FEMA, "Flood Maps" (FEMA), accessed March 2, 2023, https://www.fema.gov/flood-maps.
[9] Net value here is equivalent to the appraised value determined by the NJ MOD-IV taxation database. The net value is the sum of the appraised value of the land and improvements to the property (e.g., the value of the building). A net value is not, and should not be interpreted as, the replacement value of a structure destroyed or damaged by a flooding event.
[10] New Jersey Office of GIS, "Parcels and Mod-IV Composite of NJ (Download)" (NJGIN Open Data), accessed November 10, 2022, https://njogis-newjersey.opendata.arcgis.com/documents/406cf6860390467d9f328ed19daa359d.

planners to identify and map the communities that will most likely need support before, during, and after a hazardous event. 2020 ACS data is mapped onto 2010 Census Tract geographies.[11]

- US Geological Survey NHDPlus High Resolution. The National Hydrography Dataset depicts flow of water at 1:24,000 scale. Rutgers uses the data to depict floodways and open water.[12]
- Overburdened communities under the New Jersey Environmental Justice Law. As designated by the NJDEP,[13] an "overburdened community" refers to any Census block group in which:
    - at least 35% of the households qualify as low-income households;
    - at least 40% of the residents identify as a minority or as members of a State-recognized tribal community; or
    - at least 40% of the households have limited English proficiency.
- Rutgers Climate Snapshot. This dataset provides location data for exposed critical infrastructure for all New Jersey municipalities.[14]

Consideration of Social Vulnerability

The range of assets evaluated in this report highlight the intersectionality of disaster events and reflect the fact that flooding may trigger cascading and compounding effects in coastal communities. This is especially true for socially vulnerable and/or overburdened individuals and communities. For example, the structural impacts of floods, which include damage to homes and displacement of residents, could also exacerbate existing health issues for certain communities when mold grows under carpets after flooding events. These negative health impacts can be compounding, especially for the disabled, elderly, or others with existing medical conditions and/or with limited capacity to address health concerns when they arise.

Physical flooding damage may also: deteriorate mental health from the stresses of repetitive loss and prolonged recovery; enable the outbreak of waterborne and mosquito-borne disease; cause residential displacement that ruptures the social safety networks of families, friends, and neighbors. Potential physical effects of flooding include disruptions and structural damage to coastal assets such as buildings, water and sewer utilities, power and electricity outages, and local transportation systems. Any or all of these may impede the efficiency of rescue efforts and slow post-disaster recovery. Economically, flooding may inhibit businesses reopening, which could also lead to social and health complications for community members.[15]

---

[11] "CDC/ATSDR Social Vulnerability Index (SVI)," November 16, 2022, https://www.atsdr.cdc.gov/placeandhealth/svi/index.html.

[12] U.S. Geological Survey, "USGS National Hydrography Dataset Plus High Resolution (NHDPlus HR) for 4-Digit Hydrologic Unit - 0204 (Published 20180813)," August 13, 2018, http://viewer.nationalmap.gov/basic/.

[13] NJDEP, "What Are Overburdened Communities (OBC)?" (NJDEP), accessed March 2, 2023, https://dep.nj.gov/ej/communities/.

[14] Rutgers University, the State University of New Jersey, "Climate Snapshots" (Rutgers University, the State University of New Jersey), accessed March 2, 2023, https://climatesnapshots.rutgers.edu/.

[15] See pp.4-6 in B.E. Flanagan et al., "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Managmenent* 8, no. 1 (2011), https://doi.org/10.2202/1547-7355.1792.

3. How to Interpret Maps

Following the methodology and data sources outlined in the previous section, Rutgers created four types of flood hazard maps for Commercial Township in its entirety. This section is dedicated to helping readers understand how to interpret each map type.

Type 1 Map – Spatial Extent of Flooding Scenarios

The first type of map represents the spatial extent of flooding for 2ft, 3ft, 5ft and 7ft Total Water Level (TWL) scenarios, using raster data overlaid on the parcels within the Township.

Each map in this category represents a flooding scenario. Darker shading represents deeper water at that location. The areas that are unshaded in the map indicate that there is no flooding there.

Type 2 Map – Flood Level Exposure of Parcels

The second type of map is a more detailed version of the first type which shows the parcels whose area is more than **60 percent** flooded in a given scenario. Rutgers chose to analyze flooded parcels based on 60% inundation due to the concentration of small residential parcels in Commercial. At 60% inundation, many of these parcels, with homes taking up most of the parcel, are flooded. See Figure 2 for a visual example of this phenomenon.

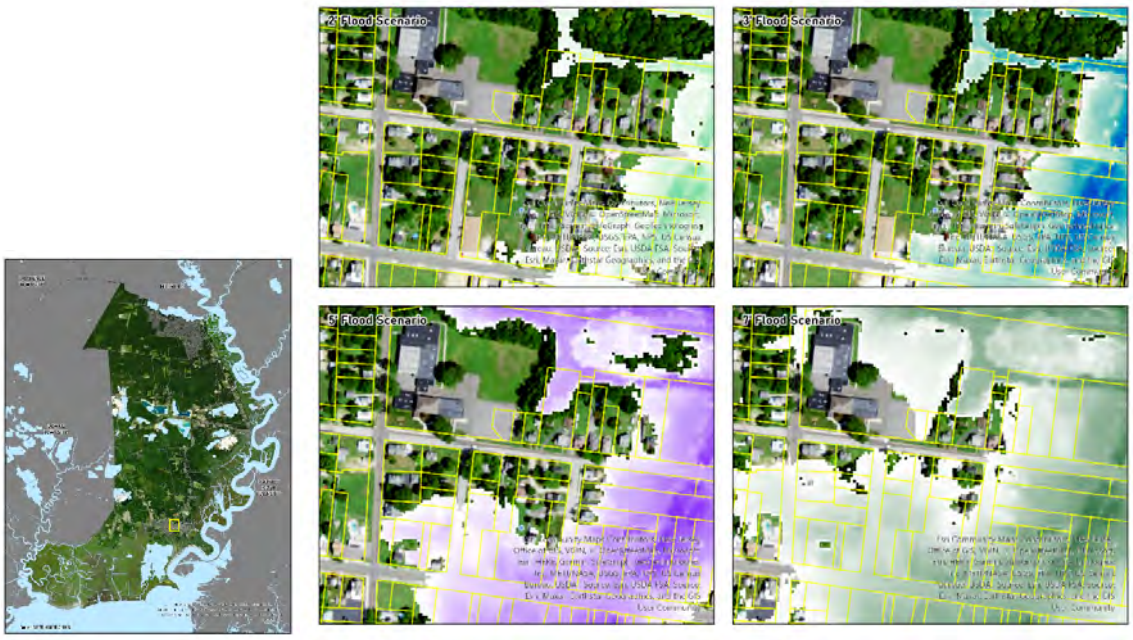


Figure 2: Inundation Analysis Criteria

The flooding at 2ft and 3ft flood scenarios is less severe than the other higher water levels included in this analysis, but also more likely to occur.

In contrast, the higher 5ft and 7ft flood scenarios are less likely to occur. As such, the flooding in these scenarios is dangerous more in terms of magnitude, rather than frequency.

Type 3 Map – Parcel Class Inundation, by Scenario

These maps build on the previous types by additionally identifying the property classification of the inundated parcels. The parcels are visually represented by property class, using the color-coding scheme within the American Planning Association's Land-Based Classification Scheme standards.[16]

Type 4 Map – FEMA Flood Hazard Zones

The fourth type of map displays the spatial extent of flood zones designated by the Federal Emergency Management Agency (FEMA). FEMA prepares Flood Insurance Rate Maps (FIRMs) illustrating the extent of flood hazards in flood-prone communities for flood insurance and risk assessment purposes.[17] To generate these maps, FEMA conducted engineering studies referred to as Flood Insurance Studies. Collectively, these maps are known as the National Flood Hazard Layer (NFHL).

Using the information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on flood maps. SFHAs are subject to inundation by floods that have a 1% or greater chance of being equaled or exceeded during any given year. This type of flood is commonly referred to as the 100-year flood or the base flood. Areas inundated by these floods are identified on the FIRMs as Zones A, AE, AH, AO, AR, V, VE, B, and C. (An additional identified zone, X, is also mapped but is not part of the SFHA as it has a lower annual chance threshold of only 0.2%). Only five FIRM zones are designated in Commercial, but all zones' descriptions are provided below for reference.

While these SFHAs delineate flood insurance requirements and/or regulate local, state, and federal management of coastal land development, the engineering studies upon which they are based may not have been updated to account for climate change-related flood hazards. Therefore, these Flood Hazard Zone maps are meant to complement the TWL scenario maps.

It is important to note a 100-year flood is not a flood that occurs once every 100 years. In fact, the 100-year flood has a 26 percent chance of occurring during a 30-year period. The 100-year flood is a regulatory standard used by Federal agencies and most states to administer floodplain management programs. The 100-year flood is used by the National Flood Insurance Program (NFIP) as the basis for insurance requirements nationwide.

The FEMA Flood Zone types are listed below. Only the **bolded Zones** are present within Commercial:

- **Zone A – The flood insurance rate zone that corresponds to the 100-year floodplains that is determined in the Flood Insurance Study by approximate methods. In these areas, detailed hydraulic analyses are not performed.**
- **Zone AE - The flood insurance rate zone that corresponds to the 100-year floodplains that is determined in the Flood Insurance Study by detailed methods. (**AE is listed as either "AE: 1% annual flood chance" or "AE: Floodway." The "AE: 1% annual flood chance" zone is consistent with the AE description listed above, while "AE: Floodway" is described below.)

[16] American Planning Association, "LBCS Standards," American Planning Association, accessed March 2, 2023, https://www.planning.org/lbcs/standards/.
[17] https://www.fema.gov/sites/default/files/2020-07/how-to-read-flood-insurance-rate-map-tutorial.txt

- Zone AH - The flood insurance rate zone that corresponds to the areas of the 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet.
- Zone AO - The flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet.
- Zone AR - The flood insurance rate zone that results from the decertification of a previously accepted flood protection system that is being restored to provide protection from the 100-year or greater flood event.
- Zone V - The flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Approximate hydraulic analyses are performed for such areas.
- **Zone VE - The flood insurance rate zone that corresponds to the 100-year coastal floodplain that have additional hazards associated with storm waves. Detailed hydraulic analyses are performed in this zone.**
- **Zone X – The flood insurance rate zone that corresponds to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. Zone X is not counted as part of the SFHA.**
- **Floodway – This designation is specific to areas that a riverine floodplain depends on to carry deeper, faster moving water.[18] It consists of the stream's channel and the adjacent lands that must remain free from obstruction so that the 100-year flood can be conveyed downstream without increasing the water surface height.**
- **Open Water – A body of open water, such as a pond, lake, ocean, etc., located within a community's jurisdictional limits, that has no defined flood hazard (may also be labeled Undescribed or Undesignated Flood Hazard).**

[18] https://www.fema.gov/pdf/floodplain/nfip_sg_unit_5.pdf

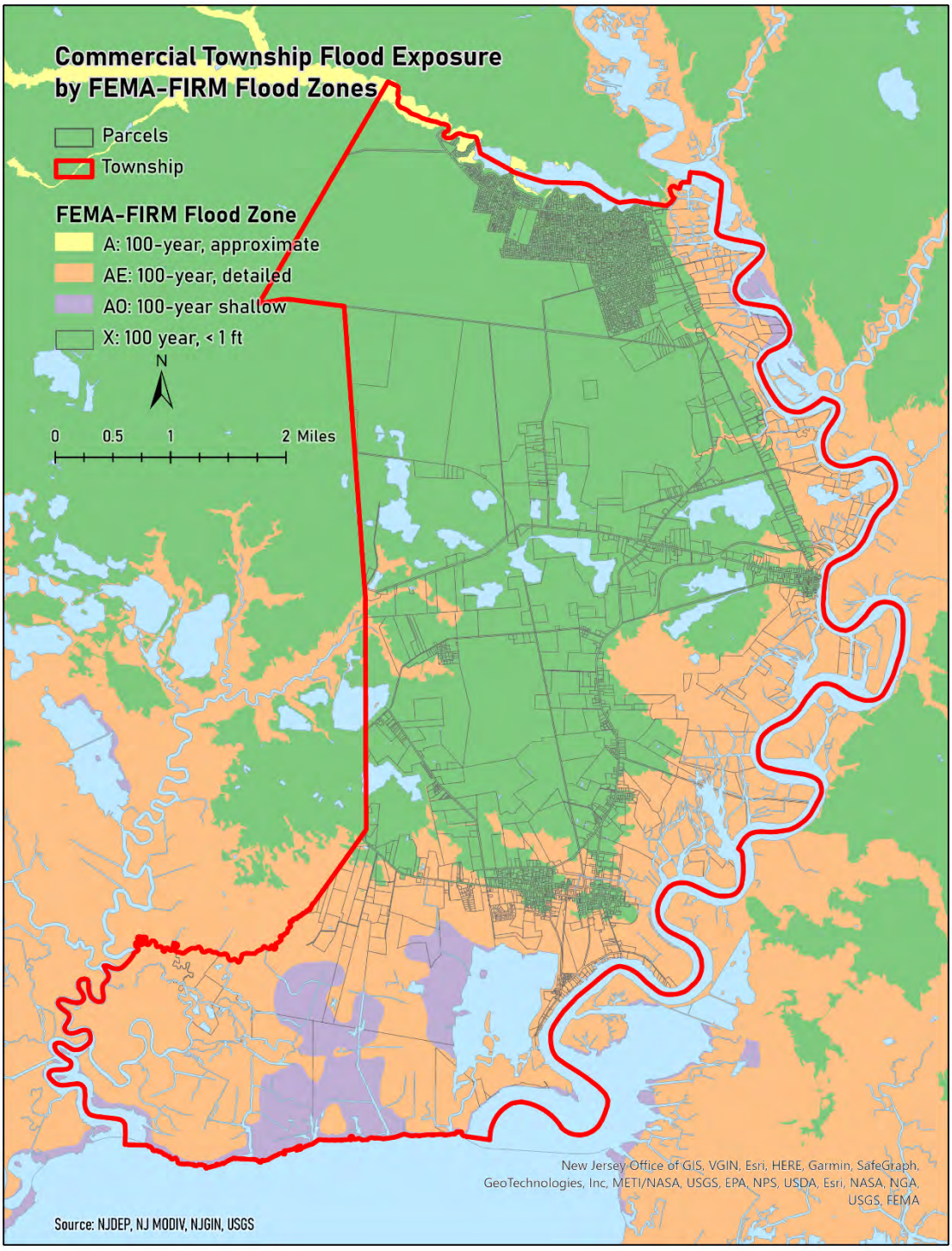


Figure 3: Commercial Township flood zones

4. FLOOD ASSESSMENT

Identified Exposures Summary

This assessment reveals patterns of flooding and its impacts on people and property at municipal and neighborhood scales. At a municipal spatial scale, three underlying patterns were observed:

- Several rivers, creeks, and meadows in the township, including Delaware River, Maurice River, Buckshutem Creek, and State Conservation Area Egg Island are subject to flooding during periods of heavy rainfall or storms. Furthermore, coastal areas like those near Delaware Bay are susceptible to flooding during storm surges and high tides.

- The areas in Commercial most vulnerable to flooding are bayside locations near Delaware Bay in Port Norris and along the southern municipal boundary. Communities along the western bank of the Maurice River, along the eastern boundary of the municipality, are at risk of riverine flooding. There are also parcels adjacent to the Cub Swamp south of Highland St that are at risk of flooding in some scenarios.

Location and Context

Commercial Township is in southern Cumberland County, surrounded by the municipalities of (clockwise from north) Millville, Maurice River Township, and Downe Township.

Due to Commercial geographic situation — within the marine- and tidally-influenced Delaware Bay and bordered on three sides by the waters of the Delaware Bay, Egg Island State Conservation Area, and Maurice River — Commercial's riverfront, bayside, and low-lying areas are exposed to high tide flooding, riverine flooding, and flooding during storm events. High tide flooding in this case refers to coastal flooding that occurs on a predictable tidal cycle basis and is commonly referred to as nuisance flooding. Riverine flooding occurs when streams and rivers exceed the capacity of their channels and water spills into adjacent land. During a storm surge event, water levels are pushed higher than expected due to the impacts of local wind stress and a change in barometric pressure.

Residential property constitutes 47% of Commercial's 4,353 parcels, making up the plurality. Next is vacant property, comprising 31.7% of the township's parcels. Public parcels comprise 4.8%.

Commercial is divided five unincorporated communities: Port Norris, Bivalve, Mauricetown, Laurel Lake, and Haleyville.

Demographics

According to the American Community Survey (2020) five-year estimates, Commercial has a total population of 4,936. Since 2010, Commercial experienced a population growth rate decline of 5%.

The population density of Commercial Township is 143 persons per square mile. The average household size is 2.75, and there are 2,096 housing units, of which 1,776 (84.7%) are occupied. Approximately 66% of the occupied housing units are owner-occupied and the median household income is $45,931. The poverty rate is 18%, and the unemployment rate for individuals aged 16 years and older is 4.3%.

The median rental cost in Commercial is $1,066 per month, while the median house value is $122,000. The median age of the township's residents is 38.7 years, with 77.2% identifying as white alone and 22.8% identifying as non-white.

Parcels and Property Classes

Table 1 shows a breakdown of the property classes in Commercial, including the total number of parcels associated with each property class. There are 6,197 total parcels in the township.

The "Residential" property class includes 2,046 parcels, or approximately 47% of all parcels. Typically, this classification includes single-family homes, duplexes, and townhouses. The next largest property class is the bundled "Vacant" class group, which includes 1,382 parcels, or 31.7% of the total.

The other property classes listed in the table include "Residential (Apartments)," "Commercial," "Industrial," “Farm,” "Education," "Church and Charitable," "Cemeteries," "Other Exempt," and “Vacant.”

PROPERTY CLASS	# PARCELS TOTAL
Residential (2)	2,046
Commercial (4A)	57
Industrial (4B)	15
Farm (3A & 3B)	47
School and Public Property (15A, 15C)	209
Church & Charitable (15D)	27
Other Exempt (15F)	53
Vacant (1)	1,382
<Null Data>	523
TOTAL	4,353

Table 1: Parcels and Property Classes

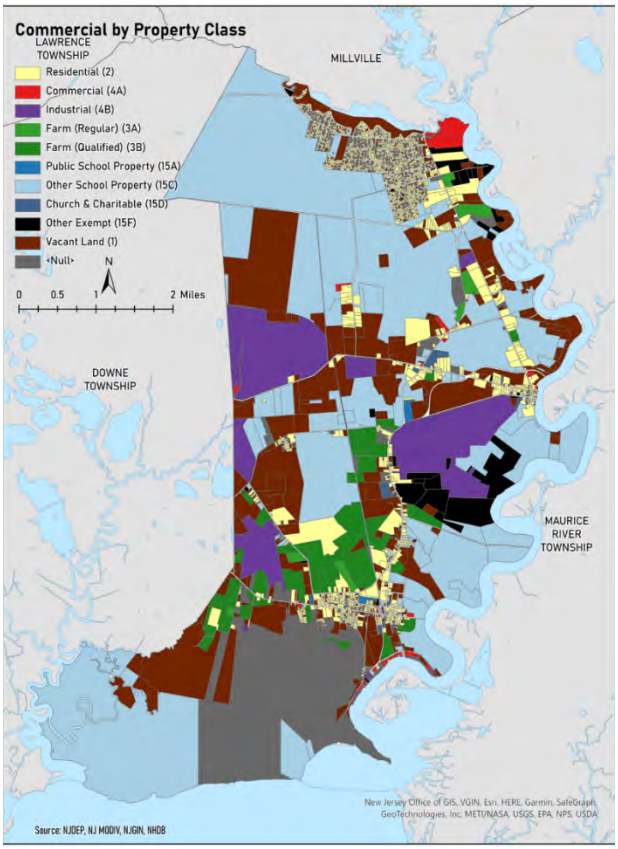


Figure 4: Parcels by Property Class

2 Ft Scenario Total Water Level

Figure 5 presents a raster layer map illustrating the 2-Foot Total Water Level flood scenario for Commercial Township. The maps indicate flooding in the low-lying areas bordering the Delaware Bay and Maurice Rivers, including the Bivalve, Port Norris, Mauricetown, and Laurel Lake communities.

Figure 6 is a map showing 347 of 4,353 parcels exposed to flooding at 2 feet Total Water Level.[19]

The 2019 Rutgers Science and Technical Advisory Panel (STAP) guide provides information on the likelihood of sea level rise in the future. Under a moderate emissions scenario, it indicates that there is a 5% chance that the sea level will rise by 2 feet between 2040-2050, a 66% chance that the sea level will rise to 2 feet by 2070, and an 83% chance that it will increase by at least 2 feet by 2100.[20]

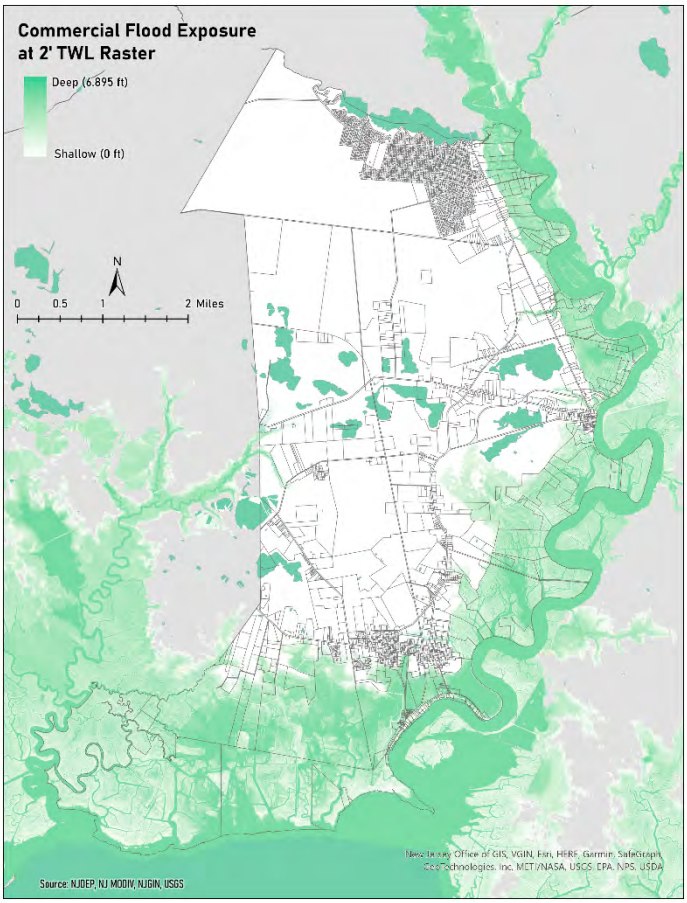


Figure 6: Spatial extent of flooding, 2' TWL

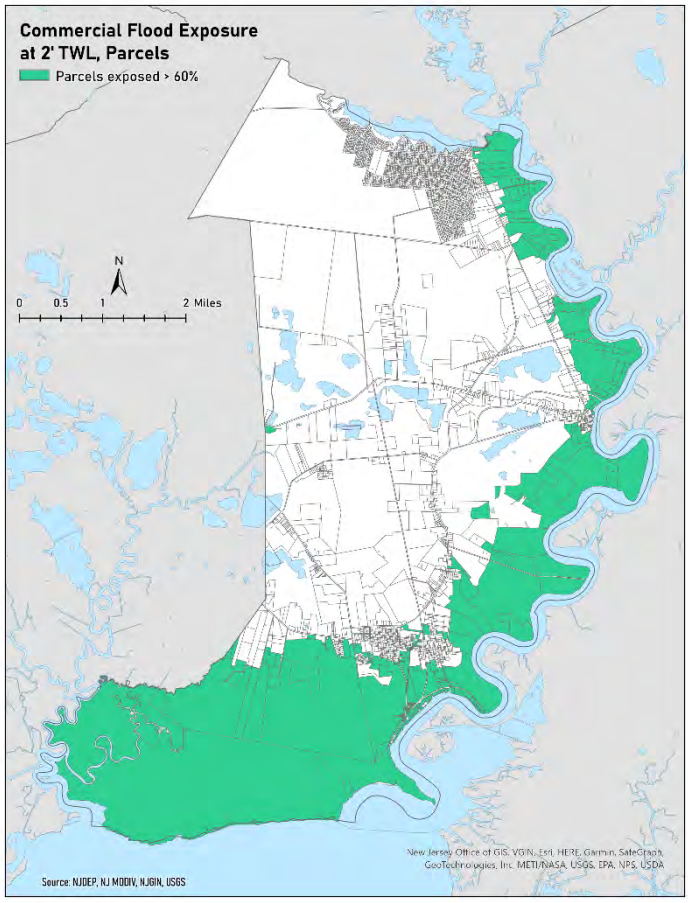


Figure 5: Flooded parcels, 2' TWL

[19] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.
[20] Kopp et al., "New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel."

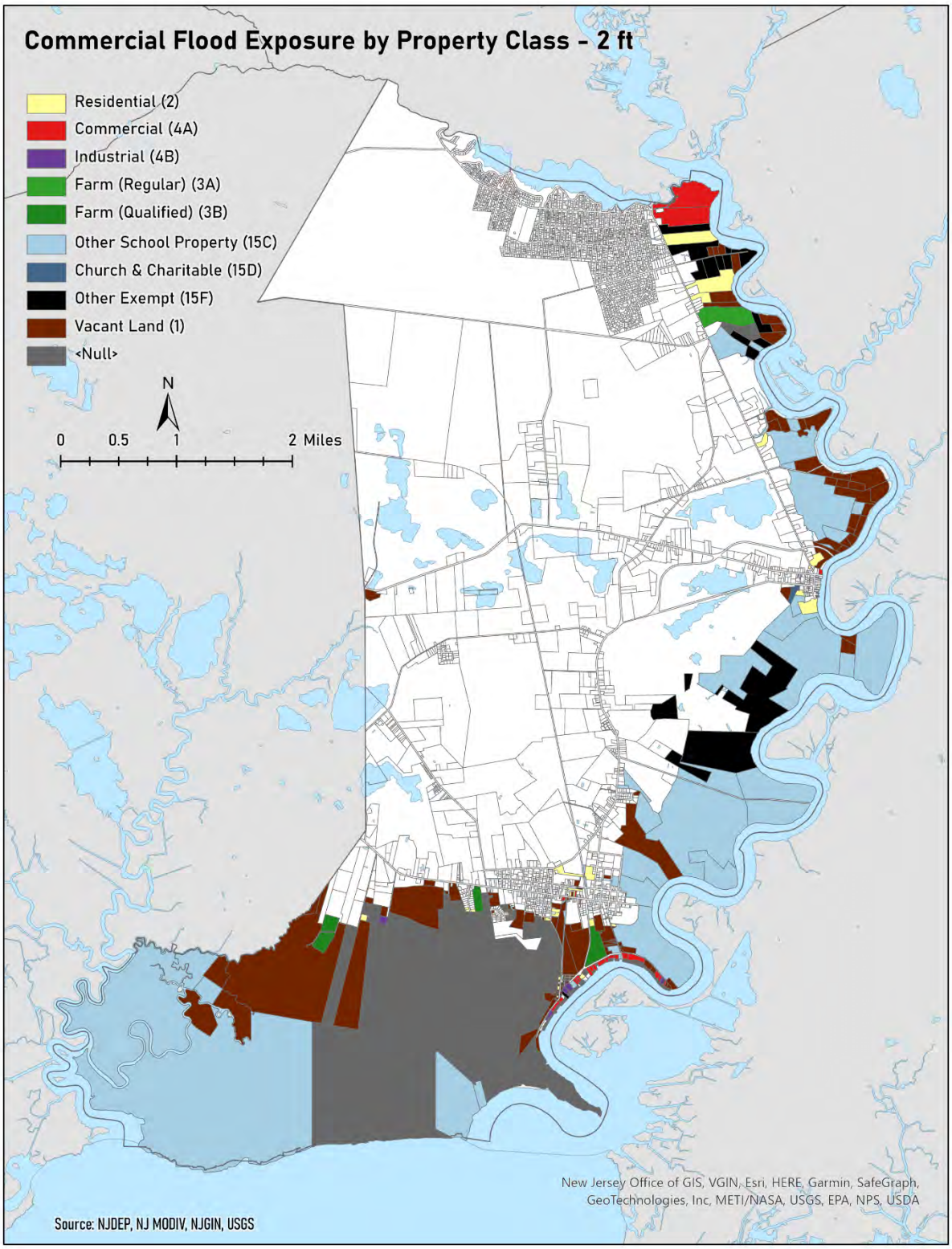


Figure 7: Flooded parcels by property class, 2' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	% OF TOTAL IN CLASS
Residential (2)	31	$3,184,300	$1,481,000	1.52
Commercial (4A)	24	$2,039,200	$2,307,200	42.11
Industrial (4B)	6	$1,675,900	$499,300	40
Farm Total (3A & 3B)	5	$107,600	$85,400	10.64
School and Public Property (15A, 15C)	45	$2,999,800	$1,467,200	21.53
Church & Charitable (15D)	2	$0	$25,800	7.41
Other Exempt (15F)	20	$1,591,000	$528,300	37.74
Vacant (1)	155	$0	$4,161,300	11.81
<Null Data>	59	<Null Data>	<Null Data>	<Null Data>
TOTAL	**347**	**$11,597,800**	**$10,555,500**	

Table 2: Parcels Exposed, 2' TWL

For each property class, Table 2 details the number and percentage of parcels flooded and the value of improvements and land. Improvement values denote the assessed value of physical structures on the property, while land values denote the value of the land itself.

The property classes with the highest percentage of flooded parcels are "Commercial," constituting 40%, followed by "Industrial 4B," and "Other Exempt 15F," at 40% and 37.74%, respectively. The three most affected property classes based on total improvement value are "Residential 2" with a value of $3,184,300, "Public and School Property 15A, 15B & 15C" with a value of $2,999,800, and "Commercial 4A" with a value of $2,039,200.

Regarding land value, the three most affected property classes are "Vacant 1" with a value of $4,161,300, "Commercial 4A" with a value of $2,307,200, and "School and Public Property 15A, 15C" with a value of $1,467,200. The information provided by Table 2 is crucial for assessing the potential impact of flooding on the community and beginning to consider flood management and mitigation strategies.

3 Ft Scenario Total Water Level

Figure 8 presents a raster layer map illustrating the 3-Foot Total Water Level flood scenario for Commercial. The map depicts slightly more flooding compared to the 2-foot scenario, with more inundation in the Port Norris area, including parcels along Memorial Rd. and south of Main St.

Figure 9 is a map showing 407 of 4,353 parcels (9.3%) exposed to flooding at 3 feet TWL.[21] There is a 17% increase in flooded parcels relative to the 2-foot TWL scenario.

According to the STAP, there is a 5% probability that the sea level will rise by 3 feet by 2060 and a 66% probability that the sea level will increase by 3 feet by 2090.

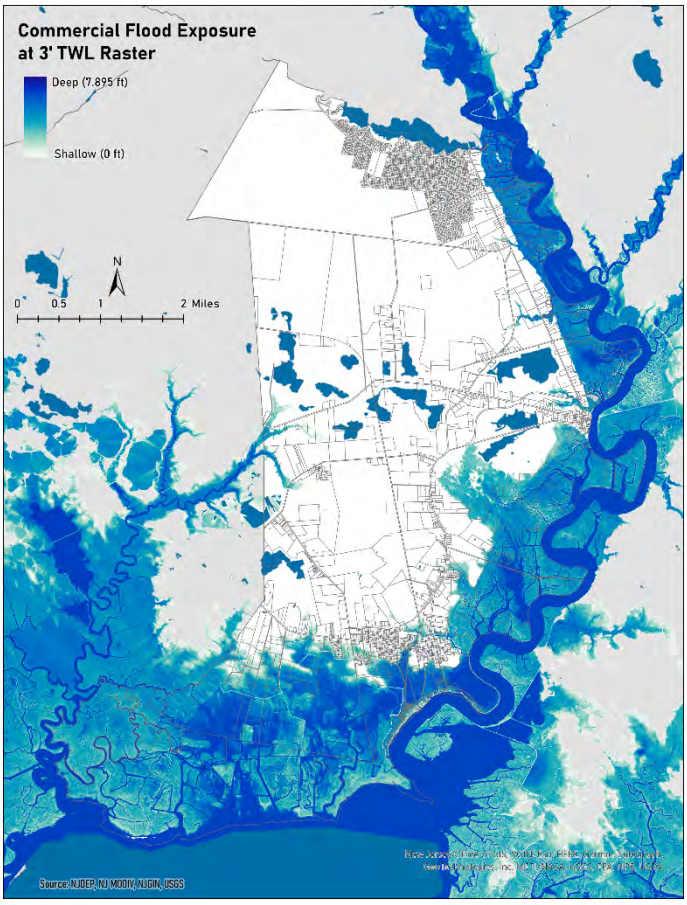


Figure 8: Spatial extent of flooding, 3' TWL

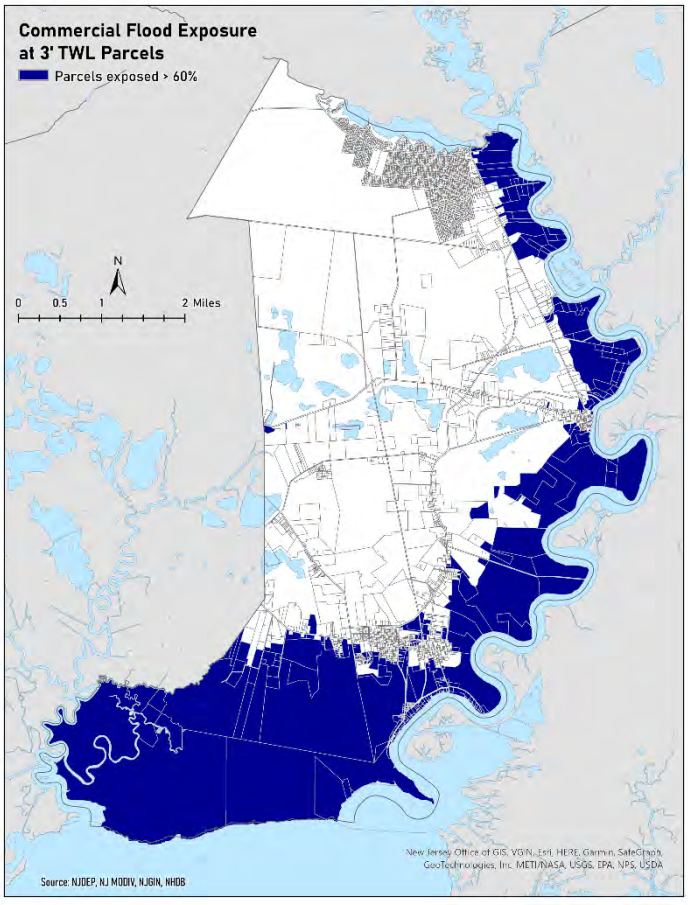


Figure 9: Flooded parcels, 3' TWL

[21] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

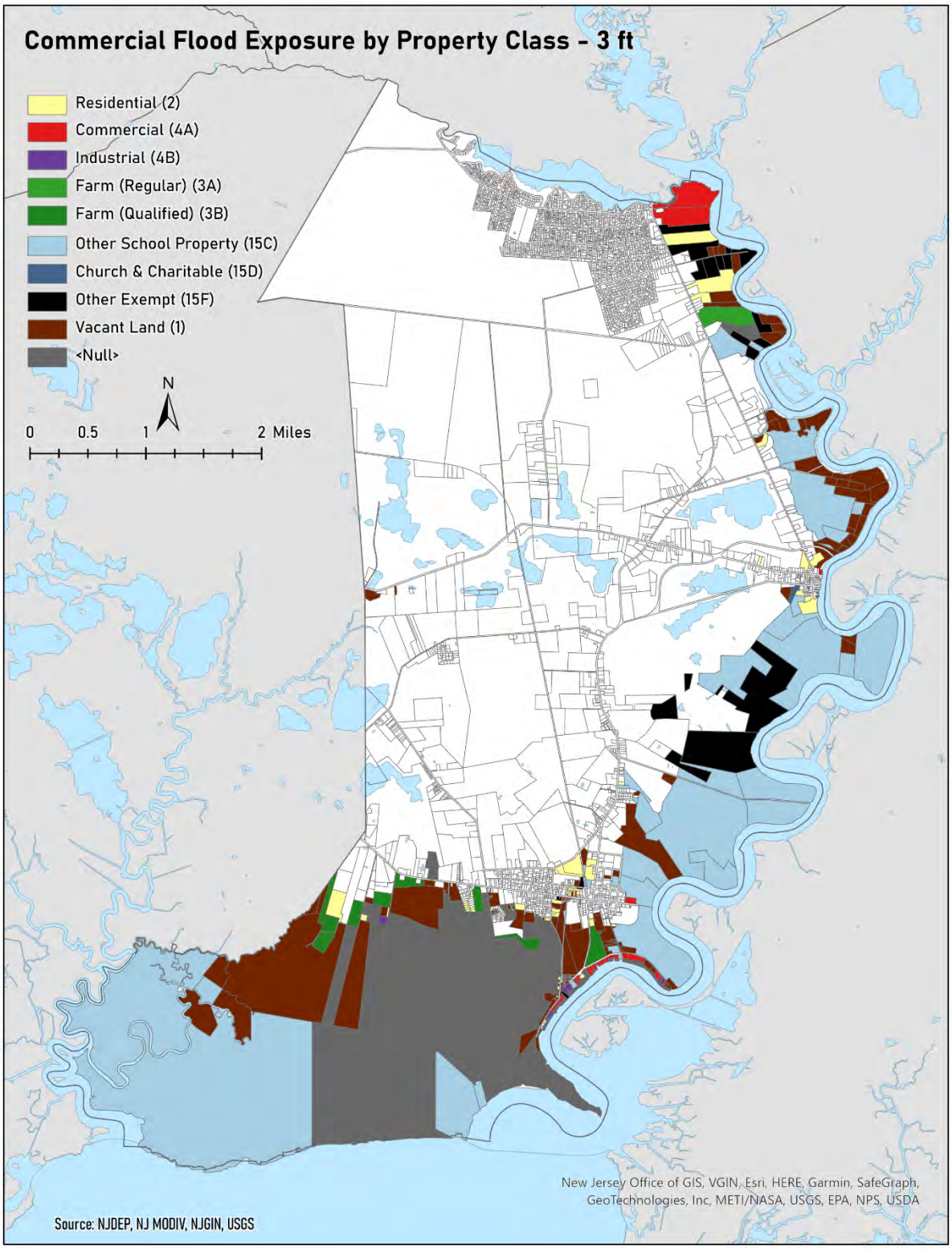


Figure 10: Flooded parcels by property class, 3' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	54	$5,269,700	$2,445,900	0	2.64
Commercial (4A)	29	$2,332,900	$2,474,300	0	50.88
Industrial (4B)	6	$1,675,900	$499,300	0	40
Farm Total (3A & 3B)	10	$107,600	$125,600	0	36.79
School and Public Property (15A, 15C)	47	$2,999,800	$1,512,200	0	23.04
Church & Charitable (15D)	2	$0	$25,800	0	7.41
Other Exempt (15F)	23	$2,008,500	$652,900	0	43.4
Vacant (1)	165	$0	$4,265,900	0	12.58
<Null Data>	71	<Null Data>	<Null Data>	71	<Null Data>
TOTAL	**407**	**$14,394,400**	**$12,001,900**	**71**	

Table 3: Parcels Exposed, 3' TWL

For each property class, Table 3 details the number and percentage of parcels flooded and the value of improvements and land.

In terms of flooded parcels, the property classes with the highest percentages are "Commercial (4A)" at 50.88%, "Other Exempt (15F)" at 43.4%, and "Industrial (4B)" at 40%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $5,269,700, "School and Public Property (15A, 15C)" with a value of $2,999,800, and "Commercial (4A)" with a value of $2,332,900.

In terms of land value, the three most affected property classes are " Vacant (1)" with a value of $4,265,900, "Commercial (4A)" with a value of $2,474,300, and "Residential (2)" with a value of $2,445,900.

5 Ft Scenario Total Water Level

Figure 11 presents a raster layer map illustrating the 5-Foot Total Water Level flood scenario. This scenario appears to drive additional flooding in the west by Dividing Creek, as well as in Port Norris and Mauricetown along the Maurice River.

Figure 12 shows 598 of 4,353 parcels (13.7%) exposed to flooding at 5-foot Total Water Level.[22] This is a 46.9% increase in flooded parcels relative to the 3-foot TWL scenario.

According to the STAP report, by 2100 the likelihood of the 5-foot Total Water Level event is less than 17 percent.

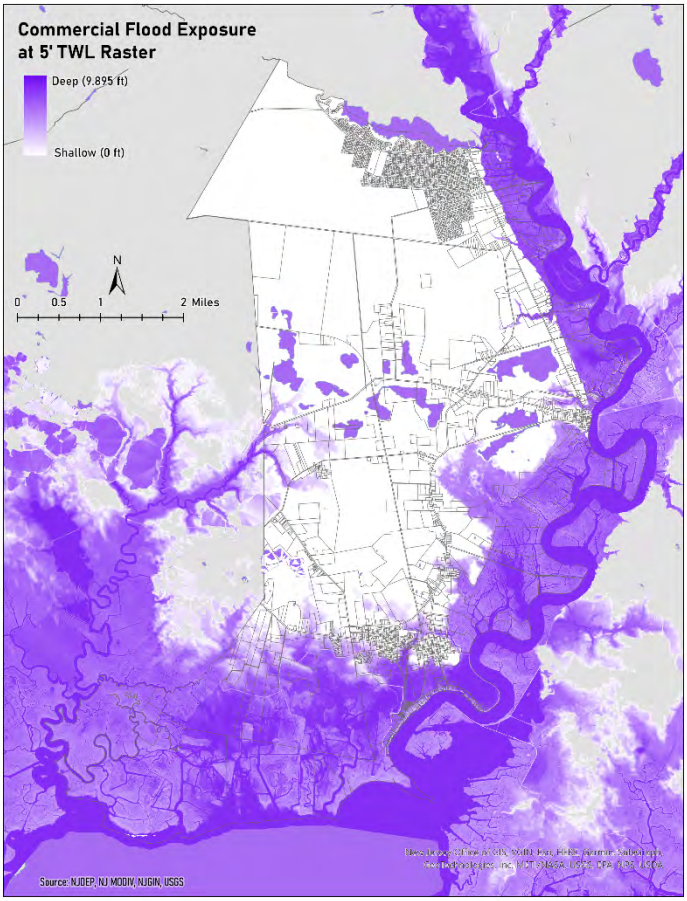


Figure 12: Spatial extent of flooding, 5' TWL

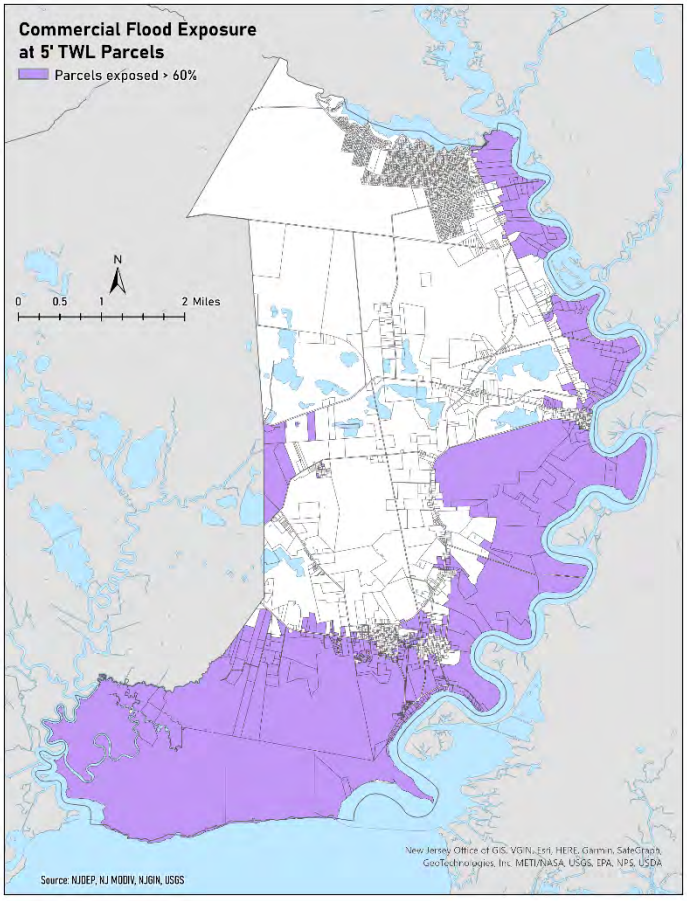


Figure 11: Flooded parcels, 5' TWL

[22] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

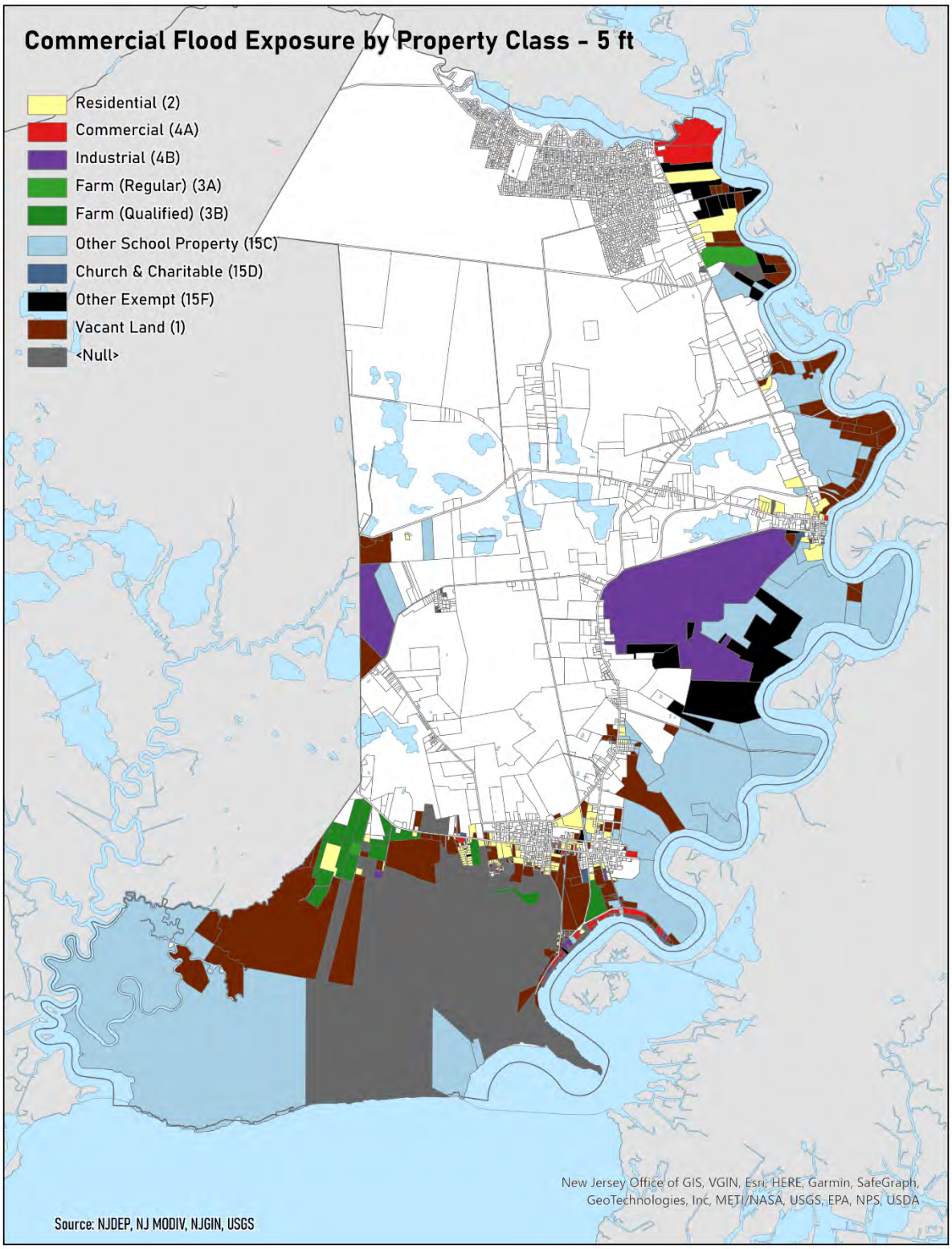


Figure 13: Flooded parcels by property class, 5' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	145	$13,093,700	$5,627,300	0	7.09
Commercial (4A)	33	$2,962,700	$2,775,300	0	57.89
Industrial (4B)	10	$3,685,400	$1,710,900	0	66.67
Farm Total (3A & 3B)	16	$287,800	$197,300	0	63.57
School and Public Property (15A, 15C)	57	$2,999,800	$1,703,400	0	27.94
Church & Charitable (15D)	5	$489,600	$125,300	0	18.52
Other Exempt (15F)	26	$2,109,000	$735,400	0	49.06
Vacant (1)	213	$0	$4,673,600	0	16.23
<Null Data>	93	<Null Data>	<Null Data>	93	<Null Data>
TOTAL	**598**	**$25,628,000**	**$17,548,500**	**93**	

Table 4: Parcels Exposed, 5’ TWL

For each property class, Table 5 details the number and percentage of parcels flooded and the value of improvements and land.

In terms of flooded parcels, the property classes with the highest percentages are Industrial 4B" at 66.67%, “Farm Total (3A & 3B)" at 63.57%, and " Commercial (4A)" at 57.89%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $13,093,700, "Industrial 4B" with a value of $3,685,400, and "Public and School Property 15A, 15B & 15C" with a value of $2,999,800.

In terms of land value, the three most affected property classes are "Residential 2" with a value of $5,627,300, "Vacant (1)" with a value of $4,673,600, and "Commercial (4A)" with a value of $2,775,300.

7 Ft Scenario Total Water Level

Figure 14 presents a raster layer map illustrating the 7-Foot Total Water Level flood scenario for. Relative to the 5-foot scenario, flooding has expanded in the western boundary area of Commercial. Most of the additional inundation occurs in the Port Norris area.

Figure 15 displays 844 of 4,353 parcels (19.4%) exposed to flooding at 7-foot TWL.[23] This is a 41.3% increase in flooded parcels relative to the 5-foot TWL scenario.

The impact of this flooding could have significant consequences for property owners and the wider community, including potential damage to infrastructure, loss of property value, and disruption to everyday life.

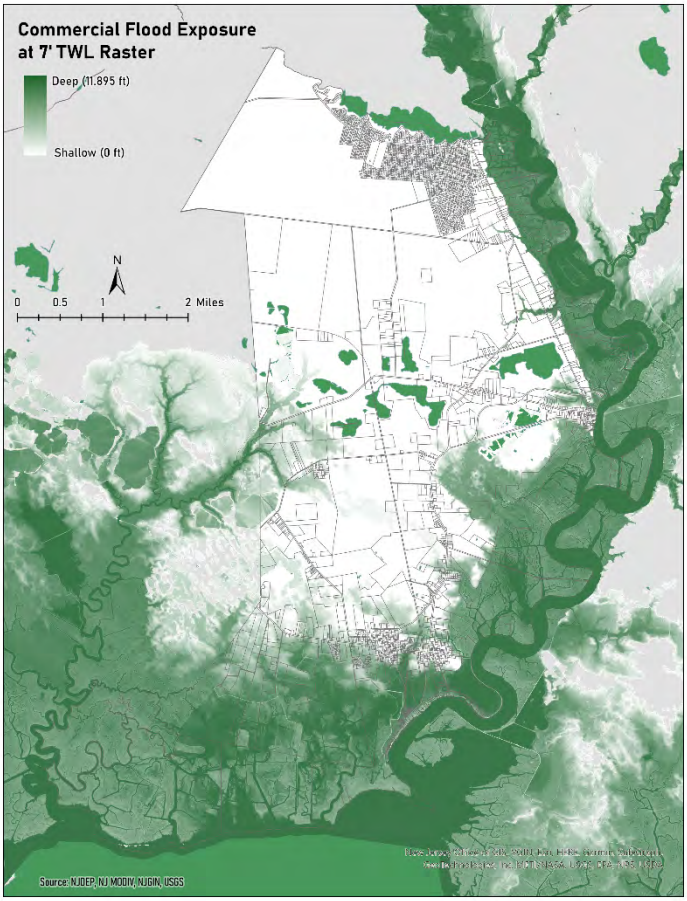


Figure 15: Spatial extent of flooding, 7' TWL

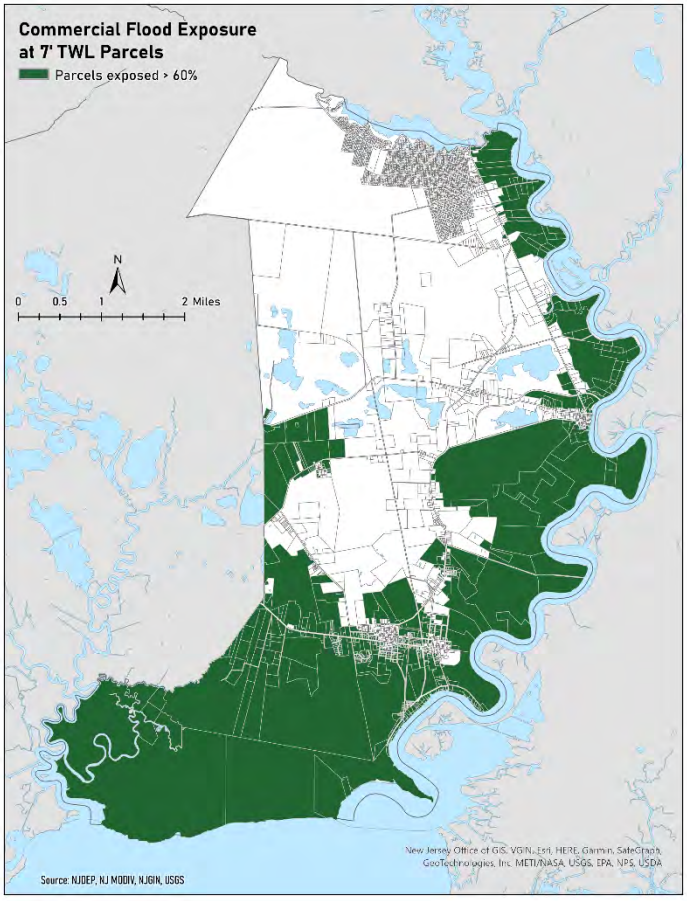


Figure 14: Flooded parcels, 7' TWL

[23] As stated above in Section 3, the criteria for a parcel to be considered flooded is 50% of parcel area inundated.

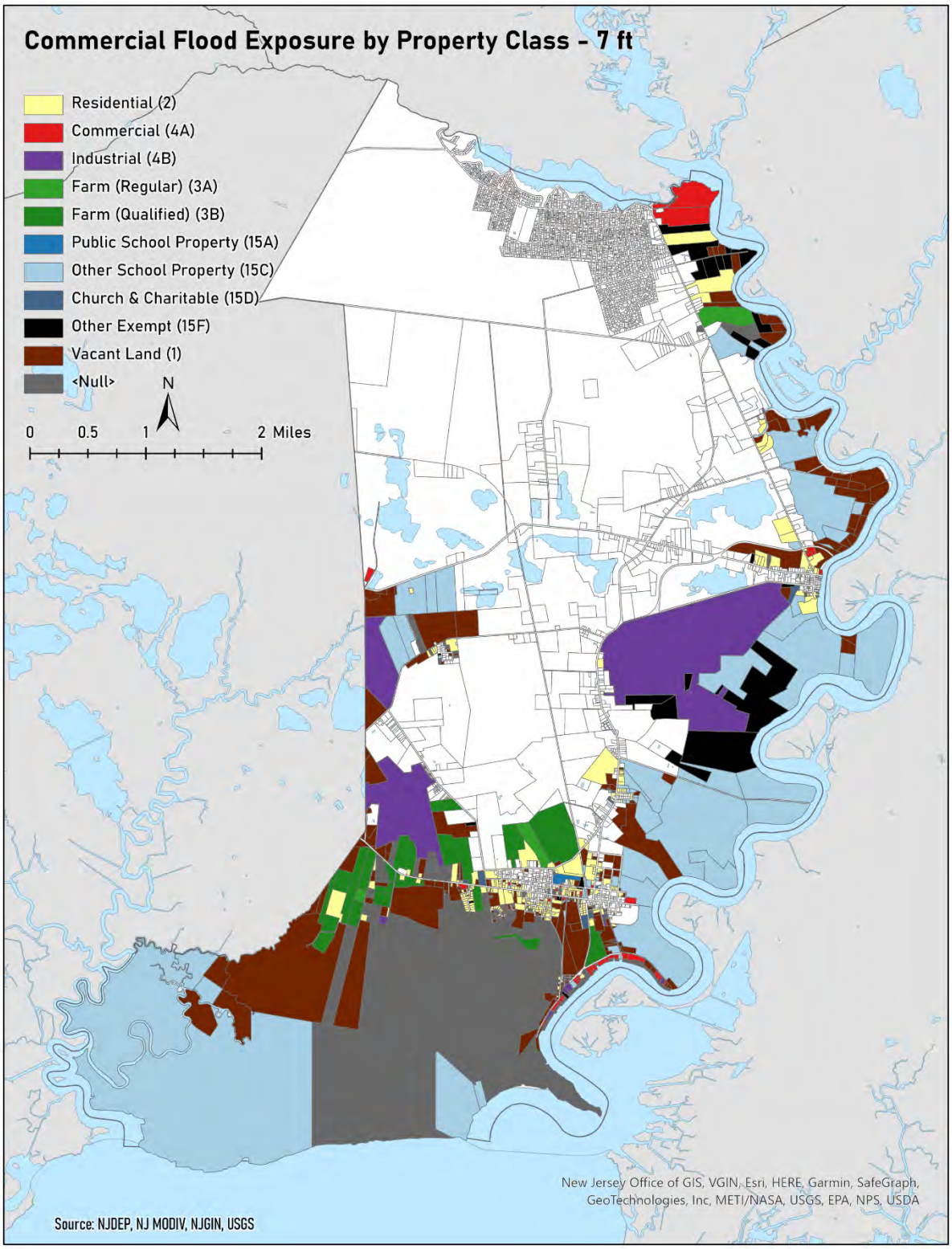


Figure 16: Flooded parcels by property class, 7' TWL

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	282	$26,116,200	$10,387,200	0	13.78
Commercial (4A)	41	$3,880,200	$3,137,500	0	71.93
Industrial (4B)	11	$3,962,600	$2,620,700	0	73.33
Farm Total (3A & 3B)	22	$287,800	$275,300	1	46.81
School and Public Property (15A, 15C)	71	$8,852,600	$2,221,100	0	73.82
Church & Charitable (15D)	10	$1,919,500	$277,100	0	37.04
Other Exempt (15F)	30	$2,429,000	$887,500	0	56.6
Vacant (1)	265	$0	$5,304,100	0	20.2
<Null Data>	112	<Null Data>	<Null Data>	112	<Null Data>
TOTAL	**844**	**$47,447,900**	**$25,110,500**	**113**	

Table 5: Parcels Exposed, 7' TWL

For each property class, Table 5 details the number and percentage of parcels flooded and the value of improvements and land.

In terms of flooded parcels, the property classes with the highest percentages are "School and Public Property (15A, 15C)" at 73.82%, "Industrial (4B)" at 73.33%, and "Commercial (4A)" at 71.93%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $26,116,200, "School and Public Property (15A, 15C)" with a value of $8,852,600, and "Industrial (4B)" with a value of $3,962,600.

In terms of land value, the three most affected property classes are "Residential 2" with a value of $10,387,200, "Vacant (1)" with a value of $5,304,100.00, and "Commercial (4A)" with a value of $3,137,500.

100-Year Event Scenario – 1% Chance

The FEMA 100-Year event describes a flood with a 1% chance of occurring in any given year. FEMA uses this scenario to assess the potential risk of flooding in different areas and develop floodplain maps.

The floodplain map for this scenario shows 541 parcels (12.4% of the total) in the township as likely be inundated in a flood that meets the FEMA 100-Year event scenario (Figure 18).

The number of parcels exposed to flooding in the FEMA 100-Year event scenario closely aligns with the 5ft TWL scenario.

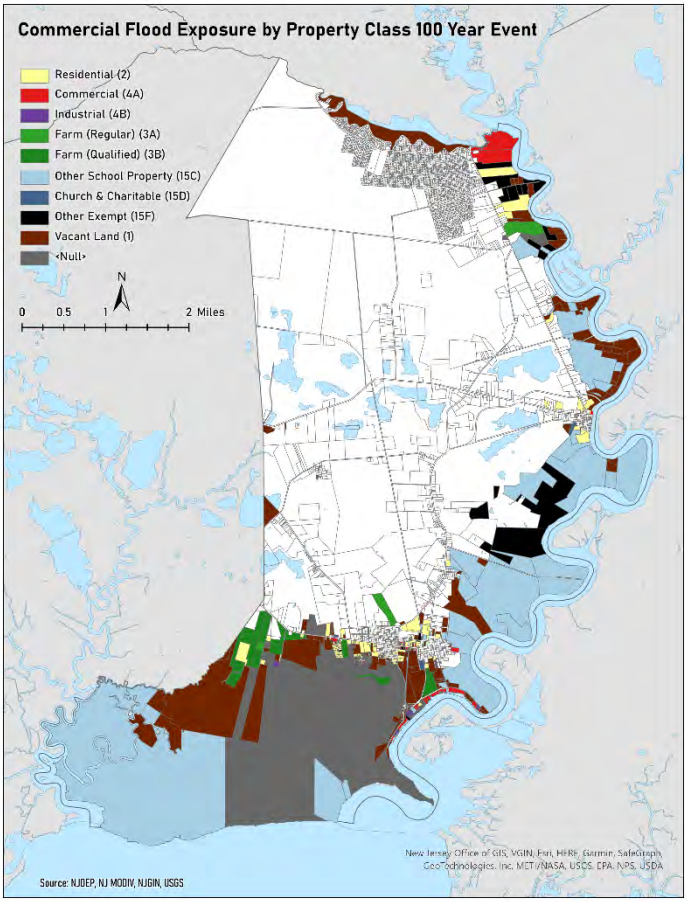


Figure 18: Flooded parcels by property class, 100-Year, 1% Event

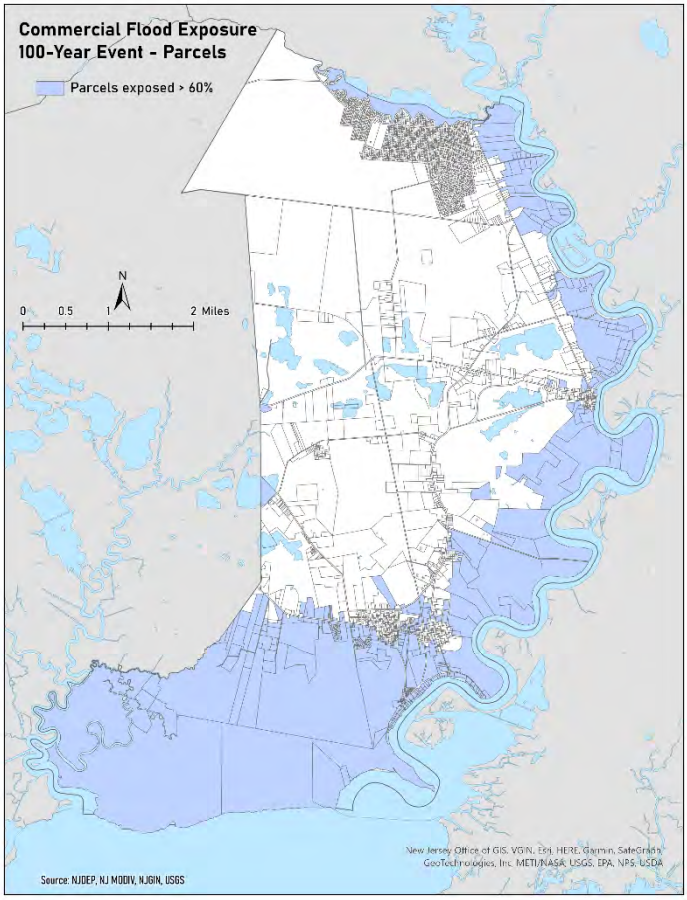


Figure 17: Flooded parcels, 100-Year, 1% Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	132	$11,682,100	$5,143,600	0	6.45
Commercial (4A)	33	$2,962,700	$2,775,300	0	57.89
Industrial (4B)	8	$2,107,100	$559,300	0	53.33
Farm Total (3A & 3B)	17	$287,800	$197,300	0	36.17
Public and School Property (15A, 15C)	50	$2,999,800	$1,616,800	0	24.51
Church & Charitable (15D)	4	$489,600	$124,000	0	14.81
Other Exempt (15F)	24	$2,109,000	$691,600	0	45.28
Vacant (1)	205	$0	$4,594,200	0	15.63
<Null Data>	68	<Null Data>	<Null Data>	68	<Null Data>
TOTAL	**541**	**$22,638,100**	**$15,702,100**	**68**	

Table 6: Parcels Exposed, 100-Year, 1% Event

For each property class, Table 6 details the number and percentage of parcels flooded and the value of improvements and land.

In terms of flooded parcels, the property classes with the highest percentages are Commercial 4A" at 57.9%, “Industrial 4B" at 53.3%, and "Other Exempt 15F" at 45.28%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $11,682,100, "Vacant 1" with a value of $4,594,200, and "Commercial 4A " with a value of $2,962,700.

In terms of land value, the three most affected property classes are "Residential 2" with a value of $5,143,600, "Industrial 4B" with a value of $34,161,600, and "Public Property 15A, 15B, & 15C" with a value of $2,775,300.

500-Year Event Scenario – 0.2% Chance

The FEMA 500-Year event describes a flood that has a 0.2% chance of occurring in any given year. This scenario is more catastrophic than the FEMA 100-Year event scenario, representing a less likely but more severe flood event.

In the FEMA 500-Year event scenario, a total of 449 parcels would be flooded (Figure 20)

The impact of the FEMA 500-year event scenario can be compared to the 7-foot TWL scenario. Based on this, the potential damage from the FEMA 500-Year event scenario may be like a flood with a 7 ft TWL.

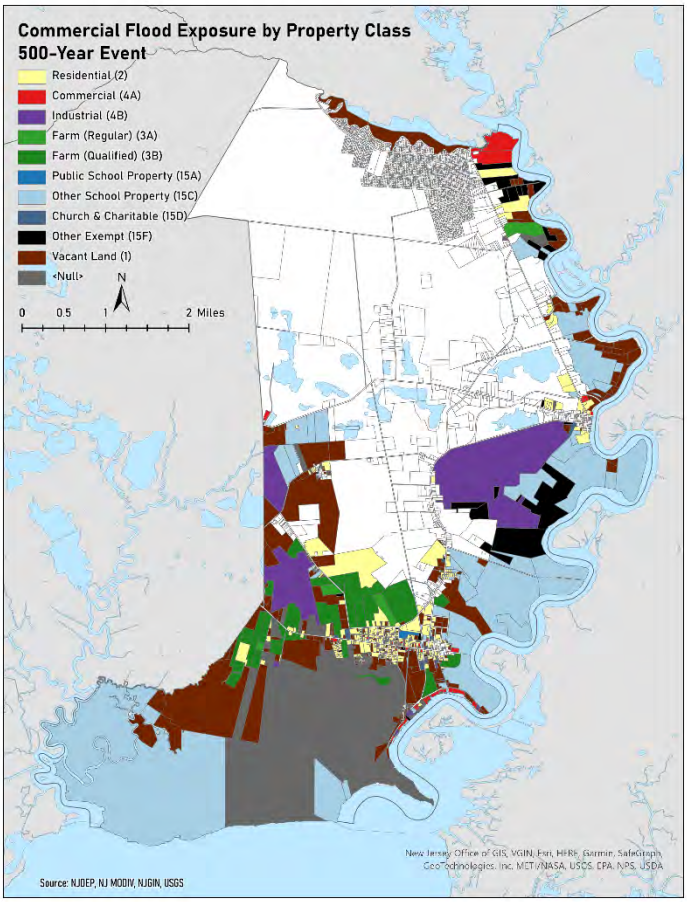


Figure 19: Flooded parcels by property class, 500-Year, 0.2% Event

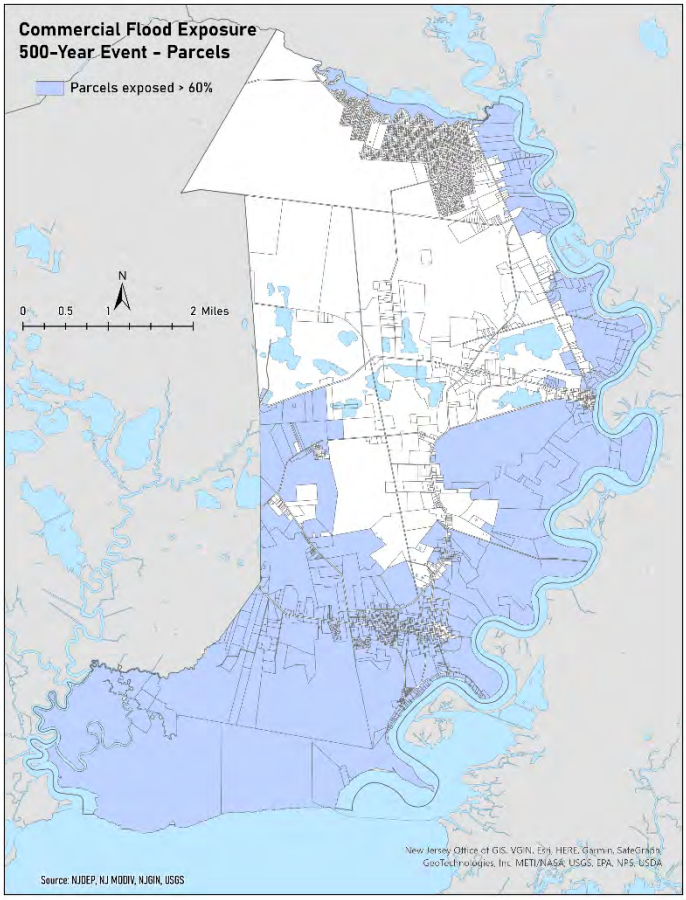


Figure 20: Flooded parcels, 500-Year, 0.2% Event

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED	# PARCELS W/ $0 VALUE	% OF TOTAL IN CLASS
Residential (2)	449	$41,780,000	$15,769,000	0	21.95
Commercial (4A)	46	$4,058,800.00	$3,307,600	0	80.7
Industrial (4B)	11	$3,962,600	$2,620,700	0	73.33
Farm Total (3A & 3B)	31	$332,700	$404,600	1	65.96
School and Public Property (15A, 15C)	80	$9,014,300	$2,465,300	0	38.28
Church & Charitable (15D)	18	$3,322,200	$445,100	0	66.67
Other Exempt (15F)	34	$2,852,400	$1,034,500	0	64.15
Vacant (1)	325	$0	$6,189,100	0	24.77
<Null Data>	110	<Null Data>	<Null Data>	110	<Null Data>
TOTAL	994	$65,323,000	$32,235,900	111	

Table 7: Parcels Exposed, 500-Year, 0.2% Event

For each property class, Table 7 details the number and percentage of parcels flooded and the value of improvements and land.

In terms of flooded parcels, the property classes with the highest percentages are “Commercial (4A)" at 80.7%, “Industrial (4B)" at 73.33%, and "Church & Charitable (15D)" at 66.67%.

The three most affected property classes based on total improvement value are "Residential 2" with a value of $41,780,000, "School and Public Property (15A, 15C)" with a value of $9,014,300, and "Commercial (4A)" with a value of $4,058,800.

In terms of land value, the three most affected property classes are "Residential 2" with a value of $15,769,000, " Vacant (1)" with a value of $6,189,100, and " Commercial (4A)"with a value of $3,307,600.

Hurricane Sandy Proxy – 4 Ft TWL Scenario

Rutgers assessed storm surge extent data from Hurricane Sandy, which was created using USGS field-verified High Water Marks (HWMs) and Storm Surge Sensor data, commonly used to assess flood damage. The Hurricane Sandy data closely aligns with the 4-foot TWL scenario. Thus, Rutgers selected the 4-foot Total Water Level data for this analysis as a proxy for Hurricane Sandy. Figures 21 and 22 display the extent of flooding using the proxy data.

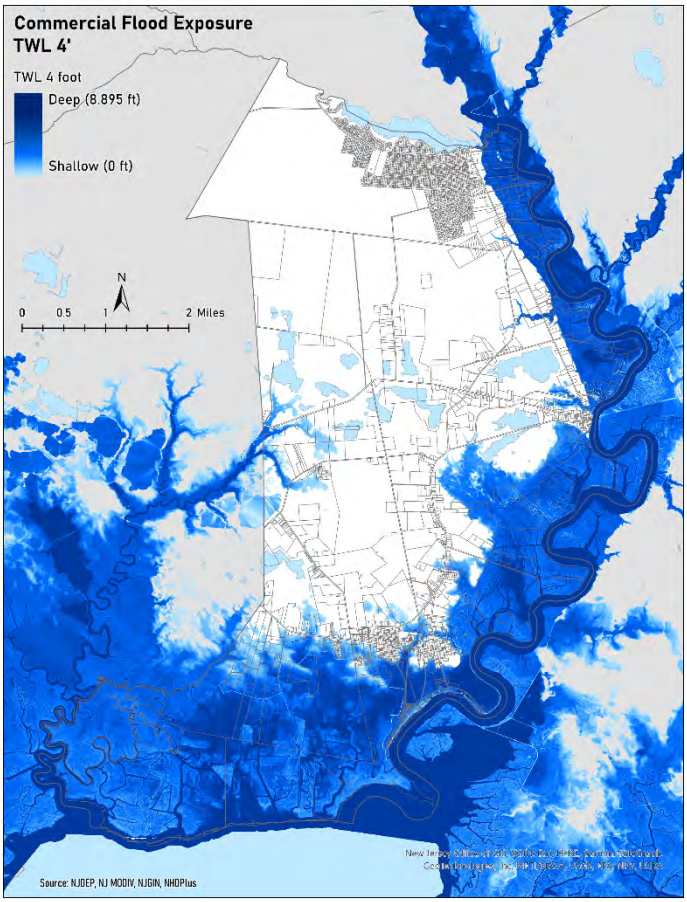


Figure 22: Spatial Extent of Flooding, 4' TWL (Hurricane Sandy Proxy)

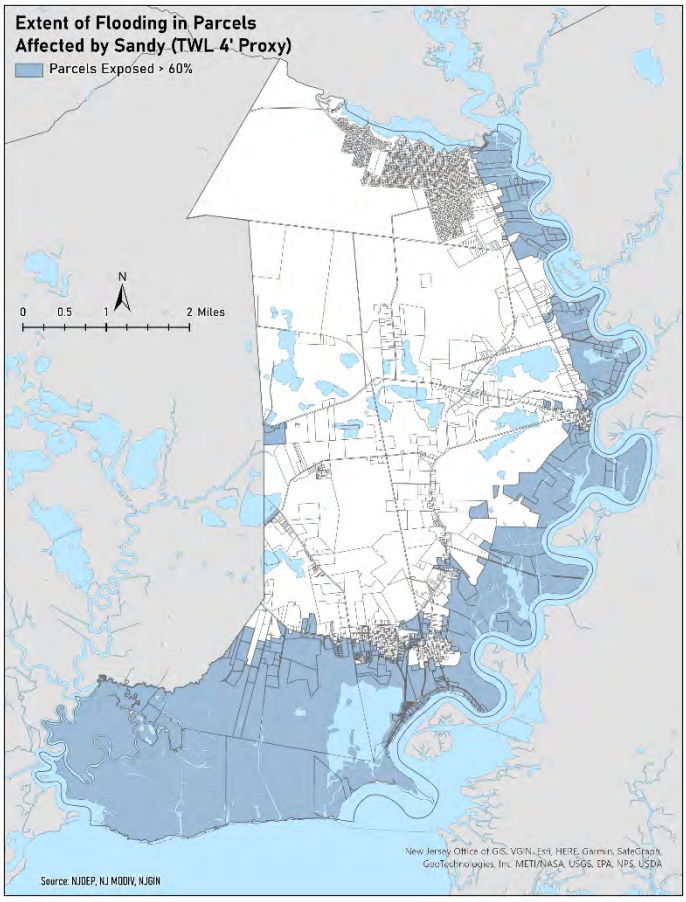


Figure 21: Flooded parcels, 4' TWL (Hurricane Sandy Proxy)

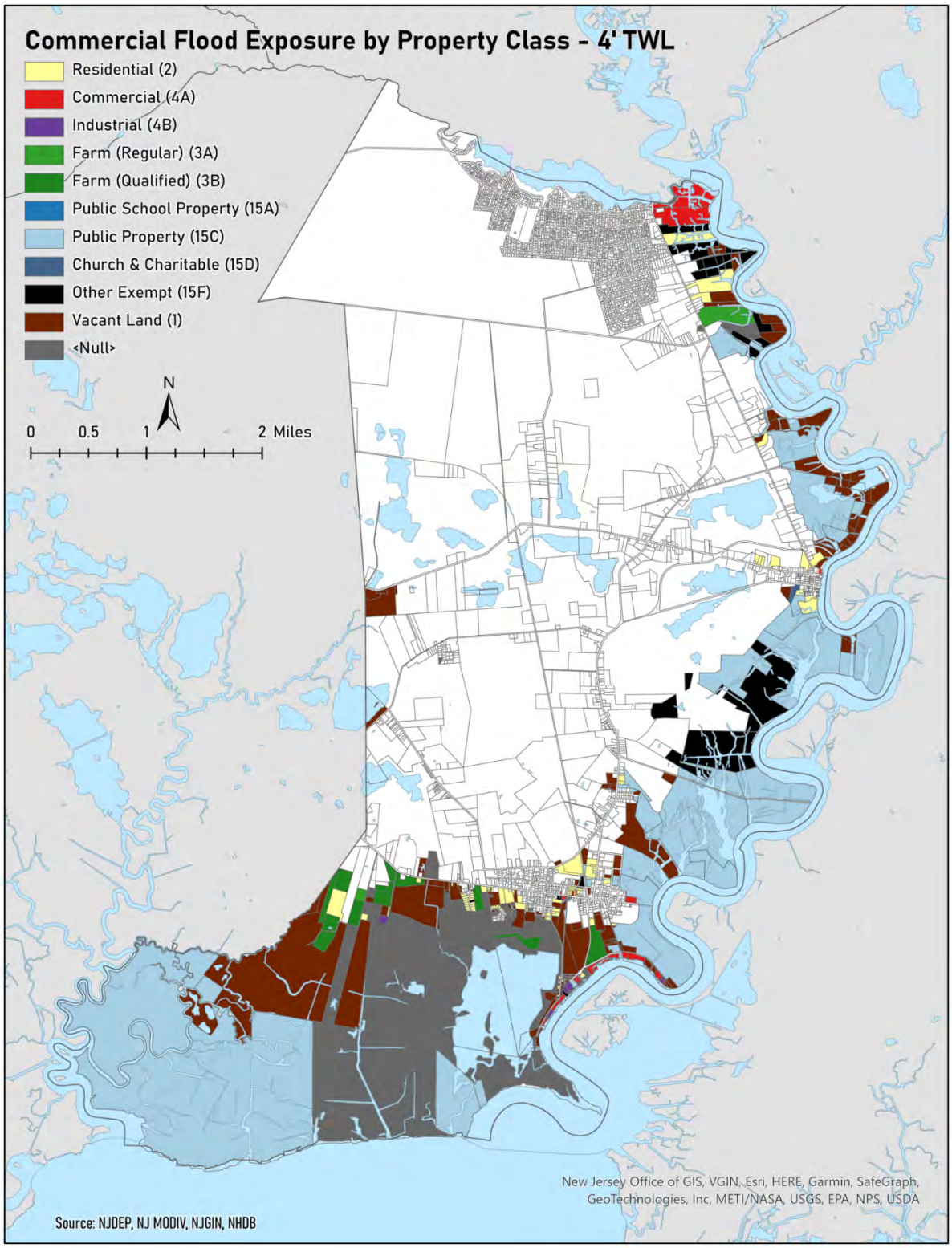


Figure 23: Flooded parcels by property class, 4' TWL (Hurricane Sandy Proxy)

PROPERTY CLASS	# PARCELS FLOODED	IMPROVEMENT $ VALUE, FLOODED	LAND $ VALUE, FLOODED
Residential (2)	1831	$182,510,900	$93,896,575
Apartment (4C)	3	$8,387,500	$4,219,800
Commercial (4A)	40	$10,639,200	$7,358,600
Industrial (4B)	2	$81,952,900	$24,229,000
Farm Total (3A & 3B)	96	$238,900	$730,900
Public and School Property (15A, 15B, 15C)	328	$15,526,300	$14,939,700
Church & Charitable (15D)	8	$4,227,100	$923,500
Other Exempt (15F)	13	$1,365,700	$583,000
Vacant (1)	398	$0	$8,944,100
TOTAL	**2719**	**$304,848,500**	**$155,825,175**

Table 8: Parcels Exposed, 4' TWL (Hurricane Sandy Proxy)

For each property class, Table 8 details the number and percentage of parcels flooded and the value of improvements and land.

"Residential (2)" was the most vulnerable property class, with 1,831 flooded parcels, a total flooded improvement value of $182,510,90, and land value of $93,896,575. The "Public and School Property (15A, 15B, 15C)" class was the second most affected, with 328 flooded parcels amounting to a total flooded improvement value of $15,526,300 and land value of $14,939,700. "Commercial (4A)" class had 40 flooded parcels, with a total flooded improvement value of $10,639,200and land value of $7,358,600. "Industrial (4B)" class had two flooded parcels, with a total flooded improvement value of $81,952,900 and land value of $24,229,000. "Vacant (1)" had the highest number of flooded parcels with 398, resulting in a total flooded land value of $8,944,100.

The remaining property classes appear to have a smaller number of flooded parcels. See Table 8 for details.

Socially Vulnerable Populations

Social vulnerability is a critical factor that must be considered in hazard planning, as not all individuals or communities are affected equally when disasters occur. Socially vulnerable populations have compounding challenges, making is more difficult to recover from natural or manmade disasters, disease outbreaks, or other public health emergencies. As a result, officials in various areas, such as disaster preparedness, public health, and emergency response, have increasingly relied on the Social Vulnerability Index (SVI) developed by the Centers for Disease Control and Prevention

Initially designed to target public health policies to specific communities, the SVI has since been applied to identify communities that may require assistance in preparing for, or recovering from, natural disasters such as storms or flooding. This index considers a wide range of social factors, including income, education, housing, access to transportation, and other factors that can impact a community's ability to cope with and recover from a disaster (Figure 24).

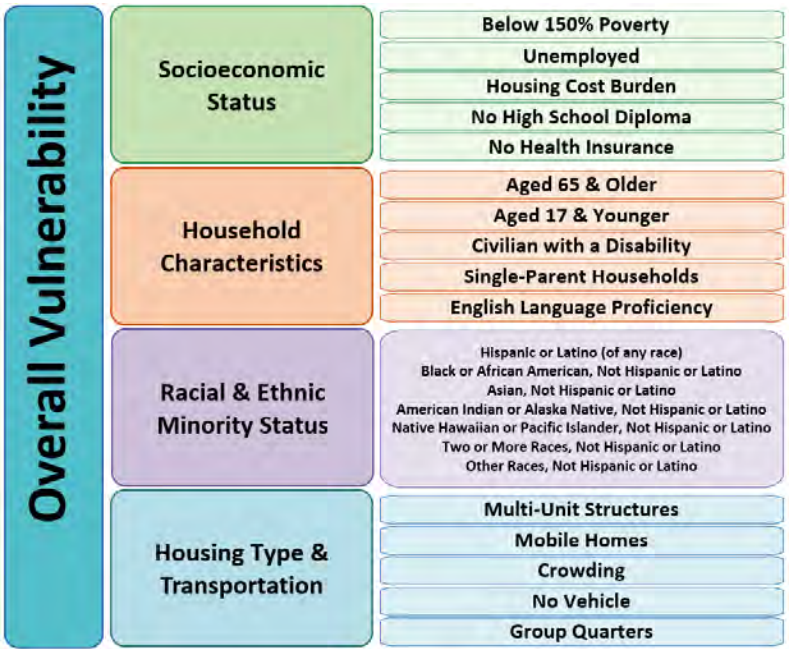


Figure 24: CDC Social Vulnerability Factors (Source: CDC SVI 2020 Documentation)

By using the SVI, public officials can more effectively target resources to the communities most in need and help ensure that vulnerable populations are not overlooked or left behind in the wake of a disaster. Ultimately, the use of the SVI is an essential tool for promoting more equitable disaster planning and response and helping to ensure that all community members have the resources and support they need to prepare for, respond to, and recover from disasters.

The SVI uses demographic, socioeconomic, and household/housing characteristics to calculate each community's vulnerability score. The percentile ranking values range from 0 to 1, with higher values indicating greater vulnerability. Each tract within a community receives a separate ranking for each of the four themes that the SVI measures. The SVI is a valuable tool for public officials in disaster preparedness, public health, emergency response, and other areas, as it helps to identify communities that may need assistance in preparing for or recovering from hazards such as storms or flooding.

Overall, this begins to provide an understanding of the social vulnerability in Commercial, highlighting areas that may require attention and resources.

The next four sections (a) through (d) will briefly explain each theme, connect it to disaster vulnerability, and identify any tract's Social Vulnerability variables that the CDC has flagged as being in the 90th percentile or higher.

The fifth section (e) covers New Jersey's Overburdened Communities (OBCs), as defined on page 7. Per the New Jersey Environmental Justice Law of 2020, when regulated facilities (such as incinerators, landfills, sewage plants) apply for permits from the NJDEP, the NJDEP must consider the impacts of such facilities on OBCs. However, instead of such regulatory considerations, this analysis report uses the OBC designations themselves as another indicator of social vulnerability.

a. Socioeconomic Status

Socioeconomic Status (SES) variables include persons in poverty (measured as below 150% of the federal poverty line), persons aged 16 and higher unemployed, housing cost burden (households that spend 30% or more of annual income on housing costs), persons without high school diplomas (age 25 and higher), and persons without health insurance. Poor populations are severely affected by disasters such as flooding events and they have lesser capacity to prepare for and recover from disaster events. The relationship between vulnerability to disaster and education is less explicit—however, education is understood as being associated with income and poverty; those with lower educational attainment have limited access to disaster preparedness/recovery information.

The CDC flagged Commercial Township for the SES theme, due to its significant population below 150% of the poverty line. There are 1,911 people that meet this criterion, representing 39.1% of the population.

b. Household Characteristics

The Household Characteristics theme comprises age-related, single parenting, disability, and English-speaking variables. Minors, senior citizens, single-parent households, persons with disabilities, and persons (age 5 and higher) who speak English "less than well" are usually the groups more vulnerable to disasters. Often, they require more financial support, medical care, or assistance with the activities of daily living. Note that in Census Bureau definitions, disability can encompass several impairments related to movement, cognition, or sensory functions.

The CDC flagged Commercial Township for the Household Characteristics theme because of the census tract's high percentage (27.9%) of noninstitutionalized disabled people.

c. Minority Status & Language Barriers

Minority Status and Language is a vulnerability theme that consists of race, ethnicity, and English language proficiency variables. Such groups may be more vulnerable as they are socially and culturally marginalized. Moreover, disaster

preparedness and recovery outreach/alerting require special efforts to reach limited-English individuals. The CDC did not flag this theme for Commercial.

d. Housing Type & Transportation

The theme of Housing Type and Transportation includes housing type, crowding, and vehicle access variables. Housing quality is an important factor in disaster vulnerability because those who live in poorly constructed housing, mobile homes, or overcrowded conditions are especially at-risk during flooding events, as well as afterwards during recovery. Overcrowding, defined as more occupants than rooms in a housing unit, can complicate the search for temporary shelter or replacement housing. Furthermore, absent a robust public transportation option during evacuation conditions, household vehicle access may be critical.

The CDC flagged Commercial for the Housing Type and Transportation theme because of the significant share of individuals living in mobile homes (19.5%).

Commercial Township – Social Vulnerability

Overall Social Vulnerability (Tract Level)

Themes	15 Variables (Census)	Estimate	Percentage	Percentile
Theme 1: Socioeconomic Status	Below 150% Poverty	1911	39.1%	0.9087
	Unemployed	157	7.9%	0.7551
	Housing-burdened units	667	37.2%	0.7095
	No High School Diploma (age 25+)	394	12.1%	0.7036
	Uninsured	260	5.3%	0.4954
Theme 2: Household Characteristics	Age 65 or older	683	13.8%	0.4053
	Age 17 or younger	1414	28.6%	0.8801
	Noninstitutionalized Disabled	1336	27.1%	0.9848
	Single-parent Household	223	12.5%	0.8612
Theme 3: Racial & Ethnic Minority Status	Minority	1387	28.1%	0.3734
Theme 4: Housing Type & Transportation	Multi-unit Structures	0	0%	0.0
	Mobile Homes	411	19.5%	0.9871
	Crowding	25	1.4%	0.4574
	No Vehicle	84	4.7%	0.4113
	Group Quarters	18	0.4%	0.6284

Table 12: The SVI scores of Commercial Township

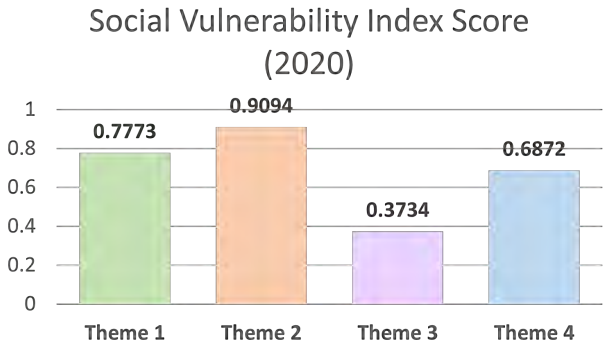


Figure 25: SVI index scores by theme

NJDEP Overburdened Communities

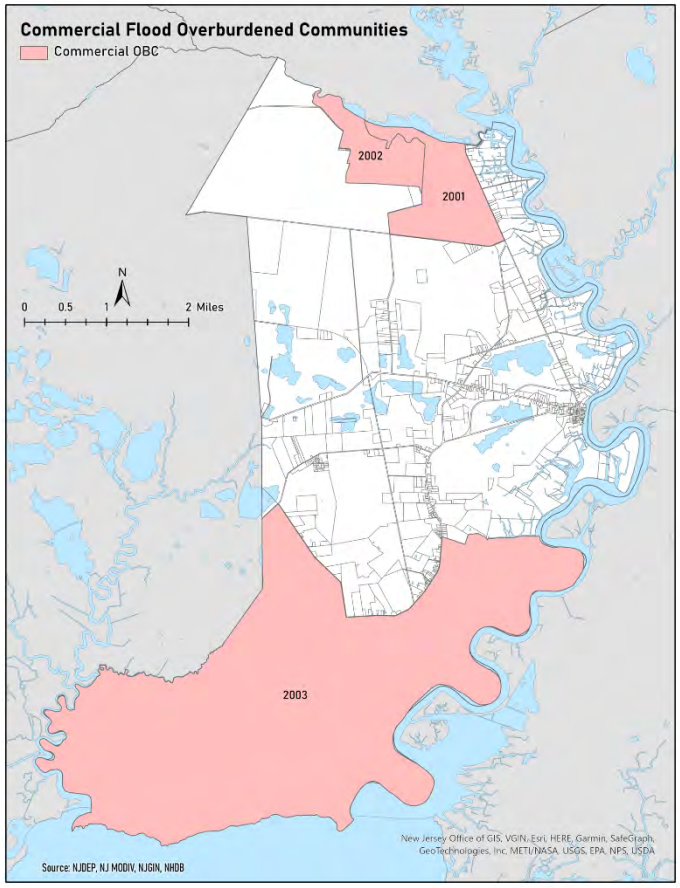


Figure 26: Commercial Overburdened Census Block Groups

Following New Jersey's Environmental Justice Law, the state must consider the effects of facilities on communities' overburdened environmental and public health conditions. **An overburdened community is defined as any census block group identified in the most recent United States Census where at least one of three conditions is met.**

First, at least 35 percent of households qualify as low-income households, meaning their income is at or below twice the poverty threshold established by the United States Census Bureau. Second, at least 40 percent of the residents identify as a member of a minority group or as members of a State-recognized tribal community. Finally, at least 40 percent of households in the census block group have limited English proficiency, meaning that no adult speaks English "very well," according to the United States Census Bureau.

The law addresses the disproportionate burden of environmental and public health risks faced by low-income, minority, and non-English speaking communities.

Table 16 provides information about Overburdened Communities (OBCs) in Commercial Township. The three communities are designated as OBCs due to their significant low-income populations.

The first column shows data for block group identifier 340110102001. The block group has a total population of 1,116 and 484 households, with 53.85% of the households qualifying as low-income and 28.95% of the population identifying as minority.

The second column provides information for block group identifier 340110102002. The block group has a total population of 1,497 and 497 households, with 54.71% of the households qualifying as low-income and 21.78% of the population identifying as minority.

The third column provides information for block group identifier 340110102003. The block group has a total population of 1,656 and 749 households, with 45.50% of the households qualifying as low-income households and 35.24% of the population identifying as minority.

Overburdened Community Block Group Identifier	340110102001	340110102002	340110102003
Total Population	1116	1497	1646
Total Households (HHs)	484	497	541
Low-Income Population	601 (53.85 %)	819 (54.71 %)	749 (45.50 %)
Minority Population	337 (28.95%)	326 (21.78 %)	580 (35.24 %)
HHs with limited English Proficiency	10	12	10

Table 16: Overburdened Communities in Commercial Township

Critical Infrastructure

Critical assets, including educational institutions, healthcare facilities, and public safety agencies, are essential to communities and their residents, particularly during natural disasters like floods. However, these critical assets may be vulnerable to flooding, which can significantly impact their ability to provide necessary services to the community. It is, therefore, crucial to identify these critical assets and assess their exposure to flood events.

Additionally, built infrastructure, such as bridges and evacuation routes, may be at risk of flooding. These assets are critical in facilitating emergency response and evacuation during flood events. Therefore, understanding their exposure to flood events and potential damages is crucial for effective community flood planning.

This report uses GIS to identify critical assets and assess their vulnerability to flooding events. GIS mapping enables the identification of flood-prone areas and the modeling potential flood scenarios to evaluate the potential impact on these assets. When planning and responding to floods in a community, it is critical to understand the extent to which essential infrastructure and assets are exposed to flooding and their accessibility during emergencies.

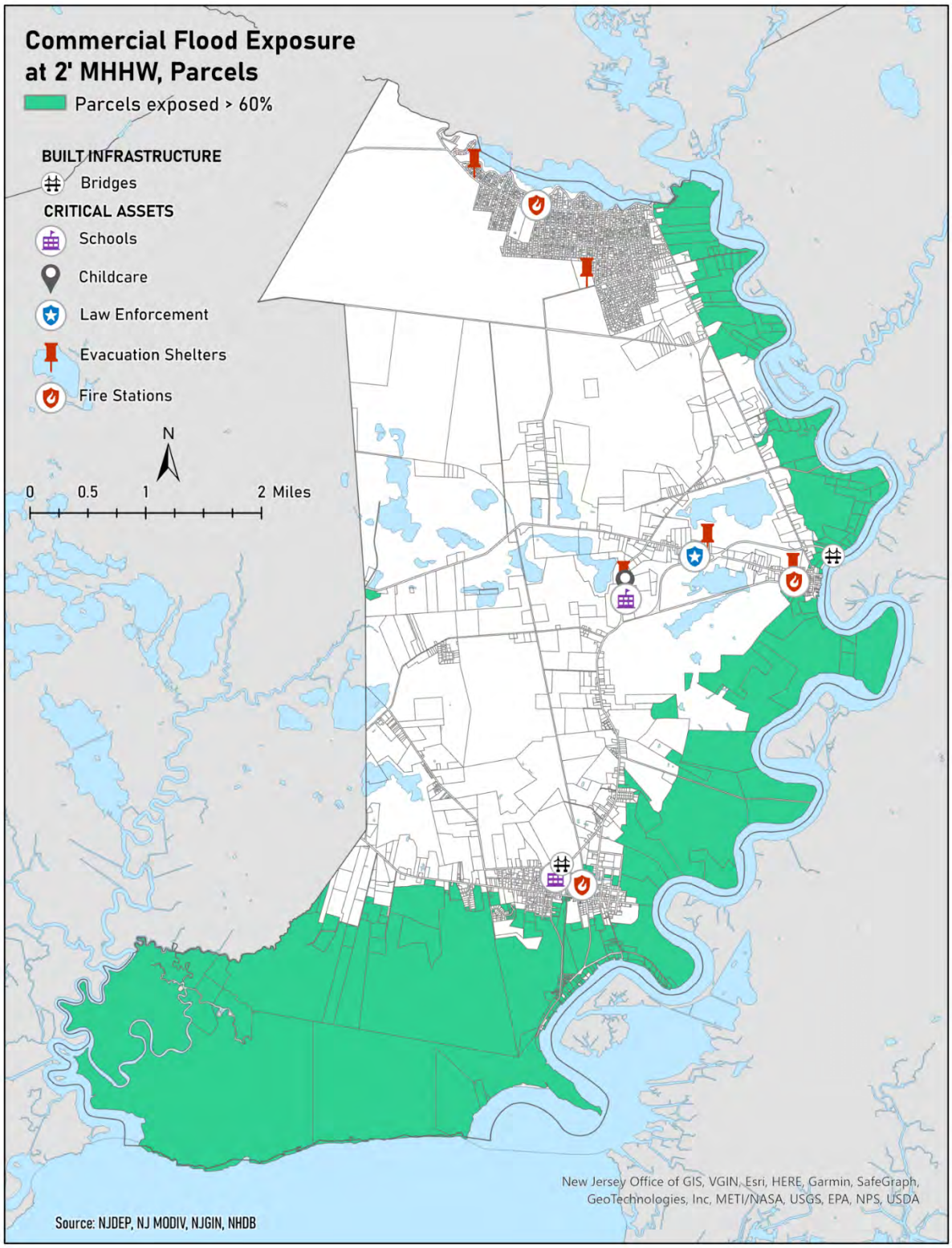


Figure 27: Spatial extent of flooding, 2' TWL, with Critical Infrastructure

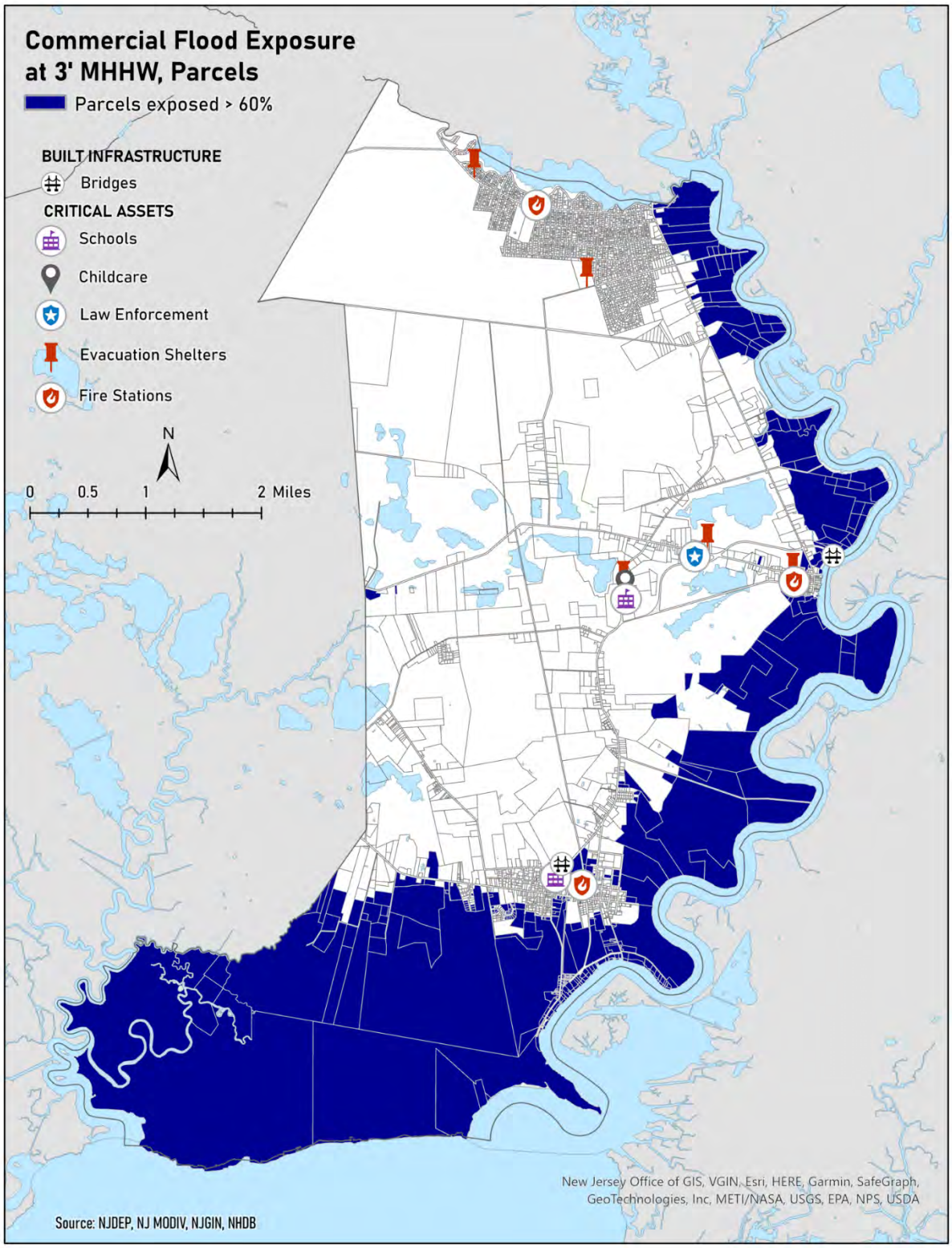


Figure 28: Spatial extent of flooding, 3' TWL, with Critical Infrastructure

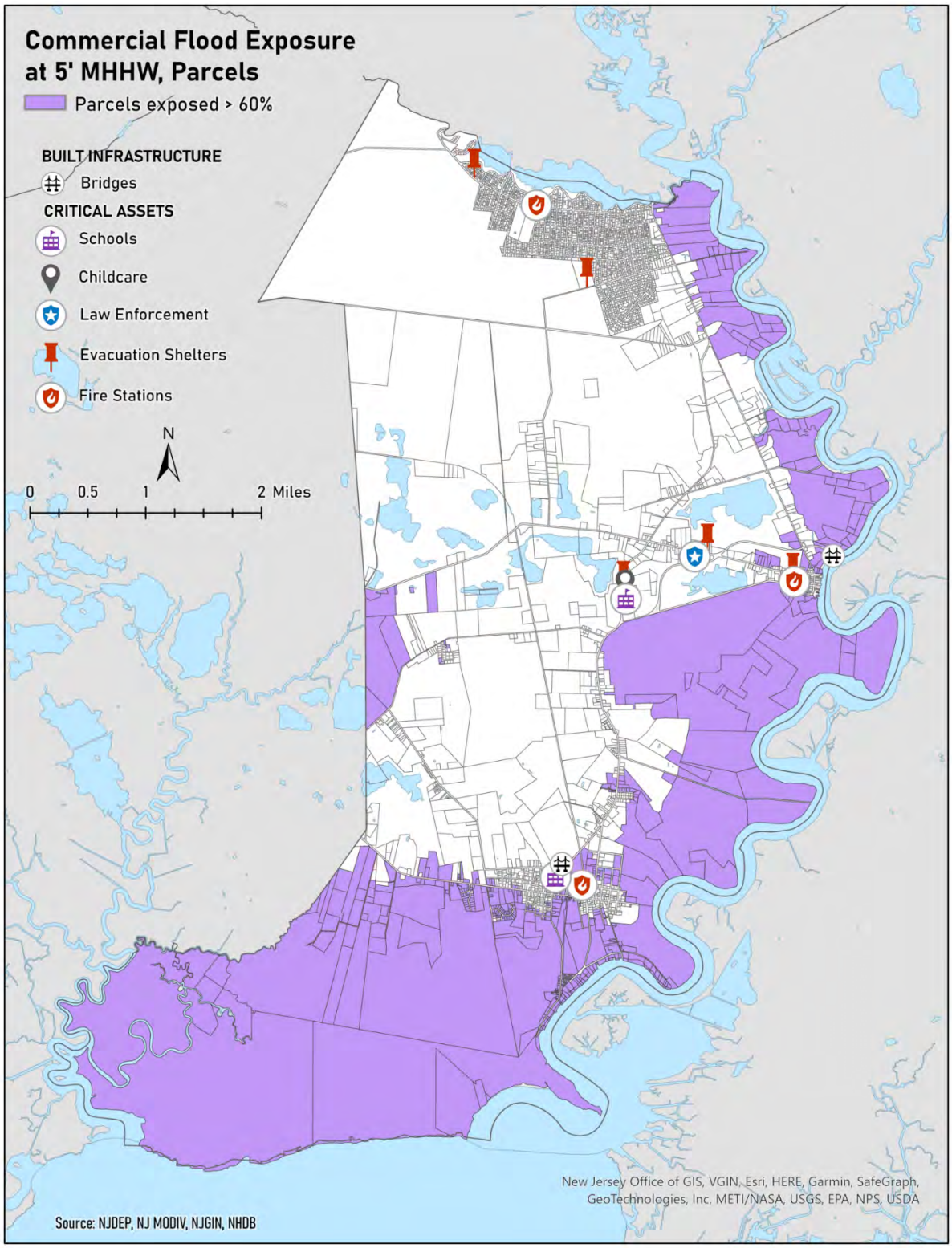


Figure 29: Spatial extent of flooding, 5' TWL, with Critical Infrastructure

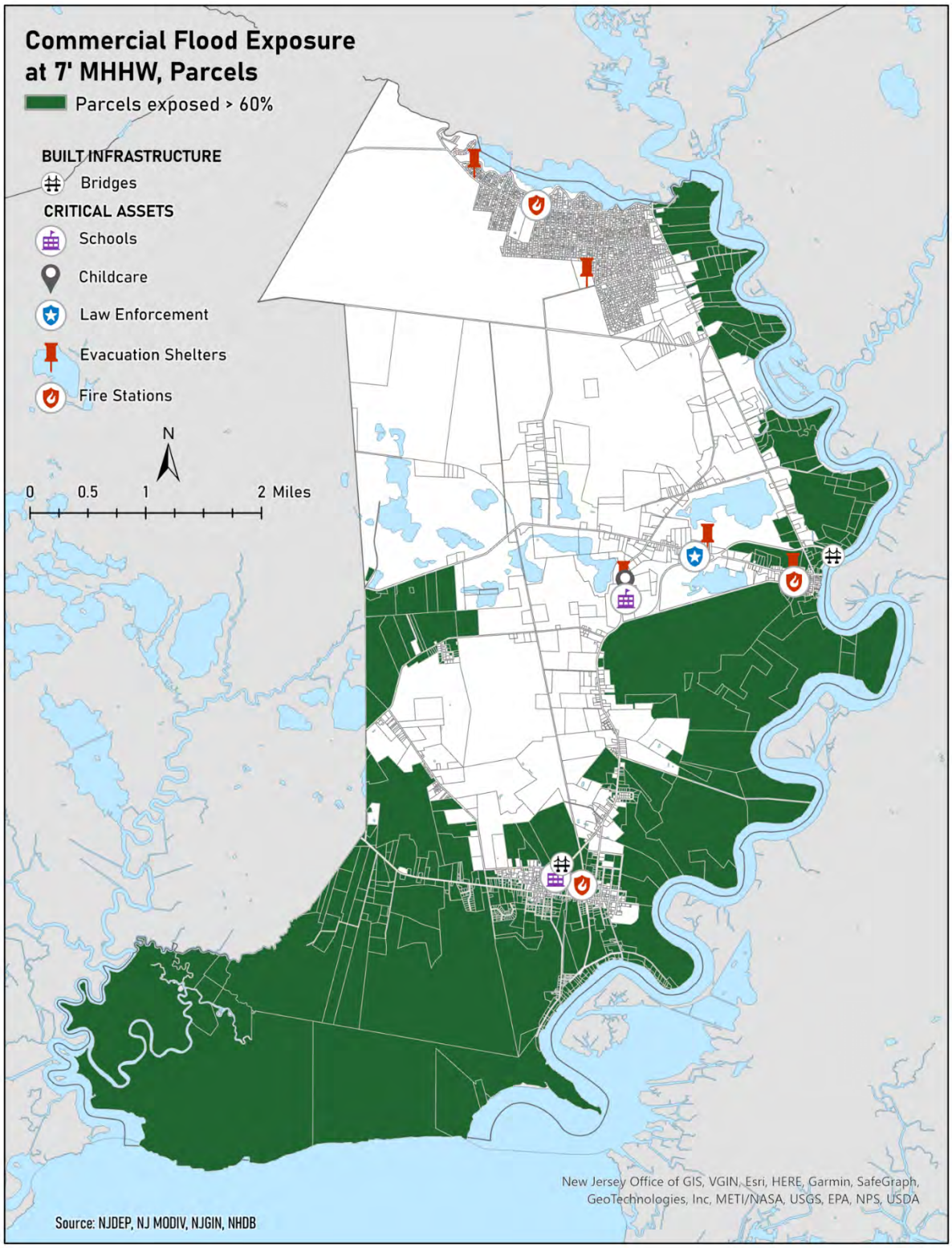


Figure 30: Spatial extent of flooding, 7' TWL, with Critical Infrastructure

Table 17 shows the number of Commercial Township critical facilities at risk of flooding at each water level. For instance, at 2 feet TWL, the only critical infrastructure that appears to be inundated is a bridge.

At 3 feet TWL, an additional bridge would be inundated, and a fire station would experience flooding. At 5 feet TWL, an evacuation shelter becomes exposed to flooding. The number of critical infrastructure facilities that experience flooding remains the same under the 7-foot TWL scenario.

Understanding which facilities are at risk of flooding at different water levels is crucial in developing emergency response plans and taking preventive measures to minimize potential damage. Emergency responders should be aware of the possibility of being unable to access fire stations and/or evacuation shelters at 3-5 feet TWL. There may be a need to relocate or deploy additional resources in these areas.

Category	2 ft	3 ft	5 ft	7 ft	Total in municipality
Bridges	1	2	2	2	2
Schools	0	0	0	0	2
Fire Stations	0	1	1	1	3
Law Enforcement	0	0	0	0	1
Child Care Facilities	0	0	0	0	1
Evacuation Shelters	0	0	1	1	5

Table 17: Critical facilities exposed at each flood scenario.

Conclusion

The flood assessment report conducted by the Rutgers Climate Corps provides valuable insight into the risk of inundation hazards in Commercial Township, NJ. Based on the sea level rise guidance from the NJ Department of Environmental Protection and the Rutgers University Science and Technology Advisory Panel, the report identifies parcels that are exposed to flooding at various total water levels.

Moreover, the report highlights the social vulnerability data from the CDC and describes overburdened communities in the township, which can be significantly impacted by flooding events. This information can help local authorities prioritize their emergency response efforts and allocate resources accordingly. Furthermore, the report identifies critical infrastructure, such as transportation nodes, schools, and water treatment facilities, that are at risk of flooding. This information can assist in planning and implementing measures to protect these critical assets.

In conclusion, the Rutgers Climate Corps' flood assessment report provides an understanding of the inundation hazards in Commercial Township, NJ. The report's findings can help inform planning decisions and guide mitigation efforts to reduce the impact of flooding on vulnerable populations and critical infrastructure.