

6) Coastal Erosion Hazard Analysis for New York City

a) Hazard Profile

i) Hazard Description

Coastal erosion results from beach-ocean interaction coupled with human activity. In its natural state, the beach system is in dynamic equilibrium. Sand is moved from one location to another but it does not leave the system. For example, winter storms may remove significant amounts of sand, creating steep, narrow beaches. In the summer, gentle waves return the sand, widening beaches and creating gentle slopes. Because there are so many factors involved in coastal erosion, including human activity, sea-level rise, seasonal fluctuations, and climate change, sand movement will not be consistent year after year in the same location.

Wind, waves, and long shore currents are the driving forces behind coastal erosion. This removal and deposition of sand permanently changes beach shape and structure. Sand may be transported to landside dunes, deep ocean trenches, other beaches, and deep ocean bottoms. Coastal erosion poses many problems to coastal communities when valuable property is lost to this dynamic beach-ocean system. Additionally, human activity may worsen the process of coastal erosion through poor land use methods. Thus, issues of beach restoration and erosion control are at the forefront in coastal communities.

ii) Severity

Geologists measure erosion as a rate of either linear retreat (feet of shoreline recession per year), or volumetric loss (cubic yards of eroded sediment per linear foot of shoreline frontage per year). According to the Evaluation of Erosion Hazards study conducted by the Heinz Center, the average annual erosion rate on the Atlantic coast is roughly two to three feet per year. States bordering the Gulf of Mexico have the nation's highest average annual erosion rates of six feet per year.

iii) Probability

Long-term coastal erosion is a continuous process and therefore 100% probable for the locations below.

iv) Location

NYSDEC has identified three distinct CEHAs for New York City:

- Coney Island, Brooklyn
- The Rockaways, Queens
- South Shore, Staten Island

Within the CEHAs, NYSDEC manages and regulates the following:

- Natural Protective Features (NPF), such as the near shore, beaches, bluffs, primary dunes, and secondary dunes

- Structural Hazard Areas (SHA), which include areas landward of the NPFs that have demonstrated a long-term average annual recession rate of one foot per year or greater

CEHA maps depict both regulated areas, including the landward limit of the NPFs and SHAs, and indicate the recession rate in feet per year, where applicable.

CEHA maps for New York City were obtained from the NYSDEC, Division of Water, Coastal Erosion Management Unit on January 14, 2008. The maps are dated 1988, with legend updates in 1991. CEHA maps were available only in hard-copy format. For the purposes of this plan, CEHAs were translated from the hard-copy maps into GIS format for more efficient viewing, sharing, and estimation of assets within the CEHA. This was not a formal translation of the hard-copy data into GIS format. The resulting image is for analysis purposes only and does not serve as official digital representation of the CEHA boundary in New York City. For New York City, the CEHA boundary was drawn at the location of NPFs; CEHA maps did not designate SHAs.

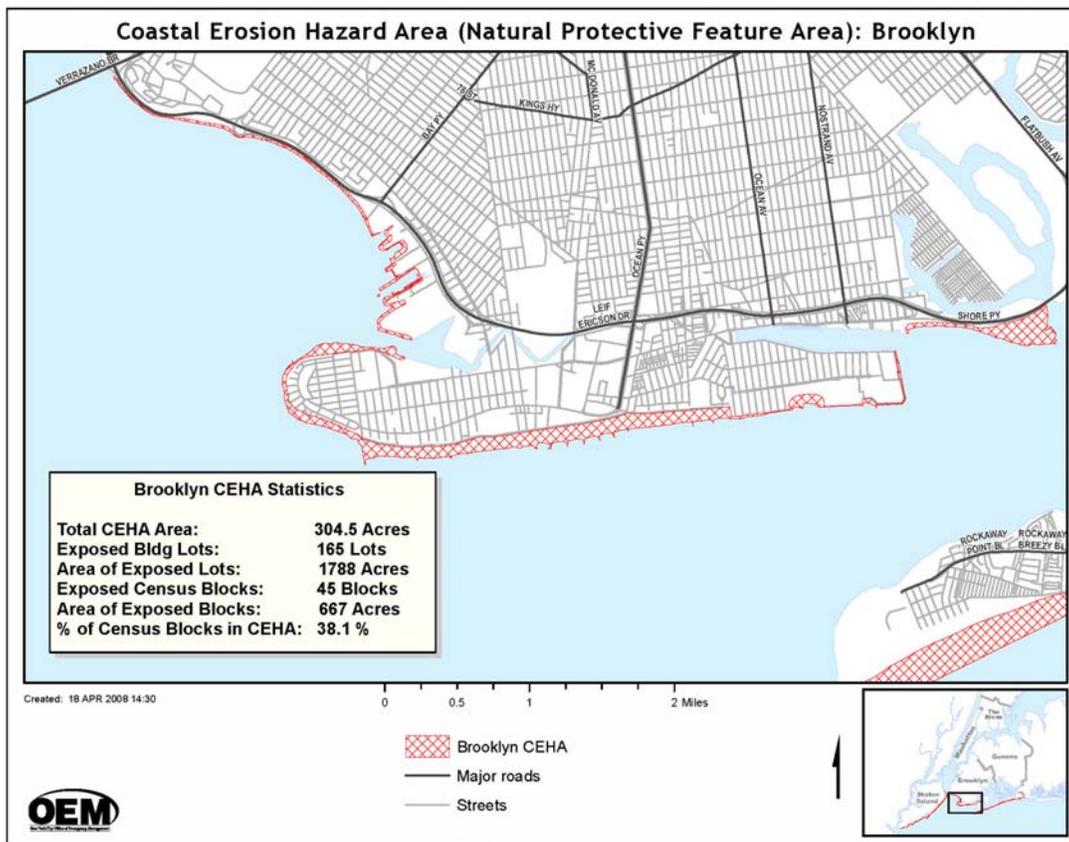


Figure 38: Brooklyn CEHA Areas

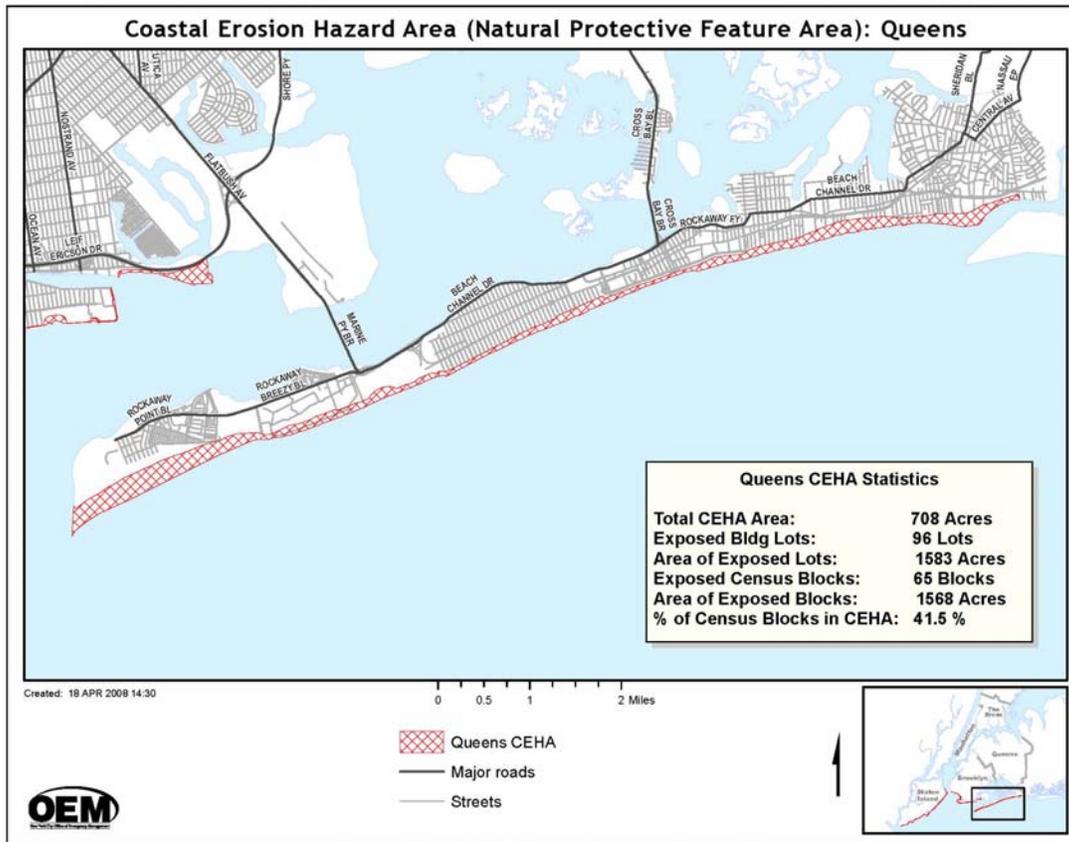


Figure 39: Queens CEHA Areas

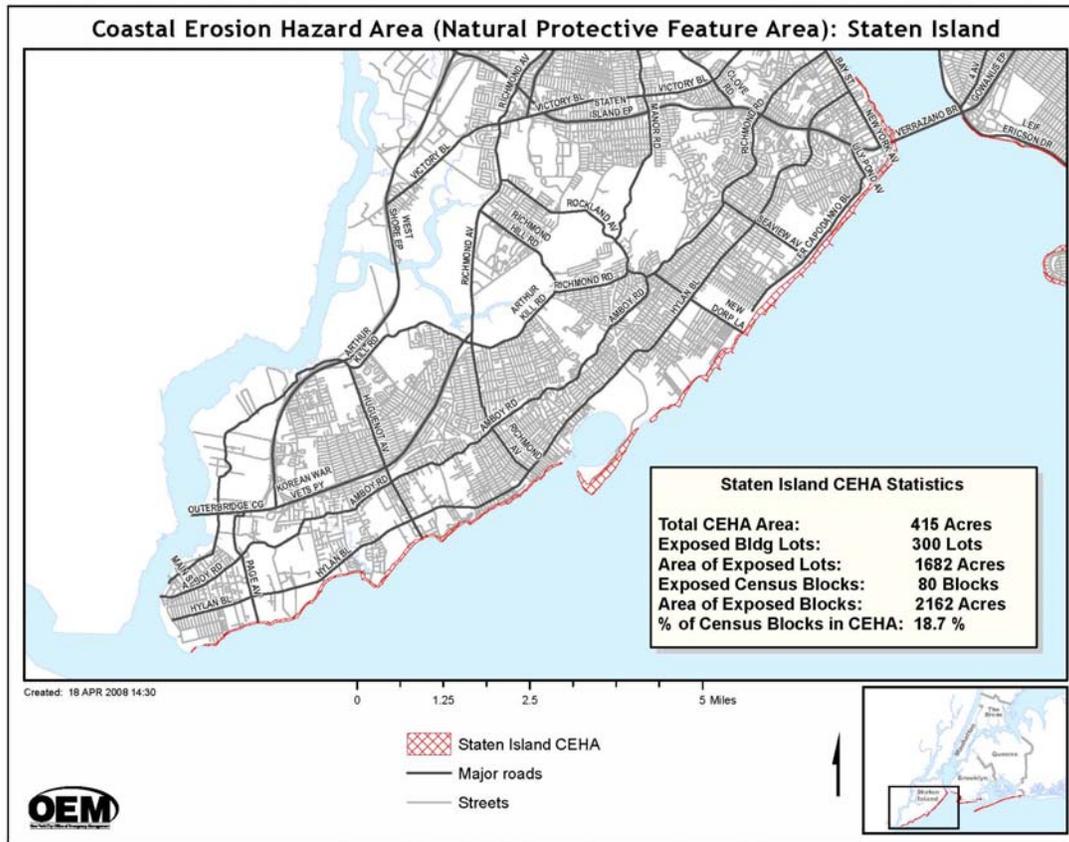


Figure 40: Staten Island CEHA Areas

v) Historic Occurrences

Coastal erosion is an ongoing natural process frequently exacerbated by human activity. Specific occurrences of coastal erosion are usually associated with a significant coastal storm, such as a nor’easter or hurricane. According to the National Climatic Data Center, 16 significant coastal storms have affected New York City since 1821. See the Coastal Storms Historical Occurrences section in this plan for more information.

b) Vulnerability Assessment

i) Impact to New York City

Coastal erosion causes extensive damage to public and private property and coastal natural resources. It may also endanger human lives. Human activities often contribute to coastal erosion problems by damaging or destroying natural protective features such as dunes, beaches, and barrier bars. Building without considering the impact of erosion, including building ill-conceived coastal erosion control structures, may increase erosion or shift it to adjacent area.

The City’s south shore is exposed to the effects of coastal erosion and wave action from the Atlantic Ocean as well as from the waters of its bays including Lower New York, Gravesend, and Jamaica Bay. Over the past 100 years, the average erosion rate along

much of Long Island's south shore, including parts of New York City's CEHAs, was at a rate of one to two feet per year. Some of the highest erosion rates, which can exceed 20 feet a year, have been observed near stabilized inlets or stone groins.

ii) Structural Vulnerability

Eroding coastlines essentially bring structures closer to the water's edge. Consequently, if not mitigated, the structures will become inundated with water causing damage or destruction. As water begins to affect the structure, the forces are similar to that of flooding, which tends to affect the contents, foundation, and utilities associated with the structure. Shoreline protection is a key part of withstanding the forces produced by coastal erosion. Engineering structures such as sea walls, riprap, armoring, and bulkheads are used to control erosion in New York City.

Approximately 1,427 acres or 0.7% of New York City's land area is located within a CEHA. The following table presents a summary of building lots, acreage, and buildings that lie within a CEHA.

Number and Acreage of Exposed Lots within the CEHA			
Coastal Erosion Hazard Area (CEHA)	Lots Exposed	Acreage Exposed	Buildings Exposed
Coney Island, Brooklyn	165	304.5	37
The Rockaways, Queens	96	708	24
South Shore, Staten Island	300	415	146
Total	561	1,427.5	207

Table 11: Number and Acreage of Lots within NYSDEC Mapped CEHA

There are three critical roadways located within New York City CEHAs:

- Verrazano Narrows Bridge
- I-278 (Highway)
- Shore Parkway

iii) Potential Loss Estimate

HAZUS-MH does not have a direct way to estimate loss due to coastal erosion. The total value of all buildings located in a CEHA was calculated using a modified HAZUS-MH flood model, which assumed a total loss of all CEHA from the current shoreline to the NPF line.

HAZUS-MH uses census blocks to calculate these values. If any part of a census block is located in a CEHA, the value of the whole block is counted, which tends to overestimate the total building value located in a CEHA. Furthermore, it does not take into account building locations within the lots. A more accurate building value can be derived by examining the census blocks, determining the number of buildings within a CEHA, and reducing the building value by that factor. Table 12 presents the approximate adjusted building values within New York City CEHAs.

Adjusted Building Value in CEHA					
CEHA Zone	Exposed Census Blocks	Buildings in Exposed Census Blocks	Building Value of Exposed Census Blocks	Number of Buildings in Exposed Census Blocks that Lie within CEHA	Adjusted* Building Value (Estimated)
Brooklyn	45	378	\$245 million	37 of 378 (9.8%)	\$24 million
Queens	65	1,203	\$2,400 million	24 of 1,203 (2%)	\$49 million
Staten Island	80	1,242	\$551 million	146 of 1,242 (11.8%)	\$65 million
Total	190	2,823	\$3.2 billion	207 of 2,823 (7.3%)	\$138 million

Table 12: Adjusted Building Values (Approximate) within New York City CEHAs

* Adjusted building value was calculated by valuing all buildings equally within a census block, and counting the number of buildings that lie within a CEHA. This approach introduces a level of inaccuracy; however, it demonstrates the actual building value at risk may be at least an order of magnitude lower than building value estimation calculated by HAZUS-MH.