# FORTIFYING LOWER MANHATTAN'S SHORELINE

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## Abstract

Lower Manhattan comprises less than 1% of the entire city's land area, but generates almost 10% of the city's total economic output, as measured by Gross City Product, and is the location of over 10% of all New York City jobs. Any climate impacts in the District will resonate across the city as a whole and beyond. Because Lower Manhattan is a critical economic, cultural, and civic hub for New York City and the region, the impacts of climate change on Lower Manhattan will make a big impact in the District. In other words, a plan for action is needed to ensure that Lower Manhattan's vitality and growth continues in this century and into the next Lower Manhattan's physical conditions present both vulnerabilities and opportunities. The District on the whole is characterized by a distinctive, densely developed mix of tall, newer towers and a large proportion of old, historic buildings. These older buildings are particularly vulnerable and challenging to adapt due to their age and structure. The District also has particularly low-lying topography in some areas, dipping below the aging bulkhead at the coastal edge. This research will recognize the unique mix of challenges and opportunities in Lower Manhattan and builds on existing efforts towards the long-term climate adaptation and resilience of the District.

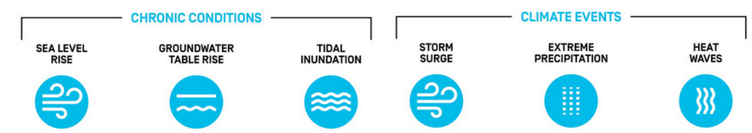
## What is Resilience?

From a non-architect point of view, resilience for some people is the ability to prepare a plan or protect something in an futuristic event that is going to or will happen from diseases or natural disasters. However, seeing the word resilience from a architect point of view is thinking at the same time about sustainability. In other words, prepare buildings or spaces to withstand newsworthy events like hurricane Sandy, adding to a growing list of other disruptive events like tsunamis, droughts, and heat waves.


## Where are we focus?

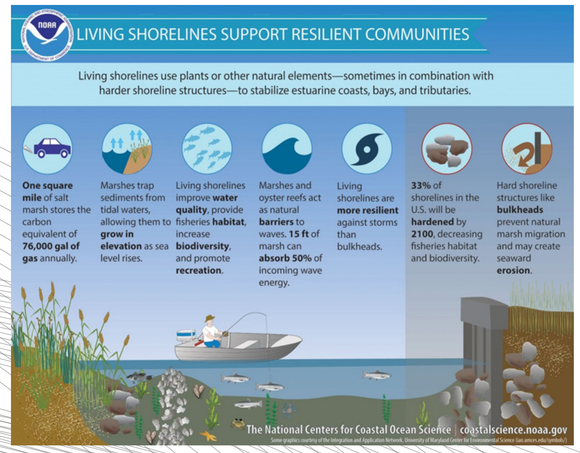
We decided to focus on Lower Manhattan due to the past catastrophic event such as Hurricane Sandy, which flooded the neighborhood in 2012, which caused $19 billion in damage to real estate and infrastructure. Another reason for selecting this area it is because Lower Manhattan's one of the core centers of the city's economy, the financial capital of the world, and it should be a national priority. This is why we decided to share 3 examples of fortifying Lower Manhattan.

**The study assessed a broad range of climate hazards, including:**



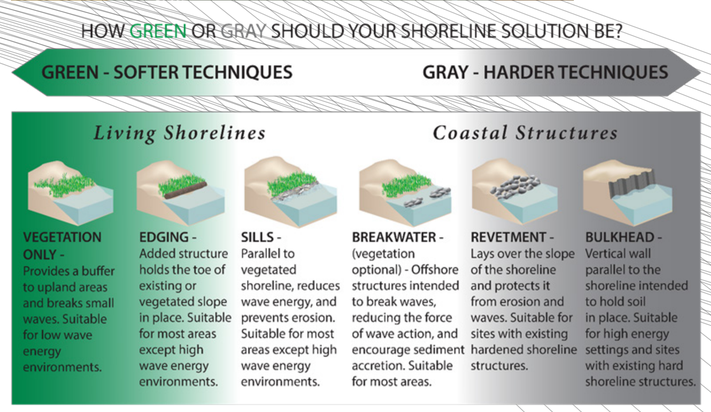

## Living Shoreline

-A broad term that encompasses a range of shoreline stabilization techniques along estuaries, bays, tributaries, and other sheltered shorelines. Living shorelines are not typically used on beaches on the open ocean. A living shoreline has a footprint that is made up mostly of native material.
-Living shorelines use plants or other natural elements – sometimes in combination with harder shoreline structures – to stabilize estuarine coasts, bays, and tributaries.
-They are effective barriers against erosion and provide habitat for coastal species. Shorelines having intact natural coastal habitats (like wetlands, dunes, mangroves, and coral reefs) experience less damage from severe storms and are more resilient than hardened shorelines. Areas with natural coastal habitat also have higher populations of fish and other living organisms important for shorebirds and for recreational and commercial purposes



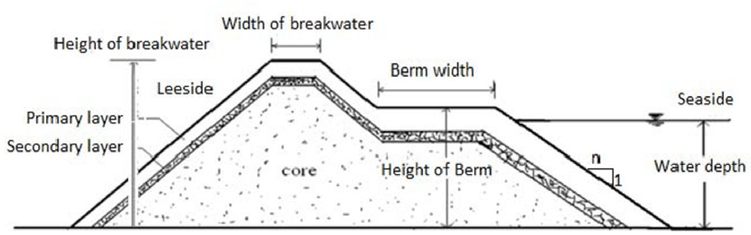

**Benefits:**

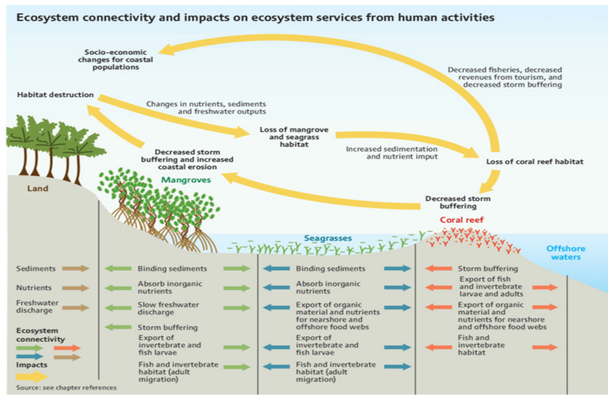
- Protect shorelines from erosion
- Provide habitat for fish and other living resources
- Improve water quality and store nutrients
- Increase stability over time
- Can outperform hardened shorelines during storm
- Attract natural wildlife

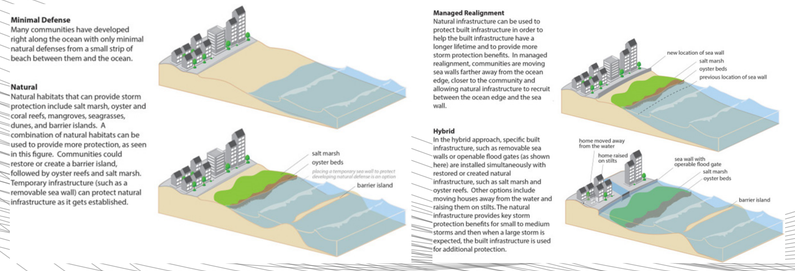



## Earthen Berms

-A berm is a level space, shelf, or raised barrier (usually made of compacted soil) separating two areas. It can serve as a fortification line, a border/separation barrier, in industrial settings, or in many other applications.
-A berm can be a man-made sediment barrier placed at the edge of a slope or a wall built adjacent to a ditch to guard against potential flooding. Berms are placed in flood-prone areas to protect against erosion, run off and high water. Typically berms are made of compost, sand, mulch or gravel materials, their density enable them to slow down and retain flood waters



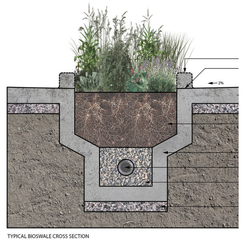



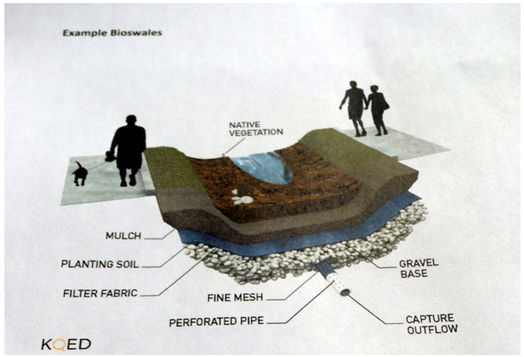

## Bioswales

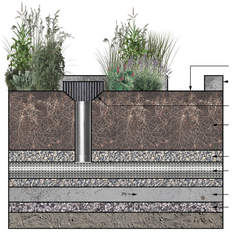
-Landscape elements designed to concentrate or remove debris and pollution out of surface runoff water. They consist of a swaled drainage course with gently sloped sides (less than 6%) and filled with vegetation, compost and/or riprap.
-Bioswales are often a nice alternative to installing a number of storm sewers. Their natural appearance has a nicer aesthetic, and studies have shown if bioswales are properly built, they can protect the environment.


**Benefits:**

- Reduces initial and long-term costs;
- Offers retrofit option;
- Provides groundwater recharge;
- Accents natural landscape;
- Reduces driving hazards by diverting stormwater from streets;



## Conclusion

Lower Manhattan will be at risk from storm surge. By 2100, with over six feet of projected sea level rise, almost 50 percent of properties will be at risk from storm surge, and 20 percent of Lower Manhattan's streets will be exposed to daily tidal inundation. This is why we decided to research about the methods that can be use to be prepared for this future scenarios. All of the methods shown are a good sustainable examples because they offer a variety of benefits such as implementing more ways to preserve nature and improve water qualities and nutrients plus this will also don't harm living organism underwater.

## Citation

"Living Shorelines." NOAA's Habitat Blueprint, www.habitatblueprint.noaa.gov/living-shorelines/. Press, Associated.
"Mayor De Blasio's $10 BILLION Plan to Save Manhattan from Rising Sea Levels." Daily Mail Online, Associated Newspapers, 14 Mar. 2019, www.dailymail.co.uk/sciencetech/article-6809285/NYC-mayor-Extend-shoreline-protect-city-storms.html. Yeo, Sophie. "As Climate Change Intensifies, Here Are the Most-and Least-Resilient Counties in America." Pacific Standard, 1 Mar. 2018, psmag.com/environment/the-most-climate-resilient-counties-in-america. "Lower Manhattan Climate Resilience Study." NYCEDC.