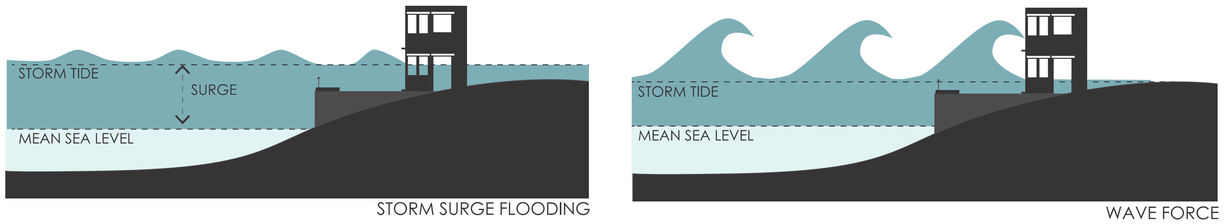
Coastal Protection

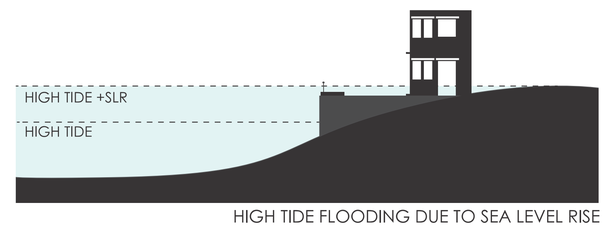
Strategy: Provide coastal flood protection

Event-Base Hazards: Surge & Waves

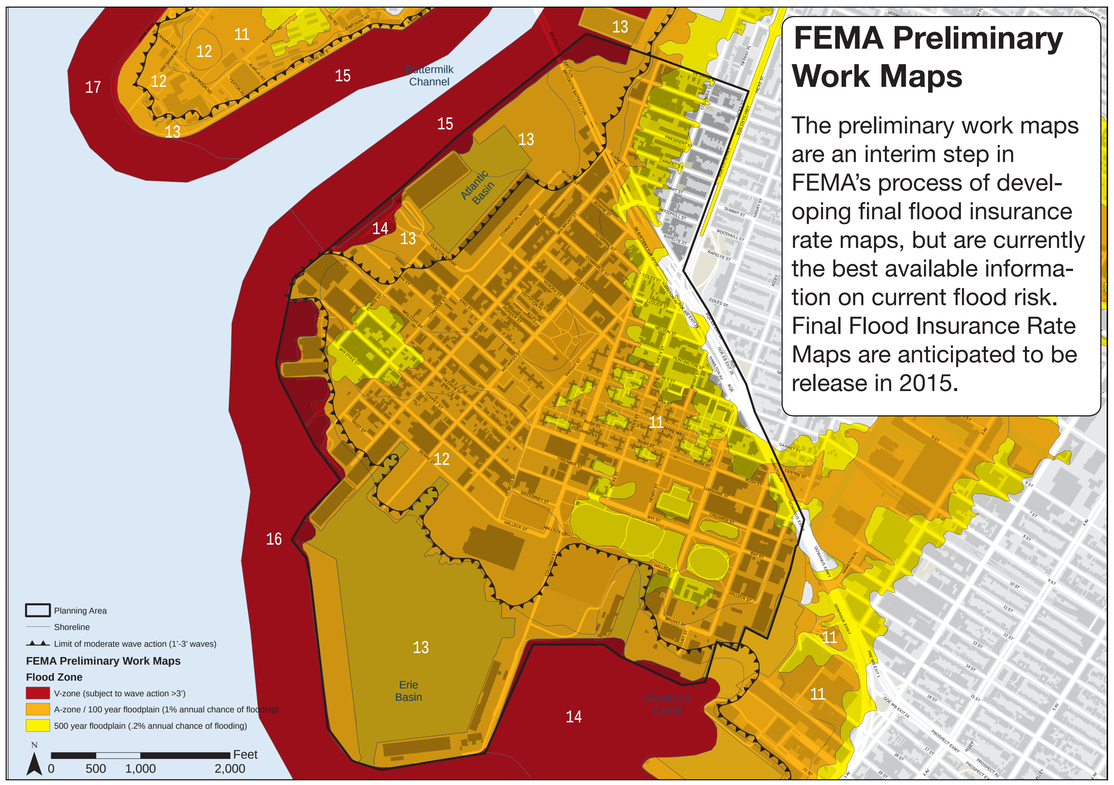


Source: NYC Department of CIty Planning, "Urban Waterfront Adaptive Strategies"

Gradual Hazards: Sea Level Rise

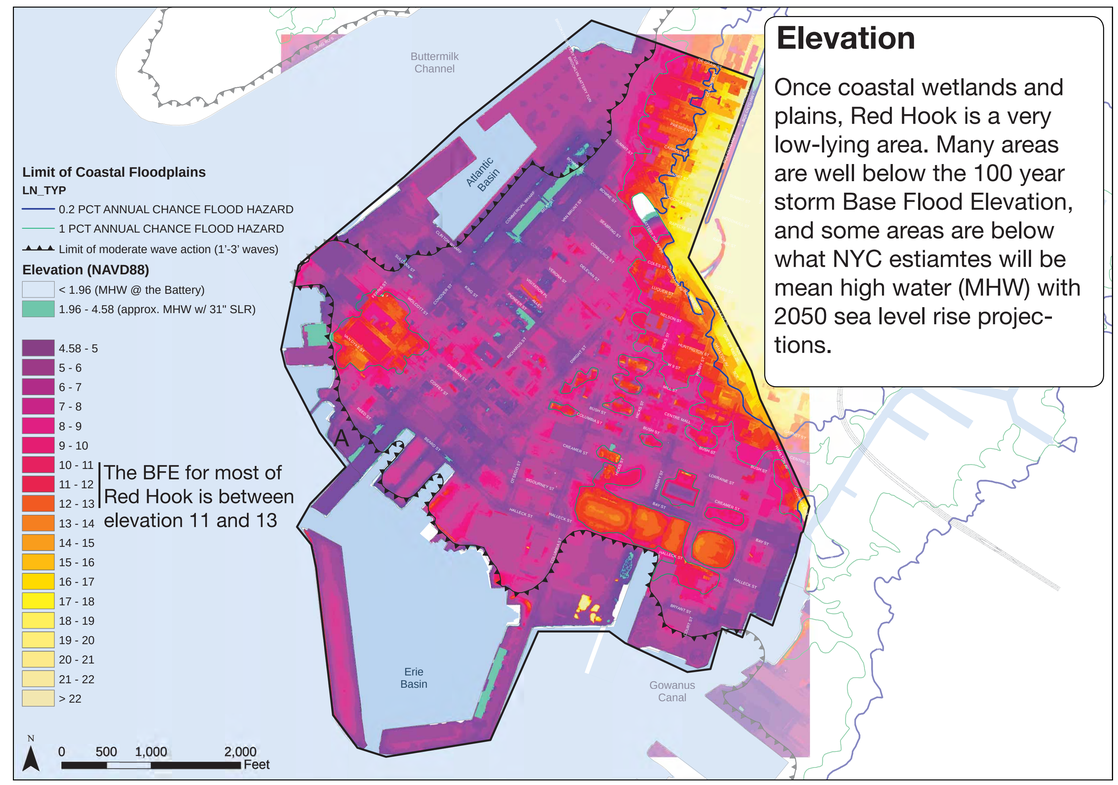


Source: NYC Department of CIty Planning, "Urban Waterfront Adaptive Strategies"



FEMA Preliminary Work Maps

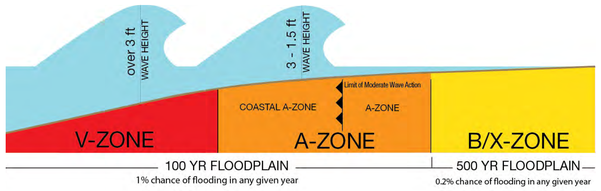
The preliminary work maps are an interim step in FEMA's process of developing final flood insurance rate maps, but are currently the best available information on current flood risk. Final Flood Insurance Rate Maps are anticipated to be release in 2015.



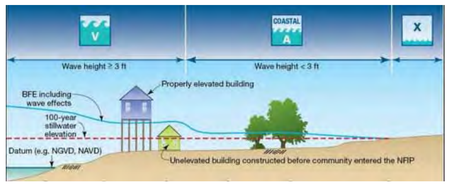
Elevation

Once coastal wetlands and plains, Red Hook is a very low-lying area. Many areas are well below the 100 year storm Base Flood Elevation, and some areas are below what NYC estiamtes will be mean high water (MHW) with 2050 sea level rise projections.

Understanding FEMA Flood Risk Information



The **FEMA Flood Risk Zones and** and how they are defined are illustrated above. The V and A zones together comprise the area with a 1% or greater chance of flooding each year. To put it in perspective, this is about 5 times as likely as getting a flush in 5 card poker. The V zone is also subject to waves over 3' high.



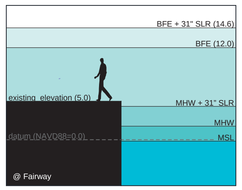
Source:

FEMA Region II Coastal Mapping Basics

http://www.region-2coastal.com/coastal-mapping-basics

The **Base Flood Elevation (BFE)** is the the elevation to which floodwater is anticipated to rise during the base flood (in this case the 100 year storm). The BFE is the federal regulatory requirement for the elevation or floodproofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium. In NYC, the Building Code and Zoning Code may require additional floodproofing or elevation.

Considering Future Change



FEMA flood risk maps reflect risk if a storm were to happen today. They do not take into account potential future change such as rising sea levels.

Sea level rise Baseline (2000-2004) 0 inches	Low-estimate (10th percentile)	Middle range (25th to 75th percentile)	High-estimate (90th percentile)
2020s	2 inches	4 to 8 inches	11 inches
2050s	7 inches	11 to 24 inches	31 inches

Based on 35 GCMs (24 for sea level rise) and two Representative Concentration Pathways. Baseline data are from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) United States Historical Climatology Network (USHCN), Version 2 (Menne et al., 2009). Shown are the 10th percentile, 25th percentile, 75th percentile, and 90th percentile 30-year mean values from model-based outcomes.Temperature values are rounded to the nearest 0.5°F; percipitation values are rounded to the nearest 5 percent, and sea level rise values rounded to the nearest inch.

Source: New York City Panel on Climate Change, "Climate Risk Information 2013"

http://www.nyc.gov/html/planyc2030/downloads/pdf/npcc_climate_risk_information_2013_report.pdf

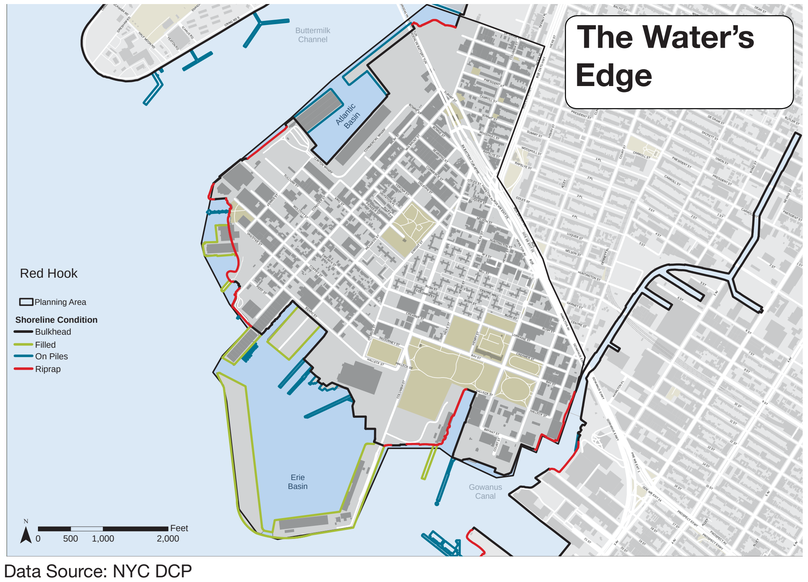
The New York City Panel on Climate Change estimates that there will be between 7 and 31 inches of sea level rise by 2050. Generally, we use the higher, more conservative estimate when anticipating risk.

Red Hook
NY RISING COMMUNITY RECONSTRUCTION

Coastal Protection

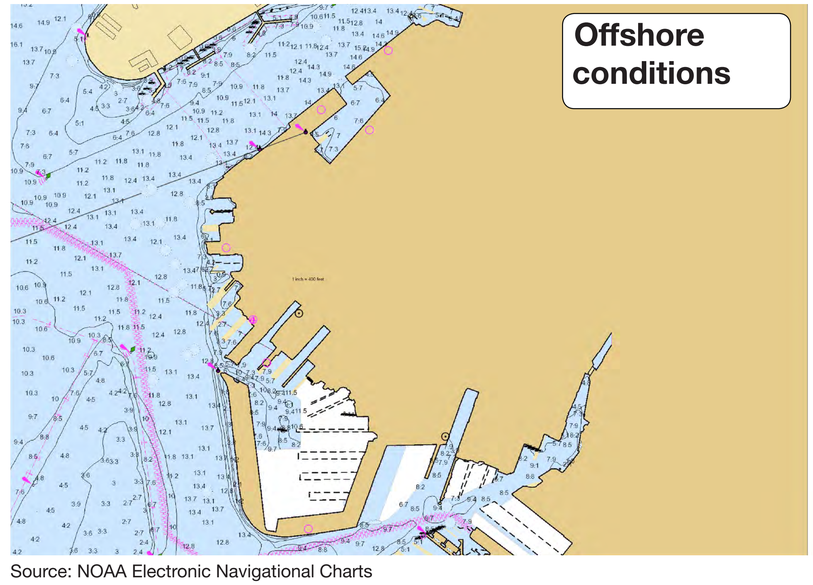
Strategy: Provide coastal flood protection

Existing Conditions



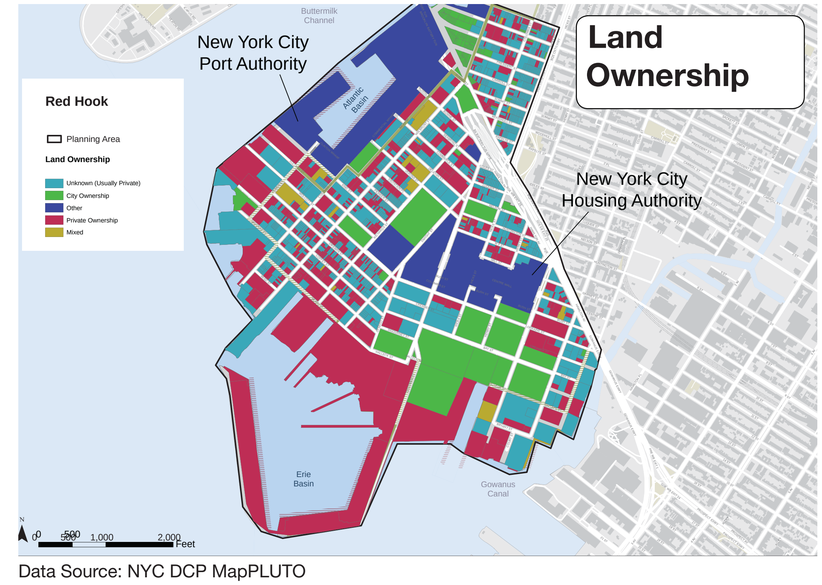
Data Source: NYC DCP

The shoreline is highly varied. In Red Hook, the shoreline is largely hardend and numerous active peirs make accomodating waterfront access and activity an important part of any coastal protection measures selected.



Source: NOAA Electronic Navigational Charts

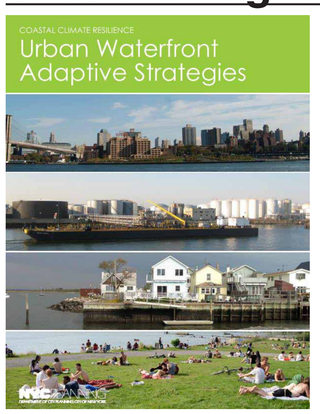
Offshore conditions, as well as on-shore conditions should be a consideration in coastal protection. Offshore conditions, particularly water depths and the presence of navigable waterways can impact water movements and wave energy at the shore. They also have implications for the type of coastal protection options appropriate to a given location.



Data Source: NYC DCP MapPLUTO

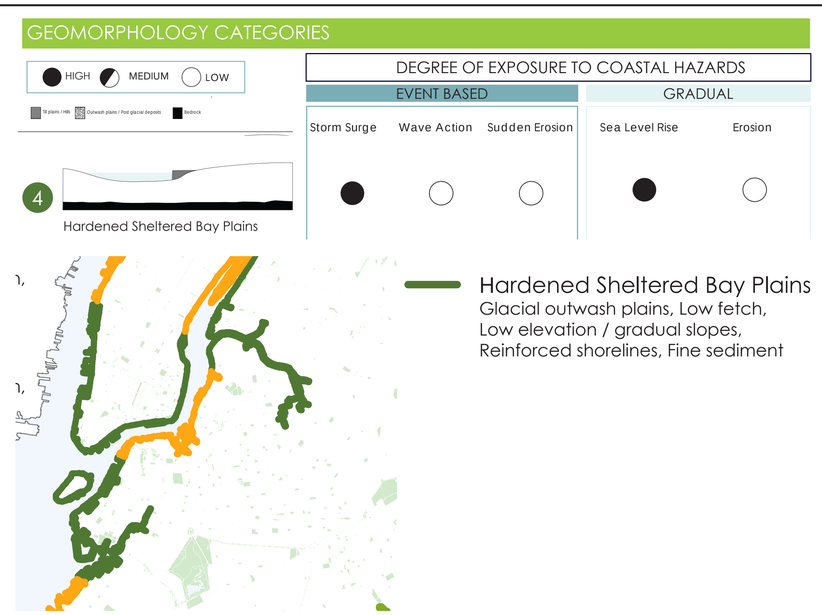
Multiple land owners would need to be engaged to provide coastal protection to the community. In addition, public funding for shoreline protection on private property can be difficult and involve requirements for the property owner.

Understanding the edge

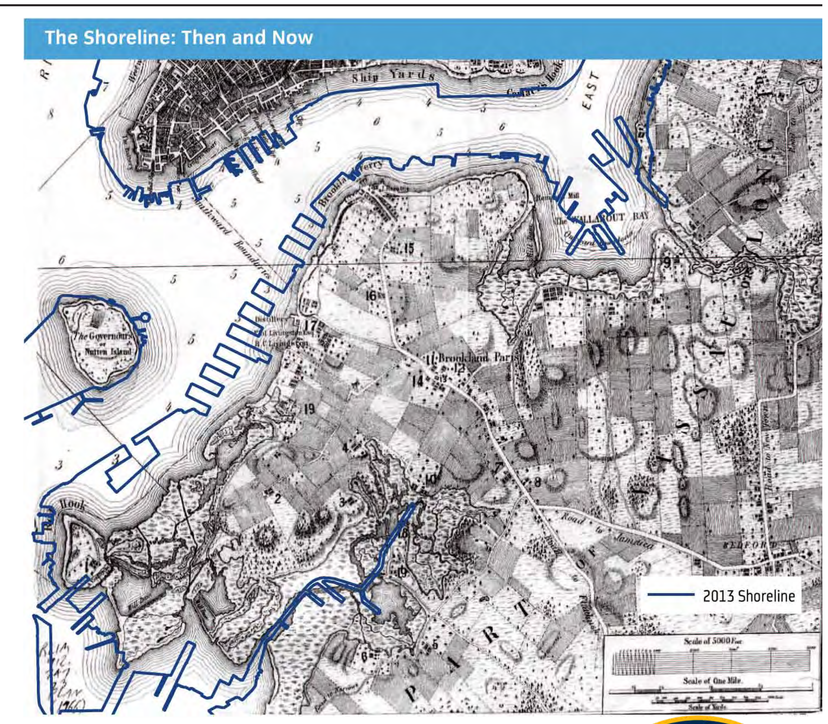


In June of 2013, The New York City Department of City Planning released "**Urban Waterfront Adaptive Strategies.**" This report is intended to be a guide for identifying and evaluating potential strategies for increasing the resilience of waterfront communities to coastal flooding and sea level rise. The report examined coastal conditions - the geomorphology as well as land use and density - and proposed adaptive strategies appropriate to different neighborhoods across the city.

Source: NYC Department of CIty Planning, "Urban Waterfront Adaptive Strategies"



Source: NYC Department of CIty Planning, "Urban Waterfront Adaptive Strategies"



Source: NYC "A Stronger, More Resilient New York"

Red Hook
NY RISING COMMUNITY RECONSTRUCTION

Coastal Protection

Strategy: Provide coastal flood protection

Potential Approaches

Protect Against Storm Surge

Levees

Levees (also called dikes) are earthen embankments located at the shoreline that provide protection from flooding. Levees are commonly used throughout the country along riverbanks to direct the flow of the river and protect communities. In New York City, there is a levee in Staten Island at Oakwood Beach that was completed by the U.S. Army Corps of Engineers in 2000.

Floodwalls

Floodwalls are permanent or deployable vertical walls used at the shoreline or upland to prevent flooding. Floodwalls are anchored into the ground and are designed to withstand flooding from either rivers or storm surge. Floodwalls sometimes have gates to allow access for a roadway or other right-of-way, which can be closed in advance of a flood event.

Deployable Floodwalls

Deployable floodwalls, which require wall components to be installed in preparation for a flood event, can be inserted into either permanent ground fixtures or vertical posts. Most deployable floodwalls require human intervention to install.

Attenuate Waves

Living Shorelines

Living shorelines are a bank stabilization technique that uses plants, sand/soil, and limited use of hard structures to provide shoreline protection and maintain valuable habitat. Living shorelines are an alternative to bulkheads or revetments that provide for a stable shoreline resistant to erosion while also providing for intertidal habitat and coastal vegetation. Living shoreline design is an emerging field.

Reefs

Reefs can be natural or artifical. Reefs are submerged, or partially submerged, structures made of rock, concrete, or other materials, that are designed to provide marine habitat for plants, invertebrates, fish, and birds, while also attenuating waves. Recent research, however, has begun exploring the use of artificial reefs as a type of off-shore "living breakwater" that mimic naturally occurring oyster reefs.

Breakwaters & Floating Breakwaters

Breakwaters are offshore structures typically made of rock or stone intended to break waves, reducing the force of wave action. Breakwaters can be either floating or fixed to the sea floor. While large breakwaters have historically served harbor protection and navigational functions, shore-parallel breakwaters have more recently been employed to protect longer stretches of coastline by attenuating or dissipating wave energy.

Protect against high tides and sea level rise

Raise Bulkheads

Bulkheads are vertical retaining walls intended to hold soil in place and allow for a stable shoreline. Approximately 25 percent of the New York City shoreline has a bulkhead. This includes the city's waterfront industrial areas as well as built-up commercial and residential areas and parkland.

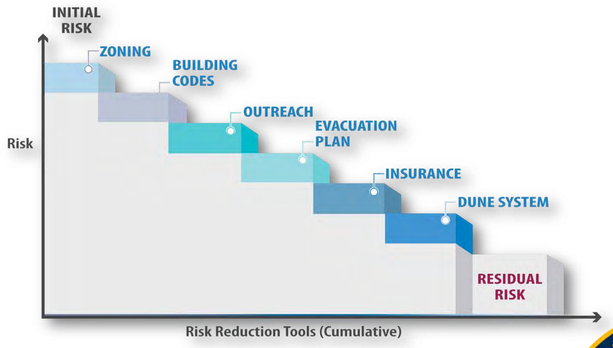
Revetments

Revetments (also called "rip-rap") are shoreline structures typically made of stone rubble or concrete blocks placed on a sloped surface to protect the underlying soil from erosion and reduce the forces of wave action. Revetments are used commonly throughout New York City as an alternative to bulkheads, as they tend to be relatively low cost and environmentally more sensitive than a hard, vertical wall.

Thinking holistically

When we discuss coastal protection, we have to consider the different types of threats and levels of risk we are protecting against. The most effective coastal protection will likely come from a combination of layered strategies that incrementally step down risk. Shoreline strategies will also be most effective when considered in concert with site and building flood protection and adaptation strategies. Such combinations of strategies may also generate co-benefits and create opportunities to increase resiliency across multiple recovery functions.

Time-frame is also important. Many approaches to coastal protection take a long time to implement due to a variety of factors including cost, permitting and the level of coordination required among agencies, communities and land owners. It is important to think about what you want to do in the short, medium and long term to reduce risk.



stepping down risk

Drainage

Initial Projects/ Recommendations	Questions	Actions, Plans, and Services Underway
• Improve maintenance of existing pipes • Expand / improve capacity of existing system • Green Infrastructure (Bioswales) • Green Roofs • Blue Roofs	• What kind of poor drainage and flooding issues do you regularly experience already? • Where do you experience issues of poor drainage, sewer backup, or flooding? • Do you have suggestions for other options to improve drainage you think should be explored?	• NYC Wastewater Resiliency Plan (NYCDEP) • Gowanus Facilities Upgrade • DEP 2-year plan to clean all sewers • DEP pilot program to remotely monitor flows inside the sewer system • A Stronger More Resilient New York (SIRR Report), Chapter 12: Water and Wastewater • Gowanus Canal Sponge Park (NYCDEP)

Coastal Protection

Initial Projects/ Recommendations	Questions	Actions, Plans, and Services Underway
• Construct Seawall(s) • Construct Levees / Berms • Integrate flood protection into new waterfront development • Leverage the Brooklyn Waterfront Greenway as part of coastal protection • Elevate perimeter streets • Increase natural edges / marshland • Flood barrier / surge protection at the Gowanus Canal	• What level of protection against flooding do you think is needed in the long term? in the short term? • What are your biggest questions and concerns regarding coastal protection for Red Hook? • What combinations of other resiliency measures do you think coastal protection should be implemented in conjunction with?	• A Stronger More Resilient New York (SIRR Report), Chapter 3: Coastal Protection • Southwest Brooklyn Waterfront Dredge Feasibility Pilot Project (PANYNJ) • Two Inflatable Dams in Brooklyn to Help Improve New York Harbor Water Quality (NYCDEP) • Post-Sandy beach restoration work (NYCDPR) • Red Hook Flats Anchorage Dredging (USACE) • North Atlantic Coast Comprehensive Study (USACE) • HUD Rebuild By Design Competition

Priority Resiliency Strategies - Preliminary Tally

Live Tally of Top Strategies based on submitted ballots

A. Increase the physical and economic resiliency of housing

B. Increase the resiliency of existing businesses & promote opportunities for economic development

C. Strengthen individual economic resiliency

D. Strengthen community capacity to prepare for, respond to, and recover from emergencies

E. Provide coastal flood protection

F. Improve drainage and reduce flooding from sewer back-up

G. Create opportunities for alternative power generation and distribution

H. Increase transit connectivity and ensure redundant transportation / transit options to facilitate evacuation and rebuilding